Kansas City PM Characterization Study

Final Report

United States
Environmental Protection
Agency

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Assessment and Standards Division
Office of Transportation and Air Quality
U.S. Environmental Protection Agency

Sponsors:

National Renewable Energy Laboratory, U.S. Department of Energy
Federal Highway Administration, U.S. Department of Transportation
STAPPA-ALAPCO Emission Inventory Improvement Program
Coordinating Research Council Inc. (Project No. E-69)

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NOTICE

This technical report does not necessarily represent final EPA decisions or positions. It is intended to present technical analysis of issues using data that are currently available. The purpose in the release of such reports is to facilitate the exchange of technical information and to inform the public of technical developments.

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KANSAS CITY PM CHARACTERIZATION STUDY

FINAL REPORT

EPA Contract #GS 10F-0036K

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The ERG team has worked hard to exceed expectations on this project, and we are pleased to have had the opportunity to work closely with the EPA and sponsors to make a study of this magnitude a success.

Sandeep Kishan

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Acronyms

ALAPCO	Association of Local Air Pollution Control Officials
AMBHC	Ambient (background) Hydrocarbon
BC	BC
BKI	Bevilacqua Knight Incorporated
BTEX	Benzene, Toluene, Ethylbenzene, and Xylenes
CEM	Continuous Emissions Monitor
CFR	Code of Federal Regulations
CMB	Chemical Mass Balance
CO	Carbon Monoxide
CO_2	Carbon Dioxide
COVs	Coefficients of Variation
CPU	Central Processing Unit
CRC	Coordinating Research Council, Inc.
CSV	Comma-separated Variables
CVS	Constant Volume Sampler
DAC	Data Acquisition and Control
DMV	Department of Motor Vehicles
DNPH	Dinitropehenylhydrazine
DOE	Department of Energy
DOT	Department of Transportation
DP	Dew Point
DR	DataRAM
DRI	Desert Research Institute
DT	DustTrak
DTC	Diagnostic Trouble Code
EC	Elemental Carbon
EPA	Environmental Protection Agency
ERG	Eastern Research Group
ESP	Environmental Systems Products
FHWA	Federal Highway Administration
FID	Flame Ionization Detector
GC/MS	Gas Chromatography / Mass Spectrometry
GC-FID	Gas Chromatography - Flame Ionization Detector
GDPMS	Gas/Diesel PM Split Study
GPS	Global Positioning System
HAP	Hazardous Air Pollutants
HC	Hydrocarbon
HH	Household
HPLC	High Performance Liquid Chromatography
HPLC-UV	High-Pressure Liquid Chromatography with UV Detector
IC	Ion Chromatography
ICP-MS	Inductively Coupled Plasma - Mass Spectrometry
I/M	Inspection and Maintenance
KCMSA	Kansas City Metropolitan Statistical Area

KCRHTS	Kansas City Regional Household Travel Survey
KS	State of Kansas
LDGV	Light Duty Gasoline Vehicles
LED	Light Emitting Diode
MARC	Mid-America Regional Council
MDL	Method Detection Limit
MO	State of Missouri
MSA	Metropolitan Statistical Area
MSAT	Mobile Source Air Toxic
MSOD	Mobile Source Observation Database
NIST	National Institute of Standards and Technology
NMHC	Non-Methane Hydrocarbon
NO	Nitric Oxide
NO2	Nitrogen Dioxide
NOX	Oxides of Nitrogen
NREL	National Renewable Energy Laboratory
OBDII	On-Board Diagnostics II (vehicle diagnostic system)
OC	Organic Carbon
ORD	Office of Research and Development (EPA)
PAH	Polycyclic Aromatic Hydrocarbons
PAMS	Portable Activity Measurement System
PDP	Positive Displacement Pump
PEMS	Portable Emissions Measurement System
PM	Particulate Matter
$PM_{2.5}$	Particulate Matter (less than 2.5 microns in diameter)
QA	Quality Assurance
QAPP	Quality Assurance Project Plan
QC	Quality Control
QCM	Quartz Crystal Microbalance
RDD	Random Digit Dialing
RFP	Request for Proposals
RH	Relative Humidity
RSD	Remote Sensing Data
SBS	Second-by-Second
SCFM	Standard Cubic Feet per Minute
SI	Spark Iginition
SMT	SEMTECH
STAPPA	State and Territorial Air Pollution Program Administrators
STN	Speciation Trends Network
SVOC	Speciated Volatile Organic Compounds
TC	Total Carbon
TEOM	Tapered Element Oscillating Microbalance
THC	Total Hydrocarbon
TIGF	Teflon Impregnated Glass Fiber
TNMHC	Total Non-Methane Hydrocarbon
TOR	Thermal Optical Reflectance

USEPA	United States Environmental Protection Agency
UV-VIS	Ultraviolet-Visible Spectroscopy
VI	Vehicle Interface
VIN	Vehicle Identification Number
VOC	Volatile Organic Compounds
VSP	Vehicle Specific Power
XML	eXtensible Markup Language
XRF	X-Ray Fluorescence

Executive Summary

Overview of Study Objectives

This program evaluates exhaust emissions from light-duty gasoline vehicles (LDGVs) which includes measuring particulate matter (PM) and other components of exhaust emissions from approximately 480 randomly selected LDGVs in the Kansas City Metropolitan Area. Data obtained from this program will be used to evaluate and update existing and future mobile source emission models (MOBILE6 and MOVES).

In an effort to understand the emissions of a fleet comprised of both new and older vehicles, EPA has conducted numerous studies to measure emissions from a sample of vehicles and then projected them to the population as a whole. Gaseous emissions have been studied extensively through the last few decades, both through special studies and through analysis of vehicle inspection and maintenance (I/M) program data. However, particulate matter (PM) emissions from gasoline-powered motor vehicles are less understood. Through this study EPA has conducted a “watershed” research experiment to characterize PM emissions from a very carefully selected random sample of vehicles in a major metropolitan area.

It should be first noted that PM is a dynamic pollutant that is constantly being influenced by its environment therefore its formation is constantly changing both in the exhaust stream and in the ambient air. Our tests are a snapshot using specific measurements under specific laboratory and thermodynamic conditions. Real-world PM may differ significantly.

Many studies have tried to characterize the distribution of PM for a vehicle fleet. However, study designs have been lacking in their focus to develop random sampling techniques with careful attention to non-responsive behavior. For this research, the Project Sponsors have developed the following goals:

- Characterize PM emissions distributions of a carefully selected random sample of gasoline vehicles in Kansas City.
- Characterize gaseous and PM toxics exhaust emissions.
- Characterize the fraction of high emitters in the fleet.

In addition, there were a number of secondary goals for the study, including:

- Demonstrate the use of a cohort, and a sampling plan to select candidate vehicles;
- Test vehicles in an ambient environment close to their operating area, gather data in summer and winter conditions;
- Refine the use of Portable Emissions Measurement Systems (PEMS) configurations for large scale implementation;
- Compare results of laboratory grade measurement devices with PEMS;
- Develop useful continuous PM measurement techniques compared to traditional gravimetric measurement;
- Develop inventory of speciated HC constituents of vehicle exhaust in PM and gaseous modes;

- Gather emissions and activity data on vehicles driven by their owners in real world conditions; and
- Gather information to relate second by second vehicle driving and resulting PM emissions for developing input data for emissions models.

Another key feature of this study was intended to identify how real-world on-board portable emission measurement devices (PEMS) could be used to collect mass-based vehicle emissions data. These devices were put on all vehicles tested in this project. Additionally, a PEMS device was connected to every vehicle while it was simultaneously measured with laboratory grade instruments on a dynamometer. EPA intends to use the results of this program to evaluate whether PEMS devices can be a primary method to collect vehicle emissions data around the country for use in the development of fleet emissions inventories.

The KC study was conducted in three distinct Phases. In the Pilot phase the test facility in Kansas City was prepared and all equipment, staff, and logistics were mobilized. The team also tested three EPA-provided “correlation” vehicles to compare EPA Ann Arbor dynamometer laboratory measurements with those obtained using the EPA portable Clayton dynamometer at the KC test facility. The main study was started in June 2004 and was called Round 1 testing. During this round, approximately 250 vehicles were tested under summer conditions at the facility. In the final testing round, Round 2, approximately 250 additional vehicles were tested under winter conditions. Approximately 40 vehicles tested during Round 1 were re-tested in Round 2 to compare exhaust emissions changes due to seasonal changes.

Summary of Contractor’s Major Findings

This report represents the first steps in an ongoing review process that are being presented to EPA by its contractor, ERG, on its testing procedures, observations and data gathered under this contract. The contractor was also responsible for providing technical assessments following standard operating procedures, review of technical assessment and to identify any data quality issues as outlined in the statement of work and as described in the quality assurance project plan (QAPP).

The following paragraphs state some of the contractor’s major findings:

<u>Sampling Methodology Area</u>

One of the research goals was to carefully select a random sample of gasoline vehicles from the Kansas City Metropolitan Statistical Area (MSA). This was accomplished in Round 1 by using the Mid-American Regional Council (MARC) travel survey study that was completed in 2004 as our starting point for analysis. By comparing the MARC study to Census 2000 data on many demographic and geographic characteristics and found it represented the Kansas City MSA population. Within the MARC survey, 2,887 household had at least one vehicle that could be tested in Round 1 but only 1,236 were contacted. Of those households, 221 agreed to participate in the emission test program; 360 refused to participate; 497 could not be contact after multiple attempts and 106 no longer had valid phone numbers. The overall response rate was 21%.

Another research question dealt with whether nonrespondents were different from respondents. A total of 51 households were able to be converted after initially refusing to participate in the emission test program. The contractor found little difference between participants and refusers when looking at geographic and demographic characteristics. This effort to recruit vehicles that had initially refused participation was only conducted during Round 1 testing.

The Round 1 households were larger and owned more vehicles (again, given that vehicle ownership was a requirement for participation in the study, this finding was not surprising). The Round 1 households show a good geographic dispersion and tend to reflect more moderate income households. The Round 2 study design was similar to Round 1 and many of the household characteristics remained relatively constant and different from the MARC and Census data. Round 2 households were larger, owned more vehicles, reflected more moderate income levels and most tended to own single-family residences. In contrast to Round 1, Round 2 households' geographic dispersion was less urban.

EPA will be continuing it investigation into the characteristics of the KC vehicle fleet to hopefully get a better understanding of possible influences that might better understand factors that we help characterize fleet emissions.

Emission Results

A major goal of the vehicle test program was to gather gaseous and particulate matter emissions from a randomly selected stratified vehicle sample. The contractor has presented some of their analysis in this report. As expected, preliminary findings show that older vehicles have higher gaseous and particulate matter emission than newer vehicles. A major finding was the role that temperature plays in the formation of particulate matter. When comparing forty – three vehicles that were tested in both Rounds but at different temperatures their particulate matter emissions increased for all vehicle bins in Round 2. EPA will be further investigating both the gaseous and particulate matter to determine if other parameters might also be contributing to these emission increases and how these relate to the general vehicle fleet population.

Dyno vs PEMS Evaluation

Another secondary goal was to investigate the capabilities of portable emission measurement system (PEMS) to be able to measure gaseous emission accurately on wide variety of vehicles and compare it to laboratory dynamometers. The contractor reported in their overall summary that the PEMS device compared very favorable to the Clayton portable dynamometer and analyzers on all gaseous measurements. EPA will be conducting further analyze between each of the test cycle's three Phases (cold start, stabilizing and warm start) and also comparing all vehicle tests performed between each Round. A special note needs to be made that improvements to the PEMS software and instrumentation were made between Round 1 and Round 2 which needs to be factored into these analysis.

RSD Data Compared to Vehicle Sample Methodology

On-road data were collected using Remote Sensing Devices (RSD) during both Rounds of the study. The purpose of these deployments was to document the on-road fleet in the Kansas City area and to measure on-road emissions.   The contractor presented preliminary results that compared RSD to PEMS second-by-second data connected to the dynamometer.   The graphs presented in this report indicates that there might be no major differences or offsets in the gaseous measurements conducted between the general fleet and the fleet randomly selected for this study.   EPA will be conducting its own investigation on the data gathered during this test program and will be releasing its conclusions in the near future.

Continuous PM Measurements Results

During this study, different types of analytical equipment were used to measure black carbon and total particle mass on a second-by-second basis. Particle mass was obtained using a DustTrak nephelometer, DataRAM4, and a quartz crystal microbalance (QCM). The contractor was able to provide some preliminary findings on these devices.

The contractor found that the black carbon rates generally decreased from older to newer vehicles. The black carbon rates and the DustTrak were generally higher for cars during the LA92's first Phase when compared to the other two Phases.   The contractor noticed that the DataRAM4 PM emission rates were in great excess of those obtained with the DustTrak except for those cases where vehicles had low emission rates. The contractor concluded that the DataRAM4 might have a problem with high concentrations where the optics measurement probably gets dirty, and adds to a scattered signal that gets interpreted erroneously as PM.

The contractor also compared the QCM to PM emission rates and noted that with the exception of Pre-1981 Cars, the QCM reports a higher emission rate than the gravimetric filter. Also the emission rate for the Pre-1981 Trucks was also shown to be less than the Pre-1981 gravimetric filters. Improvements to the QCM equipment occurred between the two Rounds which was not been taken into consideration in this contractor's report. EPA will be conducting its own investigation on the data gathered during this test program and will be releasing its conclusions in the near future.

Particulate-Phase Emissions Speciation from Light-Duty Gasoline Vehicles

Full chemical speciation was determined for 26 individual/composite samples and 6 composite dilution tunnel blank samples in each test Round.   The contractor's summary analysis can be found in this report which shows that emissions levels from individual/composite vehicle testing were well above the ranges of values for dilution tunnel blanks with the exception of hopanes and steranes emissions for the newer model-year strata. The contractor found that three PAHs could be potential markers for gasoline exhaust are indeno[123-cd]pyrene, benzo(ghi)perylene and coronene.

The contractor used the comparison of co-pollutants for assessing the overall accuracy and validity of the measurements. The contractor found that PM mass and total carbon (TC) are strongly correlated for the Phase 1 samples and poorly correlated for the lightly loaded Phase 3 samples. Similar results were obtained for elemental carbon (EC) measured by Thermal Optical Reflectance (TOR) versus average black carbon (BC) by the photoacoustic instrument. The contractor also noted when comparing to previous studies (e.g., Gasoline/Diesel PM Split Study) for highly loaded samples, PM mass is typically well correlated with TC and EC obtained by IMPROVE-TOR or STN-TOT agree with photoacoustic BC. That is not the case at lower sample loading where sampling artifacts associated with adsorbed organic compounds on the quartz filter may be relatively more important. The correlations of the sum of elements by X-Ray Fluorescence (XRF) analysis show the similar correlations to PM mass as TC, which again reflects the lower mass loadings for the Phase 3 samples. The contractor found that sulfur by XRF analysis is strongly correlated to sulfate by ion chromatography. It was shown that benzo(ghi)perylene, indeno[123-cd]pyrene and coronene all correlate well with TC emissions and that the sum of hopanes and steranes also correlated well with TC.

The contractor found abundances of various chemical species in the dilution blank and composite exhaust samples during each round of testing. Organic carbon (OC) and EC are the most abundant species in motor vehicle exhaust, accounting for over 95% of the total PM mass. For spark ignition (SI) vehicles, BC and PM emission rates can be several times larger during the cold start phase than during hot stabilized operation. Relatively clean SI vehicles produce BC emissions during the more aggressive portions of the driving cycle and during cold starts. Therefore, the emission profiles for clean SI vehicles from dynamometer tests may contain higher fractions of EC than would be produced in congested urban driving conditions. PM emissions from SI high-emitter contain predominantly OC. Variability of emissions from a vehicle may be as great as the difference between vehicles, particularly for the high emitters. The contractor found an abundances of individual organic species relative to total mass or carbon are generally consistent from profile to profile for organic and elemental carbon, PAH, hopanes & steranes, and nitroPAH. Alkanes and polars appear too variable to be useful for receptor modeling. Gasoline vehicles, whether low or high emitters, emit higher proportions of high molecular-weight particulate PAHs (e.g., benzo(b+j+k)fluoranthene, benzo(ghi)perylene, indeno(1,2,3-cd)pyrene, and coronene). Hopanes and steranes are markers for lubricating oil from internal combustion engines, and their emission rates were higher for high emitting vehicles. EPA will be conducting its own investigation on the data gathered during this test program and will be releasing its conclusions in the near future.

<u>Gaseous-Phase Emissions Speciation from Light-Duty Gasoline Vehicles</u>

Volatile organic compounds (VOC) chemical speciation was determined for the individual/composite samples and composite dilution tunnel blank samples. The contractor field-blank corrected all data and reported all their findings in this report. The contractor performed a validity check by comparing the total nonmethane hydrocarbon (NMHC) values from the DRI

VOC speciation samples to the corresponding data obtained by Bevilacqua Knight Incorporated (BKI). With the exception of two obvious outliers (S1-2 and S5-4), were shown to have good agreement for the uncomposited samples from Round 1. However, the contractor found that there was not agreement with Round 2. Further investigation, revealed a sampling train was disconnected from the main sampling line and capped off during some temperature experiments conducted between the Rounds.

The contractor developed a methodology for reconstructing the missing VOC speciation data by first calculating the ratios of reported concentration of each hydrocarbon compound to the total HC reported for each run. These ratios were then averaged for all valid canister samples and the resulting average and standard deviation of the ratios were used to estimate the hydrocarbon speciation for the invalid samples based on the total HC from BKI's bag samples. The contractor included this data in a separate table for its review.

The contractor found that that the distributions in emission rates for BTEX and formaldehyde show that newer model year vehicles are generally clean and that emissions of older vehicles are highly variable with some vehicles emitting BTEX and formaldehyde at rates exceeding that of normal emitters by more than two orders of magnitude. The contractor found an abundance of benzene, toluene, ethylbenzene and xylenes are similar among the samples and between Rounds 1 and 2. There also seems to be a strong correlation among related aromatic hydrocarbon species for all exhaust composites. EPA will be expanding its review of this data and will be conducting further analysis to make a better determination on all of these preliminary findings.

Next Steps in EPA’s Data Review and Analysis

This contractor’s report did not directly answer the main objectives of the study but the contractor provided EPA with enough quality assurances and checks for EPA to start address them. EPA will take this contractor’s report and will be reviewing its data and conducting its own comprehensive review and evaluation on the observations and data gathered during the study. EPA will release this report and data to the general public after receiving approval from our sponsors. EPA will also be comparing this data with other know emission test programs conducted by other testing organizations and by ourselves as part of its comprehensive review and will be releasing its findings in subsequent reports in its efforts better understand and address its use in the development of our models and regulations.

Overview of Test Program Results

Overview of Sample Selection and Recruiting

The recruitment process required deriving a targeted (stratified) sample of vehicles from a cohort of 2000 households generated through random sampling in the Kansas City Metropolitan Statistical Area (MSA). The Mid-American Regional Council (MARC) completed a comprehensive travel survey of Kansas City regional households in spring of 2004. [1] That study's resulting dataset was reviewed for use as the initial cohort of households.

The use of the MARC 2004 Household Travel Study (MARC Study) as the cohort from which to recruit vehicles allowed vehicle recruitment to begin earlier than planned in Round 1. It also provided, inherent in the data set, household data elements including year, make, model, body type, and fuel type for each household vehicle, home address and preferred method for contacting them. One of the challenges of Round 1 testing was that there were fewer than expected older vehicles available for recruitment. In fact, by the end of Round 1 testing, the available vehicle pool for recruiting the oldest vehicles (Pre-1981 and 1981-1990 trucks and cars) had been virtually exhausted. This posed a challenge for Round 2 testing. Fortunately, the Kansas and Missouri Vehicle Registration database provided a large pool of vehicles that can be sampled and recruited for testing. That database was used to draw representative stratified random samples for recruiting as many vehicles as necessary to achieve the desired sampling targets.

Meeting the study goals required deriving a targeted (stratified) sample of vehicles from a cohort of 2000 households generated through random sampling in the KCMSA. The methodology for generating the sample originally called for conducting a Random Digit Dialing (RDD) telephone survey of households (HH) in the KCMSA. This methodology relied on two key underlying assumptions:

- An RDD sample of HHs will generate a representative sample of the population in the Kansas City MSA, and
- The cohort of HHs participating in the RDD survey will provide a representative sample of vehicles for emissions testing.

Because ERG team member NuStats had recently completed the 2004 Kansas City Travel Behavior Survey for MARC, the use of the survey data (conducted in Spring 2004 using an RDD sample design) was recommended. NuStats conducted a comparison of the MARC data with Census 2000 data at the household and person levels using a number of demographic and geographic characteristics. As evidenced in Tables OS-1 and OS-2, using the MARC RDD sample to create a cohort of households satisfactorily represented the Kansas City MSA population on a number of demographic / geographic characteristics. [2]

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[1] Kansas City Regional Household Travel Survey Final Report, http://www.marc.org/transportation/pdf/travelsurvey2003.pdf

[2] The MARC survey distributions are unweighted (or raw), allowing for more informed assessment of the product of RDD sampling. It should be noted that survey data are typically weighted to correct for discrepancies between known Census population distributions (for selected demographic variables) and the unweighted survey results. But a comparison of *weighted* survey data and the Census distributions would mask any real differences between survey and Census distributions for those

In the process of conducting the MARC household travel survey (which forms the foundation of the cohort for the EPA Emissions Testing Project), NuStats randomly sampled and contacted 5,500 regional households. Of these, 4,001 agreed to provide their information and 3,049 ultimately completed all aspects of the survey. Non-respondents are those 1,500 households that were contacted and firmly refused to participate.

A discussion of the characteristics of those 1,500 households that chose not to participate is very limited. Most refusals took place during the introduction to the study, prior to the interviewer obtaining any demographic information about the household. The only item that can be reviewed is the geographic distribution of refusers, since all sampled telephone numbers were initially flagged with the anticipated county of residence. This distribution is shown in Table OS-3, and the proportion of refusals matched the proportion of participants by county of residence.

Of those 4,001 households that agreed to participate in the MARC survey, 2,887 with at least one vehicle comprised the Round 1 sample. Of those, a total of 1,236 were contacted about participation in this Round 1 emissions testing effort. Of these households, 221 ultimately agreed to participate in the survey. The remainder either refused to participate (360), could not be contacted after multiple attempts (497), or their phone numbers were no longer valid (106). On average, each household was attempted 2.8 times. The overall response rate for the study was 21%.

demographic variables that were used in generating the weighting adjustments. Thus, the survey data used in the comparison were not weighted.

Table OS-1. Demographic Comparison of MARC RDD Survey of Households and Census 2000 Distributions

Demographic Characteristic	RDD Survey (n=4,001)	Census 2000
Household size		
1	26.8%	27.4%
2	33.3%	33.0%
3	16.0%	16.2%
4+	23.9%	23.4%
total	*100.0%*	*100.0%*
HH Vehicles		
0	5.8%	7.4%
1	32.9%	33.9%
2	42.7%	41.7%
3+	18.6%	17.0%
total	*100.0%*	*100.0%*
HH Income		
< 15k	9.9%	12.2%
15k - < 25k	10.2%	11.3%
25k - < 50k	30.2%	30.1%
50k - < 100k	35.9%	33.6%
100k +	13.8%	12.8%
(refusal)	(5.9%)	--
total	*100.0%*	*100.0%*
Residency Type		
single family	76.8%	69.0%
all other	23.2%	31.0%
total	*100.0%*	*100.0%*
Race		
White	81.3%	81.6%
Black/African American	10.7%	14.1%
Other	8.0%	4.3%
total	*100.0%*	*100.0%*
Respondent Age		
< 20	29.6%	29.1%
20 - 24	4.3%	6.1%
25 - 54	43.3%	45.3%
55 - 64	9.9%	8.2%
65 +	12.8%	11.3%
refusal	(1.2%)	--
total	*100%*	*100.0%*

Table OS-2. Comparison of MARC RDD Survey and Census 2000 Geographic Distributions

County, State:	Census 2000	RDD Survey (N = 4,001)
Cass County, MO	4.6%	4.9%
Clay County, MO	11.1%	12.3%
Jackson County, MO	40.6%	39.9%
Platte County, MO	4.5%	4.6%
Johnson County, KS	26.6%	26.1%
Leavenworth County, KS	3.5%	3.3%
Wyandotte County, KS	9.1%	8.9%
total	100%	100%

Table OS-3. MARC Household Survey Non-Respondents and Respondents by County of Residence

County	Non-Responders	Respondents
Johnson County, KS	29.7%	26.4%
Leavenworth County, KS	3.6%	3.1%
Wyandotte County, KS	7.8%	8.6%
Clay County, MO	5.5%	4.8%
Cass County, MO	12.5%	12.3%
Jackson County, MO	37.5%	40.4%
Platte County, MO	3.5%	4.5%

Source: Non-Respondents based on Sample File for the Kansas City Regional Household Travel Survey (KCRHTS), unweighted. Includes all households that refused to participate in the study. Respondent proportion reflects the weighted distribution of households participating in the survey.

Of the 221 households that ultimately had their vehicles tested, 23 had initially refused to participate during the recruitment call but were converted after another focused attempt. An additional 29 households cancelled their initial scheduled testing, but agreed again to have the vehicle tested later during Round 1. Tables OS-4 and OS-5 compare the Round 1 participants vs. those that refused testing in terms of the county of residence, income, and vehicles owned. In terms of county of residence, the refusers were most likely to come from Jackson County, Johnson County, or Cass County. However, there was very little difference in the proportions of refusers and regular participants by county of residence. This effort to recruit vehicles that had initially refused participation was designed to be only a part of Round 1 testing.

Table OS-4. Round 1 Refusers and Respondents by County of Residence

County	Refusers	Regular Participants
Johnson County, KS	22.2%	25.6%
Leavenworth County, KS	2.2%	6.4%
Wyandotte County, KS	9.5%	10.4%
Clay County, MO	6.0%	4.8%
Cass County, MO	14.0%	9.6%
Jackson County, MO	43.2%	40.0%
Platte County, MO	2.9%	3.2%

Source: Non-Respondents based on unweighted KCRHTS data for refusers and regular participants in Round 1 of the study.

The refusers were more likely to report a lower income than that reported by regular participants (22% compared to 16%, respectively).

Table OS-5. Round 1 Refusers and Respondents by Income Level

Income	Refusers	Regular Participants
<15,000	8.8%	4.9%
15,000 - < 25,000	13.5%	10.6%
25,000 - <50,000	35.5%	37.4%
50,000 - < 75,000	18.9%	20.3%
75,000-<100,000	14.5%	17.9%
100,000+	8.8%	8.9%

Source: Non-Respondents based on unweighted KCRHTS data for refusers and regular participants in Round 1 of the study.

Section 3.2 of the main body of the report defines the study cohort as being derived from the MARC 2004 household travel study sample, and demonstrates that the MARC sample represented the KCMSA. In evaluating below the MARC sample with the Rounds 1 and 2 participant characteristics and the 2000 Census data for the study area, the first comparison is on key household characteristics, including household size, vehicles, household workers, household income, residence type, and home ownership as shown in Table OS-6. This table shows the raw and weighted MARC sample characteristics, the raw Rounds 1 and 2 participant characteristics, and the 2000 Census data for the study area.

Table OS-6. MARC Household Characteristics Compared to Census

Characteristic	MARC Raw Data	MARC Weighted Data	EPA Round 1 Data	EPA Round 2 MARC Data Only	Round 1 & Round 2	Census Data
Household Size						
1	28.40%	27.50%	16.80%	7.06%	10.84%	27.40%
2	34.00%	32.90%	32.80%	36.47%	34.94%	32.90%
3	15.80%	16.20%	14.40%	20.00%	18.07%	16.20%
4+	21.80%	23.50%	36.00%	36.47%	36.14%	23.50%
Household Vehicles						
0	5.30%	7.40%	0.00%	0.00%	0.00%	7.40%
1	32.00%	33.90%	12.80%	10.59%	12.05%	33.90%
2	44.20%	41.70%	44.80%	54.12%	49.40%	41.70%
3+	18.50%	17.00%	42.40%	35.29%	38.55%	17.00%
Household Vehicles		(Reweighted from above to include households with 1-3+ vehicles)				
1	33.79%	36.61%	12.80%	10.59%	12.05%	36.61%
2	46.67%	45.03%	44.80%	54.12%	49.40%	45.03%
3+	19.54%	18.36%	42.40%	35.29%	38.55%	18.36%
Geography						
Urban	18.50%	20.60%	23.20%	12.94%	16.87%	20.60%
Suburban 1st Ring	26.20%	26.00%	28.80%	25.88%	29.52%	26.00%
Remainder	55.20%	53.40%	48.00%	61.18%	53.61%	53.40%
Household Income						
< $15k	8.90%	9.60%	4.80%	3. 53%	4.22%	12.20%
$15k - < $25k	9.50%	9.70%	10.40%	7.06%	7.83%	11.30%
$25k- < $50k	29.70%	29.80%	36.80%	31.76%	34.34%	30.10%
$50k - < $100k	37.60%	36.10%	37.60%	40.00%	40.36%	33.60%
$100k +	14.40%	13.70%	8.80%	12.94%	10.84%	12.80%
Income refusals	5.50%	5.50%	1.60%	4.71%	2.41%	--
Residence Type						
Single family	78.40%	76.90%	87.20%	91.76%	87.95%	69.00%
All other types	21.60%	23.10%	12.80%	8.24%	12.05%	31.00%

Source: 2000 Census and Kansas City Regional Household Travel Survey (KCRHTS), weighted. As documented in the Kansas City Regional Household Travel Survey Final Report, the data were weighted by household size, household vehicles, and geography (home location). Round 1 & Round 2 participants are summarized using raw KCRHTS data as the EPA surveys didn't obtain demographic information.

- MARC Sample: For the most part, the weighted data compare favorably with the census data, indicating that the survey data set is representative of the regional population. The difference in the distribution of respondents based on residence type can be explained somewhat based on the proportion of sample types used in the study. Listed telephone numbers (those with complete address information for the household) are typically associated with households of longer tenure, which is correlated with living in a single-family dwelling and home ownership. Renters, who are considered to be more transient and living in housing types not characterized as single-family dwellings, may change telephone numbers more often and are typically more likely to have a number that is incomplete or not included in the listed telephone number database. The proportion of listed to not listed sample used in this study was 50/50, meaning that of the 40,000 pieces of sample used, 20,000 were associated with listed numbers and 20,000 were not. An effort more focused on renters would have required the use of more unlisted than listed numbers, which was not possible within the project's budget. Thus, the desire to achieve a good mix of residence type was balanced with the project budget and as a result, residence type came within 10% of the census parameters, but not within 5% like the other variables.
- Round 1 Participants. The Round 1 study design called for testing a specific combination of vehicles based on type (car vs. truck) and age. The testing goals were disproportionate to survey universe parameters, with a higher focus on older vehicles. In addition, only MARC households that owned vehicles could be considered for inclusion in the study. For comparison purposes, we have excluded households with 0 vehicles in one of the comparisons presented in Table OS-6. As a result of these various study parameters, the characteristics of the Round 1 households differs somewhat from those of the MARC and Census data. The Round 1 households were larger and owned more vehicles (again, given that vehicle ownership was a requirement for participation in the study, this finding was not surprising). The Round 1 households show a good geographic dispersion and tend to reflect more moderate income households. In terms of home ownership, there is a significantly higher proportion living in single-family residences. However, as with the main MARC survey, home ownership is a secondary variable of interest so this is not of great concern.
- Round 2 Participants. The Round 2 study design was similar to Round 1 and many of the household characteristics remained relatively constant and different from the MARC and Census data. Round 2 households were larger, owned more vehicles, reflected more moderate income levels and most tended to own single-family residences. In contrast to Round 1, Round 2 households' geographic dispersion was less urban.

Table OS-7 shows that the key person characteristics of MARC age and ethnicity also track the census fairly well. The higher proportion of "other" ethnicities reflects Hispanic respondents who identified themselves as such in answer to this question. With regard to the Rounds 1 and 2 data, the participants tend to be younger, on average. In terms of ethnicity, the Rounds 1 and 2 participants mirror the census extremely well.

Table OS-7. MARC Person Characteristics Compared To Census

Characteristic	MARC Raw Data	MARC Weighted Data	EPA Round 1 Data	EPA Round 2 MARC Data Only	Round 1 & Round 2	Census Data
Respondent Age						
<20	28.70%	30.30%	55.94%	53.94%	53.90%	29.10%
20 – 24	3.60%	3.60%	6.64%	5.45%	5.84%	6.10%
25 – 54	42.30%	41.70%	74.48%	70.91%	72.08%	45.30%
55 – 64	10.60%	9.80%	15.38%	20.61%	18.51%	8.20%
65+	14.80%	14.60%	10.14%	8.48%	9.42%	11.30%
Respondent Ethnicity						
White	84.80%	83.40%	79.20%	84.71%	82.53%	81.60%
Black/African American	9.10%	10.20%	12.80%	10.59%	11.45%	14.10%
Other	6.10%	6.40%	8.00%	4.71%	6.02%	4.30%

Source: 2000 Census and Kansas City Regional Household Travel Survey (KCRHTS), weighted. As documented in the Kansas City Regional Household Travel Survey Final Report, the data were weighted by household size, household vehicles, and geography (home location). Round 1 participants are summarized using raw KCRHTS data as the EPA surveys didn't obtain demographic information.

In addition to this MARC census comparison, ERG performed a comparison of the sample fleet with the KC fleet based on remote sensing measurements, in order to evaluate sample fleet and emissions relative to the KC fleet. The results of this analysis are provided later in this executive summary.

Testing Performed in Kansas City

The vehicle emissions tests were conducted in Kansas City using a LA-92 test cycle which consists of a cold start Phase 1 (first 310 seconds), a stabilized Phase 2 (311-1427 second), a 600-second engine off soak, and a warm start Phase 3 (repeat of Phase 1 of the LA92). Concentration and mass-based THC (total hydrocarbon), CO, CO_2, and NOx emissions measurements were gathered for study vehicles using EPA's Clayton Model CTE-50-0 portable CVS chassis dynamometer. In addition to the regulated gas pollutants measured via CVS, continuous measurements of PM mass were taken using an EPA-supplied Booker Systems Model RPM-101 Quartz Crystal Microbalance (QCM) and Thermo-MIE Inc. DataRAM 4000 Nephelometer. BC was measured continuously with a DRI photoacoustic instrument and integrated samples were collected and analyzed by DRI for PM gravimetric mass, elements, elemental and organic carbon, ions, particulate and semi-volatile organic compounds, and volatile organic air toxics. The samples were extracted from the dilution tunnel through a low particulate loss 2.5 μm cutpoint pre-classifier.

A major goal of the vehicle test program in Kansas City was to obtain up-to-date exhaust composition profiles of gasoline-powered vehicles for application in developing speciated emissions inventories and ambient source apportionment studies. An important issue in the general applicability of these vehicle exhaust composition provides as measured in Kansas City is determining whether gas-particle partitioning of certain organic compounds with the high-volume source sampling used in Kansas City differs substantially from the low-flow, ambient sampling techniques used in some source apportionment studies. To address this issue, organic samples were also collected during a portion of the second round of the study using ambient, low-flow samplers to compare with high-volume organic samples collected in the study.

Laboratory and on-road measurements of THC, CO, CO_2, and NOx emission concentrations and mass rates, along with OBD datastream information (when available) and vehicle activity data (via GPS) were gathered using eight portable emissions measurement systems (PEMS) provided by the USEPA. These systems, the SEMTECH-G manufactured by Sensors, Inc. were used to measure vehicle emissions concurrently with the dynamometer as the vehicle was receiving its LA-92 test.

The day prior to receiving the LA-92 dynamometer test, each study vehicle was driven on a pre-established "conditioning" route (similar in speed, acceleration, and distance to the LA-92 test). This conditioning drive allowed all vehicles to be similarly conditioned prior to dynamometer testing. PEMS instruments were used to measure THC, CO, CO_2, and NOx emissions information and activity data on all study vehicles as they were driven on their conditioning routes. Occasionally, study vehicles were unsuitable for dynamometer testing (generally vehicles that were too long or wide for the dynamometer of vehicles equipped with all-time all-wheel-drive). These "conditioning route" drives were also performed on these vehicles equipped with PEMS devices which allowed emissions information to be gathered on all study vehicles, regardless of dynamometer test eligibility.

In addition to PEMS measurements made during conditioning runs and dynamometer testing, over 60 program participants also participated in "driveaway" testing. This involved installing a PEMS unit on the participant's vehicle, driving the vehicle on the conditioning run, and then releasing the vehicle to the participant. The participant was encouraged to drive the vehicle as much as possible (i.e., by running their weekly errands), and to operate the vehicle as they normally would. This allowed activity, emissions, and fuel economy information to be gathered under "real-world" on-road driving conditions. The PEMS units continued to operate until the battery supply was depleted, typically 6 to 8 hours of operation.

In addition to the on-road activity data measured using PEMS instruments, activity dataloggers manufactured by Ease, Inc. were also used to gather activity data over a period of approximately one week on several study vehicles. However, these dataloggers weren't available until late during the second round of the study, limiting the amount of activity-only data gathered.

During both Rounds of the study, on-road data were collected using Environmental Systems Products (ESP)-supplied RSD equipment and personnel from the Saint Louis Clean Screen program. Two versions of RSD equipment were utilized for this study, the RSD 3000 (which is used in the St. Louis Clean Screen program), and the newer generation RSD 4000.

Fuel samples and oil samples were also gathered from all study vehicles, and sent to the USEPA NVFEL laboratory for analysis.

Summary of Results and Conclusions

It should be first noted that PM is a dynamic pollutant that is constantly being influenced by its environment therefore its formation is constantly changing both in the exhaust stream and in the ambient air. Our tests are a snapshot using specific measurements under specific laboratory and thermodynamic conditions. Real-world PM may differ significantly.

As mentioned above, all vehicles tested during the KC project were subjected to many on road and dynamometer tests. Measurements made during these tests are detailed in Section 4 of the main report. A summary is provided below. For brevity, only a summary of primarily the PM data is presented in this executive summary; all other pollutants are discussed in Section 4.

Round 1 vehicle testing targets and actual vehicles tested on the dynamometer are shown in Table OS-8. Although the total number of vehicles dynamometer tested exceeded project goals, several strata targets were not achieved (most notable in bins 1 and 5). The MARC vehicle database was solely used for vehicle recruitment (via random digit dialing, or RDD) for Round 1 recruiting. This database was supplemented with the Kansas City registration database after Round 1 to help recover these shortfalls during Round 2 recruiting.

Table OS-8. Number of Vehicles Dynamometer Tested During Round 1

Bin	Vehicle Type	Model Year Group	Round 1 Goal	Round 1 Tested	% of Goal
1	Truck	Pre-1981	16	2	13%
2	Truck	1981-1990	26	21	81%
3	Truck	1991-1995	26	18	69%
4	Truck	1996+	39	39	100%
5	Car	Pre-1981	16	6	38%
6	Car	1981-1990	51	49	96%
7	Car	1991-1995	34	39	115%
8	Car	1996+	42	87	207%
		Total	250	261	104%

Table OS-9 lists the various tests conducted during Round 1, in comparison with project goals. PEMS testing on conditioning runs was performed on all vehicles, regardless of dynamometer eligibility.

Table OS-9. Round 1 Tests Conducted

Test Type	Round 1 Goal	Round 1 Tested
PEMS Conditioning Test	All	284
Replicate PEMS Conditioning Test	1 per week	17
PEMS Driveaway Test	N/A	13
Dynamometer/PEMS Test	250	261
Dynamometer/PEMS Test Replicate	1 per week	15
Dynamometer/PEMS Control Vehicle Test	1 per week	12

In order to better achieve strata-specific test targets during Round 2 testing, the MARC database used for Round 1 recruiting was supplemented with the KC registration database for Round 2 recruiting of Bins, 1, 2, 5, and 6. As can be seen in Table OS-10, this significantly improved recruiting efforts.

Table OS-11 lists the various tests conducted during Round 2, in comparison with project goals. Regardless of dynamometer test eligibility, PEMS tests (on the conditioning run) were performed on all vehicles (excluding vehicles whose interiors would not accommodate a PEMS device).

Table OS-10. Number of Vehicles Dynamometer Tested During Round 2 (excluding Round 1 Retest Vehicles)

Bin	Vehicle Type	Model Year Group	Round 2 Goal	Round 2 Tested	% of Goal
1	Truck	Pre-1981	10	9	90
2	Truck	1981-1990	37	29	78
3	Truck	1991-1995	30	31	103
4	Truck	1996+	47	50	106
5	Car	Pre-1981	15	14	93
6	Car	1981-1990	34	36	106
7	Car	1991-1995	36	37	103
8	Car	1996+	27	29	107
		Total	236	235	100

Table OS-11. Round 2 Tests Conducted

Test Type	Round 2 Goal	Round 2 Tested
PEMS Conditioning Test (excluding replicates)	All	324
Replicate PEMS Conditioning Test	1 per week	19
PEMS Driveaway Test	50	51
Dynamometer/PEMS Test (excluding replicates)	236	235
Dynamometer/PEMS Test (Round 1Retests)	25	42
Dynamometer/PEMS Test Replicate	1 per week	11
Dynamometer/PEMS Control Vehicle Test	1 per week	12
PAMS Driveaway Test	N/A	8

Review of PM Emissions Trends

Figures OS-1 and OS-3 present composite $PM_{2.5}$ dynamometer measurements from Rounds 1and 2, respectively, classified by vehicle type and model year. Plots for all other criteria pollutants are presented in Section 4. As expected, newer vehicles have lower $PM_{2.5}$ emissions, and vehicle age appears to have a stronger influence on $PM_{2.5}$ emissions than vehicle type. The variability of emissions for vehicles in the same selection bin is also demonstrated by the plot.

Figures OS-2 and OS-4 present overlay plots of the percent projected-fleet distribution of composite $PM_{2.5}$ emissions from Rounds 1 and 2. Using both the Kansas City fleet distribution data complied for each vehicle testing stratum (vehicles taken from Kansas City vehicle registration list) and actual Rounds 1and 2 vehicle tested stratum distribution (actual vehicle recruited into the dynamometer testing program) we can project a simulated fleet distribution. A solid line represents cumulative percent projected-fleet distribution, while a dashed line represents percent projected-fleet distribution. The horizontal dashed line is a reference line that represents the maximum PM value (80 mg/mile) for Tier 1 vehicles tested under the Federal Test Procedure (approximately between model years 1996 – 2003). The $PM_{2.5}$ distribution shows that more than 95 percent of the fleet has $PM_{2.5}$ emission rates lower than 80 mg/mile. This simulation is applied here for QA/QC purposes only and not for modeling purposes. It provides some insight to the effectiveness of the recruitment process to acquire vehicles that emit high PM emissions.

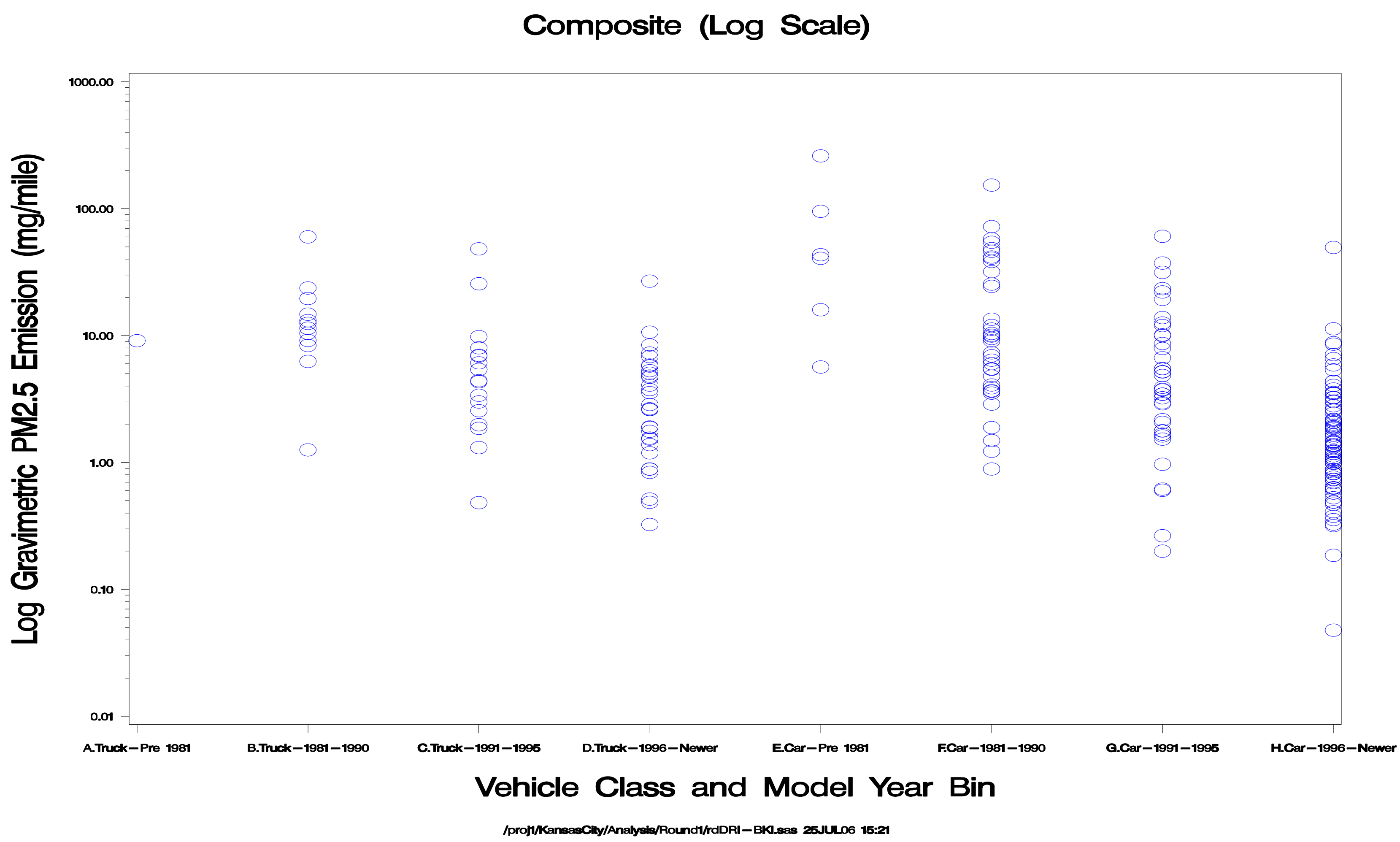


Figure OS-1. Round 1 - $PM_{2.5}$ Emissions by Class-Year Bin

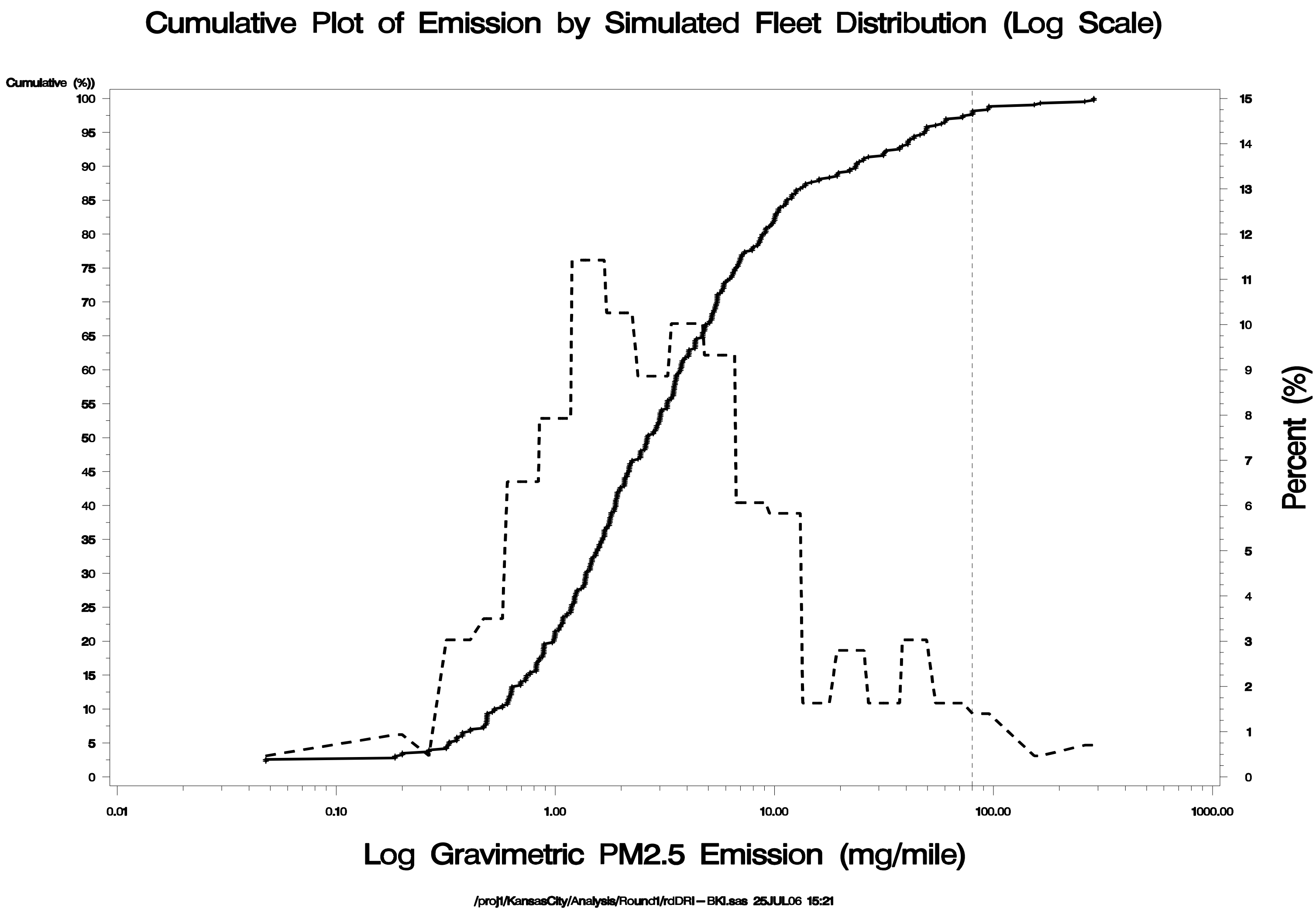


Figure OS-2. Round 1 – Percent Projected-Fleet Distribution of Composite $PM_{2.5}$

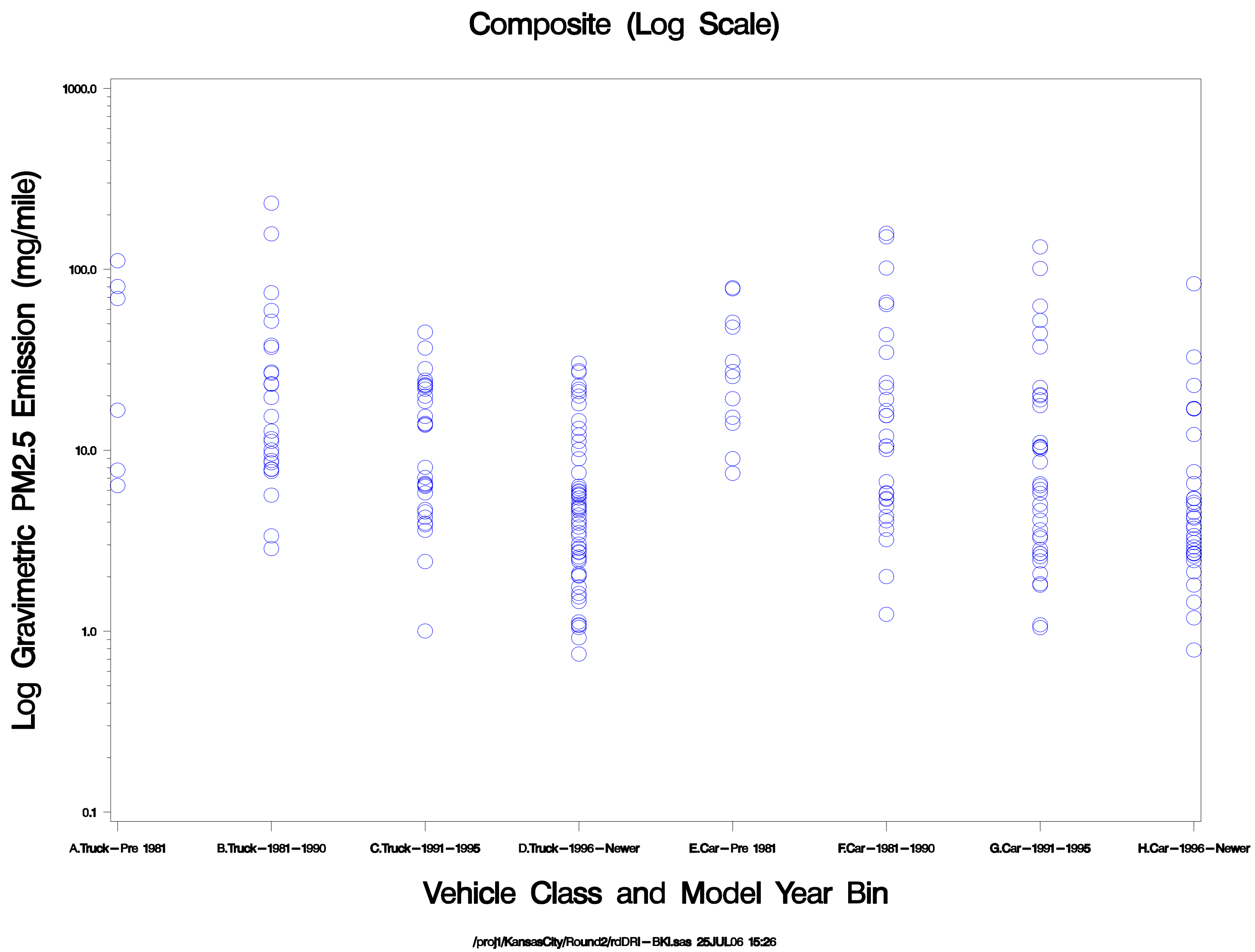


Figure OS-3. Round 2 - $PM_{2.5}$ Emissions by Class-Year Bin

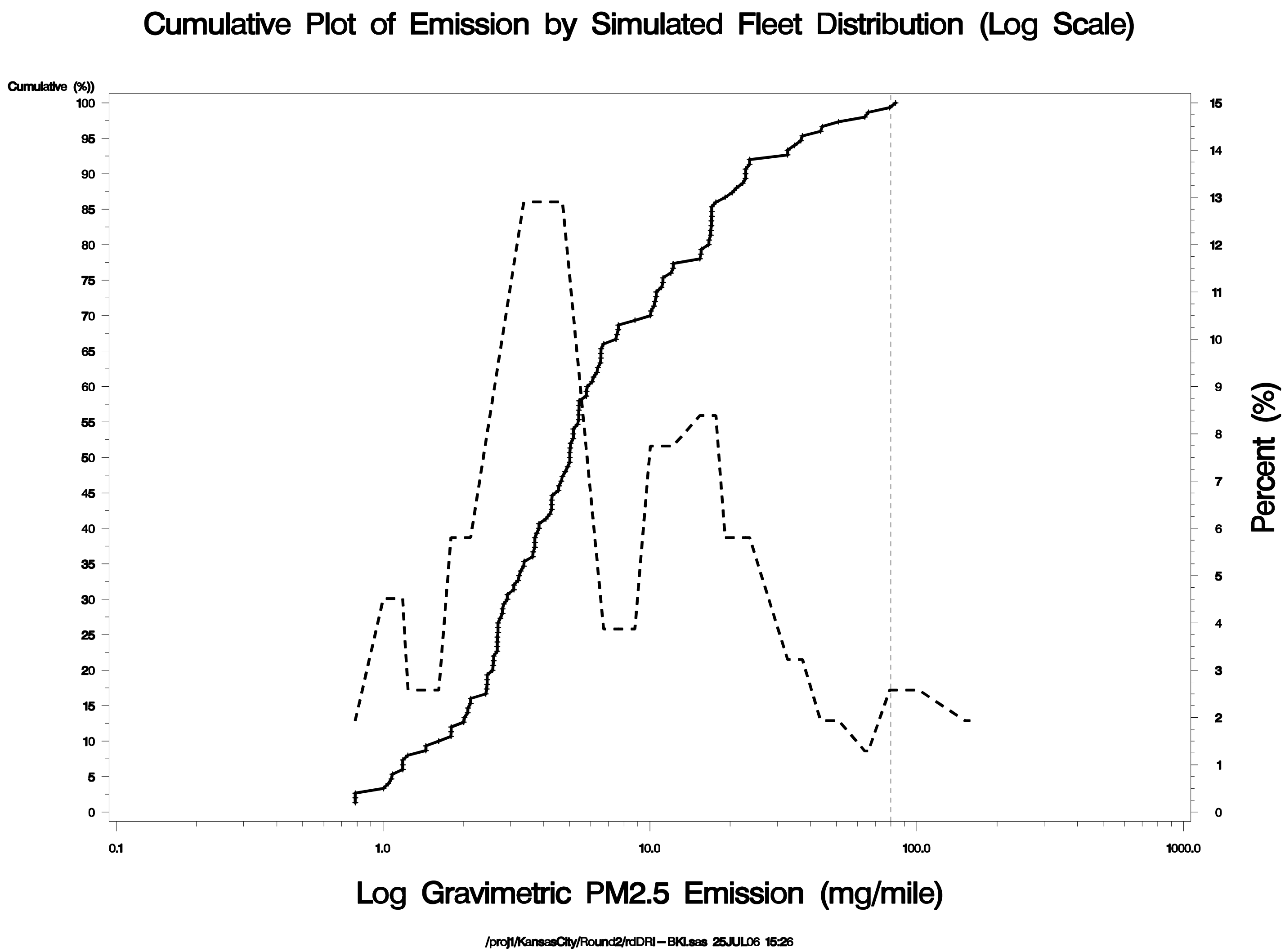


Figure OS-4. Round 2 - Percent Projected-Fleet Distribution of Composite $PM_{2.5}$

RSD Data Collection

On-road data were collected using Remote Sensing Devices (RSD) during both Rounds of the study. The purpose of these deployments was to document the on-road fleet in the Kansas City area and to measure on-road emissions. ERG subcontracted with Environmental Systems Products (ESP) to collect RSD data for this project. ESP used RSD equipment and personnel from the Saint Louis Clean Screen program. They also deployed a newer generation of RSD equipment (RSD 4000, as opposed to the older generation RSD 3000) in parallel to the equipment from their St. Louis program, so side-by-side data were collected using both generations of equipment. Note that for Round 2, only RSD 4000 equipment was used.

During Round 1 of the study, RSD sampling was conducted at eight sites. The ESP team collected data during 5-consecutive days in each of July, August, and September 2004. During Round 2, the ESP team collected RSD data at 5 sites during 5-consecutive days in each of January, February, and March of 2005.

Fleet model year distributions are presented in Section 4. The RSD measurements provided an opportunity to compare the vehicles which were tested in the KC project with the general Kansas City fleet. Even though different vehicles were contained in the two groups, the following analysis compares the individual vehicles of the same vintage in approximately similar driving conditions. ERG performed a comparison of RSD data collected in the Kansas City area with second-by-second (SBS) observations from the PEMS unit connected to the dynamometer.

Thousands of RSD observations yielded VINs, speed, acceleration, and concentrations of HC, CO, and NOx for a wide variety of vehicles in the Kansas City fleet. This data, along with measured RSD site grades and vehicle weights from the ERG VIN Decoder, were used to calculate vehicle specific power (VSP) for each instantaneous observation. The calculation was based on equations used by EPA in MOVES2004, using SAS code provided by Jim Warila.

The same calculations were performed on second-by-second observations obtained from a PEMS unit on the dynamometer. Having determined VSP for each instantaneous observation, the data was segregated by model year VSP bins for further analysis. Since the valid VSP range for RSD is 5 to 20 kW/tonne, only those measurements were retained. The VSP bins were created using ranges of 6 – 9, 9 – 12, and 12 – 18 kW/tonne. All dynamometer test cycle's Phase data gathered during Round 1 was used except data gathered during Phase 1 of the LA92 test were dropped, since these would represent cold-start emissions, a scenario unlikely at the RSD sites selected for this study.

For each model year -VSP bin combination, the mean and variance of HC, CO, and NOx were calculated for both RSD and SBS data sets. For the SBS data, for a given bin, a test vehicle's measurements were averaged first, then the average of the averages were calculated to produce the cell average.

Graphs of pollutant concentrations of RSD versus Dyno SBS for CO, and CO_2 for Rounds 1 and 2 are provided in Figures OS-5 through OS-8.

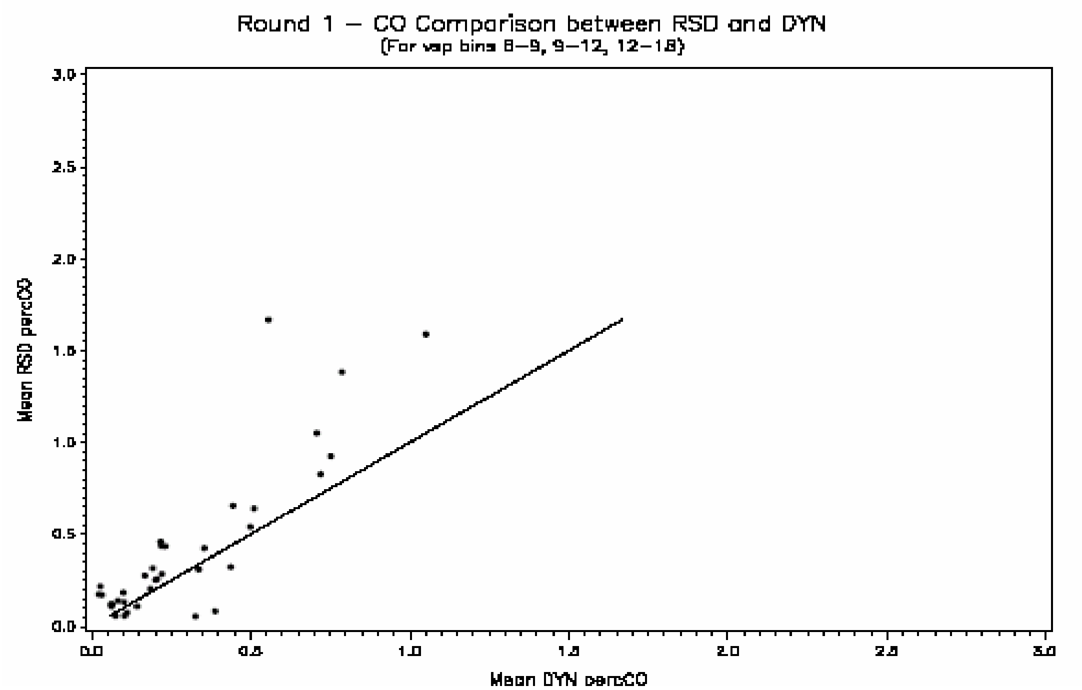


Figure OS-5. Round 1 RSD vs. Dynamometer CO Comparison

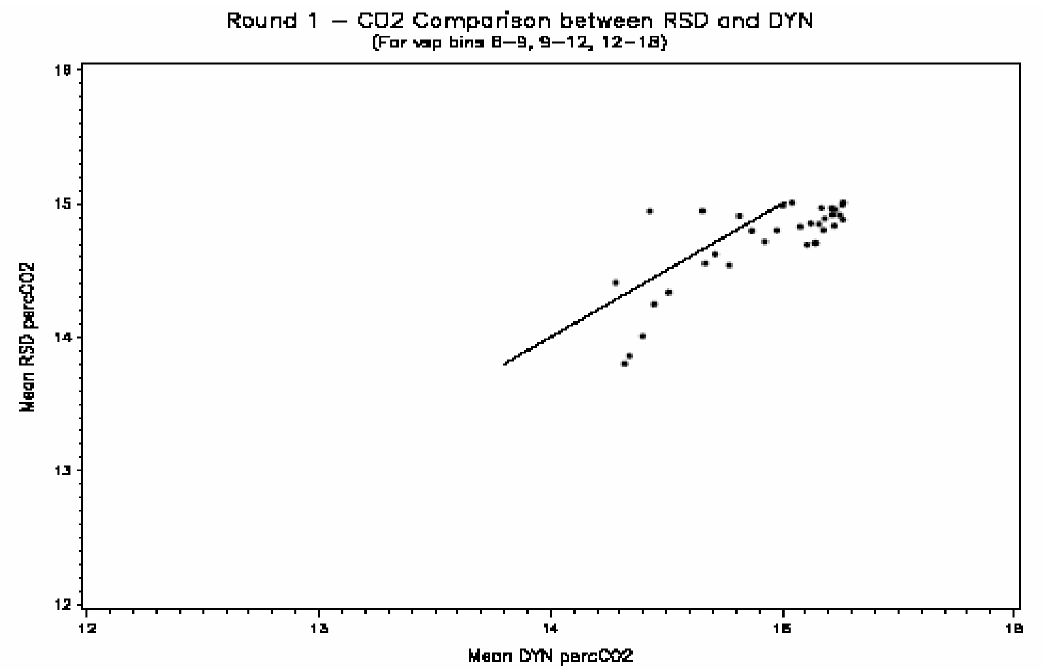


Figure OS-6. Round 1 RSD vs. Dynamometer CO_2 Comparison

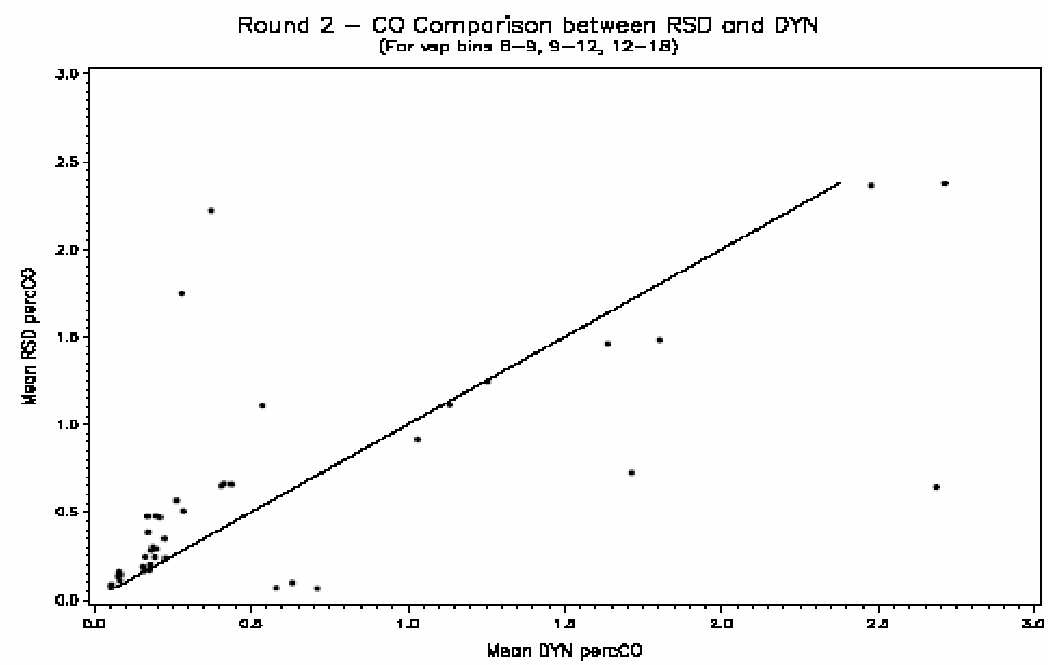


Figure OS-7. Round 2 RSD vs. Dynamometer CO Comparison

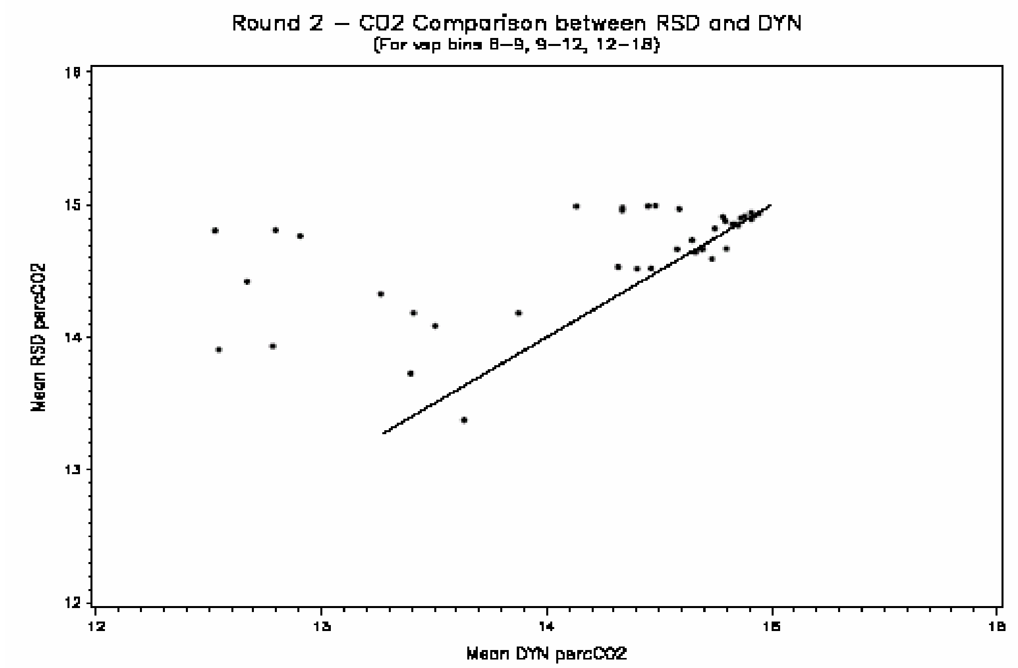


Figure OS-8. Round 2 RSD vs. Dynamometer CO_2 Comparison

Round 1 Summer Regulated Pollutants

Two hundred eighty-one vehicles were tested during Round 1. Their emissions results are summarized below in Table OS-12. This data has been aggregated together from the second-by-second files gathered from the BKI's laboratory analyzers for each individual vehicle's test phase and composite. Each vehicle's data was then average together within other vehicle data in each bin. This data has not been corrected for possible different ambient temperatures that the vehicle was conditioned and tested at.

Table OS-12. Round 1 Average Emission Data for Each Vehicle Bin including Individual Phase and Composite Test

Bin	Vehicle Type	Phase	THC g/mile	CO g/mile	CO2 g/mile	NOx g/mile	PM mg/mile
1	Truck	Phase 1	17.04	203.52	859.57	2.84	87.80
	Pre-1981	Phase 2	6.06	64.94	594.34	2.92	45.05
		Phase 3	8.54	68.45	647.32	2.9	9.14
		Composite	**1.89**	**19.81**	**136.89**	**0.6**	**44.80**
2	Truck	Phase 1	8.69	80.01	684.90	4.02	93.80
	1981-1990	Phase 2	2.58	41.25	408.36	2.29	37.85
		Phase 3	5.06	51.87	528.49	2.65	51.05
		Composite	**0.94**	**10.70**	**100.75**	**0.56**	**48.70**
3	Truck	Phase 1	4.30	34.66	770.23	4.19	14.48
	1991-1995	Phase 2	0.47	6.62	476.13	1.89	11.13
		Phase 3	1.33	11.96	636.71	2.54	14.41
		Composite	**0.31**	**2.88**	**118.96**	**0.52**	**12.37**
4	Truck	Phase 1	2.05	14.10	815.98	1.99	9.58
	1996+	Phase 2	0.11	2.12	480.59	0.51	4.01
		Phase 3	0.31	3.55	648.30	0.79	2.33
		Composite	**0.12**	**1.04**	**121.88**	**0.18**	**4.21**
5	Car	Phase 1	17.66	250.41	676.00	2.61	160.77
	Pre-1981	Phase 2	7.45	113.63	407.01	2.72	73.09
		Phase 3	11.85	137.86	515.28	2.87	63.73
		Composite	**2.20**	**30.18**	**100.38**	**0.56**	**77.09**
6	Car	Phase 1	5.70	43.34	647.44	4.20	35.02
	1981-1990	Phase 2	1.25	15.72	388.74	2.61	18.94
		Phase 3	2.62	21.62	527.28	3.33	8.79
		Composite	**0.53**	**4.76**	**98.69**	**0.64**	**19.24**
7	Car	Phase 1	3.37	25.78	634.01	2.92	11.43
	1991-1995	Phase 2	0.34	8.53	377.44	1.16	7.54
		Phase 3	0.94	10.01	510.75	1.61	5.08
		Composite	**0.24**	**2.58**	**95.67**	**0.34**	**8.22**
8	Car	Phase 1	2.00	12.76	634.13	1.87	7.40
	1996+	Phase 2	0.08	2.81	366.91	0.42	2.48
		Phase 3	0.20	2.78	492.57	0.60	1.80
		Composite	**0.11**	**1.00**	**93.51**	**0.16**	**2.86**

Round 2 Winter Regulated Pollutants

Two hundred ninety-seven vehicles were tested during Round 2. Their emissions results are summarized below in Table OS-13. This data has been aggregated together from the second-by-second files gathered from the BKI's laboratory analyzers for each individual vehicle's test phase and composite. Each vehicle's data was then average together within other vehicle data in each bin. This data has not been corrected for possible different ambient temperatures that the vehicle was conditioned and tested at.

Table OS-13. Round 2 Average Emission Data for Each Vehicle Bin including Individual Phase and Composite Test

Bin	Vehicle Type	Phase	THC g/mile	CO g/mile	CO2 g/mile	NOx g/mile	PM mg/mile
1	Truck	Phase 1	14.14	216.01	800.09	2.80	281.33
	Pre-1981	Phase 2	4.46	51.12	530.98	2.94	101.70
		Phase 3	7.17	57..96	618.29	2.93	28.12
		Composite	**1.47**	**17.82**	**123.74**	**0.59**	**106.13**
2	Truck	Phase 1	12.25	156.37	699.87	3.37	210.94
	1981-1990	Phase 2	1.78	23.64	456.72	2.4	31.43
		Phase 3	3.67	20.91	566.51	2.93	22.16
		Composite	**0.92**	**10.39**	**108.71**	**0.55**	**39.69**
3	Truck	Phase 1	5.92	79.06	776.50	3.56	40.05
	1991-1995	Phase 2	0.49	7.48	465.33	1.6	19.13
		Phase 3	1.18	10.54	587.15	2.03	5.22
		Composite	**0.37**	**4.78**	**114.33**	**0.43**	**20.65**
4	Truck	Phase 1	3.76	35.75	834.76	2.30	40.84
	1996+	Phase 2	0.14	2.89	468.84	0.64	6.02
		Phase 3	0.30	3.48	609.72	0.75	3.26
		Composite	**0.19**	**2.04**	**118.81**	**0.21**	**7.92**
5	Car	Phase 1	16.82	251.28	767.71	2.39	361.73
	Pre-1981	Phase 2	3.00	48.03	492.37	2.89	42.34
		Phase 3	4.73	57.55	609.40	3.12	14.31
		Composite	**1.30**	**16.90**	**117.49**	**0.57**	**57.47**
6	Car	Phase 1	8.83	113.86	652.62	3.49	114.81
	1981-1990	Phase 2	1.61	21.60	386.61	2.26	23.86
		Phase 3	2.81	26.61	493.37	2.79	13.68
		Composite	**0.71**	**8.68**	**95.86**	**0.54**	**28.17**
7	Car	Phase 1	6.37	89.09	701.82	2.77	55.06
	1991-1995	Phase 2	0.46	9.37	399.91	1.03	16.25
		Phase 3	1.00	10.32	525.36	1.41	6.70
		Composite	**0.38**	**5.41**	**101.08**	**0.31**	**18.51**
8	Car	Phase 1	4.11	39.35	700.27	1.79	46.88
	1996+	Phase 2	0.08	2.24	379.66	0.38	6.2
		Phase 3	0.12	2.00	494.48	0.45	4.21
		Composite	**0.19**	**2.06**	**97.47**	**0.14**	**8.23**

Summer vs. Winter Comparison of Regulated Pollutants

Forty-two vehicles were tested in both Rounds 1 and 2 of the study, for the purpose of comparing summer and winter vehicle emissions. Four of these vehicles were tested twice, for a total of forty-six retest pairs across Rounds 1 and 2. Figures OS-9 and OS-10 below present logarithmic plots comparing composite gravimetric $PM_{2.5}$ and NOx across the two Rounds of testing, with a 1:1 line provided for reference. Figure OS-11 shows the $PM_{2.5}$ measurements as a function of temperature for the two Rounds. The winter data show higher emissions and a larger variability in emissions.

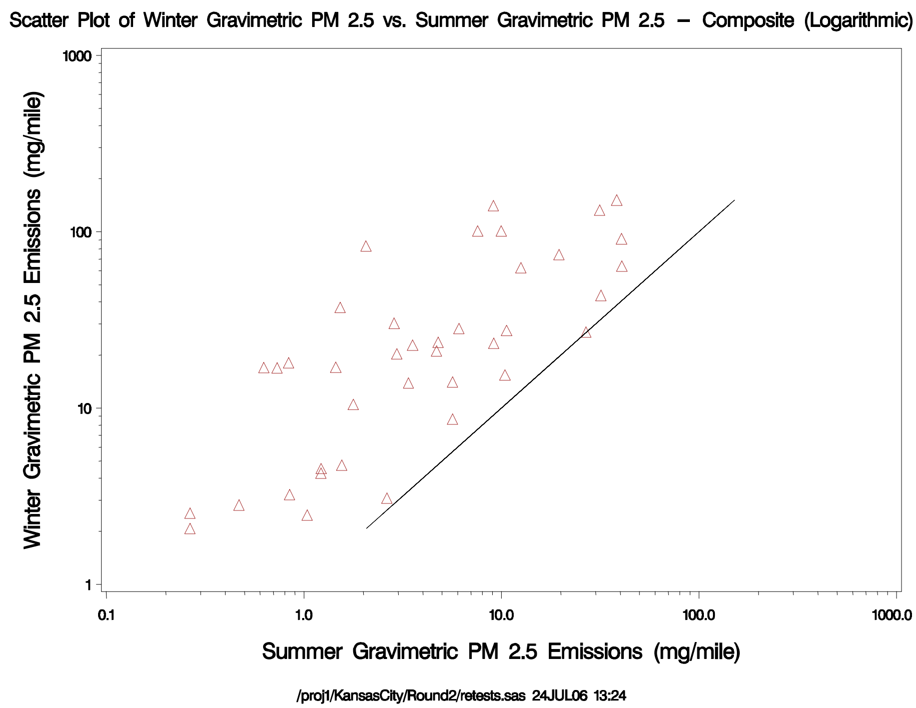


Figure OS-9. Winter vs. Summer Gravimetric PM 2.5

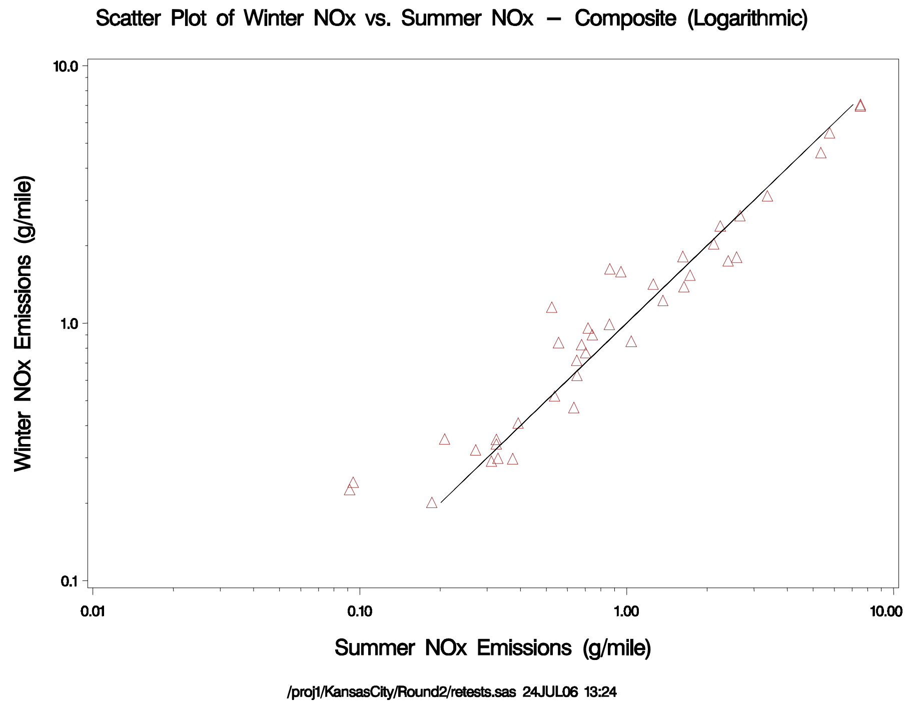


Figure OS-10. Winter vs. Summer NOx

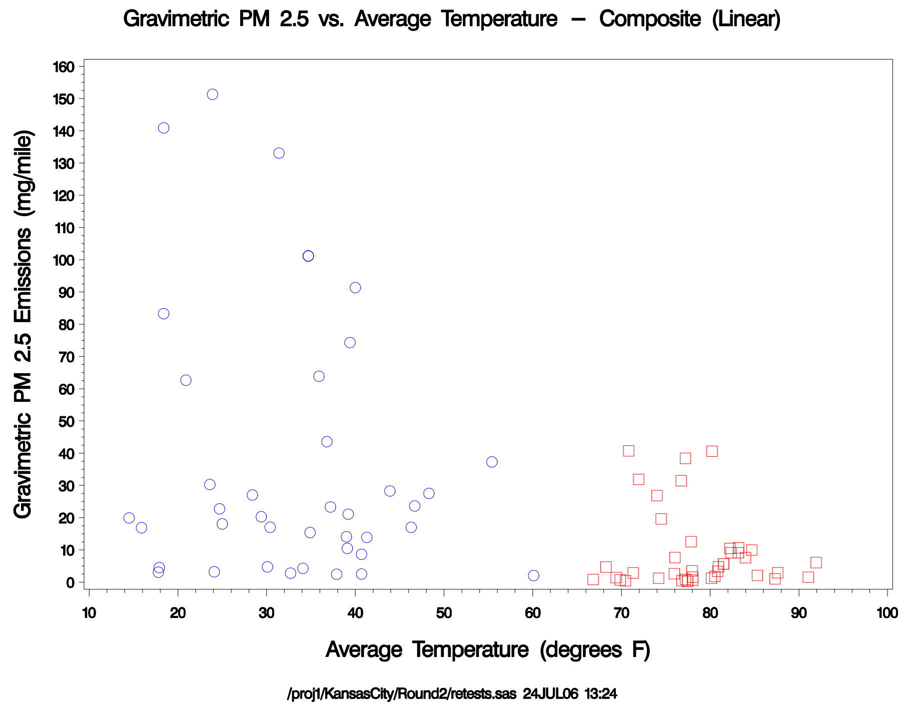


Figure OS-11. Gravimetric PM 2.5 vs. Average Temperature

Analysis of In-Round Duplicate Testing Results

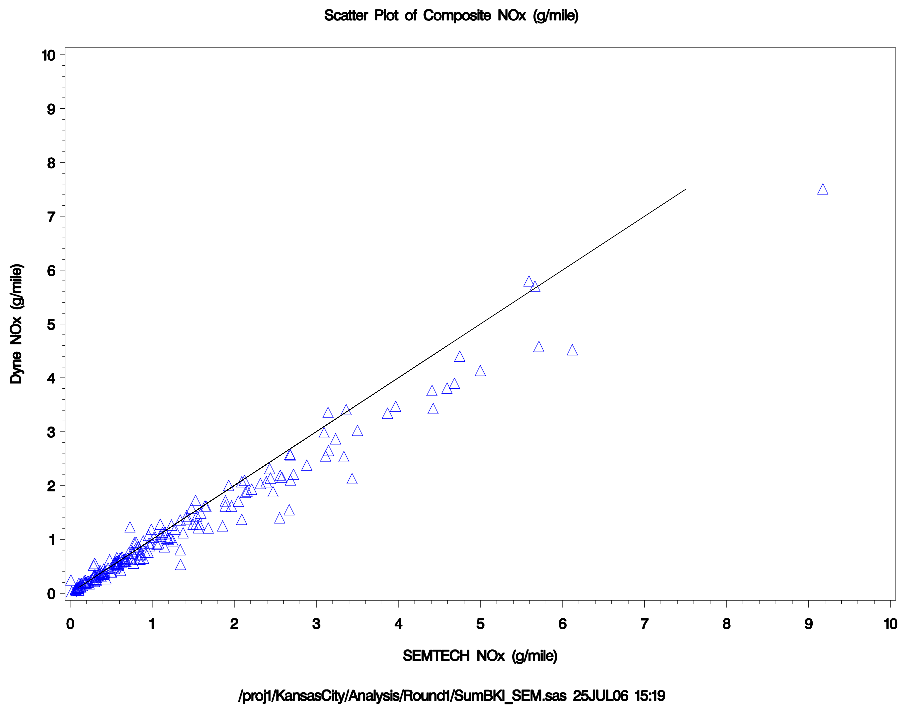
Sixteen vehicles were given duplicate tests during Round 1 of the study, while ten vehicles were given duplicate tests during Round 2. Table OS-14 shows a statistical analysis using a paired t-test on the duplicate measurements conducted during both Rounds of the study. A paired t-test is a sensitive test for evaluating repeat measurements. The table shows that random duplicate measurements were not significantly different. The relative humidity measurements were significantly different in Round 1 for the duplicates, but this does not appear to influence the NOx or other measurements in any meaningful way. We have also included the largest mean difference in the measurements in the far right column of the table. This column shows the threshold value for the mean difference beyond which the value would be called significant at the 95% confidence level for the number of paired measurements made. As shown, all mean values for all the emissions and temperatures are well below this threshold. Even the relative humidity in Round 2 was below this value and hence not significantly different.

Table OS-14. Paired t-test Results on In-Round Duplicate Tests

Round 1								
Variable	***Units***	***N***	***Mean***	***Std Error***	***t Value***	***Pr > |t|***	***t for 95% conf***	***Mean value needed for 95 % conf in diff***
PMdiff	mg/mi	15	0.03	0.66	0.05	0.96	2.15	1.41
HCdiff	g/mi	18	0.01	0.01	0.50	0.62	2.11	0.03
COdiff	g/mi	18	0.26	0.33	0.80	0.43	2.11	0.69
NXdiff	g/mi	17	0.02	0.03	0.70	0.49	2.12	0.06
tempdiff	deg. F	18	-0.76	0.85	-0.88	0.39	2.11	1.80
rhdiff	%	18	8.24	2.86	2.88	0.01	2.11	6.03
Round 2								
Variable	***Units***	***N***	***Mean***	***Std Error***	***t Value***	***Pr > |t|***	***t for 95% conf***	***Mean value needed for 95 % conf in diff***
PMdiff	mg/mi	9	-38.16	23.12	-1.65	0.14	2.31	53.32
HCdiff	g/mi	10	0.00	0.04	-0.04	0.97	2.26	0.09
COdiff	g/mi	10	1.66	2.01	0.82	0.43	2.26	4.55
NXdiff	g/mi	10	0.01	0.03	0.32	0.76	2.26	0.06
tempdiff	deg. F	10	-3.22	3.03	-1.06	0.31	2.26	6.84
rhdiff	%	10	5.40	6.05	0.89	0.40	2.26	13.68

Dynamometer vs. PEMS Emission Measurement Comparison

Figure OS-12 provides a comparison of tandem testing conducted during Round 1 (the summer portion of the study). All test results shown in Figure OS-12 are cold-start LA92 tests conducted on EPA's portable Clayton dynamometer. Results show dynamometer CO_2 and NO_x measurements made using both the dynamometer real-time (modal) bench in comparison with PEMS measurements. PEMS mass emission rates are derived from exhaust mass flow measurements made using an exhaust flowmeter assembly provided by EPA (as part of the PEMS package). Figure OS-13 shows the same information for Round 2 (the winter portion of the study). Comparison of phase-specific and total composite emission rates in the data shows a relatively good correlation between the PEMS and dynamometer methods of measurement.



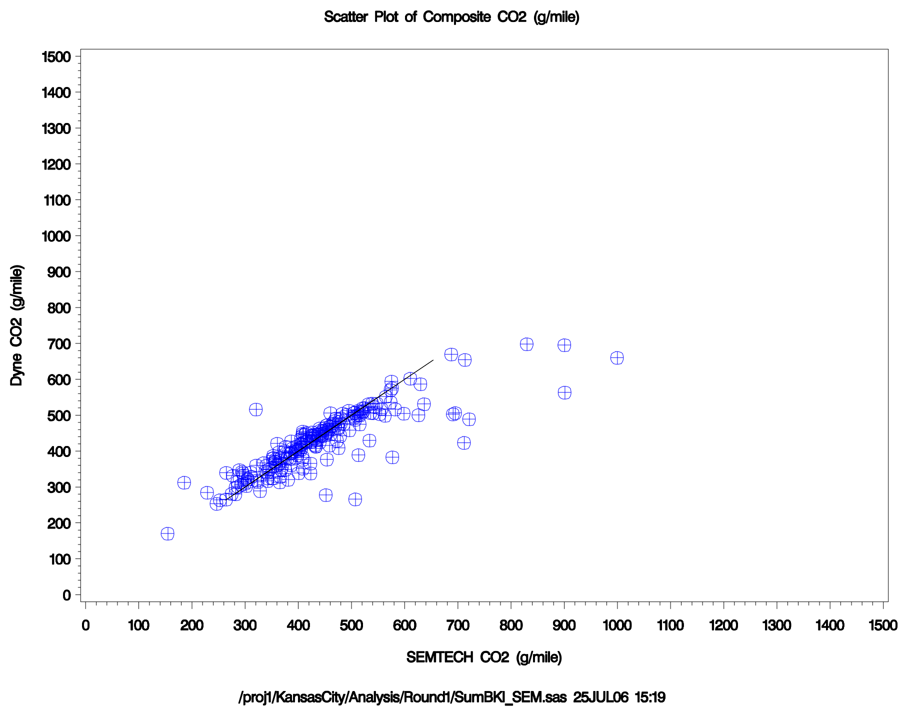
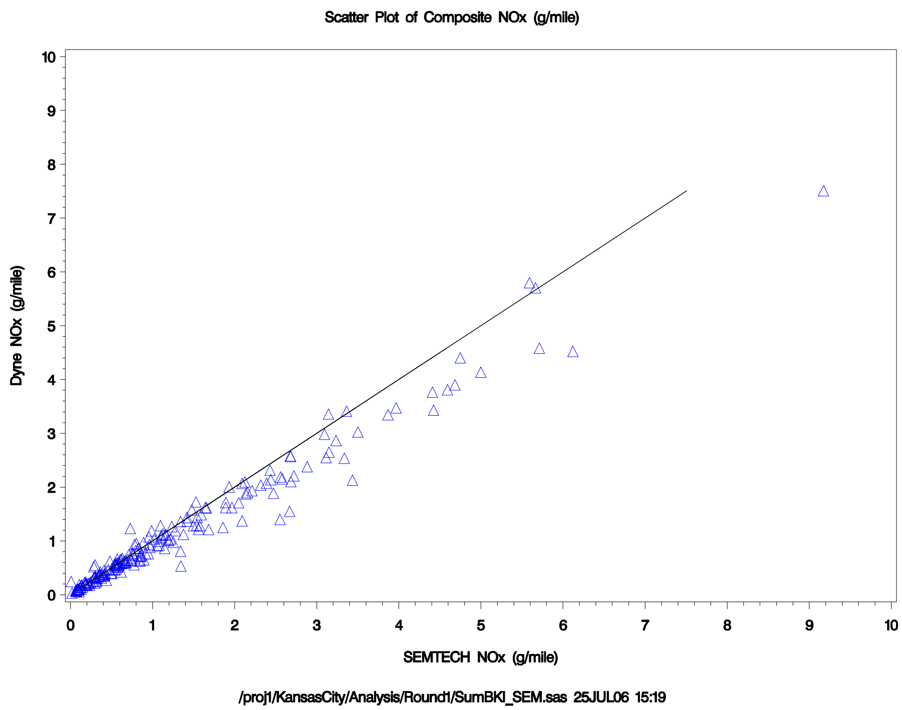


Figure OS-12. Results from Dynamometer vs. PEMS Emission Measurements Conducted During Round 1 (Summer Study)



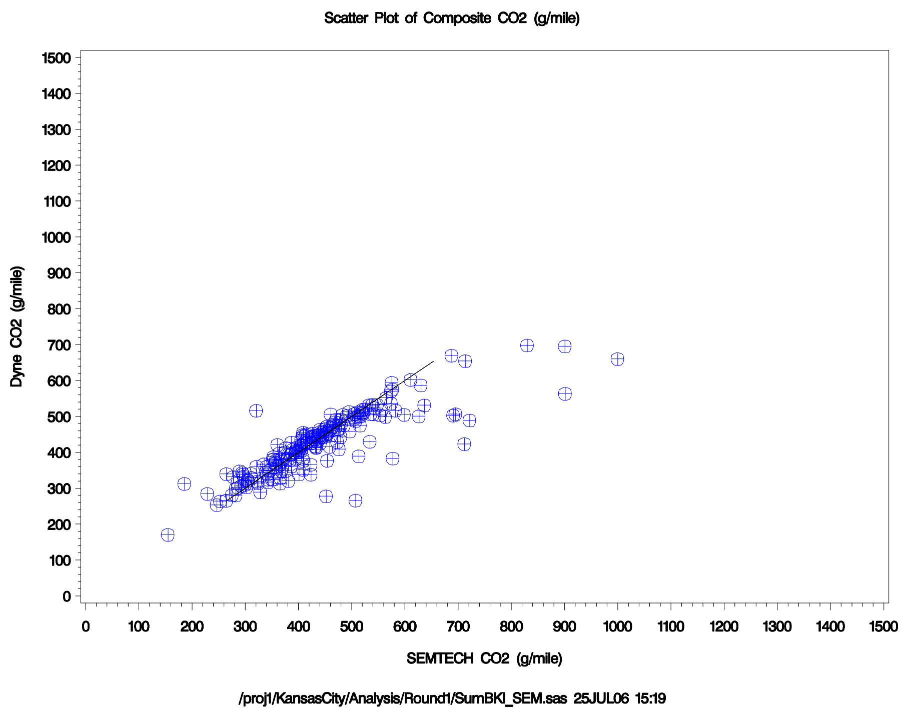


Figure OS-13. Results from Dynamometer vs. PEMS Emission Measurements Conducted During Round 2 (Winter Study)

Comparisons between fuel economy measured by the PEMS units during conditioning runs and PEMS unit measurements during the LA92 drive cycle are shown in Figures OS-14 (Round 1) and OS-15 (Round 2). These figures tend to reveal lower fuel economy determinations as measured by the PEMS in comparison with dynamometer measurements. This difference could be attributed to testing discrepancies such as how closely the laboratory LA92 drive cycle approximates the driving pattern and loads encountered with real-word driving. The difference could also be in part due to measurement discrepancies between the two systems, such as errors or bias in determining the true exhaust mass flow rate or errors or bias in the exhaust gas concentration measurements. Examination of results of tests comparing similar measurement systems but different driving patterns (such as shown in Figure OS-14 and OS-15) helps illustrate the influence of test conditions and testing variations (such as different vehicle speeds and loads), and comparison of results of tests using identical driving patterns but different measurement systems (such as shown in Figures OS-12 and OS-13) helps illustrate the measurement differences of two different systems (PEMS vs. dynamometer analytical bench).

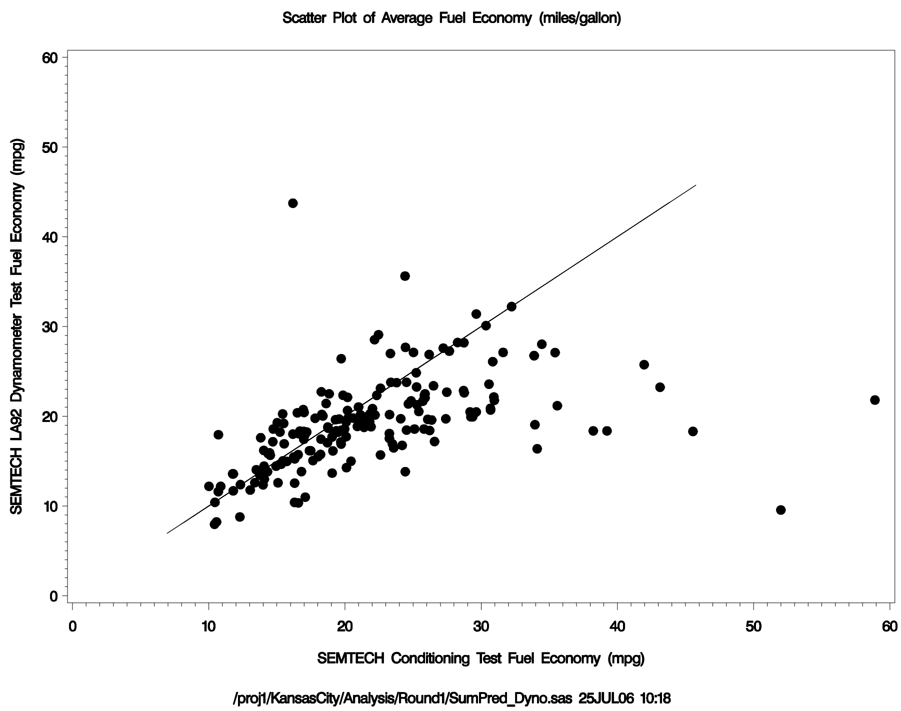


Figure OS-14. By-Vehicle Comparison of Conditioning Run vs. Dynamometer Testing Fuel Economy for Round 1

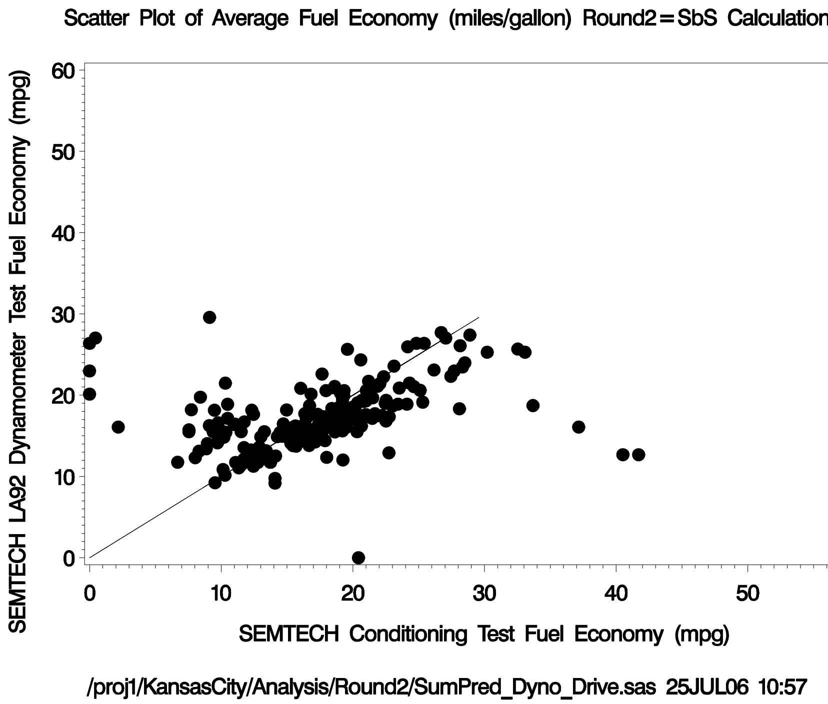


Figure OS-15. By-Vehicle Comparison of Conditioning Run vs. Dynamometer Testing Fuel Economy for Round 2

Continuous PM Emission Measurement Results

Emission rates for each phase of the unified cycle, for each stratum of vehicle model year ranges, measured continuously for BC and total particle mass (PM), are given in Tables OS-15 through OS-17. PM obtained from the DustTrak nephelometer are indicated by "DT" and those from the DataRAM4 are indicated as "DR". Note that BC emission rates generally decrease from older to newer vehicles, though because the class of older trucks (pre-1980) was only represented by 2 vehicles, the averages are highly uncertain. Note that BC and DT PM emission rates were highest (for cars) during Phase 1, though Phases 2 and 3 values were similar. Also note that emission rates computed from the DataRAM4 (DR) are usually in great excess of those obtained with the DustTrak, except for those cases of low emission rates. The DataRAM4 might have a problem with high concentrations where the optics measurement get dirty, and adds to a scattered signal that gets interpreted erroneously as PM.

Table OS-15. Emission rates in mg/mile for Phase 1 of the unified cycle for cars and trucks.

Phase 1	Car			Truck		
Model Year	BC	DustTrak	DataRam	BC	DustTrak	DataRam
Round 1						
1971-1980	63.9	249.2	396.7	72.5	171.5	194.2
1981-1990	18.1	112.7	781.8	19.7	324.8	4557.9
1991-2000	4.4	26.1	73.4	3.4	33.1	171.1
2001-2010	3.6	27.2	167.5	4.1	14.9	14.0
Round 2						
1971-1980	168.4	630.9	2285.7	57.3	422.0	2401.7
1981-1990	35.6	207.2	1026.5	68.1	364.3	1771.7
1991-2000	20.4	103.8	259.5	15.6	67.5	165.4
2001-2010	12.8	89.1	137.3	12.6	54.9	58.7

Table OS-16. Emission rates in mg/mile for Phase 2 of the unified cycle for cars and trucks.

Phase 2	Car			Truck		
Model Year	BC	DustTrak	DataRam	BC	DustTrak	DataRam
Round 1						
1971-1980	25.5	138.4	677.8	0.9	9.2	69.6
1981-1990	4.9	33.2	213.7	4.8	214.2	3800.6
1991-2000	0.7	11.8	70.6	0.5	10.9	78.4
2001-2010	0.3	3.8	32.0	0.5	3.2	2.8
Round 2						
1971-1980	20.0	50.8	82.4	3.2	41.8	129.8
1981-1990	3.1	31.3	186.0	10.4	39.4	91.3
1991-2000	1.2	20.8	111.3	0.6	15.2	32.8
2001-2010	0.4	2.5	2.9	0.3	1.5	2.0

Table OS-17. Emission rates in mg/mile for Phase 3 of the unified cycle for cars and trucks.

Phase 3		Car			Truck	
Model Year	BC	DustTrak	DataRam	BC	DustTrak	DataRam
Round 1						
1971-1980	37.5	92.1	105.6	1.9	4.8	4.7
1981-1990	3.8	22.2	142.7	7.3	192.0	2086.8
1991-2000	0.8	7.2	13.3	0.8	18.9	78.7
2001-2010	0.3	2.3	3.8	0.4	1.8	2.1
Round 2						
1971-1980	28.7	52.4	93.6	3.0	22.9	21.2
1981-1990	1.7	15.2	131.8	3.0	19.1	92.9
1991-2000	0.7	4.2	7.6	0.5	2.7	4.7
2001-2010	0.1	0.5	0.5	0.2	0.8	0.9

Comparison of QCM Versus Time-Inegrated Gravimetric Mass Measurements

Table OS-18 and OS-19 provide a summary of emission rates for each Phase of the Unified Test Cycle for both the QCM and the Gravimetric Filter results for Round 1 and Round 2, respectively. The table also lists the composite emission rate from the same calculation as that used for the FTP Cycle. It should be noted that, with the exception of Pre-1981 Cars, the QCM reports a higher emission rate than the gravimetric filter. Also the emission rate for the Pre-1981 Trucks are also shown to be less than the Pre-1981 Cars.

Table OS-18. Average Emission Rates in mg/mile Derived from QCM and Gravimetric Filter Measurements for all Test Phases.

Vehicle	QCM Emission Rates (mg/mi)			Grav Emission Rates (mg/mi)		
Year	Phase 1	Phase 2	Phase 3	Phase 1	Phase 2	Phase 3
TRUCKS						
1970-1980	62.03	50.65	22.58	87.80	45.05	9.14
1981-1990	44.23	16.74	17.20	93.80	37.65	51.05
1991-1995	18.92	8.09	11.89	14.48	11.13	14.41
1996-2005	13.20	4.53	3.44	9.58	4.01	2.33
CARS						
1970-1980	202.96	15.16	33.18	160.77	73.09	63.73
1981-1990	32.95	23.87	18.18	35.02	18.94	8.79
1991-1995	16.28	6.94	7.02	11.43	7.54	5.08
1996-2005	14.98	3.29	2.96	7.40	2.48	1.80

Table OS-19. Average Emission Rates for Round 2 in mg/mile Derived from QCM and Gravimetric Filter Measurements for all Test Phases.

Vehicle	QCM Emission Rates (mg/mi)			Grav Emission Rates (mg/mi)		
Year	Phase 1	Phase 2	Phase 3	Phase 1	Phase 2	Phase 3
TRUCKS						
1970-1980	139.04	39.79	22.27	281.33	101.70	28.12
1981-1990	104.91	20.83	21.37	210.94	31.43	22.16
1991-1995	38.25	16.28	10.95	40.05	19.13	5.22
1996-2005	33.33	8.38	7.51	40.84	6.02	3.26
CARS						
1970-1980	74.95	9.71	9.52	361.73	42.34	14.31
1981-1990	71.68	16.01	14.07	114.81	23.86	13.68
1991-1995	42.20	16.00	7.67	55.06	16.25	6.70
1996-2005	29.67	9.31	3.92	46.88	6.20	4.21

Figures OS-16 and OS-17 display the average continuous Round 1 CVS concentrations measured using the QCM for four categories (BINS) each of Cars tested for Phases 1 and 3 of the test cycle. Figures OS-18 and OS-19 present the same information for Round 2 vehicles. Comparisons of Phases 1 and 3 within each round of the study reveal continuous PM mass emission rate variations between cold start (Phase 1) and hot start (Phase 3) testing during an equivalent drive trace for the same vehicle. Comparison of equivalent Phases between both Rounds of the study may reveal seasonal continuous PM mass emission rate variation (Round 1 testing took place in the summer, while Round 2 testing occurred during the winter).

A nominal dynamometer speed trace is included in each figure for reference. Only vehicle tests for which no void or partial void was noted during reduction of the data were included in the averages. Consequently, these results should be considered as censured. It will be noted in these figures that the QCM consistently reports negative concentrations during parts of the various test cycle components. This should not be considered a flaw in the instrument but rather an indication that volatile components of particulate collected during accelerations and high-speed portions of the test cycle are desorbing from the collected particulate. This is a phenomena that is common to collected vehicle emissions particulate but not accounted for in integral filter measurements.

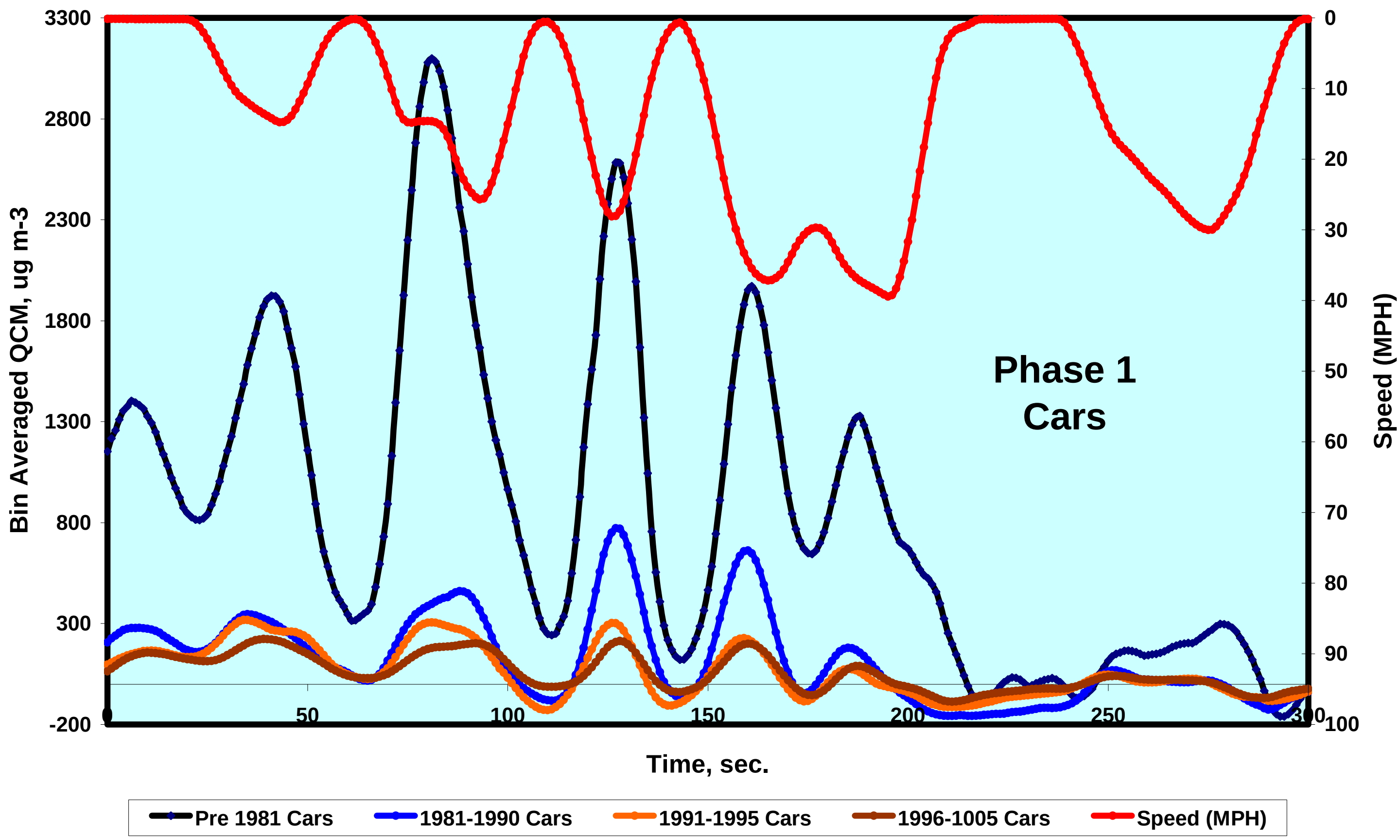


Figure OS-16 Round 1 Averaged CVS Particulate Mass Concentrations - QCM Phase 1 Cars.

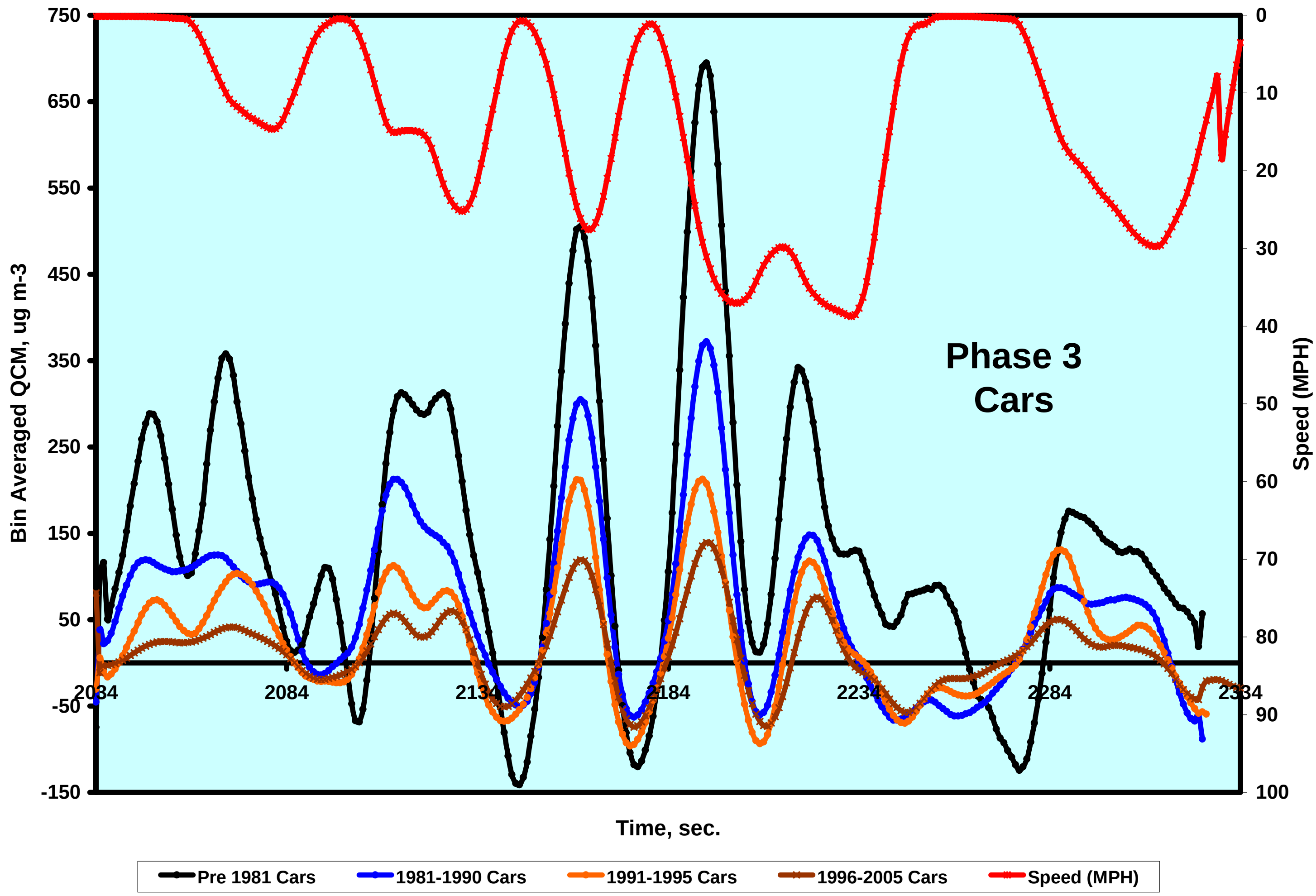


Figure OS-17 Round 1 Averaged CVS Particulate Mass Concentrations - QCM Phase 3 Cars.

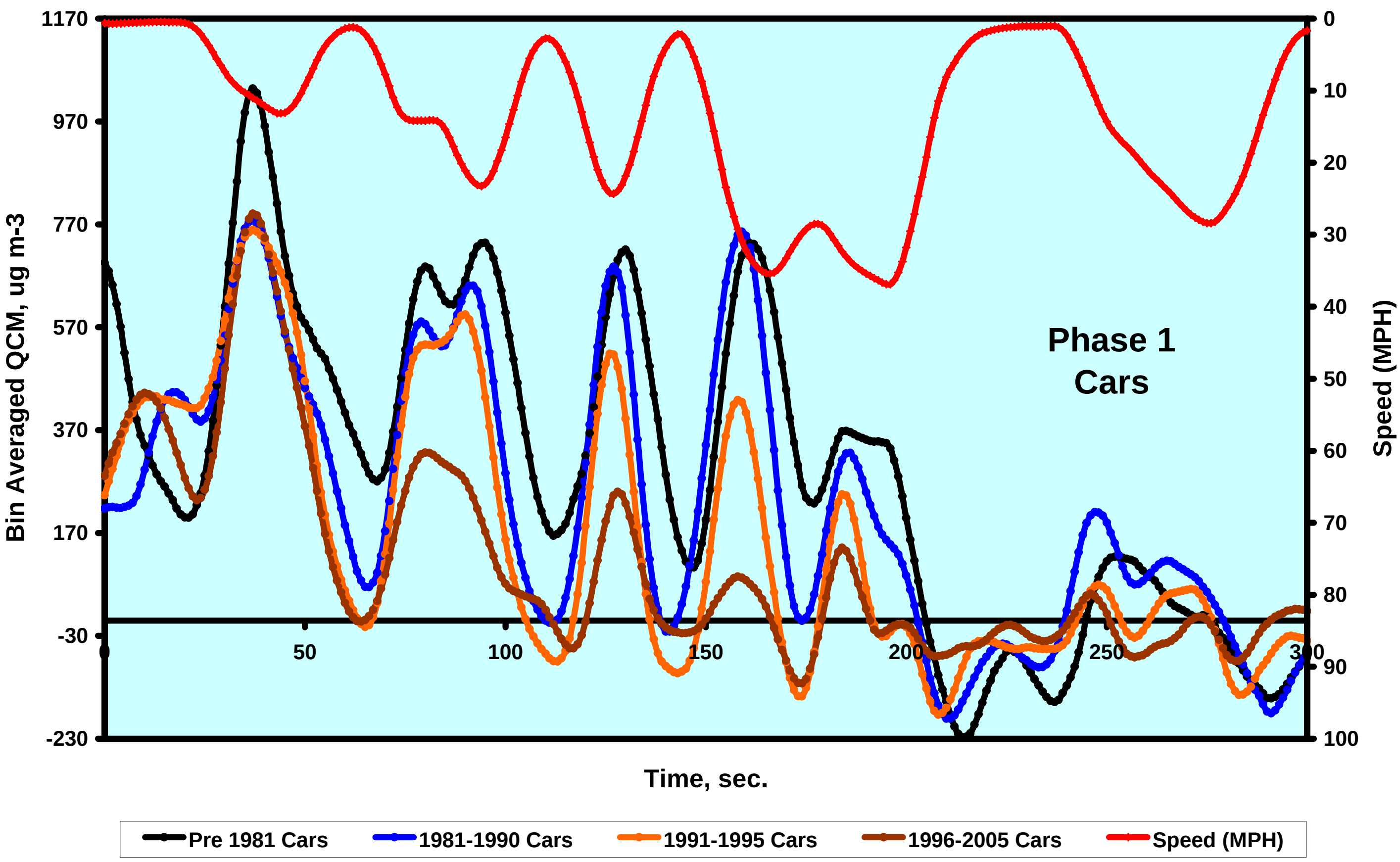


Figure OS-18 Round 2 Averaged CVS Particulate Mass Concentrations - QCM Phase 1 Cars.

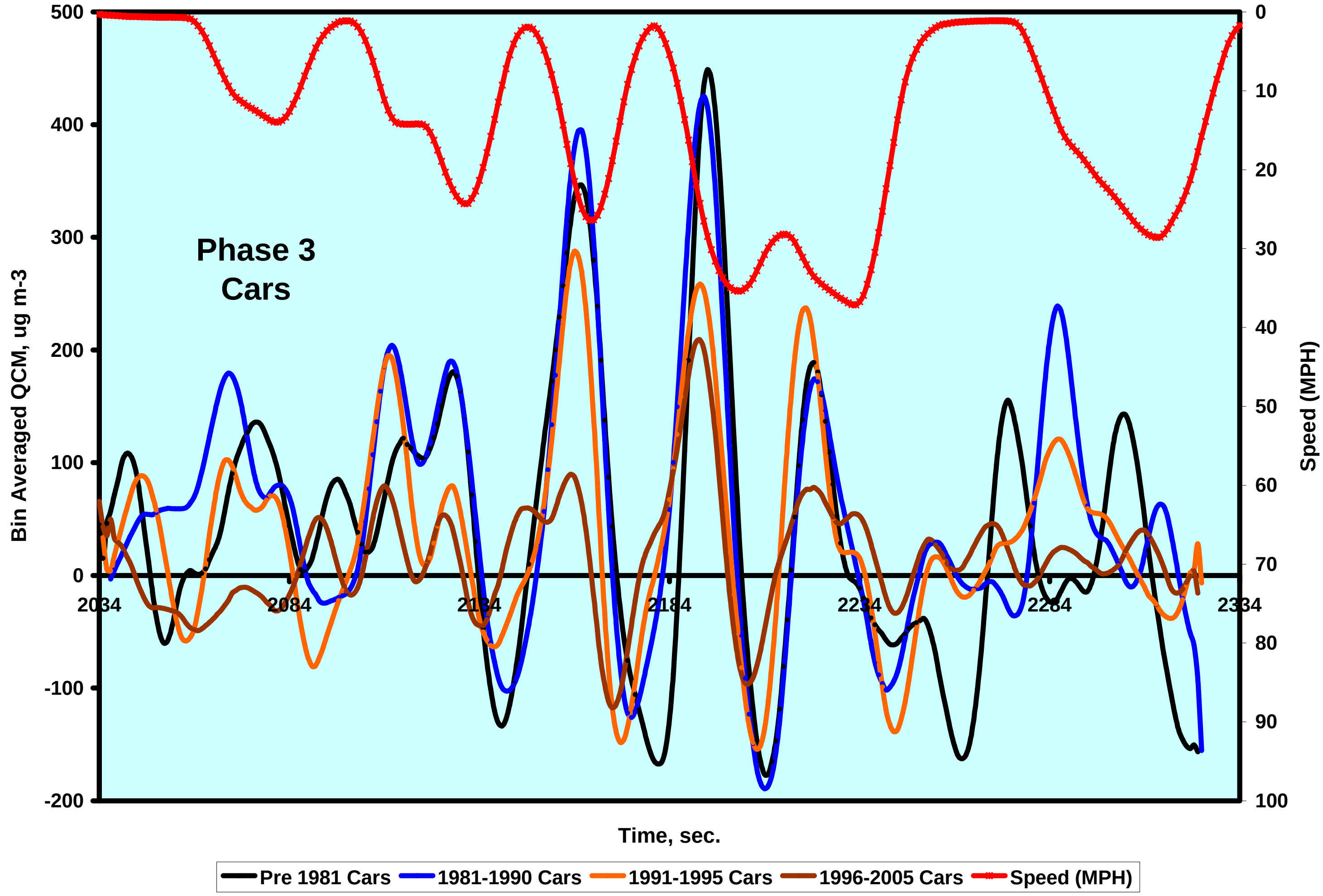


Figure OS-19 Round 2 Averaged CVS Particulate Mass Concentrations - QCM Phase 3 Cars.

Particulate-Phase Emissions Speciation from Light-Duty Gasoline Vehicles

Full chemical speciation was determined for 26 individual/composite samples and 6 composite dilution tunnel blank samples in each test round. The summaries of the PM data for composite exhaust and dilution blank samples in Tables OS-18 and OS-19 for Rounds 1 and 2, respectively, show that emissions levels are well above the ranges of values for dilution tunnel blanks with the exception of hopanes and steranes emissions for the newer model-year strata. Summary data include gravimetric mass, OC, and EC (in mg/mile) and PAH, hopanes, and steranes (in ug/mile). The three PAHs that are potential markers for gasoline exhaust are indeno[123-cd]pyrene, benzo(ghi)perylene and coronene.

Comparisons of co-pollutants can provide validation checks for assessing the overall accuracy and validity of the measurements. Species emitted from the same source type should correlate and exhibit average ratios of species that reflect the nature of the source. Figure OS-20 shows gravimetric mass versus total carbon by IMPROVE-TOR in ug/m^3 of diluted exhaust for Round 1 dynamometer test filters by test Phase. PM mass and TC are strongly correlated for the phase 1 samples and poorly correlated for the lightly loaded phase 3 samples. Similar results are shown in Figure OS-21 for the correlation of EC by TOR versus average BC by the photoacoustic instrument. As we have seen in prior studies (e.g., Gasoline/Diesel PM Split Study) for highly loaded samples, PM mass is typically well correlated with TC and EC obtained by IMPROVE-TOR or STN-TOT agree with photoacoustic BC. That is not the case at lower sample loading where sampling artifacts associated with adsorbed organic compounds on the quartz filter may be relatively more important. The correlations of the sum of elements by XRF analysis (Figure OS-22) show the similar correlations to PM mass as TC, which again reflects the lower mass loadings for the phase 3 samples. Figure OS-23 shows that sulfur by XRF analysis is strongly correlated to sulfate by ion chromatography. Figure OS-24 shows that benzo(ghi)perylene, indeno[123-cd]pyrene and coronene all correlate well with TC emissions and Figure OS-25 shows that the sum of hopanes and steranes also correlated well with TC.

The abundances of various chemical species in the dilution blank and composite exhaust samples during each round of testing are presented in Section 4. OC and EC are the most abundant species in motor vehicle exhaust, accounting for over 95% of the total PM mass. For spark ignition (SI) vehicles, BC and PM emission rates can be several times larger during the cold start phase than during hot stabilized operation. Relatively clean SI vehicles produce BC emissions during the more aggressive portions of the driving cycle and during cold starts. Therefore, the emission profiles for clean SI vehicles from dynamometer tests may contain higher fractions of EC than would be produced in congested urban driving conditions. PM emissions from SI high-emitter contain predominantly OC. Variability of emissions from a vehicle may be as great as the difference between vehicles, particularly for the high emitters. The abundances of individual organic species relative to total mass or carbon are generally consistent from profile to profile for organic and elemental carbon, PAH, hopanes & steranes, and nitroPAH. Alkanes and polars appear too variable to be useful for receptor modeling. Gasoline vehicles, whether low or high emitters, emit higher proportions of high molecular-weight particulate PAHs (e.g., benzo(b+j+k)fluoranthene, benzo(ghi)perylene, indeno(1,2,3-cd)pyrene, and coronene). Hopanes and steranes are markers for lubricating oil from internal combustion engines, and their emission rates were higher for high emitting vehicles.

Table OS-18. Summary of PM data for Round 1 composite exhaust samples[1].

Composites	PM Mass	OC	EC	EC/TC	PAH gas markers	Sum of Hopanes	Sum of Steranes
Dilution Tunnel Blanks							
S0-1	0.39	0.256	0.154	0.38	0.00	0.73	0.45
S0-2	0.53	0.129	0.020	0.13	0.16	0.73	0.48
S0-3	0.19	0.268	0.031	0.10	0.04	1.17	0.48
S0-4	0.24	0.293	0.030	0.09	0.00	0.73	0.35
S0-5	0.95	0.940	0.235	0.20	0.19	2.16	1.09
S0-6	0.70	0.588	0.142	0.19	0.18	2.42	1.90
Trucks							
S1-1	9.13	2.204	1.516	0.41	12.07	1.56	0.03
S1-2	81.73	26.070	17.884	0.41	373.42	31.36	5.79
S2-1	73.07	59.132	4.510	0.07	13.09	164.02	44.50
S2-2	20.11	11.332	6.588	0.37	113.03	8.32	3.52
S2-3	22.02	16.212	4.030	0.20	30.93	59.78	48.31
S2-4	76.16	28.193	25.780	0.48	254.90	36.02	14.42
S3-1	3.76	1.097	0.933	0.46	1.43	0.91	0.76
S3-2	22.36	8.186	5.641	0.41	39.02	22.74	6.07
S4-1	3.31	1.438	0.582	0.29	1.15	1.30	0.48
S4-2	2.12	1.801	1.178	0.40	2.28	2.82	1.73
Cars							
S5-1	18.14	9.029	9.929	0.52	128.83	120.60	0.00
S5-2	60.91	46.521	9.412	0.17	263.07	292.58	63.74
S5-3	9.46	7.177	2.549	0.26	4.62	29.35	5.18
S5-4	207.43	101.649	77.566	0.43	1031.44	405.41	63.62
S5-5	99.63	33.934	50.871	0.60	480.44	175.76	46.40
S6-1	41.62	35.609	0.639	0.02	4.01	52.49	12.35
S6-2	49.04	9.079	36.603	0.80	345.07	16.52	6.04
S6-3	10.10	3.738	4.739	0.56	19.03	5.24	0.67
S6-4	22.84	13.998	2.682	0.16	24.25	26.04	8.70
S7-1	7.66	3.856	2.316	0.38	8.04	10.84	7.25
S7-2	8.81	5.258	1.808	0.26	13.08	25.45	8.62
S7-3	4.12	1.666	0.994	0.37	11.97	11.46	0.45
S7-4	4.78	1.155	1.537	0.57	7.54	7.80	0.36
S8-1	1.81	0.983	0.544	0.36	0.34	1.01	0.57
S8-2	2.08	1.488	0.906	0.38	2.22	3.52	1.19
S8-3	3.48	2.346	1.339	0.36	2.27	3.45	1.29

[1] Gravimetric mass, OC, and EC are in mg/mile and PAH, hopanes, and steranes are in ug/mile. The three PAHs that are potential markers for gasoline exhaust are indeno[123-cd]pyrene, benzo(ghi)perylene and coronene.

Table OS-19. Summary of PM data for Round 2 composite exhaust samples[1].

Composites	PM2.5 Mass	Organic Carbon	Elemental Carbon	EC/TC ratio	PAH gas markers	Sum of Hopanes	Sum of Steranes
Dilution Tunnel Blanks							
W0-1	0.85	0.68	0.14	0.17	0.31	0.97	0.31
W0-2	0.27	0.66	0.03	0.05	0.00	0.29	0.20
W0-3	0.50	0.65	0.16	0.20	0.09	0.44	0.13
W0-4	0.39	0.71	0.08	0.10	0.13	0.49	0.18
W0-5	0.90	0.90	0.17	0.16	0.07	0.65	0.13
W0-6	0.45	0.70	0.10	0.13	0.09	0.48	0.25
Trucks							
W1-1	113.12	74.96	14.09	0.16	364.44	290.43	80.48
W1-2	43.21	31.26	10.01	0.24	87.72	93.86	5.61
W1-3	59.60	34.09	11.59	0.25	251.27	66.64	8.49
W2-1	52.30	25.69	22.84	0.47	319.34	173.27	15.77
W2-2	15.30	4.79	3.58	0.43	7.14	15.00	2.74
W3-1	5.98	2.50	2.66	0.52	128.18	23.96	1.63
W3-2	29.38	10.21	16.25	0.61	71.84	12.80	2.54
W3-3	23.57	7.94	9.00	0.53	21.35	12.01	1.29
W4-1	15.21	5.11	4.23	0.45	16.23	3.01	0.13
W2-3	6.89	2.09	3.35	0.62	9.79	1.98	0.71
W4-2	6.02	2.56	3.07	0.55	19.08	1.90	0.92
W4-3	11.65	5.30	5.24	0.50	26.19	7.96	0.87
Cars							
W5-1	16.82	8.54	7.39	0.46	14.78	6.85	0.57
W5-2	47.47	16.45	28.13	0.63	170.79	12.92	1.84
W5-3	45.26	15.57	15.66	0.50	252.19	18.94	11.78
W6-1	56.31	32.13	20.39	0.39	206.65	170.82	50.03
W6-2	17.14	7.33	9.59	0.57	24.79	5.72	3.35
W6-3	9.97	5.00	3.22	0.39	18.07	7.69	4.02
W6-4	73.13	49.20	4.27	0.08	51.57	216.55	98.98
W7-1	5.08	2.70	2.82	0.51	10.43	1.17	0.34
W7-2	12.44	6.68	3.84	0.36	34.37	6.43	2.23
W7-3	3.45	2.69	1.29	0.32	8.52	3.05	1.75
W7-4	4.65	2.58	1.49	0.37	11.31	0.75	0.46
W8-1	4.21	2.60	1.50	0.37	9.40	2.06	1.08
W8-2	8.46	2.95	4.53	0.61	14.39	2.13	1.47
W8-3	27.78	2.52	3.34	0.57	18.11	2.06	0.52

[1] Gravimetric mass, OC, and EC are in mg/mile and PAH, hopanes, and steranes are in ug/mile. The three PAHs that are potential markers for gasoline exhaust are indeno[123-cd]pyrene, benzo(ghi)perylene and coronene.

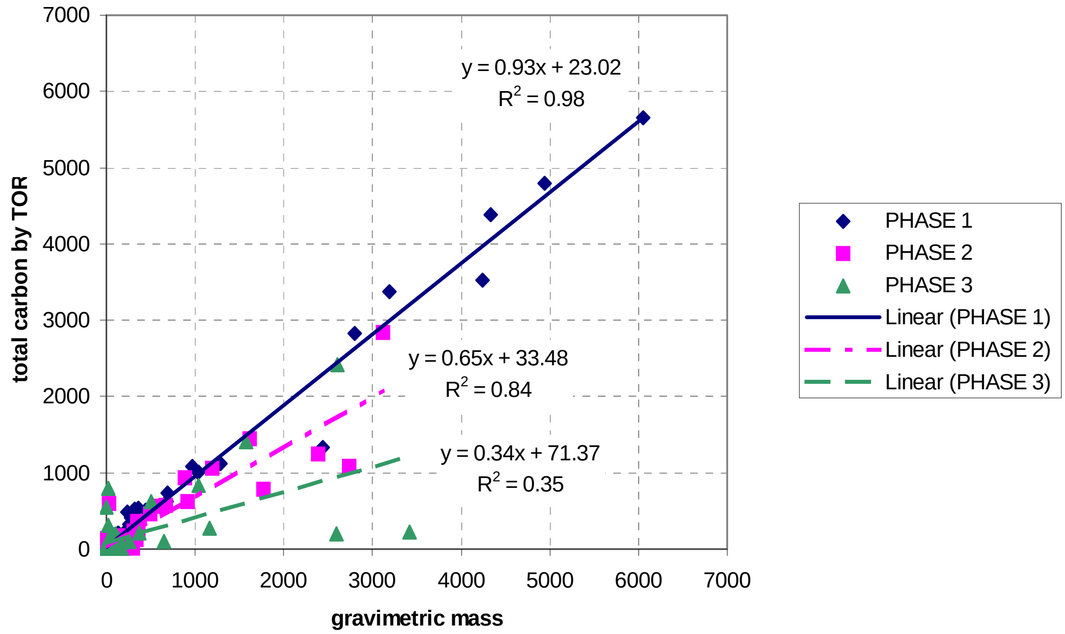


Figure OS-20. Gravimetric mass versus total carbon by TOR

For all dynamometer test filters, separated by test phase. Concentrations are in ug/m3 of diluted exhaust.

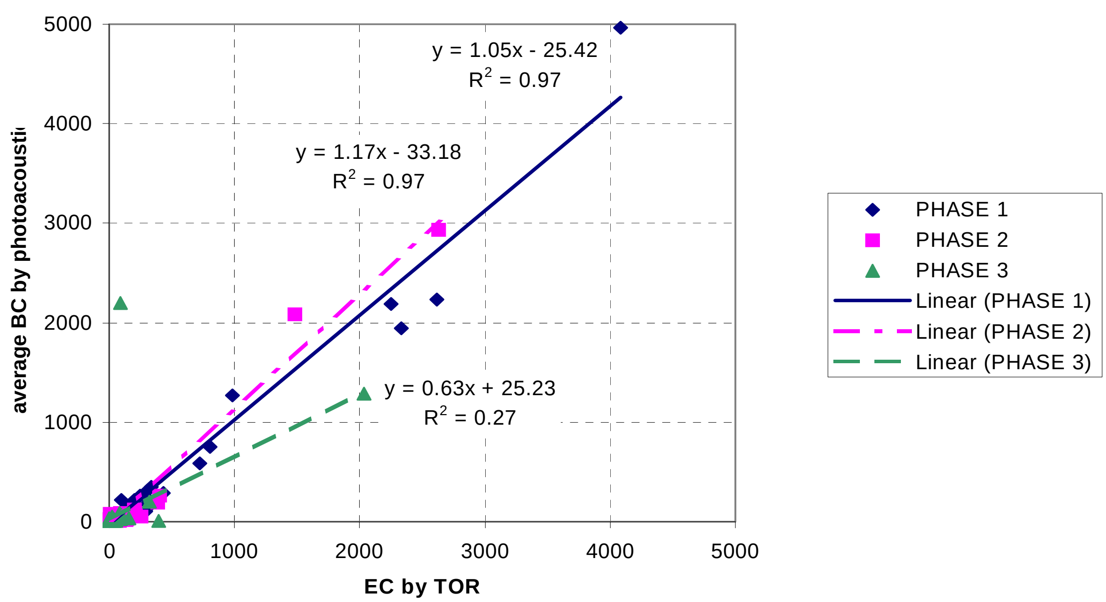


Figure OS-21. Elemental Carbon by TOR versus average BC by photoacoustic method

For all dynamometer tests, separated by test phase. Concentrations are in ug/m3 of diluted exhaust.

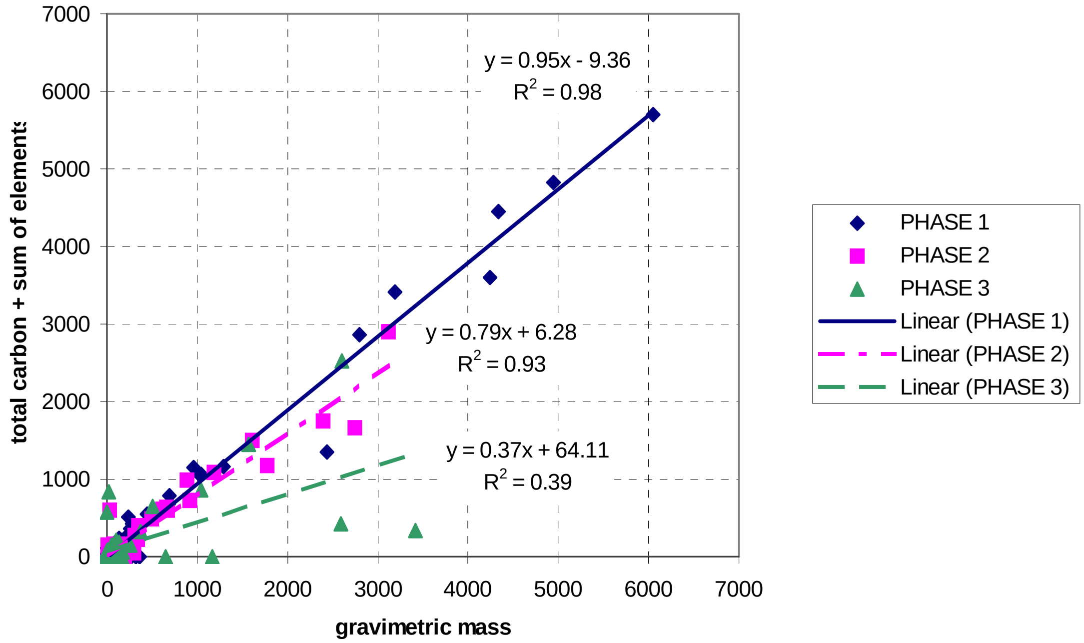


Figure OS-22. Gravimetric mass versus sum of XRF elements and total carbon by TOR

For all dynamometer tests, separated by test phase. Concentrations are in ug/m3 of diluted exhaust.

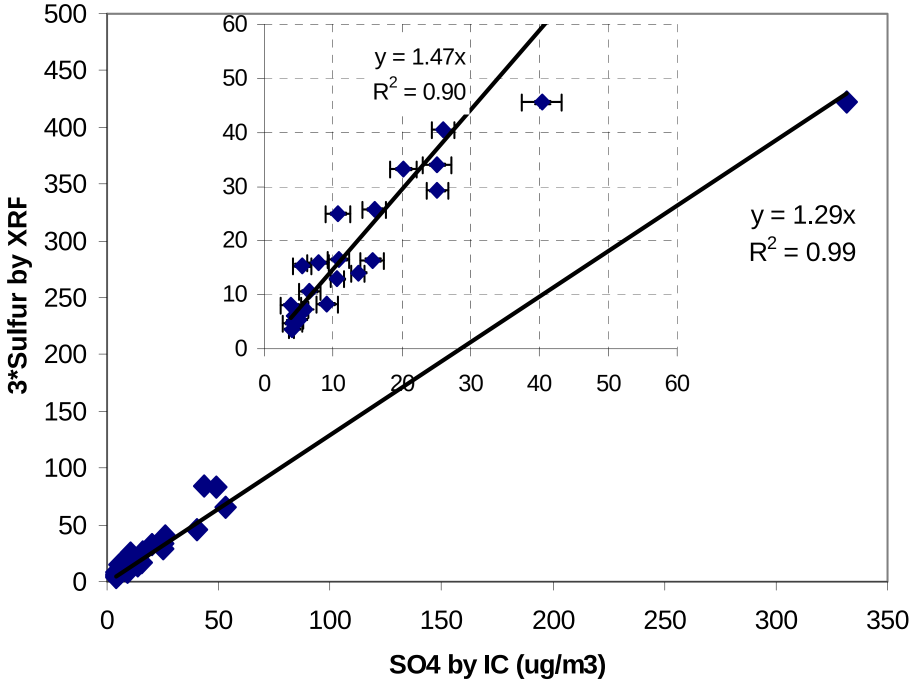


Figure OS-23. Sulfur by XRF *3 versus Sulfate by IC for all exhaust composites.

The inset shows the data without the significant outlier at SO_4=330 ug/m3. Concentrations are in ug/m3 of diluted exhaust.

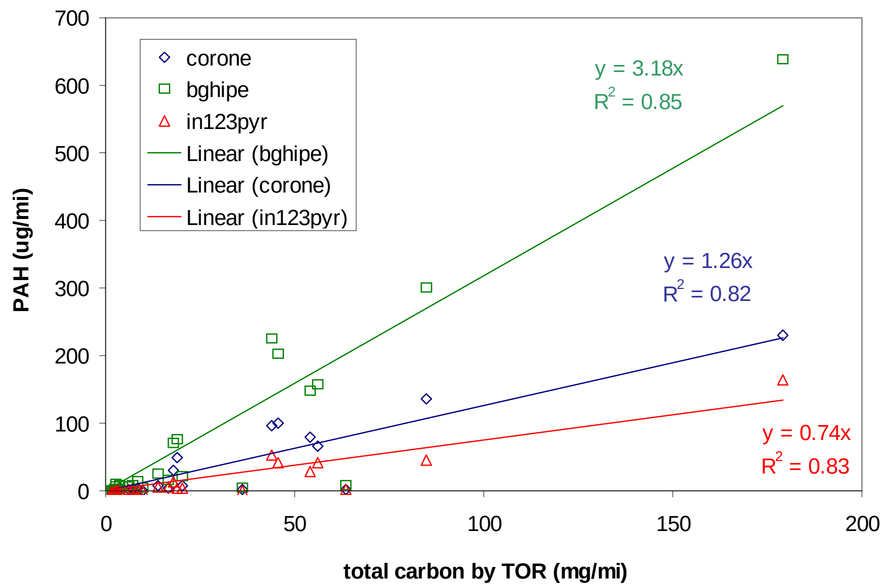


Figure OS-24. Total organic carbon by TOR versus indeno[123-cd]pyrene, benzo(ghi)pyrelene and coronene in mg/mile.

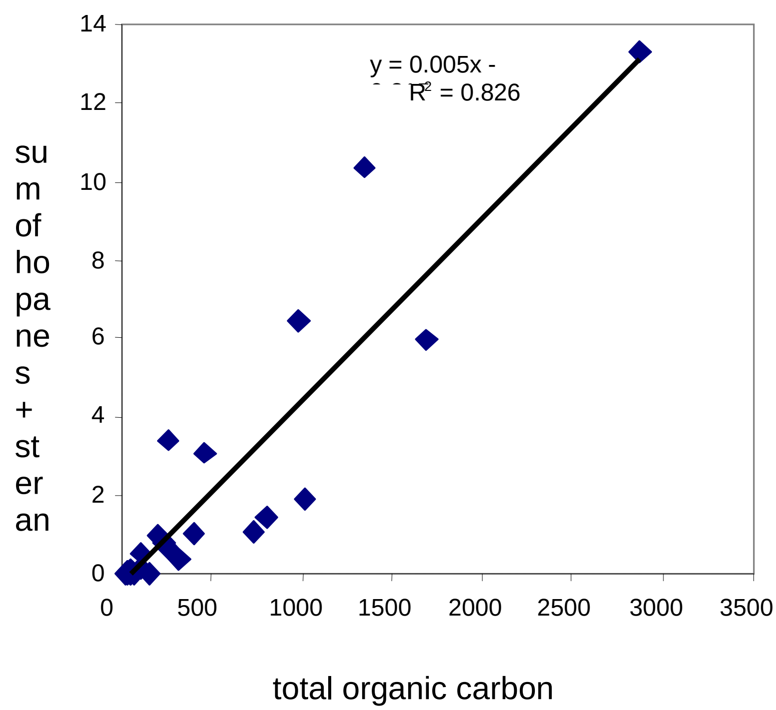


Figure OS-25. Total organic carbon by TOR versus sum of hopanes and steranes for exhaust composites.

Concentrations are in ug/m3 of diluted exhaust.

Gaseous-Phase Emissions Speciation from Light-Duty Gasoline Vehicles

VOC chemical speciation was determined for the individual/composite samples and composite dilution tunnel blank samples. All data are field-blank corrected. The chemical composition data for dilution tunnel blanks and exhaust samples are presented in Appendix B.

The total nonmethane hydrocarbon (NMHC) values from the DRI VOC speciation samples were compared to corresponding data obtained by BKI. With the exception of two obvious outliers (S1-2 and S5-4), Figure OS-26 shows good agreement for the uncomposited samples from Round 1. However, Figure OS-27 shows that there are two distinct groups of data in Round 2; one with better agreement between DRI and BKI and a second group with DRI values consistently near zero compared to widely varying values for BKI. A chronological plot of the ratios of DRI to BKI TNMHC values for Round 2 shows that DRI consistently obtained low values during the second half of Round 2. Sampling for VOC speciation was suspended for two weeks in mid-February during the NREL experiments on the effects of sampling temperature on measured PM emission rates. The appearance of consistently low DRI/BKI ratios for TNMHC coincides with the resumption of VOC sampling on February 22, 2005. The aldehyde data also show a similar chronological pattern with consistently lower values in the second half of Round 2, though not as sharply lower as the hydrocarbon data. The aldehyde sampler was connected to the same branch of the sampling train as the canister sampler. This branch of the sampling train was disconnected from the main sampling line and capped off during the temperature experiments. A leak somewhere in this part of the sampling train, which allowed room air to mix with vehicle exhaust, is the most probable explanation for the near-zero ratios after the mid point in Round 2. Accordingly, the data for VOC and carbonyl compounds for the second half of Round 2 must be considered invalid. Figure OS-28 presents a chronological figure of the ratio of TMNHC measured by DKI and BKI. Of the 57 canisters collected and analyzed for VOC speciation in Round 2, 32 were affected.

The distributions in emission rates in Figures OS-29 through OS-32 for BTEX and formaldehyde show that newer model year vehicles are generally clean and that emissions of older vehicles are highly variable with some vehicles emitting BTEX and formaldehyde at rates exceeding that of normal emitters by more than two orders of magnitude. The figures also illustrate the sampling problems that occurred during the second half of Round 2. Although unfortunate, the partial loss of VOC speciation data should be viewed in context of the two main project objectives, which are to establish the distribution of emissions for the in-use vehicles in Kansas City and chemical profiles for VOC and PM emissions. Even without the partial loss of data, the speciated emissions data alone would have not been sufficient to fully characterize the distribution of emissions of specific VOC or volatile MSAT. Rather it is the bulk hydrocarbons and PM emissions data for the larger set of test vehicles that provide the emissions distributions of the in-use vehicle fleet. The speciation profiles, averaged by appropriate factors such as season, region, or high versus normal emitters, provide the means for disaggregating total emissions to specific species.

The missing VOC speciation data were reconstructed by first calculating the ratios of reported concentration of each hydrocarbon compound to the total HC reported for each run. These ratios were then averaged for all valid canister samples and the resulting average and standard deviation of the ratios were used to estimate the hydrocarbon speciation for the invalid samples based on the total HC from BKI's bag samples. These reconstructed data are included with the data set for completeness in a separate table. The previous plots for BTEX emissions are shown in Figures OS-33 and OS-34 as fractions of individual species to the sum of BTEX. The abundances of benzene, toluene, ethylbenzene and xylenes are similar among the samples and between Rounds 1 and 2. Figure OS-35 shows the strong correlations among related aromatic hydrocarbon species for all exhaust composites.

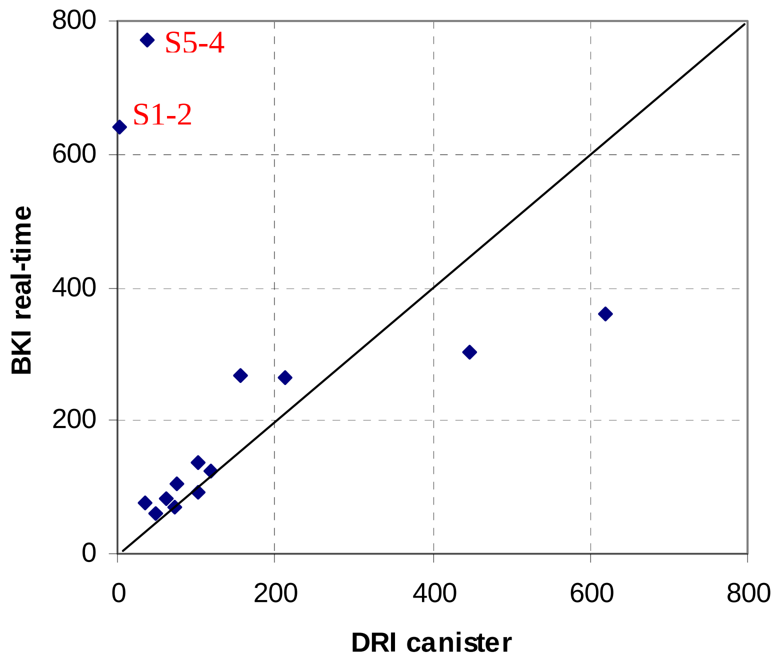


Figure OS-26. Correlation plot of BKI total TNMHC (ppmC) and DRI NMHC (ppmC) for Round 1.

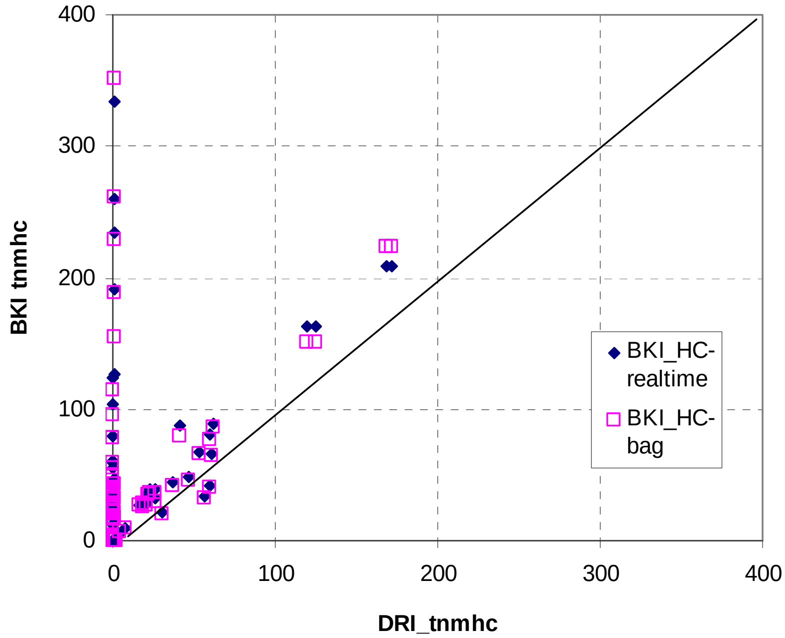


Figure OS-27. Correlation plots of BKI total TNMHC (ppmC) and DRI NMHC (ppmC) for Round 2.

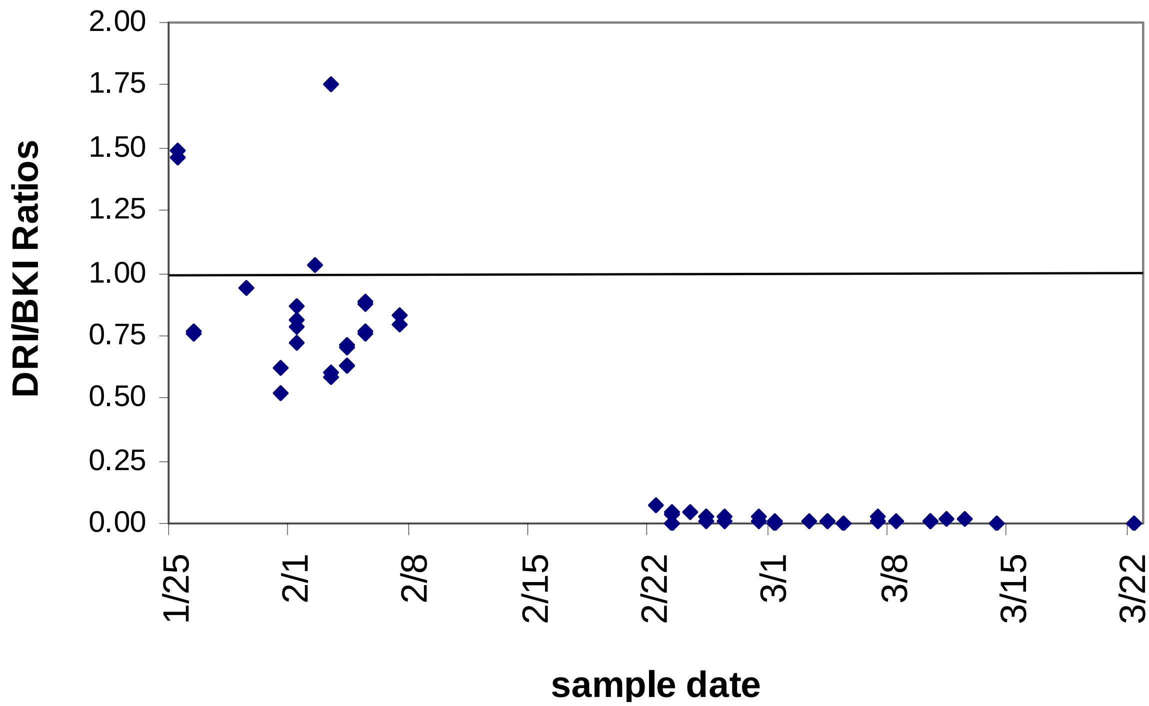


Figure OS-28. Ratios of the TNMHC measured by DRI to BKI during Round 2 shown chronologically.

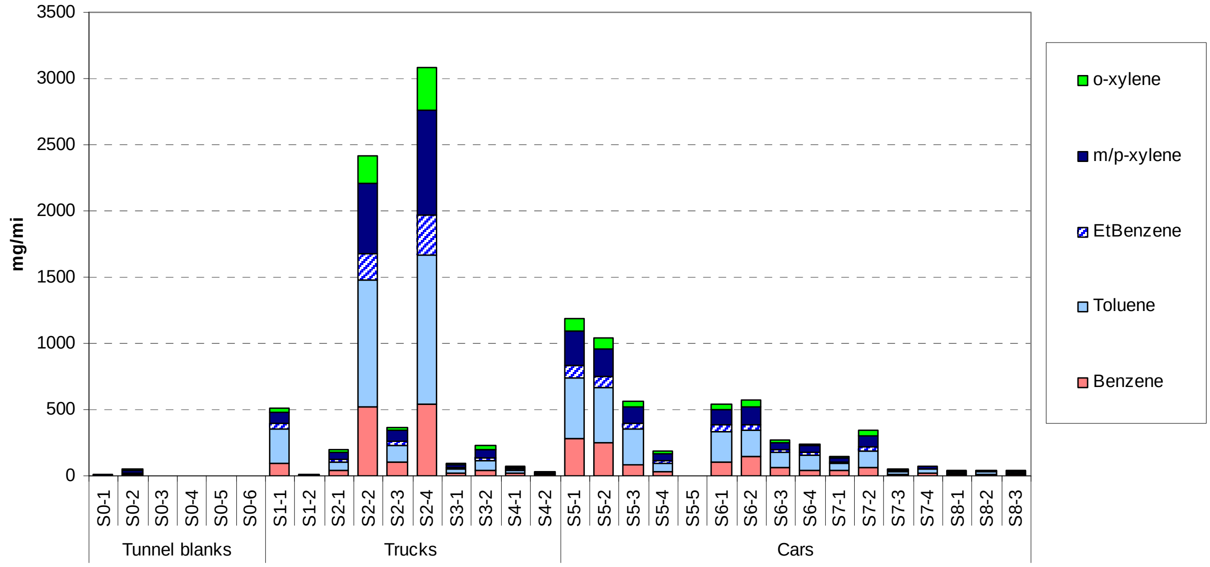


Figure OS-29. Emission rates (mg/mile) of BTEX for individual/composite samples from Round 1.

(Data for S1-2, S5-4 and S5-5 are suspect.)

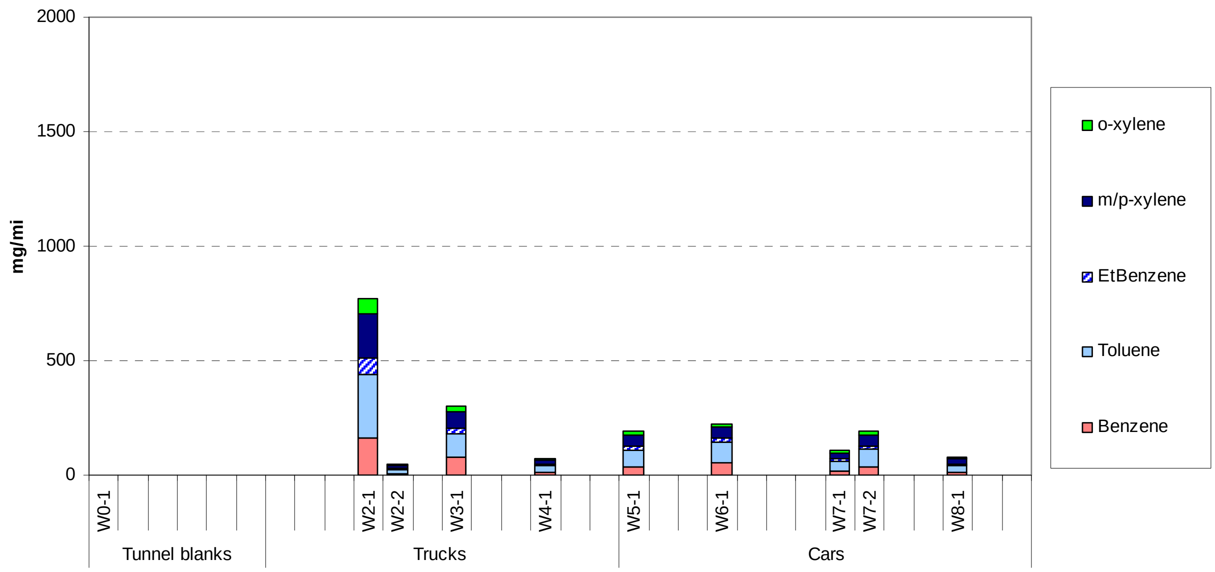


Figure OS-30. Emission rates (mg/mile) of BTEX for individual/composite samples from Round 2.

(Samples collected after mid-February 2005 are invalid and are not shown in the figures.)

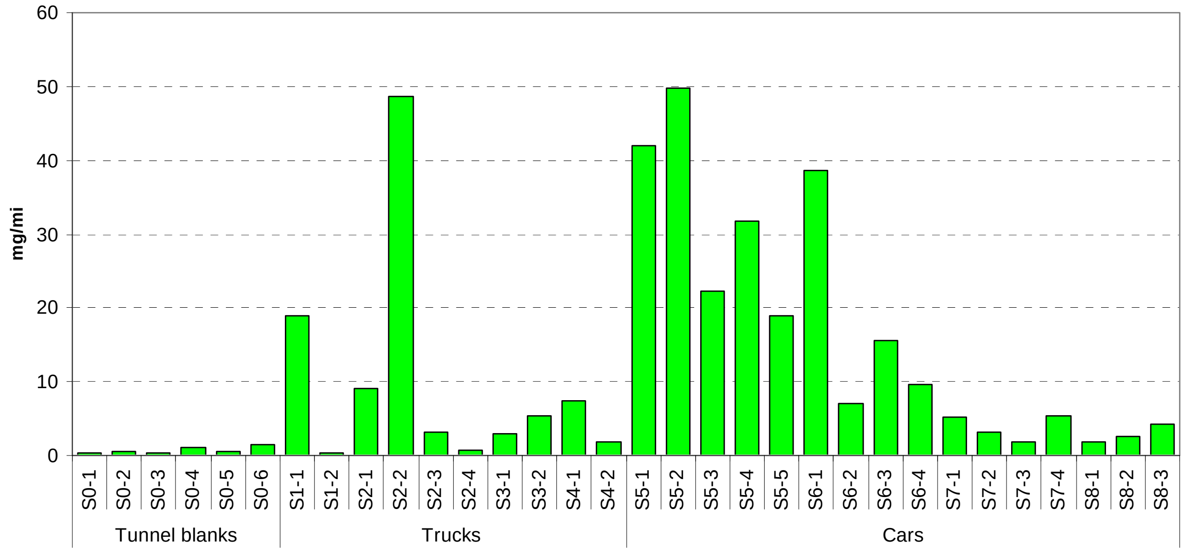


Figure OS-31. Emission rates (mg/mile) of formaldehyde for individual/composite samples from Round 1.

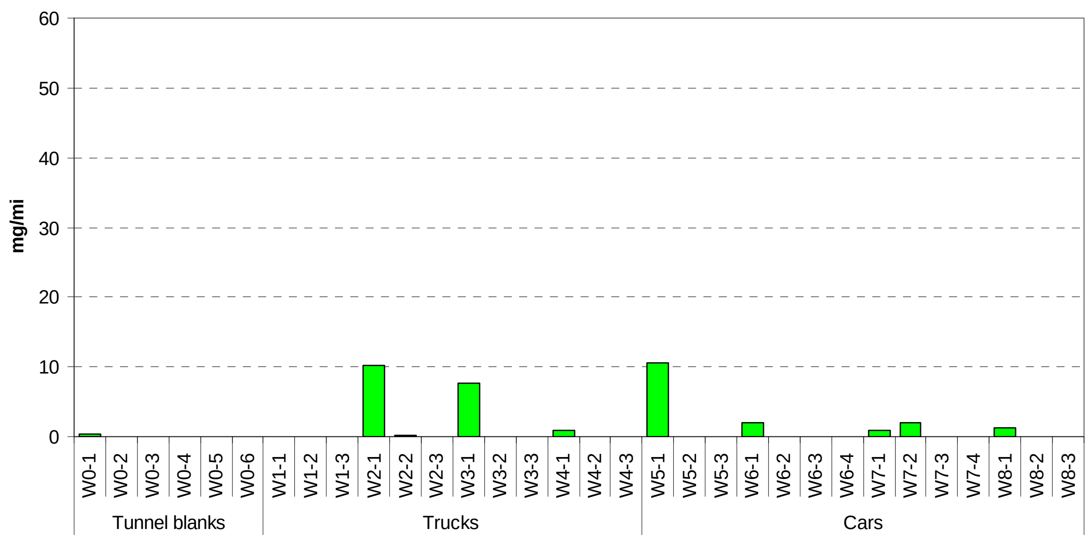


Figure OS-32. Emission rates (mg/mile) of formaldehyde for individual/composite samples from Round 2

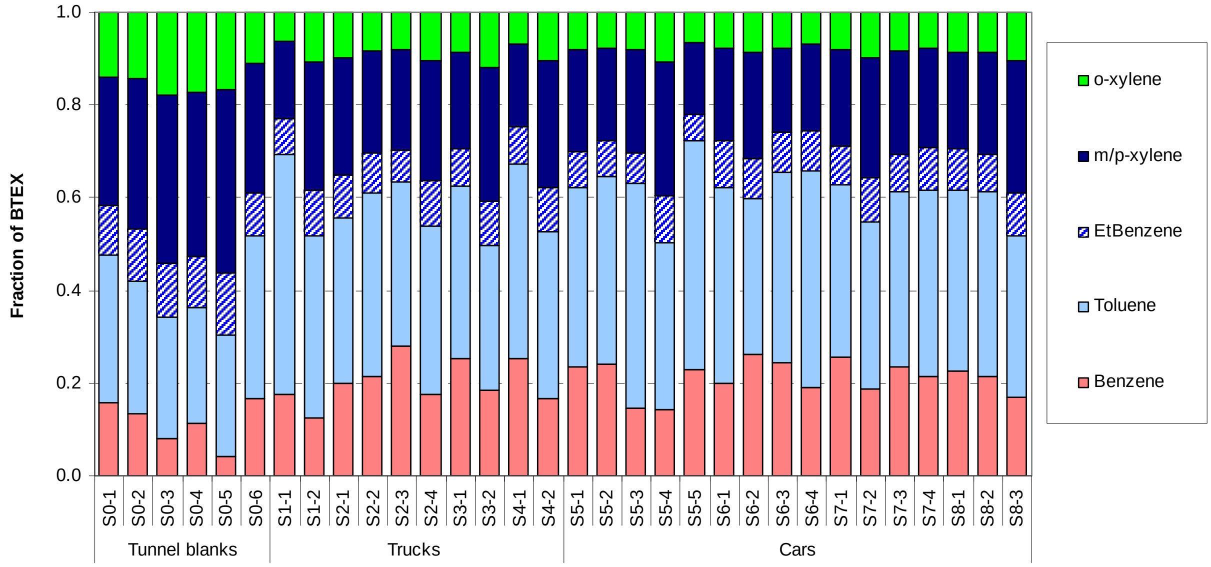


Figure OS-33. Fraction of BTEX for individual/composite samples from Round 1.

(Data for S1-2, S5-4 and S5-5 are suspect.)

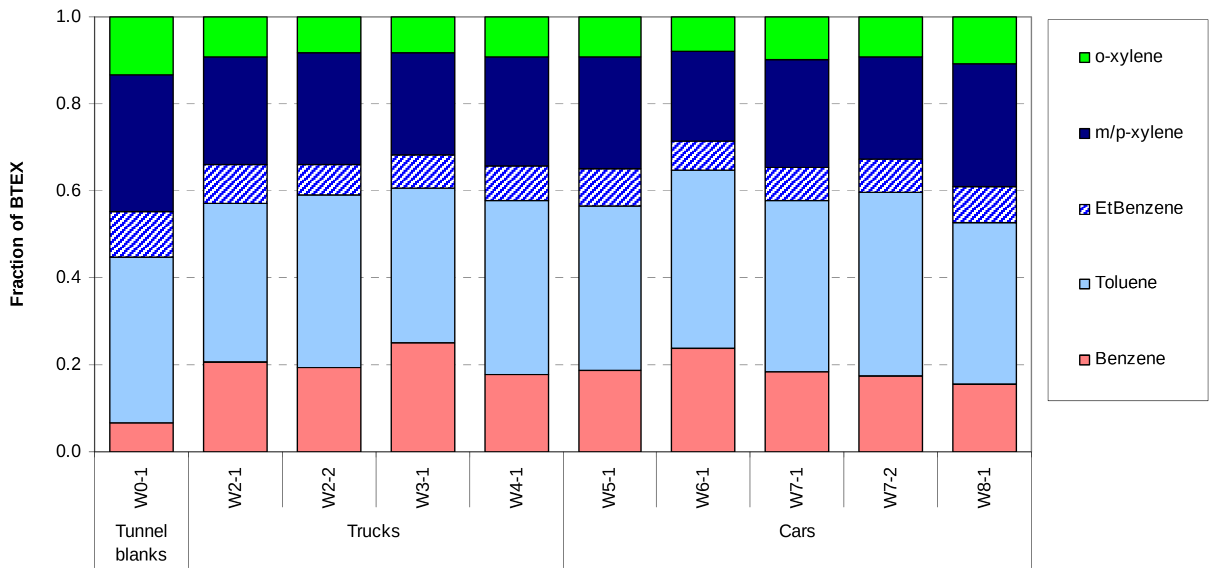


Figure OS-34. Fraction of BTEX for valid individual/composite samples from Round 2.

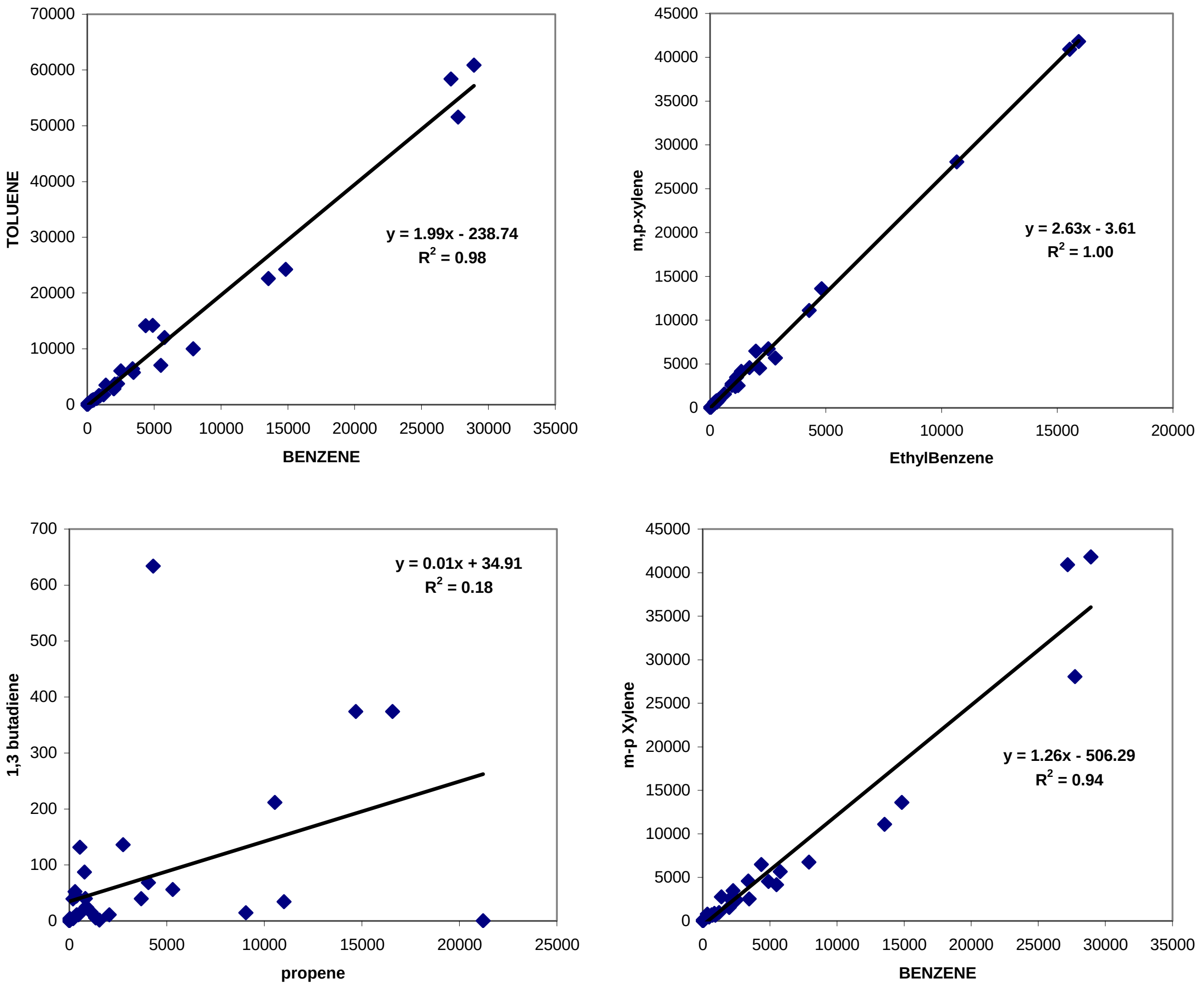


Figure OS-35. Correlation plots of related VOC species for all exhaust composites.

Concentrations shown are ppbC of diluted exhaust.

The lack of correlation and the low 1,3-butadiene/propene ratios shown in Figure OS-35 indicate that a substantial fraction of the 1,3-butadiene had been lost in most of the samples due to reaction with NOx. As previously mentioned, the true values are estimated by multiplying the propene values by the 1,3-butadiene/propene ratio from the DOE/NREL Gasoline/Diesel PM Split Study.

Acrolein is known to rearrange on DNPH cartridges to an unknown degradation product (acrolein-X) (Tejada, 1986). This rearrangement is sufficiently rapid that most of the acrolein may convert to acrolein-X, unless the sample is analyzed within a few hours. The problem is compounded by the fact that acrolein-X co-elutes in the HPLC analysis with butyraldehyde. A procedure was developed in a separate project conducted by the DRI for the Health Effects Institute (Fujita et al., 2006) and applied after the initial analyses to more accurately quantify acrolein and butyraldehyde.

In summary, the VOC profiles are very consistent across all categories for major air toxics (BTEX). Emission rates were highly variable, but higher for strata 1, 2, 5, and 6. Tunnel blanks showed very low concentrations relative to exhaust samples.

1.0 Introduction

The U.S. Environmental Protection Agency (EPA), the Coordinating Research Council (CRC), the U.S. Department of Energy's (DOE) National Renewable Energy Laboratory (NREL), the U.S. Department of Transportation (DOT) Federal Highway Administration (FHWA), and the State and Territorial Air Pollution Program Administrators/Association of Local Air Pollution Control Officials (STAPPA/ALAPCO) sponsored a program to evaluate exhaust emissions from light-duty gasoline vehicles (LDGVs). The program measured particulate matter (PM) and other components of exhaust emissions from approximately 480 randomly selected, LDGVs in the Kansas City Metropolitan Area. Data obtained from this program will be used to evaluate and update existing and future mobile source emission models (MOBILE6 and MOVES).

In the Summer of 2004, EPA established a contract with Eastern Research Group, Inc. (ERG) to conduct a program in Kansas City to evaluate exhaust emissions from light-duty gasoline vehicles. The study was conducted in Kansas City in three parts:

Part 1: Pilot Study (June 2004)
Part 2: Round I Testing (July-September 2004)
Part 3: Round II Testing (January-April 2005)

1.1 Background

Mobile sources significantly contribute to ambient concentrations of air contaminants, including PM. Recent source apportionment studies for PM_{10} and $PM_{2.5}$ indicate that mobile sources can be responsible for over half of the ambient PM measured in an urban area (Motallebi, 1999; Magliano, 1998; Dzubay et al., 1988). Some of these source apportionment studies have attempted to differentiate between contributions from gasoline and diesel combustion. Studies conducted in Denver and Phoenix indicated that gasoline combustion from mobile sources contributed more to ambient PM than diesel combustion (Lawson and Smith, 1998; Ramadan, 2000). However, studies conducted in Los Angeles and the San Joaquin Valley in California indicate that diesel combustion contributed more than gasoline combustion to ambient PM (Schauer et al., 1996; Schauer and Cass, 2000). Existing emission inventories developed by the EPA also suggest diesel vehicles contribute more than gasoline vehicles to ambient PM concentrations.

Exhaust emissions of particulate matter from gasoline-powered motor vehicles have changed significantly over the past 30 years (Cadle et al., 1999). These changes have resulted from reformulation of fuels, the wide application of exhaust gas treatment, and changes in engine design and operation. Because of these evolving tailpipe emissions, along with the wide variability of emissions between vehicles of the same class (Hildemann et al., 1991; Cadle et al., 1997; Sagebiel et al., 1997; Yanowitz et al., 2000), well-defined average emissions profiles for the major classes of motor vehicles have not been established.

The majority of exhaust PM emitted by motor vehicles is in the $PM_{2.5}$ size range. Kleeman et al. (2000) have shown that gasoline and diesel fueled vehicles produce particles that are mostly less than 2.0 μm in diameter. Cadle et al. (1999) found that 91% of PM emitted by in-use gasoline vehicles in the Denver area was in the $PM_{2.5}$ size range, which increased to 97% for "smokers" (i.e., light-duty vehicles with visible smoke emitted from their tailpipes). Durbin et al. (1999) found that 92% of the PM was smaller than 2.5 μm for smokers. The mass median diameter of the PM emitted by the gasoline vehicles sampled by Cadle et al. (1999) was about 0.12 μm, which increased to 0.18 μm for smokers. Corresponding average emissions rates of $PM_{2.5}$ were 38 mg/mi for normal emitting gasoline vehicles and 222 mg/mi for gasoline smokers.

The research by Cadleet al. (1999) and Norbeck et al. (1998) estimated the incidence of vehicles with visible smoke plumes using roadside surveys. Cadle used both remote sensing and visual surveys in Denver, Colorado and Norbeck used the visual method in Southern California. Their results were somewhat different, but the fleet average incidence was found to be about 1%.

Emissions from smokers are comparable to those from diesel vehicles. Thus, older and poorly maintained gasoline vehicles could be significant sources of $PM_{2.5}$ (Sagebiel et al., 1997; Lawson and Smith, 1998). Durbin et al. (1999) point out that although smokers constitute only 1.1 to 1.7% of the light-duty fleet in the South Coast Air Quality Management District in California, they contribute roughly 20% of the total PM emissions from the light-duty fleet. Motor vehicles that are high emitters of hydrocarbons and carbon monoxide can be high emitters of PM (Sagebiel et al., 1997; Cadle et al., 1997). National distributions of smokers and high emitting vehicles for PM have not been evaluated.

ERG has estimated the incidence of smoking vehicles in the Phoenix fleet by analyzing data from the Maricopa County Smoking Vehicle Hotline. Data from the Maricopa County Smoking Vehicle Hotline indicates that the incidence of smoking vehicles that are new is up to 100-times lower than the fleet average, and the incidence of older smoking vehicles is up to 4-times higher than the average, indicating a strong age dependence for smokers.

Many studies have tried to characterize the distribution of PM for a vehicle fleet. One example of a PM emission distribution is shown in Figure 1-1. We see that there is an age dependence in the data but also that there is a large variance among vehicles. As an example, 10-year-old vehicles can have PM emissions from 1-2 mg/mi to 1,000 mg/mi.

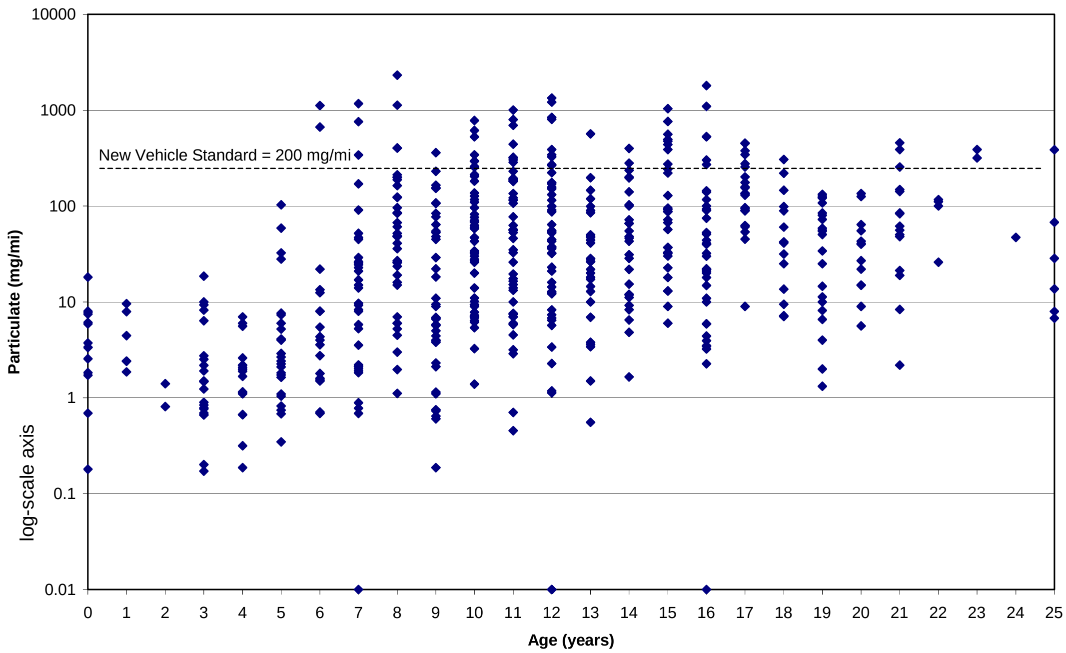


Figure 1-1. Example Plot of PM Data from Light-Duty Gasoline Cars and Trucks, Model Year 1994 and Older

Source: Burnette, A.D.; Kishan, S., "PART5-TX1: Update of the PART5 Model For Use In Texas." Final report by ERG for the Texas Natural Resource Conservation Commission (now named Texas Commission on Environmental Quality). Austin, Texas, July 14, 2000. Note: The data are from in-use vehicles recruited from private owners. The database was compiled from various research sources.

A major obstacle in previous emissions testing studies has been the recruitment of vehicles. Most studies have not incorporated random sampling in the study design due to the high non-participation rate and the high incentive costs associated with random sampling of vehicles. Therefore, few studies, and no studies evaluating light-duty PM emissions, can be used to represent the distribution of vehicle emissions in a large population.

1.2 Study outline

One of EPA's key missions has been to understand, evaluate, and reduce exhaust emissions from motor vehicles. Since the late 1960's, EPA has been focused on this mission and has implemented many regulations to achieve this goal. One primary mechanism to reduce emissions has been the promulgation of new emissions standards for pollutants from motor vehicles that require vehicle manufacturers to reduce emissions from new vehicles. However, even if a new vehicle has low emission levels, as that vehicle ages, its emissions will increase as its engine wears and its emissions control components deteriorate.

In an effort to understand the emissions of a fleet comprised of both new and older vehicles, EPA has conducted studies to measure emissions from a random sample of vehicles and then projected it to the population as a whole. Gaseous emissions have been studied extensively through the last few decades, both through special studies and through analysis of vehicle inspection and maintenance (I/M) program data. However, particulate matter (PM) emissions from gasoline-powered motor vehicles are less understood. Through this study EPA has conducted a "watershed" research experiment to characterize PM emissions from a very carefully selected random sample of vehicles in a major metropolitan area.

The metropolitan area chosen by EPA was Kansas City, MO/KS. The primary reason for this choice was that KC is the largest US metro area without an I/M program. In an I/M program area vehicles are regularly required to be tested and repaired to meet local emissions standards. Since I/M programs affect a vehicle's deterioration rate (by requiring repairs and maintenance that otherwise might not be performed), conducting a study on vehicles not subjected to an I/M program allows evaluation of vehicles under "natural" deterioration rates. The Kansas City fleet sample tested in this study was not influenced by any I/M program. In addition, PM emissions can be influenced by ambient temperature and this study was conducted throughout a wide range of summer and winter temperatures.

EPA envisioned this study to be a landmark study in which special attention was given to selecting a participating sample chosen from the general population in a scientific manner. In addition, all vehicle testing procedures were specified in a QA document approved by EPA. Calibration tests, replicate tests, laboratory correlation, non-response analysis, seasonal effects, and emissions test variability were all considered and included in the program design. EPA monitored the field testing closely, and ERG established a secure web site and an FTP site to report project status on a daily basis to EPA.

Another key feature of this study was intended to identify how real-world on board measurement devices (PEMS) could be used to collect mass-based vehicle emissions exhaust data. These devices were put on all vehicles tested in this project. Additionally, a PEMS device was connected to every vehicle while it was simultaneously measured with laboratory grade instruments on a dynamometer. This information may be used to assess the use of PEMS devices as a primary method for collecting on-road vehicle emissions data.

Data was closely managed on-site and then posted for further integrity and QA checks and analysis at other ERG offices. The data was delivered to EPA in raw and QA'd form. Quality-assured data was also put into the EPA MSOD format and delivered to EPA.

The ERG team used a prior transportation study conducted by Mid-America Regional Council as a starting point for recruiting vehicles for this project. The MARC 2004 Household study (Kansas City Regional Household Travel Survey Final Report, 2003) participants were used as a cohort for recruiting vehicles. ERG's subcontractor NuStats conducted this study for MARC.

The KC study was conducted in three distinct Phases. In the Pilot phase the KC facility was set up and all equipment, staff, and logistics were mobilized. The team also tested 3 EPA-provided "correlation" vehicles to compare EPA Ann Arbor dynamometer laboratory measurements with those obtained using the EPA portable Clayton dynamometer at the KC test facility. The Pilot Study is included in Appendix BB. The main study was started in June 2004 and was called Round 1 testing. During this round, approximately 250 vehicles were tested under summer conditions at the facility. In the final testing round, Round 2, approximately 250 additional vehicles were tested under winter conditions. Approximately 40 vehicles tested during Round 1 were re-tested in Round 2 to compare exhaust emissions changes due to seasonal changes.

During the course of testing, about 4 to 6 cars were usually tested each day. A typical scenario for testing of a vehicle was as follows. Mailouts describing the test program were initially sent to prospective vehicle owners. These vehicle owners were then recruited by ERG team personnel in call centers for participation in the study, and an incentive was established as a participation reward for each participant. An appointment for delivery of the vehicle to the testing site was established. A day before the scheduled appointment, the vehicle owner was contacted as a reminder. Once the vehicle arrived at the testing site, ERG's personnel evaluated the vehicle's condition and took several photographs to establish its general status. The test program and condition of the vehicle were discussed with the vehicle's owner, and several kinds of information were collected about the driver and the vehicle. Fuel and lubricating oil samples were extracted from each vehicle and stored for future analysis. Once the vehicle was accepted for testing, a portable emissions measurement system (PEMS) was installed on the vehicle and a conditioning test was conducted. This required that the vehicle be driven on a predetermined route for about 30 minutes to prepare it for dynamometer testing in a manner consistent with all other test vehicles. After the conditioning test, the PEMS was removed from the vehicle, and the vehicle was stored at the test site for testing the next day. On the following test day, the vehicle was pushed on to the dynamometer and the vehicle emissions testing components were attached to the vehicle. These included both the connection from the vehicle tailpipe to the dilution tunnel of the lab-grade testing equipment, and installation of PEMS device on the vehicle for simultaneous measurement. The vehicle was then driven through the three Phases of the LA-92 driving cycle, and its exhaust emissions were measured and recorded on a second by second basis. The following vehicle measurements were conducted during the testing:

Measurements via the dilution tunnel:

- THC via FID
- CO & CO2 via NDIR
- NOx via Chemiluminescence
- Gravimetric mass and elemental analysis through Teflon membrane collection
- EC/OC and Ion analysis though Quartz membrane collection
- PM and SVOC via TIGF/XAD
- Canister Sampling for 1-3 butadiene with NOx Denuder
- Carbonyls through DNPH Cartridges
- Continuous PM measurements via a Quartz Crystal Microbalance (QCM) and verified using DustTrak and DataRAM nephelometers

Measurements via PEMS devices:

- THC via FID
- CO via NDIR
- CO2 via NDIR
- O2 via Electrochemical Sensor
- NO via NDUV

- Vehicle parameters via OBDII connector (if available)
- Temperature and relative humidity via portable weather probe
- Location, velocity, altitude via GPS

In addition, all ambient and dilution tunnel conditions including temperature, humidity, and ambient THC levels were independently measured and recorded on a continuous basis. At the end of the dynamometer testing, equipment was removed from each vehicle, the vehicle was taken off the dynamometer and checked for any damage, and was then stored for customer pickup. Participants were given their incentives during vehicle pickup. Some vehicles were selected for additional instrumentation with PEMS devices before their release, and the participants were requested to drive the vehicle in their usual way. No route or duration was specified (although the drivers were encouraged to perform as much of their regular driving as possible with the PEMS device installed). Drivers then returned to the testing facility the next day for the removal of the PEMS equipment.

Another component of the testing program included the RSD testing of the general KC fleet during Round 1 and Round 2. Over the 3-4 months of in-field testing, RSD vans were conducting tests for about one week each month. This information was used to compare the KC fleet with the sample tested at the KC testing facility.

After the testing was completed, emissions data from each aspect of the testing program was put through several iterations of QA/QC. The ERG team then converted all the data into EPA's MSOD format and delivered all the information to EPA. All raw files and final MSOD data set have undergone a thorough EPA review.

Summary of Goals

Data obtained from this program will be used to evaluate and update existing and future mobile source emission models. This project will also provide a benchmark to establish various vehicle recruitment, testing, data collection, and vehicle exhaust emissions analysis protocols which EPA may use in future data collection efforts. The study itself was conducted in three parts: a Pilot Study, Round 1, and Round 2.

Initially, the Pilot Study was used to set up the testing facility in Kansas City, finalize all testing and data handling procedures, and test 3 vehicles at the EPA Ann Arbor facility and the Kansas City facility to establish the baseline relationship between the two facilities. Testing was conducted in two Rounds in the Summer of 2004 (Round 1), and the Winter of 2004/2005 (Round 2). Vehicles were recruited and then tested with Portable Emissions Measurement Systems (PEMS) and on conventional dynamometers with laboratory grade emissions measurement systems. The following sections provide an overview of the numbers of vehicles tested in both Rounds.

The KC testing program was designed by EPA to collect vehicle exhaust measurements from a randomly selected set of vehicles so that the following primary goals could be met:

- Characterize PM emissions distribution in the Kansas City fleet;
- Identify the high emitter percentage in that fleet;

- Collect exhaust emissions (both gaseous and PM toxics) for vehicles in the fleet.

In addition, there were a number of secondary goals for the study, including:

- Demonstrate the use of a cohort, and a sampling plan to select candidate vehicles;
- Test vehicles in an ambient environment close to their operating area, and gather data in summer and winter conditions;
- Refine the use of PEMS configurations for large scale implementation;
- Compare results of laboratory grade measurement devices with PEMS;
- Develop useful continuous PM measurement techniques compared to traditional gravimetric measurement;
- Develop inventory of speciated HC constituents of vehicle exhaust in PM and gaseous modes;
- Gather emissions and activity data on vehicles driven by their owners in real world conditions; and
- Gather information to relate second by second vehicle driving and resulting PM emissions for developing input data for emissions models;

Pilot Testing

The first field testing phase was Pilot Testing. Details of the Pilot Testing are available in a separate report (provided in Appendix BB). The primary goals of this phase were:

- Set up a testing facility in Kansas City that will be used for the entire study;
- Finalize all testing methodologies, testing procedures, and data handling procedures; and
- Test three vehicles in Ann Arbor and Kansas City to establish the relationship between the emission results from the two facilities.

Setting up the testing facility was an intense task. A warehouse was selected in KC to serve as the testing facility. EPA's portable dynamometer was transported to this facility and was set up for emissions testing. All testing equipment for gaseous and PM emissions measurement were arranged and detailed handling procedures for handling vehicles, equipment, and data were established. In addition, three EPA provided vehicles were tested in Ann Arbor and at this facility to compare results between the two laboratories.

1.2.2 Round 1 Testing

The main study in Kansas City started in July of 2004. This period was designated as Round 1. Vehicles were tested in typical Midwest summer conditions. Although the total number of vehicles dynamometer tested exceeded project goals, several strata targets were not achieved (most notably in bins 1 and 5). The MARC vehicle database was solely used for vehicle recruitment (via random digit dialing, or RDD) for Round 1 recruiting.

Table 1-1 lists the various tests conducted during Round 1, in comparison with project goals. PEMS testing on conditioning runs was performed on all vehicles, regardless of dynamometer eligibility.

Table 1-1. Round 1 Tests Conducted

Test Type	Round 1 Goal	Round 1 Tested
PEMS Conditioning Test	All	284
Replicate PEMS Conditioning Test	1 per week	17
PEMS Driveaway Test	N/A	13
Dynamometer/PEMS Test	250	261
Dynamometer/PEMS Test Replicate	1 per week	15
Dynamometer/PEMS Control Vehicle Test	1 per week	12

1.2.3 Round 2 Testing

The goals of the Round 2 testing were similar to those of Round 1 testing. One important additional goal of Round 2 testing was to test the vehicles in colder weather where PM formation mechanisms may be different than those in warmer weather. In order to better achieve strata-specific test targets during Round 2 testing, the MARC database used for Round 1 recruiting was supplemented with the KC registration database for Round 2 recruiting of Bins, 1, 2, 5, and 6. This significantly improved recruiting efforts. This additional database for recruiting older vehicles provided an additional pool of the older, less populated vehicle group. Due to the sampling methodology developed, more older vehicles were recruited as a fraction of their population due to the higher likelihood of high emitters as well as high emissions variability within this group.

Table 1-2 lists the various tests conducted during Round 2, in comparison with project goals. Regardless of dynamometer test eligibility, PEMS tests (during the conditioning run) were performed on all vehicles (excluding vehicles whose interior would not accommodate a PEMS device).

Table 1-2. Round 2 Tests Conducted

Test Type	Round 2 Goal	Round 2 Tested
PEMS Conditioning Test (excluding replicates)	All	324
Replicate PEMS Conditioning Test	1 per week	19
PEMS Driveaway Test	50	51
Dynamometer/PEMS Test (excluding replicates)	261	279
Dynamometer/PEMS Test Replicate	1 per week	12
Dynamometer/PEMS Control Vehicle Test	1 per week	12
PAMS Driveaway Test	N/A	8

1.2.4 Round 1 to Round 2 Retest Vehicles

Selected vehicles were originally tested during Round 1 and were then retested at the start of Round 2 in order to provide summer/winter correlation data. Forty-two of these Round 1 retest vehicles were tested (exceeding the retest target of 25 vehicles) in order to ensure all strata were filled.

1.3 Report Presentation

This report summarizes the results of the testing conducted in Kansas City, KS in July 2004 through April 2005. Section 2 presents information on facility site selection and project setup, including calibration of the instrumentation used during testing. Section 3 discusses vehicle recruitment and sampling methodologies. Section 4 presents a discussion of the testing process, as well as data summaries and test conclusions.

The report appendices contain extensive supplementary data, plots, and charts referenced in this document. A detailed index of the contents in the appendices is provided at the end of this document. The ERG team performed many levels of QA/QC on data obtained during the course of the study, and the final datasets were provided to EPA in a format suitable for loading into the Mobile Source Observation Database. As EPA uses these data for input into MOVES, further data editing may be necessary before the data are released to the public.

2.0 Site Selection and Project Setup

In March 2004, ERG conducted a pilot study to establish a testing facility in Kansas City, finalize all testing methodologies, testing procedures, and data handling procedures, and test three vehicles in Ann Arbor and Kansas City to establish the relationship between the emission results from the two facilities. At the conclusion of the study in June 2004, ERG prepared and submitted a report on its outcome.

The site chosen to conduct testing was located at 6636 Berger Avenue, Kansas City, KS. This property had about 7,000 sq ft total floor space, with about 1,000 sq ft office and 2 restrooms. With four 14' x 14' bay doors plus two wall vent fans, this site provided adequate ventilation and easy access. The facility lacked an overhead water sprinkler system, which meant it could be used at sub-freezing temperatures. About 5,000 sq ft of main floor space was available for the test area and vehicle soaking, with another 900 sq ft of area for working on and inspecting vehicles. The site also included three offices plus a common area. The front entrance and parking was ideal to greet vehicle owners. The site had ample outdoors parking and storage, and the building was ready to occupy after minor clean up.

2.1 QAPP

A final Quality Assurance Project Plan (QAPP) was prepared and submitted in August 2004, in accordance with Section 4.0 of the original EPA task order for this project. The plan, developed in consultation with the EPA’s project officer and sponsors, specifies the details required to collect and analyze the source samples in a manner consistent with the objectives of the study.

The QAPP covered aspects of the test program as outlined in the EPA task order, including the following areas:

- Contractual support in maintaining, calibrating, and operating mobile source emissions measurement equipment used in the field. The necessary support includes analyzing the collected samples, data processing, and report writing.
- Pilot programs (including a report on all sample data analyzed)
- Vehicle recruitment
- Vehicle testing
- Speciation
- Quality assurance/quality control
- Data management and integration
- Data analysis
- Oral and written reports
- A methodology for regularly transferring and reviewing all data streams within this project

2.2 Dynamometer Setup

Vehicle driving simulation was conducted using EPA-ORD’s transportable dynamometer, a Clayton Model CTE-50-0 chassis dynamometer mounted within a towable

Fruehauf trailer. The dynamometer is a vintage 1975 model and has been in service routinely over the last 15 years on similar field studies. The dynamometer is capable of simulating a continuous spectrum of loads from 3 to 50 Hp @ 50 mph and inertias from 1750 to 3000 pounds in 250 pound increments and 3000 to 5500 pounds in 500 pound increments. Cooling fluid for the dynamometer's water brake power absorption unit consists of a 50/50 mixture of water and glycol. The fluid is recirculated and cooled by a self-contained pumping and cooling system.

For this study, the dynamometer was set up in one quadrant of a large building. Large (14’ x 14’) bay doors on either end of the building were opened and provided natural ventilation to ambient conditions. Power for the dynamometer and associated utilities was obtained from the building’s power grid. The dynamometer, as mounted on the Fruehauf trailer, is elevated approximately 3 feet above ground level. Ramps and an electric winching system were installed to bring the test vehicles onto the dynamometer for cold start emissions testing.

The dynamometer and associated equipment was originally set up on site for the pilot study, and remained in place for the duration of both Rounds 1 and 2. One modification was made to the dynamometer before beginning Round 1, as suggested after reviewing results from the pilot study. The change involved switching the speed signal from the front, coupled roll, to the rear, uncoupled roll. To accomplish this, a speed encoder was installed on the rear roll, wired to the driver’s aid, and calibrated.

A Positive Displacement Pump-Constant Volume Sampler (PDP-CVS) system was used to quantitatively dilute exhaust gas from the vehicle operating on the dynamometer. The PDP-CVS system employed an 8-inch diameter stainless steel dilution tunnel with particulate filtered inlet air and a SutorBilt PDP operating at ~540 SCFM. The outside of the dilution tunnel was insulated with Insulwrap and the temperature of the diluted exhaust and dilution tunnel was maintained at a constant temperature of 46^{o}C using a 27.3 kW, electric dilution air heater (Unique Products model number 507-574) whose feedback control thermocouple had been moved to a location near the PDP inlet. The dilution air was also treated to reduce humidity levels by placing a re-generative desiccant-type dryer (TempAir model TD400) at the dilution tunnel inlet. The dryer was used only during Round 1, treating the humid air typical of Kansas City in the summer time. Both the heater and the dryer were powered with a portable, diesel-fueled 50kW generator located outside and adjacent to the facility. Diluted exhaust exiting the CVS-PDP system was routed through 8-inch diameter ducting to an existing, wall-mounted exhaust fan to remove diluted exhaust from the building.

The transportable dynamometer system has used modal emissions analysis for the determination of regulated emissions in previous field studies. A bag sampling system was constructed and installed for this study to give dual modal/bag analysis capabilities. Total Hydrocarbons (THC) were analyzed with a Horiba Model FIA-236 Flame Ionization Detector. Oxides of nitrogen (NOx) were analyzed with a Horiba Model CLA-220 Chemiluminescence instrument. Carbon monoxide (CO) and carbon dioxide (CO2) were analyzed with Horiba Model AIA-210 infrared instruments. A Horiba Model AIA-23 infrared instrument was used to analyze low level CO concentrations. All instruments were rack mounted and plumbed for introduction of zero, span, and sample gases through the use of solenoid valves and pushbutton controls. Regulated emission analytical instrumentation remained powered on 24 hours per day. Sample delay times (8-12 seconds) were measured during the Pilot Study in order to time align modal gaseous data with the vehicle speed trace. The sample line lengths were not the same lengths. The THC analyzer had a dedicated heated sample line, and the CO, CO2, and NOx instruments used a second common sample line and water trap (chiller) to remove moisture from the sample stream. Time alignment was performed for each analyzer during post processing of the data.

2.3 Maintenance and Calibration of CVS, Dynamometer and Regulated Emissions Instrumentation

Constant Volume Sampler (CVS)

As specified in Section 4.2.1 of the QAPP, and in accordance with 86.119-78 paragraph (c) of 40 CFR July 1, 1983, monthly propane injections were conducted on the CVS-PDP system to verify CVS flow. Results of the propane injections, conducted on July 25, August 30, and September 30 of 2004, and January 10, February 24, and March 29 of 2005 are given in Appendix E. Injections were conducted in triplicate on each date, with the dilution tunnel heated to its normal operating temperature of 46°C ± 3°C, and results were calculated for both bag and modal (real time) HC analysis. Propane mass injected was determined gravimetrically by recording before and after weights of the propane cylinder on a digital balance. Propane mass recovered was calculated using analyzed HC concentrations and a previously determined PDP V0 of 0.306 cubic feet/revolution. Agreement between propane injected and propane recovered was within the CFR guidelines of ± 2%, except for the bag calculated values in August 2004 and modal calculated values in January 2005. No explanation could be found (or at least verified) for the rather large percent differences (>4%) found in these two cases. No corrective actions were performed in either the August 2004 or the January 2005 cases and in each case, the next scheduled injection was within the 2% CFR guidelines.

Regulated Emissions Instrumentation

Per Section 4.2.1 of the QAPP, all analyzers used in the measurement of HC, CO, NOx, and CO_2 were calibrated in accordance with requirements 86.121-82, 86.122-78, 86.123-78, and 86.124-78, respectively, all of which can be found in 40 CFR July 1, 1983. Instrumentation used to measure regulated emissions (THC, NOx, CO, CO_2) associated with chassis dynamometer operation were checked for linearity prior to study startup and on a monthly basis during the study itself. Linearity checks were performed 5 times during the study, twice during Round 1 and three times during Round 2. Linearity checks were performed via multipoint calibrations. Appendix E presents results of the multipoint calibration checks. Known, down-scale standard concentrations ($Conc_{std}$) were generated with a capillary type 10-point gas divider using zero gas and a known concentration of the gas of interest. Instrument response to the down-scale standard concentrations was measured and recorded as $Conc_{meas}$. Linear regression was performed on the pairs of standard and measured concentrations to determine the slope, intercept, and correlation coefficient (R^2) of the best-fit first order curve. Slope and intercepts of the regression curve were applied to the measured concentrations to produce regression concentrations $Conc_{reg}$. The difference between $Conc_{std}$ and $Conc_{reg}$ are given as a percent in the last column, and in general, are less than ± 2 %, as required for certification testing. Based on the results of the monthly multipoint calibrations, the instruments were found to remain within linearity specifications and no adjustments were required.

Working span gases for the NOx, HC, CO, and CO_2 instrumentation were obtained from Scott Specialty Gases as Continuous Emissions Monitor (CEM)-1 daily standards with a vendor provided analytical accuracy of ± 1 %. Zero airs and FID fuels were obtained both from a local vendor (Kirk Gases) and from Scott Specialty Gases. Nominal NO span gas concentrations were 90 ppm. Both a high range and low range multigas was used for the CO, CO2, and HC instruments. Nominal high range gas concentrations were 900 ppm CO, 2.5% CO2, and 900 ppmC HC, while nominal low range concentrations were 90 ppm CO, 0.9% CO2, and 90 ppmC HC.

Dynamometer

Dead weight calibrations were performed on the dynamometer's torque cell throughout the course of Rounds 1 and 2, as indicated in Table 2-1. Results remained consistent throughout the study. In addition, a daily, single point dead weight check was performed starting mid-way through Round 1 to ensure the integrity and proper adjustment of the real time torque measurement system. The daily check was initiated in response to an intermittent short occurring in the torque recording system early in Round 1, which was subsequently traced to a rusted rivet connection and corrected.

Table 2-1. Dynamometer Torque Cell- Dead Weight Calibrations

Wt Applied	**Equivalent**	**Measured**	**Measured**	**Measured**	**Measured**	**Measured**	**Measured**
lbs	***Hp@50mph***	***Hp@50mph***	***Hp@50mph***	***Hp@50mph***	***Hp@50mph***	***Hp@50mph***	***Hp@50mph***
		07/25/2004	10/04/2004	1/11/05	1/25/05	2/26/05	4/7/05
50	18.5	18.6	18.6	18.5	18.6	18.5	18.6
40	14.8	14.9	14.9	14.8	14.9	14.7	14.9
15	5.55	5.6	5.5	5.5	5.5	5.3	5.5
5	1.85	2	1.8	1.8	1.8	1.6	1.8
0	0	0.1	0	0	0	0	0

Other daily performance checks included PDP speed, dynamometer speed, and dynamometer coastdowns. Coastdowns were conducted as set out in Section 4.2.1 of the QAPP, and as outlined in 40 CFR part 86. Results of the daily performance checks are presented in Appendix E. Measured PDP speeds ranged from 1772 rpm to 1765 rpm (excepting one day with a measured speed of 1748 rpm), or about 0.5%, over the course of Round 1, and from 1768 to 1780 over the course of Round 2, indicating excellent control over tunnel flows. Measured dynamometer roll speeds were within 1% of actual measured roll speeds during both Rounds excepting two days when there was a difference of ~ 1.4 %. A slight adjustment was made to the dynamometer speed measuring system midway through Round 2 which can be seen in the control chart given in Figure 2-1. This adjustment was made after replacing the dynamometer's reflective tape strip, which was used to make the daily QA speed measurement. Replacement of the reflective tape resulted in greater accuracy and less variability in the QA roll speed measurements and a speed adjustment of <0.5% was necessary.

All daily dynamometer coastdowns were performed with an inertia of 3500 pounds and a load setting of 6.0 Hp @ 50 mph (indicated). Daily dynamometer coastdown times and speeds are presented in Figures 2-2 and 2-3, respectively. During Round 1, daily measured coastdown times ranged from 22.38 to 24.62 seconds, but remained between 23 and 24 seconds for the majority of test days, with no trends toward increasing or decreasing times. This is a good indicator that no problems were developing in the dynamometer that would affect frictional losses or vehicle loading; i.e., the dynamometer was functioning consistently throughout Round 1. During Round 2, coastdown times were shorter than in Round 1 and ranged from 20.5 to 23.09 seconds. As Round 2 progressed, coastdown times generally increased and by the end of Round 2, coastdown times were approximately the same as found in Round 1. The faster coastdown times found in the beginning of Round 2 appear to coincide with the colder test days, in which dynamometer frictional (bearing) losses were presumably greater. A dynamometer roller bearing began to deteriorate on January 23, 2005 and was replaced the next day, January 24, 2005. Coastdown times measured prior to and after the bearing replacement indicate that there was no measurable change in frictional losses.

2.3.1 Setup and Calibration of Instruments and Samplers

DRI installed and operated a suite of instruments to provide continuous PM analysis and to collect batch samples of particle and gaseous exhaust components for later analysis in accordance with the methods and procedures specified in the project QAPP. These instruments collected sample air from the dynamometer dilution system via two isokinetic probes, provided by Bevilacqua-Knight Inc (BKI) and EPA, were inserted within 5 cm of the center line of the CVS dilution tunnel prior to a 90-degree bend in the dilution tunnel. Figure 2-4 illustrates the sample train as it was installed during Rounds 1 and 2, and Figures 2-5 and 2-6 present photographs of some of the instrumentation used. Heated conductive lines (47°C) carried air from the probes to the continuous instruments. Approximately 2.3 meters of heated (47°C), insulated 3/8" ID copper tubing was used to carry sample air to the time-integrated samplers[3]. As shown in the Figure 2-4 schematic, a small 2 liter stainless steel chamber containing a $PM_{2.5}$ size cut cyclone (Bendix 240) was included in the sampling lines just before they entered the filter samplers. Both the cyclone chambers and sampler plenum or diffuser were heated to 47C and insulated.

[3] Transport times were calculated to be 12 msec in the heated lines, and less than 1 second for the cyclone chambers.

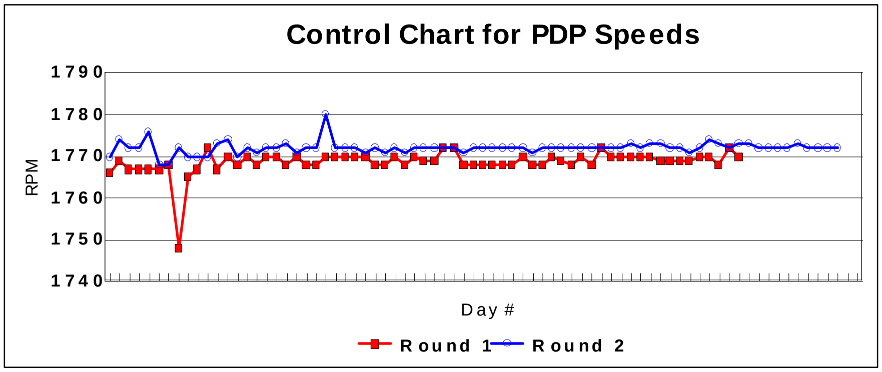


Figure 2-1. Control Chart for Daily PDP Speeds

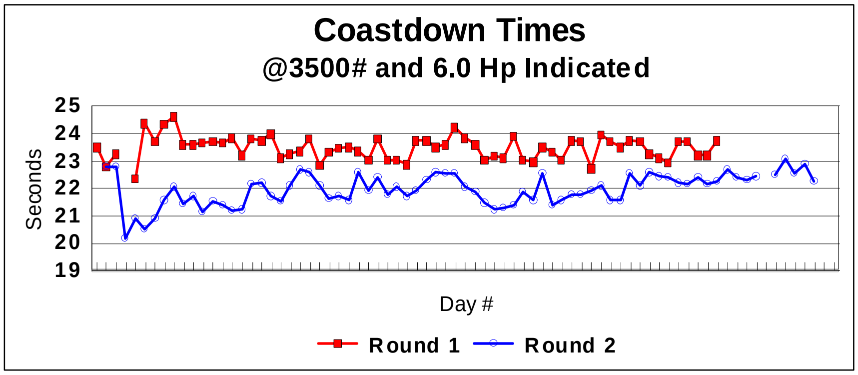


Figure 2-2. Control Chart for Daily Dynamometer Coastdown Times

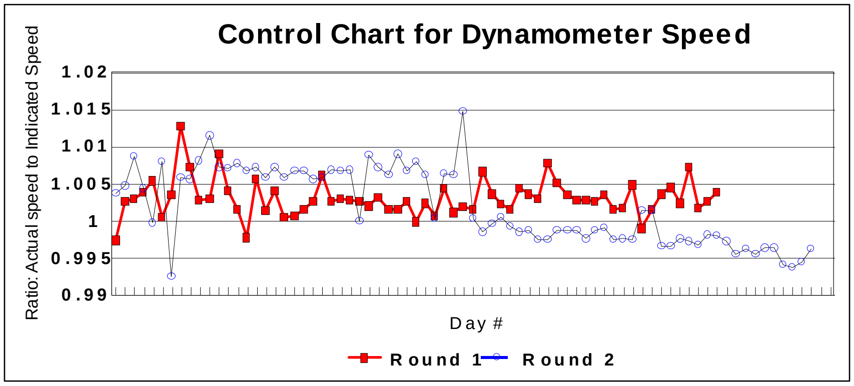
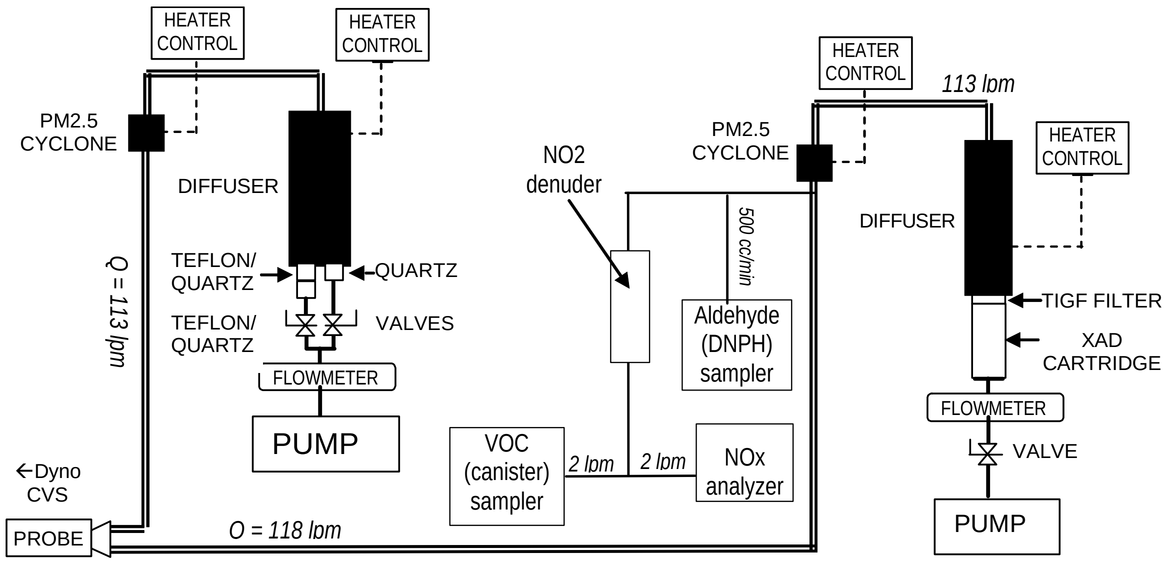


Figure 2-3. Control Chart for Daily Dynamometer Speeds



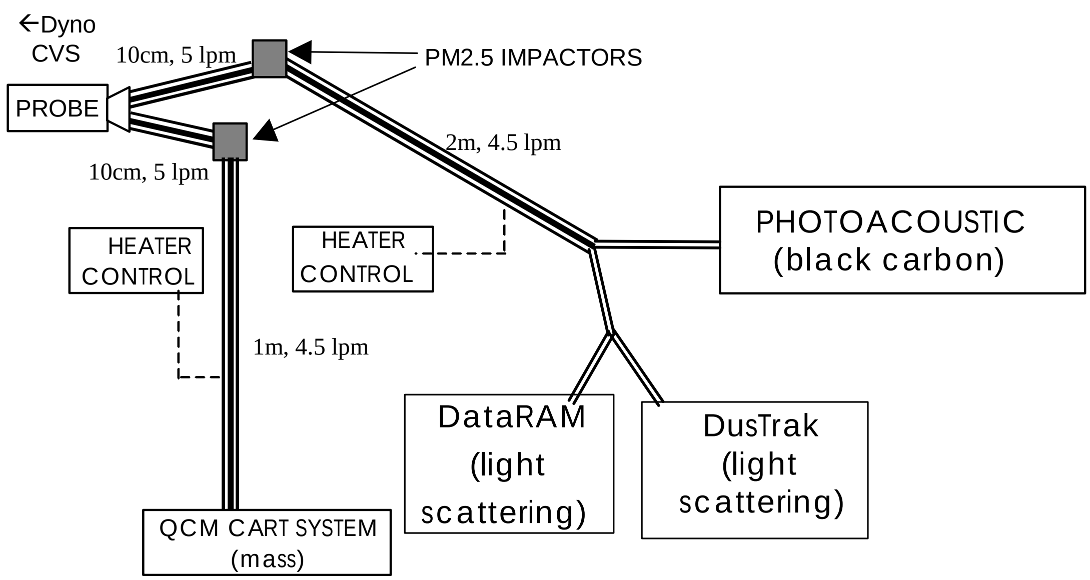


Figure 2-4. Schematic of Sampling Train with Flow Rates.
(Heated Tubing is Shown as Double Lines, all heated components are maintained at 47± 2 °C)

The following instruments were operated continuously during all tests:

A Photoacoustic instrument was designed and built at DRI. It continuously measures the concentration of light-absorbing material (primarily BC) in the airstream by the photoacoustic principle, in which the absorption of modulated light by particles results in thermal-acoustic pulses that can be detected by a highly-sensitive transducer and phase-locked amplifier. The measurement does not depend on flow rate, but flow was maintained at about 1 lpm with heated (47°C) sample lines.

The Quartz Crystal Microbalance (QCM) Cart System. This system was developed by Booker Systems specifically for the Kansas City (KC) project and is now being manufactured by SENSORS, Inc. The system, an integration of five separate components, is illustrated in Figure 2-5 and pictured in Figure 2-6. Sample air from the CVS dilution tunnel is passed through a 2.5 micron particulate pre-classifier to a micro proportional sampler (MPS) where it is either diluted or bypassed and directed to a valve unit in the flow controller system (FCS). The MPS is a clean-air dilution system used to reduce the dynamic range of the source aerosol concentration (Brockmann, 1984). The FCS, under control of a computer, will pass diluted, undiluted, or filtered ambient air to the QCM at a rate of 1 lpm depending on the expected concentration of the particulate emissions. There the QCM monitors the accumulated mass of particles on a quartz surface in real-time (Dickens and Booker, 1998). The MPS, FCS, and QCM operate at a controlled temperature of 47 ± 2 °C. The cart in which they are mounted is also temperature controlled at 47 ± 2 °C. After passing through the QCM, the sample air dew point (DP) is measured continuously using a dew point (DP) monitor (Vaisala, model M170). The computer acts as both a system control and data acquisition system for the MPS, FCS, QCM and DP monitor.

The QCM cart system was used during Part 1 of the Kansas City study as described above. The only change made for Part 2 of the KC study was the incorporation of the DP measurement into the QCM. The DP monitor was used during Part 2 as a quality assurance backup measurement. Quality Assurance for the QCM Cart System consisted of activities in three periods associated with the tests; immediately before the tests, during the tests, and during the reduction of data collected during the tests. These activities are summarized below:

- *Immediately before the tests* – All parameters on the QCM Cart are calibrated and adjusted by the manufacturer. Critical flow quantities are calibrated using both a Gilibrator (Gillian, Inc.) and a TSI model 4043 flow monitor (TSI Inc.). Both of these are transfer standards traceable to NIST standards. Pressure sensors are adjusted accordingly. Temperatures are calibrated using a platinum resistance thermometer. The sample transport flow heated lines are adjusted using K type thermocouples. These are then used to control the heated lines in use. Crystal frequency differences are checked using known mass loadings determined using an analytical gravimetric balance. Sample transport flow is determined using SKC flow controlled pumps (Model 2000). The calibration of these is tested using the TSI model 4043 and Biometrics model 2000 flow standards. The Biometrics flow monitor qualifies as a secondary standard traceable to NIST. In addition to these measures, the QCM's response to changes in sample air humidity is determined using the Vaisala, model M170 dew-point monitor.

- *Procedures Followed During the Tests* – Quality assurance during the tests consists of providing operational logs of instrument operation. This is done in two parts: first, the instrument operator keeps a personal log noting all conditions that might affect the quality of the QCM data. This includes general test conditions such as dynamometer operation and test weather conditions. Since the control computer displays all QCM parameters in real time, crystal frequency and resulting mass collection, sample flow, temperatures, and operational pressures, the operator can also assess failures in QCM operation. An example of this is failure of the quartz crystal frequency during periods when it overloads. Secondly, in addition to the operators log, the control computer creates a primary operation log for the QCM by logging all internal parameters for the instrument. This, in addition to the operator's log, represents the primary QA record for the QCM. Parameters logged by the QCM are listed in Table 4-30 of Section 4. During the test, sample transport flow is checked weekly using the TSI 4043 flow monitor. Dilution flow is also checked and the TSI flow monitor is then used to provide a continuous monitor of QCM sample flow. Periodic checks of this monitor's output are recorded in the operator's log.

- *Post Test Reduction of Data* – Reduction of the QCM mass data provides an opportunity to bring to bear all of the QA records created before and during the tests. As the data are reduced, the operator's log and the primary QA record are used to assess the validity of the results and generate QA indicators for voided data and data that should be treated as questionable pending further investigation. These indicators are listed in Table 4-32.

The Nephelometer – DataRAM is another commercially available portable monitor for particulate matter, which operates on the same principle as the DustTrak but uses two wavelengths for more uniform response to varying particle sizes. The measurement does not depend on flow rate, but flow was maintained at 2 lpm with heated (47°C) sample lines.

The DustTrak is a commercially available portable monitor for particulate matter. The TSI DustTrak estimates the concentration of particulate mass by measuring the intensity of light scattered perpendicular to a laser beam directed through the airflow stream. The measurement does not depend on flow rate, but flow was maintained at about 1.5 lpm with heated (47°C) sample lines.

Time-integrated samples for laboratory analysis were collected during each unified cycle test and a 60-minute tunnel blank each day as follows using specially adapted samplers designed and constructed at DRI:

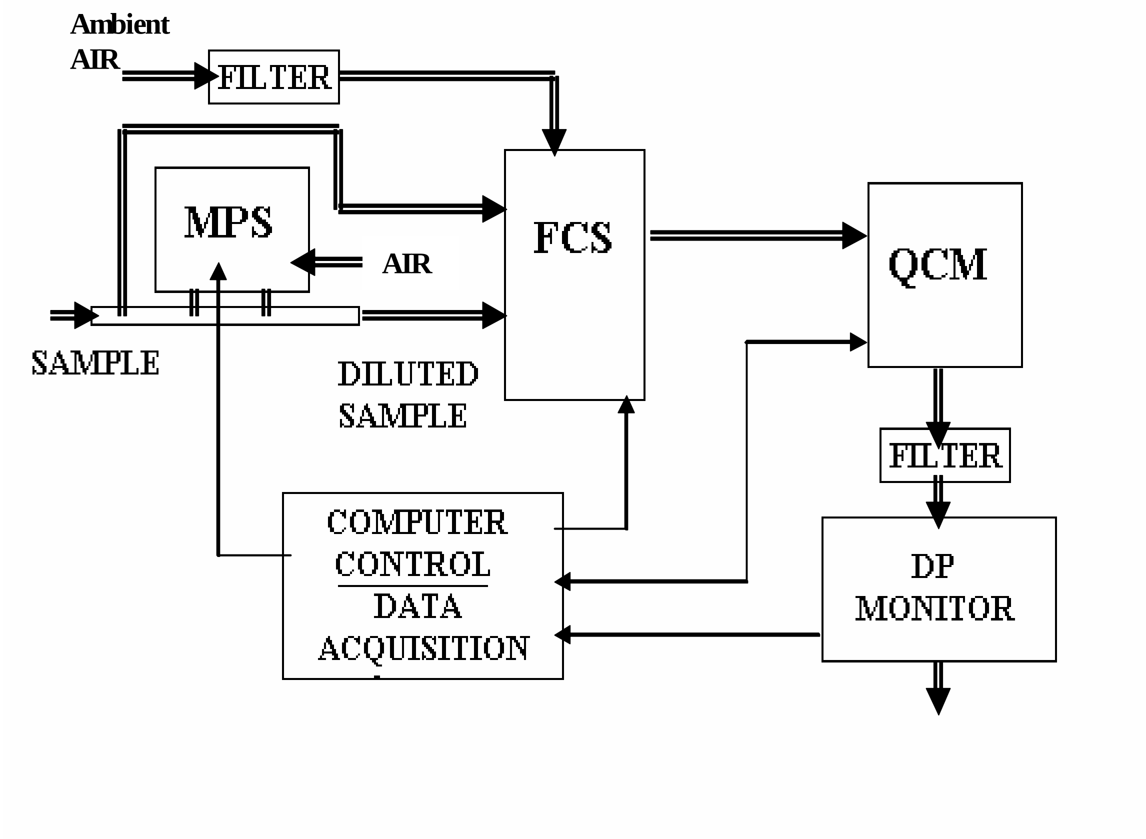
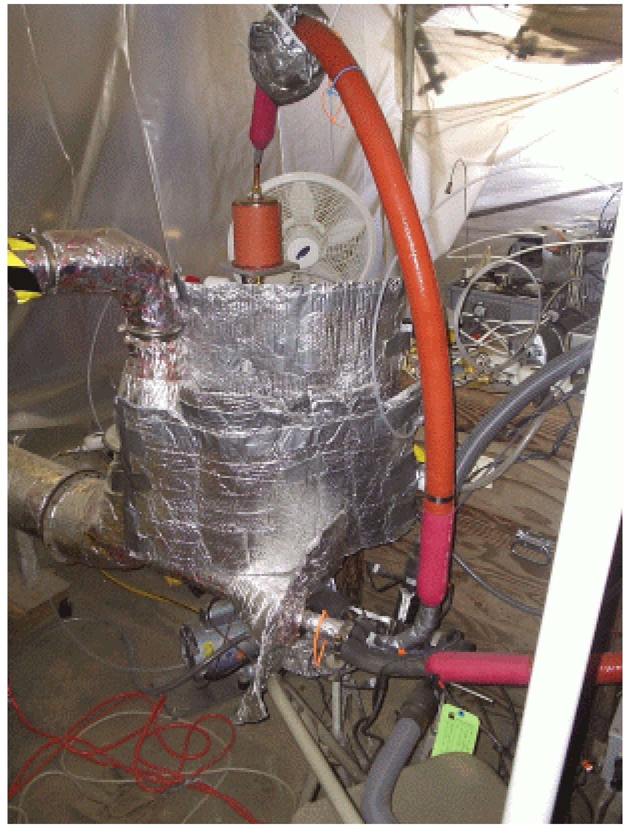


Figure 2-5. Components of the QCM Cart System

Teflon & Quartz filter sampler



Heated lines attached to probes into CVS tunnel

QCM (blue case on left) and photoacoustic instrument (right side)

Figure 2-6. Onsite Sampling Train

Figure 2-7. KC Facility Instrumentation

Filter samples were collected during each phase of the unified cycle tests using procedures and sampler design based on the widely used DRI Sequential Filter Sampler. A similar sampler was used in the Gasoline Diesel PM Split Study (Lawson et al, 2006) and was shown to collect equivalent PM mass to direct sampling from the CVS dilution tunnel. These tests were conducted to verify that no significant particle losses or adsorption artifacts occurred in the sampling train even with a much longer residence time and without temperature control. See Figure S-1 in Appendix MM (2006 Gasoline Diesel PM Split Study) for more information.

Pre-weighed Gelman polymethylpentane ringed, 2.0 mm pore size, 47 mm diameter PTFE Teflon-membrane Teflo filters (No. RPJ047) collected particles for measurement of gravimetric mass and elements. Pallflex 47 mm diameter pre-fired quartz-fiber filters (#2500 QAT-UP) were used for water-soluble chloride, nitrate and sulfate and for organic and elemental carbon measurements. Sample air was drawn from the CVS via ½” heated copper tubing to a small heated stainless steel chamber. The sample air exited via a $PM_{2.5}$ cyclone contained in the chamber to a heated diffusing chamber approximately 50 cm tall and 35 cm in diameter, manufactured from anodized aluminum, containing a temperature and relative humidity (RH) probe. From this chamber, which was necessary to allow the sample airstream to track from the inlet line to the filter ports located radially around the base without any particle loss due to impaction[4], the sample air exited through two filter cartridges. Up to eight cartridges could be installed in the base of the diffusing chamber, allowing four successive pairs of filters to sample without changing cartridges. Airflow through the cartridges was switched by means of microprocessor controlled relays and solenoid valves, that responded to TTL line digital signals from the dynamometer control. A 30 second delay was included to account for transport time thru the dynamometer and sampling system, based on empirical data collected with the continuous instruments. Flow rates for each filter were set to 56 lpm by adjustable valves to give a combined flow of approximately 113 lpm as required by the inlet cyclone, and monitored by TSI flowmeters with serial data outputs. A single oil-less pump was used to draw air through the sampler.

Samples were collected by a separate sampler for determination of particulate and semi-volatile organic compounds on Pallflex TX40HI20-WW 102 mm diameter Teflon-impregnated glass fiber (TIGF) filters followed by glass cartridges containing Aldrich Chemical Company, Inc. 20-60 mesh Amberlite XAD-4 (polystyrene-divinylbenzene) adsorbent resins at a flow rate of 112 lpm. The material collected on these media is removed by solvent extraction and analyzed at DRI by gas chromatography and mass spectrometry. A single filter and adsorbent pair were collected for each unified cycle, combining Phases 1, 2 and 3. Sampling was suspended during the 10-minute soak period by turning off the pump. Sample air was drawn from the dynamometer CVS via ½” heated copper tubing to a small heated stainless steel chamber. The sample air exited via a $PM_{2.5}$ cyclone contained in the chamber to a heated diffusing chamber, containing a thermistor temperature probe, 42 cm long and 9.5 cm in diameter. In this chamber the sample air decelerates and expands sufficiently to deposit uniformly on the 100 cm diameter filter face as it exits through the filter followed by the XAD cartridge. Flow rates were

[4] Inspection of the interior of the sampler plenum/diffusing chamber after the completion of both Rounds of testing showed no detectable particle deposits. The residence time in the chamber is difficult to estimate, since the sample air is expected to track directly to the filters, but was observed to be <30 seconds in smoke tests conducted with a DustTrak instrument connected to one of the sampler ports.

approximately 113 lpm as required by the inlet cyclone, and were monitored by an in-line TSI 4000 mass-flow meter. A single oil-less pump, switched on and off by a relay linked to TTL line signals from the dynamometer control, was used to draw air through the sampler.

Aldehydes were collected on 2,4-dinitrophenylhydrazine (DNPH) cartridges using a 6-channel sampler with integrated pump and mass flow controller. Sample air was drawn from the heated cyclone chamber via a ¼" diameter Teflon hose at 500 cc/min. A single cartridge was exposed for the duration of the 3 Phases of the unified cycle. Sampling was suspended during the 10-minute soak by switching to an unused channel by a relay linked to TTL line signals from the dynamometer control. As stated in Section 4.3 of the QAPP, for commercial 2,4-DNPH cartridges (Waters Sep-Pak XpoSure Aldehyde Sampler), DRI analyzed 5% of the purchased cartridges to ascertain the blank variability. Another 5% were analyzed if the initial data showed that the blank variability was marginally acceptable (at or slightly higher than 1/3 of the desired lower quantifiable limits (LQL)). This is necessary because unless cartridges are prepared in-house there is no other indication of the quality of the product, such as reagent and blank cartridge purity. In carbonyl measurements, the blank variability is the single most important factor in determining the lower quantifiable limit of the measurement; other factors such as flow rate, and analytical variability are secondary in importance.

VOC**:** Sample air was drawn from the heated cyclone chamber via a ¼" diameter Teflon hose and passed through a Teflon filter and a cobalt oxide denuder coated to remove NO_x before being pumped into a Summa polished steel canister. A chemiluminescence real-time NOx analyzer was installed downstream from the denuder to monitor its efficiency. Air flow for the canister sampler was controlled by a needle valve to obtain the necessary flow rate to fill the canisters to approximately 15"Hg positive pressure over the duration of the complete unified cycle. Sampling was interrupted during the 10-minute soak by switching to a bypass channel. The sampler draws a total flow of 2 lpm, but only about 300 cc/min of that was pumped into the canisters. Sampling was suspended during the 10-minute soak by switching to an unused channel by a relay linked to TTL (digital electronic) line signals from the dynamometer control.

Prior to the start of each round, all samplers were checked for leaks and the in-line flow meters were cross-calibrated using reference flow measurement devices. Leak testing was performed by capping the inlet lines leading to each sampler and turning on the pumps. If the flow meter readings decreased to less than 10% of the nominal sampling flow rate in a reasonably short time, the system was passed. If not, the source of the leak was identified and fixed, then the test repeated. With the exception of the Teflon/Quartz filter sampler, all units achieved near-zero flow rates during the leak test. Due to the friable nature of the pre-fired quartz filters, it is not possible to obtain a perfect seal in the filter holders without damaging the media, but the <10% criteria were still met for each filter individually and for the system as a whole. In addition to the vacuum test, the sum of flows through each of the two filter cartridges was compared to the total flow entering the inlet and found to agree within 5%.

All flowmeters were calibrated using either a Gillibrator electronic bubble meter (Gilian Inc.) or a rotameter (Dwyer Instruments) that had been cross-calibrated with a Roots meter at DRI. Calibration flows were measured at the inlet point of each sampler (or outlet for the canister sampler) with appropriate sampling media installed. The resulting multi-point calibrations were used to calculate the desired nominal flow rates, and these were marked on a label on each flowmeter so that the operator could observe any deviations during testing. Variations in nominal flow rate due to sampler problems were recorded in a logbook. The sampler flow calibrations are shown in Tables 2-2 and 2-3. Flows were audited periodically using the same reference devices. If the deviation from the original calibration was 10% or more the flowmeter would be re-calibrated, however, this did not prove necessary at any time. Since the DNPH sampler used an electronic mass/flow controller, only a 1-point flow audit was performed on that unit between Rounds.

Table 2-2. Round 1 Sampler Calibration and Audit Results

	rotameter	**Qactual**	**flowmeter**	**ERR**		**regression stats**				**target**	**audit**	**ERR**
	scfh	**slpm**	**slpm**			**r2**	**m**	**b**		**flow**	**reading**	
XAD	273	128	121	-6%		0.99	1.03	2.87		113	**107**	5%
	250	117	112	-4%								
	227	106	100	-6%								
Teflon	125	58	54.7	-6%		1.00	1.06	0.40		56.5	**53**	6%
	110	51	47.6	-7%								
	140	65	61	-6%								
Quartz	124	57	54.7	-5%		1.00	1.01	2.14		56.5	**54**	5%
	97	45	41.8	-7%								
	152	71	67.4	-5%								
DNPH		0.534	0.498	-7%		1.00	1.02	0.02		0.500	**0.465**	8%
		0.555	0.519	-7%								
		0.508	0.473	-7%								
		0.531	0.499	-6%								

Qactual = flow rate determined by reference method
slpm = standard liters per minute (20C, 1 atm)
scfh = standard cubic feet per hour (20C, 1 atm)
ERR = (indicated or target flow - actual flow)/actual flow
Regression stats on the slope of the line: $y = mx + b$

Table 2-3. Round 2 Sampler Calibration and Audit Results

	rotameter	Qactual	flowmeter	ERR	regression stats			target	audit	ERR
	scfh	slpm	slpm		r2	m	b	flow	reading	
XAD	255	123	122.5	0%	1.00	0.99	0.75	113	**113**	0%
	230	111	110	-1%						
	187	90	90	0%						
Teflon	133	64	65	2%	1.00	1.13	-7.04	56.5	**57**	0%
	114	55	55	0%						
	98	47	46	-2%						
Quartz	140	67	65	-4%	1.00	1.01	-3.2	56.5	**54**	4%
	119	57	55	-4%						
	99	48	45	-6%						
DNPH								495	**485**	2%

For each integrated sample, the run number, start and stop time, elapsed time, initial and final flow rate, and any exceptional occurrences were recorded on log sheets that were kept with the media at all times. Bar coded stickers with unique media IDs were attached to all media and their corresponding log sheets for tracking. Immediately after the conclusion of each test cycle, the media were repacked with the log sheets and stored in a refrigerator, except for the canisters, which were packed and shipped via 2-day express to DRI each day. All media were packed into coolers with ice packs and shipped overnight back to DRI where they were logged in and placed in cold storage until analysis. Media were shipped on a near weekly basis during Round 1. Continuous data were backed up via the wireless network and processed at the end of each sampling day to determine phase-averaged values. Run number, date, time, and vehicle license plate number were attached to all files to identify the data.

2.3.2 Additional Support Equipment

Table 2-4 lists equipment that was either rented or purchased to support the sampling efforts.

Table 2-4. Sampling Support Equipment Rented or Purchased by ERG, On-Site

Name	Purpose	Notes
Oil-less Air Compressors	To supply clean, dry dilution air to the micro-dilution system used with the QCM.	Purchased. Provides up to 5 SCFM at 100 psig. Has a 25 gal. tank. Water trap and filtration provided by EPA.
AC Electricity Generator	To supply power for the CVS dilution air heater.	Rented from United Rentals. Wacker model G-50. 50-kilowatt capacity. Diesel fueled. Power umbilical provided by BKI.
CVS Dilution Air Dryer	To reduce CVS dilution air humidity.	Rented from United Rentals. TempAir (Rupp Industries) model TD 400. Dries up to 400 CFM. Requires 230 V, 1 phase, 30 A, electric supply. Portable desiccant-type dehumidifier. Alumina silicate wheel continuously absorbs gas-phase water. Heated slip-stream of dried air re-directed back to used section of wheel to desorb water and regenerate the wheel. These were used primarily during Round 1.
Refrigerator	To store particulate filter media.	Purchased. 14 cubic feet, upright.
Freezers	To store fuel samples.	Purchased. 10 cubic feet and 24 cubic feet, chests.

2.4 PEMS Setup

The eight portable emissions monitoring systems (PEMS) and associated equipment EPA provided for Round 1 of the study were also used for Round 2 testing. These systems, the SEMTECH-G manufactured by Sensors, Inc. were used vehicle THC, CO, CO_2, and NO_x emissions during each vehicle's preconditioning run, emissions during dynamometer testing (in tandem with the dynamometer bench), and in some instances emissions from participants vehicles after the vehicles were picked up from testing. Details on PEMS testing are provided in Section 4.7. Differences between Round 1 and Round 2 PEMS testing are described in the following section.

2.4.1 Changes from Round 1

Round 2 test procedures, equipment, and testing conditions differed somewhat from those during Round 1. The most notable differences are discussed in an Appendix to the updated QAPP, and are presented below:

Onsite PEMS repair support

Onsite PEMS repair support was available throughout the Round 2, and greatly reduced equipment downtime and shortages. Most PEMS problems were minor issues such as stuck solenoids, loose or dirty contacts and fittings, water in the system, or blown relays, and were able to be repaired quickly. Most large repairs, such as system module and CPU board replacements, could also be accomplished onsite (after receipt of necessary repair materials).

Temperatures and ambient conditions

Round 2 testing was conducted during the winter, as opposed to the Round 1 summer study. Since this portion of the study was to be conducted at ambient temperatures, an enclosed and heated structure was erected in which to conduct PEMS installation activities. This prevented operation of the units sub-freezing temperatures (beyond their specified operating temperature range). Operation of the PEMS units below freezing temperatures was occasionally necessary, and resulted in various operational problems, such water freezing in the FID exhaust drain lines and internal filters, and freezing in the flowmeter pressure-differential measurement tubes and exhaust sample lines. The signal transducer boxes used with the new pressure-differential flowmeters occasionally would not warm up to operating temperature (as indicated by the "warm-up" indicator LED), and some emissions measurement drift was seen during some conditioning runs (as evidenced by pre-test and post-test audits). This drift may be due to auditing the PEMS in the heated installation bay and then performing the conditioning test in a vehicle's trunk or bed at ambient temperatures.

Flowmeter changes

Hot-wire anemometer-style flowmeters were used throughout the Round 1 summer portion of the study. These were replaced with pressure-differential style flowmeters for Round 2 of the study. These new flowmeters transmitted pressure signals through flexible tubes to a signal transducer box which converted the pressure-differential signal and exhaust temperature measurement into an exhaust mass flow rate determination.

Flowmeter mounting changes

License plate brackets and suction cup clamp assemblies were primarily used to install the flowmeters used during Round 1 of the study. This posed concerns associated with participants or pedestrians burning themselves (particularly on driveaway testing) or the assemblies falling off. Occasionally, flowmeters were hung underneath the rear of the vehicle, which was generally laborious and exposed the flowmeter to water and possible dragging damage. The new pressure-differential flowmeters were significantly larger and heavier, so common bicycle racks were used for flowmeter installations during Round 2. Wire meshes were secured to these racks to allow mounting of license plates and to protect against burns.

Software changes

Several PEMS software changes were implemented prior to or during Round 2. This new software allowed use of the new pressure-differential flowmeters, and it also allowed activation of auto-zero and automatic FID heater shut-down after a period of time (auto-zeros were performed only on drive-away testing). Another software update involved adding a "session manager" which "bundled" all the audits and second by second test information into one file. The following software changes were implemented throughout the study (including both Rounds 1 and 2):

- Rollout beginning July 12, 2004: Software Version 9.03
- Rollout beginning August 17, 2004: Software Version 9.03 SP1

- Rollout beginning November 23, 2004: Software Version 9.04
- Rollout beginning December 6, 2004: Software Version 9.05 SP1
- Rollout beginning December 16, 2004: Software Version 9.05 SP2

Testing was continued with Software Version 9.05 SP2 through the end of Round 2.

QCM changes

The QCM cart system used during Part 1 of the Kansas City study is described in Section 2.3.1. DP measurement was incorporated into the QCM for Part 2 of the KC study, in order to provide a QA backup measurement. In addition, relative humidity (RH) and the relative humidity temperature were added to the list of parameters recorded by the QCM System Computer Control/Data Acquisition System, as described in Section 4.5.2.2.

2.4.2 Procedural changes between Rounds 1 and 2

The equipment downtime experienced during Round 1 was greatly reduced during Round 2 through the addition of an on-site PEMS repair and support person. Most repairs were minor, such as stuck solenoids, loose or dirty contacts and fittings, water in the system, or blown relays, and were able to be repaired quickly. Most large repairs, such as system module and CPU board replacements, were also accomplished onsite (after necessary repair items were received onsite). This increase in equipment up-time allowed significantly more driveaways to be conducted in Round 2 than were possible during Round 1 of the study.

As mentioned in Section 2.4.1, the hot-wire anemometer-style flowmeters used throughout the Round 1 summer portion of the study were replaced with pressure-differential style flowmeters for Round 2 of the study. Measurements from the original hot-wire anemometer flowmeters were adversely affected by heat radiation effects at low vehicle speeds and idle. Since convective cooling minimized these effects when vehicles were in motion, low-speed and idle flow measurements were biased low. This bias was eliminated with the use of pressure-differential style flowmeters provided for Round 2 of the study. These flowmeters relied on a bank of differential pressure sensors (as opposed to a hot-wire anemometer) in order to determine corrected mass exhaust flowrates. However, the orifices in the differential pressure sensors used in these new flowmeters were susceptible to particulate matter clogging and moisture freezing. This condition was minimized as much as possible by thoroughly purging all orifices with high-pressure dry compressed nitrogen prior to each use, and by maintaining the flowmeters and tubing assemblies in above-freezing conditions.

Earlier in the study, problems were encountered with preventing moisture and exhaust fumes from entering vehicles during testing. The new flowmeters required additional tubing to be routed out of the trunk (generally requiring the trunk to be propped open wider). Standard household pipe insulation purchased at a hardware store was found to fairly effectively seal trunks. Carbon monoxide detectors were used to ensure vehicle exhaust was not entering the passenger compartment.

As mentioned in Section 2.4.1, Round 2 testing was conducted during the winter, as opposed to the Round 1 summer study. Operation of the PEMS units below freezing temperatures was occasionally necessary, and proved to be problematic because of water freezing in system components and measurement drift. Battery life seemed greatly reduced during Round 2 testing, perhaps due to battery cycle fatigue (these were the original batteries used since the start of the study) and also possibly due to operation in the cold temperatures.

In order to prevent trunks from inadvertently popping open, as would occasionally happen with the original vice-grip-devised trunk latches, heavy-duty zip-ties were used (with metal rings installed in the trunk latch assembly) to secure trunks. These zip ties, which are typically used for securing building ventilation and may be found at a typical hardware store, also prevented motorists from tampering with the PEMS units installed in trunks during driveaway tests.

Experience gained during Round 1 of the study helped streamline Round 2 testing. For example, installation procedures and sequences were modified in order to minimize lost time in the event of equipment malfunctions. Certain “tricks” and procedures for equipment software helped expedite installations and minimize system resets. The incorporation of a session manager into the host software also allowed consolidation of audit and test information into one test file, thereby expediting equipment setup and reducing time needed for test processing and analysis.

3.0 Vehicle Recruitment

3.1 Recruitment Process

The recruitment process required deriving a targeted (stratified) sample of vehicles from a cohort of 2000 households generated through random sampling in the Kansas City Metropolitan Statistical Area (MSA). The Mid-American Regional Council (MARC) completed a comprehensive travel survey of Kansas City regional households in spring of 2004.[5] That study's resulting dataset was reviewed for use as the initial cohort of households. As demonstrated in more detail in the next section (3.2), the MARC data, when compared with Census 2000 data at the household and person levels using a number of demographic and geographic characteristics, created a cohort that represents the Kansas City MSA population. As a result, there was no need to conduct a survey of households to develop the initial sample cohort for this study. This dataset was the primary dataset for recruitment during Rounds 1 and 2 of the study. Vehicles were recruited from the Kansas City Metropolitan Area (KCMA) (see Figure 3-1). The Kansas City MSA counties included:

- Johnson County, KS
- Leavenworth County, KS
- Wyandotte County, KS
- Clay County, MO
- Cass County, MO
- Jackson County, MO
- Platte County, MO

[5] Kansas City Regional Household Travel Survey Final Report, http://www.marc.org/transportation/pdf/travelsurvey2003.pdf

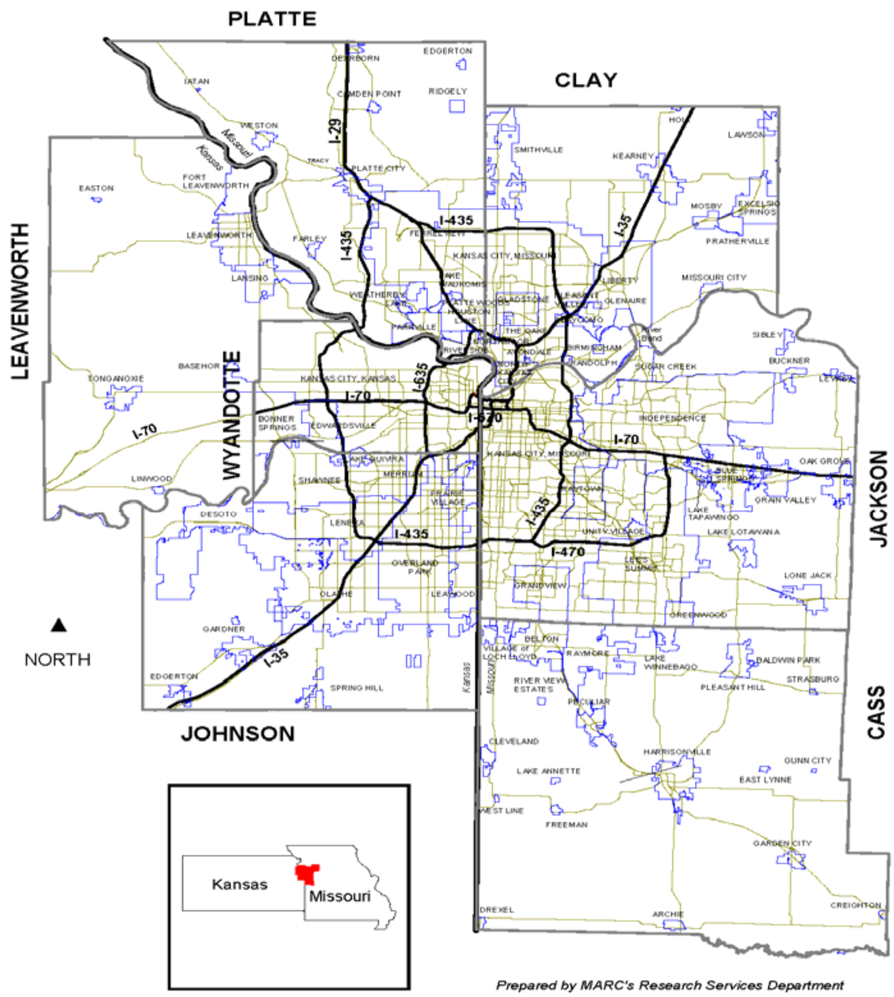


Figure 3-1. Kansas City Metropolitan Area

The use of the MARC 2004 Household Travel Study (MARC Study) as the cohort from which to recruit vehicles allowed vehicle recruitment to begin earlier than planned in Round 1. It also provided, inherent in the data set, household data elements including year, make, model, body type, and fuel type for each household vehicle, home address and preferred method for contacting owner. All participants in the MARC study were aged 21 or older.

One of the challenges of Round 1 testing was that there were fewer than expected older vehicles available for recruitment. In fact, by the end of Round 1 testing, the available vehicle pool for recruiting the oldest vehicles, i.e., Strata 1, 2, 5, 6 (Pre-1981 and 1981-1990 trucks and cars) had been virtually exhausted. This posed a challenge for Round 2 testing.

Fortunately, the Kansas and Missouri Vehicle Registration database provided a large pool of vehicles that can be sampled and recruited for testing. That database was used to draw representative stratified random samples for recruiting as many vehicles as necessary to achieve the desired sampling targets. Moreover, to ensure adequate participation, Round 2 recruitment activities commenced with the older vehicle samples, and then turned to the more prevalent newer vehicles.

As a final note on sampling, the use of the vehicle registration files did not conflict with the use of the MARC RDD sampling frame for Round 1 (and Round 2 of the more prevalent vehicle strata). The use of DMV lists triggered the adoption of an efficient dual frame sample design ("dual" because there are two sources of sample – and RDD household sample, and the DMV list of vehicles). The adoption of a dual frame design in this case is good science because (1) the DMV frame (like the RDD frame) is complete, with virtually 100% coverage of the vehicle fleet population; and (2) the efficiency of identifying rare or low prevalence vehicles (e.g., older trucks) from the DMV list is considerable relative to the alternative of large scale screening of households.

Incentives Test

Prior to the start of testing in Round 1, an incentive survey was conducted to identify the appropriate levels of incentives necessary to ensure sufficient regional vehicles would be available for the emissions testing program. The survey was successful in identifying specific levels of incentives and particular groups of respondents to help in identifying the appropriate incentive packages to initially offer potential participants. It also provided some initial insight into participation rates, especially on those who refused to participate in the study and the level of incentives that would convert them to a prospective participant. The MARC study database served as the sample for the survey.

Overall, the program description and discussion of incentives were sufficient to generate interest in the program. Two-thirds of all incentives test respondents agreed to schedule their vehicles for testing when the program would begin.

In terms of the incentives, the survey provided excellent guidance in terms of structure and application. Most respondents indicated that a full-size rental car would be sufficient for the 24- to 48-hour period during which their vehicles would be at the testing facility. Variances in acceptable cash levels led to the recommendation of offering $75 and staging incentives in $25 increments up to $200 for those who refused to participate.

Incentives were utilized in both Round 1 and Round 2 of the study. The following table provides a summary of the total number of incentives offered and amount paid for each Round and for the study as a whole. The average incentive amount needed for those that actually had their vehicle tested was about $113.00.

A summary of the incentives offered during the study is shown in Table 3-1.

Table 3-1. Summary of Incentives for the KC Study

Incentive Level	Round 1 Counts	Round 2 Counts	Total
$0-$50	10	13	23
$50-$100	81	85	166
$100-$150	166	182	348
$150-$200	45	27	72
$200-$250	9	44	53
$250-$300	3	7	10
$300-$350	1	2	3
$350-$400	1	6	7
>$400	2	0	2
Totals	318	366	684

Sampling

A questionnaire guided interviewers in screening households for vehicles that met the project needs (see Appendices C and D for all recruitment-related materials). Some vehicle types were excluded from the study, and the vehicle characteristics (e.g. body configuration) were incorporated into the questionnaire. Those vehicles that qualified were flagged for possible recruitment. Body configuration was used because certain size vehicles could not be accommodated on the dynamometer.

The sampling process was very flexible which allowed for quick changes in scheduling vehicles for testing. A vehicle file used for sampling was posted daily to the project website, along with flags to indicate eligible vehicles, those sampled, and status of scheduling (waiting to be scheduled, scheduled, tested, etc.).

Scheduling Calls

As vehicles were sampled, the households were re-contacted for scheduling (if not done at the time of sampling). The following parameters guided the scheduling process:

1) Vehicles were scheduled for drop off and pick up daily except for Sundays. A master scheduling list that showed valid scheduling dates was prepared.
2) In general, vehicles dropped off Monday through Friday were picked up Tuesday through Saturday. Vehicles dropped off on Saturday were picked up on Monday. Occasionally, vehicles were kept for more than 24-hour periods (depending on drop-off times).
3) Participants were asked to drop off vehicles between 7 and 9 am, and to pick them up between 4 and 6 pm the following day. Special times and pick-up options were offered, depending on the importance of the vehicle to the testing process.

A daily scheduling file that contains information on vehicles scheduled from the current day onward was posted on an on-line Project site. Contained in this file was the vehicle make, model, and year, along with owner name, home phone, and alternative number, as well as the incentive package promised/expected.

Packets

Scheduled participants received via U.S. mail a thank you letter, a map to the testing site (personalized from Yahoo.com), a general information brochure about the project, and contact information. The packet also included a copy of a vehicle owner survey and a checklist reminding participants to bring their driver's license and insurance card. The cover letter referenced the agreed-upon incentive.

Reminder Call

The afternoon / evening prior to the scheduled test date, participants received a reminder call regarding their appointment time for bringing the specific vehicle to the testing site.

Toll-free Hotline

A toll-free hotline was maintained for participants to use for questions and canceling or rescheduling their testing appointment.

3.2 Cohort / Vehicle Frame Analysis

Meeting the study goals required deriving a targeted (stratified) sample of vehicles from a cohort of 2000 households generated through random sampling in the KCMSA. The methodology for generating the sample originally called for conducting a Random Digit Dialing (RDD) telephone survey of households (HH) in the KCMSA. This methodology relied on two key underlying assumptions:

- An RDD sample of HHs will generate a representative sample of the population in the Kansas City MSA, and
- The cohort of HHs participating in the RDD survey will provide a representative sample of vehicles for emissions testing.

Because NuStats had recently completed the 2004 Kansas City Travel Behavior Survey for MARC, the use of the survey data (the survey was conducted in Spring 2004 using an RDD sample design) was recommended. NuStats conducted a comparison of the MARC data with Census 2000 data at the household and person levels using a number of demographic and geographic characteristics. As evidenced in Tables 3-2 and 3-3, using the MARC RDD sample to create a cohort of households satisfactorily represented the Kansas City MSA population on a number of demographic / geographic characteristics.[6] The only substantial difference appears in

[6] The MARC survey distributions are unweighted (raw), allowing for more informed assessment of the product of RDD sampling. It should be noted that survey data are typically weighted to correct for discrepancies between known Census population distributions (for selected demographic variables) and the unweighted survey results. But a comparison of *weighted* survey data and the Census distributions would mask any real differences between survey and Census distributions for those

the non-white race comparisons, and this is easily explainable and not of concern for research purposes. First, it is well known that the race/ethnicity questions were problematic in Census 2000, and the MARC RDD and Census white population percentages match up well. Secondly, and perhaps more importantly, the income distributions of the RDD sample and Census align well, suggesting that the RDD survey captured a representative sample of the population according to income (which is associated with race).

Table 3-2. Demographic Comparison of MARC RDD Survey of Households and Census 2000 Distributions

Demographic Characteristic	RDD Survey (n=4,001)	Census 2000
Household size		
1	26.8%	27.4%
2	33.3%	33.0%
3	16.0%	16.2%
4+	23.9%	23.4%
total	100.0%	100.0%
HH Vehicles		
0	5.8%	7.4%
1	32.9%	33.9%
2	42.7%	41.7%
3+	18.6%	17.0%
total	100.0%	100.0%
HH Income		
< 15k	9.9%	12.2%
15k - < 25k	10.2%	11.3%
25k - < 50k	30.2%	30.1%
50k - < 100k	35.9%	33.6%
100k +	13.8%	12.8%
(refusal)	(5.9%)	--
total	100.0%	100.0%
Residency Type		
single family	76.8%	69.0%
all other	23.2%	31.0%
total	100.0%	100.0%
Race		
White	81.3%	81.6%
Black/African American	10.7%	14.1%
Other	8.0%	4.3%
total	100.0%	100.0%
Respondent Age		
< 20	29.6%	29.1%
20 - 24	4.3%	6.1%
25 - 54	43.3%	45.3%
55 - 64	9.9%	8.2%

demographic variables that were used in generating the weighting adjustments. Thus, the survey data used in the comparison were not weighted.

65 +	12.8%	11.3%
refusal	(1.2%)	--
total	100%	100.0%

Table 3-3. Comparison of MARC RDD Survey and Census 2000 Geographic Distributions

County, State:	Census 2000	RDD Survey (N = 4,001)
Cass County, MO	4.6%	4.9%
Clay County, MO	11.1%	12.3%
Jackson County, MO	40.6%	39.9%
Platte County, MO	4.5%	4.6%
Johnson County, KS	26.6%	26.1%
Leavenworth County, KS	3.5%	3.3%
Wyandotte County, KS	9.1%	8.9%
total	100%	100%

Table 3-2 presents a number of (unweighted) comparisons of the household and person level characteristics from the RDD MARC survey to that of the Census 2000.

Table 3-3 presents the distributions of the (unweighted) RDD MARC sample and the Census 2000 on the County level.

3.3 Cohort Respondent / Nonrespondent Analysis

In the process of conducting the MARC household travel survey (which forms the foundation of the cohort for the EPA Emissions Testing Project), NuStats randomly sampled and contacted 5,500 regional households. Of these, 4,001 agreed to provide their information and 3,049 ultimately completed all aspects of the survey. Non-respondents are those 1,500 households that were contacted and firmly refused to participate.

A discussion of the characteristics for those 1,500 households that chose not to participate is very limited. Most refusals took place during the introduction to the study, prior to the interviewer obtaining any demographic information about the household. The only item that can be reviewed is the geographic distribution of refusers, since all sampled telephone numbers were initially flagged with the anticipated county of residence. This distribution is shown in Table 3-4 and the proportion of refusals matched the proportion of participants by county of residence.

Of those 4,001 households that agreed to participate in the MARC survey, 2,887 with at least one vehicle comprised the Round 1 sample. Of those, a total of 1,236 were contacted about participation in this Round 1 emissions testing effort. Of these households, 221 ultimately agreed to participate in the survey. The remainder either refused to participate (360), could not be contacted after multiple attempts (497), or their phone numbers were no longer valid (106). On average, each household was attempted 2.8 times. The overall response rate for the study was 21%.

Of the 221 households that ultimately had their vehicles tested, 23 had initially refused to participate during the recruitment call but were converted after another focused attempt. An additional 29 households cancelled their initial scheduled testing, but agreed again to have the vehicle tested later during Round 1. Tables 3-5, 3-6, 3-7, and 3-8 compare the Round 1 participants vs. those that refused testing in terms of the county of residence, income, and vehicles owned. The bin breakdown of these vehicles is presented in Section 3.6.

In terms of county of residence, the refusers were most likely to come from Jackson County, Johnson County, or Cass County. However, there was very little difference in the proportions of refusers and regular participants by county of residence.

Table 3-4. MARC Household Survey Non-Respondents and Respondents by County of Residence

County	Non-Responders	Respondents
Johnson County, KS	29.7%	26.4%
Leavenworth County, KS	3.6%	3.1%
Wyandotte County, KS	7.8%	8.6%
Clay County, MO	5.5%	4.8%
Cass County, MO	12.5%	12.3%
Jackson County, MO	37.5%	40.4%
Platte County, MO	3.5%	4.5%

Source: Non-Respondents based on Sample File for the Kansas City Regional Household Travel Survey (KCRHTS), unweighted. Includes all households that refused to participate in the study. Respondent proportion reflects the weighted distribution of households participating in the survey.

Table 3-5. Round 1 Refusers and Respondents by County of Residence

County	Refusers	Regular Participants
Johnson County, KS	22.2%	25.6%
Leavenworth County, KS	2.2%	6.4%
Wyandotte County, KS	9.5%	10.4%
Clay County, MO	6.0%	4.8%
Cass County, MO	14.0%	9.6%
Jackson County, MO	43.2%	40.0%
Platte County, MO	2.9%	3.2%

Source: Non-Respondents based on unweighted KCRHTS data for refusers and regular participants in Round 1 of the study.

The refusers were more likely to report a lower income than that reported by regular participants (22% compared to 16%, respectively).

Table 3-6. Round 1 Refusers and Respondents by Income Level

Income	Refusers	Regular Participants
<15,000	8.8%	4.9%
15,000 - < 25,000	13.5%	10.6%
25,000 - <50,000	35.5%	37.4%
50,000 - < 75,000	18.9%	20.3%
75,000-<100,000	14.5%	17.9%

100,000+	8.8%	8.9%

Source: Non-Respondents based on unweighted KCRHTS data for refusers and regular participants in Round 1 of the study.

The refusers were more likely to own a truck. As a result, trucks were added as part of the rental fleet in Round 2 (note that the mitigation of such refusals by adding trucks ultimately was inconclusive.)

Table 3-7. Round 1 Refusers and Respondents by Vehicle Type

Vehicle Type	Refusers	Regular Participants
Car	79.7%	84.2%
Truck	20.3%	15.8%

Source: Non-Respondents based on unweighted KCRHTS data for refusers and regular participants in Round 1 of the study.

As was anticipated, the refusers were somewhat more likely to own an older vehicle.

Table 3-8. Round 1 Refusers and Respondents by Vehicle Year

Vehicle Year	Refusers	Regular Participants
Pre -1981	9.3%	5.9%
1981 to 1990	35.2%	39.2%
1991 to 1995	16.4%	18.1%
1996+	39.1%	36.9%

Source: Non-Respondents based on unweighted KCRHTS data for refusers and regular participants in Round 1 of the study.

3.4 Cohort Recruitment Analysis

Section 3.2 defined the study cohort as being derived from the MARC 2004 household travel study sample and demonstrated that the MARC sample represented the KCMSA. This section compares the MARC sample with the Rounds 1 and 2 participant characteristics and the 2000 Census data for the study area.

The first comparison is on key household characteristics, including household size, vehicles, household workers, household income, residence type, and home ownership as shown in Table 3-9. This table shows the raw and weighted MARC sample characteristics, the raw Rounds 1 and 2 participant characteristics, and the 2000 Census data for the study area.

Table 3-9. MARC Household Characteristics Compared to Census

Characteristic	MARC Raw Data	MARC Weighted Data	EPA Round 1 Data	EPA Round 2 MARC Data Only	Round 1 & Round 2	Census Data
Household Size						
1	28.40%	27.50%	16.80%	7.06%	10.84%	27.40%
2	34.00%	32.90%	32.80%	36.47%	34.94%	32.90%
3	15.80%	16.20%	14.40%	20.00%	18.07%	16.20%
4+	21.80%	23.50%	36.00%	36.47%	36.14%	23.50%
Household Vehicles						
0	5.30%	7.40%	0.00%	0.00%	0.00%	7.40%
1	32.00%	33.90%	12.80%	10.59%	12.05%	33.90%
2	44.20%	41.70%	44.80%	54.12%	49.40%	41.70%
3+	18.50%	17.00%	42.40%	35.29%	38.55%	17.00%
Household Vehicles		(Reweighted from above to include households with 1-3+ vehicles)				
1	33.79%	36.61%	12.80%	10.59%	12.05%	36.61%
2	46.67%	45.03%	44.80%	54.12%	49.40%	45.03%
3+	19.54%	18.36%	42.40%	35.29%	38.55%	18.36%
Geography						
Urban	18.50%	20.60%	23.20%	12.94%	16.87%	20.60%
Suburban 1st Ring	26.20%	26.00%	28.80%	25.88%	29.52%	26.00%
Remainder	55.20%	53.40%	48.00%	61.18%	53.61%	53.40%
Household Income						
< $15k	8.90%	9.60%	4.80%	3.53%	4.22%	12.20%
$15k - < $25k	9.50%	9.70%	10.40%	7.06%	7.83%	11.30%
$25k- < $50k	29.70%	29.80%	36.80%	31.76%	34.34%	30.10%
$50k - < $100k	37.60%	36.10%	37.60%	40.00%	40.36%	33.60%
$100k +	14.40%	13.70%	8.80%	12.94%	10.84%	12.80%
Income refusals	5.50%	5.50%	1.60%	4.71%	2.41%	--
Residence Type						
Single family	78.40%	76.90%	87.20%	91.76%	87.95%	69.00%
All other types	21.60%	23.10%	12.80%	8.24%	12.05%	31.00%

Source: 2000 Census and Kansas City Regional Household Travel Survey (KCRHTS), weighted. As documented in the Kansas City Regional Household Travel Survey Final Report, the data were weighted by household size, household vehicles, and geography (home location). Round 1 & Round 2 participants are summarized using raw KCRHTS data as the EPA surveys didn't obtain demographic information.

MARC Sample: For the most part, the weighted data compare favorably with the census data, indicating that the survey data set is representative of the regional population. The difference in the distribution of respondents based on residence type can be explained somewhat based on the proportion of sample types used in the study. Listed telephone numbers (those with complete address information for the household) are typically associated with households of longer tenure, which is correlated with living in a single-family dwelling and home ownership. Renters, who are considered to be more transient and living in housing types not characterized as single-family dwellings, may change telephone numbers more often and are typically more likely to have a number that is incomplete or not including in the listed telephone number database. The proportion of listed to not listed samples used in this study was 50/50, meaning that of the 40,000 pieces of sample used, 20,000 were associated with listed numbers and 20,000 were not. An effort more focused on renters would have required the use of more unlisted than listed numbers, which was not possible within the project's budget. Thus, the desire to achieve a good mix of residence type was balanced with the project budget and as a result, residence type came within 10% of the census parameters, but not within 5% like the other variables.

Round 1 Participants. The Round 1 study design called for testing a specific combination of vehicles based on type (car vs. truck) and age. The testing goals were disproportionate to survey universe parameters, with a higher focus on older vehicles. In addition, only MARC households that owned vehicles could be considered for inclusion in the study. For comparison purposes, we have excluded households with 0 vehicles in one of the comparisons presented in Table 3-9. As a result of these various study parameters, the characteristics of the Round 1 households differs somewhat from those of the MARC and Census data. The Round 1 households were larger and owned more vehicles (again, given that vehicle ownership was a requirement for participation in the study, this finding was not surprising). The Round 1 households show a good geographic dispersion and tend to reflect more moderate income households. In terms of home ownership, there is a significantly higher proportion living in single-family residences. However, as with the main MARC survey, home ownership is a secondary variable of interest so this is not of great concern.

Round 2 Participants. The Round 2 study design was similar to Round 1 and many of the household characteristics remained relatively constant and different from the MARC and Census data. Round 2 households were larger, owned more vehicles, reflected more moderate income levels and most tended to own single-family residences. In contrast to Round 1, Round 2 households' geographic dispersion was less urban.

Round 2 Retests. Table 3-10 shows distribution of the Round 1 vehicles that were retested in Round 2, along with household characteristics. The study goals required 25 such tests to be conducted, 43 vehicles were actually retested.

Table 3-10. MARC Household Characteristics for Round 1 Retests in Round 2

Characteristics	Round 1 Retest Data (%)
Household Size	
1	9.52%
2	35.71%
3	14.29%
4+	40.48%
Total	100.00%
Household Vehicles	
1	19.05%
2	54.76%
3+	26.19%
Total	100.00%
Household Income	
0-14,999	4.76%
15,000-24,999	4.76%
25,000-34,999	9.52%
35,000-49,999	9.52%
50,000-74,999	21.43%
75,000+	28.57%
DK	11.90%
RF	9.52%
Total	100.00%
County	
Johnson	30.95%
Clay	9.52%
Platte	21.43%
Wyandotte	14.29%
Jackson	16.67%
Leavenworth	4.76%
Cass	2.38%
Total	100.00%

Table 3-11 shows that the key person characteristics of MARC age and ethnicity also track the census fairly well. The higher proportion of "other" ethnicities reflects Hispanic respondents who identified themselves as such in answer to this question. With regard to the Rounds 1 and 2 data, the participants tend to be younger, on average. In terms of ethnicity, the Rounds 1 and 2 participants mirror the census extremely well.

Table 3-11. MARC Person Characteristics Compared To Census

Characteristic	MARC Raw Data	MARC Weighted Data	EPA Round 1 Data	EPA Round 2 MARC Data Only	Round 1 & Round 2	Census Data
Respondent Age						
<20	28.70%	30.30%	55.94%	53.94%	53.90%	29.10%
20 – 24	3.60%	3.60%	6.64%	5.45%	5.84%	6.10%
25 – 54	42.30%	41.70%	74.48%	70.91%	72.08%	45.30%
55 – 64	10.60%	9.80%	15.38%	20.61%	18.51%	8.20%
65+	14.80%	14.60%	10.14%	8.48%	9.42%	11.30%
Respondent Ethnicity						
White	84.80%	83.40%	79.20%	84.71%	82.53%	81.60%
Black/African American	9.10%	10.20%	12.80%	10.59%	11.45%	14.10%
Other	6.10%	6.40%	8.00%	4.71%	6.02%	4.30%

Source: 2000 Census and Kansas City Regional Household Travel Survey (KCRHTS), weighted. As documented in the Kansas City Regional Household Travel Survey Final Report, the data were weighted by household size, household vehicles, and geography (home location). Round 1 participants are summarized using raw KCRHTS data as the EPA surveys didn't obtain demographic information.

The 2000 Census Transportation Planning Package Profile for the seven-county metropolitan region was used to review the worker flow characteristics. As shown in Figure 3-2, the commute trip characteristics of the participating MARC household members on the assigned travel day tracks those reflected in the census fairly well. In terms of gender, the MARC survey contains a slightly higher proportion of female workers compared to male workers, but still within 5% of the census. The Round 1 participants tend to have more men then women while in Round 2, participants were more likely to be women.

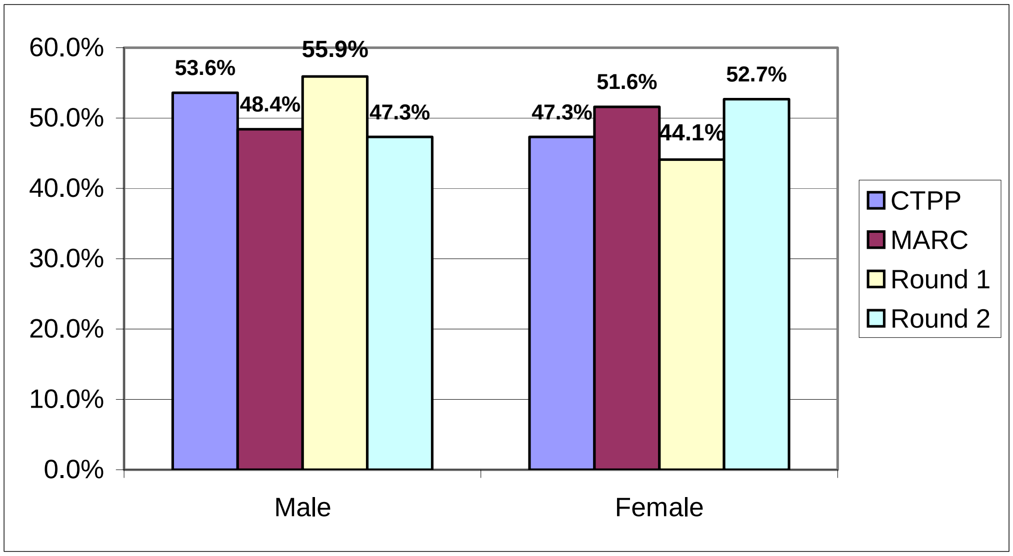


Figure 3-2. Worker Comparison

As in the journey to work data, the majority of employed respondents in the MARC survey reported driving or riding as an auto passenger to work (91%) on the assigned travel day. The proportion of MARC workers telecommuting was higher than what was reported in the census (6% compared to 3%), while the proportion of workers who commuted by walk or bike was relatively the same. "Other" responses included taxi and paratransit modes (e.g., alternative mode of flexible passenger transportation that does not follow fixed routes or schedules such as minibuses and vans).

Round 1 and Round 2 participants virtually all drove to work. The difference was expected, given the requirements of vehicle ownership and the need to drive a vehicle to the testing facility in the morning hours. Table 3-12 shows the mode to work comparison for the four datasets.

Table 3-12. Mode to Work Comparison

Mode	CTPP	MARC	ROUND 1	ROUND 2
Auto	93.7%	91.1%	99.6%	99.2%
Transit	1.3%	1.3%	0.0%	0.0%
Bike/Walk	1.3%	1.4%	0.4%	0.0%
Other	0.6%	0.3%	0.0%	0.8%
Work at Home	3.2%	5.9%	0.0%	0.0%

Source: 2000 Census and Kansas City Regional Household Travel Survey (KCRHTS), weighted. As documented in the Kansas City Regional Household Travel Survey Final Report, the data were weighted by household size, household vehicles, and geography (home location). Round 1 participants are summarized using raw KCRHTS data as the EPA study recruitment surveys did not obtain demographic information.

The MARC survey respondents reported the same work commute time as what was captured in the census journey to work data (24 minutes for the survey and 23 minutes for the census). Figure 3-3 shows the travel time comparison for the four datasets. The largest noticeable difference between the two data sources is in the 20 to 29 minute commutes, where the census shows 26% of all trips taking this long, while in the survey data, only 20% were of that length. This difference is somewhat attributable to the way the census question was worded (how many minutes did it usually take this person to get to work last week) compared to how the work trip travel time was computed (time it took to leave home and arrive at work on a specific travel day, with the trip start and end times being reported by the respondent).

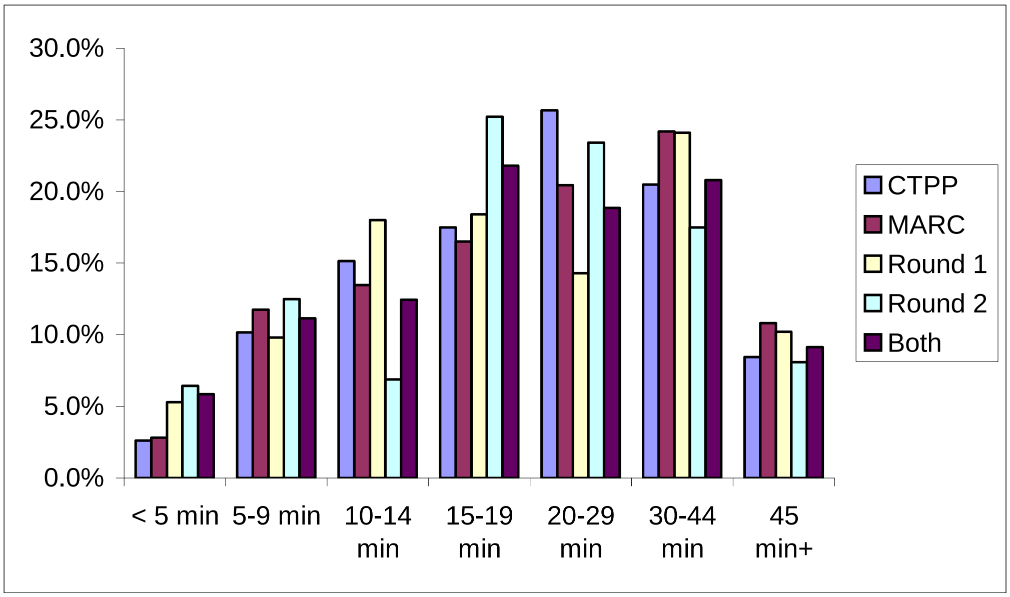


Figure 3-3. Travel Time Comparison

The Round 1 participants had shorter commutes, on average (22.5 minutes compared to 23.7 minutes overall). They reported considerably fewer commute trips of 20 to 29 minutes in particular. Round 2 participants also had shorter commutes with considerably more reported, however, in the 15 to 19 minute range than any of the other three datasets.

In general, with regard to both demographic and the journey to work information reported by the participating households, the Kansas City Regional Household Travel Survey is representative of the study area population. The Round 1 and Round 2 participants represent the vehicle-owning households in the region, and also reflect the testing goals. They are slightly larger in size, tend towards middle income, and are slightly younger. Round 1 participants are likely to be male, while Round 2 are more likely to be female.

Figure 3-4 illustrates the sample flow in deriving the 2,887 households for the emissions study from the MARC Kansas City Household Travel Study Sample. Figure 3-5 illustrates the sample flow in deriving the 4,081 households from the Vehicle Registration Database.

Figure 3-4. Kansas City Regional Household Travel Survey Sample Flow Summary

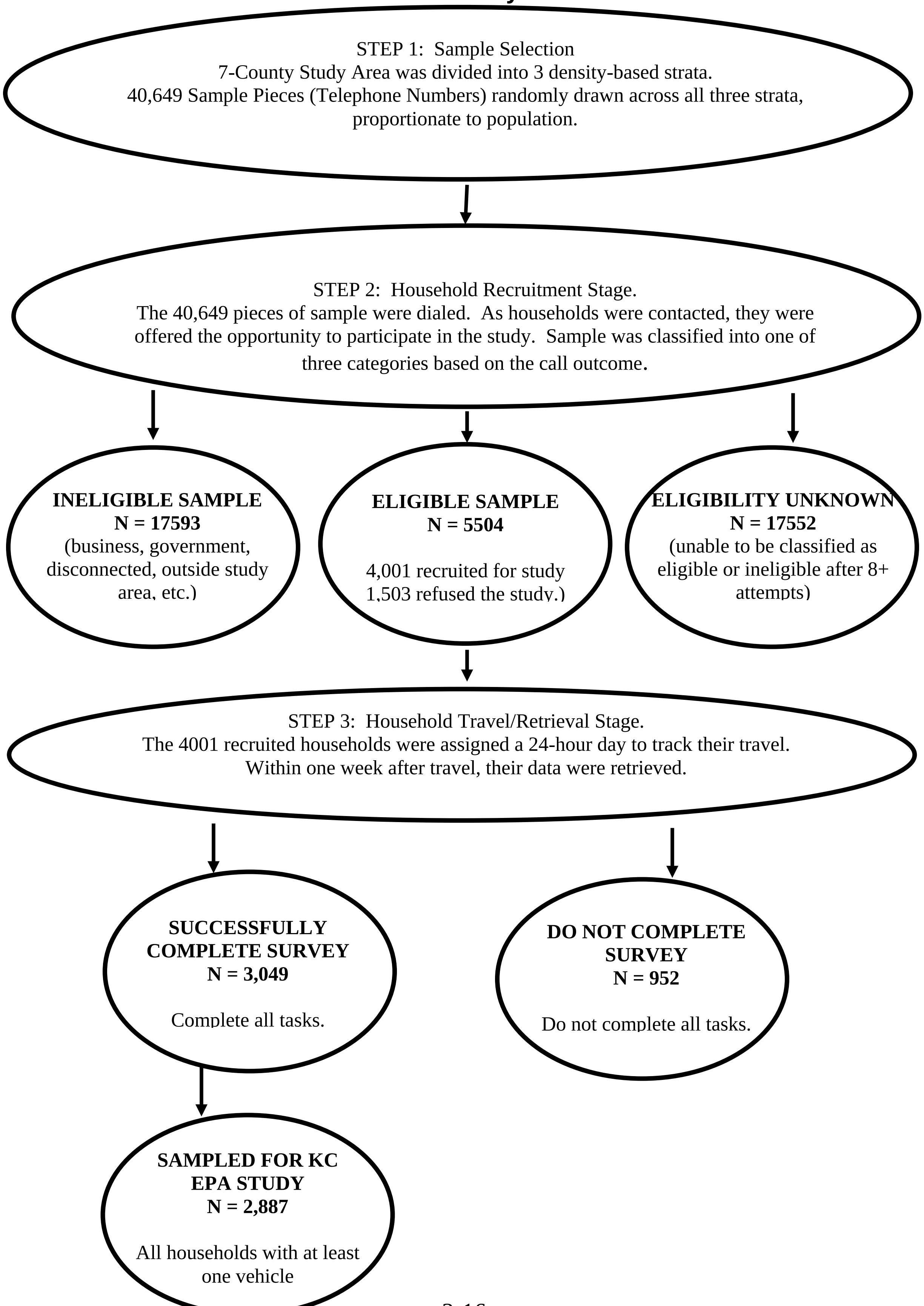
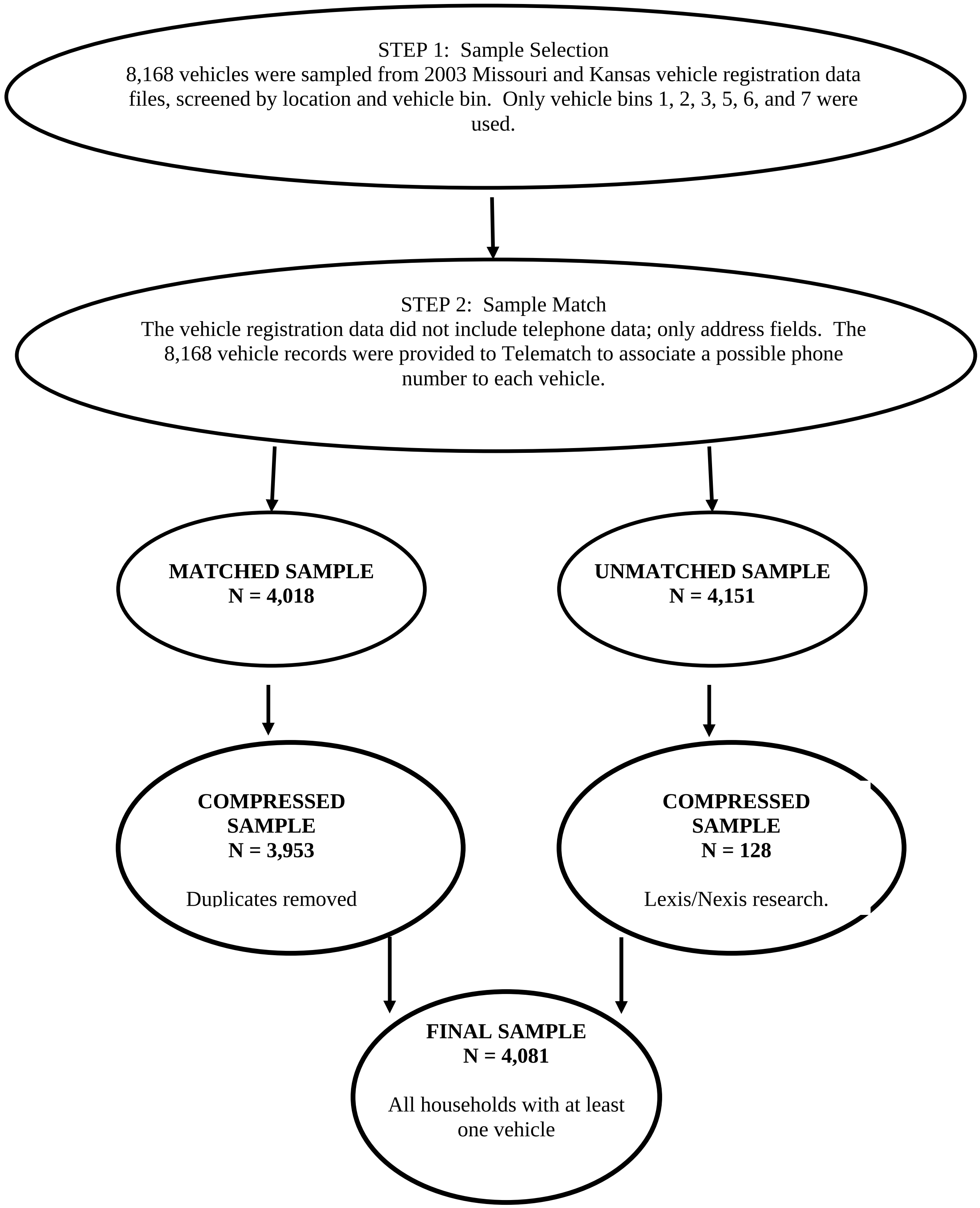


Figure 3-5. KS and MO Vehicle Registration Database Sample Flow Summary



3.5 Vehicle Recruitment Sample Plan

This section documents the sample plan and stratification scheme derived for the study. It is presented in two sections. First, the original sample plan derived for Round 1 is introduced. Second, a final sample plan designed for Round 2 using Round 1 data is presented.

Original Round 1 Sample Plan

The RFP initially proposed a stratification scheme and a sample allocation based on optimal allocation for obtaining the desired total of 480 tested vehicles across Rounds 1 and 2. After reviewing the back-up materials, the project team agreed that the data used to design the sample were subject to substantial uncertainty and that the project would benefit from re-visiting the sample design using a larger data set. Accordingly, EPA and ERG provided PM emissions data and DMV registration data for the development of an enhanced sample design. A summary of the source of the PM data provided by EPA is shown in Table 3-13.

Table 3-13. Summary of Data Used for Development of Sample Sizes for the KC Study

		Number of IM240 Tests		Total Tests
Study Number	**Study Description**	**CAR**	**TRUCK**	
CRC E-54	Central Carolina Vehicle Particulate Emission Study	158	77	235
CRC E-24-1	Cadle, S.H. et al (September 1999) "Light-Duty Motor Vehicle Partioculate Matter Measurement in the Denver, Colorado Area, *J. Air Waste Manage. Assoc*. 49 PM-164-174	56	17	73
CRC E-24-2	Measurement of Primary Particulate Matter Emissions from Light-duty Motor Vehicles (Norbeck, et al.)	212	110	322
Grand Total		426	204	630

The project team endorsed the recommendation to employ the MARC RDD data set as a source of vehicles. This was significant because the substantial pool of vehicles that is immediately available from the MARC sample involves virtually no screening effort. Therefore, the stratified sample design strategy called Neymann allocation (which ignores screening costs across vehicle class/age strata) was an appropriate starting point for designing an optimal allocation sample design.

The sample design addressed two issues:

- Determination of attractive vehicle age cutpoints to form strata; and
- Development of optimal allocation of sample sizes to individual strata.

Developing Vehicle Age Cutpoints

Eight strata for sampling vehicles are to be formed by crossing vehicle type (truck vs. car) by Vehicle Year Made (4 age groupings). There is flexibility in designating the cutpoints of the three oldest vehicle ages. The task was to use available PM data to determine appropriate cutpoints. Our approach employs a sequential strategy – first determine the best cutpoint for the oldest vehicle year make category, then address the newer age groupings.

Tables 3-14 and 3-15 present four scenarios for specifying the oldest age groupings. See the "Pre X" and "(X+1) to 1989" rows. We varied the cutpoint for the "Pre X" stratum using 1980, 1981, 1982 and 1983 (see column headings). In an ideal world we want a cutpoint to maximize "between" stratum variance yet minimize "within" stratum variance. This means we want to see divergent Mean Values across strata coupled with less divergent standard deviations across strata. Tables 3-14 and 3-15 show that the ideal world clearly does not exist, but that strata means diverge most (for cars) when X=1981 (i.e., using "Pre-1981" as the oldest make category). This was our recommendation.

Table 3-14. Mean PMs for Eight Strata Under Four Alternative Cutpoints for the Oldest Vehicles

Sampling Vehicles			X=1980	X=1981	X=1982	X=1983
Type	**Model Year**	**Strata**	**Mean PM 1**	**Mean PM 2**	**Mean PM 3**	**Mean PM 4**
Truck	Pre X	1	40.46	40.46	37.07	36.51
Truck	(X+1) to 1989	2	18.30	18.30	18.88	18.67
Truck	1990 to 1995	3	6.55	6.55	6.55	6.55
Truck	1996 & newer	4	5.28	5.28	5.28	5.28
Car	Pre X	5	39.68	39.12	36.86	34.27
Car	(X+1) to 1989	6	17.01	14.85	14.31	13.62
Car	1990 to 1995	7	5.90	5.90	5.90	5.89
Car	1996 & newer	8	3.12	3.12	3.12	3.12

Table 3-15. Standard Deviations of PMs for Eight Strata Under Four Alternative Cutpoints for the Oldest Vehicles

Sampling Vehicles			X=1980	X=1981	X=1982	X=1983
Type	**Model Year**	**Strata**	**Stdev PM 1**	**Stdev PM 2**	**Stdev PM 3**	**Stdev PM 4**
Truck	Pre X	1	39.34	39.35	38.47	37.53
Truck	(X+1) to 1989	2	20.50	20.50	20.93	21.21
Truck	1990 to 1995	3	6.89	6.89	6.89	6.89
Truck	1996 & newer	4	5.09	5.09	5.09	5.09
Car	Pre X	5	28.63	31.54	31.56	29.97
Car	(X+1) to 1989	6	23.67	20.64	19.94	20.16
Car	1990 to 1995	7	7.47	7.47	7.47	7.47
Car	1996 & newer	8	3.49	3.49	3.49	3.49

Using the recommendation above, we then examined four alternative cutpoints for the middle vehicle age strata. Tables 3-16 and 3-17 present the results of this analysis. We see in

Table 3-15 that a significant reduction in PM variation for stratum 3 occurs when using 1990 as the cutpoint to divide the range 1981-1995 into two strata. Thus, we recommended that age categories 1981-1990 and 1991-1995 be adopted.

Table 3-16. Mean PMs for Eight Strata Under Four Alternative Cutpoints for the Middle-Aged Vehicles

Means by strata			Z=1989	Z=1990	Z=1991	Z=1992
Type	Model Year	Strata	Mean PM 1	Mean PM 2	Mean PM 3	Mean PM 4
Truck	Pre -1981	1	40.46	40.46	40.46	40.46
Truck	1981 to Z	2	18.30	17.53	16.09	15.56
Truck	(Z+1) to 1995	3	6.55	4.57	4.86	5.08
Truck	1996 & newer	4	5.28	5.28	5.28	5.28
Car	Pre -1981	5	39.12	39.12	39.12	39.12
Car	1981 to Z	6	14.85	14.40	13.73	12.70
Car	(Z+1) to 1995	7	5.90	5.43	5.09	5.12
Car	1996 & newer	8	3.12	3.12	3.12	3.12

Table 3-17. PM Standard Deviations for Eight Strata Under Four Alternative Cutpoints for the Middle-Aged Vehicles

Sampling Vehicles			Z=1989	Z=1990	Z=1991	Z=1992
Type	Model Year	Strata	Stdev PM 1	Stdev PM 2	Stdev PM 3	Stdev PM 4
Truck	Pre-1981	1	39.34	39.35	39.35	39.35
Truck	1981 to Z	2	20.50	19.07	18.60	18.42
Truck	(Z+1) to 1995	3	6.89	3.95	4.20	4.31
Truck	1996 & newer	4	4.36*	4.36*	4.36*	4.36*
Car	Pre-1981	5	31.54	31.54	31.54	31.54
Car	1981 to Z	6	20.64	19.96	19.32	18.48
Car	(Z+1) to 1995	7	7.47	7.15	6.52	6.65
Car	1996 & newer	8	4.36*	4.36*	4.36*	4.36*

The data supported our recommendation to employ the following year of make categories for stratification purposes: Pre-1981; 1981-1990; 1991-1995 and 1996+. We used this in the development of an optimal design, as described in the following section.

Optimal Allocation using PM Emission Rate

We used the PM emission rate data to assess the optimal allocation of test vehicles across the eight sampling strata recommended above. Table 3-18 presents the results of this design exercise. Column A exhibits the standard deviation of PM emission rate for each stratum. The relative values across strata are used to establish differential sampling rates, shown as “Neymann relative f” in Column B. Column C is not used in the optimal allocation design, but shows how vehicles in the Kansas City area distribute naturally (proportionately) across strata. (Here we used the MARC RDD percentage distribution of vehicles across strata because we verified that this was consistent with the distributions of vehicles obtained from DMV records in the counties comprising the Kansas City MSA.)

Table 3-18. Neymann (Optimal) Allocation Using PM per Vehicle-Mile

Type	Model Year	Strata	A	B	C	D	E	F	G
			PM Emission Rate Std Dev	Neymann Relative Sampling Rates	Vehicle % using MARC RDD	Optimal Alloc %	Optimal Sample N	Available via MARC	Ratio: Available to N
Truck	Pre-1981	1	39.35	9.02	1.1%	6.1%	29	71	2.4
Truck	1981-1990	2	19.07	4.37	3.7%	9.9%	47	295	6.2
Truck	1991-1995	3	3.95	0.91	7.2%	4.0%	19	514	26.9
Truck	1996+	4	4.36	1.00	28.6%	17.5%	84	2048	24.4
Car	Pre-1981	5	31.54	7.23	1.3%	5.7%	28	84	3.0
Car	1981-1990	6	19.96	4.57	7.4%	20.7%	99	571	5.8
Car	1991-1995	7	7.15	1.64	13.4%	13.4%	64	982	15.3
Car	1996+	8	4.36	1.00	37.3%	22.8%	109	2636	24.1
Totals					100%	100%	480	7201	

The optimal differential sampling rates in Column B give rise to the distribution of the optimal sample across strata as seen in Column D. By comparing the corresponding percentages in Columns C and D we see which strata are "oversampled" and which are "undersampled" under an optimal allocation design. Column E shows the optimal allocation of vehicles to strata under a design where N=480 total vehicles are tested.

Column F shows the number of vehicles available from the pool (cohort) of MARC RDD households. Column G presents the ratio of available to needed vehicles for testing under the optimal allocation design. We see that the MARC RDD sample offered an ample supply of vehicles across all strata for recruitment.

Table 3-18 is useful for optimizing the overall estimate of mean PM emission rate during operation. However, our principal objective is to develop an estimate of total PM annual emissions, and for this we need additional information regarding the average use of vehicles (i.e., annual mileage). Data for annual mileage by vehicle class and year-of-make were provided by ERG and incorporated into Table 3-18.

The following documents the analyses used to recommend year-of-make cutpoints and develop an optimal sample design using Neymann allocation. It details several optimal allocation designs as well as a proportionate design based on annual PM emissions rather than vehicles, and an alternative design that balanced an optimal allocation (for estimating mean PM rate), the inclusion of high emitters in the older vehicle fleet, and the desire to protect ourselves against unanticipated surprises in any one stratum.

Optimal Allocation using Annual PM Emissions

Table 3-19 develops an optimal allocation design based on annual volume of PM emissions. Column A exhibits the average mileage driven by vehicles per stratum, and Column AA presents the stratum specific standard deviations formed by taking the product of PM emission standard deviation and the average annual vehicle mileage. The resulting relative sampling rates under Neymann allocation appear in Column B, and the resulting percentage allocations of sample to strata appear in Column D. The optimal allocation distribution can be contrasted with a proportionate allocation design by comparing the row entries of Columns C (for a proportionate design) to the corresponding cell in Column D (under the optimal allocation design). The optimal allocation of tests to strata under a design totaling N=480 is presented in Column E. We see that the optimal design using Annual PM emissions does not differ much from a proportionate design. This is primarily a function of the low prevalence of older, higher emitting vehicles in the active fleet.

As a parting note to this section, the optimal allocation derivation relies on a statistical estimation methodology that incorporates external auxiliary information – i.e., annual vehicle mileage. As such, the optimal allocation derivation is conditional on the average mileage data (in a formal mathematical statistical sense). The conditional approach is invoked in Column AA by using:

Std dev(annual emissions)   = Ave mileage x Std dev(PM rate).

That is, we assume that the estimate of annual PM emissions will be developed using average mileage data obtained from a source outside this study (rather than taking a measurement for each vehicle being tested). If actual vehicle mileage of each tested vehicle is to be used in the annual PM estimation process, then an additional source of variation (i.e., sampling error from annual mileage) will have to be taken into account. (Also, the estimation process will need to be explicitly specified.) However, this was not recommended because the resulting estimates are subject to very large sampling errors.

Table 3-19. Neymann (Optimal) Allocation Using Annual PM Emissions

Type	Model Year	Strata	A	A'	AA	B	C	D	E	F	G
			PM Emission Rate Std Dev	Ave annual Vehicle Mileage	Annual PM Emission Std Dev	Neymann Relative Sampling Rates	Vehicle % using MARC RDD	Optimal Alloc %	Optimal Sample N	Available Vehicles using MARC	Ratio: Available to N
Truck	Pre-1981	1	39.35	2,260	88,925	2.49	1.1%	1.5%	7	71	9.8
Truck	1981-1990	2	19.07	4,771	90,991	2.55	3.7%	5.2%	25	295	11.8
Truck	1991-1995	3	3.95	9,034	35,685	1.00	7.2%	4.0%	19	514	26.9
Truck	1996+	4	4.36	15624	68,182	1.91	28.6%	30.2%	145	2048	14.1
Car	Pre-1981	5	31.54	3,915	123,490	3.46	1.3%	2.5%	12	84	7.0
Car	1981-1990	6	19.96	5,750	114,766	3.22	7.4%	13.2%	63	571	9.0
Car	1991-1995	7	7.15	8,363	59,798	1.68	13.4%	12.4%	60	982	16.5
Car	1996+	8	4.36	12282	53599	1.50	37.3%	31.0%	149	2636	17.7
AA = A x A'						Totals	100%	100%	480	7201	

Proportionate Allocation using Annual PM Emissions.

An alternative design is one that allocates sample to strata proportionately to the percentage contribution of PM emissions from the collection of vehicles in each stratum. Table 3-20 presents this design.

Table 3-20. Sample Allocation for Proportionate Design Based on Annual Percentage PM Emissions Across Strata

			A	B	C*	D	E	F	G	H
Type	**Model Year**	**Strata**	**Avg Annual Mileage**	**Avg PM Emiss**	**Mean Annual PM Volume Per Vehicle**	**Vehicle % Using MARC RDD**	**% Contrib. Total PM Emiss.**	**Annual Volume PM Propor N**	**Avail Vehicles Using MARC**	**Ratio: Avail. to Sample N**
Truck	Pre-1981	1	2,260	40.46	91434	1.1%	1.7%	8	71	8.7
Truck	1981-1990	2	4,771	17.53	83643	3.7%	5.2%	25	295	11.7
Truck	1991-1995	3	9,034	4.57	41286	7.2%	5.0%	24	514	21.3
Truck	1996+	4	15624	5.28	82494	28.6%	39.9%	192	2048	10.7
Car	Pre-1981	5	3,915	39.12	153168	1.3%	3.4%	16	84	5.2
Car	1981-1990	6	5,750	14.4	82797	7.4%	10.4%	50	571	11.5
Car	1991-1995	7	8,363	5.43	45413	13.4%	10.3%	49	982	19.9
Car	1996+	8	12282	3.12	38321	37.3%	24.2%	116	2636	22.7
					*C = A x B	100%	100%	480	7201	

Column A of Table 3-20 presents the average annual mileage of vehicles in a given stratum (defined by the rows). Column B shows the average PM emission rate for vehicles in each stratum. The mean annual PM emissions per vehicle in each stratum is furnished in Column C by taking the product of corresponding cell values in Columns A and B.

Column E reflects the stratum percentage contribution to total PM emissions. It is calculated using the product of the mean annual PM volume per vehicle (Col. C) and the percentage of vehicles associated with each stratum (Col. D). For instance pre-1981 cars (stratum 5) represent 1.3% of vehicles in Kansas City, but account for 3.4% of annual vehicle emissions.

A proportionate allocation of sample to strata based on total annual vehicle emissions is presented in Column F.

Optimal Allocation Using Annual PM Emissions

Table 3-21 provides the analogue to Table 3-20 but using the percentage distribution of annual emissions (Column E) rather than the percentage distribution of vehicles (as shown in Table 3-19, Column C).

Table 3-21. Optimal Allocation Design Based on Annual Percentage PM Emissions Across Strata

Type	Model Year	Strata	A	B	C	D	E	F	G	H	I
			PM Std Dev	Ave annual mileage	Annual PM Emission Std Dev	Neymann Relative Sampling Rates	% Contributed to total PM Emission	Optimal Allocation %	Optimal Sample N	Available via MARC	Ratio: Available to N
Truck	Pre-1981	1	39.35	2,260	88,925	2.49	1.7%	2.1%	10	71	6.9
Truck	1981-1990	2	19.07	4,771	90,991	2.55	5.2%	6.8%	32	295	9.1
Truck	1991-1995	3	3.95	9,034	35,685	1.00	5.0%	2.5%	12	514	42.0
Truck	1996+	4	4.36	15624	68,182	1.91	39.9%	38.6%	185	2,048	11.0
Car	Pre-1981	5	31.54	3,915	123,490	3.46	3.4%	5.9%	28	84	3.0
Car	1981-1990	6	19.96	5,750	114,766	3.22	10.4%	16.9%	81	571	7.0
Car	1991-1995	7	7.15	8,363	59,798	1.68	10.3%	8.7%	42	982	23.4
Car	1996+	8	4.36	12,282	53,599	1.50	24.2%	18.4%	88	2,636	29.9
						Totals	100%	100%	480	7,201	

Allocation Using an Ad Hoc Weighting Strategy.

The optimal allocations above were designed to maximize the statistical precision of a specific estimate (e.g., annual PM emissions). However, a competing research objective is to account for the rare but higher emitting vehicles making up the older fleet. As an ad hoc way of addressing this issue, we adjusted the optimization parameters that appear in Table 3-21 by including average PM emission rate. Table 3-22 presents the results of this approach. This design shows substantial increased allocations to the pre-1981 strata, so much so that there may not be sufficient vehicles available from the MARC sample to achieve the targets.

Comparison of Designs.

Table 3-23 presents a comparison of designs presented above. The designs were derived from optimizing PM emission rates, optimizing annual PM emissions using vehicle distributions, and optimizing annual PM emissions using PM emission distributions, and appear as Columns A, B and D, respectively. Column C shows the allocation under the proportionate design -- proportionate to annual PM emissions.

Table 3-22. An Ad Hoc Weighting Strategy

Type	Model Year	Strata	A PM Std Dev	A' Ave Annual Mileage	A" Avg PM Emiss	AA Ad Hoc Weighting Factor	B Relative Sampling Rate	C MARC RDD %	D Alt. Alloc %	E Ad Hoc Sample N	F Available via MARC	G Ratio: Available to N
Truck	Pre-1981	1	39.35	2,260	40.46	3,597,921	22.06	1.1%	7.8%	38	71	1.9
Truck	1981-1990	2	19.07	4,771	17.53	1,595,077	9.78	3.7%	11.7%	56	295	5.3
Truck	1991-1995	3	3.95	9,034	4.57	163,081	1.00	7.2%	2.3%	11	514	46.0
Truck	1996+	4	4.36	15624	5.28	359,999	2.21	28.6%	20.4%	98	2,048	20.9
Car	Pre-1981	5	31.54	3,915	39.12	4,830,914	29.62	1.3%	12.5%	60	84	1.4
Car	1981-1990	6	19.96	5,750	14.4	1,652,624	10.13	7.4%	24.3%	116	571	4.9
Car	1991-1995	7	7.15	8,363	5.43	324,702	1.99	13.4%	8.6%	41	982	23.7
Car	1996+	8	4.36	12282	3.12	167,229	1.03	37.3%	12.4%	59	2,636	44.4
						AA=AxA'xA"	Totals	100%	100%	480	7201	

Table 3-23. Optimal Designs, a Proportionate Design, and Two Alternatives

Type	Model Year	Strata	A	B	C	D	E	F	G
			TABLE 3-18. Opt Alloc PM Emission Rate	TABLE 3-19 Opt Alloc PM Annual Volume & Vehicle Percent	TABLE 3-20 Annual Volume PM Propor N	TABLE 3-21. Opt Alloc PM Annual Volume & Percent Distn	TABLE 3-22 Ad Hoc Design	(New) Alternative Design	Available Vehicles
Truck	Pre-1981	1	29	7	8	10	38	30	71
Truck	1981-1990	2	47	25	25	32	56	50	295
Truck	1991-1995	3	19	19	24	12	11	50	514
Truck	1996+	4	84	145	192	185	98	75	2,048
Car	Pre-1981	5	28	12	16	28	60	30	84
Car	1981-1990	6	99	63	50	81	116	100	571
Car	1991-1995	7	64	60	49	42	41	65	982
Car	1996+	8	109	149	116	88	59	80	2,636
				480	480	480		480	7,201

480

The optimization of the average PM emission rate (Column A) presents the largest oversampling of early-make vehicles (see rows 1-2, and 5-6). Optimizing annual emissions (Columns B and D) tends to only slightly oversample vehicles relative to a design (Column C) that proportionately allocates sample based on annual PM emissions for all vehicles in a stratum. It is not the case that a proportionate design based on annual PM emissions calls for large samples from early-make vehicle strata. In fact, the proportionate design calls for samples of only 8 Pre-1981 trucks and 16 Pre-1981 cars.

Column E presents the Ad Hoc design that weights the allocation of sample to strata by all three factors – PM rate, PM emissions and mileage. Finally, for the purposes of discussion, we have added Column F, a new "alternative design." Column F was formed by establishing a minimum target representation of N=30 tests. The minimum would be invoked for three strata: (stratum 1) Pre-1981 trucks; (stratum 3) 1991-1995 trucks; and (stratum 5) Pre-1981 cars. To compensate for the increase in sample size in these strata, the sample sizes of the two largest strata (1996+ trucks and cars) were drawn down roughly proportionately.

Final Sample and Stratification

After considering the various designs, we recommended our Alternative Design (Column F, Table 3-23) for Round 1 of the study. We believed this to be a robust design because it offered protection against surprises in the data (e.g., higher than expected variability in the older fleet, and higher than expected variability in 1991-1995 trucks), yet aligns fairly closely with the original optimal allocation strategy to estimate mean PM rates.

In preparing the Round 2 sample design, the ultimate performance of the sample plan was analyzed. These considerations are discussed in full in the next section.

Final Round 2 Sample Plan

With Round 1 completed, the PM data from those tests were used to revisit the sample design for Round 2. The objective of this effort was to develop a more optimal sample for Round 2 given actual PM data from KS vehicles. Such an approach optimizes the estimate of overall (annualized) OM emissions by the KC vehicle fleet. However, the design must also take into account a competing research goal – that of measuring PM emissions in warm (summer) and cold (winter) temperature environments. This section documents the process used to develop the Round 2 sample design.

PM Distributions from Round 1 Testing

Using results from Round 1 tested vehicles, PM distribution of the overall sample was examined. It appears as Chart 1. The distribution of PMs was highly skewed: median PM is 3.10 mg/mile, the mean is 11.85, and the PM range is 0.09 to 287.15 mg/mile – large by any standard. Moreover, the 90th percentile value is about 25.7 mg/mile. In fact, the mean value lies near the 85th percentile.

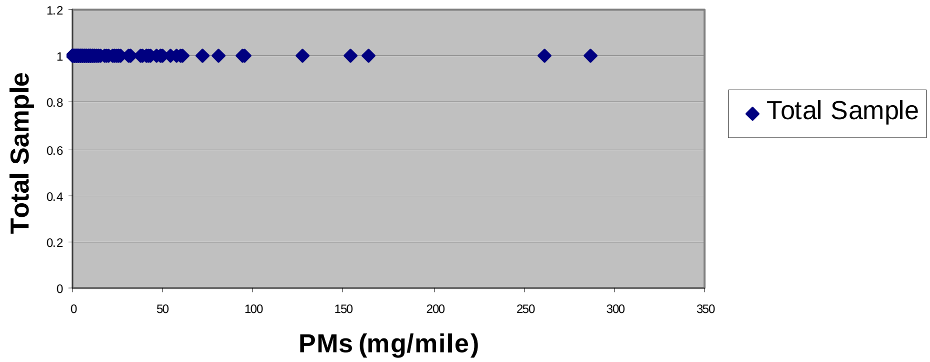


Chart 1. Distribution of Total PMs for Round 1 tested Vehicles for the Total Sample

Chart 2 presents the spread of PMs by Stratum (Bin). One can see the monotonic increase in dispersion of PMs as you go from newer vehicles to older vehicles. (1 to 4 for trucks and 5 to 9 for cars) It is also clear that the distributions of PM vary substantially across strata. It is important to note that when the goal is to develop a good statistical estimate of the PM emissions for the KC fleet, the level of emissions within each stratum is not as important as the standard deviation of PM distributions within strata.

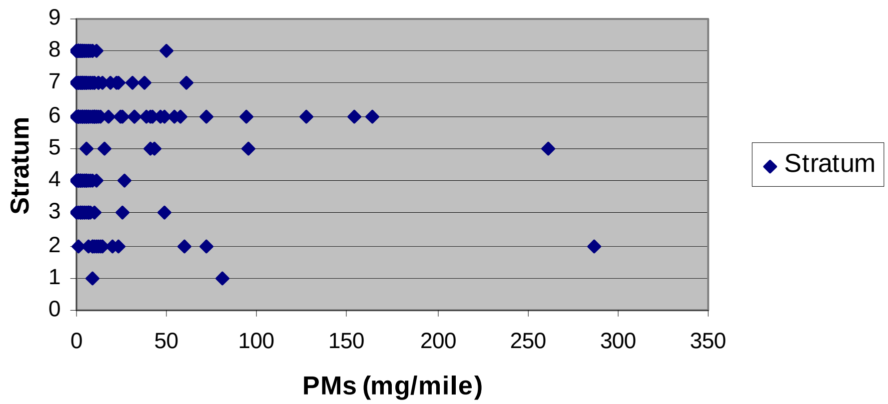


Chart 2. Comparative Distributions of Round 1 Tested Vehicle PMs by Strata/Bin

Another aspect of PM production is observed in older vehicles. Older vehicles tend to be driven less than newer ones, and this serves to dampen the older vehicle contribution to total annual vehicle PM emissions in the KC vehicle fleet. The lower use of older vehicles is illustrated in Chart 3. On average, older vehicles are driven far fewer miles annually than newer vehicles. For this initial evaluation model year average miles driven data from the MOBILE6 was used.

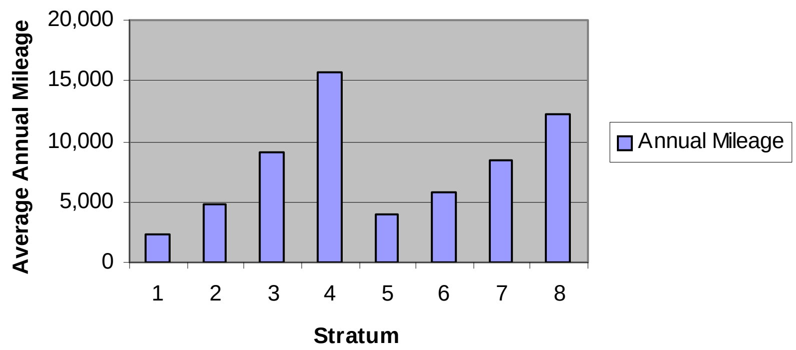


Chart 3. Average Annual Mileage Per Vehicle by Stratum

Chart 4 compares the percentage distributions across strata for three measures:

- annual PM volume,
- vehicles in the KC fleet, and
- total miles driven by KC fleet vehicles.

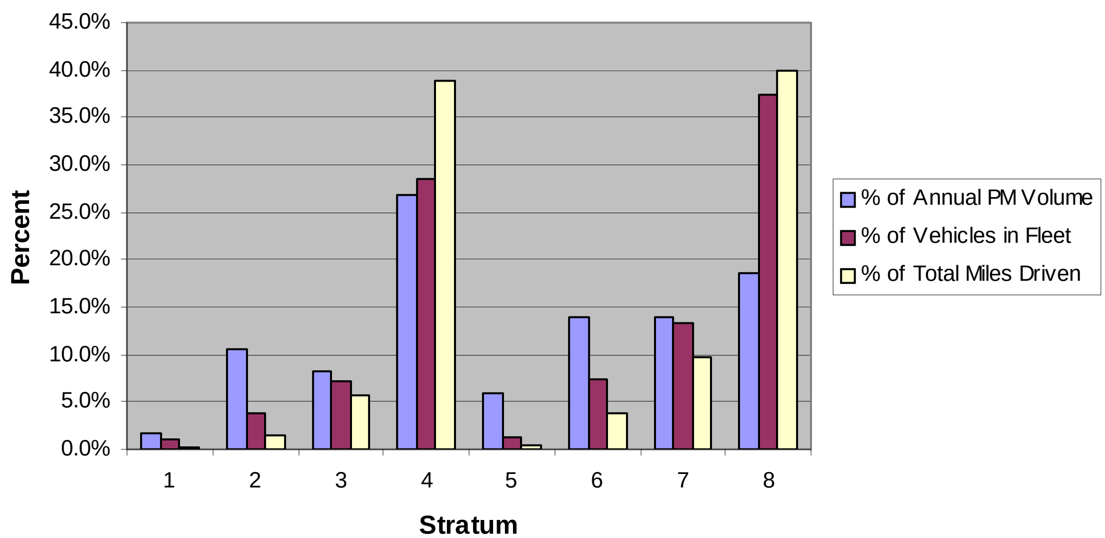


Chart 4. Percentages of Annual PM Volume, Vehicles in Fleet and Total Miles Driven Relative to Total by Stratum

The oldest vehicles not only comprise the smallest portion of the fleet, but they also account for a small fraction of all vehicle miles driven. For instance, roughly 80% of annual vehicle miles are driven by 1996+ cars and trucks, while under 1% of total vehicle miles are driven by Pre-1981 cars and trucks combined. Similarly, Pre-1981 cars and trucks account for about 7% of total annual PM volume, while 1996+ vehicles account for roughly 45% of PM volume. Even if the emissions rates of older vehicles are very high, their low usage in terms of vehicle-miles relative to the rest of the fleet results in a relatively small percentage contribution total PMs.

Revised Optimal Allocation Using the Round 1 PM Emissions Rate

The PM emission rate data from Round 1 vehicle testing to assess the optimal allocation of test vehicles across the eight sampling strata that cross-classify vehicle type (truck vs. car) and year of make (Pre-1981, 1981-1990, 1991-1995; 1996+). Table 3-24 presents the results of this design exercise and compares this to the original optimal sample design and the hybrid design currently being used. Column A exhibits the standard deviation of PM emission rate for each stratum based on actual Round 1 vehicle testing. (The standard deviation measures the variability of PM emission rates within a stratum.) Column B presents the standard deviation of annualized PM emissions using the revised PM emissions data from Round 1 testing and EPA data on annual usage (available previously).

Table 3-24. Using Round 1 Annualized PM Volume to Compare Original & Revised Optimal Allocations with the Current Sample Design

Type	Model Year	Strata	A REVISED PM Std Dev	B REVISED Annual Volume PM Std Dev	C ORIGINAL Optimal Sample N	D REVISED Optimal Sample N	E CURRENT Design	F (D - E) Rev. Opt -Current Difference
Truck	Pre-1981	1	44.76	101148	7	8	30	-22
Truck	1981-1990	2	39.35	187734	25	50	50	0
Truck	1991-1995	3	8.20	74097	19	38	50	-12
Truck	1996+	4	4.23	66123	145	135	75	60
Car	Pre-1981	5	89.23	349380	12	32	30	2
Car	1981-1990	6	21.47	123453	63	65	100	-35
Car	1991-1995	7	8.17	68291	60	65	65	0
Car	1996+	8	2.64	32442	149	86	80	6
				Totals	480	480	480	

The original optimal allocation using EPA data appears in Column C. The revised optimal allocation using Round 1 vehicle testing data appears in Column D. Column E presents the allocation of tests under our current sampling plan. Note, for instance, that sample allocations for the original (Col. C) and revised (Col. D) optimal allocations are similar for Pre-1981 and 1996+ trucks as well as 1981-1995 cars, but very different for all other Strata.

A striking difference between the original optimal design and the revised optimal design is the suggested decrease in the sample size of newer cars (1996+): from 149 to 86. This is principally due to the revised estimated PM standard deviation for stratum 8 – the estimate dropped by roughly 40% from 4.36 to 2.64. This had a corresponding reduction in the optimal sample size for that stratum.

More striking is the similarity of the revised optimal allocation design (Col. D) and our Current Design (Col. E). This is illustrated in Column F, showing the difference between the revised optimal design and our current design (F = D-E) for each stratum. Half of the strata (i.e., Strata 2, 5, 7, 8) are within a few tests of the actual "optimal". The largest discrepancies are with Pre-1981 trucks (which was explicitly planned to be an oversample), 1996+ trucks, and 1981-1990 cars.

The suggested reduction of sample size from Pre-1981 cars is consistent with the original optimal allocation. The low prevalence of these vehicles in the population does not warrant the oversampling of this stratum for the purpose of estimating overall PM emissions from the KC fleet. Relative to the smaller optimal sample size of 1996+ cars (n=86), the larger optimal sample size of 1996+ trucks (n=145) is easy to understand. There is 60% higher variation in PM standard deviation of 1996+ trucks (relative to 1996+ cars, i.e., 4.23/2.64 = 1.60) because they include large gas-guzzlers (e.g., heavy duty pick-ups) as well as smaller more fuel efficient trucks (e.g., compact pick-ups and car-based SUVs). This represents a wide variation in vehicle emitting capacity (much wider than what exists for newer cars). All such trucks enjoy popularity and this wide variation needs to be picked up in the sample, meaning a larger sample of tests from 1996+ trucks. Having said this, we recognize and need to adapt our final design to reflect the fact that some newer, larger trucks cannot be tested with present equipment. This should be taken into account when setting the final sample sizes.

Other issues that need to be taken into account and would draw the design away from a strict optimal allocation design are the need to test cars and trucks more heavily in the middle strata that feature vehicles built between 1981-1995. Finally, there is the goal of measuring cold temperature vehicle emissions. The final design must balance these competing needs and objectives.

Final Sample Design

Table 3-25 presents final design, along with its impact on Round 2 recruiting given Round 1 performance. Column A shows the current design, Column B presents the revised optimal design (based on Round 1 PM tests), and Column F exhibits the final design (which was the result of extensive dialogue with EPA and stakeholders reviewing the material in this memo and other research data).

Table 3-25. Sample Allocation for Three Designs and Impact of Final Design on Round 2 Testing

Type	Model Year	Strata	A Current Design	B REVISED Optimal Sample N	C FINAL DESIGN REVISION	D Round 1 Vehicles Tested	E Recommended Round 2 Goals	F FINAL ROUND 2 Goals
Truck	Pre-1981	1	30	8	12	2	10	10
Truck	1981-1990	2	50	50	56	21	35	37
Truck	1991-1995	3	50	38	48	18	30	30
Truck	1996+	4	75	135	84	39	45	47
Car	Pre-1981	5	30	32	21	6	15	15
Car	1981-1990	6	100	65	84	49	35	34
Car	1991-1995	7	65	65	74	39	35	36
Car	1996+	8	80	86	112	87	25	27
			480	480	491	261	230	236

The goal was to recalibrate the design to increase the precision of estimating PM emissions for the KC vehicle fleet. The major revisions feature:

- a reduction of the Pre-1981 Truck tests from 30 to 12,
- a reduction of tests for 1981-1990 cars from 100 to 84,
- an increase of tests for 1996+ cars from 80 to 112.

Although the final design reduces variance by only 1.4% relative to the current design, the goals of winter testing and representation of middle category vehicles (i.e., those built between 1981-1995) are better addressed under the final design.

Implications by Round

Column D of Table 3-25 presents the number of Round 1 vehicle tests by Stratum. A smaller number of vehicle tests are required for the older truck and car strata relative to the current design. This is because the Round 1 PM data reinforced the appropriateness of smaller sample sizes from these strata because they contribute relatively little to overall PM emissions.

3.6 Round 1 Recruitment – Goals and Recruitment Statistics

This section reviews the Round 1 vehicle recruitment goals and documents efforts in meeting these goals. Table 3-26, details the overall study recruitment goals and Round 1 goals by Vehicle year, type (truck or car) and demonstrates the progress made in reaching those goals.

Table 3-26. Vehicle Recruitment Goals for Round 1

CLASS	Year	Strata	Goal	Scheduled	Round 1 Tested	Tested % of Goal	Round 1 Goals	Tested % of Round 1 Goals
Truck	Pre-1981	1	30	4	2	7%	16	13%
Truck	1981 to 1990	2	50	26	21	38%	26	73%
Truck	1991 to 1995	3	50	24	18	36%	26	69%
Truck	1996 & newer	4	75	59	39	49%	39	95%
Car	Pre-1981	5	30	7	6	20%	16	38%
Car	1981 to 1990	6	100	63	49	50%	51	98%
Car	1991 to 1995	7	65	52	39	58%	34	112%
Car	1996 & newer	8	80	106	87	106%	42	202%
			480	341	261	53%	250	102%

The sample flow can be viewed in two perspectives: household sample flow and vehicle recruitment sample flow. The household sample flow during the recruitment process is illustrated in Figure 3-6. A total of 341 vehicles were recruited and scheduled for testing during Round 1. Seventy-six percent (76%) of those were tested (261). Some vehicles were not tested (20 vehicles did not qualify for dynamometer testing; 16 of those participated in PEMS testing only). Because not all cars scheduled were tested, progress in meeting the Round 1 goals can best be measured in viewing the "Tested % of Round 1" column. Two classes of vehicles, Class 7 and Class 8, met 100% of their Round 1 goals. Class 4 and class 6 were slightly below their Round 1 goal. The remaining classes were under tested due to eligibility and sampling constraints.

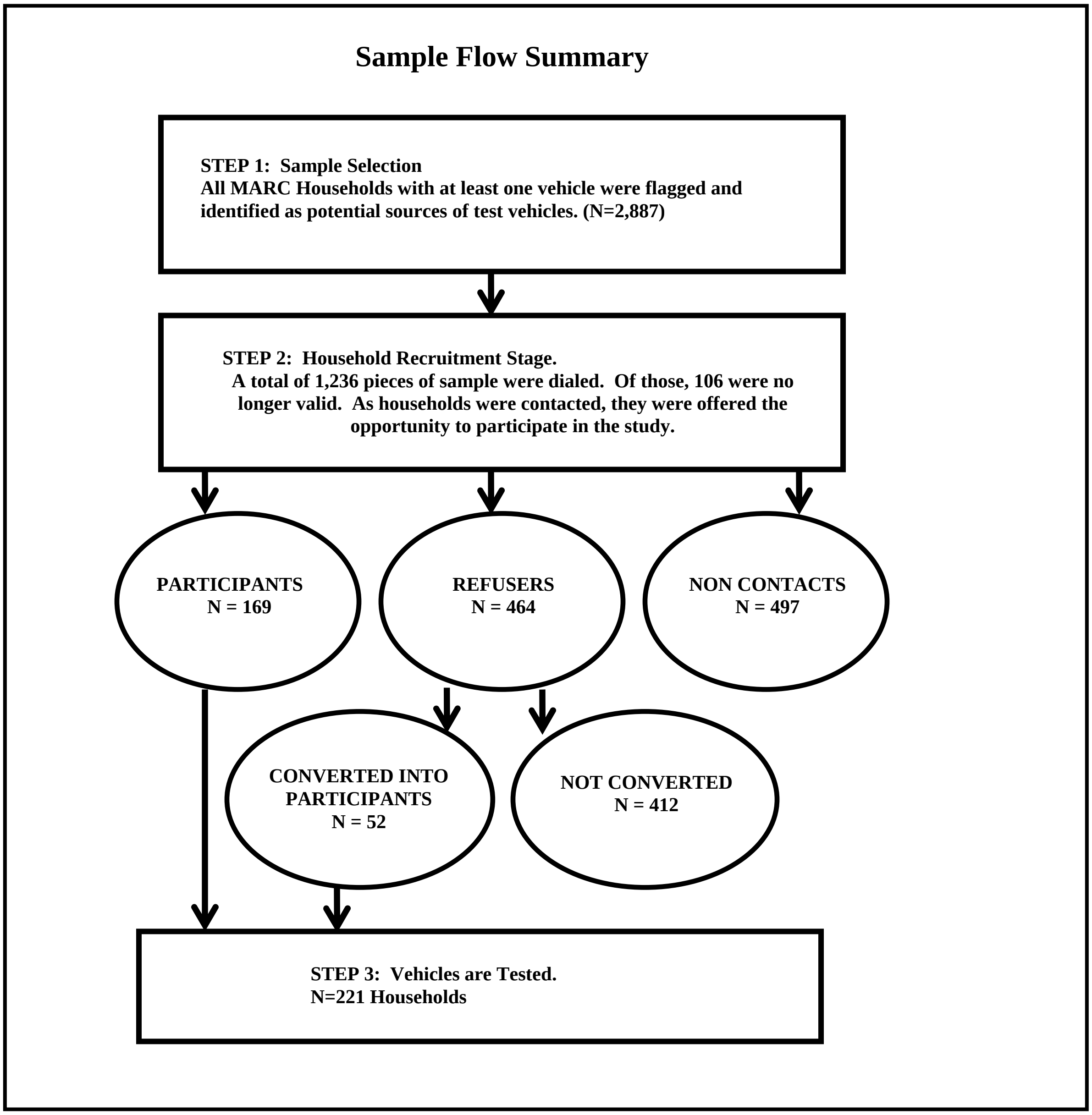


Figure 3-6. Household Sample Flow Summary

One of the challenges of Round 1 testing was that there were fewer than expected older vehicles available for recruitment. In fact, by the end of Round 1 testing, our available vehicle pool for recruiting the oldest vehicles, i.e., Strata 1, 2, 5, 6 (Pre-1981 and 1981-1990 trucks and cars) had been virtually exhausted. The impact of this is observed in the total percentages that were tested for Classes 1, 2, 5, and 6 (13%, 73%, 38% and 98%, respectively) in Table 3-26. The sample flow for vehicle recruitment is summarized in Table 3-27.

Table 3-27. Vehicle Recruitment Sample Flow by Class, Round 1

Strata	Year	Body Type	Project Goal	Round 1 Scheduled	Round 1 Vehicles Tested	Round 1 Goals	Vehicles Contacted by Phone	Canceled Scheduled Refusers	Scheduled Vehicle Refusers Recruited	Final Vehicles Refused Participation	Final Vehicles not Contacted
1	Pre-1981	Truck	30	4	2	16	73	0	0	23	24
2	1981 to 1990	Truck	50	26	21	26	268	7	7	94	90
3	1991 to 1995	Truck	50	24	18	26	178	8	6	43	59
4	1996 & newer	Truck	75	59	39	39	487	13	10	151	123
5	Pre-1981	Car	30	7	6	16	90	1	1	38	26
6	1981 to 1990	Car	100	63	49	51	561	12	10	175	192
7	1991 to 1995	Car	65	52	39	34	311	22	9	82	91
8	1996 & newer	Car	80	106	87	42	669	27	15	177	208
Total			480	341	261	250	2637	90	58	783	813

3.7 Round 2 Recruitment – Goals and Recruitment Statistics

This section reviews the Round 2 vehicle recruitment goals and documents efforts in meeting these goals. Table 3-28 details the overall study recruitment goals and Round 2 goals by Vehicle year, type (truck or car) and demonstrates the progress made in reaching those goals.

Table 3-28. Vehicle Recruitment Goals For Round 2

Strata	Year	Btype	Project Goal	Round 2 Scheduled	Round 2 Tested	Tested % of Goal	Round 2 Goals	Tested % of Round 2 Goals
1	Pre-1981	Truck	30	13	9	30%	10	90%
2	1981 to 1990	Truck	50	61	29	58%	37	78%
3	1991 to 1995	Truck	50	53	31	62%	30	103%
4	1996 & newer	Truck	75	82	50	67%	47	106%
5	Pre-1981	Car	30	19	14	47%	15	93%
6	1981 to 1990	Car	100	52	36	36%	34	106%
7	1991 to 1995	Car	65	49	37	57%	36	103%
8	1996 & newer	Car	80	41	29	36%	27	107%
			480	370	235	49%	236	100%

The sample flow can be viewed in two perspectives: household sample flow and vehicle recruitment sample flow. The household sample flow during the recruitment process is illustrated in Figure 3-7. A total of 370 vehicles were recruited and scheduled for testing during Round 1. Sixty-four percent (64%) of those were tested (235). Some vehicles were not tested (48 vehicles did not qualify for dynamometer testing; 37 of those participated in PEMS testing only). Three classes of vehicles, Class 1, Class 2, and Class 6, were below their Round 2 goal. All other classes were 100% or higher. The sample flow for Round 2 vehicle recruitment is summarized in Table 3-29.

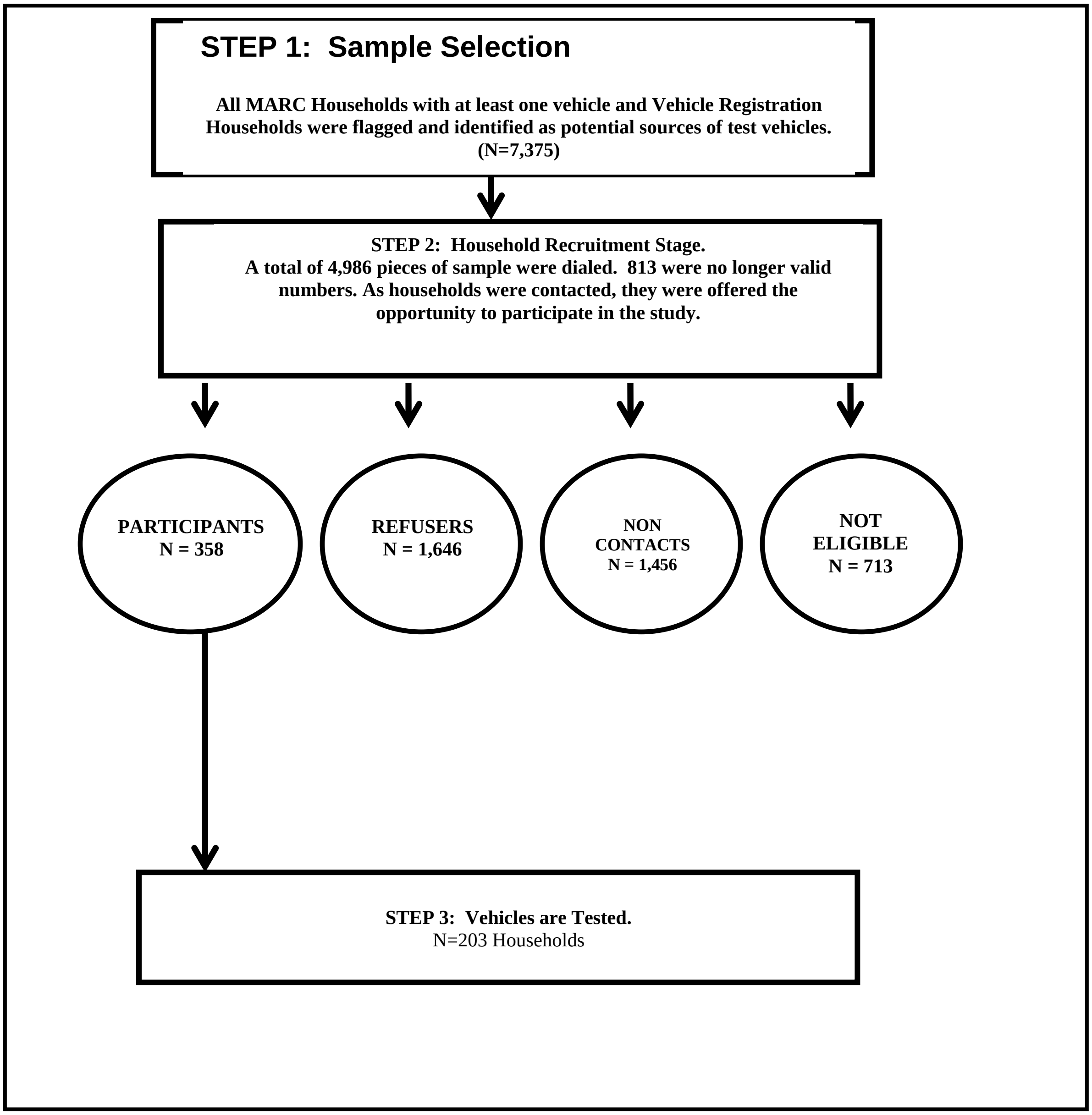


Figure 3-7. Sample Flow Summary for Round 2

Table 3-29. Round 2 Vehicle Recruitment Sample Flow by Class

Class	Year	Body Type	Project Goal	Round 2 Scheduled	Round 2 Tested	Round 2 Goals	Number Vehicles Contacted by Phone	Final Vehicles Refused Participation	Final Vehicles Not Contacted
1	Pre-1981	Truck	30	13	9	10	479	153	65
2	1981 to 1990	Truck	50	61	29	37	986	424	149
3	1991 to 1995	Truck	50	53	31	30	796	200	395
4	1996 & newer	Truck	75	82	50	47	1232	358	558
5	Pre-1981	Car	30	19	14	15	767	307	75
6	1981 to 1990	Car	100	52	36	34	910	274	269
7	1991 to 1995	Car	65	49	37	36	543	131	219
8	1996 & newer	Car	80	41	29	27	1121	312	504
Total			480	370	235	236	6834	2159	2234

3.8 Tested Vehicles

3.8.1 Round 1

Round 1 Vehicle testing targets and actual vehicles dynamometer tested are shown in Table 3-30. Although the total number of vehicles dynamometer tested conducted exceeded project goals, several strata targets were not achieved (most notable in bins 1 and 5). The MARC vehicle database was solely used for vehicle recruitment (via random digit dialing, or RDD) for Round 1 recruiting. This database was supplemented with the Kansas City registration database after Round 1 to help recover these shortfalls during Round 2 recruiting.

Table 3-30. Number of Vehicles Dynamometer Tested During Round 1

Bin	Vehicle Type	Model Year Group	Round 1 Goal	Round 1 Tested	% of Goal
1	Truck	Pre-1981	16	2	13%
2	Truck	1981-1990	26	21	81%
3	Truck	1991-1995	26	18	69%
4	Truck	1996+	39	39	100%
5	Car	Pre-1981	16	6	38%
6	Car	1981-1990	51	49	96%
7	Car	1991-1995	34	39	115%
8	Car	1996+	42	87	207%
		Total	250	261	104%

Table 3-31 lists the various tests conducted during Round 1, in comparison with project goals. PEMS testing on conditioning runs was performed on all vehicles, regardless of dynamometer eligibility.

Table 3-31. Round 1 Tests Conducted

Test Type	Round 1 Goal	Round 1 Tested
PEMS Conditioning Test	All	284
Replicate PEMS Conditioning Test	1 per week	17
PEMS Driveaway Test	N/A	13
Dynamometer/PEMS Test	250	261
Dynamometer/PEMS Test Replicate	1 per week	15
Dynamometer/PEMS Control Vehicle Test	1 per week	12

3.8.2 Round 2

In order to better achieve strata-specific test targets during Round 2 testing, the MARC database used for Round 1 recruiting was supplemented with the KC registration database for Round 2 recruiting of Bins, 1, 2, 5, and 6. As can be seen in Table 3-32, this significantly improved recruiting efforts.

Table 3-32. Number of Vehicles Dynamometer Tested During Round 2 (excluding Round 1 Retest Vehicles)

Bin	Vehicle Type	Model Year Group	Round 2 Goal	Round 2 Tested	% of Goal
1	Truck	Pre-1981	10	9	90
2	Truck	1981-1990	37	29	78
3	Truck	1991-1995	30	31	103
4	Truck	1996+	47	50	106
5	Car	Pre-1981	15	14	93
6	Car	1981-1990	34	36	106
7	Car	1991-1995	36	37	103
8	Car	1996+	27	29	107
		Total	236	235	100

Despite addition of the KC registration database, recruitment and testing of “older” vehicles (Bins 1, 2, 4, and 5) was challenging for several reasons:

- Overall, fewer older vehicles were available in the MARC and registration databases (relative to newer vehicles).
- A large percentage of the registration database households listed with a 1981 or older truck no longer had access to that vehicle.
- Unwillingness or inability of a vehicle owner to participate and a high number of incorrect owner contact information were other factors which hampered efforts for older bin recruiting.

All possible efforts, such as increasing incentives for vehicles in these bins and offering special vehicle pick-up and drop-off services, were made to encourage program participation, especially in these hard to fill bins. In addition, the records with VINs that were matched to households with incorrect contact information were researched to obtain current owner contact information.

In addition to recruitment challenges, testing older vehicles was problematic because these vehicles were often in such a state of disrepair that they would be unsafe to test on the dynamometer. Repairs were performed on all possible vehicles in order to maximize test percentages (i.e., replacement of brakes, tires, motor mounts, fuel pumps, etc.). Vehicles were only rejected from dynamometer testing if repairs were too extensive (such as a vehicle that would require a new clutch or transmission to test) or if the vehicle would be unsafe to test (and repairs to render the vehicle safe were again too extensive).

Other issues that hindered dynamometer testing included the recruitment of vehicles that could not be tested due to dimensions (too long or wide for the dyne), vehicles with all-time all-wheel drive, or vehicles with traction control that could not be disengaged. Air-cooled vehicles also were rejected from dynamometer testing in order to avoid engine damage from overheating.

In order to minimize the number of untestable vehicles recruited, feedback is provided to recruitment staff on all vehicles that cannot be tested because of the above reasons. In addition, recruiting targets were adjusted (increased) during Round 2 in order to better achieve goals for bins 1, 2, 5, and 6. As can be seen from Table 3-32, based on all the efforts exerted to meet the goals for testing vehicles in each bin, we were quite successful in meeting most of the targets.

Table 3-33 lists the various tests conducted during Round 2, in comparison with project goals. Regardless of dynamometer test eligibility, PEMS tests (on the conditioning run) were performed on all vehicles (excluding vehicles whose interior would not accommodate a PEMS device).

Table 3-33. Round 2 Tests Conducted

Test Type	Round 2 Goal	Round 2 Tested
PEMS Conditioning Test (excluding replicates)	All	324
Replicate PEMS Conditioning Test	1 per week	19
PEMS Driveaway Test	50	51
Dynamometer/PEMS Test (excluding replicates)	236	235
Dynamometer/PEMS Test (Round 1Retests)	25	43
Dynamometer/PEMS Test Replicate	1 per week	11
Dynamometer/PEMS Control Vehicle Test	1 per week	12
PAMS Driveaway Test	N/A	8

3.8.3 Round 1 to Round 2 Retest Vehicles

Table 3-34 shows recruiting and testing statistics for vehicles which were originally tested during Round 1 and were then retested at the start of Round 2 in order to provide summer/winter correlation data. Forty-two of these Round 1 retest vehicles were tested (exceeding the retest target of 25 vehicles) in order to ensure all strata were filled. Results of the Round 1 to Round 2 retest vehicle testing are presented in Section 4.

Table 3-34. Round 2 Dynamometer Tests of Vehicles Originally Tested During Round 1

BIN	Vehicle Type	Model Year Group	Retest Goal	Actual Retested	% of Goal
1	Truck	Pre-1981	1	1	100%
2	Truck	1981-1990	4	4	100%
3	Truck	1991-1995	2	2	100%
4	Truck	1996+	5	9	200%
5	Car	Pre-1981	2	3	150%
6	Car	1981-1990	4	4	100%
7	Car	1991-1995	4	7	175%
8	Car	1996+	3	12	400%
		Total	25	42	172%

4.0 Vehicle Emission Testing

4.1 Typical Testing Day

Vehicles arrived at the test facility at an appointed time determined via the NuStats scheduling process. Upon arrival, each vehicle first received a unique identification code for documentation tracking purposes, and was then inspected for test worthiness. Specific vehicle information, in the form of digital photographs, interview questionnaires, checklists, and hard copy data forms, was recorded for later input into the MSOD data table EQUIP_IN.dbf.

During the inspection process, each test vehicle was evaluated for recently performed repairs, as well as potential repairs which might be necessary. This served primarily to ensure that the vehicle could safely be operated on the road and dynamometer. If repairs were required, the vehicle owner was notified and his/her permission was obtained before repairs were performed. If the repairs could not be performed on-site, the vehicle was taken to a local repair shop. Records of the repair, along with a brief narrative, were maintained. Following repair, the vehicle was outfitted in the normal fashion, conditioned, and cued for testing.

A SEMTECH PEMS unit was then installed on the vehicle to monitor emissions. The PEMS unit used for the conditioning drive underwent a complete warm-up, zero and audit sequence to verify CO, CO_2, NO_x, and THC measurement accuracy. Calibrations were performed as necessary to bring the PEMS into proper calibration. At this point, each test vehicle was prepped using a predetermined route that included high speed accelerations, driving at freeway speeds, and driving at stop and go traffic patterns. This route is described in detail in Appendix K. This vehicle preparation was conducted for about 45 minutes, at which point the PEMS was uninstalled and the vehicle was soaked overnight at ambient temperatures for testing the next day.

The following day, the vehicle was mounted on the dynamometer, and a PEMS unit was installed on the vehicle to monitor undiluted emissions, in tandem with the emissions measurements to be performed by the dynamometer bench. A Positive Displacement Pump-Constant Volume Sampling (PDP-CVS) system was used to dilute and transport the vehicle tailpipe exhaust to analyzers during the dynamometer test (shown in Figure 4-1).

In addition to the regulated gas pollutants measured via CVS, continuous measurements of PM mass were taken using an EPA-supplied Booker Systems Model RPM-101 Quartz Crystal Microbalance (QCM) manufactured by Sensor's, Inc. and a Thermo-MIE Inc. DataRAM 4000 Nephelometer. BC was measured continuously with a DRI photoacoustic instrument and integrated samples were collected and analyzed by DRI for PM gravimetric mass, elements, elemental and OC, ions, particulate and semi-volatile organic compounds, and volatile organic air toxics. The samples were extracted from the dilution tunnel through a low particulate loss 2.5 μm cutpoint pre-classifier. Figure 4-2 presents a schematic of the sampling instrumentation.

It should be first noted that PM is a dynamic pollutant that is constantly being influenced by its environment therefore its formation is constantly changing both in the exhaust stream and in the ambient air. Our tests are a snapshot using specific measurements under specific laboratory and thermodynamic conditions. Real-world PM may differ significantly.

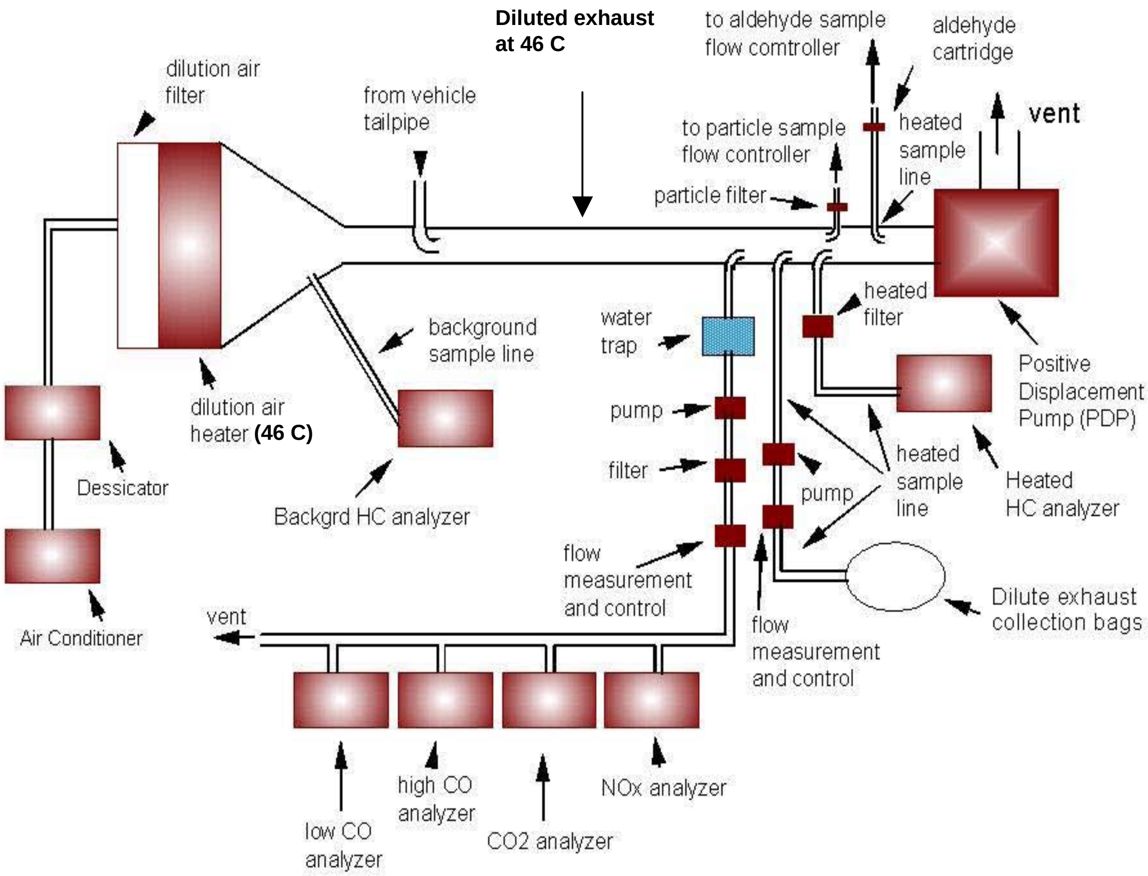


Figure 4-1. CVS Sampling System Schematic

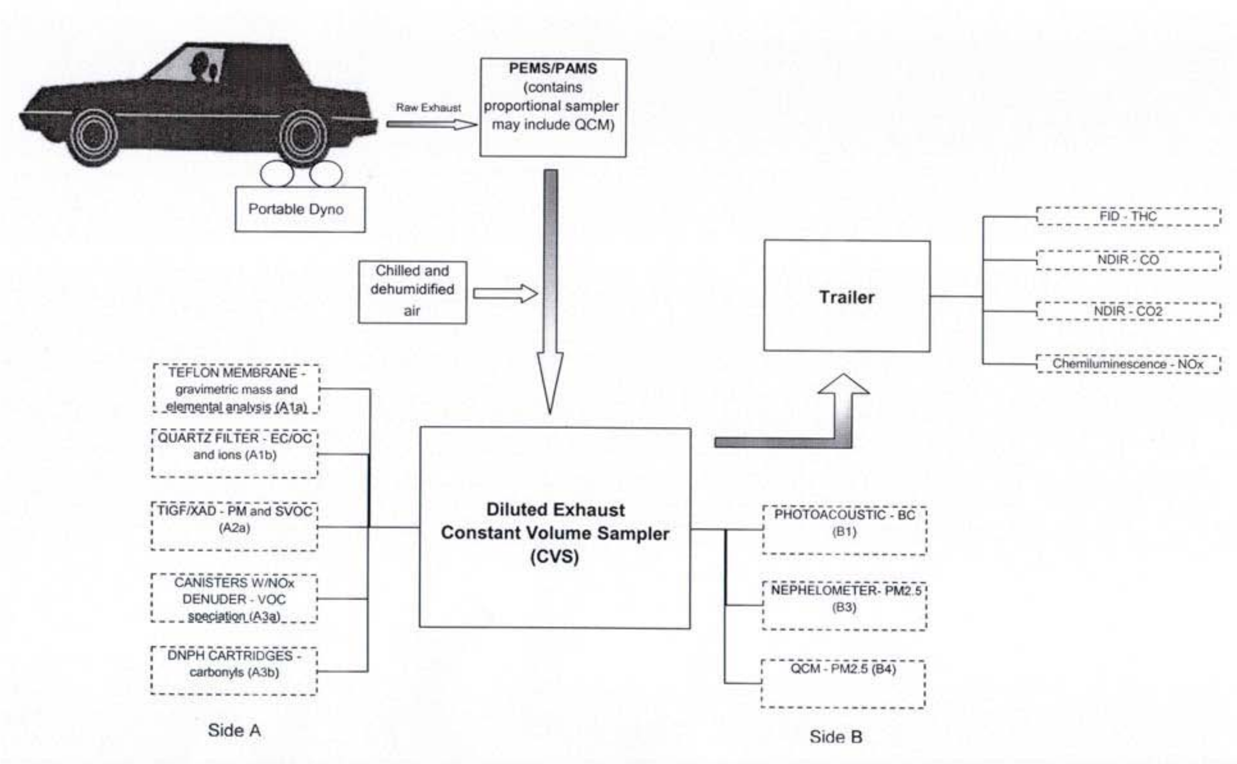
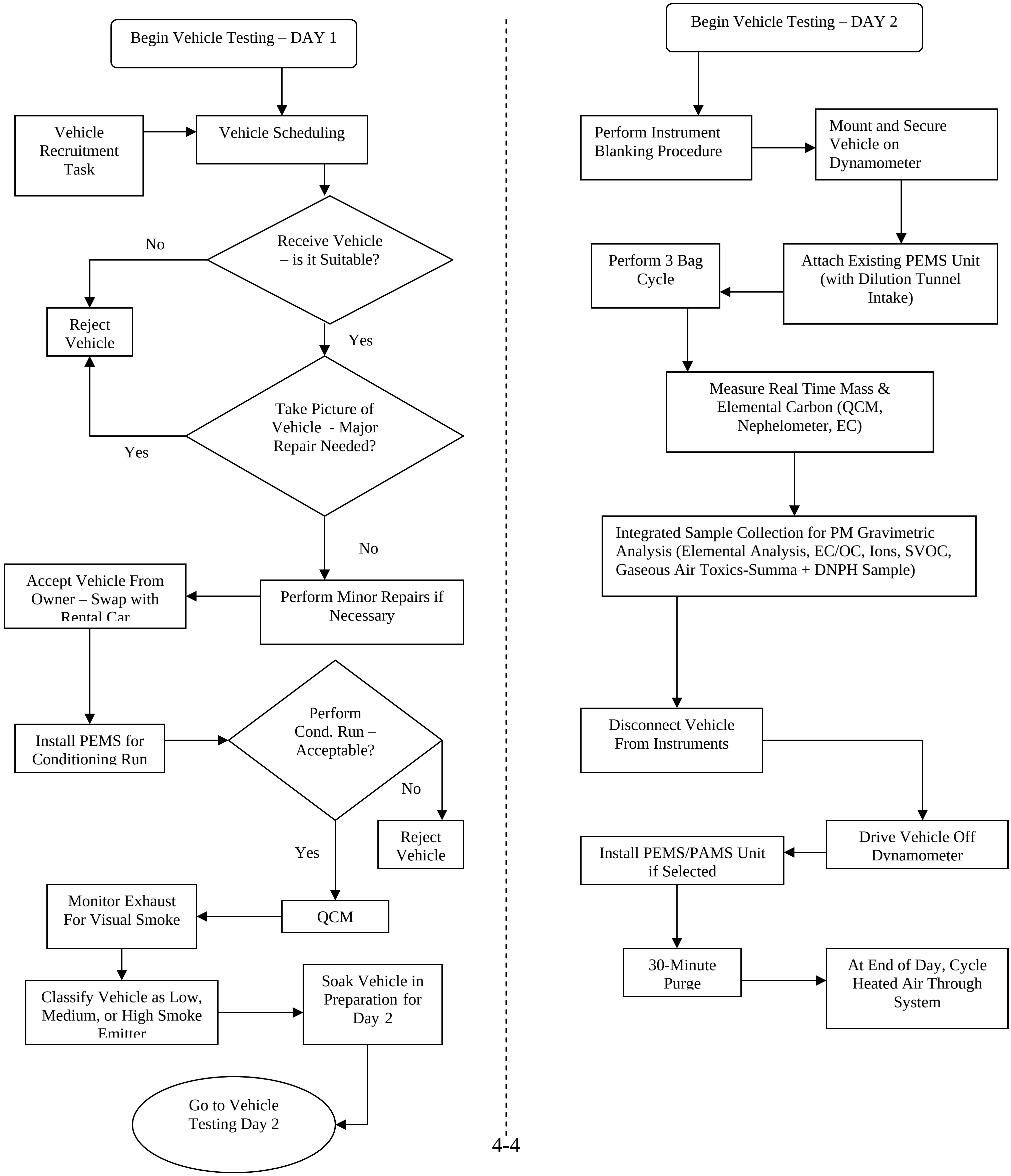


Figure 4-2. Kansas City Exhaust Measurement Flowchart

Figure 4-3. Daily Testing Flowchart



At the conclusion of vehicle testing, the vehicle was unloaded, disconnected from the PEMS and dynamometer sampling systems and removed from the dynamometer. Figure 4-3 presents a flowchart of daily vehicle testing activities.

4.2 Collection and Validation of Data from the Chassis Dynamometer

Round 1 and Round 2 regulated emission results for the participants' vehicles, along with detailed calculation methods, are presented in Appendices G and H. In addition, much more comprehensive data files, containing additional emissions and test data, have been transmitted to EPA. Summaries and graphs of the regulated emission results can be found elsewhere in this report. The following sub-sections describe the data file structures, data validation, and known data quality issues associated with the chassis dynamometer regulated emission data collected in the Kansas City study.

Dynamometer/Regulated Emission Modal Data

In addition to the calculated emission data described above, modal data that were collected from the dynamometer and regulated emissions bench were uploaded to the project FTP site. The modal data for each test were collected at a rate of 1 sample-per-second and were archived as a tab-delimited text file, named with its test number and a PRN extension. A total of 14 data fields are archived in the modal files, as listed in Table 4-1. Four of the data fields, AmbHC, PAU TEM, Torque, and Frt Spd, are not used in our emission rate calculations and were collected for QA/QC purposes. Unusual conditions that could have an influence on emissions measurements are discussed in the subsequent data validation section.

Table 4-1. Dynamometer Modal File Data Fields

Field Name	Units	Description
PDPTEMP	Centigrade	Temperature of PDP inlet
Hi CO	ppm	Diluted exhaust CO concentration from the high range CO analyzer
HotHC	ppmC	Diluted exhaust HC concentration from the Heated FID
NOx	ppm	Diluted exhaust NOx concentration from the NOx analyzer
CO_2	Percent	Diluted exhaust CO2 concentration from the high range CO2 analyzer
AMBTEMP	Centigrade	Ambient temperature (measured at the test cell)
REL HUM	Percent	Ambient relative humidity (measured at the test cell)
LoCO	ppm	Diluted exhaust CO concentration from the low range CO analyzer
AmbHC	ppmC	Ambient HC concentration from the ambient HC analyzer
Rr Spd	MPH	Dynamometer rear roll speed
PBAR	mmHg	Barometric Pressure (measured at the test cell)
PAU TEM	Centigrade	Temperature of the dynamometer's water-cooled Power Absorption Unit
Torque	Ft-Lbs	Instantaneous torque measured by the Dynamometer's torque cell
Frt Spd	MPH	Dynamometer front roll speed

Gaseous data contained in these files have been time aligned to account for sample transport delay times. Real time data acquisition and control (DAC) for the dynamometer was started manually via keyboard stroke. Once started, the DAC sent a start signal to the driver's aid to begin the driver's trace, and simultaneously began second-by-second data acquisition. The same signal that started the driver's aid was also sent to peripheral PM sampling equipment operated by DRI. Hence, all real time data and the start of peripheral sampling equipment were initially automatically aligned to the start of the driving trace. Real-time data from those sensors that have essentially instantaneous response, such as speed, torque, temperatures, and pressures, required no further time alignment. However, to account for normal sample transport time and instrument response times, real time gas data was time aligned with the vehicle speed. This was accomplished during post-processing of the collected real time data file. As described in Section 2.2, sample delays were measured for each analyzer during the pilot study.

There are two considerations to be given to the time alignment of gaseous data. The first is simply a delay time for sample transport; that is, the time it takes the leading edge of an emission spike leaving the engine to reach the analyzer. Transport of the sample through the dilution tunnel and sample lines is constant. However, travel time through the vehicle's exhaust system is variable due to the transient nature of exhaust flows and exhaust system configuration differences between manufacturers. So, the total sample transport delay time is somewhat variable from vehicle to vehicle, and from within different portions of the transient driving cycle. Unfortunately, it is not possible to account for this variability (which amounts to probably up to 3 seconds) during the time alignment process. Therefore, an average delay time (8-12 seconds) as measured during the pilot study was used to time align data from each gas analyzer.

Secondly, resolution of emission spikes is lost in the sampling and analysis process. For instance, what may be a 0.5 second engine out emission event may show up as a 5-10 second spike in the real time data. The loss of resolution is due to sample dilution and diffusion, as well as instrument response times (analyzer cell flushing). There is no way to regain resolution through data manipulation, so, although data are sampled and reported at a rate of 1 sample per second, the "real" resolution is actually on the order of 5-10 seconds. A choice must be made when time aligning this data: whether to align to the leading edge of an emission spike, or to the emission spike's maximum value, or somewhere in between. In determining the average delay times above, the leading edge of the emission spike was chosen. Specifically, the leading edge of the emission spike from the vehicle's first acceleration in Phase 1 was used as the alignment guide. The delay times for 10 different tests were determined in this manner, an average for these 10 tests was taken, and these average delay times were used for all of the remaining tests. Spot checks of a number of additional tests indicated that this process worked well.

Dynamometer load settings for 2000-2005 model year vehicles were found in the Certified Vehicle Test Result Report (http://www.epa.gov/otaq/crttst.htm). For 1999 and older vehicles, the Lookup Table Data for Inspection/Maintenance http://epa.gov/otaq/epg/techguid.htm) was used to determine dynamometer load settings. Inertias were generally rounded down in order to prevent overloading participant vehicles.

Edits were also made to several fields of the raw, real-time data for selected tests in order to correct known errors. A description of these edits is given in the following section.

Data Validation and Data Quality Issues for Dynamometer Generated Data

Data Validation

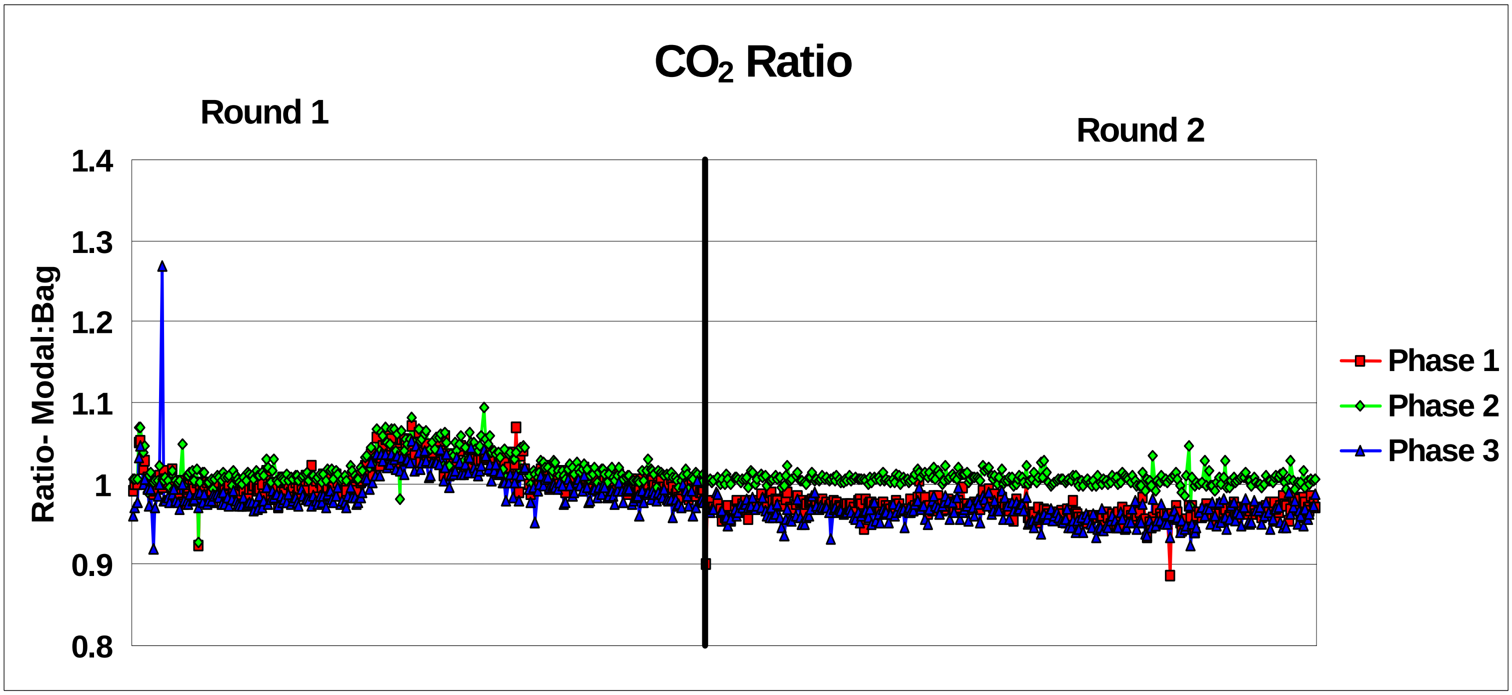
The contractor was responsible for gathering and conducting a review on the data as it pertains to data validation and to identify any data quality issues. The contractor has not conducted a full review and analysis of the data. EPA plans to conduct further analysis on the data to better determine its validity and its use in our modeling efforts.

At the conclusion of the study, all dynamometer and associated regulated emissions data were imported into summary spreadsheets. Numerical elements within each data field were then compared and checked, using control charts and graphs, for completeness and correctness. Text data elements were checked manually.

In the case of data input via keyboard by a technician, i.e., bag concentration values or vehicle and test information, errors that were detected during the data validation process were reconciled, whenever possible, with input bag concentration values, vehicle and test values entered on the handwritten test data form.

Collection of the modal data was automated through the use of a data acquisition system. In this case, data could be compromised due to a fault in the measurement system or with the measuring sensor itself. If possible, compromised modal data was corrected. This was possible in only a couple of cases, when it was known that inappropriate conversion factors were applied as a result of instrument range changes.

The data were also examined to determine if problems existed in the methodology. For instance, modal gaseous data were compared to bag gaseous data, and any differences found were cause for closer examination. For each test phase of each test, the ratio of modal-to-bag concentrations was computed and plotted. Figure 4-4 shows these plots for CO_2, CO, NOx, and HC concentrations for both rounds of the study (Round 1 data is to the left of the vertical line in each plot). Ratios that varied significantly from 1.0 were investigated. These plots were used initially to check for gross errors in keyboard input of the bag data, and the plots shown here have all keyboard errors corrected. For clarity, some invalid values resulting from test issues on several runs were removed from the plots shown in Figure 4-4, as listed in Table 4-2 below. Additional information on suspect dynamometer test data was investigated and is discussed in the following section and in Appendices S and V. In general, data was not eliminated or modified unless explicitly stated in this section or Appendices S or V.



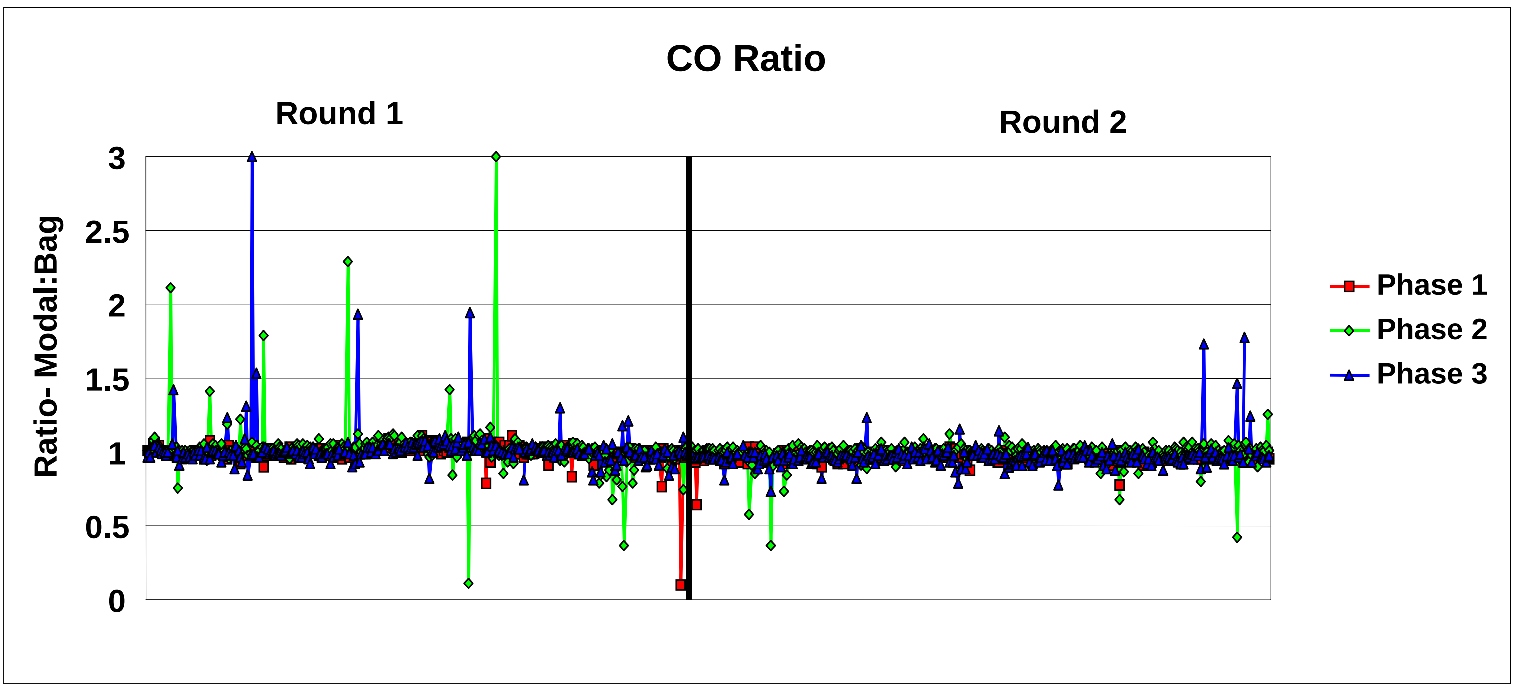
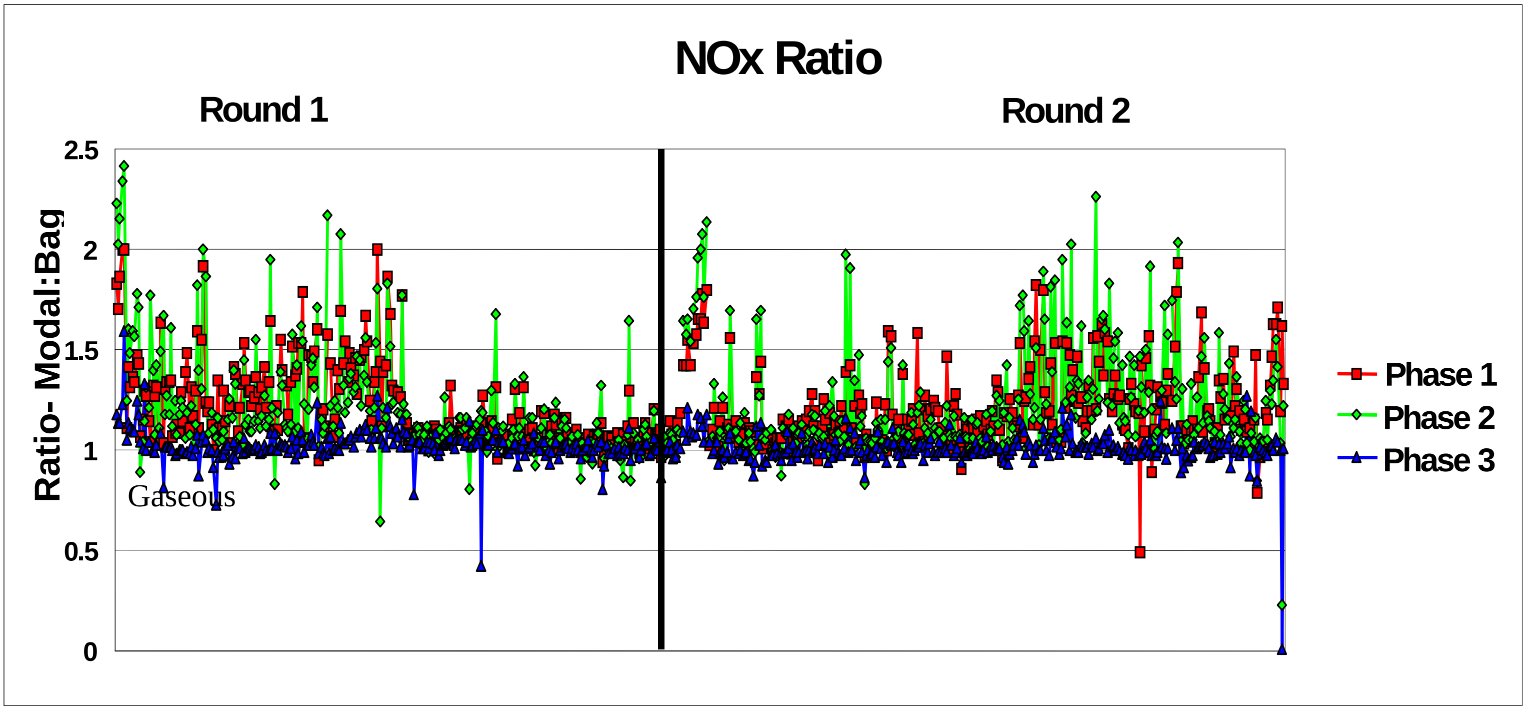


Figure 4-4. Modal to Bag Ratios for CO_2, CO, NOx, and THC



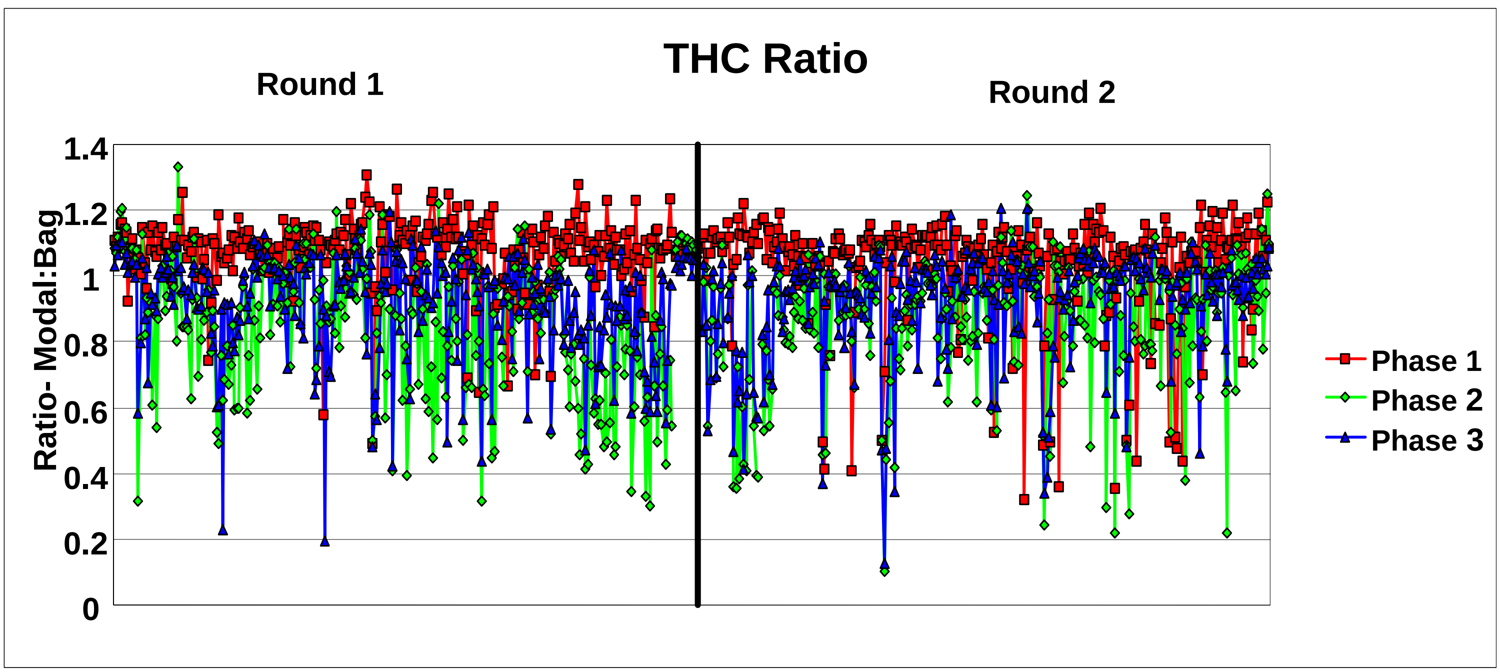


Figure 4-4. Modal to Bag Ratios for CO_2, CO, NOx, and THC (continued)

Table 4-2. Null Data Removed From Figures 4-4 through 4-6

Run #	Issue
84032	No Phase 3 bag NO_x data
84039	No Phase 3 bag NO_x data
84047	No Phase 3 bag NO_x data
84093	No Phase 1 bag NO_x data
84127	Bags were being evacuated for the first 30 seconds of Phase 1, Round 1 bag data voided
84140	No Phase 3 bag NO_x data
84149	No Phase 3 bag CO data
84156	No bag data for Phases 1 or 2
84192	No Phase 3 bag CO data
84201	No bag data for Phases 1 and 2
84235	Bag did not fill during Phase 1
84265	No Phase 3 bag CO data
84278	No bag data available for test
84297	No modal (real-time second-by-second) NO_x data for Phase 3
84334	No Phase 1 bag CO data
84343	No modal NO_x data for test
84349	No Phase 3 bag CO data
84393	Bags not fully evacuated prior to start of test, no bag data for any pollutant or phase
84408	No Phase 3 bag CO data
84409	Bags not fully evacuated prior to start of test, no bag data for any pollutant or phase
84414	No Phase 3 bag CO data
84430	Bags not fully evacuated prior to start of test, no bag data for any pollutant or phase
84438	No Phase 3 bag CO data
84444	No Phase 3 bag CO data
84464	No Phase 3 bag NO_x data
84536	Bags inadvertently evacuated during Phases 1 and 2, Phase 3 bag data is only phase available
84624	No bag CO_2 data for Phase 3
84766	No Phase 3 bag CO data
84773	No bag CO data for Phase 3
84777	Bags not fully evacuated prior to start of test, no bag data for any pollutant or phase

Known Data Quality Issues

The following section describes issues associated with the Kansas City data, along with corrective actions applied. Affected test numbers described in the following sections are summarized in the list of known test issues included in Appendices S and V.

Measurements:

While both modal and bag measurements were made for the regulated emissions, our intent was to provide the modal analysis as the primary source of emissions data, with the bag data to serve as a back-up and cross-check to the modal data. As shown in Tables 4-3 through 4-7, there generally was good agreement between the modal and bag data. The primary quality issue associated with the modal measurements is under-reporting of HC and CO emission rates for very high emitters due to concentrations higher than the instruments designed measuring range.

Table 4-3. HC Emissions for the EPA975 Control Vehicle during Rounds 1 and 2.

Test #	**Odometer**	**Date**	**Amb. Temp**	**Ph1_Bag**	**Ph2_Bag**	**Ph3_Bag**	**Wtd_Bag**	**Ph1_Modal**	**Ph2_Modal**	**Ph3_Modal**	**Wtd_Modal**
Rnd 1	*Miles*		*F*	*gm/mile*	*gm/mile*	*gm/mile*	*gm/mile*	*gm/mile*	*gm/mile*	*gm/mile*	*gm/mile*
84081	13139	07/26/2004	76.4	5.362	2.104	3.567	2.372	4.740	1.877	3.342	2.124
84114	13158	8/02/2004	93.5	5.367	2.208	4.040	2.495	4.824	2.009	3.618	2.263
84143	13170	08/07/2004	81.5	6.561	2.083	3.561	2.417	5.754	1.816	3.265	2.120
84177	13189	08/14/2004	74.1	5.351	2.082	3.602	2.355	4.529	1.711	3.159	1.955
84187	13208	08/18/2004	77.4	5.356	2.137	3.523	2.401	4.524	1.743	3.130	1.983
84218	13239	08/25/2004	81.0	5.451	2.263	3.813	2.534	4.682	2.074	3.619	2.314
84259	13250	09/08/2004	72.0	6.180	2.181	3.552	2.481	5.462	1.908	3.336	2.189
84290	13266	09/14/2004	87.7	5.222	2.160	3.499	2.411	5.607	1.938	3.370	2.227
84348	13303	09/24/2004	79.6	5.208	2.055	3.424	2.311	4.764	1.885	3.276	2.129
84360	13323	09/27/2004	77.6	5.448	2.059	3.534	2.338	4.798	1.855	3.316	2.110
84374	13352	09/29/2004	73.7	5.475	2.042	3.417	2.313	5.211	1.900	3.356	2.170
84387	13370	10/01/2004	72.0	5.932	2.173	3.501	2.463	5.414	1.989	3.341	2.262
		Average	*78.873*	*5.576*	*2.129*	*3.586*	*2.407*	*5.026*	*1.892*	*3.344*	*2.154*
		Standard Deviation		*0.403*	*0.066*	*0.167*	*0.070*	*0.419*	*0.100*	*0.142*	*0.104*
		Coeff of Var		*7.233*	*3.112*	*4.668*	*2.916*	*8.328*	*5.307*	*4.257*	*4.818*
Rnd 2											
84450	13729	01/22/2005	24.9	13.345	2.438	3.629	3.095	12.585	2.272	3.562	2.905
84461	13748	01/26/2005	43.9	7.749	2.230	3.397	2.601	7.192	2.020	3.233	2.376
84480	13768	01/31/2005	40.2	8.217	2.351	3.659	2.745	7.546	2.072	3.602	2.461
84507	13788	02/05/2005	58.9	6.805	2.179	3.434	2.509	6.261	1.915	3.286	2.239
84536	13809	02/11/2005	51.7	7.937	2.336	3.602	2.720				
84544	13828	02/14/2005	54.0	7.707	2.297	3.669	2.679	7.078	2.106	3.424	2.461
84578	13871	02/22/2005	43.8	7.475	2.340	3.760	2.708	6.697	2.073	3.473	2.413
84606	13936	03/03/2005	51.9	9.369	2.273	3.587	2.730	8.661	2.046	3.292	2.474
84624	14013	03/08/2005	44.6	8.379	2.166	3.262	2.565	7.793	1.939	3.181	2.330
84651	14033	03/14/2005	46.1	9.600	2.305	3.668	2.775	8.911	2.096	3.487	2.544
84697	14052	03/22/2005	42.6	8.255	2.416	3.925	2.829	7.684	2.148	3.599	2.541
84741	14072	03/31/2005	53.9	7.940	2.401	3.710	2.783	7.197	2.149	3.400	2.501
		Average	*46.354*	*8.565*	*2.311*	*3.608*	*2.728*	*7.964*	*2.076*	*3.413*	*2.477*
		Standard Deviation		*1.615*	*0.084*	*0.168*	*0.143*	*1.637*	*0.095*	*0.141*	*0.161*
		Coeff of Var		*18.854*	*3.644*	*4.663*	*5.227*	*20.560*	*4.565*	*4.133*	*6.505*

Table 4-4. NOx Emissions for the EPA975 Control Vehicle during Rounds 1 and 2.

Test #	Odometer	Date	Amb. Temp	Ph1_Bag	Ph2_Bag	Ph3_Bag	Wtd_Bag	Ph1_Modal	Ph2_Modal	Ph3_Modal	Wtd_Modal
Rnd 1	*Miles*		*F*	*gm/mile*	*gm/mile*	*gm/mile*	*gm/mile*	*gm/mile*	*gm/mile*	*gm/mile*	*gm/mile*
84081	13139	07/26/2004	76.4	6.900	5.623	6.962	5.780	3.704	2.490	5.824	2.778
84114	13158	8/02/2004	93.5	8.199	6.808	8.555	6.998	4.824	3.359	7.548	3.719
84143	13170	08/07/2004	81.5	7.543	5.755	6.973	5.931	4.044	2.674	6.152	2.985
84177	13189	08/14/2004	74.1	7.062	5.352	6.689	5.532	3.535	2.291	5.451	2.572
84187	13208	08/18/2004	77.4	7.543	6.351	8.092	6.533	3.776	2.634	5.079	2.862
84218	13239	08/25/2004	81.0	7.595	6.129	8.032	6.335	6.808	4.910	7.632	5.195
84259	13250	09/08/2004	72.0	7.745	5.918	7.173	6.098	5.481	3.704	6.316	3.974
84290	13266	09/14/2004	87.7	7.027	5.993	7.276	6.135	5.358	4.048	6.565	4.291
84348	13303	09/24/2004	79.6	7.152	5.498	6.832	5.675	5.246	3.457	6.207	3.739
84360	13323	09/27/2004	77.6	7.922	6.259	8.050	6.470	5.933	3.995	7.381	4.332
84374	13352	09/29/2004	73.7	6.872	5.470	6.841	5.637	4.594	3.045	5.441	3.290
84387	13370	10/01/2004	72.0	5.862	4.607	5.580	4.741	4.071	2.687	4.731	2.902
		Average	*78.873*	*7.285*	*5.814*	*7.255*	*5.989*	*4.781*	*3.274*	*6.194*	*3.553*
		Standard Dev		*0.589*	*0.543*	*0.779*	*0.558*	*0.970*	*0.751*	*0.918*	*0.761*
		Coeff of Var		*8.080*	*9.348*	*10.732*	*9.316*	*20.282*	*22.940*	*14.816*	*21.405*
Rnd 2											
84450	13729	01/22/2005	24.9	5.039	4.695	6.314	4.828	3.549	2.853	5.804	3.100
84461	13748	01/26/2005	43.9	5.928	4.958	6.030	5.084	4.160	3.149	5.764	3.385
84480	13768	01/31/2005	40.2	6.183	5.216	6.731	5.369	4.005	3.132	5.586	3.345
84507	13788	02/05/2005	58.9	5.959	4.993	6.289	5.134	4.201	3.238	5.782	3.467
84536	13809	02/11/2005	51.7	5.391	4.611	5.231	4.696				
84544	13828	02/14/2005	54.0	5.918	5.006	6.451	5.155	3.856	2.935	5.934	3.192
84578	13871	02/22/2005	43.8	6.208	4.999	5.909	5.126	3.953	2.838	5.508	3.082
84606	13936	03/03/2005	51.9	5.668	4.845	5.974	4.966	3.431	2.474	5.085	2.706
84624	14013	03/08/2005	44.6	4.715	4.301	5.640	4.416	2.844	2.139	4.848	2.366
84651	14033	03/14/2005	46.1	5.496	4.521	5.676	4.651	3.093	2.173	5.098	2.423
84697	14052	03/22/2005	42.6	5.998	4.799	5.914	4.940	3.671	2.726	5.711	2.985
84741	14072	03/31/2005	53.9	5.727	4.767	5.981	4.902	3.189	2.235	5.069	2.484
		Average	*46.354*	*5.686*	*4.809*	*6.012*	*4.939*	*3.632*	*2.717*	*5.472*	*2.958*
		Standard Dev		*0.437*	*0.240*	*0.383*	*0.251*	*0.432*	*0.385*	*0.359*	*0.382*
		Coeff of Var		*7.683*	*4.997*	*6.375*	*5.079*	*11.887*	*14.179*	*6.560*	*12.913*

Table 4-5. CO Emissions for the EPA975 Control Vehicle during Rounds 1 and 2.

Test #	Odometer	Date	Amb. Temp	Ph1_Bag	Ph2_Bag	Ph3_Bag	Wtd_Bag	Ph1_Modal	Ph2_Modal	Ph3_Modal	Wtd_Modal
Rnd 1	*Miles*		*F*	*gm/mile*	*gm/mile*	*gm/mile*	*gm/mile*	*gm/mile*	*gm/mile*	*gm/mile*	*gm/mile*
84081	13139	07/26/2004	76.4	34.977	13.353	20.406	14.950	34.747	13.245	21.056	14.887
84114	13158	8/02/2004	93.5	27.959	14.581	24.411	15.936	27.801	14.452	24.464	15.818
84143	13170	08/07/2004	81.5	32.694	13.242	20.255	14.734	32.347	13.122	20.911	14.655
84177	13189	08/14/2004	74.1	32.244	13.546	21.736	15.070	30.533	12.646	20.815	14.128
84187	13208	08/18/2004	77.4	31.351	15.365	20.090	16.526	29.486	14.030	19.173	15.191
84218	13239	08/25/2004	81.0	27.324	13.648	20.142	14.798	26.567	13.109	20.147	14.286
84259	13250	09/08/2004	72.0	38.321	13.538	21.472	15.358	36.865	12.916	20.854	14.694
84290	13266	09/14/2004	87.7	29.708	13.170	19.738	14.481	29.612	12.970	19.644	14.293
84348	13303	09/24/2004	79.6	31.081	12.899	20.405	14.348	31.314	12.846	20.663	14.331
84360	13323	09/27/2004	77.6	31.475	12.983	21.085	14.509	31.479	12.859	21.134	14.404
84374	13352	09/29/2004	73.7	32.212	13.858	20.318	15.245	32.493	13.682	20.880	15.143
84387	13370	10/01/2004	72.0	36.440	12.967	19.895	14.677	36.483	12.863	20.008	14.596
		Average	*78.873*	*32.149*	*13.596*	*20.830*	*15.053*	*31.644*	*13.228*	*20.812*	*14.702*
		Standard Dev		*3.080*	*0.695*	*1.230*	*0.614*	*3.058*	*0.524*	*1.248*	*0.468*
		Coeff of Var		*9.581*	*5.114*	*5.905*	*4.076*	*9.664*	*3.959*	*5.994*	*3.180*
Rnd 2											
84450	13729	01/22/2005	24.9	126.810	22.085	25.226	27.803	130.208	21.423	25.934	27.452
84461	13748	01/26/2005	43.9	69.908	15.115	20.550	18.372	75.064	14.980	21.365	18.581
84480	13768	01/31/2005	40.2	76.089	17.209	20.899	20.523	118.858	16.828	22.039	22.491
84507	13788	02/05/2005	58.9	55.299	13.618	20.626	16.293	56.276	13.385	21.347	16.191
84536	13809	02/11/2005	51.7	69.732	15.236	21.025	18.521				
84544	13828	02/14/2005	54.0	64.861	15.664	23.548	18.818	67.155	15.508	24.013	18.834
84578	13871	02/22/2005	43.8	66.274	15.972	21.851	19.023	70.433	15.730	22.697	19.087
84606	13936	03/03/2005	51.9	79.561	16.556	21.995	20.180	82.804	16.164	22.657	20.049
84624	14013	03/08/2005	44.6	88.814	17.962	22.438	21.948	92.296	17.599	23.072	21.854
84651	14033	03/14/2005	46.1	83.019	17.171	23.222	20.985	85.587	16.885	24.229	20.936
84697	14052	03/22/2005	42.6	73.603	17.594	24.529	21.024	75.408	17.236	25.317	20.859
84741	14072	03/31/2005	53.9	62.267	15.879	21.838	18.726	65.368	15.743	22.918	18.846
		Average	*46.354*	*76.353*	*16.672*	*22.312*	*20.185*	*83.587*	*16.498*	*23.235*	*20.471*
		Standard Dev		*17.617*	*2.006*	*1.470*	*2.726*	*21.655*	*1.919*	*1.429*	*2.770*
		Coeff of Var		*23.073*	*12.034*	*6.586*	*13.504*	*25.907*	*11.632*	*6.149*	*13.531*

Table 4-6. CO_2 Emissions for the EPA975 Control Vehicle during Rounds 1 and 2.

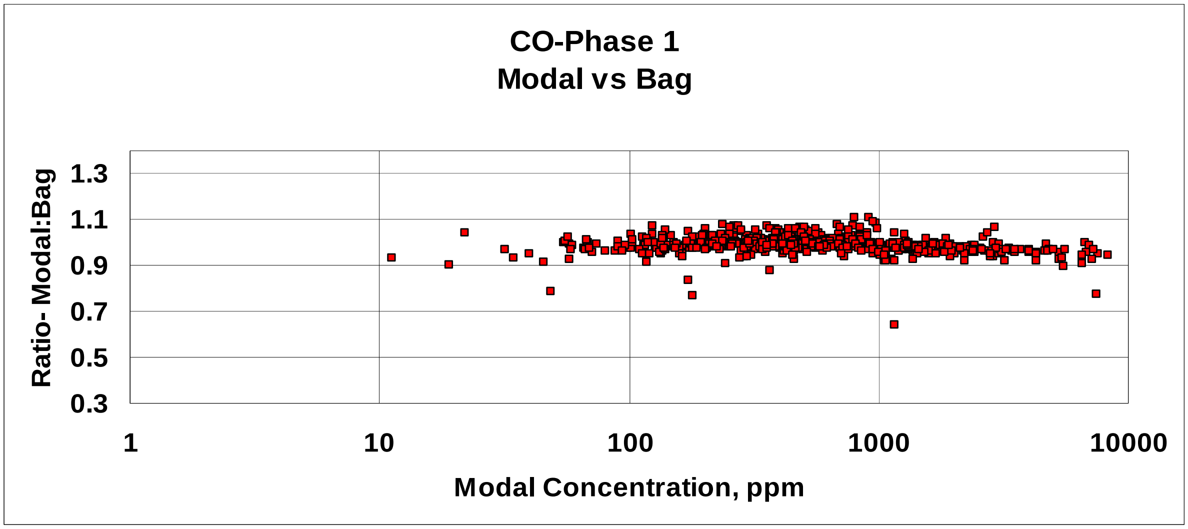
Test #	Odometer	Date	Amb. Temp	Ph1_Bag	Ph2_Bag	Ph3_Bag	Wtd_Bag	Ph1_Modal	Ph2_Modal	Ph3_Modal	Wtd_Modal
Rnd 1	*Miles*		*F*	*gm/mile*	*gm/mile*	*gm/mile*	*gm/mile*	*gm/mile*	*gm/mile*	*gm/mile*	*gm/mile*
84081	13139	07/26/2004	76.4	655.596	386.177	546.714	410.991	660.250	383.352	566.654	410.095
84114	13158	8/02/2004	93.5	701.022	401.557	573.925	428.644	702.250	399.921	593.783	428.619
84143	13170	08/07/2004	81.5	698.986	394.152	561.646	421.490	699.583	391.552	575.821	420.211
84177	13189	08/14/2004	74.1	668.594	385.104	537.781	410.177	633.353	358.689	518.947	383.831
84187	13208	08/18/2004	77.4	662.173	407.598	576.557	432.517	626.736	380.095	551.493	404.767
84218	13239	08/25/2004	81.0	671.201	400.773	582.138	427.151	660.720	385.876	584.863	413.690
84259	13250	09/08/2004	72.0	686.038	394.461	522.006	418.218	662.598	374.387	515.336	398.889
84290	13266	09/14/2004	87.7	641.921	382.460	535.629	406.503	637.310	387.625	540.899	411.169
84348	13303	09/24/2004	79.6	664.857	385.410	540.777	410.449	669.062	380.866	556.551	407.760
84360	13323	09/27/2004	77.6	660.165	383.192	540.884	408.592	658.169	378.604	544.969	404.744
84374	13352	09/29/2004	73.7	676.372	393.683	554.462	419.272	685.317	394.606	610.149	424.383
84387	13370	10/01/2004	72.0	666.596	386.881	533.293	411.738	670.909	385.451	549.878	411.871
		Average	*78.873*	*671.127*	*391.787*	*550.484*	*417.145*	*663.855*	*383.419*	*559.112*	*410.002*
		Standard Dev		*16.534*	*7.875*	*18.396*	*8.367*	*23.018*	*10.105*	*27.412*	*11.345*
		Coeff of Var		*2.464*	*2.010*	*3.342*	*2.006*	*3.467*	*2.636*	*4.903*	*2.767*
Rnd 2											
84450	13729	01/22/2005	24.9	714.152	400.129	539.755	426.560	736.229	399.200	560.667	428.396
84461	13748	01/26/2005	43.9	656.205	383.396	512.578	406.759	671.182	380.906	532.453	406.752
84480	13768	01/31/2005	40.2	720.258	410.801	551.668	436.486	740.207	408.635	573.823	437.125
84507	13788	02/05/2005	58.9	647.458	379.259	518.918	403.106	668.852	378.133	538.290	404.597
84536	13809	02/11/2005	51.7	690.058	393.408	517.852	417.783				
84544	13828	02/14/2005	54.0	661.944	390.467	535.082	414.876	684.845	389.656	547.342	416.227
84578	13871	02/22/2005	43.8	681.418	394.107	529.037	418.546	703.068	393.037	548.544	420.095
84606	13936	03/03/2005	51.9	681.971	392.582	512.840	415.889	716.592	389.410	533.069	416.298
84624	14013	03/08/2005	44.6	640.040	374.459	506.561	397.494	669.567	373.870	-	-
84651	14033	03/14/2005	46.1	694.395	390.042	516.104	414.465	727.570	386.607	541.654	414.925
84697	14052	03/22/2005	42.6	673.616	393.320	518.953	416.850	694.603	391.273	550.234	418.348
84741	14072	03/31/2005	53.9	631.061	386.203	513.754	408.001	665.312	387.348	540.866	412.708
		Average	*46.354*	*674.381*	*390.681*	*522.759*	*414.735*	*698.003*	*388.916*	*546.694*	*417.547*
		Standard Dev		*26.935*	*9.088*	*12.777*	*9.932*	*27.168*	*9.207*	*12.108*	*9.088*
		Coeff of Var		*3.994*	*2.326*	*2.444*	*2.395*	*3.892*	*2.367*	*2.215*	*2.177*

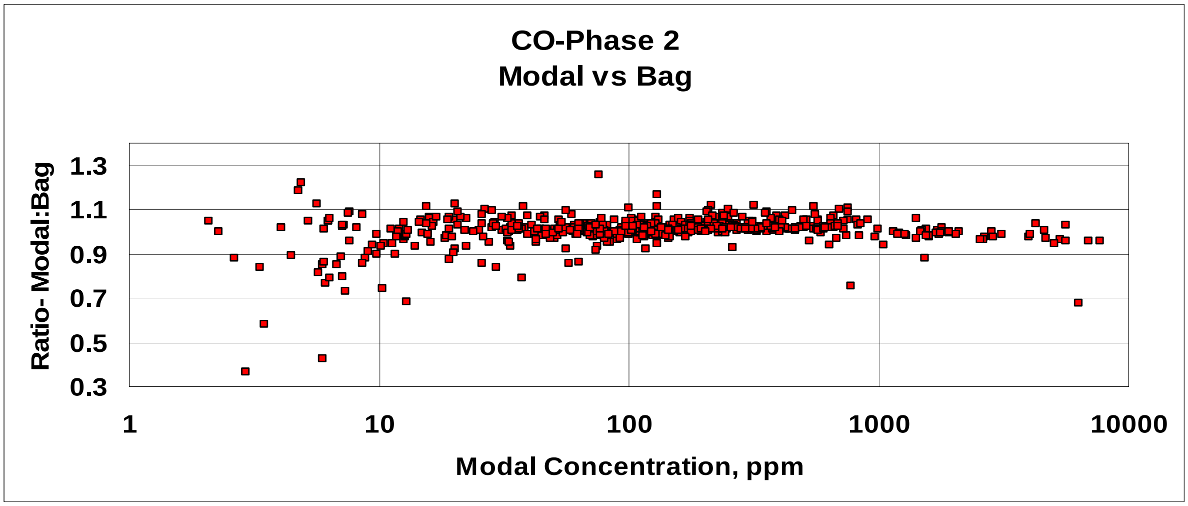
Table 4-7. Fuel Economy for the EPA975 Control Vehicle during Rounds 1 and 2.

Test #	Odometer	Date	Amb. Temp	Ph1_Bag	Ph2_Bag	Ph3_Bag	Wtd_Bag	Ph1_Modal	Ph2_Modal	Ph3_Modal	Wtd_Modal
Rnd 1	*Miles*		*F*	*mpg*	*mpg*	*mpg*	*mpg*	*mpg*	*mpg*	*mpg*	*Mpg*
84081	13139	07/26/2004	76.4	11.83	20.80	14.59	19.47	11.793	20.989	14.103	19.553
84114	13158	8/02/2004	93.5	11.30	19.95	13.77	18.65	11.308	20.065	13.372	18.686
84143	13170	08/07/2004	81.5	11.16	20.42	14.23	19.03	11.198	20.596	13.905	19.130
84177	13189	08/14/2004	74.1	11.69	20.84	14.76	19.50	12.373	22.417	15.325	20.881
84187	13208	08/18/2004	77.4	11.82	19.63	13.90	18.47	12.522	21.115	14.551	19.791
84218	13239	08/25/2004	81.0	11.77	20.05	13.75	18.78	12.000	20.840	13.707	19.410
84259	13250	09/08/2004	72.0	11.24	20.37	15.18	19.12	11.666	21.480	15.407	20.069
84290	13266	09/14/2004	87.7	12.21	20.99	14.90	19.70	12.268	20.784	14.778	19.533
84348	13303	09/24/2004	79.6	11.79	20.88	14.75	19.55	11.737	21.148	14.361	19.696
84360	13323	09/27/2004	77.6	11.84	20.99	14.71	19.62	11.908	21.270	14.622	19.831
84374	13352	09/29/2004	73.7	11.56	20.40	14.41	19.10	11.433	20.391	13.170	18.916
84387	13370	10/01/2004	72.0	11.59	20.78	14.95	19.45	11.548	20.894	14.542	19.476
		Average	*78.873*	*11.650*	*20.509*	*14.492*	*19.203*	*11.813*	*20.999*	*14.320*	*19.581*
		Standard Dev		*0.286*	*0.430*	*0.460*	*0.392*	*0.402*	*0.566*	*0.672*	*0.543*
		Coeff of Var		*2.459*	*2.096*	*3.171*	*2.040*	*3.406*	*2.693*	*4.691*	*2.773*
Rnd 2											
84450	13729	01/22/2005	24.9	9.02	19.46	14.58	17.94	8.788	19.570	14.057	17.916
84461	13748	01/26/2005	43.9	10.90	20.79	15.50	19.40	10.611	20.961	14.945	19.420
84480	13768	01/31/2005	40.2	9.95	19.34	14.45	18.04	9.059	19.499	13.894	17.932
84507	13788	02/05/2005	58.9	11.40	21.13	15.32	19.72	11.085	21.251	14.792	19.701
84536	13809	02/11/2005	51.7	10.45	20.28	15.32	18.91				
84544	13828	02/14/2005	54.0	10.93	20.39	14.76	19.02	10.599	20.471	14.452	18.986
84578	13871	02/22/2005	43.8	10.65	20.19	14.97	18.85	10.317	20.296	14.470	18.815
84606	13936	03/03/2005	51.9	10.30	20.23	15.41	18.88	9.856	20.442	14.872	18.902
84624	14013	03/08/2005	44.6	10.69	21.03	15.60	19.57	10.265	21.124	-	-
84651	14033	03/14/2005	46.1	10.08	20.30	15.27	18.88	9.678	20.515	14.579	18.892
84697	14052	03/22/2005	42.6	10.57	20.09	15.11	18.77	10.288	20.256	14.321	18.756
84741	14072	03/31/2005	53.9	11.43	20.57	15.39	19.30	10.894	20.559	14.656	19.128
		Average	*46.354*	*10.528*	*20.316*	*15.139*	*18.939*	*10.131*	*20.450*	*14.504*	*18.845*
		Standard Dev		*0.631*	*0.519*	*0.357*	*0.518*	*0.691*	*0.532*	*0.324*	*0.536*
		Coeff of Var		*5.993*	*2.552*	*2.357*	*2.733*	*6.821*	*2.602*	*2.235*	*2.845*

1.) **CO_2**: CO_2 ratios, shown in Figure 4-4, which includes both Round 1 and Round 2 data, typically showed the most consistency of all the regulated gaseous emissions and remained around 1.0. The primary exceptions are issues listed above (which have been removed from Figure 4-4).

2) **CO:** In the graph of modal:bag ratios for CO shown in Figure 4-4, quite a few more excursions away from a ratio of 1.0 are found. These excursions are primarily found at concentration levels below 10 ppm, as the minimum detectable limit of 0.5% of full scale (5 ppm) as specified by Horiba Instruments is approached. This can be seen in Figure 4-5, which shows the modal:bag ratios plotted as a function of concentration. Ratios also start to decrease as measured concentrations increase, in two cases markedly. This is the result of transient CO spikes occurring in the real time which are beyond the analytical capability of the analyzer (i.e., off-scale real time data). The more off-scale points occurring during a phase, the larger the decrease in the real time to bag ratio. Due to the use of two different CO analyzers covering different ranges (0-1,000 ppm and 0-10,000 ppm), this problem is minimized for CO measurement and only occurred in two instances as can be seen in Figure 4-5 Phase 1 data. Appendices S and V provide information on tests where instrument “pegging” may have occurred.





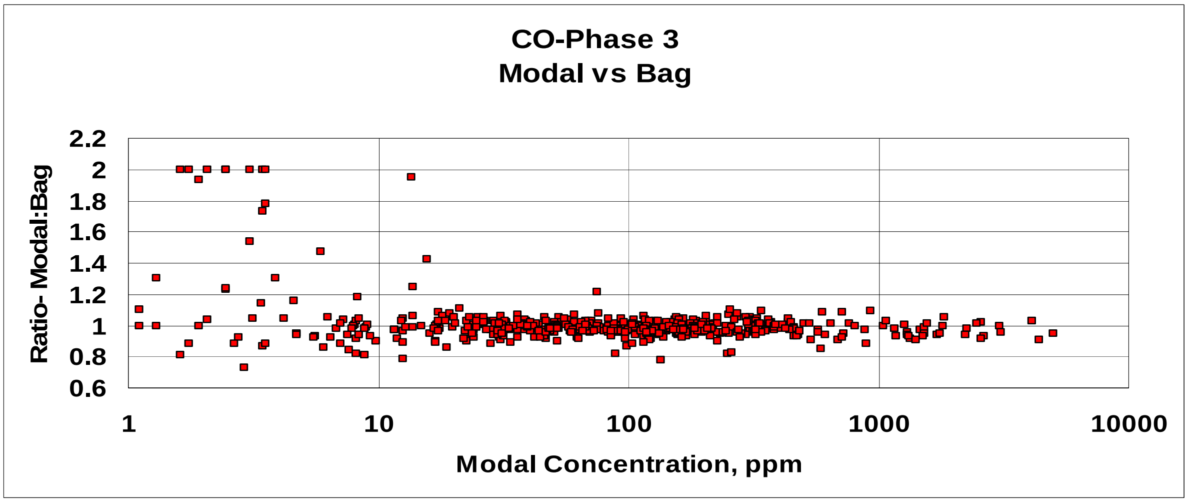


Figure 4-5. By-Phase Modal to Bag CO Ratios vs. Modal CO Concentration, both Rounds

3.) **HC:** As with CO measurements, agreement between the modal and bag HC measurements drops off for very low and very high HC concentrations. In Figure 4-6, the HC modal to bag ratios are plotted against HC concentration. For higher emitting vehicles, the modal data contains a larger number of off-scale data points (i.e., >1,250 ppmC), resulting in the modal data under-reporting HC. A couple of factors influenced the disagreement between modal and bag HC measurements on the lower end. First, bag HC measurements were recorded to ± 1 ppm, while modal HC measurements were recorded to ± 0.001 ppm. Secondly, CVS bags were not purged between the last (and dirtiest) test of one day and the first (and cleanest) test of the next day. HC desorbtion from the bag surfaces from an extremely high HC emitter could elevate HC bag concentrations from a lower emitter. Conversely, at higher concentration measurements, some HC could adsorb onto the bag surface, thereby decreasing the measured HC concentration. No correction was applied to the HC bag data to account for the potential absorption/adsorption in the bag. Likewise no correction was performed to the modal data to account for underreporting of HC data due to off-scale measurements. Since vehicles were generally tested from the "cleanest" to the "dirtiest" on a daily basis, Figure 4-6 compares the first test of the day (lowest emitting vehicle) to the last test of the day (highest emitting vehicle). This could help illustrate bag desorbtion influences on the modal to bag ratio results for the first test of the day.

AMBHC- An FID was dedicated to measuring the building background HC concentrations. These measurements are not used in the emission rate calculations, but were recorded to document building background HC levels. This instrument was functional only during portions of Round 1, and not at all during Round 2. During the last half of Round 1, the instrument was operated on the 0-1000 ppmC range instead of the 0-100 ppmC range. This resulted in a scaling factor error of 10. AMBHC measurements on all affected runs were edited by dividing by 10 to reflect true concentrations. In addition, the sampling valve for the AMBHC instrument was turned to the wrong position at the start of one run (84079), resulting in diluted exhaust, instead of building background air, being sampled during the first 630 seconds of this test. AMBHC for the first 630 seconds of this run are therefore void, as indicated in the edited PRN file for this run. This and other test issues, as well as data corrections performed, are listed in Appendices S and V.

4) **NOx:** NOx converter efficiency, affecting NOx bag measurements, is the culprit in the bad agreement between NOx modal and bag measurements, as seen in Figure 4-4. Due to the large differences seen, all NOx bag data for Rounds 1 and 2 have been invalidated, and should not be used. With the exception of the NOx bag data shown here in comparison with modal data, all dynamometer "by phase" results are based on real-time modal measurements, not bag measurements. Modal NO_x was lost on two runs (84343 and 84297) due to the instrument's ozonator air running out or being turned off. NO_x for the entire 84343 test was lost, while only Phase 2 and Phase 3 of 84297 were lost.

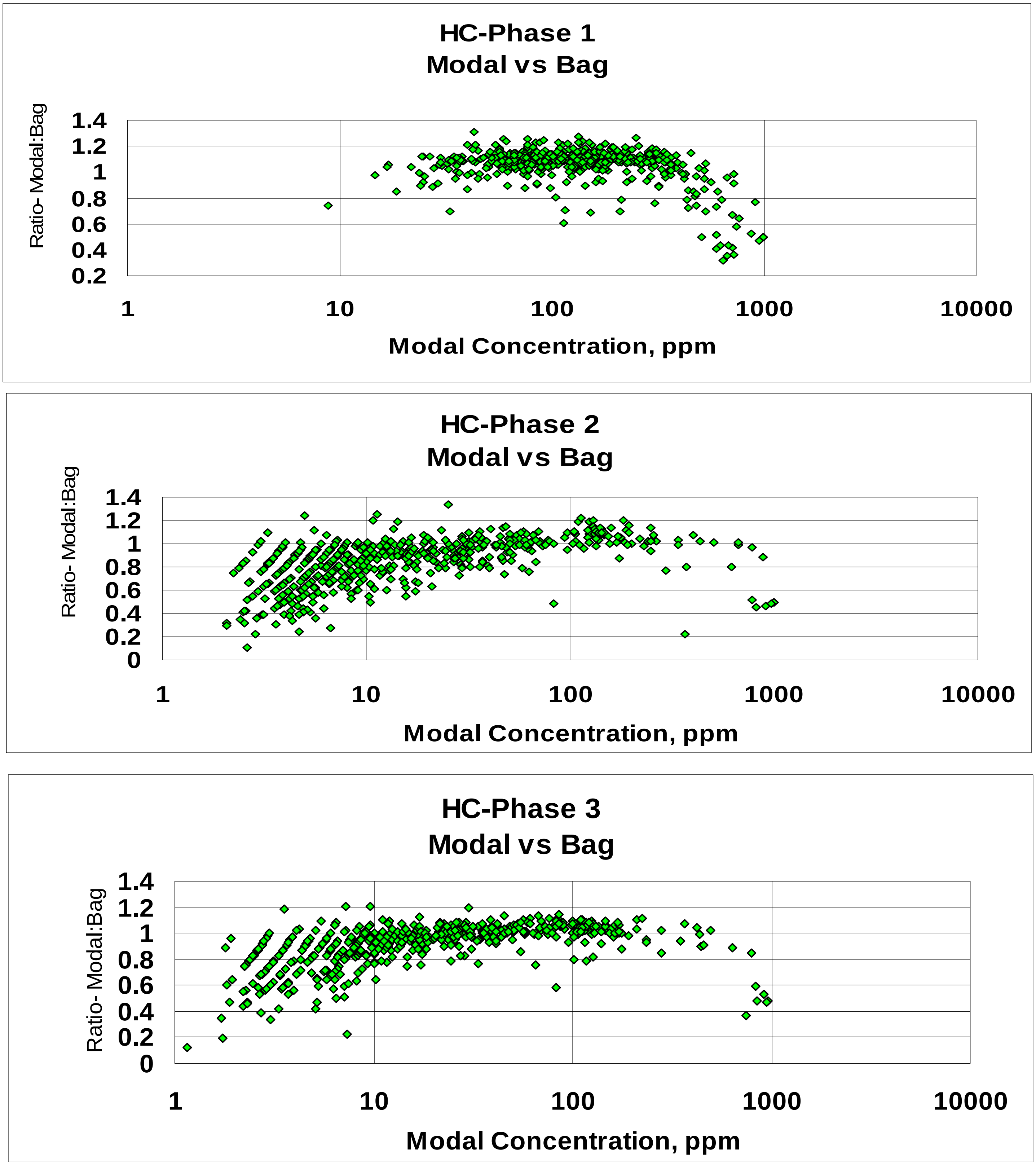


Figure 4-6. By-Phase Modal to Bag HC Ratios vs. Modal HC Concentration, both Rounds

One final note on the modal data, although it was collected and is being reported at the rate of 1 hertz (1 sample per second), the smallest mode that can be realistically resolved is probably on the order of 10 seconds. This is due to the effects of sample transport from the vehicle's exhaust system to the analyzer and inherent analyzer response times. The problem is twofold. First, transient engine-out emissions (spikes) may only last a half second or so. But once diluted and transported to the analyzer, the same emission spike will be recorded by the analyzer as a 5-10 second event. Secondly, exhaust transport times through the vehicle's exhaust system and transfer tube will be changing continuously due to the transient nature of the driving cycles. These effects must be considered when using the data for second-by-second analysis or emissions models. Both true bag and true modal data were collected during this study and are being provided to the EPA for a final determination regarding how the data should be used.

Dynamometer Measurements:

Torque- Zero offset in the torque measurement system was a noticeable, intermittent problem on ~ 25 runs during the first portion of Round 1 testing. The cause of the zero offsets was traced to a faulty connection on an in-line fuse holder within the torque measurement circuit. The fuse holder was replaced and no further problems were encountered. The torque zero offset was calculated for each run in Round 1 as the average torque signal obtained during the engine off portion of the test (T = 1500 to 2000 seconds). Corrections for zero offset were determined and applied only to the Round 1 torque data, as the Round 2 torque data were unaffected by the offset.

Torque data for one run (84141) was lost due to the extremely large offset (177ft-lbs.). The next 24 most affected runs had offsets ranging from 5.54 to 0.10 ft lbs, all of which were satisfactorily corrected. The remaining tests had zero offsets of less than 0.10 ft-lbs. On four runs (84073, 84109, 84214, 84215) only Phase 3 was baseline corrected as the baseline drift apparently began during the hot soak. Torque data from another run (84051) were voided due to negative baseline drift. In addition, the torque board became dislodged during Phase 2 of one test (84279), so only Phase 1 torque data are good for this run.

Torque measurement for another 25 runs in Round 1 was affected when a gain potentiometer was inadvertently adjusted. This affected the real time torque measurement only, not the dynamometer loading circuit nor the readout meter used to set load and display coastdown values. The tests affected by this were conducted from July 20 through July 24 (runs 84051-84076). The potentiometer was readjusted late on July 24, 2004 and from that point forward, was checked on a daily basis during the mid-day blank collection. No further adjustment was required for the remainder of the summer phase. Affected real time data were corrected by applying a correction factor to the second by second data. A correction factor was determined by noting that, on average, the dynamometer set point loading (Hp@ 50 mph) was 89% of the average torque measured during Phase 2 for unaffected runs, while only 55% on affected runs. The correction factor 89/55 = 1.62 was applied to torque for the affected runs.

Torque measurement on one test in Round 2 was affected as a result of the torque board dislodging during the test. The affected test was 84614. For this test, no valid torque measurement was made; however, the torque control system remained functional, maintaining the proper vehicle loading.

The affected runs described in this section are included in the list of known test issues provided in Appendices S and V. In addition, Appendix BB provides results from the pilot study, which shows a good correlation between EPA's dynamometer laboratory in Ann Arbor, Michigan and EPA's portable Clayton dynamometer used for this study.

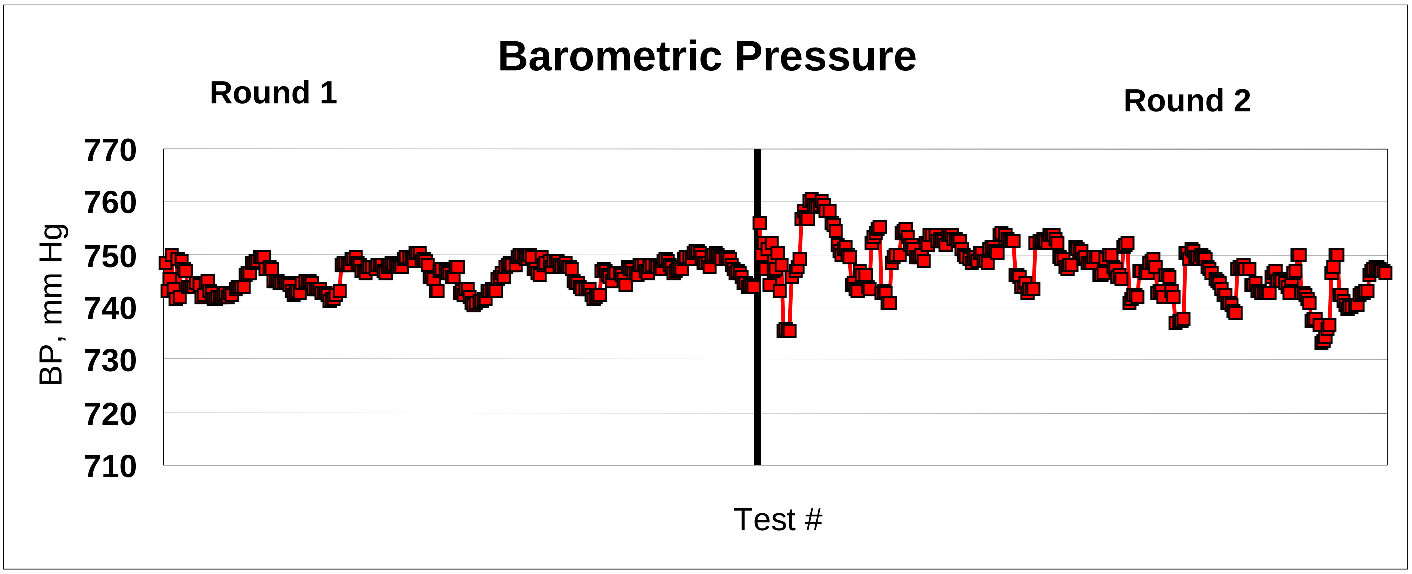
Relative humidity measurements- On a few occasions, the relative humidity sensor was operated on a dead 9 vdc battery, which resulted in invalid relative humidity measurements. The affected Round 2 tests include 84532-84534 on 2/11/05 and 84681-84687 on 3/19/05. The affected Round 1 test is 84258 on 9/8/04. In order to provide humidity/temperature corrected NOx values, the invalid relative humidity data for these tests was supplemented with relative humidity data from the KC airport. Details for all affected tests are provided in Appendices S and V.

Other Chassis Dynamometer Test Conditions

Round 1 and Round 2 test temperatures and barometric pressures are shown in Figure 4-7.

Dilution Tunnel Temperatures: As seen in Figure 4-8, dilution tunnel temperatures, as measured at the PDP inlet, remained fairly constant throughout Round 1 and Round 2 testing. Phase 1 and Phase 3 PDP inlet temperatures remained around 46^{o}C except for a couple of occasions during Round 1 (the dilution heater was not turned on) and also during Round 2 (the heater contactor failed) when temperatures remained near ambient. Phase 2 PDP inlet temperatures were also maintained around 46^{o}C, except for the larger vehicles, where dilution factors were low and raw exhaust temperatures were high, particularly during high vehicle speed and acceleration operation. On twenty of the larger vehicles, Phase 2 tunnel temperatures averaged over 50^{o}C. Tunnel air temperatures should not significantly affect gaseous regulated emission measurements. Temperature effects on particulate measurements are unknown. All tests where the average dilution tunnel temperatures exceeded 50C during any phase are included in the list of known test issues provided in Appendices S and V.

Driving violations- Numerous driving violations (as defined in the CFR for certification testing) were known to occur during the course of testing. Driving violations occurred mostly due to trouble stopping or slowing the test vehicles while following the aggressive deceleration rates of the LA92 driving cycle on the Clayton dynamometer. A few of the older, rear wheel drive vehicles had weak rear brakes to start off with which became weaker as they heated as the cycle proceeded. Many of the newer test vehicles would lose traction on the dynamometer's rolls while braking resulting in "skidding" of the stopped tires on the still moving dynamometer rolls. On the other hand, many of the older test vehicles ran poorly and had trouble maintaining the acceleration rates and higher speeds of the LA92 driving cycle. Driving violations were not quantified, although field notes indicate when obvious trace violations occurred. This information is provided in the list of known test issues provided in Appendices S and V. However, the modal data files contain the actual vehicle speed versus time trace for each test, so driving violations can be analyzed at a later date by comparing target vehicle speed for the LA92 test to that provided in the modal data. In the current presentation of the emissions data, no tests were invalidated due to driving violations.



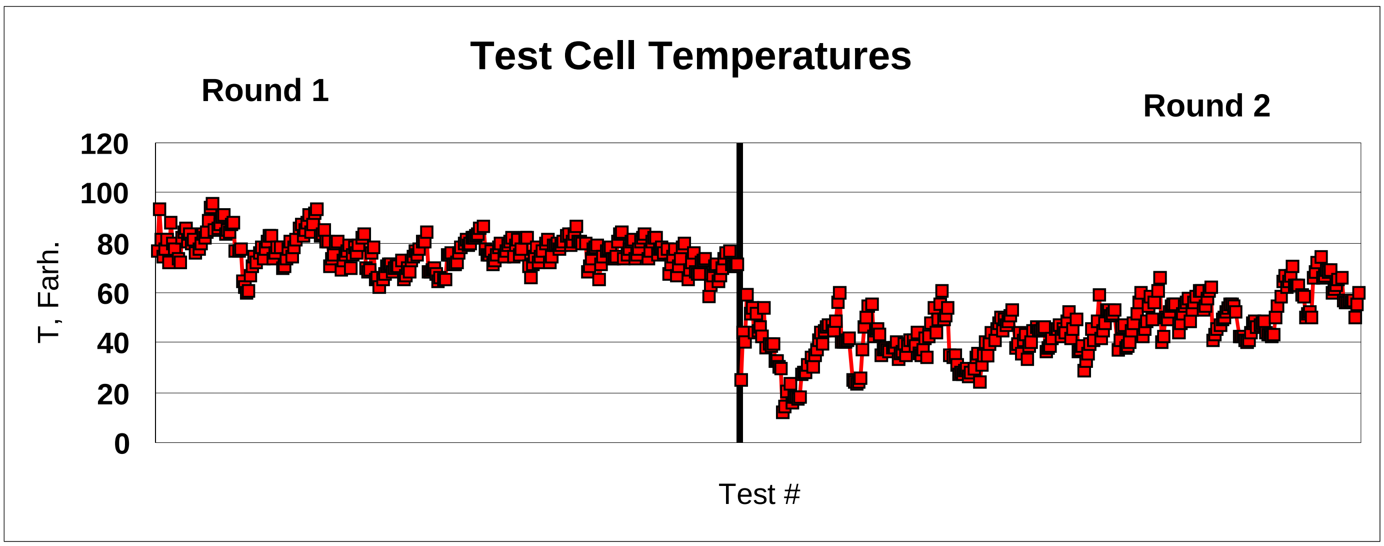


Figure 4-7. Rounds 1 and 2 Test Temperatures and Barometric Pressure

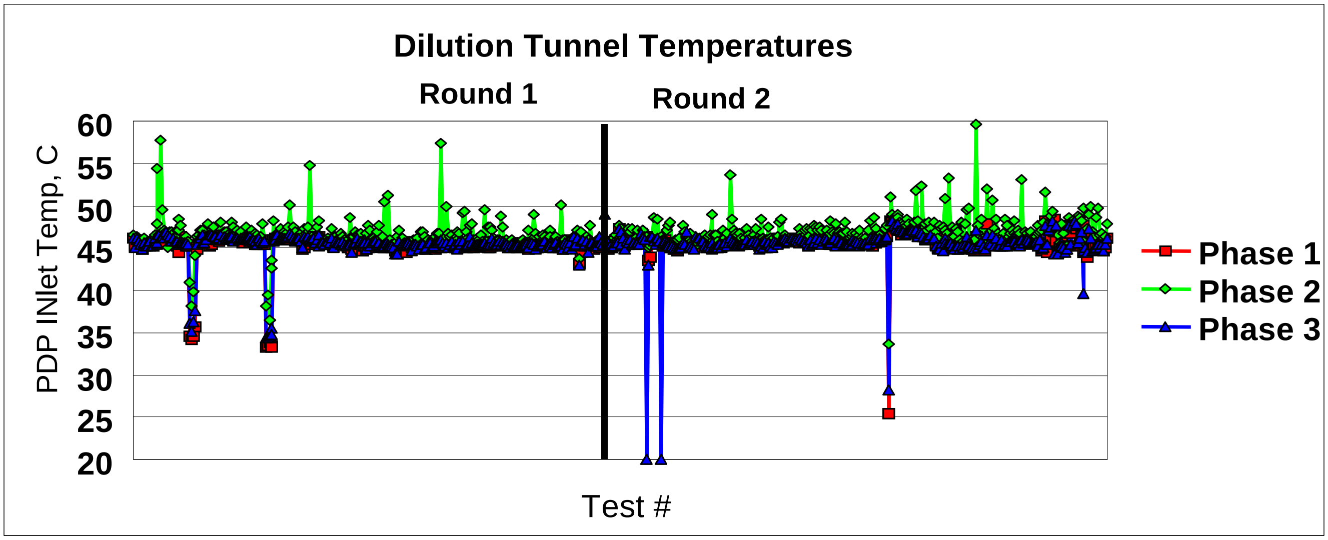


Figure 4-8. Rounds 1 and 2 Dilution Tunnel Temperatures.

HC Background Concentrations: Hydrocarbon background concentrations were measured through the dilution tunnel during the 10-minute engine-off period between Phase 2 and Phase 3. Background concentrations were low, indicating good ventilation through the test area. Average measured concentrations were over 10 ppmC on 4 occasions, as seen in Figure 4-9. These four incidents occurred while testing extremely high HC emitters with known exhaust leaks; however, the HC background could also be elevated due to other vehicles being operated in the area. The HC background as measured through the dilution tunnel during the 10 minute soak was used to perform HC bag/modal reading corrections for all tests, including those in which the background exceeded 10 ppmC. As no limits had been established for background levels, no tests were invalidated due to elevated background levels.

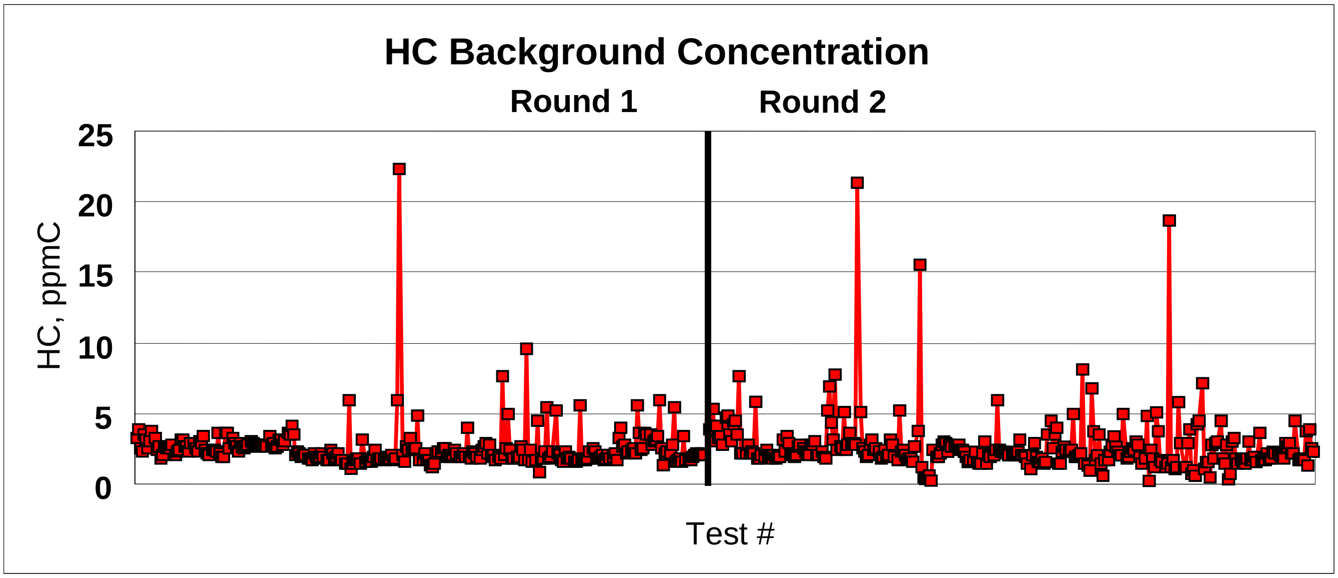


Figure 4-9. Rounds 1 and 2 Tunnel HC Levels With Engine Off Between Phase 2 and Phase 3.

Control Vehicle Tests

Several steps were taken to ensure precise and accurate emission test results were gathered during the Kansas City Study. As described in Appendix BB, a pilot study was conducted using vehicles tested both at EPA's dynamometer laboratory in Ann Arbor, Michigan and at the Kansas City test facility using EPA's portable Clayton dynamometer. After the pilot study was concluded, one of EPA's test vehicles (a 1988 Ford Taurus) was retained to use throughout the Kansas City study to use as a control test vehicle. This section presents regulated emission results from the Round 1 and Round 2 dynamometer testing conducted on the EPA provided control vehicle (EPA975). Additional details on the control vehicle testing, including PEMS results and results from dynamometer testing in Ann Arbor, can be found in Section 4.4.3, *Control Vehicle Results*. A total of 24 chassis dynamometer tests were conducted on the control vehicle in Kansas City using the transportable dynamometer. This included twelve tests in Round 1 and twelve tests in Round 2. Tests were conducted over the cold-start LA92 driving cycle. The control vehicle was fueled using an Indolene fuel provided by EPA. Phase 1, Phase 2, Phase 3, and weighted regulated emission rates and fuel economy results for these tests, along with average emission rates, standard deviations, and coefficients of variation (COV) are presented in Tables 4-3 (HC bag and modal results), 4-4 (NO_x bag and modal results), 4-5 (CO bag and modal results), 4-6 (CO_2 bag and modal results) and 4-7 (Fuel economy bag and modal results). Differences in emission rates and coefficients of variation can be seen from Round 1 to Round 2, particularly in Phase 1 HC and CO emission rates. These differences are more than likely due to ambient temperature effects. Average test temperatures for the control vehicle during Rounds 1 and 2 were 78.9^{o}F and 46.4^{o}F, respectively. The lowest test temperature encountered for the control vehicle during Round 2 was ~ 25 F. This test resulted in extremely high HC emissions for Phase 1 and high CO emission during all three Phases, which skewed Round 2 COVs upward for these compounds, as can be seen in Tables 4-3 and 4-5. Without results from this test included, COVs for Rounds 1 and 2 would be very similar. With the exception of NO_x (to which a humidity correction factor was applied), bag and modal results have not been corrected for temperature, barometric pressure or relative humidity.

With the exceptions noted above, Rounds 1 and 2 COVs for HC, CO, CO_2, and fuel economy were generally less than about 5% for the stabilized Phase 2 and warm-start transient Phase 3. Somewhat higher COVs occurred for the cold-start Phase 1 HC and CO emissions, again presumably the result of cold start ambient temperature conditions. Precision for NO_x was not as good, with the COV at just under 10 % for the humidity corrected NO_x emission rates. Although not shown in the table, the precision for the uncorrected NO_x was somewhat better, with a COV of 5.7 %. This suggests that applying the NO_x correction factor, with such diverse humidity and temperature conditions, is at least partially responsible for the decay in precision for the corrected NO_x emission rates. The NO_x correction factor used for both the PEMS and dynamometer systems is that defined in the Code of Federal Regulations, Title 40, part 86.1342-90. For gasoline combustion, this correction factor is specified as:

$$K_1 = \frac{1}{1 - 0.0047(H - 75)}$$

where H is the absolute humidity in grains of water per pound of dry air. Since this correction factor is based on a relatively small study conducted on pre-catalyst vehicles under limited conditions, it's applicability to extreme temperature and humidity conditions seen in Kansas City may be limited. Future analysis of NO_x emissions using a revised correction factor applicable to a wider temperature/humidity range may be of benefit.

Bag data were also collected on a routine basis as a backup and verification of modal results. Precision for bag HC, CO, CO_2, and fuel economy was similar to the modal results, with coefficients of variation in general less than 5 %. Excellent agreement was also found between modal and bag CO and CO_2 emissions, indicating that no flow/leak problems existed. Bag HC emissions were slightly less than modal HC emissions, probably as a result of some HC absorption on the unheated surfaces of the bag analysis system.

As can be seen in Table 4-4, Bag NO_x values were only ~50-80 % of the modal NO_x values. This is attributable to a known issue with the bag analysis, where older NO_x converters were used. Actually, two different NO_x converters were used over the course of the study. However, neither one maintained its converter efficiency for very long. The second converter, installed in the bag analysis system after the fifth test on the control vehicle, was considerably better than the first for a short period. Phase 1 NO_x values were most affected due to the longer time available for NO conversion to NO2 (all bags were read at the end of the test). Agreement between Phase 3 modal and bag NO_x values were quite good regardless of the NO_x converter issues, which indicates that most of the NO_x was originally emitted as NO. Again, however, the primary intent of collecting bag data was to provide a back-up and cross-check to the modal data. Modal data was collected as the primary source of emissions data, and all "by phase" emissions presented in the report for this study are based on modal data. The cumulative by-phase MSOD data submitted for this project is based on actual tedlar bag samples, as described in Section 5.

4.3 PEMS Test Procedures

PEMS testing was conducted on all vehicles entering the program. The general PEMS installation procedures used during the study are described in the following sections. The various types of PEMS testing conducted during the study are described in Sections 4.3.1.4 through 4.3.1.6.

4.3.1 PEMS Installation and Testing

4.3.1.1 Installation

Prior to the installation of the PEMS, OBDII scans were performed using a handheld scan tool, and readiness status along with pending and confirmed codes were recorded. Detailed information about each vehicle was also collected for future reference to be used in Mobile Source Observation Database (MSOD) table population, including vehicle make, model, model year, odometer, vehicle identification number (VIN), engine displacement, number of cylinders, engine and evaporative family identification numbers, transmission details, and emission control system information. Fuel and oil samples were collected for study vehicles (unless unavailable because of anti-siphon devices).

Once vehicle information was gathered, a warmed-up PEMS unit was installed, along with batteries in the trunk or truck bed of the test vehicle. Two batteries were used for all installations, to prevent system shutdown during conditioning runs and to maximize acquisition time during the driveaway. Flame ionization detector (FID) fuel pressure was checked, and the FID fuel bottle was replaced if under 200 PSI would be available for the conditioning run. A new (full) fuel bottle was always installed for all driveaways. FID exhaust and drainage tubes were connected to the PEMS unit and routed outside the vehicle. Various instruments and sensors were then connected to the PEMS unit, including a vehicle interface (VI) cable, a weather probe, an auxiliary thermocouple, and a Global Positioning System (GPS) antenna. A flowmeter and matching control box were also connected to the PEMS, purged with dry compressed nitrogen gas (flowmeter only), and powered on (all flowmeter boxes remained powered up throughout the day to minimize warm-up time). This flowmeter was attached to the rear of the vehicle using a common bicycle rack which had been slightly modified for use in this study. Vehicle exhaust was routed from the tailpipe to the flowmeter through a silicon tube with stainless-steel unions. A connection from a laptop computer to the PEMS was used to set system parameters and configuration settings, perform audits and calibrations, and control data acquisition.

4.3.1.2 Onsite Quality Assurance

Once the PEMS was physically installed in the test vehicle, several steps were taken to ensure that the PEMS was in proper working order and to ensure that complete accurate test results would be obtained. Prior to each use of the equipment, leak tests were performed for the FID fuel and PEMS systems, internal PEMS pressures and ambient conditions were recorded, and analyzer sample rates were verified. Once initial system checks were complete, and after full system warm-up, the vehicle was started (for conditioning runs only). The vehicle was turned on, allowed to slightly warm up, and the hydrocarbon reading from the road test screen was noted. This reading was used to determine the appropriate calibration range for the vehicle being tested. The unit was recalibrated, if needed and a zero and gas audit were performed. Spans and re-audits were performed if necessary. Additional checks were made to ensure that the equipment was collecting data for VI, GPS, flow, emissions, and other parameters – and that these parameters seemed reasonable upon inspection. The voltages of the two fully-charged batteries were verified. A test session was begun after successful completion of initial system checks, zeros, and audits. Copies of the installation checklists and data collection sheets are included in Appendix J for reference. Complete installation guidelines (details which supplement the installation checklists) are provided in Appendix I.

Once PEMS installation and setup was completed, a person other than the installer (generally the onsite manager) performed a review of the installation, to verify system parameters and confirm proper installation. A copy of this installation review checklist, along with other onsite data quality checks that were performed, is provided in Appendix N.

After every conditioning run, vehicle emissions and fuel economy values measured during the conditioning run were reviewed. If any suspect values were identified, the PEMS system and installation were reviewed to try to determine the source of the problem. If the problem was found, it was corrected (if possible), and the vehicle was given another conditioning run. If a problem was not found, or not correctable, the suspect or faulty equipment was taken out of service for repair. The vehicle was then outfitted with new equipment and another conditioning run was performed.

After onsite checks of the data were performed, the raw (XML) and processed (.csv) files were uploaded daily to the project FTP site for perusal by other project team members. Additional checks on the data were later performed by Austin ERG staff using SAS scripting, including confirmation of the presence of VI and flow data, verification of transport delays, test duration, vehicle speed, and test distance, analysis of audit and calibration data, and evidence of any system faults or warnings.

Further detail on specific PEMS QA procedures can be found in Appendix M: Off-site data quality and results analysis queries, and Appendix N: Onsite installation and data quality checks

4.3.1.3 PEMS Test Issues

The equipment downtime experienced during Round 1 was greatly reduced during Round 2 through the addition of an on-site PEMS repair and support person. Most repairs were minor, such as stuck solenoids, loose or dirty contacts and fittings, water in the system, or blown relays, and were able to be repaired quickly. Most larger repairs, such as system module and CPU board replacements, were also accomplished onsite (after necessary repair items were received onsite). This increase in equipment up-time allowed significantly more driveaways to be conducted in Round 2 than were possible during Round 1 of the study.

As mentioned in Section 2.4.1 (changes from Round 1), the hot-wire anemometer-style flowmeters used throughout the Round 1 summer portion of the study were replaced with pressure-differential style flowmeters for Round 2 of the study. Measurements from the original hot-wire anemometer flowmeters were adversely affected by heat radiation effects at low vehicle speeds and idle. Since convective cooling minimized these effects when vehicles were in motion, low-speed and idle flow measurements were biased low. This bias was eliminated with the use of pressure-differential style flowmeters provided for Round 2 of the study. These flowmeters relied on a bank of differential pressure sensors (as opposed to a hot-wire anemometer) in order to determine corrected mass exhaust flowrates. However, the orifices in the differential pressure sensors used in these new flowmeters were susceptible to PM clogging and moisture freezing. This condition was minimized as much as possible by thoroughly purging all orifices with high-pressure dry compressed nitrogen prior to each use, and by maintaining the flowmeters and tubing assemblies in above-freezing conditions.

Earlier in the study, problems were encountered with preventing moisture and exhaust fumes from entering vehicles during testing. The new flowmeters required additional tubing to be routed out of the trunk (generally requiring the trunk to be propped open wider). Standard household pipe insulation purchased at a hardware store was found to fairly effectively seal trunks. Carbon monoxide detectors were used to ensure vehicle exhaust was not entering the passenger compartment.

As mentioned in Section 2.4.1, Round 2 testing was conducted during the winter, as opposed to the Round 1 summer study. Operation of the PEMS units below freezing temperatures was occasionally necessary, and proved to be problematic because of water freezing in system components and measurement drift. Battery life seemed greatly reduced during Round 2 testing, perhaps due to battery cycle fatigue (these were the original batteries used since the start of the study) and also possibly due to operation in the cold temperatures.

In order to prevent trunks from inadvertently popping open, as would occasionally happen with the original vice-grip-devised trunk latches, heavy-duty zip-ties were used (with metal rings installed in the trunk latch assembly) to secure trunks. These zip ties, which are typically used for securing building ventilation and may be found at a typical hardware store, also prevented motorists from tampering with the PEMS units installed in trunks during driveaway tests.

Experience gained during Round 1 of the study helped streamline Round 2 testing. For example, installation procedures and sequences were modified in order to minimize lost time in the event of equipment malfunctions. Certain “tricks” and procedures for equipment software helped expedite installations and minimize system resets. The incorporation of a session manager into the host software also allowed consolidation of audit and test information into one test file, thereby expediting equipment setup and reducing time needed for test processing and analysis.

4.3.1.4 Conditioning Testing

PEMS units were installed to determine emissions and fuel economy on conditioning runs performed prior to dynamometer testing. After the installation and QC procedures were completed, the flowmeter installation was photographed, and the vehicle was driven on a “conditioning” route (similar in speed, acceleration, and distance to the LA-92 test). This conditioning drive allowed emissions and mileage data to be gathered on all vehicles driven in a consistent manner, and it also allowed all vehicles to be similarly conditioned prior to dynamometer testing. After the conditioning run was completed, a host laptop was connected to the PEMS and the vehicle's fuel economy over the conditioning drive was calculated by using cumulative grams/mile emissions estimates derived from the conditioning run segment of the test record. If the fuel economy estimate from the conditioning run seemed reasonable, the test was stopped, and a post-test audit and zero were performed to help gather information on instrument drift that may have occurred during the conditioning drive. If the fuel economy and/or emissions determined from the conditioning run were not reasonable, the problem was investigated and corrected as described in Section 4.3.1.2.

The overall travel distance for the standard conditioning run was approximately 8 miles over approximately 1300 seconds. Figure 4-10 shows a sample speed and acceleration plot for a typical conditioning run. The speed and acceleration profile for the drive is shown in Figure 4-11.

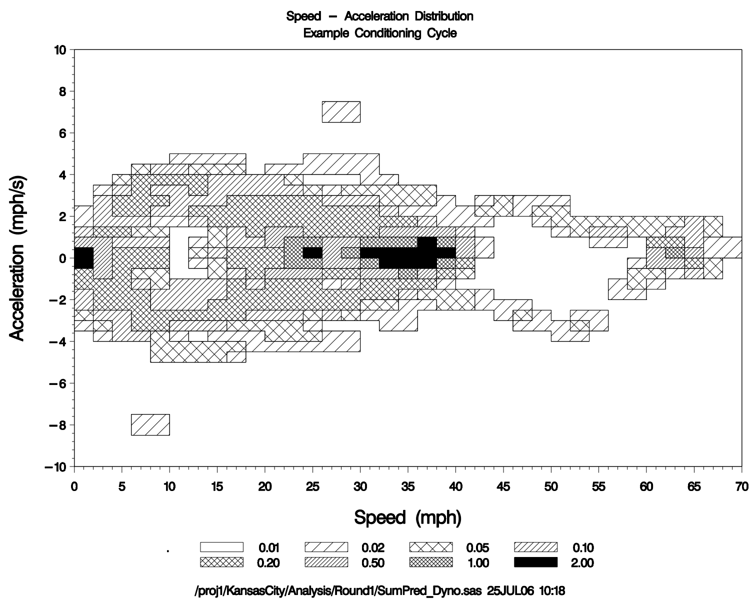


Figure 4-10. Sample Speed Trace for a Dynamometer Conditioning Run

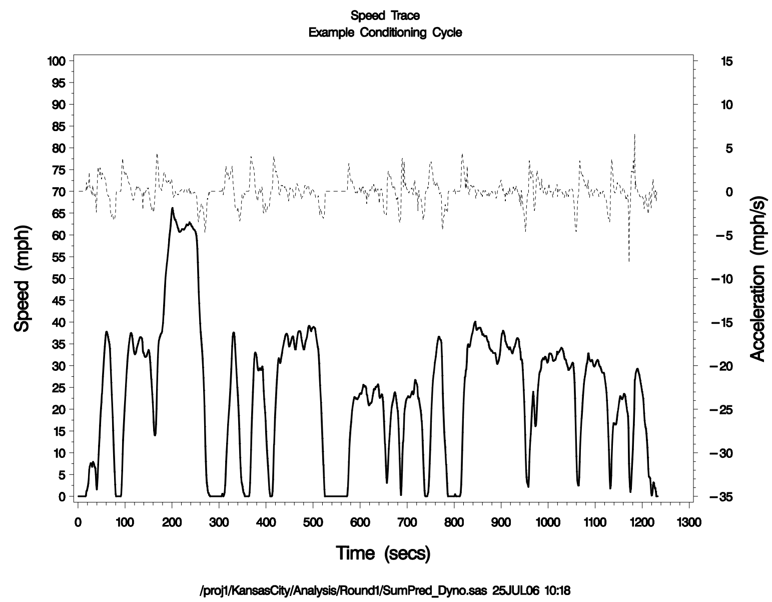


Figure 4-11. Sample Speed-Acceleration Distribution for A Dynamometer Conditioning Run

On occasion, some vehicles could not be tested on the dynamometer for various reasons. Some examples of untestable vehicles include those with four-wheel drive, certain exhaust leaks, rough running/stalling, tailpipe rust, transmission problems, or vehicles that were too large for the dynamometer to handle. For these vehicles, conditioning runs were still performed, but an extended conditioning route (approximately 18 miles) was used for the run. Details of the "standard" 8 mile conditioning route and also of this "extended" conditioning route are provided in Appendix K. Details pertaining to all conditioning runs are provided in Appendix K.

4.3.1.5 Drive-Away Testing

In addition to conditioning and dynamometer testing, some program participants were solicited for "driveaway" testing. This involved installing a PEMS unit on the participant's vehicle, driving the vehicle on the conditioning run, and then releasing the vehicle to the participant (after conditioning run fuel economy and emissions were reviewed, and the setup was independently verified). This conditioning drive allowed emissions and mileage data to be gathered on all vehicles driven in a consistent manner, and it also allowed all vehicles to be similarly conditioned prior to release to the owners. In order to maximize battery life, power supplies were connected to the PEMS units and batteries during troubleshooting and while waiting for motorists to return to pick up their driveaway test vehicles. Immediately before releasing the vehicle to the motorist for the driveaway test, the vehicle's trunk or hatch was sealed with standard household pipe insulation to prevent vehicle exhaust or moisture from entering the vehicle.

Prior to vehicle release, the participant was encouraged to drive the vehicle as much as possible (i.e., by running their weekly errands), and to drive the vehicle as they normally would. This allowed activity, emissions, and fuel economy information to be gathered under "real-world" on-road driving conditions. The PEMS unit continued to operate until the battery supply was depleted, typically 6 to 8 hours of operation. The flame ionization detector used for total hydrocarbon (THC) measurements continued to operate until the PEMS shut down or until FID fuel was depleted, resulting in a loss of THC measurements. Although a THC measurement loss could result in a slight error in fuel economy and THC emission values, this was generally not the case since FID shutdown usually occurred long after the vehicle was parked for the day.

Participants were generally scheduled to return the following day in order to have the PEMS unit removed. Upon their return, they were interviewed about their driving experience and also provided information on passenger pick-ups and drop-offs and any other significant driving events that occurred during testing. Vehicle miles traveled for driveaway runs varied from 13 miles to 66 miles, and the total number of recorded seconds also ranged from 576 seconds to 38,000 seconds.

Although eight PEMS units were provided for Round 1 of the study, equipment malfunctions generally prevented concurrent use of all eight units. This reduced the number of drive-away tests that could be performed during Round 1. Onsite PEMS repair and maintenance support provided during Round 2 greatly reduced equipment downtime, and allowed a significantly higher number of driveaway tests to be conducted.

4.3.1.6 PEMS Testing Concurrent with Dynamometer Testing

PEMS testing was performed in tandem with dynamometer testing, to provide dynamometer vs. PEMS comparative results. Some notable differences between use of the PEMS for dynamometer testing vs. in-vehicle testing (such as conditioning run and driveaway testing) include:

- Rather than exhausting to the environment, the PEMS' flowmeter/sample line assembly was attached directly to the vehicle's exhaust, after which the vehicle's exhaust was routed through the dynamometer's transfer tube to the CVS tunnel. The exhaust sample was drawn from the PEMS's sample port and flow meter tube into the transition tube feeding the dynamometer's CVS.
- Since the vehicle was stationary on the dynamometer, no GPS signal was collected
- An analog voltage signal proportional to dynamometer roller speed (ratio of 0.1 volt = 1 mph) was acquired through external analog input 3. For certain Round 1 tests, speed from external analog input 3 needed to be adjusted by a factor of 10 (tests 84242 – 84392). For still other Round 1 tests, the external analog input 3 was not usable because the voltage signal was found to be erratic during data analysis; in these cases (tests 84153 – 84241) the actual dynamometer speed as recorded by BKI was used. For the remainder of the Round 1 tests, as well as all tests in Round 2, the external analog input 3 signal was found to be accurate. Adjustment of speeds was performed during post-processing and QA of the data using SAS.
- An external event marker switch was used to indicate the start of a run, and also to distinguish between test Phases. However, for accuracy purposes, test-phase delineation was based on test timing rather than manually inserted markers during data analysis.

- Full quality control procedures, as described above in 4.3.1.2, were performed during PEMS/dynamometer testing, including leak checks, zeros, audits, and spans/reaudits as necessary. Emission readings derived from the conditioning testing previously performed were used to determine which concentration calibration gas should be used to calibrate the PEMS unit prior to vehicle testing.

4.4 Regulated Emissions Measurement Results

PEMS sampling was performed concurrently with all dynamometer testing. By-phase and total composite emission rates as measured using each system (PEMS / dynamometer) were then calculated and are presented in the following section. These results are based on time-aligned test data to which the necessary corrections (humidity, dilution, and flow) have been applied.

For each system, phase-specific grams/mile emission rates were calculated by dividing the total phase emissions by the distance the vehicle traveled during that phase. For all calculations, mileage was that as measured by the rear dynamometer rollers. Composite emission rates for the entire run were calculated using the following formula:

$$C = 0.43\left[\frac{Pol1 + Pol2}{D1 + D2}\right] + 0.57\left[\frac{Pol2 + Pol3}{D2 + D3}\right]$$

Where:

C = Composite emission rate for the run (grams/mile)
Pol1 = Total pollutant (HC, CO, CO_2, NO_x or $PM_{2.5}$) emissions for phase 1 (grams/mg)
Pol2 = Total pollutant (HC, CO, CO_2, NO_x or $PM_{2.5}$) emissions for phase 2 (grams/mg)
Pol3 = Total pollutant (HC, CO, CO_2, NO_x, or $PM_{2.5}$) emissions for phase 3 (grams/mg)
D1 = Phase 1 distance traveled (miles)
D2 = Phase 2 distance traveled (miles)
D3 = Phase 3 distance traveled (miles)

4.4.1 Summary of Round 1 Regulated Emissions Measurements

288 dynamometer tests were conducted from July 12, 2004 through October 2, 2004. 47 tests were performed using the new pitot-tube flowmeter, and 241 tests were performed with the hot-wire anemometer flowmeter. Table 4-8 provides a side-by-side comparison of Round 1 PEMS vs. dynamometer composite results aggregated from second-by-second (SBS) data. The PEMS data was obtained using the hot-wire anemometer. Control vehicle test results are not included in Table 4-8. The dynamometer test results are based on speed and emissions time-aligned second-by-second data, integrated for each phase. The PEMS test results were calculated by using speed and emissions time-alignment methodology developed by Sensors, Inc. Although EPA staff identified some incorrect flow rate readings as measured by the PEMS hot-wire anemometer flowmeters, the data presented in Table 4-8 are based on emission rate calculations corrected for these flow inaccuracies.

Table 4-8. By-Test Comparison of Round 1 PEMS vs. Dynamometer Composite Results

RunID	Temp (F)	RH (%)	Composite HC (g/mi)			Composite CO (g/mi)			Composite NO_x (g/mi)			Composite CO_2 (g/mi)			PM2.5 (mg/mi)	PEMS DATASuspect	Dyno DATASuspect
			PEMS	Dyno	%Diff	PEMS	Dyno	%Diff	PEMS	Dyno	%Diff	PEMS	Dyno	%Diff			
84032	82.3	55.9	0.05	0.12	62.14	0.49	0.43	12.9	0.09	0.1	8.1	358.89	359.64	0.21	2.667	x	
84034	84.1	59.4	0.1	0.12	15.75	3.12	2.15	45.04	0.54	0.46	17.11	553.22	502.92	10	2.735		
84035	85.6	58.1	0.26	0.29	11.34	4.84	3.47	39.47	0.58	0.51	12.41	829.64	697.48	18.95	5.943		
84036	80.5	65.7	0.2	0.2	2.59	7.48	6.64	12.7	1.64	1.63	1.07	343.57	347.55	1.15	1.861	x	
84037	83.2	58.5	2.18	1.55	40.93	54	32.34	66.98	1.86	1.25	48.88	999.49	659.41	51.57	9.205	x	
84039	79.5	79.7	0.17	0.22	22.77	2.42	2.05	17.72	0.23	0.18	31.51	687.53	668.97	2.77	2.705		
84042	76.0	75.6	0.32	0.31	2.08	5.54	4.74	17.02	0.67	0.63	6.23	322.05	318.2	1.21	2.717		
84043	77.5	70.5	0.63	0.57	11.74	12.34	10.41	18.57	2.43	2.31	5.14	328.11	288.37	13.78	3.551		
84047	79.9	66.2	0.12	0.14	16.4	1	0.87	15.61	0.07	0.07	0.31	426.67	437.27	2.42	1.735		
84048	83.2	63.9	0.95	1.1	13.26	9.77	9.04	8.1	3.36	3.41	1.35	404.66	419.55	3.55	60.070		
84050	82.0	80.3	0.07	0.08	7.8	3.35	2.88	16.55	0.07	0.06	30.9	422.82	365.13	15.8	1.589		
84051	84.0	71.8	0.17	0.18	4.48	5.25	5.15	1.92	0.83	0.86	3.59	340.36	359.84	5.42	0.580		
84052	89.1	60.0	0.48	0.47	3.12	6.28	5.22	20.17	2.13	2.1	1.38	496.24	457.68	8.42	5.563		
84054	94.1	47.5	0.19	0.21	7.45	3.16	2.83	11.69	1.17	1.1	5.74	520.38	507.74	2.49	2.641		
84055	95.8	50.1	1.1	1.06	3.37	11.62	9.7	19.79	5	4.13	20.92	598.08	504.1	18.64	4.883		
84056	85.4	70.3	0.1	0.1	0.79	3.86	3.43	12.43	0.31	0.3	5.07	532.78	531.17	0.3	1.468		
84057	85.9	69.2	0.51	0.51	1.8	16.55	16.17	2.34	0.1	0.09	6.16	274.9	280.47	1.99	1.213		
84058	87.3	65.2	0.12	0.13	10.7	0.97	0.92	5.39	0.29	0.33	10.84	453.18	459.34	1.34	1.123		
84060	90.3	63.8	0.1	0.1	0.5	1.11	1	10.46	0.96	0.93	3.1	454.28	472.34	3.82	1.080		
84061	91.5	57.7	0.59	0.53	10.71	5.9	4.87	21.29	1.11	1.06	4.17	408.73	350.69	16.55	1.573		
84062	83.9	80.3	0.07	0.07	5.39	0.71	0.64	11.19	0.86	0.92	6.37	442.69	479.74	7.72			
84063	85.3	72.5	0.13	0.13	0.83	0.71	0.78	9.57	0.54	0.55	1.53	310.08	340.02	8.8	2.144		
84064	84.7	72.3	0.27	0.28	2	4.1	3.36	22.28	1.23	1.27	2.51	426.96	441.66	3.33			
84066	87.4	66.1	1.12	0.46	**142.77**	27.96	15.44	81.07	0.59	0.37	58.1	672.38	434.73	54.66	6.465		x

RunID	Temp (F)	RH (%)	Composite HC (g/mi)			Composite CO (g/mi)			Composite NO_x (g/mi)			Composite CO_2 (g/mi)			PM2.5 (mg/mi)	PEMS DATASuspect	Dyno DATASuspect
			PEMS	Dyno	%Diff	PEMS	Dyno	%Diff	PEMS	Dyno	%Diff	PEMS	Dyno	%Diff			
84067	87.8	65.0	0.4	0.44	9.02	5.99	5.51	8.74	1.48	1.58	6.15	425.97	443.94	4.05	1.944		
84068	76.7	88.6	0.09	0.11	12.8	2.42	1.97	22.77	0.29	0.32	10.11	440.7	463.2	4.86	0.404		
84069	76.8	84.1	0.2	0.21	8.53	1.56	1.44	8.32	0.63	0.68	6.85	408.86	444.44	8	0.566		
84071	77.2	84.5	2.63	2.23	18.02	14.42	11.21	28.6	3.68	5.29	30.48	410.91	340	20.86	38.519		
84072	64.7	92.0	0.07	0.1	22.2	0.63	0.54	15.42	0.19	0.19	0.17	494.59	512.39	3.47	1.614		
84073	62.4	84.5	0.38	0.39	2.49	5.93	6.07	2.31	1.42	1.44	1.1	439.84	455.74	3.49	3.083		
84074	60.2	88.5	0.51	0.36	44.49	18.22	12.17	49.77	6.12	4.52	35.26	512.97	388.82	31.93	6.481		
84076	61.1	92.3	4.94	4.7	5.03	66.23	67.86	2.4	3.87	3.34	15.68	515.34	474.27	8.66	16.155		
84077	66.6	85.0	0.08	0.07	10.87	3.24	3.17	2.26	0.19	0.2	7.11	252.5	263.19	4.06	0.905		
84078	70.4	70.3	0.12	0.12	3.12	2.27	2.75	17.45	0.31	0.31	0.81	353.85	380.25	6.94	0.554		
84079	74.1	61.9	2.6	1.86	39.81	101.49	63.78	59.11	1.64	0.98	67.65	675.47	368.01	83.55	32.506	x	x
84082	71.9	53.0	0.05	0.06	9.09	0.55	0.44	23.56	0.11	0.11	0.15	446.18	456.78	2.32	1.068		
84083	76.1	42.5	0.09	0.09	1.94	2.89	3.12	7.35	0.2	0.18	12.17	365.09	366.75	0.45	0.850		
84084	78.0	38.4	0.11	0.12	9.68	1.07	1.02	4.93	0.74	0.65	14.28	396.86	413.29	3.98	0.711		
84086	73.7	49.4	0.1	0.1	1.81	1.36	1.33	2.29	0.1	0.11	7.94	535.43	505.9	5.84	2.760		
84087	77.4	44.1	0.12	0.11	7.06	1.26	1.11	13.23	0.4	0.35	13	382.21	394.33	3.07	1.757		
84088	80.1	40.8	0.22	0.23	7.24	2.23	2.32	3.99	1.35	0.53	**152.28**	413	446.05	7.41	1.304		
84090	83.1	40.5	0.11	0.13	15.49	1.31	1.21	8.47	0.36	0.35	3.65	458.94	467.92	1.92	0.693		
84091	82.9	43.9	0.26	0.28	8.13	5.61	5.52	1.59	0.84	0.72	17.69	521.32	519.31	0.39	1.053		
84092	73.9	58.1	0.05	0.07	19.16	0.54	0.5	6.86	0.97	0.88	10.15	285.43	313.93	9.08	1.452		
84093	75.7	51.1	0.15	0.19	21.33	1.54	1.5	2.46	0.68	0.6	14.23	334.93	366.35	8.58	1.327		
84094	78.0	47.1	0.28	0.3	6.74	9.66	8.4	14.93	2.47	1.89	31.06	522.59	510.49	2.37	2.055		
84096	78.6	45.7	0.95	1.04	8.92	10.44	10.25	1.87	1.89	1.62	16.79	507.19	486.87	4.17	5.146		
84097	69.9	65.0	0.06	0.08	20.46	0.31	0.2	57.76	0.09	0.09	0.47	429.7	435.3	1.29	0.809		
84098	70.8	63.5	0.16	0.16	1.04	1.61	1.38	16.51	0.41	0.36	13.31	468.78	483.86	3.12	0.603		
84099	73.4	57.6	0.3	0.32	5.93	1.85	1.74	6.45	0.42	0.38	10.93	376.14	411.83	8.67	3.350		

RunID	Temp (F)	RH (%)	Composite HC (g/mi)			Composite CO (g/mi)			Composite NO_x (g/mi)			Composite CO_2 (g/mi)			PM2.5 (mg/mi)	PEMS DATASuspect	Dyno DATASuspect
			PEMS	Dyno	%Diff	PEMS	Dyno	%Diff	PEMS	Dyno	%Diff	PEMS	Dyno	%Diff			
84101	77.4	49.9	0.56	0.55	1.79	26.29	22.72	15.69	2.58	2.16	19.71	380.55	381.24	0.18	10.186		
84102	80.8	44.5	0.18	0.19	4.99	7.23	7.13	1.4	0.67	0.59	13.13	246.24	252.93	2.64	0.717		
84103	74.6	60.7	0.16	0.17	7.42	1.08	1	7.8	0.56	0.48	16.35	423.43	424.34	0.22	0.459		
84104	78.1	55.7	0.18	0.18	3.6	2.16	2.16	0.01	0.86	0.71	20.27	470.87	490.8	4.06	1.640		
84105	81.1	51.7	0.31	0.32	2.72	4.77	4.36	9.47	0.59	0.54	8.46	286.23	300.67	4.8	1.264		
84107	86.0	39.4	0.25	0.27	6.89	4.06	3.78	7.31	0.86	0.73	17.14	454.52	451.4	0.69	3.963		
84108	87.6	38.7	0.68	0.64	5.63	14.14	12.21	15.81	3.15	2.65	18.8	349.93	323.96	8.01			
84109	83.0	59.1	0.16	0.17	6.63	2.07	1.96	5.52	0.88	0.75	18.46	468.47	475.23	1.42			x
84110	84.7	56.8	0.19	0.19	4.23	5.31	5.04	5.19	0.63	0.58	7.96	346.26	349	0.78	10.088		
84111	88.4	51.6	0.18	0.17	4.52	2.57	2.33	10.15	1.06	0.91	16.6	449.39	464.32	3.22	4.147		
84115	84.0	57.1	0.22	0.23	6.39	7.84	5.92	32.56	0.58	0.7	17.92	361.49	362.39	0.25		x	
84116	87.6	49.5	0.21	0.2	5.12	2.94	2.43	21.27	0.77	0.91	15.94	464.24	465.33	0.24		x	
84119	91.9	44.5	1.57	1.83	14.18	13.25	13.96	5.12	5.67	5.7	0.67	504.9	506.36	0.29		x	
84121	82.9	60.0	0.06	0.08	20.56	0.5	0.39	27.73	0.06	0.08	15.37	453.09	454.15	0.23	0.718	x	
84122	83.3	57.5	0.14	0.17	13.89	1.25	1.31	4.69	0.35	0.34	3.1	469.83	470.91	0.23	1.847	x	
84123	85.1	56.2	0.85	0.91	6.5	26.57	25.94	2.42	1.02	1.04	1.93	264.32	264.99	0.25		x	
84126	80.5	61.7	0.78	0.84	7.51	10.08	11.56	12.88	1.53	1.73	11.35	505.74	507.19	0.29	2.971	x	
84128	73.5	47.6	0.24	0.24	2.22	2.74	3.03	9.81	0.41	0.45	9.4	399.38	400.4	0.25	4.448	x	
84129	75.4	45.2	0.21	0.24	11.63	3.12	3.27	4.73	0.38	0.43	12.78	368.91	369.72	0.22	2.529	x	x
84131	79.4	38.8	0.14	0.15	7.94	4.41	3.73	18.33	0.55	0.59	7.26	361.6	362.3	0.19	2.209	x	
84132	80.3	38.3	0.99	1.08	8.73	12.24	11.43	7.08	2.3	2.47	6.87	460.73	461.58	0.18	4.399	x	
84133	68.8	53.0	0.15	0.15	2.19	1.25	1.25	0.42	0.3	0.35	12.62	438.83	439.81	0.22	0.901	x	
84134	72.9	43.6	0.25	0.28	12.29	9.34	8.29	12.66	1.66	1.61	2.72	525.48	519.88	1.08	2.051		
84135	75.2	38.3	0.4	0.43	7.05	4.7	5.02	6.4	0.59	0.57	4.34	352.89	386.86	8.78	2.257		
84137	76.9	34.9	0.4	1.04	61.57	4.17	10.16	58.92	0.58	2.37	75.53	176.3	463.33	61.95		x	
84140	75.1	44.9	0.08	0.09	13.19	1.02	1.01	1.01	0.23	0.21	6.14	460.13	505.35	8.95			

RunID	Temp (F)	RH (%)	Composite HC (g/mi)			Composite CO (g/mi)			Composite NO_x (g/mi)			Composite CO_2 (g/mi)			PM2.5 (mg/mi)	PEMS DATASuspect	Dyno DATASuspect
			PEMS	Dyno	%Diff	PEMS	Dyno	%Diff	PEMS	Dyno	%Diff	PEMS	Dyno	%Diff			
84145	79.2	49.2	1.12	1.15	2.78	14.79	13.71	7.86	2.39	2.07	15.48	281.88	279.58	0.82	1.344		
84146	82.4	46.6	1.51	1.18	28.04	12.94	9.78	32.24	1.97	1.62	21.4	453.86	376.33	20.6			
84148	83.8	43.5	1.91	1.16	64.14	17.53	7.67	**128.7**	4.42	3.43	28.97	533.7	429.21	24.35	46.326	x	
84149	69.6	49.4	0.07	0.08	15.79	0.71	0.71	0.26	0.07	0.09	19.64	293.88	341.68	13.99	0.959		
84150	68.3	48.5	0.16	0.16	1.45	4.6	4.44	3.59	0.38	0.37	2.67	511.06	511.43	0.07	4.786	x	
84151	69.4	46.8	0.08	0.09	11.95	1.92	3.32	42.29	0.21	0.21	1.84	373.98	399.82	6.46			
84153	76.0	38.1	0.11	0.12	5.19	0.83	0.66	25.32	0.49	0.4	22.15	573.64	569.86	0.66	6.948		
84154	78.4	33.7	23.02	12.04	91.22	177.32	112.41	57.75	6.65	4.58	45.36	932.19	563.62	65.39	80.266	x	x
84156	65.4	59.4	0.11	0.11	3.82	4.96	4.64	6.91	0.24	0.22	9.73	361.58	393.14	8.03			
84157	65.9	54.5	0.49	0.46	6.23	6.19	5.64	9.86	0.8	0.82	3.29	281.97	297.23	5.13	2.989		
84160	62.0	56.0	0.13	0.12	0.77	2.29	2.07	10.72	0.39	0.35	14.23	394.08	382.2	3.11	0.669		
84161	65.4	52.9	0.23	0.25	4.17	0.99	0.98	0.43	0.75	0.78	4.59	478.11	479.84	0.36	6.567	x	x
84162	67.3	41.7	0.65	0.47	38.08	27.86	23.98	16.2	1.34	0.81	65.95	711.57	422.92	68.25	25.586	x	
84164	70.8	36.6	0.18	0.19	3.14	1.54	1.46	5.88	0.27	0.26	1.46	408.6	454.16	10.03			
84165	71.6	37.5	3.57	3.39	5.25	14.02	12.96	8.11	4.75	4.4	7.82	323.41	313.81	3.06	19.417		
84166	71.5	39.2	0.36	0.34	5.63	7.82	7.07	10.63	1.35	1.24	8.26	431.62	435.04	0.78	0.690		
84168	70.1	46.7	0.12	0.14	14.74	2.11	1.97	6.92	0.76	0.78	2.48	445.32	446.85	0.34		x	
84169	70.7	44.0	0.26	0.27	4.8	6.02	4.8	25.56	1.1	1.28	14.48	424.72	426.15	0.33		x	
84171	70.8	44.8	2.77	1.18	**134.28**	29.06	14.79	96.46	2.09	1.37	52.59	451.7	277.37	62.85	40.870	x	
84172	73.0	39.6	0.39	0.45	13.06	6.75	5.72	18.14	0.78	0.93	16.32	472.75	428.61	10.3	13.510		
84173	65.2	57.5	0.45	0.47	4.29	5.38	5.18	3.74	1.16	1.12	3.38	357.56	376.71	5.08		x	
84174	66.9	54.6	0.36	0.37	2.69	2.16	1.65	31.23	1.54	1.29	19.17	538.76	532	1.27		x	
84175	70.1	47.8	1.31	1.26	4.34	8.27	7.75	6.76	2.05	1.71	19.83	460.86	446.42	3.23	3.696		
84178	68.7	54.4	0.22	0.23	2.79	2.96	2.67	10.79	0.65	0.61	7.03	363.72	396.68	8.31	1.165		
84179	72.9	43.5	0.48	0.49	1.71	7.4	6.67	10.93	1.57	1.28	23.06	509.54	498.51	2.21	1.972		
84180	74.6	44.4	1.32	1.33	1.24	10.27	9.09	12.97	2.34	2	17.34	461.23	465.02	0.82	9.349		

RunID	Temp (F)	RH (%)	Composite HC (g/mi)			Composite CO (g/mi)			Composite NO_x (g/mi)			Composite CO_2 (g/mi)			PM2.5 (mg/mi)	PEMS DATASuspect	Dyno DATASuspect
			PEMS	Dyno	%Diff	PEMS	Dyno	%Diff	PEMS	Dyno	%Diff	PEMS	Dyno	%Diff			
84182	76.7	45.1	0.71	0.47	53.35	20.37	12.04	69.1	2.55	1.4	82.37	900.91	562.68	60.11	12.074		
84183	74.8	58.9	0.15	0.14	5.73	1.89	1.54	22.3	0.57	0.59	3.95	297.19	332.35	10.58			
84184	77.6	53.1	0.16	0.15	7.12	8.19	7.05	16.2	0.13	0.11	23.91	303.94	320.72	5.23	1.944		
84185	80.5	50.6	0.34	0.36	3.75	5.31	4.85	9.42	0.78	0.68	15.72	299.76	309.48	3.14	3.319		
84188	80.2	45.7	6.68	4.67	42.96	86.71	65.36	32.66	2.69	2.1	27.66	626.1	499.83	25.26	40.325		
84189	84.4	41.4	2.25	18.42	87.79	252.9	198.38	27.48	1.98	1.51	31.4	429.35	347.12	23.69	287.856		x
84191	68.4	45.9	0.32	0.22	46.45	2.32	2.11	9.72	0.38	0.38	1.28	351.62	379.88	7.44	2.254		
84192	68.7	45.6	0.09	0.07	35.64	1.1	1.09	1.34	0.21	0.19	7.05	460.46	502.92	8.44	5.243		x
84193	68.9	45.0	0.09	0.1	13.08	3.52	2.97	18.87	0.56	0.56	0.21	405.09	434.16	6.7	5.842		
84195	70.2	44.1	0.09	0.13	36.08	1.1	1	10.13	0.51	0.4	28.1	407.91	448.15	8.98	0.572		
84196	68.0	51.4	1.23	2.06	40.51	15.75	14.98	5.15	3.5	3.03	15.73	485.34	475.38	2.09	8.027		
84197	64.3	66.6	0.32	0.35	9.46	6.51	6.51	0.04	2.09	2.07	1	360.07	420.63	14.4	0.969		
84198	65.8	63.2	0.41	0.42	2.91	4.07	4.92	17.18	0.58	0.58	1.46	289.04	346.82	16.66	2.165		
84200	65.2	68.8	0.46	0.48	3.51	5.45	6.26	12.82	0.67	0.66	1.89	294.91	355.58	17.06			
84201	65.0	67.6	5.95	5.66	5.24	72.76	78.19	6.94	3.97	3.47	14.3	433.29	413.92	4.68	12.512		
84205	75.1	68.8	0.15	0.14	4.07	4.38	3.49	25.59	0.77	0.56	38.59	610.43	601.46	1.49	8.527		
84206	75.2	67.1	0.87	0.8	8.76	13.89	13.02	6.65	0.89	0.65	37.54	576.25	574.84	0.25	1.392		
84208	75.7	66.8	2.23	2.21	1.11	31.08	28.44	9.28	4.68	3.9	20.15	513	500.58	2.48	54.502	x	
84209	71.7	71.1	0.48	0.52	6.43	11.52	12.33	6.55	4.41	3.77	17.09	401.39	404.63	0.8			
84210	71.3	69.7	0.7	0.82	14.17	12.51	11.52	8.56	3.24	2.87	12.82	340.46	338.87	0.47	12.448		
84211	71.9	69.1	0.45	0.46	3.6	11.18	9.59	16.52	1.22	1.04	17.35	431.67	416.66	3.6	31.956		
84213	75.7	54.3	0.68	0.59	14.07	31.47	23.22	35.57	1.25	0.97	28.56	564.77	551.42	2.42	6.098		
84214	78.6	61.5	0.05	0.15	67.84	2.09	1.92	8.58	0.85	0.63	34.34	479.04	490.94	2.42	6.799		
84215	79.8	58.5	0.1	0.19	48.08	2.46	2.03	21.23	0.84	0.63	33.49	440.71	450.1	2.09	3.811		
84242	79.2	10.4	0.15	0.25	38.71	1.37	1.34	2.3	0.62	0.43	44.75	425.81	452.08	5.81			
84244	80.8	45.4	0.95	1.56	38.78	23.32	20.15	15.7	3.09	2.98	3.82	365.96	327.95	11.59	22.176		

RunID	Temp (F)	RH (%)	Composite HC (g/mi)			Composite CO (g/mi)			Composite NO_x (g/mi)			Composite CO_2 (g/mi)			PM2.5 (mg/mi)	PEMS DATASuspect	Dyno DATASuspect
			PEMS	Dyno	%Diff	PEMS	Dyno	%Diff	PEMS	Dyno	%Diff	PEMS	Dyno	%Diff			
84245	81.8	24.3	1.13	2.97	61.82	26.69	18.05	47.81	3.44	2.13	61.27	576.97	382.58	50.81	48.725	x	
84246	74.7	49.7	0.58	0.73	20.6	12.84	10.54	21.79	1.68	1.21	38.9	505.35	493.75	2.35	23.560		
84250	81.1	46.2	0.95	2.93	67.72	33.67	27.26	23.51	2.68	2.57	4.44	342.18	316.52	8.11	10.171		
84252	75.1	34.4	0.12	0.16	24.56	1.33	1.24	7.77	0.11	0.06	88.23	462.3	467.93	1.2			
84253	77.7	35.8	0.14	0.21	33.92	5.88	5.04	16.59	1.08	0.92	17.17	451.6	444.32	1.64			
84256	81.7	36.9	0.23	0.42	45.76	9.99	8.86	12.77	1.54	1.44	7.5	432.05	445.46	3.01	6.269		
84257	82.1	37.1	0.4	0.55	27.24	6.47	5.69	13.76	2.56	2.19	17.01	476.04	464.02	2.59			
84258	70.8	1.5	0.26	0.29	9.59	3.96	4.23	6.46	2.04	1.49	36.95	458.31	483.61	5.23	4.880		x
84261	66.0	65.7	0.87	1.22	29	11.1	11.69	4.99	1.93	2	3.6	154.42	170.06	9.19	9.607	x	
84262	71.8	50.2	0.28	0.44	35.04	9.32	8.32	11.97	1.8	1.57	14.46	463.88	486.53	4.66			x
84263	74.5	41.8	0.86	1.2	28.65	52.41	42.59	23.04	2.68	2.58	3.75	387.27	396.37	2.3	19.701		
84265	78.4	37.2	0.92	11.11	91.69	57.84	132.78	56.43	0.73	1.23	40.73	320.45	515.74	37.87	153.506		
84266	72.3	54.8	0.05	0.09	37.52	0.4	0.3	34.39	0.13	0.14	7.02	320.85	359.95	10.86	2.271		
84267	74.3	47.5	0.24	0.34	27.99	5.95	5.56	6.85	1.28	1.19	7.27	367.62	374.95	1.96	3.600		
84268	76.7	39.8	0.5	0.72	31.29	3.31	2.72	21.6	4.59	3.81	20.52	629.69	586.28	7.41	25.712		
84270	79.6	30.6	0.71	0.94	25.05	12.16	11.1	9.56	1.89	1.71	10.38	504.6	497.67	1.39	24.542		
84271	81.5	30.2	0.86	1.28	32.45	13.26	11.8	12.31	9.17	7.51	22.18	540.77	505.67	6.94	5.753		
84272	72.3	65.2	0.08	0.08	1.08	1.03	1.14	9.7	0.08	0.08	2.01	409.29	424.22	3.52	1.957		
84274	74.4	49.6	0.53	0.5	7.01	8.24	7.29	13.03	2.14	1.87	14.07	292.09	305.88	4.51	5.607		
84276	78.7	33.8	0.2	0.21	0.92	2.67	2.48	7.48	1.38	1.12	22.71	474.2	465.55	1.86	1.967		
84277	79.3	30.4	19.51	14.49	34.62	304.96	149.22	**104.37**	1.19	1.02	16.46	507.06	265.49	90.99	260.854	x	
84278	79.9	33.7	0.61	0.57	7.23	11.29	10.73	5.18	0.74	0.63	18.02	440.4	424.36	3.78	11.551		
84279	77.1	47.2	0.09	0.11	18.12	5.48	4.02	36.29	0.2	0.18	12.26	443.29	467.22	5.12	4.789		x
84280	78.9	44.4	0.08	0.08	3	3.34	2.93	13.81	0.7	0.65	7.68	305.53	314.33	2.8	1.076		
84281	80.5	38.7	0.49	0.47	4.09	12.69	11.12	14.12	1.56	1.22	28.34	713.07	653.66	9.09	9.896		
84283	82.8	37.2	7.79	5.75	35.46	106.71	78.62	35.74	2.41	1.65	46.12	663.41	429.87	54.33	73.083	x	x

RunID	Temp (F)	RH (%)	Composite HC (g/mi)			Composite CO (g/mi)			Composite NO_x (g/mi)			Composite CO_2 (g/mi)			PM2.5 (mg/mi)	PEMS DATASuspect	Dyno DATASuspect
			PEMS	Dyno	%Diff	PEMS	Dyno	%Diff	PEMS	Dyno	%Diff	PEMS	Dyno	%Diff			
84284	83.9	35.6	1.46	1.31	12.04	40.52	29.33	38.13	5.71	4.58	24.63	556.28	516.67	7.67	72.460		
84285	79.2	56.1	0.12	0.13	11.01	5.94	5.7	4.24	0.12	0.14	11.81	295.44	337.93	12.57	2.000		
84286	80.7	53.0	0.2	0.23	11.64	5.43	5.15	5.41	2.72	2.21	23.1	547.65	531.74	2.99	2.888		
84287	83.5	49.8	1.2	0.64	87.61	12.12	7.57	60.15	2.67	1.55	72.17	721.21	488.37	47.68	48.349	x	
84289	86.7	41.2	5.66	4.96	14.21	79.72	69.04	15.46	5.56	4.96	12.17	514.29	456.03	12.77	163.729		x
84291	80.4	56.4	0.21	0.28	23.67	3.54	4.34	18.47	0.35	0.36	1.1	228.46	283.81	19.5	5.454		
84292	80.8	56.9	0.29	0.28	4.11	10.1	7.53	34.16	0.95	0.76	24.53	432.66	411.99	5.02	11.424		
84293	79.7	61.8	1.23	1.1	12.43	11.93	10.07	18.53	3.11	2.55	22.24	475.82	408.26	16.55	6.235		
84295	79.5	59.8	8.09	4	**102.05**	50.87	44.74	13.71	3.34	2.54	31.42	562.93	498.48	12.93	58.905		
84296	68.1	64.6	0.08	0.09	16.5	3.64	3.66	0.37	0.07	0.08	3.26	257.72	276.26	6.71	3.077		x
84297	70.9	50.9	0.37	0.36	2.48	9.17	8.5	7.9	0.86	.		410.81	387.82	5.93	1.762		x
84298	74.0	44.2	0.26	0.23	10.94	10.17	7.55	34.72	1.15	0.86	33.52	900.28	694.88	29.56	27.060		
84300	77.1	33.1	0.17	0.18	5.17	1.96	1.88	4.32	0.42	0.39	7.68	456.95	459.54	0.56	1.305		
84301	78.1	31.3	5.12	3.35	52.57	58.69	31.8	84.53	2.7	1.66	62.71	822.24	467.13	76.02	9.748	x	x
84302	79.1	32.1	0.5	0.53	6.83	6.81	6.14	10.94	2.16	1.9	13.65	573.72	535.35	7.17	7.079		
84303	65.1	63.6	0.06	0.07	21.51	0.88	0.75	16.98	0.32	0.25	30.28	581.99	516.09	12.77	2.529		
84304	71.2	47.3	0.04	0.05	25.73	1.17	1.07	8.75	0.15	0.15	3.37	311.6	328.26	5.08	2.158		
84305	74.2	42.5	0.12	0.13	5.26	1.72	1.7	1.1	0.58	0.52	10.08	403.45	409.78	1.55	1.305		
84307	76.8	41.1	0.2	0.22	8.96	3.81	3.6	5.71	0.6	0.6	0.31	385.04	392.86	1.99	1.710		
84308	77.4	42.3	0.25	0.27	6.61	8.39	8.04	4.39	2.32	2.04	13.88	405.69	409.38	0.9	4.001		
84309	78.2	42.1	11.96	9.21	29.91	234.68	173.08	35.59	2.44	2.14	14.08	690.72	502.38	37.49	43.598		
84310	73.6	63.3	0.09	0.07	27.48	1.05	0.82	27.29	0.3	0.22	34.41	636.26	530.59	19.92	5.962	x	
84311	74.0	62.2	0.36	0.39	9.02	11.17	11.45	2.46	1.13	1.13	0.58	277.29	331.19	16.27	9.175		
84312	74.3	61.1	0.21	0.22	4.73	7.96	7.76	2.63	2.32	2	16.06	402.17	404.4	0.55			
84314	80.6	48.3	0.79	0.69	13.99	23.95	18.81	27.31	2.88	2.38	21.11	385.99	360.73	7	3.767		
84315	83.4	46.4	0.88	0.99	11.19	7.13	6.7	6.41	2.21	1.93	14.38	357.28	369.35	3.27	60.851		

RunID	Temp (F)	RH (%)	Composite HC (g/mi)			Composite CO (g/mi)			Composite NO_x (g/mi)			Composite CO_2 (g/mi)			PM2.5 (mg/mi)	PEMS DATASuspect	Dyno DATASuspect
			PEMS	Dyno	%Diff	PEMS	Dyno	%Diff	PEMS	Dyno	%Diff	PEMS	Dyno	%Diff			
84316	84.6	46.3	0.83	0.86	2.62	9.04	7.9	14.41	0.92	0.76	20.16	367.52	347.47	5.77	49.626		
84318	75.3	36.7	0.21	0.28	26.15	2.95	3.83	22.89	0.96	1.08	11.24	264.34	339.2	22.07	3.564		
84319	77.5	35.3	0.21	0.21	1.06	2.99	2.58	15.97	0.66	0.62	6.2	398.4	387.87	2.71	4.143		
84321	80.5	33.3	0.19	0.2	1.78	1.14	0.97	17.9	0.5	0.48	4.48	433.83	430.66	0.74	1.449		
84322	81.4	31.5	0.3	0.3	1.49	8.67	7.44	16.44	1.5	1.28	16.88	365.19	313.03	16.66	9.987		
84324	75.4	45.1	0.25	0.25	3.45	5.57	4.86	14.64	0.46	0.47	1.07	405.25	403.8	0.36	3.141		
84325	77.6	43.7	0.38	0.41	6.72	2.12	2.14	0.99	0.42	0.41	2.52	396.19	404.01	1.94	3.101		
84327	80.8	41.5	0.12	0.12	0.84	2.17	1.85	16.82	0.31	0.26	17.08	445.01	441.46	0.81	0.610		
84328	82.0	40.7	0.21	0.21	1.98	1.14	0.94	21.26	0.68	0.47	45.11	429.3	425.13	0.98			
84329	83.2	38.3	0.23	0.2	12.65	3.49	2.19	58.98	0.44	0.27	61.91	694.82	505.63	37.42		x	
84355	65.4	55.0	0.05	0.07	25.03	0.92	1.05	12.95	0.25	0.23	6.55	414.86	450.2	7.85	1.136		
84356	69.1	54.6	0.17	0.19	10.65	4.85	5.07	4.35	1.34	1.36	1.24	355.85	370.06	3.84	3.879		
84357	72.4	51.9	0.96	1.06	9.69	41.62	44.14	5.71	0.55	0.56	2.45	302.17	302.85	0.22	8.001		
84359	76.0	51.8	0.24	0.2	18.58	3.75	3.13	19.82	1.11	1.1	0.79	422.94	337.8	25.2			
Average*					**17.95**			**18.06**			**17.6**			**10.37**			

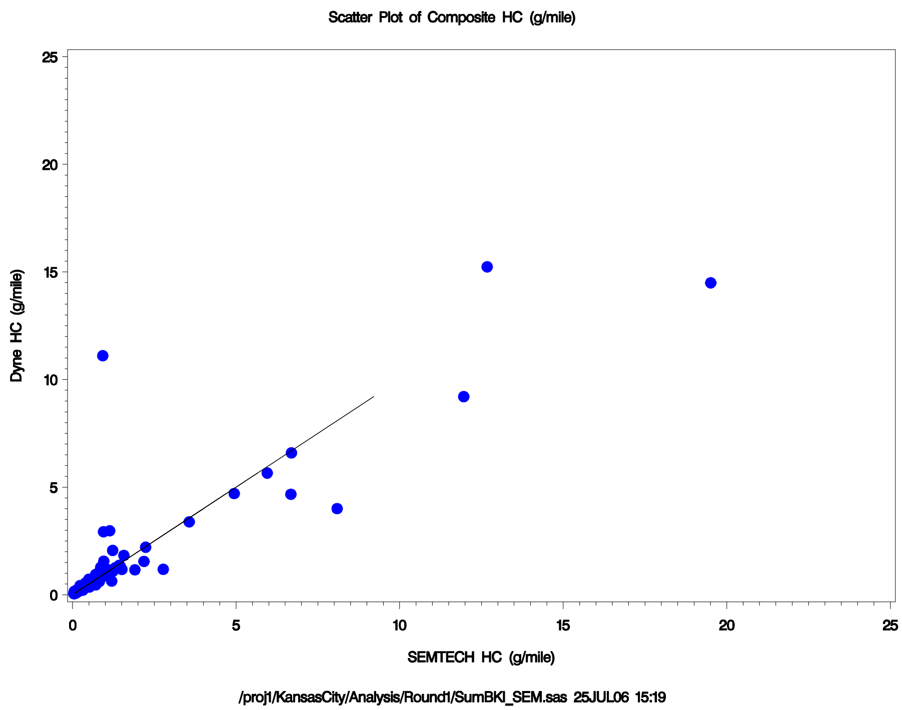
*The average percentage difference shown here is the average of the absolute value of the percentage difference for each run

In Table 4-8, percentage difference of gaseous emissions results between the PEMS and dynamometer two systems is shown for each run, and results with overall differences greater than 100% are indicated with bold font. Out of 220 tests, only six show a difference greater than 100% for a pollutant. Overall average percent differences are in the range of 10-18 percent for HC, CO, NO_x and CO_2. Comparison of phase-specific and total composite emission rates in the data shows a relatively good correlation between the PEMS and dynamometer methods of measurement. Complete (by-phase) results are provided in Appendices G and H. Analysis of results from the "Measurement Allowance for In-Use Testing" study being conducted in 2006 at Southwest Research Institute in San Antonio, Texas and also analysis of the dynamometer correlation results between the EPA dynamometer in Ann Arbor and the EPA portable Clayton dynamometer gathered during the Kansas City Pilot Study may provide insight into any possible bias issues between the two types of measurements systems. Results from DRI's gravimetrically-collected $PM_{2.5}$ measurements are also shown in Table 4-8 for reference. Additional information and results from particulate matter measurements are provided in Section 4.5.

The last two columns of Table 4-8 indicate dyno and PEMS records which may have suspicious regulated gaseous pollutant results, based on review of test data. For the dynamometer data, an "x" in the "dyno data suspect" column indicates either a test anomaly was noted in the onsite test log, or some issue was identified with the dynamometer data during subsequent data analysis, which could influence the overall test result. Some examples of data issues that would be noted include tests for which part or all of the real-time data was improperly collected or voided, tests where incorrect dynamometer loading was applied, tests where real-time sensors were saturated (pegged at maximum value), tests with equipment failures that would affect overall results, or tests where significant drive trace violations occurred. This review was only applied to dynamometer measurements collected during the study. Detailed notes pertaining to QC review of all dynamometer measurements are provided in Appendices S and V.

In addition to the dynamometer data review, all PEMS data was analyzed to identify missing information and indicators of potentially invalid results. This analysis involved performing a comparison of exhaust mass flow rates for each test with those of other vehicles with a similar engine displacement, comparison of exhaust temperatures of each tests with the exhaust temperatures of other vehicles of similar engine displacement, review of exhaust dilution levels (percentage CO + CO_2 in exhaust), review of ambient temperature measured during testing and review of test durations, distances, and measured fuel economy. PEMS tests with highly suspicious results are indicated with an "x" in the "PEMS data suspect" in Table 4-8, and detailed notes collected during review of Round 1 dyno PEMS tests are provided in Appendix O.

Figure 4-12 provides the same Round 1 PEMS vs. dyno comparison information graphically with a l:1 line for reference. HC, CO, NOx, and CO2 are depicted using dots, squares, triangles, and circle-crosses, respectively. Additional scatter plots of dynamometer results vs. the PEMS for each particular phase can be located in Appendices G and H. Results listed as "suspect" in Table 4-8 are not included in Figure 4-12.



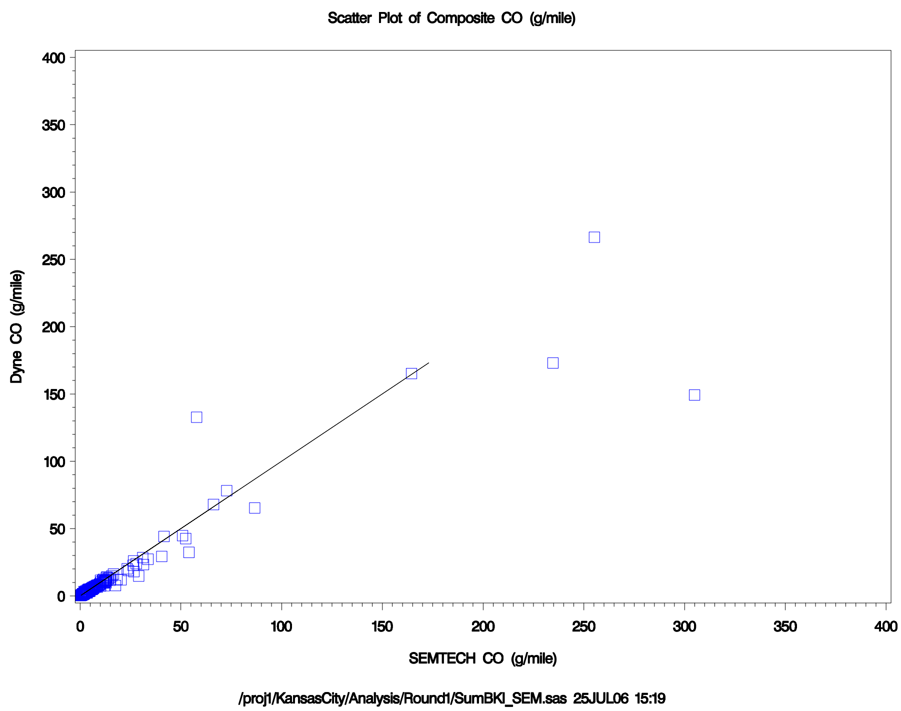
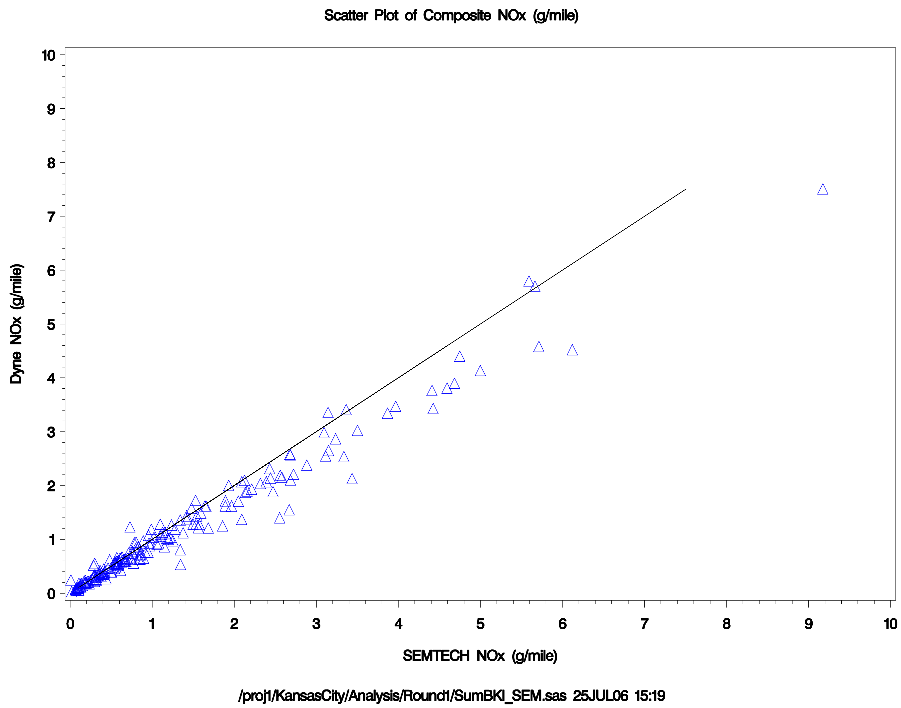


Figure 4-12. Plots of Round 1 Dyno vs. PEMS Measurements



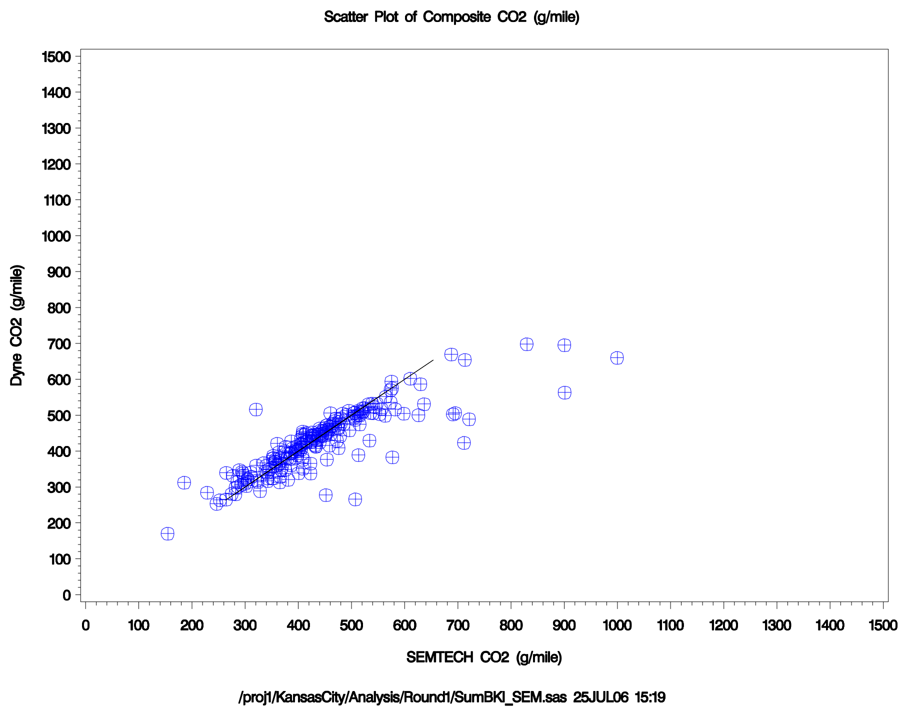


Figure 4-12 (Continued). Plots of Round 1 Dyno vs. PEMS Measurements

Table 4-9 provides results of all conditioning run tests conducted during Round 1, and Table 4-10 provides results of all driveaway tests conducted during Round 1. As with the PEMS data collected on the dynamometer, all conditioning run and driveaway results were reviewed to identify missing information and indicators of potentially invalid results, including an evaluation of exhaust mass flow rates, exhaust temperatures, dilution levels, ambient temperature measurements, test duration and distance and measured fuel economy. PEMS tests with highly suspicious results are indicated with an “x” in the “PEMS data suspect” column in Tables 4-9 and 4-10, and detailed notes collected during review of all Round 1 conditioning run and driveaway PEMS tests are provided in Appendices Q and R.

Table 4-9. Round 1 Conditioning Run Test Results

CTR_TST_ID	Make	Model	Model Year	Disp	Test Date	Test Duration (minutes)	Test Distance (miles)	Fuel Used (gal)	Test FE (mpg)	Composite CO2 (gpm)	Composite CO (gpm)	Composite NOx (gpm)	Composite THC (gpm)	Suspect Data
C_KS1_002_1	FORD	F150	1979	2.3	8/9/2004	23	.	1.39	N/A	N/A	N/A	N/A	N/A	x
C_KS1_003_1	DODGE	RAM250	1994	5.2	7/13/2004	22	7.8	0.84	9.3	929.9	14.47	3.22	0.84	
C_KS1_004_1	ISUZU	TROOPER	1999	3.5	7/13/2004	0	0.0	0.00	N/A	N/A	N/A	N/A	N/A	x
C_KS1_004_2	ISUZU	TROOPER	1999	3.5	7/13/2004	21	8.0	0.46	17.3	506.7	3.05	0.85	0.19	
C_KS1_005_1	GMC	YUKON XL	2001	5.3	7/13/2004	22	8.0	0.76	10.5	845.4	2.66	0.47	0.18	
C_KS1_006_1	FORD	ESCORT LX	1995	1.9	7/14/2004	21	8.0	0.30	26.5	327.3	5.75	0.91	0.20	
C_KS1_007_1	FORD	F-250	1979	5.7	7/14/2004	52	8.0	0.76	10.6	728.4	74.79	1.00	1.73	
C_KS1_009_1	TOYOTA	RAV4	2000	2.2	7/14/2004	23	8.0	0.39	20.4	427.9	5.40	0.69	0.26	
C_KS1_010_1	DODGE	SPIRIT	1990	2.5	7/15/2004	25	8.1	0.34	23.9	360.1	7.50	1.41	0.49	
C_KS1_011_1	FORD	F-150 XLT	2001	5.4	7/15/2004	22	8.0	0.65	12.3	713.5	6.29	0.38	0.32	
C_KS1_013_1	HONDA	CIVIC	1996	1.6	7/16/2004	21	8.0	0.26	30.4	269.5	14.14	0.67	0.59	
C_KS1_017_1	MAZDA	626	2001	2.5	7/17/2004	23	8.6	0.34	25.5	348.2	0.67	0.07	0.09	
C_KS1_018_1	DODGE	CARAVAN SE	1989	3	7/17/2004	23	8.1	0.40	20.3	423.1	7.69	3.37	1.62	
C_KS1_020_1	CHEVROLET	CORSICA	1996	2.2	7/19/2004	23	7.8	0.32	24.5	352.7	5.68	0.84	0.36	
C_KS1_021_1	HONDA	CIVIC SI	2002	2	7/19/2004	18	8.0	0.31	26.1	336.7	3.12	0.04	0.07	
C_KS1_022_1	GMC	JIMMY	1995	4.2	7/19/2004	21	8.0	0.57	14.0	623.5	5.78	1.48	0.34	
C_KS1_023_1	OLDSMOBILE	CUTLASS CIERA	1988	3.8	7/19/2004	28	8.0	0.33	24.2	357.0	5.94	1.05	0.55	
C_KS1_024_1	JEEP	CHEROKEE SPORT	1998	4	7/19/2004	0	.	0.00	N/A	N/A	N/A	N/A	N/A	x
C_KS1_024_2	JEEP	CHEROKEE SPORT	1998	4	7/19/2004	20	6.8	0.48	14.3	592.5	14.02	4.28	2.39	
C_KS1_025_1	CHEVROLET	CAVALIER	1990	2.2	7/20/2004	24	8.4	0.41	20.6	422.9	4.58	1.02	0.58	
C_KS1_026_1	CHRYSLER	300	1999	3.5	7/20/2004	21	7.7	0.41	18.8	468.1	2.83	0.41	0.40	
C_KS1_027_1	GMC	SATURN	2001	1.9	7/20/2004	20	8.1	0.23	34.5	257.2	0.71	0.24	0.04	
C_KS1_028_1	BUICK	LESABRE	1998	3.8	7/21/2004	19	7.5	0.41	18.2	487.3	0.65	1.30	0.13	
C_KS1_028_2	BUICK	LESABRE	1998	3.8	7/20/2004	22	8.1	0.41	19.5	460.6	0.34	0.66	0.10	
C_KS1_028_3	BUICK	LESABRE	1998	3.8	7/20/2004	1	0.0	0.00	N/A	N/A	N/A	N/A	N/A	x
C_KS1_030_1	NISSAN	FRONTIER	2002	3.3	7/20/2004	21	8.0	0.56	14.5	608.5	2.96	0.37	0.07	
C_KS1_032_1	SATURN	SATURN	1996	1.9	7/21/2004	21	8.0	0.41	19.7	447.9	1.26	0.66	0.20	
C_KS1_033_1	DODGE	CARAVAN	1995	3.3	7/21/2004	21	8.0	0.53	15.0	577.5	7.38	2.21	0.64	
C_KS1_035_1	MERCURY	VILLAGER LS	1994	2.5	7/21/2004	23	7.7	0.50	15.5	567.2	2.46	1.58	0.43	
C_KS1_036_1	JEEP	WRANGLER	1995	2.5	7/21/2004	19	6.3	0.45	14.0	617.8	9.87	0.68	0.47	
C_KS1_037_1	GMC	PONTIAC GRAND AM	1989	2.3	7/22/2004	19	7.7	0.39	19.7	419.0	16.07	6.88	2.54	
C_KS1_040_1	TOYOTA	SOLARA SLE	2001	3	7/22/2004	21	7.7	0.41	18.7	471.1	1.98	0.33	0.16	
C_KS1_041_1	DODGE	GRAND CARAVAN SPORT	1997	3.3	7/22/2004	20	8.0	0.52	15.4	573.6	1.35	1.31	0.16	
C_KS1_043_1	CHEVROLET	BLAZER	1995	4.3	7/23/2004	22	6.5	0.44	14.7	595.2	5.50	1.68	0.25	
C_KS1_044_1	CHEVROLET	S-10	2003	4.3	7/23/2004	22	7.7	0.50	15.5	570.7	1.27	0.84	0.18	

CTR_TST_ID	Make	Model	Model Year	Disp	Test Date	Test Duration (minutes)	Test Distance (miles)	Fuel Used (gal)	Test FE (mpg)	Composite CO2 (gpm)	Composite CO (gpm)	Composite NOx (gpm)	Composite THC (gpm)	Suspect Data
C_KS1_049_1	LINCOLN	TOWNCAR	1990	5	7/26/2004	20	8.0	0.55	14.7	560.5	23.42	2.11	4.62	x
C_KS1_050_1	HONDA	CIVIC EX	1999	1.6	7/24/2004	21	.	0.20	N/A	N/A	N/A	N/A	N/A	x
C_KS1_051_1	HONDA	ACCORD	1997	2.2	7/24/2004	23	8.0	0.32	25.3	352.3	1.23	0.37	0.09	
C_KS1_052_1	HONDA	ACCORD LX	1989	2	7/24/2004	20	7.6	0.47	16.3	420.7	80.42	1.08	2.31	x
C_KS1_056_1	HONDA	ACCORD EX	2000	2.2	7/26/2004	22	8.0	0.43	18.8	471.9	2.14	0.39	0.09	
C_KS1_056_2	HONDA	ACCORD EX	2000	2.2	7/26/2004	4	.	0.00	N/A	N/A	N/A	N/A	N/A	x
C_KS1_057_1	FORD	TAURUS SES	2003	3	7/26/2004	20	8.0	0.36	21.9	408.7	0.10	0.07	0.02	
C_KS1_057_2	FORD	TAURUS SES	2003	3	7/26/2004	6	.	0.00	N/A	N/A	N/A	N/A	N/A	x
C_KS1_058_1	CHEVROLET	MALIBU LS	1998	3.1	7/26/2004	19	8.0	0.38	21.0	424.4	1.02	0.68	0.18	
C_KS1_061_1	HONDA	ODYSSEY	2004	3.5	7/27/2004	20	8.0	0.48	16.6	538.0	1.14	0.12	0.18	
C_KS1_062_1	NISSAN	PATHFINDER LE	2003	3.5	7/27/2004	18	.	0.51	N/A	N/A	N/A	N/A	N/A	x
C_KS1_063_1	CHEVROLET	LUMINA	1998	3.1	7/27/2004	21	8.5	0.38	22.2	399.7	1.11	0.55	0.18	
C_KS1_064_1	FORD	MUSTANG	1999	4.6	7/27/2004	19	7.7	0.30	26.2	334.5	4.25	0.38	0.17	
C_KS1_065_1	HYUNDAI	TIBURON	2000	2	7/27/2004	20	7.7	0.31	24.9	408.7	1.32	0.33	0.06	
C_KS1_066_1	CADILLAC	SEVILLE	1991	4.9	7/27/2004	21	8.0	0.55	14.5	602.0	8.63	0.85	0.53	
C_KS1_067_1	SATURN	SL1	1999	1.9	7/28/2004	26	8.0	0.36	22.5	392.0	3.03	1.49	0.20	
C_KS1_067_2	SATURN	SL1	1999	1.9	7/28/2004	1	.	0.00	N/A	N/A	N/A	N/A	N/A	x
C_KS1_068_1	FORD	EXPLORER	1993	4	7/28/2004	42	8.0	0.56	14.4	608.5	8.47	2.76	0.33	
C_KS1_069_1	ISUZU	RODEO SL	1999	3.2	7/28/2004	21	8.0	0.46	17.4	501.5	6.92	1.67	0.70	
C_KS1_071_1	TOYOTA	RAV4	2000	2	7/28/2004	22	7.9	0.43	18.4	478.4	3.78	0.82	0.41	
C_KS1_072_1	NISSAN	SENTRA GXE	1997	1.6	7/28/2004	19	8.0	0.37	21.4	414.5	1.06	1.12	0.14	
C_KS1_073_1	FORD	RANGER	1999	3	7/29/2004	23	8.1	0.47	17.0	521.7	0.87	0.24	0.06	
C_KS1_074_1	MERCURY	SABLE LS	2002	3	7/29/2004	22	8.0	0.33	24.1	370.5	0.20	0.09	0.02	
C_KS1_075_1	TOYOTA	CAMRY	1994	2.2	7/29/2004	21	7.8	0.43	18.4	456.7	17.73	2.99	0.41	
C_KS1_076_1	HONDA	CIVIC	1984	1.5	8/3/2004	24	8.6	0.23	37.3	217.0	12.52	1.19	0.48	
C_KS1_076_2	HONDA	CIVIC	1984	1.5		0		0.27	0.0	N/A	N/A	N/A	N/A	x
C_KS1_077_1	TOYOTA	AVALON	1999	3	7/29/2004	21	8.0	0.31	25.7	344.9	1.19	0.46	0.23	
C_KS1_078_1	HONDA	CIVIC DX	1991	1.5	7/30/2004	23	8.0	0.40	19.9	429.5	11.05	2.87	1.03	
C_KS1_078_2	HONDA	CIVIC DX	1991	1.5	7/30/2004	0	.	0.00	N/A	N/A	N/A	N/A	N/A	x
C_KS1_080_1	JEEP	GRAND CHEROKEE	1995	4	8/2/2004	23	7.4	0.19	38.6	217.1	6.61	3.86	0.85	x
C_KS1_081_1	DODGE	RAM LE	1991	5.2	8/2/2004	22	8.0	0.56	14.4	585.1	17.71	3.36	1.31	
C_KS1_082_1	TOYOTA	COROLLA	1997	1.6	7/30/2004	21	7.8	0.28	28.3	311.7	1.92	0.68	0.32	
C_KS1_083_1	NISSAN	MAXIMA	2000	3	7/30/2004	20	8.0	0.38	21.3	416.4	1.03	0.89	0.20	
C_KS1_085_1	FORD	F-150	1995	5	7/31/2004	21	8.0	0.47	17.2	507.4	6.55	1.41	0.27	
C_KS1_086_1	FORD	CONTOUR	1995	2	7/31/2004	21	8.0	0.34	23.4	372.7	4.91	0.45	0.23	
C_KS1_088_1	CHEVROLET	S-10	1996	4.3	7/31/2004	21	8.0	0.32	25.1	351.1	2.48	0.50	0.18	
C_KS1_090_1	PONTIAC	GRAND PRIX	1993	3.1	7/31/2004	22	8.0	0.38	20.9	413.3	7.11	1.82	0.66	
C_KS1_092_1	FORD	EXPLORER	2000	4	8/2/2004	19	8.0	0.30	26.6	332.4	1.14	0.28	0.02	
C_KS1_093_1	CHEVROLET	SILVERADO	2002	5.3	8/2/2004	33	9.4	0.45	20.6	429.2	0.78	0.36	0.11	

CTR_TST_ID	Make	Model	Model Year	Disp	Test Date	Test Duration (minutes)	Test Distance (miles)	Fuel Used (gal)	Test FE (mpg)	Composite CO2 (gpm)	Composite CO (gpm)	Composite NOx (gpm)	Composite THC (gpm)	Suspect Data
C_KS1_094_1	PLYMOUTH	VOYAGER	1998	3.3	8/3/2004	21	.	0.46	N/A	N/A	N/A	N/A	N/A	x
C_KS1_094_2	PLYMOUTH	VOYAGER	1998	3.3	7/30/2004	22	8.0	0.40	20.1	441.3	1.60	0.63	0.17	
C_KS1_095_1	BUICK	LESABRE	1989	3.8	7/30/2004	19	7.9	0.41	19.2	459.9	2.08	0.87	0.30	
C_KS1_096_1	SUBARU	OUTBACK LEGACY	1996	2.2	7/29/2004	21	8.1	0.43	18.9	453.9	11.09	1.12	0.48	
C_KS1_097_1	FORD	THUNDERBIRD	1988	3.8	8/3/2004	47	8.5	0.55	15.5	542.5	18.36	1.91	1.43	x
C_KS1_098_1	FORD	EXPLORER XLT	1995	4	8/3/2004	21	8.1	0.56	14.5	603.6	6.07	2.85	0.25	
C_KS1_099_1	VOLVO	S80	2001	2.9	8/3/2004	18	8.0	0.30	26.4	335.0	0.74	0.22	0.10	
C_KS1_100_1	MAZDA	PROTÉGÉ	1991	1.8	8/11/2004	29	8.0	0.34	23.8	343.9	14.04	3.75	3.77	x
C_KS1_1012_1	NISSAN	MAXIMA	1992	3	8/24/2004	22	8.0	0.00	N/A	0.0	0.00	0.00	0.00	x
C_KS1_102_1	DODGE	GRAND CARAVAN SE	1999	3.3	8/3/2004	20	8.0	0.30	26.3	335.0	1.21	0.45	0.15	
C_KS1_103_1	CHRYSLER	TOWN & COUNTRY	2000	3.3	8/4/2004	21	8.0	0.46	17.4	509.4	1.17	0.59	0.11	
C_KS1_104_1	TOYOTA	CELICA	1999	2.2	8/4/2004	20	8.0	0.35	22.7	1023.5	2.71	0.04	0.17	x
C_KS1_105_1	JEEP	CHEROKEE SPORT	1993	4	8/6/2004	23	7.8	0.48	16.2	531.9	11.73	2.89	1.41	
C_KS1_105_2	JEEP	CHEROKEE SPORT	1993	4	8/4/2004	31	8.6	0.32	26.4	321.6	7.84	2.03	0.90	
C_KS1_107_1	TOYOTA	CAMRY LE	2000	2.2	8/4/2004	21	7.9	0.27	29.1	298.9	3.75	0.41	0.14	
C_KS1_108_1	CHEVROLET	CAVALIER	1997	2.2	8/4/2004	21	8.0	0.24	33.1	264.4	2.46	0.49	0.11	
C_KS1_109_1	MERCURY	GRAND MARQUIS GS	1997	4.6	8/5/2004	22	8.0	0.35	22.6	386.2	6.01	0.76	0.13	
C_KS1_110_1	BUICK	CENTURY LIMITED	1998	3.1	8/5/2004	22	7.7	0.25	30.5	288.9	3.01	0.26	0.19	
C_KS1_110_2	BUICK	CENTURY LIMITED	1998	3.1	8/5/2004	0	.	0.00	N/A	N/A	N/A	N/A	N/A	x
C_KS1_112_1	FORD	PROBE	1993	2.5	8/5/2004	23	8.0	0.43	18.5	458.3	15.39	0.94	1.06	
C_KS1_113_1	FORD	BRONCO	1995	5.8	8/5/2004	17	7.5	0.56	13.5	644.1	12.05	2.47	0.44	
C_KS1_114_1	CHRYSLER	CONCORD	2000	2.7	8/5/2004	20	8.0	0.39	20.4	433.8	2.56	0.94	0.39	
C_KS1_116_1	FORD	ESCORT ZX2	1999	2	8/6/2004	27	8.0	0.32	25.3	342.4	7.43	0.73	0.16	
C_KS1_117_1	CHEVROLET	BLAZER LS	2002	4.3	8/6/2004	22	8.0	0.48	16.6	537.6	1.12	0.33	0.14	
C_KS1_118_1	LINCOLN	TOWNCAR	1987	4.3	8/6/2004	22	8.0	0.53	15.0	567.8	15.95	4.96	1.35	
C_KS1_120_1	HONDA	ACCORD	1990	2.2	8/6/2004	20	8.0	0.31	25.6	328.7	12.17	1.04	0.80	
C_KS1_121_1	DODGE	DYNASTY	1988	3.3	8/7/2004	21	8.0	0.22	36.1	237.0	4.86	1.68	0.96	
C_KS1_123_1	JEEP	CHEROKEE	1990	4	8/7/2004	21	8.1	0.26	31.6	272.6	5.61	2.62	0.63	x
C_KS1_124_1	FORD	ESCORT	2002	2	8/9/2004	22	7.9	0.36	22.2	401.7	0.43	0.06	0.05	
C_KS1_126_1	PLYMOUTH	VOYAGER	1993	3	8/7/2004	21	.	0.31	N/A	N/A	N/A	N/A	N/A	x
C_KS1_127_1	HONDA	ODYSSEY	2000	3.5	8/9/2004	21	8.0	0.46	17.3	510.6	3.27	0.47	0.19	
C_KS1_128_1	HONDA	ACCORD	2000	2.3	8/9/2004	20	8.0	0.31	25.9	339.6	3.09	0.28	0.10	
C_KS1_129_1	FORD	F150	2000	4.2	8/9/2004	22	7.8	0.41	18.9	462.2	6.28	0.33	0.35	
C_KS1_132_1	FORD	RANGER XLT	1988	2.3	8/7/2004	24	7.6	0.55	13.8	607.5	21.17	2.31	2.46	
C_KS1_133_1	HONDA	ACCORD LX	2001	2.3	8/10/2004	24	8.0	0.44	18.3	488.6	0.67	0.10	0.03	
C_KS1_134_1	NISSAN	SENTRA	1994	2.3	8/10/2004	30	7.7	0.00	N/A	0.0	0.00	0.00	0.00	x
C_KS1_134_2	NISSAN	SENTRA	1994	1.6	8/11/2004	24	7.8	0.26	30.4	281.7	8.25	0.65	0.36	
C_KS1_138_1	CHRYSLER	LEBARON	1983	2.6	8/10/2004	30	8.1	0.62	13.0	646.8	24.88	1.83	0.68	x
C_KS1_139_1	VOLVO	850	1997	2.4	8/11/2004	20	7.8	0.31	25.3	352.7	0.52	0.38	0.16	

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C_KS1_140_1	MERCURY	TOPAZ GS	1994	2.3	8/13/2004	21	6.8	0.30	22.4	394.1	3.37	0.61	0.28	
C_KS1_140_2	MERCURY	TOPAZ GS	1994	2.3	8/11/2004	21	8.0	0.24	33.9	258.5	3.09	0.58	0.19	
C_KS1_141_1	FORD	FOCUS SE	2001	2	8/11/2004	20	8.0	0.28	28.0	315.4	3.33	0.17	0.08	
C_KS1_142_1	PLYMOUTH	VOYAGER	1999	3.3	8/11/2004	24	8.0	0.49	16.5	540.9	0.91	0.36	0.17	
C_KS1_147_1	HONDA	CIVIC DX	1988	1.5	8/12/2004	22	8.0	0.33	24.4	336.1	17.24	1.32	1.61	
C_KS1_148_1	BUICK	REGAL	1996	3.8	8/12/2004	23	8.0	0.30	26.7	333.5	1.05	0.47	0.10	
C_KS1_149_1	CADILLAC	CIMMARON	1986	2.8	8/12/2004	25	8.1	0.37	21.5	405.0	5.94	0.69	0.88	
C_KS1_150_1	FORD	RANGER	1999	3	8/12/2004	20	8.0	0.32	25.2	348.3	3.43	0.63	0.48	
C_KS1_151_1	PONTIAC	BONNEVILLE	1988	3.8	8/14/2004	29	.	0.31	N/A	N/A	N/A	N/A	N/A	x
C_KS1_152_1	MERCURY	TOPAZ	1994	2.3	8/13/2004	34	8.0	0.45	18.0	493.3	1.72	0.59	0.35	
C_KS1_153_1	MERCURY	SABLE	1996	3	8/13/2004	29	8.0	0.11	75.6	115.5	1.76	0.29	0.12	x
C_KS1_154_1	JEEP	CHEROKEE	1998	4	8/14/2004	34	8.0	0.42	19.1	461.5	4.10	1.41	0.47	
C_KS1_159_1	FORD	THUNDERBIRD LX	1995	4.6	8/14/2004	48	8.0	0.15	52.0	165.6	4.20	0.44	0.20	x
C_KS1_160_1	TOYOTA	CAMRY	1997	2.2	8/14/2004	59	8.1	0.29	27.5	322.3	2.05	0.53	0.18	
C_KS1_164_1	TOYOTA	COROLLA	1996	1.8	8/16/2004	66	7.8	0.22	35.4	251.0	2.15	0.52	0.23	x
C_KS1_165_1	HONDA	CIVIC	2000	1.6	8/16/2004	33	8.0	0.26	30.8	287.2	1.88	0.11	0.05	
C_KS1_166_1	TOYOTA	CAMRY	2000	2.2	8/18/2004	25	8.0	0.33	24.2	366.9	1.58	0.45	0.15	
C_KS1_167_1	TOYOTA	COROLLA	2000	1.8	8/16/2004	20	8.0	0.29	27.7	320.7	1.25	0.51	0.12	
C_KS1_167_2	TOYOTA	COROLLA	2000	1.8	8/16/2004	17	.	0.00	N/A	N/A	N/A	N/A	N/A	x
C_KS1_171_1	SUBARU	OUTBACK	2000	2.5	8/17/2004	32	18.6	0.88	21.1	418.5	2.38	0.07	0.05	x
C_KS1_171_2	SUBARU	OUTBACK	2000	2.5	8/17/2004	2	0.0	0.00	N/A	N/A	N/A	N/A	N/A	x
C_KS1_173_1	CHEVROLET	MONTE CARLO	1977	5	8/17/2004	20	8.2	0.48	17.1	444.2	43.08	11.58	3.85	
C_KS1_175_1	HYUNDAI	SANTA FE	2001	2.4	8/18/2004	21	8.0	0.47	17.0	521.4	1.93	0.63	0.08	
C_KS1_178_1	CHEVROLET	LUMINA	1999	2.2	8/18/2004	22	8.0	0.48	16.7	533.3	3.97	0.52	0.11	x
C_KS1_179_1	GMC	SAFARI	1993	4.3	8/18/2004	34	8.0	0.34	23.6	360.2	8.22	0.91	2.00	
C_KS1_180_1	GMC	SONOMA SLS	2001	4.3	8/18/2004	0	.	0.00	N/A	N/A	N/A	N/A	N/A	x
C_KS1_180_2	GMC	SONOMA SLS	2001	4.3	8/18/2004	26	8.0	0.34	23.7	375.8	0.16	0.11	0.02	
C_KS1_181_1	SATURN	SL1	1994	3.1	8/20/2004	23	8.0	0.34	23.3	365.4	11.24	0.85	0.48	
C_KS1_182_1	BUICK	REGAL	1990	3.1		0		0.31	0.0	N/A	N/A	N/A	N/A	x
C_KS1_187_1	CHEVROLET	ASTRO VAN	1991	4.3	8/20/2004	59	18.6	1.12	16.6	513.3	17.66	1.24	1.01	
C_KS1_189_1	CHEVROLET	S-10 TRUCK	1985	2.8	8/20/2004	23	8.0	0.49	16.3	415.3	79.13	1.64	5.37	
C_KS1_193_1	FORD	ECONOLINE	1983	5.8	8/21/2004	33	18.6	0.33	55.9	116.0	26.67	1.11	1.21	x
C_KS1_194_1	LINCOLN	TOWNCAR	1989	5	8/21/2004	30	8.0	0.39	20.4	397.2	24.38	2.59	0.96	x
C_KS1_195_1	FORD	F150 TRUCK	1998	4.2	8/21/2004	24	8.0	0.48	16.8	529.1	1.10	0.44	0.15	
C_KS1_196_1	FORD	WINDSTAR	1999	4.2	8/21/2004	21	8.0	0.37	21.9	404.6	1.78	0.40	0.05	
C_KS1_197_1	CHEVROLET	C 1500	1994	5.7	8/21/2004	40	8.0	0.59	13.5	637.3	15.08	0.60	0.61	
C_KS1_199_1	DODGE	STRATUS ES	1996	2.4	8/23/2004	25	8.0	0.40	20.2	421.8	10.72	5.63	0.48	
C_KS1_201_1	MAZDA	MX-6	1988	2.2	8/23/2004	42	8.1	0.36	22.6	374.4	10.92	3.34	0.71	
C_KS1_203_1	OLDSMOBILE	NINETY EIGHT	1985	3.8	8/23/2004	35	8.0	0.58	13.7	587.1	42.08	1.09	0.68	

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		REGENCY												
C_KS1_204_1	LINCOLN	TOWNCAR	1987	5	8/23/2004	25	8.0	0.07	116.3	73.5	1.21	0.27	0.38	x
C_KS1_207_1	PONTIAC	BONNEVILLE	1994	3.8	8/25/2004	20	8.0	0.34	23.5	374.6	1.93	0.47	0.18	
C_KS1_208_1	FORD	F150	1990	4.9	8/25/2004	22	8.0	0.00	N/A	0.0	0.00	0.00	0.00	x
C_KS1_210_1	FORD	TAURUS	2002	3	8/26/2004	48	8.0	0.47	17.1	518.1	0.29	0.26	0.12	
C_KS1_212_1	CHRYSLER	CONCORD	1994	3.5	8/25/2004	21	8.0	0.30	26.3	324.1	6.77	2.38	0.70	x
C_KS1_212_2	CHRYSLER	CONCORD	1994	3.5	8/25/2004	21	8.0	0.30	26.3	324.1	6.77	2.38	0.70	x
C_KS1_213_1	OLDSMOBILE	EIGHTY-EIGHT	1994	3.8	8/27/2004	30	8.0	0.37	21.4	411.7	1.98	0.51	0.14	
C_KS1_215_1	FORD	CROWN VICTORIA	1985	5	8/26/2004	20	8.0	0.70	11.4	686.8	56.07	1.38	1.31	
C_KS1_219_1	HONDA	CIVIC	2000	1.6	8/26/2004	30	8.0	0.27	29.7	292.0	4.33	0.09	0.00	
C_KS1_221_1	BUICK	CENTURY	1997	3.1	8/26/2004	22	8.0	0.00	N/A	0.0	0.00	0.00	0.00	x
C_KS1_222_1	PONTIAC	GRAND AM	1992	2.3	8/26/2004	25	8.0	0.32	25.2	321.6	19.60	5.32	0.48	
C_KS1_223_1	DODGE	GRAND CARAVAN	2005	3.8	8/26/2004	46	8.1	0.42	19.2	459.7	0.83	0.17	0.07	
C_KS1_225_1	TOYOTA	COROLLA	1989	1.6	8/27/2004	23	8.0	0.34	23.9	334.2	24.47	1.42	0.54	
C_KS1_226_1	NISSAN	SENTRA	1993	1.3	8/27/2004	21	8.0	0.26	30.4	275.5	10.41	0.20	0.28	
C_KS1_226_2	NISSAN	SENTRA	1993	1.3	8/27/2004	0	.	0.00	N/A	N/A	N/A	N/A	N/A	x
C_KS1_228_1	OLDSMOBILE	SILHOUETTE	2000	3.4	8/27/2004	49	8.0	0.33	24.3	363.4	0.90	0.49	0.10	
C_KS1_233_1	FORD	TAURUS	1987	3	8/28/2004	8	0.0	0.00	4.3	378.4	12.97	0.00	0.00	x
C_KS1_233_2	FORD	TAURUS	1987	3	8/28/2004	20	8.0	0.37	21.7	402.6	5.35	1.48	0.20	
C_KS1_234_1	FORD	F150 4X2	1987	4.9	8/28/2004	32	18.6	1.31	14.2	502.3	68.81	6.03	7.19	
C_KS1_235_1	PONTIAC	6000	1988	2.8	8/28/2004	23	8.0	0.28	28.9	298.4	4.89	1.36	0.69	
C_KS1_236_1	OLDSMOBILE	ACHIEVA	1992	2.3	8/28/2004	27	8.0	0.45	17.8	489.8	6.54	3.02	0.45	
C_KS1_236_2	OLDSMOBILE	ACHIEVA	1992	1.9		0		0.33	0.0	N/A	N/A	N/A	N/A	x
C_KS1_237_1	GEO	PRISM	1990	1.6	8/28/2004	22	8.0	0.19	41.1	200.4	7.26	3.19	1.79	
C_KS1_239_1	FORD	ESCORT	1993	1.8	8/30/2004	20	8.0	0.08	98.4	75.1	9.28	0.72	0.58	x
C_KS1_240_1	FORD	CONTOUR	1998	2.5	8/30/2004	23	8.0	0.34	23.4	351.6	18.41	0.35	0.68	x
C_KS1_241_1	CADILLAC	SEDAN DE VILLE	1993	4.9	8/30/2004	21	8.0	0.45	17.7	460.5	26.00	2.12	1.05	
C_KS1_243_1	HONDA	ACCORD	1987	2	8/30/2004	20	8.0	0.40	20.1	408.4	21.92	3.11	0.72	
C_KS1_244_1	INFINITI	I30	1998	3	8/30/2004	19	8.0	0.15	52.0	171.1	0.29	0.19	0.07	x
C_KS1_245_1	PLYMOUTH	VOYAGER	1997	3.3	8/30/2004	18	8.0	0.30	26.4	336.5	1.14	0.82	0.18	
C_KS1_246_1	EAGLE	TALON	1994	1.8	8/31/2004	24	8.0	0.23	34.1	259.7	0.88	1.05	0.24	
C_KS1_247_1	FORD	RANGER	1987	2.9	8/31/2004	22	8.0	0.51	15.8	541.4	11.63	2.26	1.63	
C_KS1_248_1	VOLVO	240 GL	1983	2.3	8/31/2004	23	8.0	0.30	26.6	329.8	3.34	1.46	0.33	
C_KS1_249_1	CHEVROLET	S-10	1989	4.3	8/31/2004	20	8.0	0.41	19.7	440.2	6.66	1.22	0.39	
C_KS1_250_1	FORD	ESCORT	1987	1.9	8/31/2004	17	5.2	0.15	35.6	178.7	44.12	1.05	3.20	x
C_KS1_253_1	BUICK	REGAL	1992	3.8	9/1/2004	22	8.0	0.44	18.2	479.7	5.40	2.67	0.39	
C_KS1_254_1	MERCURY	SABLE	1997	3	9/1/2004	24	8.0	0.18	45.5	192.7	1.88	0.42	0.10	x
C_KS1_255_1	FORD	TAURUS	2001	3	9/1/2004	20	8.0	0.40	20.1	443.5	0.55	0.03	0.05	
C_KS1_259_1	PLYMOUTH	ACCLAIM	1990	2.5	9/1/2004	41	18.7	0.34	55.5	94.4	40.45	0.58	2.47	x

CTR_TST_ID	Make	Model	Model Year	Disp	Test Date	Test Duration (minutes)	Test Distance (miles)	Fuel Used (gal)	Test FE (mpg)	Composite CO2 (gpm)	Composite CO (gpm)	Composite NOx (gpm)	Composite THC (gpm)	Suspect Data
C_KS1_282_1	OLDSMOBILE	DELTA 88	1991	3.8	9/8/2004	19	8.0	0.35	23.3	377.8	4.19	1.19	0.29	
C_KS1_290_1	DODGE	RAM 50	1989	2.3	9/8/2004	20	8.0	0.32	24.5	356.4	5.01	3.88	0.52	
C_KS1_294_1	BUICK	CENTURY	1984	3	9/8/2004	22	8.0	0.75	10.7	623.4	118.30	0.96	12.33	x
C_KS1_297_1	KIA	SEPHIA	2000	1.8	9/9/2004	23	8.0	0.19	42.0	212.9	0.28	0.07	0.01	
C_KS1_298_1	CHEVROLET	CAVALIER	1989	2	9/9/2004	18	8.0	0.14	58.9	149.3	1.44	0.39	0.18	
C_KS1_299_1	BUICK	LESABRE	1979	4.9	9/9/2004	19	8.0	0.45	17.6	492.6	5.37	8.08	2.11	
C_KS1_300_1	FORD	F150	1994	5	9/9/2004	19	8.0	0.58	13.8	645.4	2.41	4.53	0.74	x
C_KS1_301_1	MERCURY	GRAND MARQUIS	1986	5	9/9/2004	23	8.0	0.46	17.5	492.8	10.37	1.26	1.25	
C_KS1_302_1	BUICK	ELECTRA PARK AVE	1989	3.8	9/10/2004	22	8.0	0.42	19.0	465.2	2.97	0.63	0.33	
C_KS1_304_1	FORD	ASPIRE	1995	1.3	9/10/2004	21	8.0	0.31	26.2	330.0	6.29	1.77	0.64	
C_KS1_305_1	HONDA	ACCORD	2001	3.8	9/10/2004	23	8.0	0.47	17.0	525.1	1.41	0.20	0.14	
C_KS1_306_1	JEEP	GRAND CHEROKEE	1995	4	9/11/2004	33	18.7	1.11	16.7	525.9	4.57	2.82	0.44	x
C_KS1_307_1	GMC	JIMMY	1990	4.3	9/10/2004	31	8.0	0.41	19.4	450.0	7.01	0.62	0.43	
C_KS1_308_1	MG	MG	1978	1.8	9/10/2004	35	8.1	0.66	12.3	363.6	230.00	1.14	16.16	x
C_KS1_309_1	OLDSMOBILE	SILHOUETTE	1997	3.4		0		0.52	0.0	N/A	N/A	N/A	N/A	x
C_KS1_312_1	HONDA	CIVIC	2000	1.6	9/14/2004	24	8.0	0.29	27.2	322.3	2.68	0.34	0.17	
C_KS1_314_1	GMC	SIERRA	1995	4.3	9/13/2004	21	8.0	0.68	11.8	683.7	39.96	2.33	4.45	x
C_KS1_316_1	HONDA	CIVIC	1997	1.6	9/14/2004	20	8.0	0.33	24.4	332.7	20.20	0.61	0.66	
C_KS1_317_1	OLDSMOBILE	CUSTOM CRUISER STATI	1984	5	9/13/2004	18	8.0	0.57	14.1	518.6	60.87	5.89	7.79	
C_KS1_318_1	VOLVO	GL	1984	2.3	9/14/2004	21	8.0	0.41	19.7	432.3	10.52	3.69	1.19	
C_KS1_319_1	CHEVROLET	CAPRICE	1987	5	9/14/2004	22	8.0	0.60	13.4	519.4	88.36	2.32	4.89	
C_KS1_321_1	DODGE	RAM	1997	5.9	9/14/2004	35	18.6	1.66	11.2	780.5	10.80	3.32	0.29	x
C_KS1_322_1	FORD	F150	1993	4.9	9/15/2004	25	8.0	0.52	15.3	569.1	7.45	1.62	0.81	
C_KS1_323_1	PONTIAC	GRAND PRIX	1989	3.1	9/15/2004	20	8.0	0.62	12.9	604.7	38.84	1.85	8.45	x
C_KS1_324_1	BUICK	LESABRE	1990	3.8	9/15/2004	20	8.0	0.48	16.7	531.6	1.08	0.95	0.15	
C_KS1_325_1	DODGE	STRATUS	1996	2.4	9/15/2004	21	8.0	0.42	19.3	448.2	7.32	0.86	0.41	
C_KS1_326_1	TOYOTA	CAMRY	1997	2.5	9/14/2004	20	8.0	0.37	21.4	409.2	3.96	0.89	0.24	
C_KS1_327_1	DODGE	DURANGO	1999	5.9	9/15/2004	22	8.0	0.82	9.8	904.5	4.62	1.03	0.06	
C_KS1_328_1	HONDA	CIVIC	1998	1.6	9/15/2004	22	8.0	0.25	32.2	270.1	3.72	0.11	0.06	
C_KS1_329_1	HONDA	CIVIC	2001	1.7	9/15/2004	34	18.6	0.55	33.9	260.0	2.01	0.17	0.01	
C_KS1_329_2	HONDA	CIVIC	2001	1.7	9/15/2004	34	18.6	0.55	33.9	260.0	2.01	0.17	0.01	
C_KS1_330_1	HONDA	ACCORD	1992	2.2	9/16/2004	25	8.0	0.43	18.6	476.4	2.88	0.64	0.32	
C_KS1_331_1	PONTIAC	GRAND AM	1994	2.3	9/16/2004	29	8.0	0.37	21.9	397.2	7.18	1.93	0.44	
C_KS1_332_1	CHEVROLET	MALIBU	1999	3.1	9/16/2004	27	8.0	0.40	20.2	443.0	0.85	0.48	0.07	
C_KS1_333_1	OLDSMOBILE	SILHOUETTE	2002	3.4	9/16/2004	23	8.0	0.51	15.7	568.7	0.87	0.26	0.01	
C_KS1_335_1	M.BENZ	280 SE	1973	4.5	9/16/2004	23	8.0	0.77	10.4	564.1	180.28	1.45	10.18	
C_KS1_336_1	CHEVROLET	G-20	1993	5.7	9/16/2004	45	14.1	0.43	32.6	197.2	42.55	0.38	3.22	x
C_KS1_337_1	FORD	F150	1997	4.6	9/20/2004	31	18.6	1.21	15.4	566.4	10.16	0.52	0.24	x

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C_KS1_338_1	CHEVROLET	VENTURE	2003	3.4	9/17/2004	20	8.0	0.42	19.1	468.7	0.61	0.19	0.09	
C_KS1_339_1	PLYMOUTH	VOYAGER	1991	3	9/17/2004	23	8.0	0.36	22.3	385.2	7.40	1.91	1.30	
C_KS1_341_1	DODGE	AVENGER	1996	2	9/17/2004	16	8.0	0.26	31.0	263.5	14.83	0.78	1.00	
C_KS1_343_1	TOYOTA	COROLLA	1989	1.6	9/17/2004	20	8.0	0.28	28.7	305.7	3.18	1.18	0.35	
C_KS1_344_1	NISSAN	SENTRA	1997	3	9/18/2004	14	5.6	0.19	29.6	293.5	4.44	0.71	0.22	
C_KS1_346_1	TOYOTA	CAMRY	1990	2	9/18/2004	21	8.0	0.29	27.7	296.6	14.58	0.98	0.83	
C_KS1_347_1	NISSAN	ALTIMA	2000	2.4	9/18/2004	25	8.0	0.47	17.0	512.2	7.61	1.30	0.14	
C_KS1_348_1	PLYMOUTH	SUNDANCE	1989	2.3	9/17/2004	21	8.0	0.41	19.6	436.4	12.70	1.56	0.62	
C_KS1_349_1	FORD	WINDSTAR	2001	3.8	9/29/2004	22	8.0	0.42	19.1	470.5	0.56	0.11	0.04	
C_KS1_350_1	TOYOTA	AVALON	1996	3	9/18/2004	19	8.0	0.38	21.1	416.6	2.43	0.94	0.35	
C_KS1_350_2	TOYOTA	AVALON	1996	3	9/20/2004	18	8.0	0.40	20.1	443.5	1.24	0.70	0.25	
C_KS1_351_1	NISSAN	MAXIMA	1997	3	9/20/2004	20	8.0	0.33	24.7	359.9	1.77	0.29	0.36	
C_KS1_352_1	TOYOTA	CAMRY	1999	2.2	9/20/2004	20	8.0	0.37	21.8	406.6	2.85	0.48	0.17	
C_KS1_354_1	FORD	TAURUS	1998	3	9/20/2004	22	8.0	0.42	19.3	456.3	4.61	0.21	0.05	
C_KS1_355_1	JEEP	WRANGLER	1997	4	9/20/2004	21	8.0	0.49	16.3	540.0	5.97	0.37	0.24	
C_KS1_356_1	KIA	RIO	2004	1.6	9/20/2004	19	7.8	0.25	31.8	281.0	0.38	0.08	0.04	
C_KS1_358_1	CHEVROLET	CAPRICE-ESTATE	1990	5	9/21/2004	22	7.9	0.52	15.1	530.1	34.66	1.32	3.28	
C_KS1_359_1	MERCURY	GRAND MARQUIS	1988	5	9/21/2004	22	8.0	0.13	63.8	135.8	1.87	0.26	0.51	x
C_KS1_360_1	TOYOTA	PICKUP	1987	2.4	9/20/2004	25	8.0	0.44	18.3	485.7	2.04	4.57	0.77	
C_KS1_361_1	CHEVROLET	CAVALIER	2004	2.2	9/21/2004	18	8.0	0.36	22.3	399.5	0.77	0.04	0.04	
C_KS1_363_1	PONTIAC	GRAND AM SE	1997	2.4	9/22/2004	21	7.7	0.37	20.9	419.9	4.90	0.88	0.15	
C_KS1_363_2	PONTIAC	GRAND AM SE	1997	2.4	9/21/2004	23	8.0	0.37	21.6	403.1	6.52	0.79	0.19	
C_KS1_364_1	SATURN	SEDAN	2001	2.4	9/21/2004	20	8.0	0.36	22.0	404.9	0.49	0.22	0.02	
C_KS1_364_2	SATURN	SEDAN	2001	2.4	9/21/2004	23	8.1	0.32	25.4	337.1	9.29	0.30	0.18	
C_KS1_367_1	PLYMOUTH	VOYAGER	1999	3.8	9/22/2004	22	9.4	0.48	19.7	451.1	1.80	0.56	0.13	
C_KS1_368_1	TOYOTA	CAMRY	1994	3	9/22/2004	21	8.0	0.31	25.8	337.9	5.23	0.31	0.33	x
C_KS1_369_1	FORD	RANGER	2003	4	9/22/2004	19	8.0	0.47	16.9	527.2	0.77	0.22	0.05	
C_KS1_369_2	FORD	RANGER	2003	4	9/22/2004	21	8.0	0.46	17.3	513.6	2.98	0.20	0.06	
C_KS1_372_1	KIA	SEDONA	2004	3.5	9/23/2004	20	8.0	0.49	16.2	547.3	3.38	0.00	0.02	
C_KS1_373_1	TOYOTA	COROLLA	1995	1.6	9/23/2004	21	8.0	0.27	29.2	302.2	2.18	0.86	0.21	
C_KS1_373_2	TOYOTA	COROLLA	1995	1.6	9/23/2004	23	8.0	0.27	29.6	292.0	5.50	0.75	0.38	
C_KS1_374_1	TOYOTA	SIENNA	2000	3	9/23/2004	21	7.5	0.46	16.2	545.3	2.14	0.86	0.43	
C_KS1_377_1	OLDSMOBILE	CUTLASS	1987	2.5	9/23/2004	25	8.0	0.74	10.8	699.5	58.28	5.92	12.94	
C_KS1_379_1	CHEVROLET	LUMINA	1997	3.1	9/24/2004	22	8.0	0.47	17.0	513.0	9.89	0.80	0.25	
C_KS1_381_1	FORD	CONTOUR	1996	2	9/24/2004	23	8.0	0.27	29.4	295.8	5.83	0.27	0.20	x
C_KS1_381_2	FORD	CONTOUR	1996	2	9/24/2004	22	8.0	0.27	29.2	297.6	5.37	0.20	0.26	x
C_KS1_383_1	FORD	F150	1989	4.9	9/24/2004	20	8.0	0.54	14.9	580.9	8.89	6.34	2.05	
C_KS1_383_2	FORD	F150	1989	4.9	9/24/2004	25	8.0	0.57	14.1	612.4	10.78	5.55	3.12	
C_KS1_384_1	SATURN	WAGON	1993	1.9	9/24/2004	37	22.1	0.72	30.7	270.7	12.36	0.82	0.87	

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C_KS1_385_1	CHEVROLET	TRACKER	2003	2.5	9/24/2004	19	8.0	0.40	20.2	442.0	0.98	0.23	0.14	
C_KS1_386_1	CHEVROLET	CAPRICE CLASSIC WAGO	1987	5	9/11/2004	17	8.0	0.45	17.8	455.1	29.95	5.03	1.15	
C_KS1_386_2	CHEVROLET	CAPRICE CLASSIC WAGO	1987	5	9/11/2004	19	8.0	0.56	14.2	563.5	39.83	5.99	1.68	
C_KS1_387_1	FORD	ESCORT	1999	2	9/11/2004	19	8.0	0.32	25.0	351.2	4.03	0.93	0.07	
C_KS1_388_1	TOYOTA	CAMRY	2001	3	9/11/2004	20	8.0	0.40	20.0	443.8	2.90	0.13	0.07	
C_KS1_389_1	DODGE	RAM	1986	3.7	9/11/2004	19	8.0	0.48	16.6	396.3	79.53	2.15	7.92	
C_KS1_390_1	CHEVROLET	SUBURBAN	1995	5.7	9/11/2004	20	8.0	0.75	10.7	806.3	18.40	1.66	0.51	
C_KS1_394_1	TOYOTA	COROLLA	1992	1.6	9/25/2004	24	8.0	0.37	21.8	404.6	3.78	1.13	0.26	
C_KS1_394_2	TOYOTA	COROLLA	1992	1.6	9/25/2004	21	7.7	0.36	21.2	413.2	5.41	0.92	0.39	
C_KS1_395_1	PONTIAC	GRAND AM	1997	2.4	9/25/2004	22	8.0	0.28	28.7	306.6	3.16	1.12	0.18	
C_KS1_398_1	MERCURY	TRACER	1995	1.9	9/25/2004	22	8.0	0.19	43.1	200.6	4.18	0.94	0.14	
C_KS1_399_1	CHEVROLET	LUMINA	2001	3.1	9/25/2004	23	7.7	0.33	23.3	382.9	0.90	0.21	0.16	
C_KS1_416_1	FORD	TAURUS SE	1998	3	9/27/2004	22	8.0	0.44	18.3	486.8	1.86	0.29	0.15	
C_KS1_417_1	TOYOTA	COROLLA	1996	1.8	9/27/2004	20	8.0	0.28	28.8	301.8	5.27	1.73	0.50	
C_KS1_419_1	NISSAN	MAXIMA	2002	3.5	9/27/2004	21	8.0	0.35	22.9	389.6	0.94	0.21	0.12	
C_KS1_420_1	M.BENZ	SEL	1980	4.5	9/27/2004	21	8.0	0.80	10.0	392.8	331.04	0.03	17.80	
C_KS1_420_2	M.BENZ	SEL	1980	4.5	9/27/2004	20	8.0	0.73	10.9	376.3	294.59	0.18	15.19	
C_KS1_421_1	FORD	TAURUS	1993	3.8	9/27/2004	22	7.1	0.48	14.7	597.2	6.86	0.94	0.56	
C_KS1_424_1	CHEVROLET	ASTRO	1990	4.3	9/28/2004	38	8.0	0.68	11.8	633.5	73.24	1.50	6.18	
C_KS1_424_2	CHEVROLET	ASTRO	1990	4.3	9/28/2004	25	8.0	0.68	11.8	579.6	107.72	1.47	6.84	
C_KS1_425_1	VOLVO	850 TURBO	1996	2.3	9/28/2004	24	8.0	0.20	39.2	225.7	1.61	0.67	0.06	x
C_KS1_425_2	VOLVO	850 TURBO	1996	2.3	9/28/2004	24	8.0	0.21	38.2	231.2	1.85	0.77	0.12	x
C_KS1_426_1	TOYOTA	CAMRY	1994	3	9/28/2004	22	8.0	0.32	25.3	338.3	10.78	0.24	0.39	x
C_KS1_427_1	SATURN	SL1	1997	1.9	9/28/2004	21	8.0	0.24	33.0	266.7	2.40	0.36	0.28	
C_KS1_428_1	FORD	TAURUS	1995	3	9/28/2004	19	7.6	0.36	21.1	420.1	2.19	0.89	0.23	
C_KS1_429_1	OLDSMOBILE	CUTLASS WAGON	1989	3.3	9/27/2004	19	8.0	0.46	17.2	503.1	11.31	0.85	0.36	
C_KS1_429_2	OLDSMOBILE	CUTLASS WAGON	1989	3.3	9/27/2004	23	8.0	0.52	15.2	564.7	14.11	1.26	0.86	
C_KS1_430_1	HONDA	ODYSSEY	2000	3.5	9/29/2004	24	8.0	0.44	18.2	482.7	6.07	0.81	0.59	
C_KS1_432_1	LINCOLN	CONTINENTAL	1995	4.6	9/29/2004	19	8.0	0.37	21.5	410.0	4.55	1.26	0.65	x
C_KS1_433_1	FORD	F-150	1989	4.9	9/29/2004	34	18.6	1.12	16.5	487.6	30.52	2.24	2.95	x
C_KS1_434_1	MERCURY	MARQUIS	1994	4.6	9/29/2004	21	8.0	0.43	18.7	464.4	8.24	0.97	1.04	
C_KS1_436_1	PONTIAC	GRAND AM GT	1998	2.4	9/29/2004	27	8.1	0.29	27.4	320.0	4.69	0.63	0.19	x
C_KS1_437_1	TOYOTA	CAMRY	1996	2.2	9/30/2004	22	8.0	0.26	30.7	291.0	0.69	0.22	0.03	
C_KS1_437_2	TOYOTA	CAMRY	1996	2.2	9/30/2004	8	.	0.00	N/A	N/A	N/A	N/A	N/A	x
C_KS1_438_1	CHEVROLET	AVALANCHE	2002	2.2	9/30/2004	34	18.6	1.42	13.1	680.9	1.74	0.46	0.12	x
C_KS1_439_1	GEO	PRISM	1996	1.6	9/30/2004	22	8.0	0.26	30.6	281.3	6.55	0.91	0.66	
C_KS1_440_1	FORD	BRONCO	1990	5	9/30/2004	36	18.5	1.12	16.6	504.0	20.91	1.87	1.37	x

CTR_TST_ID	Make	Model	Model Year	Disp	Test Date	Test Duration (minutes)	Test Distance (miles)	Fuel Used (gal)	Test FE (mpg)	Composite CO2 (gpm)	Composite CO (gpm)	Composite NOx (gpm)	Composite THC (gpm)	Suspect Data
C_KS1_441_1	HONDA	ACCORD	1997	2.1	9/29/2004	23	8.0	0.32	25.2	351.8	2.71	0.47	0.15	
C_KS1_442_1	NISSAN	MAXIMA	1990	3	9/30/2004	21	8.0	0.30	26.4	330.2	4.23	0.89	0.96	
C_KS1_443_1	VW	CABRIO	1999	2	9/30/2004	20	7.7	0.25	30.9	287.5	1.18	0.29	0.09	
C_KS1_982_1	TOYOTA	CAMRY	1998	2.2	9/18/2004	23	8.0	0.47	16.9	512.4	8.35	1.10	0.53	

Table 4-10. Round 1 Driveaway Test Results

CTR_TST_ID	Make	Model	Model Year	Disp	Test Date	Test Duration (minutes)	Test Distance (miles)	Fuel Used (gal)	Test FE (mpg)	Composite CO2 (gpm)	Composite CO (gpm)	Composite NOx (gpm)	Composite THC (gpm)	Suspect Data
D_KS1_036_1	JEEP	WRANGLER	1995	2.5	7/23/2004	556	64.5	3.70	17.5	503.02	4.25	0.40	0.15	
D_KS1_095_1	BUICK	LESABRE	1989	3.8	8/2/2004	550	17.8	0.86	20.7	416.51	7.66	1.09	0.54	
D_KS1_096_1	SUBARU	OUTBACK LEGACY	1996	2.2	7/29/2004	421	23.8	0.77	30.7	275.02	9.44	0.91	0.24	
D_KS1_097_1	FORD	THUNDERBIRD	1988	3.8	8/5/2004	371	35.8	1.05	34.2	253.07	4.95	0.84	0.42	
D_KS1_124_1	FORD	ESCORT	2002	2	8/10/2004	523	42.4	1.58	26.9	326.00	4.43	0.15	0.05	
D_KS1_134_1	NISSAN	SENTRA	1994	1.6	8/11/2004	347	30.4	0.85	35.8	245.41	3.13	0.17	0.14	
D_KS1_138_1	CHRYSLER	LEBARON	1983	2.6	8/12/2004	362	13.5	0.80	16.9	491.50	23.78	1.51	0.49	x
D_KS1_149_1	CADILLAC	CIMMARON	1986	2.8	8/13/2004	366	59.4	2.21	26.9	326.98	2.74	0.74	0.40	
D_KS1_200_1	FORD	TEMPO	1986	2.3	8/24/2004	426	28.3	1.32	21.5	393.78	13.22	1.19	0.35	
D_KS1_203_1	OLDSMOBILE	NINETY EIGHT REGENCY	1985	3.8	8/24/2004	150	29.6	0.39	75.1	116.41	1.14	0.38	0.06	x
D_KS1_254_1	MERCURY	SABLE	1997	3	9/2/2004	298	66.8	3.13	21.3	408.45	6.59	1.19	0.19	
D_KS1_282_1	OLDSMOBILE	DELTA 88	1991	3.8	9/10/2004	229	41.3	1.39	29.7	296.47	2.49	1.17	0.21	
D_KS1_317_1	OLDSMOBILE	CUSTOM CRUISER STATI	1984	5	9/15/2004	492	23.0	1.44	16.0	478.21	38.73	5.48	6.21	
D_KS1_386_1	CHEVROLET	CAPRICE CLASSIC WAGO	1987	5	9/14/2004	602	26.8	1.49	18.0	449.92	26.56	7.85	1.64	
D_KS1_1012_1	NISSAN	MAXIMA	1992	3	8/25/2004	449	33.5	0.02	2009.8	2.20	0.02	0.00	0.00	x

A fuel economy comparison of Round 1 conditioning runs and LA92 drive cycle tests performed on the dynamometer is presented in Figure 4-13 (with a 1:1 line shown for reference). Appendices F and L provides formulas for calculating fuel economy from both the dynamometer and the PEMS. Results identified as "suspicious" in Tables 4-8 and 4-9 are excluded from Figure 4-13.

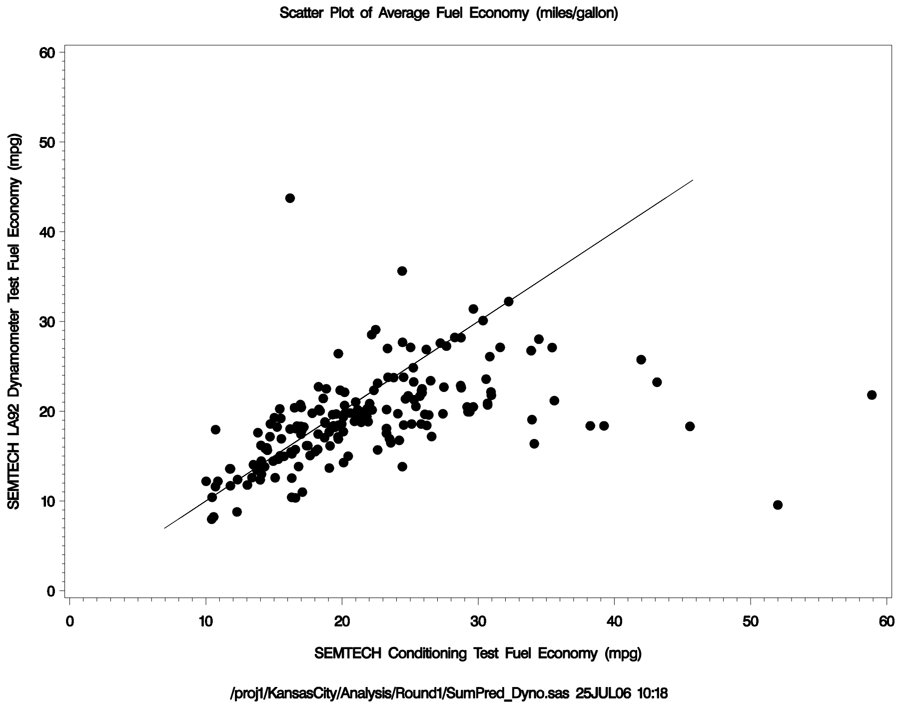

Figure 4-13. By-Vehicle Comparison of Conditioning Run vs. Dynamometer Testing Fuel Economy for Round 1

A fuel economy comparison of the driveaway tests and the LA92 dynamometer tests performed during Round 1 is shown in Figure 4-14, and Figure 4-15 provides a by-vehicle comparison of Round 1 condition run vs. driveaway test fuel economy. Again, 1:1 lines are provided for reference, and all "suspect" results are excluded from these figures. These figures tend to reveal lower fuel economy determinations as measured by the PEMS in comparison with dynamometer measurements. This difference could be attributed to testing discrepancies such as how closely the laboratory LA92 drive cycle approximates the driving pattern and loads encountered with real-word driving. The difference could also be in part due to measurement discrepancies between the two systems, such as errors or bias in determining the true exhaust mass flow rate or errors or bias in the exhaust gas concentration measurements. Examination of comparison of results of tests using similar measurement systems but different driving patterns (such as shown in Figure 4-15) helps illustrate the influence of testing variations, and examination of comparison of results of tests using identical driving patterns but different measurement systems (such as shown in Figures 4-12 and 4-16) helps illustrate the difference in results as measured by two different systems (PEMS vs. dynamometer).

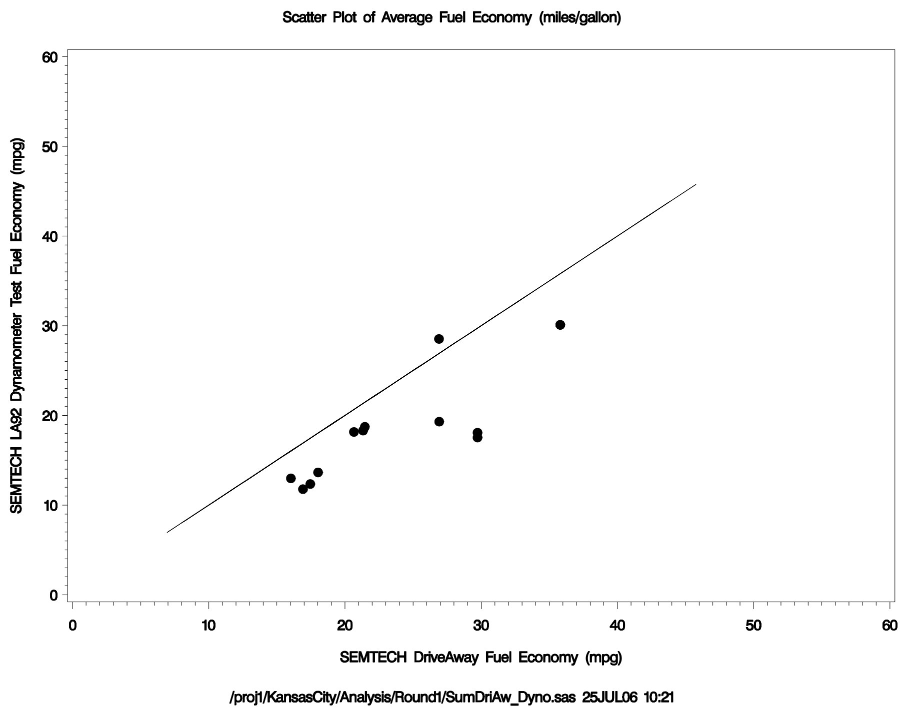

Figure 4-14. By-Vehicle Comparison of Driveaway vs. Dynamometer Testing Fuel Economy for Round 1

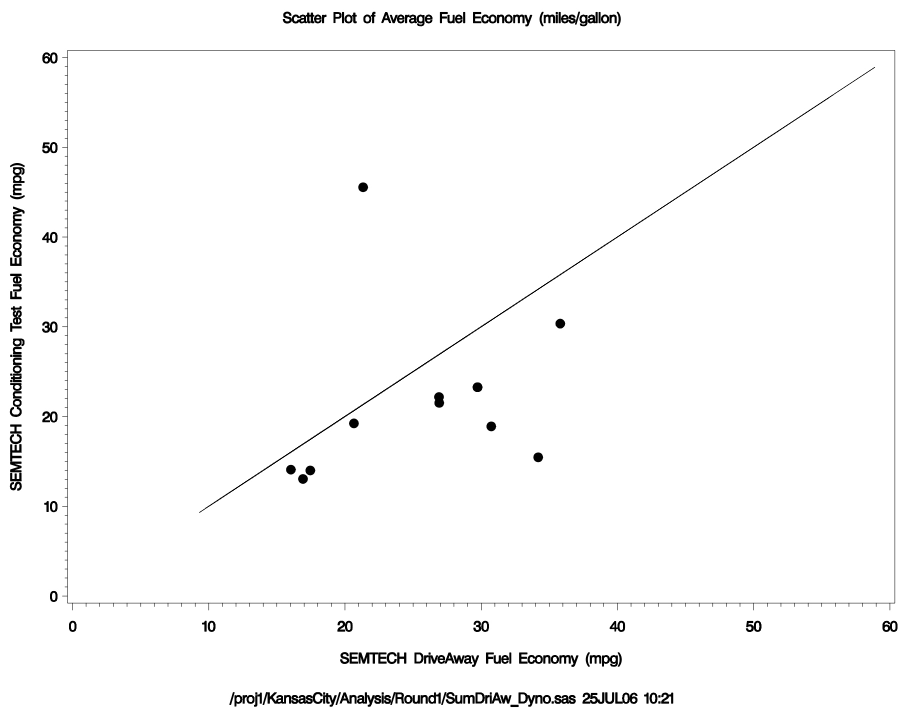

Figure 4-15. By-Vehicle Comparison of Driveaway vs. Conditioning Run Fuel Economy for Round 1

As previously indicated, an attempt was made to collect fuel and oil samples from all study vehicles. Occasionally, anti-siphon devices prevented collection of fuel samples from certain study vehicles. All fuel and oil samples were sent to the USEPA's National Vehicle and Fuel Emissions Laboratory for analysis. No oil samples were analyzed during the study (subsequent analysis is expected). Results of all fuel analysis performed prior to April 2006 were included in the MSOD data submission for this study and are shown in Table 4-11. Results of fuels analysis performed after April 2006 were not included in the MSOD submission (and are not shown in Table 4-11) but are included in Appendix FF (KC_fuels_analysis_complete.pdf) for reference.

Table 4-11. Fuel Analysis Results from Round 1 Vehicle Samples

Laboratory Fuel Batch ID	Vehicle ID	Sulfur (ppm)	Initial Boiling Point (F)	10% Distillation Point (F)	50% Distillation Point (F)	90% Distillation Point (F)	End Point (F)	Specific Gravity at 60 F	Degrees API at 60 F	Oxygen Weight %	Oxygenate Type	Total Recovery (mL)	Residue (mL)	Loss (mL)	Reid Vapor Pressure (psi)	Olefins (Vol %)	Saturates (Vol %)	Aromatics (Vol %)
13619	KS1_181	175	102		228	329	419	0.7588	54.98	0	NONE	97.8	0.8	1.4	6.3	7.6	56.9	35.5
13620	KS1_068	73	100	138	218	341	431	0.7504	57.08	0	NONE	98.2	0.7	1.1	6.8	12.7	57.2	30.1
13621	KS1_003	210	94	127	206	333	431	0.7381	60.21	0	NONE	97.7	0.8	1.5	8.1	8.3	65	26.7
13622	KS1_330	75	101	148	225	346	435	0.7566	55.53	0	NONE	97.9	0.8	1.3	6.1	10	57.6	32.4
13623	KS1_148	150	102	143	223	334	424	0.7578	55.22	0	NONE	98.1	0.8	1.1	6.6	9.5	55.6	34.9
13624	KS1_044	199	100	133	222	332	416	0.7541	56.15	0.47	ETHANOL	97.7	0.8	1.5	7.8	8	58.6	33.4
13625	KS1_151	166	99	143	222	340	445	0.7506	57.02	0	NONE	97.8	1	1.2	6.5	9.7	60.8	29.5
13626	KS1_082	107	100	141	223	339	422	0.7621	54.16	0.2	NONE	97.7	0.9	1.4	6.9	8	56	36
13627	KS1_189	94	102	142	223	338	426	0.7576	55.27	0	NONE	97.5	0.9	1.6	6.7	8.7	57.4	33.9
13632	KS1_132	79						0.7574	55.33	11.47	ETHANOL				8.2	6.9	74	19.1
13633	KS1_432	83	95	129	217	343	426	0.7491	57.4	0	NONE	97.3	0.8	1.9	8.2	9.3	60.3	30.4
13634	KS1_439	130	92	123	221	341	429	0.7507	57	0	NONE	97.3	0.7	2	8.4	9.1	58.6	32.3
13636	KS1_051	215	102	145	226	329	413	0.7581	55.15	0	NONE	97.7	0.8	1.5	6.5	8.3	57.7	34
13649	KS1_160	159	99	138	223	331	414	0.7541	56.14	0	NONE	97.6	0.8	1.6	7.4	8.4	59.6	32
13652	KS1_121	73	102	145	231	355	427	0.7653	53.41	0	NONE	97.9	0.7	1.4	6.1	10.4	52.9	36.7
13653	KS1_369	138	104	145	227	332	419	0.7599	54.7	0	NONE	97.8	0.8	1.4	6.1	8.1	56	35.9
13654	KS1_355	23	103	161	228	318	399	0.7496	57.28	0	NONE	97.5	0.9	1.6	5.9	2.4	69.6	28
13655	KS1_024	112	100	142	224	338	424	0.7542	56.12	0	NONE	97.7	0.8	1.5	6.3	10.1	58.5	31.4
13656	KS1_430	38						0.7485	57.55	0	NONE				10.7	3.7	63.3	33
13657	KS1_108	159	101	146	223	337	442	0.7524	56.56	0	NONE	97.8	0.7	1.5	6.4	10.3	59.5	30.2
13658	KS1_297	106	102	146	225	347	451	0.7573	55.35	0	NONE	97.7	0.9	1.5	6.2	10	57.3	32.7
13659	KS1_389	174	100	142	224	330	423	0.7566	55.53	0	NONE	97.9	0.7	1.4	6.9	8	58.1	33.9
13661	KS1_335	67	103	141	222	342	435	0.7539	56.2	0	NONE	97.5	0.8	1.7	6.5	10.7	57.1	32.2
13662	KS1_399	153	97	129	212	329	426	0.7421	59.17	0	NONE	98.1	0.8	1.1	8.1	9.4	62.6	28

Laboratory Fuel Batch ID	Vehicle ID	Sulfur (ppm)	Initial Boiling Point (F)	10% Distillation Point (F)	50% Distillation Point (F)	90% Distillation Point (F)	End Point (F)	Specific Gravity at 60 F	Degrees API at 60 F	Oxygen Weight %	Oxygenate Type	Total Recovery (mL)	Residue (mL)	Loss (mL)	Reid Vapor Pressure (psi)	Olefins (Vol %)	Saturates (Vol %)	Aromatics (Vol %)
13663	KS1_139	115	102	140	224	343	412	0.75	57.18	0	NONE	97.9	0.8	1.3	6.6	7.6	62.6	29.8
13726	KS1_083	43	98	151	227	322	406	0.7468	57.97	0	NONE	98	0.9	1.1	7	2.3	69.8	27.9
13727	KS1_123	313	94	131	213	334	411	0.7348	61.08	0	NONE	97.6	0.9	1.5	8.6	10	68.8	21.2
13728	KS1_005	70	102	141	225	348	428	0.7518	56.71	0	NONE	97.8	0.9	1.3	6.8	12.1	58.5	29.5
13729	KS1_306	154	101	144	226	330	415	0.761	54.46	0	NONE	98.2	0.8	1	6.8	9.7	55.1	35.2
13730	KS1_109	117	104	148	225	335	432	0.7536	56.26	0	NONE	98.2	0.9	0.9	6.4	8.6	61.4	30
13731	KS1_107	146	102	145	222	332	426	0.7552	55.87	0	NONE	98.1	0.9	1	6.5	8.6	59.6	31.8
13732	KS1_153	133	102	142	224	336	423	0.7584	55.09	0	NONE	98.1	0.9	1	6.9	8.3	56.4	35.3
13733	KS1_033	106	102	141	225	340	438	0.7554	55.81	0.14	ETHANOL	97.8	0.8	1.4	6.7	9.6	59.4	31.1
13734	KS1_384	134	96	134	219	331	416	0.7505	57.05	0	NONE	97.9	0.8	1.3	8.2	8	61.5	30.5
13738	KS1_419	41	93	139	226	318	406	0.7416	59.31	0	NONE	97.5	0.8	1.7	8.2	2.1	71.6	26.3
13823	KS1_173	170	101	147	226	342	433	0.7585	55.06	0	NONE	98	0.8	1.2	6.3	9.5	57.4	33.1
13824	KS1_169	166	99	143	225	340	453	0.7526	56.51	0	NONE	97.7	0.8	1.5	6.6	9.5	61	29.5
13825	KS1_367	141	98	132	221	341	433	0.7543	56.09	0	NONE	98.2	0.8	1	7.3	9.4	58.4	32.2
13826	KS1_002	179	106	148	226	332	422	0.7575	55.3	0	NONE	98.2	0.8	1	6.5	7.8	57.9	34.3
13839	KS1_358	149	102	141	225	334	418	0.7555	55.8	0	NONE	98	0.9	1.1	7.2	8.9	58.1	33
13840	KS1_308	174	99	146	227	331	418	0.7603	54.62	0	NONE	97.6	0.8	1.6	6.2	7.7	56.6	35.7
13841	KS1_317	98	105	144	230	350	420	0.7708	52.07	0	NONE	98.1	0.8	1.1	6.4	10.6	48.6	40.8
13842	KS1_319	48	103	140	223	350	437	0.7538	56.21	0	NONE	98.2	0.7	1.1	6.8	11.7	58	30.3
14277	KS1_299	13	99	155	227	319	402	0.745	58.43	0	NONE	97.5	0.9	1.6	6.4	2.1	70.7	27.2
14284	KS1_007	55	98	144	232	339	428	0.7614	54.36	0	NONE	97.5	1	1.5	6.5	10.5	54.1	35.5
14289	KS1_004	321	103	147	227	334	422	0.7506	57.03	0	NONE	97.5	1	1.5	6.4	8.7	63.4	27.9

4.4.2 Summary of Round 2 Regulated Emissions Measurements

As with the Round 1 data, regulated pollutant measurements from the dynamometer are based on speed and emissions time-aligned second-by-second data, integrated for each phase. The PEMS test results were calculated by using speed and emissions time-alignment methodology developed by Sensors, Inc. Table 4-12 provides a side-by-side comparison of Round 2 PEMS vs. dynamometer composite results for each test (excluding control runs). Percentage difference between the two systems is shown for each run, and results with overall differences greater than 100% are indicated with bold-faced font. Out of 279 tests, six report a difference greater than 100% for at least one pollutant. Results from DRI's gravimetrically-collected $PM_{2.5}$ measurements are also shown in Table 4-12 for reference. Additional information and results from particulate matter measurements are provided in Section 4.5

Comparison of phase-specific and total composite emission rates in the data shows a relatively good correlation between the PEMS and dynamometer methods of measurement. A composite emission comparison is provided in this section, and complete (by-phase) results are provided in Appendices G and H for both Rounds 1 and 2 of the study. As with the Round 1 PEMS vs. dynamometer comparison data shown in Table 4-8, analysis of results of future studies, such as the "Measurement Allowance for In-Use Testing" study being conducted in 2006 at Southwest Research Institute in San Antonio, Texas, may help illustrate any discrepancies between results measured using these two systems.

As with the Round 1 data, the last two columns of Table 4-12 indicate dyno and PEMS records which may have suspicious regulated gaseous pollutant results, based on review of test data. For the dynamometer data, an "x" in the "dyno data suspect" column indicates either a test anomaly was noted in the onsite test log, or some issue was identified with the dynamometer data during subsequent data analysis, which could influence the overall test result. Some examples of data issues that would be noted include tests for which part or all of the real-time data was improperly collected or voided, tests where incorrect dynamometer loading was applied, tests where real-time sensors were saturated (pegged at maximum value), tests with equipment failures that would affect overall results, or tests where significant drive trace violations occurred. This review was only applied to dynamometer measurements collected during the study. Detailed notes pertaining to QC review of all dynamometer measurements are provided in Appendices S and V.

All Round 2 PEMS data was also analyzed to identify missing information and indicators of potentially invalid results. This analysis involved performing a comparison of exhaust mass flow rates for each test with those of other vehicles with a similar engine displacement, comparison of exhaust temperatures of each tests with the exhaust temperatures of other vehicles of similar engine displacement, review of exhaust dilution levels (percentage $CO + CO_2$ in exhaust), review of ambient temperature measured during testing and review of test durations, distances, and measured fuel economy. PEMS tests with highly suspicious results are indicated with an "x" in the "PEMS data suspect" in Table 4-12, and detailed notes collected during review of all Round 2 dyno PEMS tests are provided in Appendix P.

Table 4-12. By-Test Comparison of Round 2 PEMS vs. Dynamometer Composite Results

RunID	Temp (F)	RH (%)	HC (g/mi)			CO (g/mi)			NOx (g/mi)			CO2 (g/mi)			PM2.5 (mg/mi)	PEMS DATASuspect	Dyno DATASuspect
			PEMS	Dyno	% Diff	PEMS	Dyno	% Diff	PEMS	Dyno	% Diff	PEMS	Dyno	% Diff			
84393	37.9	70.6	0.58	0.34	41.85	6.07	3.17	47.69	0.33	0.30	8.13	768.10	449.54	41.47	2.48	x	
84394	39.2	69.1	0.51	0.31	39.74	9.95	5.26	47.13	0.47	0.30	36.07	855.25	530.00	38.03	21.09	x	
84396	39.1	65.5	0.27	0.30	-9.58	9.56	8.69	9.11	1.34	1.38	-3.43	371.92	385.82	-3.74	10.49		
84397	39.3	65.8	8.56	4.94	42.28	123.99	73.51	40.71	4.28	3.54	17.35	808.69	559.58	30.80	80.42	x	
84398	32.8	45.7	0.38	0.20	47.50	5.30	3.11	41.34	0.27	0.16	42.16	717.85	402.69	43.90	5.41	x	
84399	32.7	43.4	0.46	0.25	46.16	12.26	6.68	45.54	0.49	0.29	40.47	720.62	399.66	44.54	2.82	x	
84401	30.1	41.3	0.59	0.34	42.21	8.18	4.57	44.13	1.39	0.95	31.21	811.75	495.01	39.02	4.75	x	
84402	29.4	39.2	1.12	1.02	9.08	20.92	17.36	17.01	2.85	2.61	8.24	379.47	337.87	10.96	20.31		
84403	12.2	41.7	1.90	0.60	68.17	9.31	5.20	44.18	0.45	0.33	26.27	789.19	474.11	39.93	7.52	x	
84407	23.9	32.5	1.27	2.90	**-128.74**	39.00	24.18	38.01	5.20	4.58	11.91	557.01	367.97	33.94	151.32	x	
84409	17.9	43.5	0.61	0.50	18.80	7.85	8.41	-7.24	0.94	1.15	-22.43	434.76	432.62	0.49	4.54		
84411	18.4	43.9	0.52	0.53	-1.01	2.42	5.39	**-122.96**	0.54	0.84	-55.84	166.12	384.08	**-131.21**	83.29	x	
84412	17.8	44.8	0.28	0.56	**-100.49**	6.64	9.57	-44.23	0.21	0.47	**-123.70**	171.91	305.99	-78.00	3.09	x	
84413	18.4	47.0	.	1.87	N/A	.	33.86	N/A	.	1.40	N/A	.	700.36	N/A	140.91	x	
84414	27.2	40.1	0.09	0.12	-22.41	1.48	1.59	-7.25	0.20	0.11	45.32	452.20	449.79	0.53	2.56		x
84415	28.4	33.7	0.29	0.33	-13.68	7.68	8.11	-5.65	1.47	1.62	-10.27	696.66	713.39	-2.40	27.03		
84416	28.2	36.0	0.19	0.19	-3.82	7.44	6.63	10.81	0.10	0.08	16.95	321.06	281.73	12.25	3.84		
84419	34.1	30.8	0.44	0.44	-0.92	6.61	6.88	-4.12	0.60	0.52	12.90	470.93	442.39	6.06	4.29		
84420	30.4	39.4	0.19	0.25	-31.96	5.40	5.15	4.66	0.39	0.35	10.31	469.59	379.66	19.15	17.05		
84421	34.9	36.4	0.23	0.24	-5.06	2.45	2.28	7.00	0.43	0.41	5.54	394.82	363.08	8.04	4.21		
84422	37.4	38.5	1.69	1.50	11.37	19.07	16.83	11.73	5.74	5.25	8.63	547.06	522.20	4.54	18.68		x
84424	41.3	41.5	0.27	0.24	9.70	4.69	4.02	14.20	2.43	2.37	2.62	597.83	579.49	3.07	13.91	x	
84425	43.9	39.3	2.40	2.21	7.81	18.67	16.01	14.26	6.07	5.47	9.85	574.97	532.63	7.36	28.28	x	
84426	39.4	61.8	0.20	0.22	-9.28	6.68	6.48	3.04	0.11	0.10	15.51	346.19	306.34	11.51	6.91		
84427	45.2	58.3	0.10	0.11	-14.50	0.92	0.86	6.70	0.14	0.13	6.31	378.39	353.87	6.48	1.45		
84428	46.3	56.5	0.35	0.38	-9.34	5.61	5.57	0.78	0.80	0.71	11.21	429.14	418.70	2.43	17.01		
84430	46.7	56.0	0.80	0.63	21.14	20.97	16.13	23.09	1.78	1.74	1.94	449.98	390.15	13.30	23.64		

RunID	Temp (F)	RH (%)	HC (g/mi)			CO (g/mi)			NOx (g/mi)			CO2 (g/mi)			PM2.5 (mg/mi)	PEMS DATASuspect	Dyno DATASuspect
			PEMS	Dyno	% Diff	PEMS	Dyno	% Diff	PEMS	Dyno	% Diff	PEMS	Dyno	% Diff			
84431	47.1	54.9	0.86	1.15	-34.14	10.00	12.64	-26.42	1.25	1.36	-8.23	487.00	510.38	-4.80	27.39		x
84432	44.7	60.5	0.41	0.41	-0.90	3.05	2.91	4.60	0.32	0.29	11.88	337.72	300.92	10.90	6.55		
84433	48.3	57.4	0.30	0.28	8.12	4.68	3.58	23.62	0.35	0.32	9.64	537.00	486.68	9.37	27.54		
84436	56.3	50.5	0.38	0.36	4.63	10.11	9.28	8.18	0.77	0.64	16.89	540.07	491.97	8.91	3.87		
84437	60.1	47.0	0.27	0.30	-11.63	2.61	2.58	1.23	0.35	0.34	2.37	431.28	430.76	0.12	2.08		
84438	40.3	60.9	0.11	0.11	-6.65	2.10	2.13	-1.58	0.13	0.10	24.91	469.97	439.08	6.57	2.68		
84439	40.6	60.1	0.37	0.39	-5.50	6.03	5.65	6.25	1.71	1.63	4.60	479.21	463.43	3.29	7.32		x
84442	40.7	59.6	0.28	0.30	-7.82	2.61	2.62	-0.41	0.38	0.35	5.88	451.12	471.80	-4.59	2.53		
84443	41.5	61.0	0.59	0.60	-1.63	6.72	6.60	1.78	2.15	1.93	10.21	348.42	331.88	4.75	19.00		
84444	25.0	32.6	0.27	0.31	-16.88	1.21	1.19	1.52	0.19	0.20	-7.26	439.68	449.71	-2.28	18.07		
84445	24.1	33.4	0.26	0.24	7.93	2.37	2.18	8.06	0.11	0.24	**-114.00**	252.55	424.38	-68.03	3.24	x	
84446	23.6	35.8	0.80	0.76	5.05	5.09	5.17	-1.45	0.73	0.62	14.44	537.87	509.89	5.20	30.30		
84448	24.7	38.9	0.44	0.44	-0.74	5.98	6.21	-3.83	0.44	0.41	7.77	535.31	522.17	2.45	22.75		
84449	25.8	39.0	0.44	0.44	-1.09	8.05	7.91	1.77	1.15	1.13	2.12	493.77	473.77	4.05	10.15		
84450	24.9	41.1	3.30	3.09	6.52	30.51	27.69	9.24	5.37	4.81	10.33	454.71	424.96	6.54	20.88		
84452	46.3	49.6	0.28	0.27	1.54	6.99	6.26	10.43	1.04	1.09	-4.82	472.58	459.17	2.84	6.07		x
84453	50.1	47.8	0.46	0.53	-14.69	3.80	4.07	-7.28	0.95	1.07	-12.76	382.63	429.73	-12.31	6.53		
84455	54.9	42.7	0.23	0.24	-5.82	5.13	4.62	9.90	0.45	0.44	1.86	439.62	427.58	2.74	1.83		
84456	55.4	44.1	2.36	1.46	37.99	41.02	25.46	37.94	1.57	1.53	2.49	598.07	487.81	18.44	37.30	x	
84457	42.2	59.8	0.49	0.49	0.82	10.07	6.93	31.18	1.68	2.02	-20.25	494.92	492.17	0.56	22.22		
84458	45.0	52.6	0.71	0.68	3.84	17.01	16.79	1.34	1.38	1.30	6.03	511.47	489.03	4.39	19.93		
84459	45.4	51.6	0.45	0.43	5.22	9.34	8.73	6.54	2.01	1.84	8.16	500.59	468.54	6.40	4.70		
84462	42.9	50.9	3.56	3.32	6.67	99.70	99.11	0.59	1.19	1.15	3.20	393.09	391.90	0.30	38.05		
84463	34.7	62.5	0.25	0.25	-2.61	9.23	7.51	18.65	0.66	0.77	-17.10	378.72	366.52	3.22	101.18		
84464	37.2	61.2	0.61	0.61	-0.08	6.11	5.93	2.89	0.84	0.88	-4.78	470.42	445.46	5.31	32.94		x
84465	37.9	56.0	0.21	0.23	-6.50	3.35	3.32	0.89	0.88	0.92	-3.81	506.96	523.56	-3.28	188.71		
84467	37.2	55.0	2.11	1.61	23.58	21.89	17.60	19.61	1.83	1.81	0.88	408.71	360.11	11.89	23.32		
84468	36.6	46.3	0.22	0.23	-6.20	3.57	3.54	0.69	0.73	0.78	-6.68	485.25	498.02	-2.63	5.22		
84469	37.6	43.0	1.44	1.38	3.90	17.70	15.24	13.89	2.62	2.58	1.46	454.60	441.30	2.93	138.65		x

RunID	Temp (F)	RH (%)	HC (g/mi)			CO (g/mi)			NOx (g/mi)			CO2 (g/mi)			PM2.5 (mg/mi)	PEMS DATASuspect	Dyno DATASuspect
			PEMS	Dyno	% Diff	PEMS	Dyno	% Diff	PEMS	Dyno	% Diff	PEMS	Dyno	% Diff			
84470	38.0	42.9	61.47	16.14	73.74	237.74	210.51	11.46	2.08	2.09	-0.45	571.61	509.39	10.88	332.68	x	x
84472	40.0	40.9	8.72	4.26	51.17	82.10	59.14	27.96	1.91	2.02	-5.95	544.44	489.49	10.09	91.37	x	
84473	33.3	72.6	0.20	0.19	6.29	3.63	3.17	12.64	0.87	0.83	4.29	590.07	574.45	2.65	13.22		
84474	35.9	67.1	1.32	1.08	18.73	14.67	10.62	27.61	1.30	1.22	5.99	322.60	268.88	16.65	63.87		
84475	36.8	65.2	1.75	1.61	7.93	31.84	31.35	1.54	0.84	0.85	-1.29	408.81	398.80	2.45	43.59		
84477	39.4	59.8	1.45	1.49	-2.81	57.06	58.25	-2.07	1.98	1.80	9.30	439.23	421.54	4.03	74.32		
84479	35.0	78.3	0.38	0.39	-2.92	5.78	5.43	6.13	0.78	0.76	2.12	499.39	492.78	1.32	7.99		
84482	39.0	70.1	1.11	1.11	0.20	13.01	12.75	2.06	8.32	6.97	16.17	520.14	510.14	1.92	14.10		
84483	41.1	58.3	0.41	0.38	7.15	4.48	3.99	11.06	0.43	0.41	4.39	386.15	352.43	8.73	5.01		
84484	40.7	56.8	1.06	1.04	1.84	12.85	12.39	3.61	8.43	7.05	16.31	511.04	506.80	0.83	8.66		
84485	38.9	59.2	1.28	1.10	14.03	28.15	25.09	10.90	1.04	1.02	2.08	624.86	571.32	8.57	20.05		
84487	44.1	46.8	1.01	0.96	5.16	50.98	45.73	10.31	2.86	2.86	-0.07	432.14	420.65	2.66	22.53		
84488	35.4	65.4	0.19	0.19	0.06	3.56	3.00	15.59	0.79	0.84	-7.20	482.94	472.03	2.26	2.58		
84489	34.9	63.0	0.73	0.67	7.05	3.44	3.12	9.30	3.34	3.12	6.51	414.93	385.26	7.15	15.40		
84490	36.9	55.0	1.13	0.97	14.34	28.26	24.95	11.74	1.00	1.02	-1.61	609.41	556.44	8.69	3.84		
84492	41.4	39.7	2.83	1.46	48.50	23.16	20.95	9.54	1.70	1.63	4.18	581.85	544.35	6.44	52.72		
84493	34.5	58.9	0.05	0.06	-21.26	0.63	0.51	19.16	0.03	0.03	-15.71	473.60	462.63	2.32	1.09		
84494	42.9	52.4	0.21	0.22	-7.65	5.27	4.58	13.00	1.22	1.19	2.01	398.22	375.23	5.77	2.75		
84495	47.9	49.4	0.38	0.32	15.36	7.18	5.67	20.96	0.55	0.52	5.29	390.95	363.23	7.09	2.08		
84497	53.8	43.3	0.36	0.37	-1.41	8.60	7.42	13.72	0.61	0.55	10.10	593.97	564.85	4.90	24.40	x	
84498	43.7	55.8	0.32	0.28	11.39	4.33	3.33	23.08	0.43	0.42	2.91	491.62	470.13	4.37	10.10		
84499	49.7	51.9	0.41	0.47	-14.08	8.72	8.90	-1.98	0.34	0.32	4.16	349.35	348.21	0.32	4.66		
84500	55.1	46.1	0.51	0.53	-4.52	6.67	6.06	9.13	1.98	1.89	4.34	401.17	409.04	-1.96	4.82		
84503	49.2	45.0	0.11	0.11	-4.57	1.07	0.74	30.79	0.19	0.20	-5.28	477.64	476.38	0.26	2.80		
84504	51.3	43.9	0.37	0.38	-2.73	3.07	2.82	8.40	0.42	0.38	10.24	442.28	434.87	1.67	2.46		
84505	54.3	40.1	0.62	0.62	0.45	7.69	6.63	13.74	1.73	1.69	2.18	465.15	439.47	5.52	8.63		
84507	58.9	27.1	2.80	2.51	10.61	20.14	16.15	19.79	5.83	5.12	12.15	443.27	401.66	9.39	2.44		
84508	34.6	63.0	0.45	0.47	-3.24	11.38	11.61	-2.02	0.60	0.59	0.72	263.38	273.72	-3.93	2.69		
84509	34.0	60.4	2.37	2.13	10.23	19.49	17.24	11.56	4.05	3.49	13.71	586.33	516.86	11.85	14.08		

RunID	Temp (F)	RH (%)	HC (g/mi)			CO (g/mi)			NOx (g/mi)			CO2 (g/mi)			PM2.5 (mg/mi)	PEMS DATASuspect	Dyno DATASuspect
			PEMS	Dyno	% Diff	PEMS	Dyno	% Diff	PEMS	Dyno	% Diff	PEMS	Dyno	% Diff			
84510	34.9	55.5	3.04	2.74	10.01	34.42	31.65	8.03	4.06	3.75	7.74	648.26	625.32	3.54	22.33		
84512	31.0	57.6	72.24	17.97	75.13	226.14	179.00	20.84	0.68	0.70	-3.27	437.15	374.06	14.43	181.76		x
84514	27.0	56.1	0.29	0.21	27.96	1.49	1.26	15.78	0.26	0.21	20.71	478.55	470.46	1.69	3.85		x
84515	28.2	58.1	0.41	0.33	18.12	9.98	8.38	16.04	0.80	0.71	11.55	485.14	403.43	16.84	5.43		
84517	27.7	62.7	0.40	0.40	1.17	3.58	3.62	-1.16	0.70	0.65	6.72	508.30	511.52	-0.63	21.76		
84518	28.7	62.8	0.60	0.58	3.37	9.81	9.26	5.58	0.74	0.75	-0.43	441.86	435.76	1.38	2.69		
84519	29.6	61.7	1.41	1.13	19.81	15.74	11.19	28.88	3.67	3.19	13.21	553.44	465.20	15.95	23.01		
84520	26.8	52.3	0.13	0.13	2.15	1.20	1.07	11.02	0.18	0.18	1.34	482.03	474.17	1.63	2.68		
84521	28.2	85.1	0.24	0.25	-3.02	5.12	5.04	1.47	0.47	0.48	-1.58	400.40	404.90	-1.12	2.60		
84522	29.3	103.1	0.32	0.29	8.16	3.42	2.88	15.74	0.41	0.41	-0.57	536.22	505.22	5.78	5.74		
84524	33.8	94.9	0.41	0.41	1.08	6.75	6.58	2.45	1.22	1.27	-4.58	361.99	351.43	2.92	4.26		
84526	35.7	86.6	0.77	0.79	-2.02	9.82	9.29	5.38	1.08	1.20	-10.74	507.29	506.58	0.14	52.17		
84527	24.3	35.3	0.80	0.65	18.63	12.57	10.28	18.22	0.67	0.55	17.53	743.67	650.11	12.58	15.39		
84528	31.4	24.0	0.63	0.61	3.21	10.91	8.79	19.44	1.50	1.58	-5.22	526.88	526.18	0.13	133.10		
84529	35.2	20.7	1.41	1.10	21.71	22.32	20.87	6.53	1.55	1.46	5.80	390.26	386.18	1.05	56.52		
84531	40.3	17.3	0.88	0.73	17.71	22.05	22.00	0.20	1.70	1.71	-0.63	354.69	351.92	0.78	18.61		
84532	34.9	2.4	0.21	0.21	2.88	3.57	3.84	-7.34	0.28	0.26	5.17	500.88	507.07	-1.24	5.81		x
84533	39.8	1.3	0.34	0.31	7.48	4.98	4.21	15.51	1.15	1.07	7.11	693.60	670.09	3.39	6.46		
84534	44.1	5.1	0.59	0.58	2.46	5.45	5.20	4.59	0.73	0.71	2.91	402.44	412.17	-2.42	28.13		x
84537	40.9	63.8	0.30	0.30	0.41	5.61	4.48	20.10	0.82	0.73	10.01	587.41	533.31	9.21	3.18		x
84538	45.6	58.5	0.14	0.14	1.19	3.56	2.77	22.15	1.11	1.10	0.86	499.99	509.84	-1.97	1.07		
84539	47.9	57.4	0.63	0.61	3.38	8.76	7.49	14.54	0.82	0.75	7.89	612.67	589.85	3.73	3.95		
84541	49.8	68.3	0.79	0.70	11.03	16.98	13.57	20.10	1.29	1.05	18.26	542.43	467.28	13.85	6.33		
84542	44.6	61.3	0.73	0.74	-1.63	15.74	14.81	5.91	1.06	1.08	-2.29	462.55	478.70	-3.49	4.91		
84543	49.5	52.5	0.24	0.24	3.65	5.25	4.03	23.30	0.85	0.75	11.28	587.66	534.29	9.08	3.98		
84546	47.0	63.1	0.44	0.37	16.37	7.32	5.51	24.78	0.74	0.72	3.25	533.03	500.90	6.03	2.72		
84547	48.6	59.8	0.34	0.38	-11.72	3.87	3.78	2.40	0.42	0.42	0.45	299.57	305.26	-1.90	17.67		
84548	50.5	53.6	0.45	0.47	-4.13	4.20	3.79	9.87	0.63	0.63	-0.47	424.38	427.29	-0.68	2.84		
84550	53.3	42.2	2.54	2.50	1.96	18.43	17.53	4.88	2.07	2.07	0.06	509.46	524.94	-3.04	22.27		

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			PEMS	Dyno	% Diff	PEMS	Dyno	% Diff	PEMS	Dyno	% Diff	PEMS	Dyno	% Diff			
84551	37.9	56.4	0.23	0.25	-5.13	4.64	4.14	10.93	0.25	0.24	5.00	509.68	520.95	-2.21	5.64		
84552	39.5	51.8	0.16	0.17	-4.75	3.13	3.27	-4.44	0.24	0.20	15.25	488.16	483.63	0.93	2.04		
84554	44.3	38.0	0.76	0.67	12.19	10.46	9.22	11.84	1.44	1.44	0.05	639.27	609.71	4.62	13.76		
84556	35.8	54.9	0.27	0.27	0.01	4.32	4.12	4.69	0.83	0.83	-0.83	481.60	493.01	-2.37	4.63		
84557	40.7	42.4	0.20	0.21	-6.60	2.07	2.06	0.85	0.36	0.34	5.28	511.55	503.02	1.67	2.70		
84558	43.5	36.3	0.96	0.65	32.26	6.70	5.77	13.78	0.40	0.37	8.26	569.08	547.54	3.79	36.01		x
84560	48.8	36.1	0.32	0.24	26.41	4.01	2.59	35.41	0.45	0.31	31.46	450.99	316.54	29.81	6.10		x
84562	33.3	47.8	0.11	0.10	8.87	0.95	0.78	18.04	0.12	0.10	18.30	543.05	503.15	7.35	4.39		
84563	38.5	39.6	0.17	0.17	-1.58	2.27	1.87	17.50	0.14	0.14	-3.94	524.23	527.05	-0.54	0.92		
84564	40.1	36.7	0.25	0.26	-4.02	3.44	3.46	-0.66	0.71	0.67	5.01	477.35	483.15	-1.21	5.44		
84566	44.8	32.7	0.50	0.51	-3.48	7.86	7.98	-1.52	0.47	0.49	-5.61	452.12	466.10	-3.09	36.75		
84567	46.6	30.4	12.49	12.44	0.40	260.54	246.30	5.47	0.25	0.40	-60.56	413.85	400.09	3.32	44.26		
84568	45.0	61.8	0.74	0.61	17.42	11.84	9.03	23.74	1.43	1.39	2.55	400.19	391.76	2.11	4.11		
84569	45.1	62.4	0.32	0.30	5.85	7.14	6.38	10.61	0.88	0.88	-0.74	444.84	430.50	3.22	3.37		
84570	45.4	64.5	0.46	0.33	28.04	12.20	9.09	25.52	0.54	0.49	9.15	447.77	392.10	12.43	1.00		
84572	46.6	65.6	0.39	0.42	-6.51	7.76	8.00	-3.08	1.07	1.10	-2.23	397.89	408.23	-2.60	3.64		
84573	36.5	71.8	0.22	0.22	1.08	3.37	3.08	8.58	1.04	1.01	3.09	526.77	519.34	1.41	5.03		
84574	37.7	67.3	0.34	0.35	-1.62	8.06	7.80	3.24	0.91	0.89	2.57	413.90	416.33	-0.59	1.05		
84575	39.0	65.5	0.92	0.89	2.90	19.86	18.51	6.79	1.55	1.54	1.06	446.92	439.91	1.57	5.78		
84577	42.0	62.2	0.21	0.22	-2.95	8.18	7.16	12.48	2.10	1.67	20.48	521.50	503.33	3.48	5.97		
84580	45.3	45.8	.	0.19	N/A	.	3.12	N/A	.	0.61	N/A	.	510.78	N/A	8.98	x	
84581	45.5	45.8	0.47	0.40	15.18	7.08	6.24	11.87	0.79	0.78	1.06	429.74	414.46	3.56	1.09		
84582	47.2	40.4	2.09	2.07	0.99	26.27	24.39	7.16	1.44	1.37	4.99	377.35	377.87	-0.14	15.57		
84584	42.5	53.9	0.32	0.31	1.39	5.25	4.62	11.96	0.36	0.32	12.05	395.96	390.46	1.39	5.82		
84587	43.9	45.7	0.68	0.64	5.01	4.86	4.85	0.08	1.04	1.12	-7.43	471.10	486.39	-3.25	12.14		
84588	48.3	40.6	2.35	1.78	24.39	49.00	44.23	9.74	1.51	1.53	-1.78	656.38	634.10	3.39	19.30		
84589	52.6	36.0	0.12	0.14	-14.05	1.51	1.50	0.90	0.18	0.17	4.87	305.59	305.68	-0.03	32.80		
84591	41.4	51.6	0.36	0.36	-0.37	7.94	7.16	9.78	1.74	1.63	6.52	546.21	549.47	-0.60	21.79		
84592	45.5	46.2	11.23	5.76	48.72	83.51	75.85	9.18	2.31	1.89	18.29	379.45	344.28	9.27	79.12		

RunID	Temp (F)	RH (%)	HC (g/mi) PEMS	HC (g/mi) Dyno	HC (g/mi) % Diff	CO (g/mi) PEMS	CO (g/mi) Dyno	CO (g/mi) % Diff	NOx (g/mi) PEMS	NOx (g/mi) Dyno	NOx (g/mi) % Diff	CO2 (g/mi) PEMS	CO2 (g/mi) Dyno	CO2 (g/mi) % Diff	PM2.5 (mg/mi)	PEMS DATASuspect	Dyno DATASuspect
84593	49.5	43.0	0.14	0.13	5.29	3.48	3.30	5.05	0.16	0.16	-2.91	365.10	369.05	-1.08	3.38		
84595	36.7	43.7	0.15	0.15	-0.69	4.76	4.15	12.90	1.14	1.13	0.18	331.06	339.68	-2.60	2.13		x
84597	38.4	40.9	0.87	0.87	0.52	17.46	17.55	-0.53	0.46	0.46	0.15	355.75	354.16	0.45	.		
84599	29.1	43.9	0.58	0.57	1.69	3.35	3.28	2.22	0.28	0.28	-1.57	422.68	427.98	-1.25	12.22		
84600	32.3	37.6	0.44	0.42	4.94	9.23	8.50	7.91	1.29	1.24	4.14	594.55	570.58	4.03	22.84		
84601	35.8	31.4	5.73	4.53	20.97	81.91	61.33	25.13	2.89	2.79	3.50	529.17	478.50	9.58	47.94		
84603	39.4	42.0	3.78	2.85	24.43	12.84	13.40	-4.30	3.13	3.33	-6.20	298.54	309.04	-3.52	7.46		
84605	45.9	44.8	2.69	1.70	37.00	27.17	16.19	40.41	2.38	2.57	-7.82	519.96	498.77	4.07	50.99	x	
84609	48.8	65.2	5.69	3.64	36.09	56.98	44.72	21.52	3.05	2.92	4.23	589.28	488.40	17.12	25.56		
84611	59.2	41.0	0.40	0.43	-8.39	5.58	6.11	-9.52	1.57	1.54	2.16	434.32	446.87	-2.89	5.42		
84612	42.1	55.2	0.03	0.14	**-314.48**	1.19	2.08	-75.15	0.23	0.55	**-140.82**	376.53	488.62	-29.77	0.75		
84616	52.9	47.8	0.13	0.15	-14.61	1.17	0.98	16.13	0.25	0.25	-0.92	457.91	466.89	-1.96	1.05		
84617	53.1	46.5	0.35	0.34	3.65	6.11	4.92	19.46	1.15	1.07	6.88	667.77	617.99	7.45	5.67		
84618	50.6	47.7	0.95	0.66	30.44	25.04	19.55	21.93	3.70	4.04	-9.00	594.72	447.57	24.74	6.31		
84620	51.8	42.1	5.25	2.76	47.46	42.57	21.38	49.77	2.00	3.09	-55.00	478.64	416.35	13.01	8.05		
84621	52.8	35.1	0.56	0.51	8.09	8.29	7.47	9.90	1.12	1.14	-1.67	476.73	451.38	5.32	4.56		
84622	37.4	45.9	0.83	0.47	43.58	6.99	4.09	41.50	0.61	0.43	30.43	609.37	395.53	35.09	7.62		
84623	41.1	39.1	1.66	0.82	50.60	37.82	18.40	51.36	3.75	3.43	8.55	564.77	357.33	36.73	27.09		
84626	46.2	35.5	1.21	1.20	1.14	35.85	36.13	-0.76	1.89	1.69	10.64	454.01	429.85	5.32	19.60		
84627	47.0	34.9	36.53	14.84	59.37	86.27	68.54	20.55	3.75	3.72	0.70	638.02	547.12	14.25	232.12		
84628	37.9	44.0	0.46	0.41	11.27	4.92	4.74	3.59	0.32	0.31	5.04	576.61	582.37	-1.00	14.58		
84629	38.9	38.6	0.40	0.40	-0.86	6.58	6.78	-2.98	0.19	0.17	12.66	432.73	421.14	2.68	5.16		
84630	40.4	36.1	1.28	1.14	10.63	30.95	29.30	5.34	0.50	0.51	-0.93	400.17	371.43	7.18	10.56		
84632	45.0	30.4	40.53	15.16	62.60	108.94	88.15	19.09	3.73	3.63	2.53	659.57	567.58	13.95	99.41		
84633	47.8	46.9	1.42	1.29	9.42	63.89	59.03	7.59	1.29	1.23	4.64	433.92	392.32	9.59	.		
84634	51.9	43.8	1.10	1.06	3.03	12.48	11.56	7.40	3.77	3.14	16.54	473.99	464.05	2.10	23.18		
84635	56.5	33.1	1.67	1.51	9.17	19.13	16.34	14.58	1.45	1.53	-5.37	481.67	469.67	2.49	65.85		
84637	59.7	23.7	4.13	3.78	8.64	73.58	69.22	5.92	4.08	3.89	4.81	462.42	465.32	-0.63	146.94		
84638	42.5	36.3	1.39	1.29	6.71	24.27	22.69	6.52	1.27	1.34	-5.69	468.83	471.90	-0.65	2.57		

RunID			HC (g/mi)			CO (g/mi)			NOx (g/mi)			CO2 (g/mi)					
	Temp (F)	**RH (%)**	**PEMS**	**Dyno**	**% Diff**	**PEMS**	**Dyno**	**% Diff**	**PEMS**	**Dyno**	**% Diff**	**PEMS**	**Dyno**	**% Diff**	**PM2.5 (mg/mi)**	**PEMS DATASuspect**	**Dyno DATASuspect**
84639	45.6	33.5	0.35	0.32	9.48	6.37	5.41	15.01	0.71	0.75	-5.27	357.61	327.89	8.31	1.80		
84640	48.7	32.4	0.27	0.26	4.74	9.53	7.92	16.84	1.30	1.32	-1.21	531.04	526.67	0.82	.		
84642	55.0	29.7	0.60	0.54	10.79	22.01	19.15	12.97	1.55	1.49	3.95	426.25	393.81	7.61	5.78		
84643	58.5	24.2	1.98	1.81	8.41	33.33	29.75	10.75	2.78	2.63	5.24	368.63	341.79	7.28	146.04		
84644	49.7	42.3	0.23	0.21	8.80	3.30	3.17	4.12	0.38	0.36	6.70	539.31	528.40	2.02	5.05		
84645	56.5	34.2	0.48	0.48	-0.24	5.28	4.82	8.72	0.46	0.48	-5.01	448.69	438.10	2.36	6.37		
84646	60.7	31.4	0.84	0.70	16.37	19.91	15.70	21.14	1.42	1.41	0.61	437.79	369.17	15.67	6.27		x
84648	65.7	24.2	1.11	1.09	1.27	21.77	22.08	-1.42	1.84	1.71	7.14	530.95	515.29	2.95	37.11		
84649	40.2	43.9	0.91	0.73	19.74	9.82	7.07	28.05	0.81	0.71	11.96	562.10	463.40	17.56	6.49		
84650	42.5	38.7	0.69	0.60	12.45	13.19	11.24	14.73	1.51	1.55	-2.14	481.95	455.82	5.42	7.63		
84653	50.2	27.1	5.79	3.91	32.47	89.24	71.68	19.68	5.81	5.10	12.17	737.72	688.25	6.71	111.61	x	
84655	49.4	26.0	0.38	0.39	-1.98	4.75	4.79	-0.74	1.28	1.28	0.03	484.11	472.30	2.44	5.35		
84656	52.0	25.2	0.50	0.43	14.22	10.14	7.96	21.48	1.28	1.31	-2.76	452.44	426.19	5.80	7.84		
84658	54.8	24.0	0.85	0.86	-1.59	12.34	11.18	9.41	3.00	2.85	4.92	401.29	381.53	4.92	6.65		x
84659	55.5	23.7	2.98	1.73	41.88	36.83	31.08	15.61	2.99	2.72	9.13	437.14	420.67	3.77	15.53		
84660	55.6	23.6	1.34	1.27	5.39	8.20	7.09	13.50	2.85	3.00	-5.11	466.47	457.67	1.89	157.13		
84661	44.3	50.7	0.32	0.29	11.31	4.71	3.67	22.00	1.31	1.34	-2.20	448.87	428.46	4.55	4.07		
84662	47.8	48.7	2.49	2.17	12.94	45.92	41.43	9.79	5.32	5.01	5.98	558.34	520.33	6.81	19.07		x
84663	51.4	42.8	1.13	0.91	19.30	16.97	12.60	25.76	1.57	1.60	-1.56	441.54	376.29	14.78	22.22		x
84665	54.9	34.2	0.61	0.58	5.18	12.99	12.07	7.12	2.86	2.79	2.52	544.58	505.47	7.18	10.04		
84666	56.4	28.3	1.04	1.07	-2.43	12.48	12.56	-0.68	2.85	2.89	-1.38	590.71	600.24	-1.61	12.77		
84667	57.8	22.8	7.77	6.88	11.45	69.05	65.68	4.88	3.27	3.29	-0.44	632.92	605.14	4.39	12.39		x
84668	48.9	37.3	0.17	0.17	5.37	2.26	1.92	15.33	1.46	1.36	6.90	487.41	459.26	5.78	2.45		
84669	53.0	30.7	1.25	1.03	17.60	23.53	20.32	13.62	2.56	2.70	-5.53	426.87	397.18	6.96	27.15		x
84670	55.9	27.3	0.76	0.70	8.01	15.52	14.10	9.15	1.22	1.25	-1.75	428.30	388.45	9.30	10.56		
84672	58.3	24.1	0.42	0.41	0.99	7.05	5.91	16.20	0.88	0.91	-2.93	294.79	265.97	9.78	4.91		
84673	60.5	21.4	12.67	6.47	48.93	305.06	213.11	30.14	2.63	0.65	75.22	703.78	674.27	4.19	83.99	x	x
84674	60.7	20.1	3.19	2.49	21.91	48.33	42.38	12.30	2.56	2.70	-5.16	545.13	500.75	8.14	8.98		
84675	52.9	28.9	0.33	0.34	-3.81	5.00	4.86	2.74	1.88	1.99	-5.81	400.47	395.88	1.15	4.11		

RunID	Temp (F)	RH (%)	HC (g/mi)			CO (g/mi)			NOx (g/mi)			CO2 (g/mi)			PM2.5 (mg/mi)	PEMS DATASuspect	Dyno DATASuspect
			PEMS	Dyno	% Diff	PEMS	Dyno	% Diff	PEMS	Dyno	% Diff	PEMS	Dyno	% Diff			
84676	54.8	25.6	0.99	0.89	10.20	19.21	17.58	8.51	2.16	2.29	-5.93	540.03	513.65	4.88	8.78		
84677	57.9	24.1	0.28	0.27	2.88	4.52	4.14	8.52	0.64	0.60	5.61	478.77	448.88	6.24	2.03		
84679	60.5	25.4	1.42	1.20	15.12	18.60	14.41	22.55	1.31	1.36	-3.76	390.69	341.77	12.52	7.87		
84680	62.1	24.2	53.89	16.94	68.56	148.84	111.35	25.19	1.82	2.34	-28.55	606.50	527.49	13.03	417.10		
84681	41.3	68.7	0.29	0.31	-4.74	4.02	4.09	-1.77	1.88	2.15	-14.10	406.11	401.57	1.12	.		x
84682	43.1	33.1	2.30	2.39	-3.95	46.58	46.27	0.65	0.90	0.90	0.01	430.75	436.33	-1.29	20.09		x
84683	45.5	39.4	1.18	1.04	11.69	15.28	12.86	15.80	2.74	2.87	-4.53	423.70	404.59	4.51	9.18		x
84685	46.9	22.6	1.69	1.21	28.30	7.12	5.50	22.73	1.83	1.90	-4.11	641.39	603.75	5.87	66.01		x
84686	49.3	14.1	6.62	3.27	50.61	26.05	18.29	29.80	4.61	3.90	15.33	537.08	439.63	18.15	27.30		x
84687	49.9	3.2	2.33	1.90	18.58	51.55	43.90	14.85	1.65	1.58	4.14	681.37	622.69	8.61	32.52	x	x
84688	52.1	38.9	0.42	0.41	2.27	6.86	6.47	5.77	1.30	1.28	1.77	490.93	459.18	6.47	10.36		
84689	54.2	38.2	0.26	0.26	-3.14	7.26	6.72	7.44	0.67	0.67	0.20	327.55	308.20	5.91	2.43		
84690	55.2	38.3	0.70	0.68	2.68	9.95	9.29	6.64	1.05	1.26	-20.81	372.43	378.31	-1.58	2.00		
84692	55.8	35.3	7.05	7.62	-8.09	161.33	158.99	1.45	0.22	0.26	-21.20	290.43	284.65	1.99	19.12		
84693	54.7	43.3	1.06	1.00	4.95	16.73	15.58	6.88	1.83	1.91	-4.70	557.86	543.17	2.63	5.66		
84694	52.1	51.9	2.91	1.91	34.14	27.93	20.69	25.93	5.11	4.43	13.28	596.16	492.64	17.36	26.68		
84695	42.4	67.6	0.71	0.63	10.57	9.06	7.38	18.61	1.00	1.20	-20.87	385.47	390.72	-1.36	2.12		
84696	42.2	67.7	6.17	3.73	39.51	31.60	25.23	20.15	3.35	3.60	-7.49	473.70	391.13	17.43	51.72		
84699	42.6	71.1	8.22	5.18	36.98	76.51	61.85	19.16	2.03	2.48	-21.68	560.64	514.41	8.25	158.21		
84700	40.8	72.9	8.22	6.11	25.70	78.09	65.54	16.07	3.31	3.38	-1.90	669.95	613.09	8.49	68.99		
84701	40.2	66.9	0.51	0.49	3.56	3.85	3.39	11.91	2.07	2.21	-6.72	399.99	394.25	1.44	11.59		
84702	41.2	64.8	1.38	1.27	8.35	15.46	12.60	18.51	1.61	1.69	-4.46	653.84	587.59	10.13	8.53		
84703	43.7	60.9	1.23	1.09	11.50	29.87	26.32	11.91	5.69	5.33	6.36	528.25	505.96	4.22	11.19		
84705	48.1	54.2	2.37	2.25	4.91	72.01	75.48	-4.81	0.76	0.78	-3.02	496.27	486.48	1.97	27.23		
84707	48.6	52.8	4.63	2.75	40.63	45.21	38.52	14.81	1.95	2.10	-7.36	713.34	669.72	6.11	78.06	x	
84708	46.0	60.0	0.10	0.10	0.32	1.28	1.11	13.36	0.55	0.51	5.63	485.14	460.99	4.98	11.19		
84709	47.0	60.4	1.49	1.12	24.75	21.79	18.00	17.39	1.32	1.33	-0.37	430.60	365.17	15.20	3.37		
84710	48.2	59.3	2.33	1.29	44.55	22.28	21.31	4.33	0.62	0.66	-5.45	414.17	412.37	0.43	39.89		x
84712	48.8	61.3	12.63	6.36	49.65	80.06	75.65	5.51	1.79	2.09	-17.25	413.05	396.93	3.90	30.98		

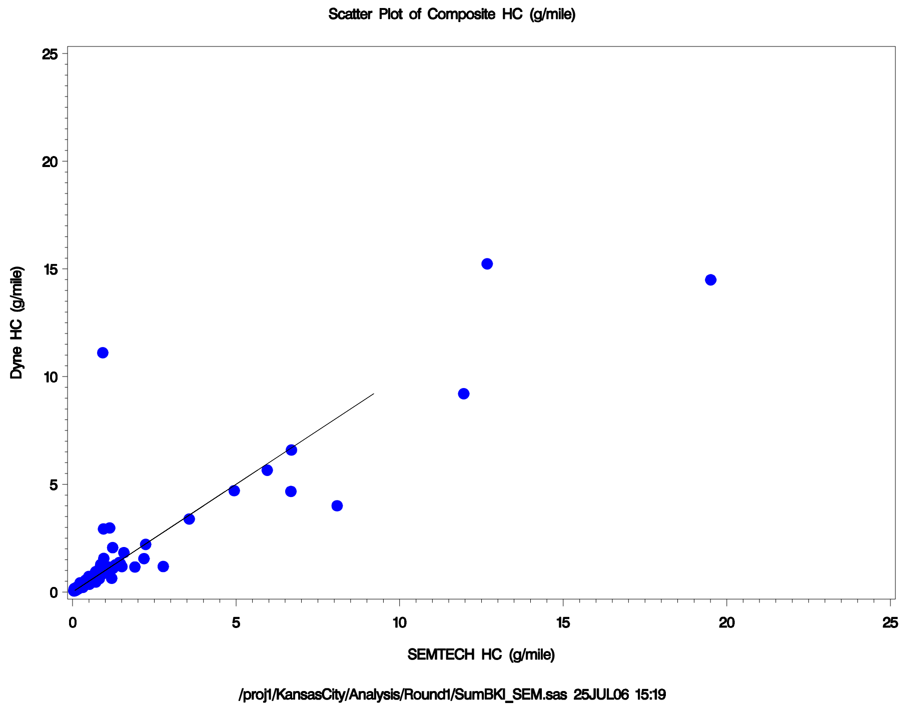
RunID	Temp (F)	RH (%)	HC (g/mi)			CO (g/mi)			NOx (g/mi)			CO2 (g/mi)			PM2.5 (mg/mi)	PEMS DATASuspect	Dyno DATASuspect
			PEMS	Dyno	% Diff	PEMS	Dyno	% Diff	PEMS	Dyno	% Diff	PEMS	Dyno	% Diff			
84713	44.1	74.1	0.41	0.36	12.60	7.34	6.16	16.09	0.57	0.60	-6.30	512.17	508.62	0.69	2.45		
84714	43.2	71.4	0.35	0.34	2.79	4.99	5.23	-4.93	0.22	0.27	-22.71	318.77	302.51	5.10	10.46		
84715	43.2	72.6	2.46	2.08	15.41	39.40	37.92	3.75	1.61	1.76	-9.56	390.35	361.07	7.50	59.26		
84719	42.7	62.0	0.43	0.32	25.36	8.49	6.92	18.45	1.09	1.12	-3.08	489.94	434.34	11.35	1.24		
84720	43.6	59.9	2.05	1.81	11.68	19.36	17.63	8.96	2.95	2.97	-0.59	685.23	614.65	10.30	9.57		
84722	50.5	47.4	0.21	0.18	14.42	2.50	2.15	14.04	1.69	1.45	13.97	530.69	498.32	6.10	2.87		
84723	54.7	43.2	2.40	1.95	19.09	18.95	14.48	23.57	3.33	3.71	-11.45	400.78	353.94	11.69	11.05		
84724	58.8	35.3	0.76	0.52	30.67	8.91	6.40	28.20	1.48	1.51	-1.76	477.91	408.42	14.54	4.31		
84726	64.4	29.1	0.73	0.59	18.40	18.88	15.75	16.58	1.49	1.42	4.68	541.37	453.30	16.27	2.86		
84727	66.5	26.5	0.80	0.77	3.16	13.76	13.98	-1.54	1.11	1.14	-2.90	528.49	511.19	3.27	34.79	x	
84728	62.5	43.4	0.16	0.14	9.01	0.95	0.67	29.19	0.09	0.14	-63.59	466.10	443.83	4.78	5.89		
84729	64.6	41.5	0.18	0.18	2.58	3.09	2.86	7.50	0.29	0.29	1.90	319.05	387.32	-21.40	2.13		
84730	66.6	39.6	1.40	1.04	25.55	13.25	9.79	26.06	0.59	0.58	1.38	535.18	479.25	10.45	6.57		
84732	70.6	37.1	4.86	3.75	22.91	84.37	69.27	17.90	4.02	4.59	-14.20	480.18	440.96	8.17	7.78		
84733	63.4	42.7	0.28	0.25	10.90	2.39	2.20	7.81	0.67	0.64	4.59	481.69	449.98	6.58	1.44		x
84734	63.0	42.9	0.65	0.58	9.42	8.48	7.86	7.28	1.58	1.61	-1.71	497.26	457.62	7.97	3.61		
84737	59.5	49.5	0.25	0.26	-2.33	10.72	10.58	1.38	0.93	0.89	3.68	419.50	378.23	9.84	10.10		
84738	58.2	50.7	5.53	4.62	16.54	159.32	145.23	8.84	1.81	2.17	-20.15	652.37	614.61	5.79	15.24		
84739	50.1	52.1	0.51	0.53	-3.58	7.99	7.71	3.56	0.68	0.78	-15.28	305.08	350.72	-14.96	22.84		
84740	51.6	48.7	0.68	0.57	15.80	9.94	8.11	18.39	0.85	0.86	-1.32	532.50	488.72	8.22	6.71		
84743	52.4	42.3	.	0.20	N/A	.	5.39	N/A	.	1.09	N/A	.	295.12	N/A	1.19		
84745	50.2	38.5	0.72	0.66	8.26	15.11	12.51	17.23	2.00	1.97	1.37	298.20	277.54	6.93	16.61		
84747	63.6	36.9	0.08	0.03	60.96	1.27	-0.93	**173.07**	0.49	0.48	0.49	519.53	382.85	26.31	.		x
84748	66.1	36.9	0.10	0.10	3.55	2.49	1.85	25.75	0.73	0.75	-2.59	535.67	489.93	8.54	1.62		
84749	68.0	37.3	0.15	0.13	12.28	2.43	1.64	32.55	0.25	0.25	1.00	470.47	429.24	8.76	1.13		
84751	72.3	35.9	0.16	0.16	4.56	6.72	5.96	11.34	1.14	1.31	-14.18	308.51	332.03	-7.62	2.92		
84752	74.1	33.5	0.41	0.45	-10.32	2.80	2.57	8.29	1.56	1.52	2.21	253.43	246.05	2.91	6.38	x	
84753	66.0	59.6	0.14	0.13	6.17	1.36	1.04	23.14	0.22	0.20	9.77	520.58	485.51	6.74	6.15		
84754	67.0	58.3	0.08	0.08	-0.09	0.78	0.51	35.11	0.36	0.34	5.38	516.47	481.02	6.86	3.38		

RunID	Temp (F)	RH (%)	HC (g/mi)			CO (g/mi)			NOx (g/mi)			CO2 (g/mi)			PM2.5 (mg/mi)	PEMS DATASuspect	Dyno DATASuspect
			PEMS	Dyno	% Diff	PEMS	Dyno	% Diff	PEMS	Dyno	% Diff	PEMS	Dyno	% Diff			
84755	69.1	54.7	0.10	0.10	4.16	2.45	2.40	2.20	0.14	0.12	13.63	509.45	501.79	1.51	2.88		
84757	68.2	50.0	0.18	0.19	-4.18	1.98	1.52	23.33	0.49	0.46	4.98	531.78	498.01	6.35	2.02		
84758	68.9	49.1	3.59	3.19	11.24	54.92	53.57	2.45	1.38	1.53	-11.05	665.06	624.18	6.15	16.66		
84759	60.2	73.3	0.05	0.05	-2.94	1.21	1.02	16.05	0.03	0.03	6.95	351.05	357.69	-1.89	0.79		
84760	61.8	68.6	0.09	0.09	-6.08	1.23	1.03	15.83	0.05	0.06	-12.22	477.75	454.34	4.90	1.46		
84761	62.9	62.5	0.08	0.09	-10.00	1.23	1.03	16.63	0.08	0.07	8.14	518.77	529.55	-2.08	2.51		
84763	65.4	56.1	0.13	0.12	5.78	2.04	1.74	14.75	0.13	0.14	-8.14	512.35	511.31	0.20	3.51		
84765	66.2	53.9	6.11	4.27	30.12	113.55	103.26	9.06	1.27	1.52	-19.74	511.56	465.69	8.97	101.74		
84766	56.8	64.8	0.16	0.14	10.28	1.78	1.49	16.34	0.33	0.35	-4.91	513.45	488.72	4.82	1.76		
84767	56.5	64.2	0.51	0.36	30.72	14.16	9.77	31.05	2.31	2.09	9.52	549.19	408.99	25.53	3.03		
84768	56.2	63.7	0.81	0.70	13.82	3.34	3.20	4.29	1.30	1.37	-5.62	602.31	577.16	4.18	7.08		
84770	56.9	63.4	0.60	0.56	7.16	5.90	5.69	3.56	2.17	2.26	-4.31	632.53	605.50	4.27	23.63		
84771	56.4	64.5	3.57	3.05	14.65	27.01	22.49	16.73	2.66	2.92	-9.57	500.77	467.51	6.64	45.02		
84772	56.7	64.1	0.56	0.49	12.72	8.13	6.79	16.46	2.48	2.50	-0.69	467.98	470.37	-0.51	6.41		
84773	50.0	72.9	0.22	0.18	16.27	2.09	1.65	21.33	0.57	0.59	-3.32	530.19	477.23	9.99	1.55		
84774	55.6	60.3	0.43	0.38	11.70	5.07	3.55	29.92	0.87	0.29	66.48	506.34	454.49	10.24	3.95		
84775	60.0	40.1	1.38	1.19	13.66	14.56	12.12	16.75	2.67	2.58	3.32	687.87	616.25	10.41	3.76		
84777	63.8	29.3	0.91	0.88	2.66	16.56	15.58	5.91	3.38	3.48	-2.86	473.78	462.83	2.31	3.65		
Average*					**15.70**			**14.76**			**10.21**			**8.27**			

*The average percentage difference shown here is the average of the absolute value of the percentage difference for each run

Figure 4-16 provides a by-pollutant comparison of dynamometer vs. PEMS emissions with a 1:1 reference line. HC, CO, NOx, and CO2 are depicted using dots, squares, triangles, and circle-crosses, respectively. Additional scatter plots of dynamometer results vs. the PEMS for each particular phase can be located in Appendices G and H. Results listed as “suspect” in Table 4-12 are not included in Figure 4-16.

Table 4-13 provides results of all conditioning run tests conducted during Round 2, and Table 4-14 provides results of all driveaway tests conducted during Round 2. All conditioning run and driveaway results were reviewed to identify missing information and indicators of potentially invalid results, including an evaluation of exhaust mass flow rates, exhaust temperatures, dilution levels, ambient temperature measurements, test duration and distance and measured fuel economy. PEMS tests with highly suspicious results are indicated with an “x” in the “PEMS data suspect” column in Tables 4-13 and 4-14, and detailed notes collected during review of all PEMS tests are provided in Appendices T and U.



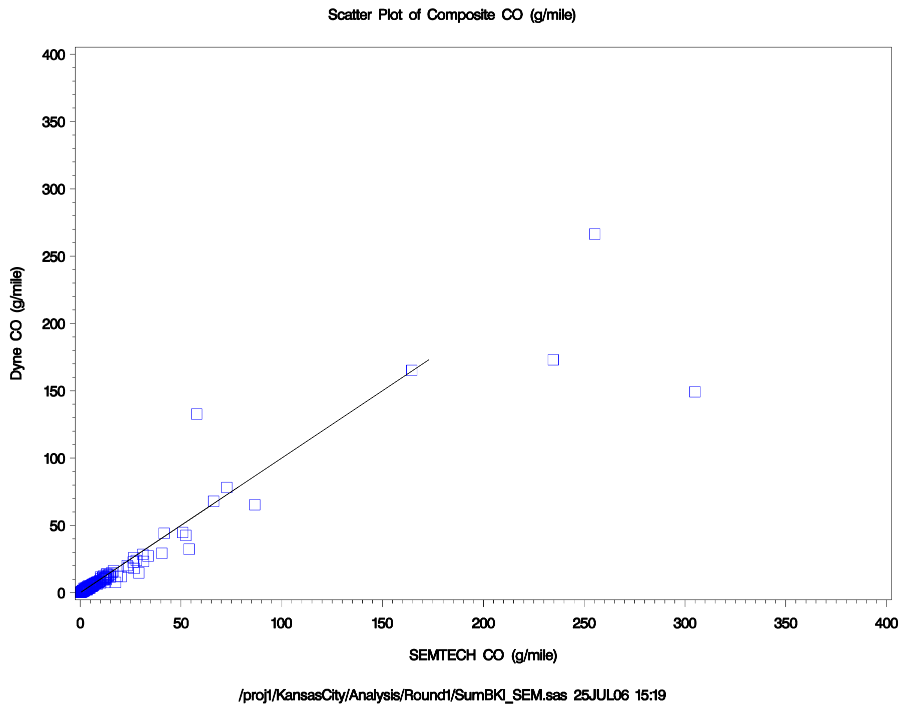
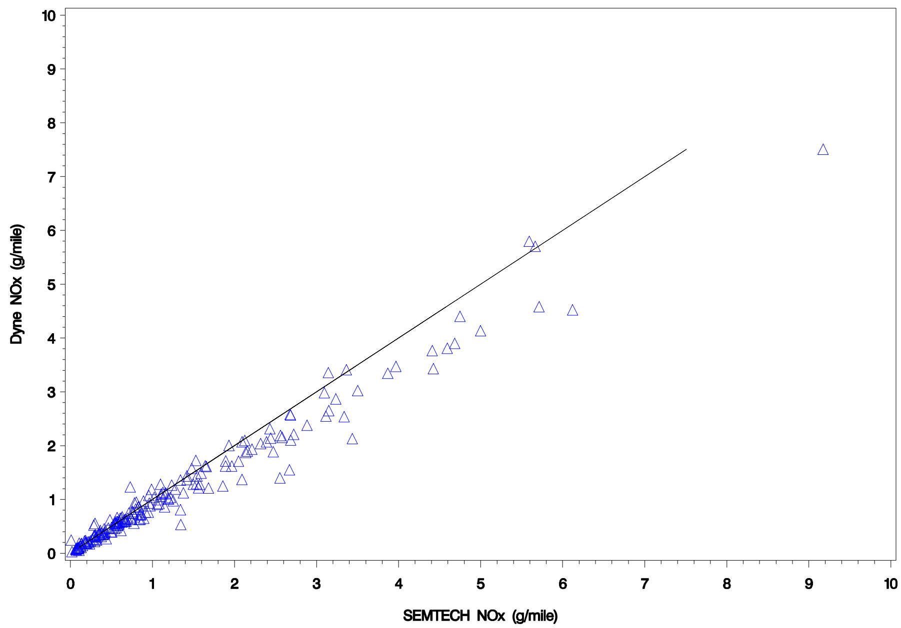


Figure 4-16. Plots of Round 2 Dynamometer vs. PEMS Measurements

Scatter Plot of Composite NOx (g/mile)



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Scatter Plot of Composite CO2 (g/mile)

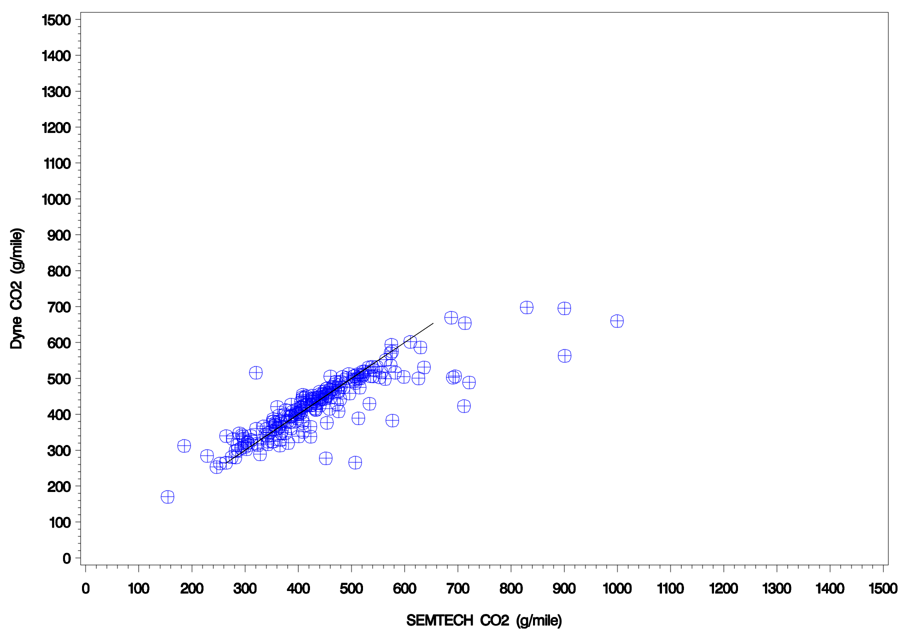

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Figure 4-16 (Continued). Plots of Round 2 Dynamometer vs. PEMS Measurements

Table 4-13. Round 2 Conditioning Run Test Results

CTR_TST_ID	Make	Model	Model Year	Disp	Test Date	Test Duration (minutes)	Test Distance (miles)	FuelUsed (gal)	Test FE (mpg)	Composite CO2 (gpm)	Composite CO (gpm)	Composite NOx (gpm)	Composite THC (gpm)	Suspect Data
C_KS2_453_1	HONDA	ODYSSEY	2002	3.5	4/4/2005	20	8.0	0.51	15.6	567.0	4.22	0.21	0.05	
C_KS2_462_1	KIA	SEDONA	2004	3.5	4/5/2005	22	8.0	0.42	18.9	472.3	0.55	0.01	0.02	
C_KS2_484_1	CHRYSLER	TOWN & COUNTRY	2002	3.8	2/22/2005	22	8.1	0.42	19.0	469.4	2.53	0.51	0.07	
C_KS2_491_1	HONDA	ODYSSEY	2003	3.5	4/5/2005	29	8.0	0.41	19.5	456.7	0.87	0.18	0.03	
C_KS2_495_1	JEEP	CHEROKEE 4X4	2001	4	4/4/2005	24	8.0	0.60	13.3	667.0	5.05	0.85	0.23	
C_KS2_511_1	TOYOTA	SIENNA LE	2001	3	4/2/2005	26	8.0	0.38	21.0	425.3	2.99	0.19	0.07	
C_KS2_518_1	DODGE	GRAND CARAVAN	2002	3.3	4/2/2005	42	8.0	0.39	20.3	439.6	2.14	0.83	0.10	
C_KS2_521_1	MITSUBISHI	MONTERO	2003	3.8	2/7/2005	63	8.3	0.97	8.6	1038.1	6.02	1.51	0.21	
C_KS2_530_1	FORD	ESCORT LX	1995	1.9	1/11/2005	25	8.0	0.39	20.4	425.6	9.31	1.13	0.35	
C_KS2_531_1	CHEVROLET	SILVERADO	1976	3.5	1/11/2005	31	8.0	1.34	6.0	1201.3	168.71	7.46	12.88	x
C_KS2_532_1	CHRYSLER	300M	1999	3.5	1/11/2005	29	8.0	0.42	18.9	475.2	1.01	0.21	0.12	
C_KS2_533_1	HONDA	ODYSSEY	2000	3.5	1/11/2005	36	8.0	0.47	17.3	515.1	3.17	0.33	0.30	
C_KS2_534_1	HONDA	ACCORD	1997	2.2	1/12/2005	27	8.0	0.37	21.8	408.9	2.22	0.46	0.14	
C_KS2_537_1	PLYMOUTH	VOYAGER	1998	3.3	1/12/2005	24	8.0	0.44	18.3	487.4	2.17	0.85	0.22	
C_KS2_538_1	HONDA	ACCORD	2001	2.3	1/12/2005	37	8.2	0.43	19.3	465.2	0.87	0.10	0.10	
C_KS2_539_1	HONDA	CIVIC	1991	1.5	1/12/2005	30	8.0	0.42	19.1	442.6	16.13	3.04	1.29	
C_KS2_540_1	TOYOTA	COROLLA	1995	1.6	1/13/2005	51	8.0	0.40	20.3	439.1	2.74	0.98	0.41	
C_KS2_541_1	DODGE	CARAVAN	1997	3.3	1/13/2005	27	8.0	0.43	18.9	475.6	1.24	0.75	0.14	
C_KS2_542_1	PONTIAC	GRAND AM	1989	2.3	1/13/2005	32	8.0	0.47	17.0	492.2	17.93	4.34	3.37	
C_KS2_543_1	DODGE	CARAVAN	2000	3	1/13/2005	26	8.0	0.81	9.8	912.2	2.49	0.49	0.57	x
C_KS2_544_1	MERCURY	SABLE	2002	3	1/14/2005	34	8.0	0.45	17.7	507.5	0.75	0.12	0.06	
C_KS2_545_1	FORD	F250	1979	5.7	1/14/2005	31	8.0	1.32	6.1	1268.6	124.93	2.27	9.81	
C_KS2_546_1	CHEVROLET	MALIBU	1999	3.1	1/14/2005	49	8.0	0.40	20.0	439.7	6.75	0.85	0.68	
C_KS2_547_1	HONDA	CIVIC	1996	1.6	1/14/2005	31	8.0	0.31	26.1	331.7	7.70	0.70	0.50	
C_KS2_548_1	SATURN	NULL	1996	1.9	1/14/2005	46	8.0	0.35	22.8	390.5	2.84	0.90	0.32	

CTR_TST_ID	Make	Model	Model Year	Disp	Test Date	Test Duration (minutes)	Test Distance (miles)	FuelUsed (gal)	Test FE (mpg)	Composite CO2 (gpm)	Composite CO (gpm)	Composite NOx (gpm)	Composite THC (gpm)	Suspect Data
C_KS2_549_1	CHEVROLET	LUMINA	1998	3.1	1/15/2005	39	8.1	0.36	22.5	394.7	2.76	0.51	0.40	
C_KS2_550_1	PONTIAC	GRAND AM	1997	2.4	1/15/2005	35	8.0	0.38	20.8	428.3	2.82	0.88	0.23	
C_KS2_551_1	CHEVROLET	IMPALA	2003	3.8	1/15/2005	58	8.0	0.39	20.4	434.3	4.28	0.09	0.17	
C_KS2_552_1	DODGE	DURANGO	1999	5.9	1/15/2005	46	8.0	1.20	6.7	1304.4	26.02	1.13	1.27	x
C_KS2_553_1	HONDA	CIVIC	1998	1.6	1/15/2005	36	8.0	0.25	32.5	267.8	5.71	0.11	0.28	
C_KS2_555_1	JEEP	GRAND CHEROKEE	1995	4	1/17/2005	35	8.0	0.95	8.5	1006.1	28.26	7.25	4.09	
C_KS2_556_1	HONDA	ACCORD	2000	2.3	1/17/2005	32	8.0	0.35	22.8	392.1	2.44	0.31	0.20	
C_KS2_557_1	FORD	EXPLORER	1995	4	1/17/2005	48	8.0	0.89	9.0	986.5	9.56	3.14	0.58	
C_KS2_558_1	SATURN	LS1	2000	2.2	1/17/2005	37	8.1	0.33	24.6	361.9	2.33	0.40	0.22	
C_KS2_559_1	JEEP	CHEROKEE	1998	4	1/17/2005	35	8.0	0.85	9.5	883.4	36.42	7.77	4.38	x
C_KS2_562_1	CHEVROLET	MALIBU	1998	3.1	1/18/2005	45	8.1	0.36	22.5	395.6	3.11	0.89	0.37	
C_KS2_563_1	DODGE	SPIRIT	1990	2.5	1/18/2005	36	8.0	0.45	17.8	487.4	11.76	1.66	0.66	
C_KS2_564_1	SATURN	SC2	2001	1.9	1/18/2005	33	8.6	0.30	28.3	315.9	1.38	0.12	0.08	
C_KS2_565_1	MITSUBISHI	GALANT	2001	2.4	1/18/2005	51	8.1	0.36	22.3	402.0	0.59	0.18	0.09	
C_KS2_566_1	MERCURY	GRAND MARQUIS STATIO	1991	5	1/18/2005	160	8.1	0.82	9.9	882.3	13.34	2.31	2.90	x
C_KS2_567_1	JEEP	WRANGLER	1997	4	1/19/2005	57	8.0	0.85	9.4	930.2	15.62	0.87	1.21	
C_KS2_567_2	JEEP	WRANGLER	1997	4	1/19/2005	53	8.2	0.80	10.2	869.1	7.20	0.68	0.77	
C_KS2_567_3	JEEP	WRANGLER	1997	4	1/19/2005	35	8.1	0.70	11.5	769.9	6.66	0.60	0.63	
C_KS2_568_1	TOYOTA	CAMRY	1994	3	1/20/2005	51	8.5	0.34	25.3	352.7	1.18	0.36	0.23	
C_KS2_569_1	CHEVROLET	S-10	1995	4.3	1/19/2005	26	8.0	0.78	10.2	870.5	6.56	1.50	0.59	
C_KS2_570_1	SATURN	SEDAN	1999	1.9	1/19/2005	56	8.2	0.29	28.5	307.6	4.25	0.34	0.44	
C_KS2_571_1	BUICK	PARK AVENUE	1995	3.8	1/19/2005	40	8.1	0.71	11.4	771.9	8.57	0.93	0.81	
C_KS2_572_1	CHEVROLET	SILVERADO	2002	5.3	1/20/2005	24	8.0	0.73	11.0	808.5	6.49	0.47	0.64	
C_KS2_574_1	BUICK	CENTURY	2001	3.1	1/20/2005	25	8.0	0.40	20.1	445.8	1.16	0.10	0.06	
C_KS2_575_1	FORD	F150	2001	4.6	1/20/2005	31	8.0	0.81	9.9	905.6	3.13	0.52	0.30	
C_KS2_576_1	GEO	PRIZM	1991	1.6	1/20/2005	74	8.0	0.35	23.1	373.1	8.26	2.14	0.92	
C_KS2_577_1	PONTIAC	BONNEVILLE	1995	3.8	1/20/2005	39	10.7	1.05	10.2	862.7	9.01	2.04	0.81	

CTR_TST_ID	Make	Model	Model Year	Disp	Test Date	Test Duration (minutes)	Test Distance (miles)	FuelUsed (gal)	Test FE (mpg)	Composite CO2 (gpm)	Composite CO (gpm)	Composite NOx (gpm)	Composite THC (gpm)	Suspect Data
C_KS2_579_1	TOYOTA	SIENNA	2000	3	1/21/2005	37	8.1	0.83	9.7	918.9	3.36	1.20	0.48	x
C_KS2_580_1	PLYMOUTH	VOYAGER	1999	3.8	1/21/2005	34	8.1	0.74	11.0	795.4	12.02	0.89	0.53	
C_KS2_581_1	SATURN	SEDAN	2001	2.2	1/21/2005	33	8.0	0.42	19.0	470.5	2.12	0.32	0.12	
C_KS2_582_1	CHEVROLET	TRACKER	2003	2.5	1/21/2005	73	8.1	0.39	20.8	428.8	1.36	0.21	0.13	
C_KS2_583_1	BUICK	REGAL	1994	3.1	1/22/2005	43	8.0	0.73	11.0	798.9	9.23	2.09	1.50	
C_KS2_583_2	BUICK	REGAL	1994	3.1	1/21/2005	46	8.1	0.76	10.6	835.9	7.52	1.34	0.88	
C_KS2_584_1	NISSAN	MAXIMA	1995	3	1/22/2005	36	8.0	0.36	22.0	401.0	3.58	0.82	0.58	
C_KS2_585_1	FORD	TAURUS	1995	3	1/22/2005	48	8.0	0.41	19.7	451.0	4.28	0.91	0.24	
C_KS2_586_1	PONTIAC	GRAND PRIX LE	1993	3.1	1/22/2005	77	8.2	1.02	8.1	918.5	116.66	1.57	6.43	x
C_KS2_593_1	FORD	AEROSTAR	1993	3	1/25/2005	84	8.1	0.44	18.6	469.2	7.32	1.32	0.59	
C_KS2_594_1	PLYMOUTH	VOYAGER	1989	3	1/25/2005	41	8.1	0.78	10.4	745.7	79.40	2.49	3.67	
C_KS2_595_1	FORD	RANGER	1988	2.3	1/26/2005	59	8.0	0.48	16.7	500.8	17.32	1.45	2.77	
C_KS2_596_1	FORD	CROWN VICTORIA	1995	4.6	1/25/2005	44	8.1	0.88	9.1	958.0	16.52	2.13	1.39	
C_KS2_597_1	FORD	AEROSTAR	1992	3	1/25/2005	32	8.1	0.46	17.6	497.5	8.32	2.07	0.70	
C_KS2_599_1	CHEVROLET	LUMINA LS	1994	3.8	1/27/2005	40	8.0	0.73	11.0	813.3	1.87	0.84	0.65	
C_KS2_599_2	CHEVROLET	LUMINA LS	1994	3.8	1/26/2005	43	8.1	0.43	18.8	472.6	3.27	0.43	0.44	
C_KS2_600_1	FORD	CONTOUR	1995	2	1/26/2005	34	8.0	0.33	24.3	357.9	6.96	0.59	0.29	
C_KS2_602_1	DODGE	INTREPID	1994	3.3	1/26/2005	32	8.0	0.69	11.6	761.0	9.32	1.66	1.16	x
C_KS2_605_1	DODGE	CARAVAN	1989	3	1/27/2005	25	8.1	0.37	21.7	398.9	7.81	2.16	1.16	
C_KS2_606_1	CHEVROLET	SILVERADO 1500	1996	5	1/27/2005	55	18.6	1.60	11.6	765.2	5.44	1.08	0.26	x
C_KS2_607_1	FORD	TEMPO	1986	2.3	1/28/2005	44	8.0	0.50	16.2	382.3	112.27	1.98	7.43	
C_KS2_608_1	M.BENZ	280 SE	1973	4.5	1/27/2005	52	8.1	1.13	7.2	560.3	313.91	1.75	96.52	
C_KS2_609_1	CHEVROLET	MONTE CARLO	1977	5	1/27/2005	39	8.0	0.67	11.9	629.1	71.09	2.73	8.01	
C_KS2_611_1	FORD	EXPLORER	1996	4	1/28/2005	65	8.0	0.90	8.9	993.1	7.28	1.51	0.67	
C_KS2_612_1	DODGE	RAM	1989	2	1/28/2005	45	8.1	0.39	21.0	404.1	14.14	2.66	1.53	
C_KS2_614_1	HONDA	CIVIC	1988	1.5	1/28/2005	29	8.0	0.39	20.6	382.9	29.94	1.76	2.95	
C_KS2_616_1	JEEP	CHEROKEE	1998	4	1/29/2005	34	18.6	1.60	11.6	763.8	7.17	1.22	0.30	x

CTR_TST_ID	Make	Model	Model Year	Disp	Test Date	Test Duration (minutes)	Test Distance (miles)	FuelUsed (gal)	Test FE (mpg)	Composite CO2 (gpm)	Composite CO (gpm)	Composite NOx (gpm)	Composite THC (gpm)	Suspect Data
C_KS2_617_1	DODGE	NEON	1996	2	1/29/2005	55	8.1	0.37	21.9	402.8	4.97	0.71	0.35	
C_KS2_618_1	BUICK	LASABRE	1979	4.9	1/29/2005	36	8.0	1.06	7.6	1156.9	7.52	14.17	8.16	
C_KS2_619_1	DODGE	CARAVAN	1996	3.3	1/29/2005	29	8.0	0.82	9.8	910.7	5.20	1.36	0.83	x
C_KS2_622_1	MAZDA	B2200	1992	2.1	1/31/2005	26	8.1	0.44	18.6	434.1	31.64	3.00	0.65	
C_KS2_623_1	CADILLAC	FLEETWOOD	1991	4.9	2/1/2005	31	8.0	1.00	8.0	1077.0	26.95	1.38	1.20	
C_KS2_623_2	CADILLAC	FLEETWOOD	1991	4.9	1/31/2005	26	8.1	0.57	14.1	609.9	16.37	0.66	1.31	x
C_KS2_624_1	FORD	RANGER	1990	2.3	1/31/2005	26	8.2	0.50	16.4	489.2	35.45	4.30	1.52	
C_KS2_624_2	FORD	RANGER	1990	2.3	1/31/2005	26	8.0	0.49	16.3	465.5	48.16	3.98	3.82	
C_KS2_625_1	BUICK	RAINER	2004	4.2	2/2/2005	51	8.1	1.02	8.0	1127.0	2.37	0.09	0.38	x
C_KS2_626_1	TOYOTA	TRUCK	1987	2.4	2/2/2005	46	8.0	0.44	18.1	493.3	1.62	2.90	1.32	
C_KS2_627_1	BUICK	LESABRE	1995	3.8	2/2/2005	53	8.0	0.40	19.8	451.1	2.18	0.81	0.10	
C_KS2_627_2	BUICK	LESABRE	1995	3.8	2/2/2005	37	8.0	0.46	17.5	507.4	4.23	0.54	0.14	
C_KS2_627_3	BUICK	LESABRE	1995	3.8	2/1/2005	24	8.0	0.76	10.5	852.1	3.78	0.88	0.27	
C_KS2_628_1	CHEVROLET	C10 SILVERADO	1984	5	2/1/2005	27	7.9	0.95	8.3	1021.0	32.63	2.60	4.03	x
C_KS2_631_1	FORD	RANGER XLT	1997	2.3	2/2/2005	32	8.0	0.41	19.5	451.4	6.99	1.52	0.25	
C_KS2_632_1	GMC	SONOMA	1996	2.2	2/2/2005	25	8.0	0.43	18.6	474.6	6.19	0.72	0.30	
C_KS2_633_1	FORD	FREESTAR SEL	2004	4.2	2/2/2005	25	8.0	0.49	16.4	550.8	0.32	0.02	0.04	
C_KS2_634_1	TOYOTA	4RUNNER SR5	1995	3	2/2/2005	88	8.0	0.92	8.7	993.0	24.62	0.86	1.61	x
C_KS2_635_1	CHEVROLET	SUBURBAN	1995	5.7	2/2/2005	45	18.6	1.18	15.7	554.3	9.75	1.56	1.06	
C_KS2_638_1	TOYOTA	SIENNA XLE	2001	3	2/3/2005	53	8.0	0.68	11.8	759.2	3.90	0.60	0.14	
C_KS2_639_1	ACURA	INTEGRA	1995	1.8	2/3/2005	79	8.0	0.31	26.2	331.8	6.76	0.34	0.52	
C_KS2_640_1	NISSAN	FRONTIER	1998	2.4	2/3/2005	27	8.0	0.45	18.0	489.2	6.11	1.88	0.71	
C_KS2_641_1	CHRYSLER	CONCORD	1996	3.5	2/3/2005	25	8.0	0.42	19.1	467.4	2.41	0.63	0.13	
C_KS2_642_1	FORD	TAURUS	2002	3	2/4/2005	27	8.0	0.40	20.2	444.0	0.76	0.29	0.03	
C_KS2_643_1	CHRYSLER	CONCORD LXI	2000	3.2	2/4/2005	37	8.0	0.76	10.5	845.5	7.39	0.54	0.55	x
C_KS2_644_1	DODGE	INTREPID	1993	3.3	2/4/2005	33	8.0	0.36	22.2	395.0	5.16	1.97	0.76	
C_KS2_644_2	DODGE	INTREPID	1993	3.3	2/4/2005	35	8.1	0.37	21.9	401.0	6.03	2.00	0.12	

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C_KS2_645_1	FORD	F150	1989	5	2/4/2005	36	18.6	1.26	14.8	594.6	8.04	1.24	0.41	x
C_KS2_646_1	CHEVROLET	ASTROVAN	1992	4.3	2/5/2005	39	8.0	0.90	8.9	968.3	21.28	7.52	4.44	
C_KS2_647_1	CHEVROLET	SUBURBAN	1994	5.7	2/5/2005	27	8.0	0.65	12.3	679.2	27.32	5.41	2.93	
C_KS2_648_1	FORD	F150	2001	5.4	2/5/2005	44	18.6	1.12	16.6	540.1	1.41	0.09	0.14	
C_KS2_649_1	HONDA	CIVIC	1992	1.5	2/5/2005	30	8.0	0.88	9.1	947.2	22.91	1.87	1.33	x
C_KS2_651_1	CHEVROLET	CAPRICE	1982	4.4	2/6/2005	28	8.0	0.97	8.3	483.8	272.91	0.61	80.71	
C_KS2_653_1	CHRYSLER	CONCORDE	2002	3.5	2/7/2005	41	8.0	0.50	16.0	555.6	4.24	0.26	0.66	
C_KS2_654_1	BUICK	SKYLARK	1994	3.1	2/7/2005	33	8.0	0.36	22.5	354.4	29.35	0.32	0.58	
C_KS2_655_1	CHEVROLET	ASTRO VAN	1993	4.3	2/8/2005	51	8.2	0.74	11.0	749.9	37.70	2.05	3.53	
C_KS2_656_1	DODGE	CARAVAN	1992	3	2/7/2005	40	8.0	0.82	9.7	888.3	19.72	5.04	2.71	x
C_KS2_660_1	DODGE	GRAND CARAVAN	1998	3.3	2/7/2005	123	8.0	0.02	507.0	4.1	0.11	0.00	0.00	x
C_KS2_661_1	LINCOLN	TOWNCAR	1991	4.6	2/10/2005	30	8.0	0.48	16.6	511.4	18.57	1.06	1.55	
C_KS2_662_1	ISUZU	PICKUP	1995	2.3	2/8/2005	35	8.0	0.45	17.7	493.5	8.22	1.62	1.00	
C_KS2_663_1	FORD	TAURUS	2001	3	2/8/2005	37	8.8	0.45	19.4	462.0	1.01	0.14	0.07	
C_KS2_664_1	HONDA	ACCORD	1997	2.2	2/9/2005	26	8.0	0.38	21.0	423.2	3.18	0.39	0.09	
C_KS2_665_1	DODGE	GRAND CARAVAN	2003	3	4/2/2005	22	8.0	0.44	18.4	489.4	0.47	0.43	0.03	
C_KS2_667_1	CHEVROLET	C1500	1996	4.3	2/8/2005	30	8.1	0.50	16.0	561.3	1.73	0.29	0.15	
C_KS2_668_1	DODGE	RAM PU	1995	5.9	2/9/2005	31	8.1	0.79	10.1	862.2	17.01	1.08	0.60	x
C_KS2_670_1	GEO	TRACKER	1992	1.6	2/9/2005	30	8.0	0.38	21.2	387.8	22.02	1.67	0.99	
C_KS2_671_1	PLYMOUTH	SUNDANCE	1992	2.5	2/9/2005	37	8.0	0.38	21.0	409.7	12.20	1.41	0.39	
C_KS2_674_1	HONDA	CRV	1998	2	2/10/2005	42	18.6	1.08	17.2	513.6	4.15	0.25	0.09	x
C_KS2_675_1	CHEVROLET	SUBURBAN	1999	5.7	2/10/2005	28	8.0	0.74	10.8	819.3	8.30	1.32	0.52	
C_KS2_676_1	SUBARU	LEGACY WAGON	1993	2.2	2/10/2005	49	8.0	0.42	18.9	463.6	7.19	1.00	0.64	
C_KS2_677_1	PONTIAC	MONTANA	2003	3.4	2/10/2005	24	8.0	0.38	20.9	427.4	2.02	0.19	0.07	
C_KS2_677_2	PONTIAC	MONTANA	2003	3.4	2/10/2005	29	8.1	0.39	20.8	431.5	0.61	0.14	0.03	
C_KS2_679_1	FORD	RANGER	1998	4	2/11/2005	29	8.0	0.42	19.2	465.2	2.17	0.72	0.16	
C_KS2_680_1	CHEVROLET	TAHOE	1996	5.7	2/11/2005	78	8.3	0.67	12.3	710.5	12.01	1.07	1.21	

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C_KS2_681_1	DODGE	GRAND CARAVAN	1996	3.3	2/12/2005	34	8.0	0.47	17.2	493.8	16.61	1.24	0.70	
C_KS2_681_2	DODGE	GRAND CARAVAN	1996	3.3	2/11/2005	25	8.0	0.37	21.5	401.8	10.31	0.95	0.51	
C_KS2_681_3	DODGE	GRAND CARAVAN	1996	3.3	2/11/2005	35	8.0	0.00	53605.6	0.0	0.00	0.00	0.00	x
C_KS2_682_1	JEEP	CHEROKEE SPORT	2000	4	2/12/2005	22	8.0	0.53	15.0	580.9	10.82	1.15	0.31	
C_KS2_682_2	JEEP	CHEROKEE SPORT	2000	4	2/11/2005	28	8.0	0.52	15.3	578.7	6.12	0.71	0.19	
C_KS2_685_1	DODGE	DAKOTA	1999	3.9	2/14/2005	22	8.0	0.46	17.4	503.2	6.81	0.99	0.60	
C_KS2_686_1	TOYOTA	COROLLA	1995	1.8	2/14/2005	19	8.0	0.28	28.9	306.0	2.95	0.45	0.23	
C_KS2_689_1	LINCOLN	TOWN CAR	1988	5	2/14/2005	33	8.0	0.48	16.6	512.2	14.16	1.64	2.79	
C_KS2_689_2	LINCOLN	TOWN CAR	1988	5	2/14/2005	0	0.0	0.00	N/A	.	.	.	.	x
C_KS2_693_1	ISUZU	AXIOM	2002	3.5	2/15/2005	38	8.0	0.50	16.2	550.4	2.42	0.27	0.12	
C_KS2_694_1	OLDS	SILHOUTTE	2002	3.4	2/15/2005	56	8.0	0.41	19.6	455.5	1.07	0.37	0.08	
C_KS2_695_1	FORD	F150	1992	4.9	2/15/2005	31	8.0	0.60	13.4	664.7	3.79	1.08	0.65	
C_KS2_698_1	CHRYSLER	TOWN & COUNTRY LX	2001	3.3	2/16/2005	28	8.0	0.44	18.2	487.4	4.21	0.91	0.21	
C_KS2_700_1	BUICK	PARK AVENUE	2000	3.8	2/16/2005	31	8.0	0.39	20.7	429.0	4.46	0.17	0.13	
C_KS2_701_1	DODGE	DAKOTA	1998	3.9	2/16/2005	35	8.2	0.51	16.0	548.9	8.35	0.63	0.31	
C_KS2_702_1	CHEVROLET	S-10	2001	4.3	2/16/2005	45	8.0	0.52	15.4	581.1	1.89	0.24	0.07	
C_KS2_703_1	FORD	COUNTRY SQUIRE	1986	5	2/16/2005	38	8.0	0.50	16.0	504.2	28.96	2.16	4.87	
C_KS2_704_1	CADILLAC	SEDAN DEVILLE	1992	4.9	2/17/2005	62	8.1	0.78	10.3	451.6	266.45	0.14	14.30	
C_KS2_705_1	DODGE	DAKOTA	2004	3.7	2/17/2005	37	8.0	0.47	16.9	523.8	4.38	0.06	0.33	
C_KS2_706_1	HONDA	ODYSSEY	1995	2.2	2/17/2005	33	8.0	0.84	9.5	925.5	9.61	0.81	0.74	x
C_KS2_707_1	DODGE	GRAND CARAVAN	1998	3.3	2/17/2005	43	8.2	0.44	18.8	472.4	4.60	0.63	0.21	
C_KS2_709_1	FORD	RANGER	2002	4	2/17/2005	30	8.0	0.00	N/A	0.0	0.00	0.00	0.00	x
C_KS2_709_2	FORD	RANGER	2002	4	2/17/2005	28	8.0	0.53	15.2	591.7	2.21	0.18	0.11	x
C_KS2_711_1	MERCURY	TOPAZ	1994	2.3	2/18/2005	37	11.5	0.46	25.1	356.0	1.49	0.77	0.15	
C_KS2_712_1	FORD	RANGER	1996	2.3	2/18/2005	38	8.0	0.41	19.3	453.8	7.04	1.26	0.69	
C_KS2_713_1	FORD	TAURUS	1995	2.2	2/18/2005	47	8.0	1.04	7.7	1125.7	13.71	1.30	1.04	x
C_KS2_715_1	CHEVROLET	SILVERADO	1994	5.7	2/19/2005	29	8.1	0.62	12.9	681.5	6.90	1.00	0.91	

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C_KS2_716_1	FORD	TAURUS	1993	3.8	2/19/2005	49	8.0	0.00	N/A	0.0	0.00	0.00	0.00	x
C_KS2_716_2	FORD	TAURUS	1993	3.8	2/19/2005	14	3.9	0.20	19.2	442.6	15.66	1.21	0.35	
C_KS2_718_1	BUICK	PARK AVENUE	1993	3.8	2/19/2005	35	8.0	0.46	17.4	507.7	6.13	0.95	0.19	
C_KS2_719_1	CHEVROLET	LUMINA	1994	3.1	2/19/2005	39	8.0	0.44	18.2	466.3	16.04	1.63	0.92	
C_KS2_721_1	FORD	WINDSTAR	1998	3.8	2/21/2005	36	8.0	0.47	17.2	509.7	7.59	1.73	0.20	
C_KS2_721_2	FORD	WINDSTAR	1998	3.8	2/21/2005	35	8.0	0.42	19.2	459.5	5.61	1.50	0.10	
C_KS2_722_1	VOLVO	960	1993	2.9	3/11/2005	25	8.0	0.41	19.8	451.6	2.08	0.38	0.10	
C_KS2_722_2	VOLVO	960	1993	2.9	3/11/2005	25	8.0	0.53	15.0	590.7	6.44	0.32	0.42	
C_KS2_723_1	FORD	TEMPO	1993	2.3	3/17/2005	31	8.0	0.34	23.5	377.6	2.87	1.93	0.20	
C_KS2_723_2	FORD	TEMPO	1993	2.3	3/18/2005	25	8.0	0.37	21.4	412.5	4.64	2.19	0.21	
C_KS2_724_1	CHEVROLET	BLAZER	1996	4.3	3/24/2005	24	8.0	0.52	15.4	572.3	6.08	0.55	0.25	
C_KS2_725_1	CHRYSLER	TOWN & COUNTRY	2002	3.8	4/5/2005	22	8.0	0.44	18.1	491.6	2.33	0.61	0.08	
C_KS2_726_1	CHEVROLET	S-10 LS	1995	4.3	3/28/2005	26	8.0	0.52	15.3	570.2	9.94	0.59	0.67	
C_KS2_727_1	BMW	528E	1988	2.7	2/22/2005	8	0.0	0.01	0.0	.	.	.	.	x
C_KS2_727_2	BMW	528E	1988	2.7	2/22/2005	24	8.0	0.48	16.8	458.9	41.53	1.55	3.93	
C_KS2_728_1	CHEVROLET	CORSICA	1995	3.1	2/22/2005	30	8.0	0.33	24.1	370.0	1.82	0.43	0.15	
C_KS2_728_2	CHEVROLET	CORSICA	1995	3.1	2/22/2005	43	3.5	0.15	23.4	369.4	8.02	0.85	0.65	x
C_KS2_729_1	CHRYSLER	TOWN & COUNTRY	1996	3.8	3/10/2005	34	8.0	0.44	18.1	466.8	17.02	1.39	0.93	
C_KS2_731_1	FORD	ESCORT	1993	1.9	2/23/2005	25	7.8	0.31	24.9	353.0	5.32	1.99	0.14	
C_KS2_733_1	NISSAN	PICKUP XE	1995	2.4	2/23/2005	28	8.1	0.50	16.0	539.8	12.83	0.43	0.64	
C_KS2_734_1	PLYMOUTH	VOYAGER	1993	3	3/29/2005	33	4.7	0.27	17.3	498.3	10.91	2.24	0.57	
C_KS2_736_1	MERCURY	VILLAGER	1997	3	2/25/2005	33	8.0	0.38	21.0	415.1	8.41	0.80	0.20	
C_KS2_737_1	BUICK	LESABRE	1978	5.7	2/24/2005	27	8.0	0.64	12.4	621.9	60.96	1.43	3.70	
C_KS2_738_1	SATURN	SL 2	2001	1.9	2/24/2005	27	8.0	0.30	27.1	331.6	0.76	0.19	0.05	
C_KS2_738_2	SATURN	SL 2	2001	1.9	2/24/2005	47	8.0	18.07	0.4	20238.6	9.92	2.66	0.72	x
C_KS2_739_1	FORD	TAURUS	1993	3	3/19/2005	25	8.0	0.39	20.6	426.8	5.28	1.22	0.50	
C_KS2_740_1	FORD	ESCAPE	2002	3	3/21/2005	27	7.9	0.42	18.9	472.9	1.59	0.18	0.08	

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C_KS2_743_1	FORD	LTD	1979	5	2/26/2005	77	5.8	0.16	37.2	209.8	17.30	1.75	1.39	x
C_KS2_743_2	FORD	LTD	1979	5	2/26/2005	5	0.0	0.00	2.2	2578.9	590.65	0.33	130.07	x
C_KS2_743_3	FORD	LTD	1979	5	2/28/2005	15	4.8	0.35	13.4	577.7	50.45	3.30	5.49	
C_KS2_743_4	FORD	LTD	1979	5	2/28/2005	30	8.0	0.50	16.1	516.2	25.29	4.44	1.79	
C_KS2_744_1	HONDA	ACCORD EX	1998	2.3	2/25/2005	48	8.1	0.29	27.4	323.9	2.67	0.30	0.11	
C_KS2_747_1	TOYOTA	4 RUNNER	1993	3	2/25/2005	23	8.0	0.47	17.2	498.0	16.46	1.12	0.36	
C_KS2_749_1	PONTIAC	SUNBIRD	1994	2	2/26/2005	28	8.1	0.78	10.3	826.3	25.46	0.43	1.87	x
C_KS2_750_1	FORD	ESCORT SE	1998	2	2/26/2005	31	8.0	0.28	28.3	312.7	3.14	0.87	0.06	
C_KS2_751_1	FORD	TAURUS GL	1997	3	2/26/2005	32	8.0	0.64	12.5	710.0	6.71	0.65	0.77	
C_KS2_753_1	FORD	WINDSTAR	1998	3.8	3/25/2005	36	8.1	0.46	17.6	504.5	4.00	1.96	0.32	
C_KS2_757_1	BUICK	REGAL	1979	3.8	2/28/2005	33	8.0	0.58	13.7	531.7	74.72	3.08	4.96	
C_KS2_760_1	MAZDA	PROTÉGÉ	1998	1.5	3/30/2005	26	8.0	0.29	28.2	312.3	3.86	0.56	0.18	
C_KS2_761_1	DATSUN	210 WAGON	1979	1.4	3/1/2005	15	0.0	0.01	2.9	2672.3	228.98	3.25	18.59	x
C_KS2_761_2	DATSUN	210 WAGON	1979	1.4	3/1/2005	21	8.0	0.26	30.2	281.4	8.86	2.48	1.23	x
C_KS2_761_3	DATSUN	210 WAGON	1979	1.4	3/1/2005	26	8.0	0.24	33.1	259.4	6.11	2.20	1.35	x
C_KS2_764_1	BUICK	SKYLARK	1998	3.1	3/29/2005	34	8.0	0.39	20.4	433.6	3.74	0.39	0.41	
C_KS2_767_1	DATSUN	280Z	1977	2.8	3/2/2005	26	8.0	0.63	12.7	697.2	5.67	1.18	0.59	
C_KS2_770_1	TOYOTA	CAMRY	1989	2.5	3/3/2005	27	8.2	0.24	33.7	257.8	5.51	0.93	0.19	x
C_KS2_772_1	BUICK	REGAL	1978	3.8	3/3/2005	30	8.0	0.42	19.2	393.6	42.86	2.91	3.18	
C_KS2_774_1	NISSAN	QUEST	1996	3	3/4/2005	30	8.0	0.39	20.5	435.6	1.59	0.42	0.13	
C_KS2_774_2	NISSAN	QUEST	1996	3	3/4/2005	32	8.1	0.41	19.5	448.4	6.79	0.64	0.67	
C_KS2_775_1	OLDSMOBILE	DELTA 88	1990	3.8	3/4/2005	22	8.0	0.53	15.0	564.8	16.33	1.26	3.06	
C_KS2_776_1	FORD	F-150	1987	4.9	3/4/2005	36	8.0	0.57	14.1	510.2	80.96	3.06	1.49	
C_KS2_777_1	FORD	RANGER XLT	2000	4	3/4/2005	37	.	0.47	N/A	.	.	.	.	x
C_KS2_778_1	FORD	F-250	1989	7.5	3/4/2005	58	8.0	0.69	11.6	753.1	14.88	2.87	1.07	
C_KS2_779_1	OLDSMOBILE	DELTA 88	1978	5.7	3/4/2005	39	8.1	0.51	15.8	504.7	34.27	1.51	4.31	
C_KS2_780_1	CHEVROLET	SUBURBAN	1997	5.7	3/5/2005	30	8.0	0.66	12.1	731.1	8.02	1.24	0.66	

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C_KS2_782_1	PLYMOUTH	VOYAGER	1999	3.3	3/5/2005	32	8.0	0.40	20.1	444.9	1.18	0.29	0.13	
C_KS2_782_2	PLYMOUTH	VOYAGER	1999	3.3	3/5/2005	36	8.1	0.44	18.4	482.6	3.77	0.44	0.25	
C_KS2_783_1	PLYMOUTH	VOYAGER	1992	2.5	3/5/2005	42	8.0	0.45	18.0	469.8	17.66	4.30	0.86	
C_KS2_784_1	FORD	RANGER XLT	1992	2.3	3/5/2005	31	8.0	0.49	16.4	461.5	52.65	1.40	1.52	
C_KS2_785_1	FORD	RANGER	1992	3	3/5/2005	50	8.3	0.63	13.0	668.7	12.27	0.78	0.77	
C_KS2_787_1	VW	BEETLE	1973	1.3	3/7/2005	21	8.1	0.36	22.4	325.8	43.05	2.27	3.57	x
C_KS2_788_1	PLYMOUTH	ACCLAIM	1989	2.5	3/7/2005	24	8.0	0.20	40.5	213.8	4.97	1.81	0.34	x
C_KS2_788_2	PLYMOUTH	ACCLAIM	1989	2.5	3/7/2005	22	8.0	0.19	41.7	206.6	5.58	1.72	0.29	x
C_KS2_788_3	PLYMOUTH	ACCLAIM	1989	2.5	3/8/2005	30	0.0	0.00	N/A	0.0	0.00	0.00	0.00	x
C_KS2_789_1	DODGE	RAM PICKUP	1987	3.7	3/7/2005	38	8.1	0.52	15.5	510.7	42.52	1.58	1.30	
C_KS2_791_1	TOYOTA	CAMRY	1999	2.2	3/7/2005	26	8.1	0.36	22.7	390.5	2.79	0.51	0.24	
C_KS2_792_1	CHEVROLET	TRAIL BLAZER	2002	4.2	3/8/2005	45	8.0	0.50	15.9	556.5	5.46	0.33	0.25	
C_KS2_795_1	FORD	CROWN VICTORIA LTD	1989	5	3/9/2005	37	8.1	0.49	16.4	518.6	16.16	1.94	1.94	
C_KS2_796_1	HONDA	ACCORD SEI	1989	2	3/8/2005	25	8.0	0.35	23.0	375.9	9.43	0.92	0.36	
C_KS2_797_1	ACURA	2.5 TL	1996	2.5	3/8/2005	33	8.1	0.40	20.4	430.3	6.70	0.31	0.62	
C_KS2_800_1	OLDSMOBILE	CUTLASS	1990	3.3	3/14/2005	32	8.0	0.40	20.3	436.3	4.64	1.11	0.27	
C_KS2_801_1	PLYMOUTH	VOYAGER SE	1988	3	3/9/2005	25	8.0	0.43	18.6	459.9	16.11	2.68	0.60	
C_KS2_802_1	VOLVO	740 TURBO	1987	2.3	3/9/2005	24	8.0	0.86	9.3	562.8	274.94	0.58	5.37	
C_KS2_805_1	CHEVROLET	CAVALIER	1995	2.2	3/10/2005	0	0.0	0.00	0.0	.	.	.	.	x
C_KS2_805_2	CHEVROLET	CAVALIER	1995	2.2	3/10/2005	23	8.0	0.29	27.7	317.4	4.73	0.71	0.19	
C_KS2_806_1	DODGE	SPIRIT	1989	2.5	3/10/2005	51	8.1	0.65	12.3	710.1	12.16	1.18	0.42	x
C_KS2_807_1	FORD	ESCORT	1987	1.9	3/10/2005	27	6.6	0.78	8.4	972.3	56.03	4.17	3.75	x
C_KS2_808_1	FORD	EXPLORER	1994	4	3/10/2005	22	8.0	0.55	14.5	607.1	9.31	1.20	0.27	
C_KS2_809_1	NISSAN	PATHFINDER	2001	3.5	3/11/2005	29	8.0	0.50	16.0	558.9	2.30	0.46	0.12	
C_KS2_809_2	NISSAN	PATHFINDER	2001	3.5	3/12/2005	32	8.1	0.81	10.0	720.5	100.14	6.01	10.28	x
C_KS2_811_1	DODGE	SE DAKOTA	1987	3.9	3/11/2005	31	8.1	0.56	14.3	566.5	40.08	1.75	1.06	
C_KS2_813_1	HONDA	ACCORD LXI	1988	2	3/11/2005	33	8.0	0.43	18.7	455.2	15.80	1.68	0.89	

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C_KS2_815_1	GMC	SONOMA	1995	4.3	3/12/2005	38	8.0	0.45	17.9	496.8	4.40	1.16	0.38	
C_KS2_816_1	NISSAN	PICKUP	1988	2.2	3/14/2005	32	8.0	0.31	25.8	327.9	12.76	1.42	0.59	
C_KS2_818_1	CHEVROLET	LUMINA APV	1990	3.1	3/12/2005	41	8.0	0.41	19.6	444.6	8.15	1.69	0.54	
C_KS2_820_1	BUICK	PARK AVENUE ELECTRA	1990	3.8	3/14/2005	28	8.0	0.46	17.5	510.5	2.96	1.51	0.26	
C_KS2_821_1	CHRYSLER	LEBARON	1988	2.5	3/16/2005	31	8.0	0.00	266963.9	0.0	0.00	0.00	0.00	x
C_KS2_821_2	CHRYSLER	LEBARON	1988	2.5	3/16/2005	22	8.1	0.36	22.5	382.0	10.34	1.98	0.63	
C_KS2_822_1	CADILLAC	ELDORADO	1990	4.5	3/15/2005	31	8.0	0.49	16.3	522.1	17.93	5.48	1.31	
C_KS2_823_1	CHEVROLET	LUMINA	1990	3.1	3/14/2005	65	8.2	0.44	18.7	468.9	7.51	1.57	0.31	
C_KS2_824_1	CHEVROLET	ASTROVAN	1989	4.3	3/14/2005	32	8.1	0.44	18.4	472.8	10.01	4.27	0.95	
C_KS2_825_1	DODGE	CARAVAN SE	1988	3	3/14/2005	37	8.0	0.46	17.3	503.5	7.43	2.92	1.72	
C_KS2_826_1	FORD	F250 PICKUP	1982	5.3	3/15/2005	36	8.0	0.74	10.9	665.5	87.86	3.52	9.59	
C_KS2_826_2	FORD	F250 PICKUP	1982	5.3	3/15/2005	13	4.8	0.49	9.7	663.0	147.90	2.99	14.97	
C_KS2_827_1	BUICK	CENTURY	1990	3.3	3/15/2005	26	8.0	0.43	18.7	469.0	7.06	1.20	0.41	
C_KS2_827_2	BUICK	CENTURY	1990	3.3	3/15/2005	1	0.0	0.00	0.0	.	.	.	.	x
C_KS2_828_1	FORD	F-150	1988	5	3/15/2005	36	8.0	0.62	12.9	678.3	10.90	2.10	1.29	
C_KS2_829_1	TOYOTA	PICKUP	1989	3	3/15/2005	0	0.0	0.00	N/A	.	.	.	.	x
C_KS2_829_2	TOYOTA	PICKUP	1989	3	3/15/2005	30	8.1	0.51	15.8	556.4	8.01	3.49	0.64	
C_KS2_829_3	TOYOTA	PICKUP	1989	3	3/15/2005	33	8.1	0.05	161.1	45.6	5.83	0.24	0.47	x
C_KS2_830_1	CHEVROLET	CORSICA	1989	2	3/15/2005	28	8.0	0.39	20.8	419.1	7.75	1.63	1.03	
C_KS2_833_1	MERCURY	TOPAZ	1989	2.3	3/16/2005	25	8.0	0.40	19.8	436.6	10.73	1.36	0.72	
C_KS2_834_1	TOYOTA	TERCEL SR5	1983	1.6	3/16/2005	28	8.1	0.30	26.7	322.2	8.45	0.93	0.80	
C_KS2_835_1	DODGE	SPIRIT	1990	2.5	3/16/2005	29	8.0	0.35	22.9	369.2	13.75	2.14	1.07	
C_KS2_836_1	HONDA	ACCORD	1988	2	3/29/2005	31	8.1	0.34	23.7	363.4	8.88	1.30	0.51	
C_KS2_836_2	HONDA	ACCORD	1988	2	3/30/2005	44	.	0.51	N/A	.	.	.	.	x
C_KS2_837_1	PONTIAC	FIREBIRD	1979	6.6	3/16/2005	27	10.1	0.75	13.4	530.1	86.32	2.73	4.26	
C_KS2_838_1	OLDSMOBILE	DELTA 88	1991	3.8	3/17/2005	55	8.1	0.46	17.5	510.2	1.57	1.43	0.17	
C_KS2_839_1	GMC	VANDURA	1983	5	3/16/2005	33	8.1	0.97	8.3	773.2	194.47	1.29	5.87	

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C_KS2_840_1	FORD	BRONCO	1990	5	3/17/2005	29	8.1	0.62	13.0	644.0	29.58	2.72	0.98	
C_KS2_842_1	TOYOTA	PICKUP	1983	2.2	3/17/2005	40	8.0	0.39	20.5	414.7	12.77	1.52	1.74	
C_KS2_844_1	CADILLAC	FLEETWOOD	1989	5	3/17/2005	24	8.0	0.24	34.0	94.3	93.04	0.03	21.29	x
C_KS2_846_1	CHEVROLET	CHEYENNE PICKUP	1973	5	3/17/2005	28	8.0	0.00	133122.7	0.0	0.00	0.00	0.01	x
C_KS2_846_2	CHEVROLET	CHEYENNE PICKUP	1973	5	3/17/2005	22	8.0	0.65	12.4	448.2	113.56	1.99	38.27	x
C_KS2_848_1	CHEVROLET	EL CAMINO	1976	5.7	3/18/2005	28	8.0	0.61	13.0	612.7	45.64	1.97	2.89	
C_KS2_849_1	FORD	F-150	1986	4.9	3/18/2005	25	8.0	0.57	14.2	575.2	22.51	7.28	8.35	
C_KS2_850_1	FORD	RANGER	1990	2.9	3/19/2005	42	8.0	0.52	15.3	559.4	15.93	4.35	1.74	
C_KS2_851_1	FORD	F-150	1988	4.9	3/18/2005	24	8.1	0.57	14.0	633.6	3.16	1.95	1.64	
C_KS2_855_1	TOYOTA	CAMRY	1990	2.5	3/18/2005	26	8.1	0.41	19.9	406.4	26.64	0.72	1.61	
C_KS2_856_1	OLDSMOBILE	CUTLASS	1989	2.8	3/21/2005	40	8.1	0.38	21.4	400.3	11.48	1.32	1.05	
C_KS2_856_2	OLDSMOBILE	CUTLASS	1989	2.8	3/19/2005	40	8.4	0.45	18.6	460.0	12.92	1.21	1.30	
C_KS2_857_1	CHEVROLET	C-10	1983	4.1	3/19/2005	33	8.0	0.64	12.6	664.3	28.53	6.00	3.00	
C_KS2_858_1	FORD	F-150	1988	5	3/19/2005	26	8.1	0.47	17.1	512.8	6.48	1.41	0.98	
C_KS2_859_1	BUICK	CENTURY	1988	2.8	3/19/2005	31	8.0	0.45	17.7	255.5	175.28	0.11	1.08	
C_KS2_862_1	GMC	JIMMY	1992	4.3	3/19/2005	23	8.0	0.30	26.7	326.1	6.60	0.76	0.25	
C_KS2_862_2	GMC	JIMMY	1992	4.3	3/19/2005	0	.	0.00	N/A	.	.	.	.	x
C_KS2_866_1	CHEVROLET	CAPRICE	1985	5	3/21/2005	30	8.0	0.70	11.5	588.8	112.48	2.83	6.42	
C_KS2_867_1	FORD	F-150	1978	6.5	3/21/2005	28	8.2	1.06	7.7	886.4	165.92	4.14	7.51	
C_KS2_868_1	TOYOTA	PICKUP 4X4 TURBO	1987	2.4	3/21/2005	30	8.0	0.52	15.6	513.0	30.59	4.19	5.75	
C_KS2_870_1	OLDSMOBILE	CUTLASS SUPREME	1987	5	4/7/2005	32	8.0	0.46	17.4	501.4	7.82	4.18	0.87	
C_KS2_870_2	OLDSMOBILE	CUTLASS SUPREME	1987	5	4/7/2005	13	4.2	0.28	14.7	560.2	29.01	4.72	1.75	
C_KS2_871_1	CHEVROLET	NOVA	1976	4.1	3/22/2005	29	8.0	0.49	16.3	448.3	57.10	1.87	5.54	
C_KS2_872_1	CHEVROLET	IMPALA	1973	5.7	3/22/2005	37	8.1	1.03	7.9	942.4	120.90	2.60	5.05	
C_KS2_873_1	FORD	F-150	1990	4.9	3/23/2005	33	8.1	0.42	19.3	460.2	2.63	3.44	0.48	
C_KS2_875_1	CHEVROLET	MALIBU	1980	3.8	3/22/2005	33	8.0	0.52	15.5	467.6	70.80	0.66	1.75	
C_KS2_876_1	CHEVROLET	G20 VAN	1989	5.7	3/22/2005	33	8.1	0.62	13.0	661.8	14.80	2.62	1.52	

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C_KS2_876_2	CHEVROLET	G20 VAN	1989	5.7	3/22/2005	36	7.1	0.60	11.7	728.4	20.20	3.19	2.16	
C_KS2_877_1	CHEVROLET	BLAZER 4X4	1987	2.8	3/22/2005	27	7.9	0.47	17.0	503.0	14.06	6.77	0.95	
C_KS2_878_1	DODGE	CARAVAN ES	2003	3.8	3/23/2005	36	8.0	0.49	16.5	545.0	0.82	0.67	0.06	
C_KS2_878_2	DODGE	CARAVAN ES	2003	3.8	3/23/2005	27	8.0	0.45	17.7	507.4	0.96	0.60	0.07	
C_KS2_881_1	FORD	RANGER XLT	1989	2.3	3/23/2005	27	8.0	0.43	18.5	464.6	12.42	1.68	0.99	
C_KS2_883_1	CHEVROLET	MONTE CARLO	1984	5	3/23/2005	30	8.1	0.38	21.2	392.4	19.70	0.65	0.69	
C_KS2_885_1	SATURN	STATION WAGON	1994	1.9	3/24/2005	33	8.0	0.33	24.2	352.9	10.49	0.45	0.88	
C_KS2_887_1	FORD	MUSTANG	1979	2.3	3/24/2005	33	8.1	0.67	12.2	524.5	118.91	1.18	13.37	
C_KS2_888_1	VW	THING	1974	1.6	3/24/2005	35	8.1	0.35	23.2	275.1	60.08	2.59	7.88	
C_KS2_889_1	MAZDA	B2200	1988	2.2	3/24/2005	26	8.0	0.42	18.9	350.4	76.13	0.97	4.05	
C_KS2_891_1	MAZDA	PROTÉGÉ	1999	1.6	4/1/2005	24	8.1	0.28	28.3	306.8	6.59	1.16	0.14	
C_KS2_894_1	CHEVROLET	SILVERADO 1500	1989	5	3/25/2005	29	8.0	0.59	13.7	617.3	20.74	3.42	1.84	
C_KS2_894_2	CHEVROLET	SILVERADO 1500	1989	5	3/25/2005	35	8.0	0.58	13.7	613.0	22.23	3.10	2.22	
C_KS2_895_1	OLDSMOBILE	CUTLASS	1990	3.1	3/25/2005	36	8.1	0.39	20.6	421.5	9.50	1.21	0.27	
C_KS2_897_1	JEEP	CJ-7	1979	4.2	3/28/2005	69	8.3	0.70	11.7	581.1	108.97	6.31	7.34	
C_KS2_898_1	CHEVROLET	CAVALIER	1991	2.2	3/26/2005	30	8.0	0.43	18.7	423.5	32.23	3.53	2.85	
C_KS2_901_1	OLDSMOBILE	CUTLASS CIERRA	1990	3.3	3/26/2005	56	8.1	0.42	19.0	455.3	10.83	1.69	0.80	
C_KS2_902_1	FORD	GRANADA	1982	3.3	3/26/2005	39	8.1	0.49	16.4	525.5	12.71	1.35	0.69	
C_KS2_903_1	FORD	AEROSTAR	1990	3	3/26/2005	51	8.0	0.49	16.6	509.8	19.66	1.98	0.79	
C_KS2_905_1	TOYOTA	CAMRY	2001	2.2	3/28/2005	25	8.0	0.41	19.6	447.5	7.07	0.53	0.21	
C_KS2_906_1	FORD	ESCAPE	2002	3	3/28/2005	32	8.0	0.37	21.7	413.7	0.55	0.09	0.05	
C_KS2_910_1	PONTIAC	GRAND PRIX	1976	5.7	3/29/2005	35	8.1	0.85	9.5	672.8	168.62	1.49	7.23	x
C_KS2_911_1	CHEVROLET	CELEBRITY	1984	2.5	3/29/2005	28	8.1	0.37	21.5	402.5	8.83	1.07	0.46	
C_KS2_915_1	HONDA	CIVIC	1990	1.5	4/1/2005	42	8.3	0.33	24.8	346.7	9.11	2.45	0.60	
C_KS2_916_1	CHEVROLET	VAN 20	1986	5	4/1/2005	35	8.1	0.93	8.7	695.4	189.94	1.34	20.51	
C_KS2_917_1	FORD	F 100 RANGER	1978	4.9	4/2/2005	21	8.0	0.24	33.6	260.0	4.42	2.37	0.61	x
C_KS2_918_1	FORD	ESCORT	1998	2	4/2/2005	25	0.0	0.00	0.0	.	.	.	.	x

CTR_TST_ID	Make	Model	Model Year	Disp	Test Date	Test Duration (minutes)	Test Distance (miles)	FuelUsed (gal)	Test FE (mpg)	Composite CO2 (gpm)	Composite CO (gpm)	Composite NOx (gpm)	Composite THC (gpm)	Suspect Data
C_KS2_918_2	FORD	ESCORT	1998	2	4/2/2005	15	.	0.01	N/A	.	.	.	.	x
C_KS2_918_3	FORD	ESCORT	1998	2	4/2/2005	22	8.0	0.31	25.4	349.7	2.74	0.56	0.14	
C_KS2_922_1	CHEVROLET	BEAUVILLE 10	1979	5.7	4/4/2005	22	8.1	0.71	11.3	676.2	64.80	2.54	5.24	
C_KS2_923_1	FORD	ESCAPE	2005	3	4/5/2005	29	8.1	0.39	20.5	434.9	0.74	0.08	0.12	
C_KS2_924_1	FORD	FOCUS	2005	2	4/5/2005	39	8.1	0.38	21.5	412.1	2.65	0.06	0.09	
C_KS2_925_1	DODGE	CARAVAN SE	1992	3.3	4/6/2005	39	8.0	0.49	16.5	528.6	8.63	3.64	0.54	
C_KS2_926_1	FORD	F-150 XL	1995	4.9	4/6/2005	40	8.0	0.51	15.7	545.7	4.50	75.58	0.91	x
C_KS2_927_1	CHEV	ASTRO VAN	1994	4.3	4/6/2005	29	8.0	0.55	14.7	557.9	28.99	2.97	4.33	x
C_KS2_927_2	CHEV	ASTRO VAN	1994	4.3	4/6/2005	1	0.0	0.00	N/A	.	.	.	.	x
C_KS2_928_1	DODGE	GRAND CARAVAN SPORT	2000	3.3	4/6/2005	52	8.0	0.54	14.9	591.7	4.30	0.73	0.41	
C_KS2_929_1	CHEVROLET	SUBURBAN	1997	5.7	4/7/2005	31	8.1	0.63	12.8	677.6	13.41	3.62	1.14	
C_KS2_929_2	CHEVROLET	SUBURBAN	1997	5.7	4/7/2005	35	8.0	0.72	11.1	777.3	17.76	3.87	1.25	
C_KS2_930_1	TOYOTA	FORERUNNER	1998	3.4	4/6/2005	32	8.0	0.43	18.8	475.0	1.13	0.61	0.09	
C_KS2_935_1	FORD	F-250	1995	4.9	4/6/2005	24	8.0	0.58	13.9	638.1	4.12	2.10	0.65	
C_KS2_937_1	DODGE	CARAVAN	1995	3	4/7/2005	52	8.1	0.04	225.4	39.0	0.19	0.03	0.02	x
C_KS2_937_2	DODGE	CARAVAN	1995	3	4/7/2005	47	8.0	0.42	19.2	456.8	6.69	1.04	0.31	
C_KS2_939_1	CHEVROLET	ASTROVAN	1992	3	4/9/2005	38	18.6	1.12	16.5	503.8	21.19	7.33	1.94	
C_KS2_941_1	PLYMOUTH	VOYAGER	1992	3.3	4/8/2005	38	8.0	0.47	17.2	499.4	13.58	3.69	1.14	
C_KS2_944_1	CHEVROLET	BLAZER 4X4	1993	4.3	4/8/2005	41	18.6	1.06	17.6	499.3	6.56	1.22	0.40	
C_KS2_945_1	CHRYSLER	VOYAGER	2002	3.3	4/8/2005	50	18.7	0.92	20.4	439.0	0.82	0.43	0.05	
C_KS2_946_1	JEEP	CHEROKEE	1996	2.5	4/8/2005	41	8.1	0.51	15.7	562.8	5.07	0.42	0.42	
C_KS2_950_1	FORD	CLUB WAGON E150	1989	5	4/9/2005	51	18.6	0.64	29.2	240.6	34.20	0.41	4.45	
C_KS2_984_1	DODGE	STRATUS	1999	2.4	2/7/2005	36	8.0	0.43	18.8	460.8	10.60	0.91	0.32	
C_KS2_985_1	DODGE	INTREPID	1995	3.3	2/14/2005	40	8.0	0.39	20.7	425.5	4.28	0.88	0.67	
C_KS2_986_1	TOYOTA	AVALON	1998	3	2/28/2005	49	8.1	0.36	22.5	397.0	1.59	0.33	0.13	
C_KS2_987_1	FORD	EXPLORER	1993	4	2/28/2005	26	8.0	0.48	16.7	528.0	7.13	1.33	0.51	
C_KS2_989_1	DODGE	GRAND CARAVAN	2003	3.3	4/4/2005	30	8.1	0.41	19.5	455.3	0.66	0.50	0.07	

CTR_TST_ID	Make	Model	Model Year	Disp	Test Date	Test Duration (minutes)	Test Distance (miles)	FuelUsed (gal)	Test FE (mpg)	Composite CO2 (gpm)	Composite CO (gpm)	Composite NOx (gpm)	Composite THC (gpm)	Suspect Data
C_KS2_989_2	DODGE	GRAND CARAVAN	2003	3.3	4/4/2005	30	8.0	0.43	18.6	480.6	1.07	0.20	0.07	
C_KS2_1013_1	TOYOTA	CAMRY	1994	3	1/19/2005	59	8.0	0.29	28.1	317.2	1.08	0.33	0.32	
C_KS2_1014_1	MERCURY	GRAND MARQUIS	1994	4.6	2/9/2005	43	8.0	0.51	15.8	555.7	7.03	0.99	1.29	

Table 4-14. Round 2 Driveaway Test Results

CTR_TST_ID	Make	Model	Model Year	Disp	Test Date	Test Duration (minutes)	Test Distance (miles)	Fuel Used (gal)	Test FE (mpg)	Composite CO2 (gpm)	Composite CO (gpm)	Composite NOx (gpm)	Composite THC (gpm)	Suspect Data
D_KS2_618_1	BUICK	LASABRE	1979	4.9	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	x
D_KS2_677_1	PONTIAC	MONTANA	2003	3.4	2/11/2005	285	48.8	2.10	23.3	383.601	2.019	0.23	0.053	
D_KS2_679_1	FORD	RANGER	1998	4	2/12/2005	164	40.7	2.18	18.7	474.869	2.661	1.081	0.353	
D_KS2_689_1	LINCOLN	TOWN CAR	1988	5	2/15/2005	139	10.9	0.89	12.2	684.39	28.495	3.263	3.16	
D_KS2_689_2	LINCOLN	TOWN CAR	1988	5	2/15/2005	101	18.7	1.07	17.5	443.557	41.189	2.339	1.981	
D_KS2_698_1	CHRYSLER	TOWN & COUNTRY LX	2001	3.3	2/17/2005	49	18.6	0.88	21.1	418.766	4.529	0.785	0.129	
D_KS2_698_2	CHRYSLER	TOWN & COUNTRY LX	2001	3.3	2/17/2005	190	13.8	0.14	96.7	81.49	1.048	0.14	0.264	x
D_KS2_703_1	FORD	COUNTRY SQUIRE	1986	5	2/17/2005	76	20.8	1.03	20.2	403.008	22.486	2.773	3.185	
D_KS2_704_1	CADILLAC	SEDAN DEVILLE	1992	4.9	2/18/2005	259	21.1	1.58	13.4	342.322	207.497	0.173	8.368	
D_KS2_705_1	DODGE	DAKOTA	2004	3.7	2/18/2005	215	32.1	1.42	22.6	395.931	1.725	0.059	0.096	
D_KS2_711_1	MERCURY	TOPAZ	1994	2.3	2/19/2005	240	47.7	2.46	19.4	433.667	5.067	1.028	0.072	
D_KS2_722_1	VOLVO	960	1993	2.9	2/21/2005	215	40.8	1.60	25.5	351.182	1.015	0.311	0.105	
D_KS2_723_1	FORD	TEMPO	1993	2.3	2/21/2005	263	37.7	2.12	17.8	460.366	7.451	1.715	0.54	
D_KS2_724_1	CHEVROLET	BLAZER	1996	4.3	2/21/2005	280	40.8	2.11	19.4	457.864	3.737	0.647	0.201	
D_KS2_726_1	CHEVROLET	S-10 LS	1995	4.3	2/22/2005	316	50.7	2.65	19.2	454.78	8.917	0.612	0.428	
D_KS2_729_1	CHRYSLER	TOWN & COUNTRY	1996	3.8	2/22/2005	230	32.9	1.63	20.3	414.799	17.42	2.008	0.631	
D_KS2_730_1	FORD	RANGER	1994	3	2/23/2005	241	33.2	1.26	26.3	N/A	N/A	N/A	N/A	x
D_KS2_730_2	FORD	RANGER	1994	3	2/23/2005	48	18.6	0.72	26.0	339.502	4.116	0.364	0.299	
D_KS2_734_1	PLYMOUTH	VOYAGER	1993	3	2/23/2005	109	19.6	0.86	22.8	381.814	7.238	1.864	0.371	
D_KS2_735_1	DODGE	CARAVAN SE	1995	3.3	2/23/2005	169	30.4	1.14	26.6	334.906	1.171	0.269	0.067	
D_KS2_739_1	FORD	TAURUS	1993	3	2/24/2005	75	18.6	0.92	20.3	435.753	3.534	0.768	0.364	
D_KS2_739_2	FORD	TAURUS	1993	3	2/24/2005	194	11.3	0.84	13.5	648.561	6.817	1.414	0.932	
D_KS2_745_1	FORD	ECONOLINE E 150	2001	5.4	2/25/2005	472	55.4	3.67	15.1	589.838	3.393	0.4	0.14	
D_KS2_753_1	FORD	WINDSTAR	1998	2	2/26/2005	110	11.3	0.68	16.7	531.102	4.094	2.467	0.275	
D_KS2_759_1	JEEP	CHEROKEE	1988	4	2/28/2005	178	35.3	1.87	18.8	464.985	7.652	1.591	0.521	
D_KS2_760_1	MAZDA	PROTÉGÉ	1998	1.5	2/28/2005	374	32.8	3.27	10.1	878.367	9.696	0.988	0.649	
D_KS2_764_1	BUICK	SKYLARK	1998	3.1	3/1/2005	293	60.2	1.95	30.8	291.559	0.605	0.259	0.07	
D_KS2_766_1	JEEP	GRAND CHEROKEE	1993	5.2	3/1/2005	323	33.2	1.86	17.8	488.76	8.861	1.528	0.47	
D_KS2_769_1	HONDA	CIVIC	1999	1.8	3/2/2005	232	40.2	0.93	43.4	195.673	7.41	0.191	0.051	

CTR_TST_ID	Make	Model	Model Year	Disp	Test Date	Test Duration (minutes)	Test Distance (miles)	Fuel Used (gal)	Test FE (mpg)	Composite CO2 (gpm)	Composite CO (gpm)	Composite NOx (gpm)	Composite THC (gpm)	Suspect Data
D_KS2_770_1	TOYOTA	CAMRY	1989	2.5	3/5/2005	677	62.6	2.25	27.8	319.434	2.198	1.142	0.068	
D_KS2_773_1	FORD	E-150	1991	4.9	3/3/2005	293	52.9	3.59	14.7	564.493	21.576	4.39	4.149	
D_KS2_774_1	NISSAN	QUEST	1996	3	3/5/2005	129	31.5	1.29	24.4	364.925	2.103	0.347	0.128	
D_KS2_783_1	PLYMOUTH	VOYAGER	1992	2.5	3/7/2005	310	42.7	1.77	24.2	347.368	14.897	3.646	0.457	
D_KS2_786_1	FORD	ECONOLINE	1996	4.9	3/8/2005	440	34.1	2.03	16.8	532.548	2.257	1.861	0.127	
D_KS2_788_1	PLYMOUTH	ACCLAIM	1989	2.5	3/8/2005	510	78.8	2.81	28.1	307.99	7.963	2.552	0.206	
D_KS2_791_1	TOYOTA	CAMRY	1999	2.2	3/8/2005	156	42.6	1.78	23.9	371.101	3.413	0.387	0.19	
D_KS2_792_1	CHEVROLET	TRAIL BLAZER	2002	4.2	3/9/2005	348	56.9	3.05	18.7	479.503	2.272	0.255	0.047	
D_KS2_795_1	FORD	CROWN VICTORIA LTD	1989	5	3/10/2005	115	7.5	0.53	14.0	619.052	10.784	1.509	1.996	
D_KS2_801_1	PLYMOUTH	VOYAGER SE	1988	3	3/10/2005	52	8.1	0.45	17.9	484.622	9.561	3.658	1.201	
D_KS2_805_1	CHEVROLET	CAVALIER	1995	2.2	3/11/2005	331	18.7	0.66	28.3	306.899	6.14	0.763	0.393	
D_KS2_808_1	FORD	EXPLORER	1994	4	3/11/2005	393	27.5	1.64	16.8	518.482	9.847	1.449	0.253	
D_KS2_813_1	HONDA	ACCORD LXI	1988	2	3/13/2005	531	35.7	1.61	22.2	380.369	15.321	1.718	0.565	
D_KS2_818_1	CHEVROLET	LUMINA APV	1990	3.1	3/14/2005	222	38.8	1.36	28.5	307.7	4.722	0.928	0.276	
D_KS2_820_1	BUICK	PARK AVENUE ELECTRA	1990	3.8	3/16/2005	187	58.1	2.51	23.1	384.258	2.652	1.637	0.214	
D_KS2_824_1	CHEVROLET	ASTROVAN	1989	4.3	3/15/2005	20	3.0	0.28	10.7	804.307	21.621	6.235	0.845	
D_KS2_825_1	DODGE	CARAVAN SE	1988	3	3/16/2005	305	38.9	1.78	21.9	397.207	6.27	2.16	1.452	
D_KS2_830_1	CHEVROLET	CORSICA	1989	2	3/17/2005	405	13.5	0.73	18.4	466.347	10.08	1.605	1.427	
D_KS2_835_1	DODGE	SPIRIT	1990	2.5	3/17/2005	103	30.2	1.20	25.1	337.901	11.944	2.231	0.686	
D_KS2_836_1	HONDA	ACCORD	1988	2	3/31/2005	562	44.1	1.78	24.8	343.804	10.172	1.04	0.392	
D_KS2_847_1	GMC	1500 SLE SIERRA	1988	5.7	3/18/2005	353	31.5	2.10	15.0	578.631	11.976	1.583	0.763	
D_KS2_859_1	BUICK	CENTURY	1988	2.8	3/21/2005	235	39.8	1.84	21.7	203.899	138.646	0.2	5.81	
D_KS2_904_1	SUBARU	FORESTER	2001	2.5	3/28/2005	109	23.4	0.96	24.4	362.232	3.774	5.764	0.136	
D_KS2_910_1	PONTIAC	GRAND PRIX	1976	5.7	3/30/2005	317	32.6	3.12	10.5	667.948	117.053	2.47	4.294	
D_KS2_913_1	BUICK	LESABRE	1990	3.8	3/31/2005	453	42.6	1.88	22.7	380.574	9.196	0.656	0.327	

A fuel economy comparison of Round 2 conditioning runs and LA92 drive cycle tests performed on the dynamometer is shown with a 1:1 reference line in Figure 4-17. Appendices F and L provide formulas for calculating fuel economy from both the dynamometer and the PEMS. Results listed as “suspicious” in Tables 4-12 and 4-13 are excluded from Figure 4-17.

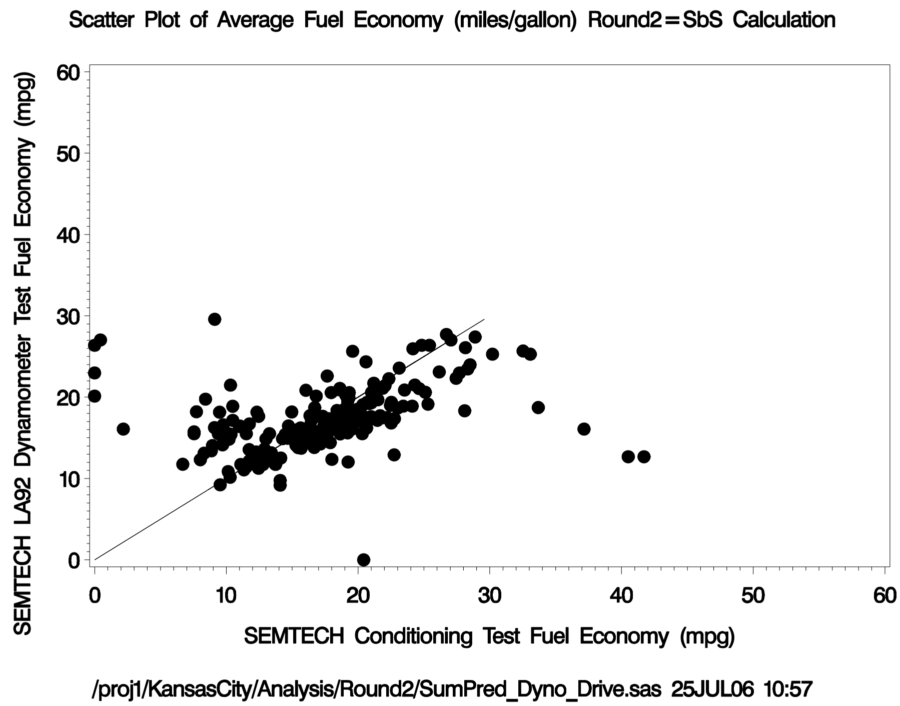


Figure 4-17. By-Vehicle Comparison of Conditioning Run vs. Dynamometer Testing Fuel Economy for Round 2

A fuel economy comparison of the 51 vehicles that received driveaway tests and LA92 dynamometer tests performed during Round 2 is shown in Figure 4-18. Figure 4-19 provides a by-vehicle comparison of Round 2 condition run vs. driveaway test fuel economy. 1:1 lines are provided for reference. As previously discussed, these figures reveal differences in results using the same test system (PEMS) but different tests (dynamometer LA-92 vs. standardized conditioning route vs. “real-world driving”).

Table 4-15 contains results of the Round 2 fuel samples that were analyzed during the study. Results of all fuel analysis performed prior to April 2006 were included in the MSOD data submission for this study and are shown in Table 4-15. Results of fuels analysis performed after April 2006 were not included in the MSOD submission (and are not shown in Table 4-15) but are included in Appendix FF (KC_fuels_analysis_complete.pdf) for reference.

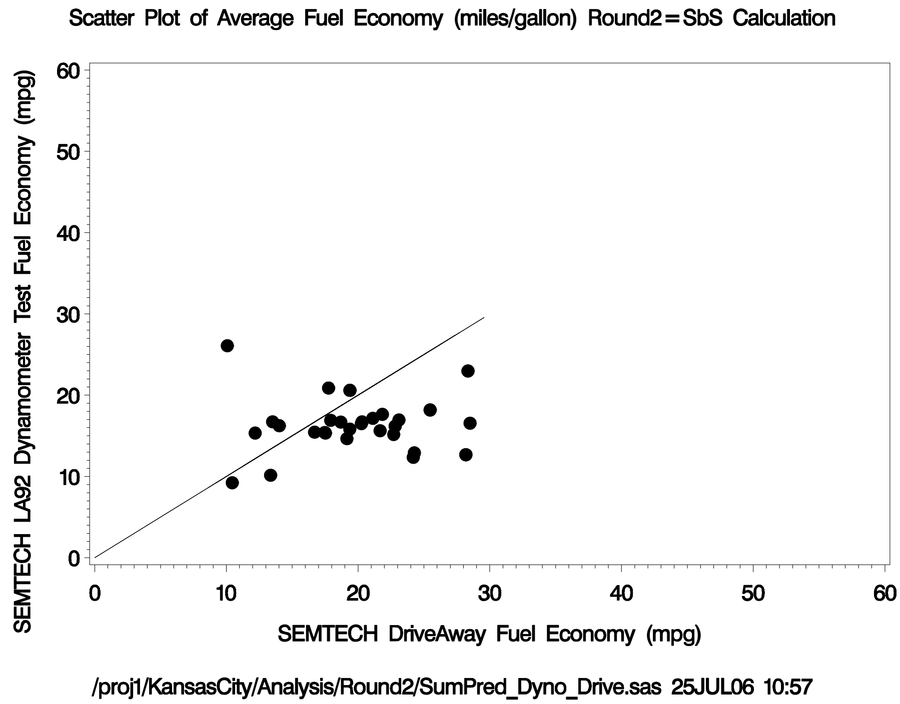


Figure 4-18. By-Vehicle Comparison of Driveaway vs. Dynamometer Testing Fuel Economy for Round 2

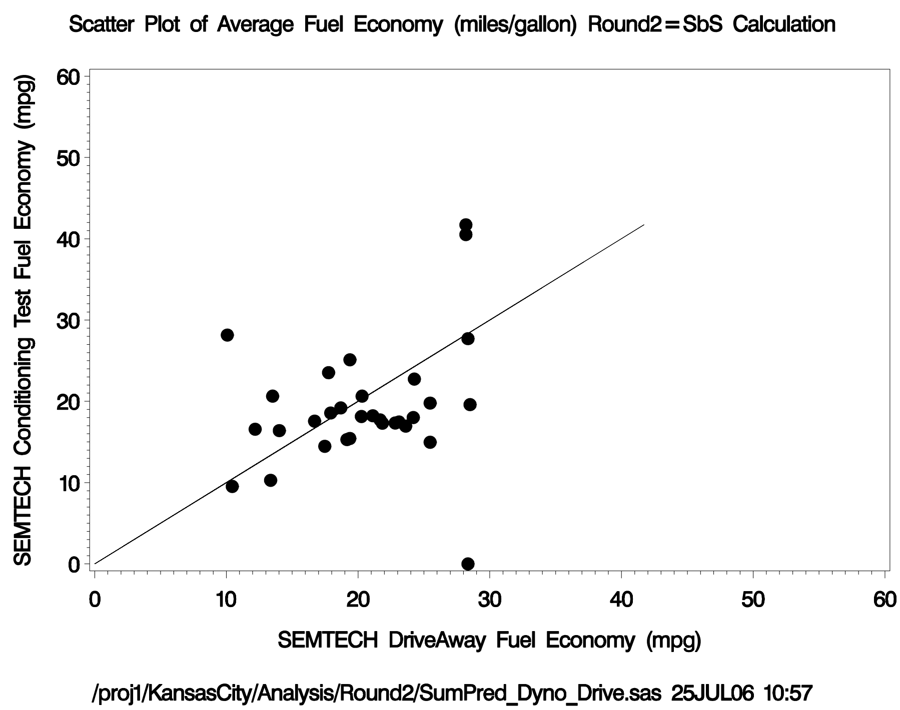


Figure 4-19. By-Vehicle Comparison of Driveaway vs. Conditioning Run Fuel Economy for Round 2

Table 4-15. Fuel Analysis Results from Round 2 Vehicle Samples

Laboratory Fuel Batch ID	Vehicle ID	Sulfur (ppm)	Initial Boiling Point (F)	10% Distillation Point (F)	50% Distillation Point (F)	90% Distillation Point (F)	End Point (F)	Specific Gravity at 60 F	Degrees API at 60 F	Oxygen Weight %	Oxygenate Type	Total Recovery (mL)	Residue (mL)	Loss (mL)	Reid Vapor Pressure (psi)	Olefins (Vol %)	Saturates (Vol %)	Aromatics (Vol %)
13629	KS2_533	134	78	95	193	327	421	0.7251	63.64	0	NONE	96.3	0.4	3.3	14	9.9	68.7	21.4
13720	KS2_685	258	79	101	199	320	402	0.7276	62.97	0	NONE	96.4	0.7	2.9	13.6	9.5	68.7	21.8
13721	KS2_575	330	82	100	196	320	399	0.7282	62.81	0	NONE	96.7	0.9	2.4	14.1	8.8	68.8	22.4
13722	KS2_634	214	79	98	198	323	407	0.7276	62.97	0	NONE	96.3	0.7	3	14.5	9.2	69.3	21.5
13723	KS2_622	153	80	99	198	328	427	0.7263	63.33	0	NONE	96.8	0.8	2.4	14.5	10.5	67.7	21.8
13724	KS2_579	129	78	97	199	328	433	0.7243	63.85	0	NONE	97	0.5	2.5	14.5	10	69.5	20.5
13725	KS2_568	103	82	105	215	321	410	0.7313	62.01	0	NONE	96.9	0.8	2.3	12.8	5.3	70.2	24.5
13736	KS2_670	255	80	96	193	319	401	0.7266	63.25	0	NONE	96.9	0.9	2.2	14.3	8.9	68.7	22.4
13739	KS2_679	346	82	102	196	318	403	0.7268	63.2	0	NONE	96.8	0.7	2.5	13.8	9.7	67.6	22.7
13827	KS2_605	310	80	102	201	322	412	0.7276	62.98	0	NONE	96.8	0.8	2.4	13.3	9.6	68.6	21.8
13828	KS2_756	163	83	104	196	328	406	0.7323	61.73	0	NONE	96.3	0.8	2.9	12.2	10.5	65.1	24.4
13829	KS2_675	235	82	101	197	323	405	0.7299	62.37	0	NONE	96.9	0.7	2.4	13.5	10.7	65.2	24.1
13830	KS2_569	101	82	99	193	322	412	0.7278	62.93	0	NONE	96.8	0.8	2.4	14.1	11.4	63	25.6
13831	KS2_596	206	79	100	200	324	430	0.7282	62.82	0	NONE	96.6	0.8	2.6	13.8	9.4	68.9	21.7
13832	KS2_572	292	81	96	199	321	406	0.7257	63.49	0	NONE	96.4	0.6	3	14.2	9.7	69	21.3
13833	KS2_556	373	81	100	199	318	403	0.7272	63.07	0	NONE	96.8	0.8	2.4	14.2	10.2	67.5	22.3
13834	KS2_594	130	80	99	201	329	425	0.727	63.13	0	NONE	96.6	0.9	2.5	13.3	10.8	67.5	21.7
13835	KS2_786	177	88	109	159	321	408	0.7366	60.61	3.33	ETHANOL	97.6	0.7	1.7	12.8	9.3	68.3	22.4
13836	KS2_626	350	80	100	198	319	401	0.7259	63.43	0	NONE	96.8	0.9	2.3	13.5	10.6	65.4	24
13837	KS2_582	351	84	100	195	319	405	0.7262	63.34	0	NONE	96.7	0.8	2.5	14.2	9.4	68.7	21.9
13838	KS2_740	273	81	103	202	321	411	0.7275	63.01	0	NONE	96.7	0.9	2.4	13.1	9.8	69	21.2
13843	KS2_757	129	84	107	197	332	413	0.7335	61.42	0	NONE	97.3	0.8	1.9	12.2	10.3	63.8	25.9
13844	KS2_872	131	84	108	199	330	423	0.7346	61.12	0	NONE	96.6	0.8	2.6	11.3	9.5	65.8	24.7
13845	KS2_773	128	86	112	203	328	411	0.7357	60.84	0	NONE	97.5	0.8	1.7	12.3	9.7	64.7	25.6
13846	KS2_917	197	91	127	214	329	408	0.7416	59.3	0	NONE	97.7	0.9	1.4	9.2	8.9	64.6	26.5
13847	KS2_910	143	84	111	200	330	419	0.7332	61.49	0	NONE	96.8	0.9	2.3	11	11.7	64.4	23.9
13848	KS2_776	121	86	113	204	332	426	0.7323	61.73	0	NONE	97.6	0.7	1.7	11.6	7.2	70.5	22.3
13850	KS2_623	84	83	108	219	323	409	0.7338	61.34	0	NONE	97.3	0.7	2	12.2	5	69.5	25.5
14276	KS2_782	119	82	105	192	323	414	0.7265	63.26	0	NONE	96.8	0.9	2.3	12.6	7.8	70.4	21.8
14278	KS2_725	195	83	103	199	322	407	0.7288	62.67	0	NONE	96.7	0.9	2.4	12.7	9.4	68.2	22.4
14279	KS2_736	230	83	104	195	321	408	0.7285	62.73	0	NONE	96.8	0.8	2.4	12.4	9.7	67.7	22.6
14280	KS2_618	172	81	98	199	329	425	0.7238	63.99	0	NONE	96.6	0.9	2.5	14	10.7	68.8	20.5
14281	KS2_727	139	84	104	194	331	413	0.7295	62.47	0	NONE	96.9	1	2.1	12.7	13.1	62.9	24

Laboratory Fuel Batch ID	Vehicle ID	Sulfur (ppm)	Initial Boiling Point (F)	10% Distillation Point (F)	50% Distillation Point (F)	90% Distillation Point (F)	End Point (F)	Specific Gravity at 60 F	Degrees API at 60 F	Oxygen Weight %	Oxygenate Type	Total Recovery (mL)	Residue (mL)	Loss (mL)	Reid Vapor Pressure (psi)	Olefins (Vol %)	Saturates (Vol %)	Aromatics (Vol %)
14282	KS2_632	347	79	98	198	318	401	0.7234	64.12	0	NONE	96.7	0.9	2.4	14	9.2	70.2	20.6
14283	KS2_619	389	79	99	198	317	397	0.7245	63.82	0	NONE	96.7	0.9	2.4	13.7	9.8	69.6	20.6
14285	KS2_640	86	81	103	218	322	408	0.7329	61.58	0	NONE	96.8	0.9	2.3	12.7	5.2	69.1	25.7
14286	KS2_633	77	84	108	221	315	408	0.7383	60.16	0	NONE	96.9	0.8	2.3	12.1	3.7	68.5	27.8
14287	KS2_819	146	85	110	198	329	416	0.7312	62.02	0	NONE	97.1	1	1.9	11.4	8.9	67.1	24
14288	KS2_801	94	80	102	196	323	416	0.7231	64.18	0	NONE	96.7	1	2.3	13.1	8.9	70.9	20.2
14290	KS2_721	290	81	101	197	320	400	0.7287	62.68	0.89	NONE	96.8	0.9	2.3	13.7	9	68.2	22.8
	Min	77.00	78.00	95.00	159.00	315.00	397.00	0.72	59.30	0.00	N/A	96.30	0.40	1.40	9.20	3.70	62.90	20.20
	Mean	202.50	82.03	103.18	199.20	323.63	411.23	0.73	62.55	0.11	N/A	96.84	0.81	2.36	13.08	9.27	67.76	22.97
	Median	174.50	82.00	102.00	198.00	322.50	408.50	0.73	62.88	0.00	N/A	96.80	0.80	2.40	13.30	9.55	68.55	22.40
	Max	389.00	91.00	127.00	221.00	332.00	433.00	0.74	64.18	3.33	N/A	97.70	1.00	3.30	14.50	13.10	70.90	27.80
	Std Dev	93.67	2.74	6.00	9.68	4.65	9.15	0.00	1.13	0.54	N/A	0.34	0.13	0.37	1.15	1.82	2.14	1.89

4.4.3 Control vehicle results

4.4.3.1 Round 1 Control Vehicle Test Results

Five LA92 dynamometer tests were performed for a 1988 Ford Taurus control vehicle at EPA's testing facility in Ann Arbor, MI. Results for these tests are presented in Table 4-16.

Table 4-16. Emissions Summary for Ann Arbor Control Vehicle Testing

Test ID	Phase	HC (g/mi)	CO (g/mi)	NO_x (g/mi)	CO_2 (g/mi)	PM (mg/mi)
VETS012378	1	4.058	25.897	5.875	617.341	32.016
VETS012378	2	1.93	13.328	3.947	370.998	10.093
VETS012378	3	3.076	20.455	6.1	527.129	5.219
VETS012380	1	3.881	28.92	6.191	622.316	11.46
VETS012380	2	1.799	13.73	3.927	369.915	6.39
VETS012380	3	3.015	21.487	5.994	525.609	6.164
VETS012384	1	3.853	29.673	5.782	602.62	11.964
VETS012384	2	1.847	13.126	3.83	365.109	8.815
VETS012384	3	2.952	20.811	6.198	523.356	6.434
VETS012395	1	4.07	29.92	5.722	619.329	22.228
VETS012395	2	1.867	13.004	3.65	367.479	5.846
VETS012395	3	3.015	22.147	5.602	524.237	4.193
VETS012398	1	3.887	29.82	5.896	609.913	13.908
VETS012398	2	1.897	13.153	3.7	365.632	4.814
VETS012398	3	2.982	21.39	5.605	522.037	6.354

A total of twelve LA92 dynamometer tests were performed for the same 1988 Ford Taurus control vehicle on site in Kansas City. Nine of the tests used a hot-wire flow meter and the remaining three tests were performed using a new pitot-tube flow meter for the PEMS measurements. Table 4-17 shows an emission summary of the dynamometer control tests performed in Kansas City measured with the PEMS in comparison with emissions measured by the dynamometer bench, by phase and composite (comp) measurements. Highlighted emission values (in blue) represent measurements taken with the newer pitot-tube flowmeter. In order to eliminate any opportunity for pitot-tube orifices to become blocked with particulate matter or ice, pitot-tube flowmeters were purged with high-pressure dry nitrogen gas prior to each test, and the flowmeters were stored in above-freezing temperatures when not in use.

Table 4-17. Round 1 by Phase Emissions Summary for Control Vehicle Testing in Kansas City

RunID	Phase	Temp (F)	RH (%)	HC (g/mi)		CO (g/mi)		NO_x (g/mi)		CO_2 (g/mi)		PM2.5 (mg/mi)	Distance (miles)	PEMS DATA Suspect	Dyno DATA Suspect
				PEMS	Dyno	PEMS	Dyno	PEMS	Dyno	PEMS	Dyno				
84081	1				5.35	36.9	34.95	7.23	6.88	658.16	653.31	5.45	1.18		
84081	2			2.07	2.1	14.75	13.29	6.61	5.54	400.34	384.22	1.28	8.64		
84081	3			5.04 3.3	3.55	21.86	20.33	7.1	7.07	556.98	544.6	0.54	1.17		
84081	Comp	76.4	40.6	2.31	2.36	16.38	14.89	6.67	5.71	424.33	409.04	1.44	10.99		
84114	1				5.35	.	27.88	.	8.1	.	699.36	2.55	1.17		
84114	2		.		2.2	.	14.49	.	6.78	.	399.54	0.73	8.61		
84114	3		.		4.03	.	24.31	.	8.39	.	572.8	0.9	1.17		
84114	Comp	93.5	45.0 .	.	2.49	.	15.85	.	6.96	.	426.75	0.84	10.95	x	
84143	1				6.55	.	32.54	.	7.49	.	697.04	13.53	1.19		
84143	2		.		2.08	.	13.18	.	5.72	.	392.47	0.87	8.64		
84143	3		.		3.55	.	20.18	.	6.98	.	560.04	1.42	1.19		
84143	Comp	81.5	38.2 .	.	2.41	.	14.67	.	5.9	.	419.84	1.56	11.02	x	
84177	1			5.13	5.34	33.65	32.11	7.16	7.07	629	666.3	5.31	1.17		
84177	2			2.06	2.07	14.02	13.48	6	5.38	372.86	383.39	1	8.64		
84177	3			3.33	3.59	21.98	21.63	6.52	6.58	510.4	535.89	1.2	1.19		
84177	Comp	74.1	35.0	2.31	2.35	15.58	15	6.09	5.55	395.52	408.46	1.24	11		
84187	1			5.09	5.34	32.64	31.23	7.2	7.57	621.04	659.96	5.14	1.2		
84187	2			2.06	2.13	15.98	15.26	6.67	6.37	387.53	405.57	1.47	8.66		
84187	3			3.28	3.51	20.42	20	7.59	7.97	544.32	574.61	1.34	1.19		
84187	Comp	77.4	54.2	2.3	2.39	17.16	16.43	6.76	6.54	410.54	430.52	1.66	11.05		x
84218	1			1.3	5.43	7.36	27.19	3.74	7.27	214.91	668.85	4.59	1.18		
84218	2			0.41	2.26	2.92	13.58	1.3	6.14	78.14	398.89	0.61	8.61		
84218	3				3.8	2.97	20.05	1.54	8.01	95.97	580.22	1.4	1.18		
84218	Comp	81.0	60.8	0.46	2.53	3.15	14.72	1.44	6.33	86.17	425.28	0.87	10.96	x	
84259	1			0.51	6.17	.	38.12	.	7.74	.	684.21	7.58	1.18		
84259	2		.		2.17	.	13.47	.	5.95	.	392.9	0.8	8.65		
84259	3		.		3.54	.	21.39	.	7.12	.	520.83	2	1.18		
84259	Comp	72.0	47.9 .	.	2.47	.	15.28	.	6.12	.	416.7	1.23	11.01		
84290	1			5.07	5.2	35.33	29.58	7.05	6.95	677.75	639.47	8.01	1.18		
84290	2			2.1	2.15	15.05	13.11	6.64	6.03	411.65	380.71	4.01	8.62		
84290	3				3.48	23.7	19.62	7.52	7.2	586.5	533.41	36.51	1.2		
84290	Comp	87.7	39.0	2.34	2.4	16.7	14.42	6.73	6.16	437.55	404.72	6.47	10.99		
84348	1			3.43 5.39	5.2	34.48	30.89	6.44	7.04	718.31	662.79	6.11	1.16		
84348	2			2.22	2.05	14.51	12.85	4.85	5.5	413.2	383.73	0.21	8.61		
84348	3			3.75	3.42	23.95	20.37	6.09	6.77	616.86	539.02	9.37	1.19		
84348	Comp	79.6	26.8	2.49	2.3	16.19	14.29	5.01	5.66	442.89	408.78	1.15	10.96		
84360	1			5.36	5.44	32.75	31.28	5.93	7.86	683.84	658.38	6.38	1.2		

RunID	Phase	Temp (F)	RH (%)	HC (g/mi)		CO (g/mi)		NO_x (g/mi)		CO_2 (g/mi)		PM2.5 (mg/mi)	Distance (miles)	PEMS DATA Suspect	Dyno DATA Suspect
				PEMS	Dyno	PEMS	Dyno	PEMS	Dyno	PEMS	Dyno				
84360	2			2.17	2.05	14	12.91	4.8	6.24	398.71	381.41	0.63	8.74		
84360	3			3.68	3.52	23.58	20.96	6.22	7.98	592.59	538.64	1.42	1.22		
84360	Comp	77.6	51.5	2.44	2.33	15.65	14.43	4.96	6.45	427.2	406.81	0.98	11.17		
84374	1			5.25	5.47	32.01	32.02	5.96	6.86	671.99	674.8	3.13	1.17		
84374	2			2.1	2.04	14.49	13.79	4.71	5.45	394.49	392.19	0.37	8.6		
84374	3			3.47	3.41	22.04	20.23	5.82	6.82	575.84	553.01	0.32	1.19		
84374	Comp	73.7	17.5	2.35	2.31	15.91	15.17	4.85	5.61	421.23	417.81	0.51	10.95		
84387	1			5.34	5.92	33.13	36.26	5.75	5.84	630.52	663.77	4.97	1.21		
84387	2			2.25	2.17	13.3	12.9	4.48	4.58	375.99	385.07	1.06	8.76		
84387	3			3.44	3.49	21.07	19.78	5.43	5.56	533.35	531.4	0.99	1.23		
84387	Comp	72.0	14.1	2.5	2.45	14.9	14.6	4.61	4.72	400.57	409.91	1.26	11.21		

Table 4-18 presents a composite emissions summary for Round 1 control testing. Average and standard deviation of the reported emission values were calculated and are listed at the bottom of Table 4-18, both including an excluding Run 84218.

Table 4-18. Round 1 Composite Emission Summary for Control Vehicle Testing in Kansas City

RunID	Composite HC (g/mi)			Composite CO (g/mi)			Composite NO_x (g/mi)			Composite CO_2 (g/mi)			PM2.5 (mg/mi)
	PEMS	Dyno	%Diff	PEMS	Dyno	%Diff	PEMS	Dyno	%Diff	PEMS	Dyno	%Diff	
84081	2.31	2.36	2.36	16.38	14.89	10.00	6.67	5.71	16.85	424.33	409.04	3.74	1.44
84114	.	2.49		.	15.85		.	6.96		.	426.75		0.84
84143	.	2.41		.	14.67		.	5.90		.	419.84		1.56
84177	2.31	2.35	1.65	15.58	15.00	3.87	6.09	5.55	9.89	395.52	408.46	3.17	1.24
84187	2.30	2.39	3.85	17.16	16.43	4.45	6.76	6.54	3.39	410.54	430.52	4.64	1.66
84218	0.46	2.53	81.72	3.15	14.72	78.58	1.44	6.33	77.33	86.17	425.28	79.74	0.87
84259	.	2.47		.	15.28		.	6.12		.	416.70		1.23
84290	2.34	2.40	2.45	16.70	14.42	15.81	6.73	6.16	9.22	437.55	404.72	8.11	6.47
84348	2.49	2.30	7.88	16.19	14.29	13.24	5.01	5.66	11.50	442.89	408.78	8.35	1.15
84360	2.44	2.33	4.67	15.65	14.43	8.41	4.96	6.45	23.15	427.20	406.81	5.01	0.98
84374	2.35	2.31	2.04	15.91	15.17	4.87	4.85	5.61	13.57	421.23	417.81	0.82	0.51
84387	2.50	2.45	1.83	14.90	14.60	2.03	4.61	4.72	2.25	400.57	409.91	2.28	1.26
All Avg	2.17	2.40	12.05	14.62	14.98	15.70	5.24	5.98	18.57	382.89	415.39	12.87	1.60
All Std	0.64	0.07	26.20	4.35	0.63	24.02	1.68	0.58	22.94	112.37	8.70	25.20	1.57
Avg*	2.38	2.39	3.34	16.06	15.00	7.84	5.71	5.94	11.23	419.98	414.49	4.51	1.67
Std*	0.08	0.06	2.11	0.71	0.66	4.89	0.94	0.60	6.84	16.78	8.52	2.64	1.63

* Statistic values were compiled from all runs except run 84218.

4.4.3.2 Round 2 Control Vehicle Test Results

A total of twelve LA92 dynamometer tests were performed for the same 1988 Ford Taurus control vehicle that was used for Round 1 control testing in Kansas City and Ann Arbor. All Round 2 testing was conducted using pressure-differential flow meter for the PEMS exhaust flow measurements. Table 4-19 shows an emissions summary of the dynamometer control tests performed in Kansas City measured with the PEMS in comparison with emissions measured by the dynamometer bench.

Table 4-19. Round 2 by Phase Emissions Summary for Control Vehicle Testing in Kansas City

RunID	Phase	Temp (F)	RH (%)	HC (g/mi)		CO (g/mi)		NO_x (g/mi)		CO_2 (g/mi)		PM2.5 (mg/mi)	Distance (miles)	PEMS DATASuspect	Dyno DATASuspect
				PEMS	Dyno	PEMS	Dyno	PEMS	Dyno	PEMS	Dyno				
84451	1			5.23	5.52	75.65	80.77	2.99	3.27	777.86	751.03	39.06	1.19		
84451	2			0.10	0.10	3.33	2.85	1.03	1.10	452.31	435.12	2.84	8.68		
84451	3			0.26	0.31	6.49	5.75	1.30	1.49	604.31	578.39	1.46	1.20		
84451	Comp	37.6	61.3	0.38	0.40	7.35	7.10	1.15	1.24	480.06	461.47	4.62	11.08		x
84461	1			7.98	7.73	84.41	69.40	5.90	5.92	701.86	653.87	46.54	1.21		
84461	2			2.46	2.22	17.97	15.05	5.49	4.94	404.78	382.08	2.98	8.72		
84461	3			3.80	3.39	27.29	20.43	7.82	6.00	587.57	510.60	3.06	1.22		
84461	Comp	43.9	50.6	2.85	2.59	22.12	18.28	5.67	5.07	433.21	405.38	5.26	11.16		
84480	1			7.81	8.20	85.63	75.59	6.61	6.15	766.18	717.55	49.90	1.20		
84480	2			2.45	2.35	18.92	17.11	5.70	5.20	424.64	409.46	3.99	8.68		
84480	3			3.98	3.66	28.17	20.85	7.61	6.71	620.07	550.38	4.83	1.18		
84480	Comp	40.2	69.6	2.84	2.74	23.02	20.41	5.88	5.36	455.89	435.12	6.44	11.05		x
84536	1			8.04	7.93	82.15	69.75	6.30	5.38	758.84	688.07	48.30	1.22		
84536	2			2.52	2.33	17.32	15.13	5.40	4.59	409.04	391.94	3.88	8.66		
84536	3			3.99	3.59	28.41	20.91	6.82	5.21	590.62	515.45	2.49	1.21		
84536	Comp	51.7	1.2	2.91	2.71	21.50	18.43	5.54	4.68	440.18	416.26	6.14	11.09		x
84544	1			8.25	7.68	83.95	64.55	6.00	5.88	725.71	658.37	47.00	1.23		
84544	2			2.46	2.29	18.37	15.56	5.49	4.98	404.19	388.53	5.28	8.74		
84544	3			4.04	3.66	32.66	23.39	7.37	6.43	599.19	532.41	5.65	1.21		
84544	Comp	54.0	49.7	2.87	2.67	22.81	18.70	5.64	5.13	434.62	412.84	7.52	11.18		
84578	1			7.93	7.45	84.77	66.25	6.42	6.17	758.51	678.12	32.10	1.21		
84578	2			2.57	2.33	18.67	15.86	5.26	4.98	414.82	392.47	3.74	8.65		
84578	3			4.36	3.75	30.48	21.70	6.75	5.89	624.20	527.04	4.60	1.20		
84578	Comp	43.8	55.9	2.97	2.70	22.94	18.92	5.42	5.10	447.29	416.83	5.29	11.06		
84596	1			2.61	2.76	43.96	44.56	2.58	2.43	798.00	740.10	1.67	1.21		
84596	2			0.08	0.07	3.41	3.28	0.64	0.67	438.02	437.63	1.89	8.68		
84596	3			0.32	0.26	4.70	3.33	1.12	1.14	591.70	542.37	0.77	1.21		
84596	Comp	37.4	41.9	0.23	0.22	5.63	5.46	0.77	0.80	467.60	460.89	1.80	11.11		
84606	1			9.23	9.35	96.47	79.62	5.91	5.62	748.72	679.46	51.20	1.18		
84606	2			2.35	2.26	18.53	16.45	5.15	4.82	402.34	391.20	3.23	8.66		
84606	3			3.96	3.58	31.44	21.77	6.88	5.96	602.65	510.53	3.62	1.21		

RunID	Phase	Temp (F)	RH (%)	HC (g/mi)		CO (g/mi)		NO_x (g/mi)		CO_2 (g/mi)		PM2.5 (mg/mi)	Distance (miles)	PEMS DATASuspect	Dyno DATASuspect
				PEMS	Dyno	PEMS	Dyno	PEMS	Dyno	PEMS	Dyno				
84606	Comp	51.9	40.9	2.82	2.72	23.48	20.08	5.31	4.94	434.25	414.42	5.73	11.05		
84624	1			9.02	8.36	109.72	88.34	4.85	4.68	709.87	636.64	46.80	1.20		
84624	2			2.44	2.16	20.53	17.89	4.74	4.28	394.42	372.95	1.55	8.77		
84624	3			3.78	3.26	31.09	22.20	6.68	5.62	587.65	503.89	2.22	1.23		
84624	Comp	44.6	35.0	2.87	2.56	25.89	21.85	4.88	4.40	424.38	395.84	3.93	11.21		
84651	1			9.77	9.58	101.18	82.64	5.13	5.48	766.92	691.08	71.62	1.18		
84651	2			2.55	2.30	19.61	17.09	4.41	4.50	407.49	388.32	4.27	8.67		
84651	3			4.16	3.66	32.27	23.05	5.90	5.65	599.09	513.51	5.51	1.20		
84651	Comp	46.1	34.2	3.03	2.77	24.70	20.88	4.55	4.63	439.31	412.64	7.82	11.06		
84697	1			2.26	8.23	101.79	73.10	5.89	5.96	815.75	670.52	35.40	1.21		
84697	2			1.19	2.41	22.34	17.52	4.67	4.78	458.85	391.96	3.14	8.66		
84697	3			1.73	3.91	37.67	24.26	6.25	5.88	654.52	516.64	4.33	1.22		
84697	Comp	42.6	69.4	1.28	2.82	27.62	20.92	4.85	4.92	491.50	415.37	4.92	11.09		
84741	1			8.69	7.92	85.84	62.04	5.44	5.69	740.86	627.60	38.55	1.21		
84741	2			2.92	2.39	20.09	15.78	4.63	4.75	440.52	384.35	2.71	8.71		
84741	3			4.32	3.70	31.00	21.66	6.21	5.95	619.51	511.17	3.11	1.23		
84741	Comp	53.9	43.0	3.32	2.77	24.33	18.62	4.79	4.88	469.02	406.04	4.61	11.16		

Table 4-20 presents a composite emissions summary for Round 2 control testing. Average and standard deviation values are reported at the bottom of Table 4-20, both for all runs, and also for all runs except Run numbers 84451 and 84697. In general, the dynamometer (BKI) emission measurements appear to be lower than those measured by the PEMS (SMT). Additional investigation may be warranted to identify the source of this discrepancy. Results from the "Measurement Allowance for In-Use Testing" study being conducted in 2006 at Southwest Research Institute in San Antonio, Texas may provide insight into any possible PEMS bias issues. Additional analysis of the dynamometer correlation results between the EPA dynamometer in Ann Arbor and the EPA portable Clayton dynamometer gathered during the Kansas City Pilot Study may provide insight into any possible dynamometer bias issues.

Table 4-20. Round 2 Composite Emission Summary for Control Vehicle Testing in Kansas City

RunID	Composite HC (g/mi)			Composite CO (g/mi)			Composite NO_x (g/mi)			Composite CO_2 (g/mi)			PM2.5 (mg/mi)
	PEMS	Dyno	%Diff	PEMS	Dyno	%Diff	PEMS	Dyno	%Diff	PEMS	Dyno	%Diff	
84451	0.38	0.40	-5.22	7.35	7.10	3.40	1.15	1.24	-7.67	480.06	461.47	3.87	4.62
84461	2.85	2.59	8.82	22.12	18.28	17.34	5.67	5.07	10.65	433.21	405.38	6.43	5.26
84480	2.84	2.74	3.37	23.02	20.41	11.34	5.88	5.36	8.85	455.89	435.12	4.56	6.44
84536	2.91	2.71	6.80	21.50	18.43	14.30	5.54	4.68	15.63	440.18	416.26	5.43	6.14
84544	2.87	2.67	7.03	22.81	18.70	18.01	5.64	5.13	9.21	434.62	412.84	5.01	7.52
84578	2.97	2.70	9.29	22.94	18.92	17.54	5.42	5.10	5.93	447.29	416.83	6.81	5.29
84596	0.23	0.22	2.60	5.63	5.46	3.01	0.77	0.80	-2.88	467.60	460.89	1.43	1.80
84606	2.82	2.72	3.44	23.48	20.08	14.47	5.31	4.94	6.93	434.25	414.42	4.57	5.73
84624	2.87	2.56	10.83	25.89	21.85	15.60	4.88	4.40	9.88	424.38	395.84	6.73	3.93
84651	3.03	2.77	8.71	24.70	20.88	15.44	4.55	4.63	-1.84	439.31	412.64	6.07	7.82
84697	1.28	2.82	-119.56	27.62	20.92	24.26	4.85	4.92	-1.48	491.50	415.37	15.49	4.92
84741	3.32	2.77	16.48	24.33	18.62	23.49	4.79	4.88	-1.97	469.02	406.04	13.43	4.61
All Avg	2.36	2.31	-3.95	20.95	17.47	14.85	4.54	4.26	4.27	451.44	421.09	6.65	5.34
All Std	1.08	0.94	36.79	6.97	5.37	6.55	1.72	1.54	7.13	21.21	20.85	3.96	1.61
average*	2.46	2.26	6.56	20.34	17.16	13.99	4.51	4.20	4.79	447.80	421.61	5.85	5.38
st dev*	1.08	0.97	5.55	6.97	5.51	6.12	1.80	1.60	7.24	17.88	21.78	2.95	1.69

* Statistic values were compiled from all runs except run 84697

4.4.4 Comparison of Emissions from Vehicles Measured in Both Rounds of the Study

Forty-one vehicles were tested in both Rounds 1 and 2 for the purpose of comparing summer and winter vehicle emissions. Four of these vehicles were tested twice for a total of forty-five valid retest pairs across Rounds 1 and 2 (two vehicles were tested with different load settings and were therefore excluded from this evaluation). Table 4-21 presents composite emissions for both Rounds. Figures 4-20 through 4-27 present linear and logarithmic plots comparing composite gravimetric $PM_{2.5}$, HC, CO, and NO_x across the two Rounds of testing, with a 1:1 line provided for reference. Figures 4-28 through 4-31 present plots of each pollutant versus ambient temperature. Appendices G and H contains by-phase plots for all pollutants of interest.

Table 4-21. Round 1/ Round 2 Retest Composite Emissions

Round 1							Round 2						
Run #	Temp (F)	RH (%)	Grav PM (mg/mi)	HC (g/mi)	CO (g/mi)	NOx (g/mi)	Run #	Temp (F)	RH (%)	Grav PM (mg/mi)	HC (g/mi)	CO (g/mi)	NOx (g/mi)
84078	70.45	70.3	0.47	0.12	2.76	0.31	84399	32.70	43.4	2.82	0.25	6.72	0.29
84037	83.18	58.5	9.12	1.56	32.78	1.26	84413	18.40	47.0	140.91	1.88	34.24	1.42
84055	95.84	50.1	4.80	1.07	9.77	4.15	84422	37.40	38.5	18.68	1.50	16.91	5.27
84309	78.17	42.1	43.42	9.25	174.36	2.16	84470	38.00	42.9	332.68	16.18	212.79	2.14
84110	84.69	56.8	10.01	0.20	5.06	0.58	84463	34.70	62.5	101.18	0.25	7.56	0.77
84115	83.99	57.1	7.60	0.23	5.95	0.70	84463	34.70	62.5	101.18	0.25	7.56	0.77
84271	81.51	30.2	5.66	1.28	11.88	7.53	84482	39.00	70.1	14.10	1.11	12.85	6.99
84271	81.51	30.2	5.66	1.28	11.88	7.53	84484	40.70	56.8	8.66	1.05	12.37	7.08
84342	77.46	46.0	0.27	0.19	1.32	0.33	84437	60.10	47.0	2.08	0.30	2.59	0.34
84342	77.46	46.0	0.27	0.19	1.32	0.33	84442	40.70	59.6	2.53	0.30	2.63	0.35
84097	69.85	65.0	0.73	0.08	0.20	0.09	84408	15.90	45.3	16.91	0.38	0.86	0.23
84069	76.81	84.1	0.49	0.21	1.44	0.68	84404	14.50	43.0	19.94	0.58	5.84	0.83
84042	75.97	75.6	2.63	0.31	4.76	0.63	84412	17.80	44.8	3.09	0.56	9.62	0.47
84171	70.82	44.8	40.75	1.19	14.86	1.37	84474	35.90	67.1	63.87	1.08	10.66	1.23
84347	77.85	31.4	12.55	0.36	5.18	0.86	84406	20.90	36.0	62.64	0.79	9.47	0.99
84058	87.30	65.2	1.04	0.13	0.92	0.33	84393	37.90	70.6	2.48	0.34	3.19	0.30
84349	66.81	60.0	0.84	0.10	0.48	0.19	84444	25.00	32.6	18.07	0.31	1.20	0.20
84125	80.85	59.9	3.39	0.22	6.12	2.24	84424	41.30	41.5	13.91	0.24	4.04	2.39
84036	80.53	65.7	1.78	0.20	6.70	1.64	84396	39.10	65.5	10.49	0.30	8.74	1.39
84119	91.94	44.5	6.10	1.84	14.08	5.77	84425	43.90	39.3	28.28	2.23	16.13	5.50
84104	78.06	55.7	1.56	0.19	2.17	0.72	84401	30.10	41.3	4.75	0.34	4.57	0.96
84113	91.05	47.8	1.53	0.89	19.54	1.73	84456	55.40	44.1	37.30	1.46	25.72	1.54
84263	74.48	41.8	19.61	1.21	43.05	2.59	84477	39.40	59.8	74.32	1.50	58.74	1.81
84063	85.32	72.5	2.06	0.13	0.78	0.56	84411	18.40	43.9	83.29	0.53	5.42	0.84
84332	76.78	39.7	2.24	0.15	1.92	0.58	84418	31.40	33.5		0.24	3.92	0.90
84341	76.02	54.3	7.65	0.19	3.34	0.74	84418	31.40	33.5		0.24	3.92	0.90
84146	82.37	46.6	9.16	1.18	9.86	1.63	84467	37.20	55.0	23.32	1.62	17.69	1.82
84151	69.41	46.8	1.45	0.09	3.36	0.21	84420	30.40	39.4	17.05	0.25	5.16	0.36
84305	74.18	42.5	1.22	0.13	1.71	0.53	84409	17.90	43.5	4.54	0.50	8.38	1.15
84150	68.26	48.5	4.70	0.16	4.54	0.38	84394	39.20	69.1	21.09	0.31	5.25	0.30
84336	82.22	33.4	10.44	0.59	1.11	3.37	84489	34.90	63.0	15.40	0.67	3.14	3.12
84381	76.74	17.8	31.49	0.49	6.55	0.95	84528	31.40	24.0	133.10	0.61	8.85	1.59
84040	80.95	75.6	4.79	0.36	8.98	2.40	84430	46.70	56.0	23.64	0.63	16.22	1.75
84108	87.62	38.7	2.96	0.64	12.27	2.66	84402	29.40	39.2	20.31	1.02	17.42	2.62
84338	77.22	46.7	0.85	0.06	0.56	0.09	84445	24.10	33.4	3.24	0.24	2.18	0.24
84339	77.95	46.6	3.56	0.19	1.28	0.39	84448	24.70	38.9	22.75	0.44	6.22	0.41
84329	83.21	38.3	10.64	0.20	2.22	0.27	84433	48.30	57.4	27.54	0.28	3.62	0.32
84344	71.33	49.3	2.86	0.38	2.25	0.65	84446	23.60	35.8	30.30	0.76	5.18	0.63
84211	71.93	69.1	31.90	0.46	9.69	1.04	84475	36.80	65.2	43.59	1.61	31.43	0.85
84048	83.23	63.9	59.98	1.10	9.09	3.44	84469	37.60	43.0	138.65	1.39	15.30	2.59
84296	68.06	64.6	2.99	0.09	3.67	0.08	84416	28.20	36.0	3.84	0.19	6.60	0.08
84071	77.22	84.5	38.43	2.23	11.26	5.35	84407	23.90	32.5	151.32	2.90	24.18	4.59
84088	80.14	40.8	1.22	0.23	2.34	0.54	84419	34.10	30.8	4.29	0.45	6.90	0.52
84188	80.21	45.7	40.64	4.71	66.09	2.12	84472	40.00	40.9	91.37	4.28	59.49	2.04
84298	74.01	44.2	26.89	0.24	7.69	0.87	84415	28.40	33.7	27.03	0.33	8.13	1.63

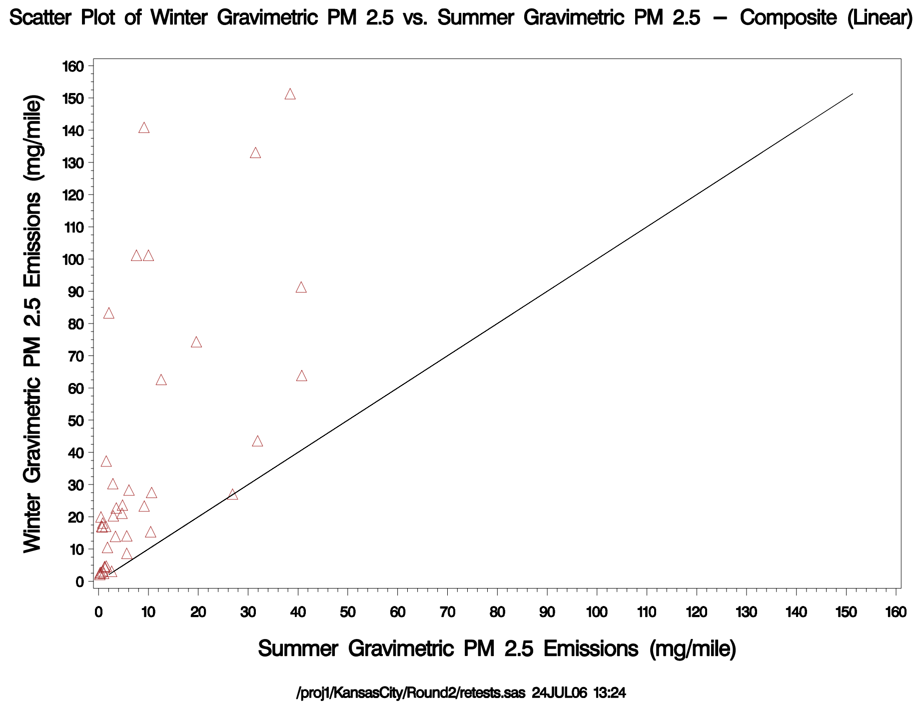


Figure 4-20. Winter vs. Summer Gravimetric PM 2.5 - Linear

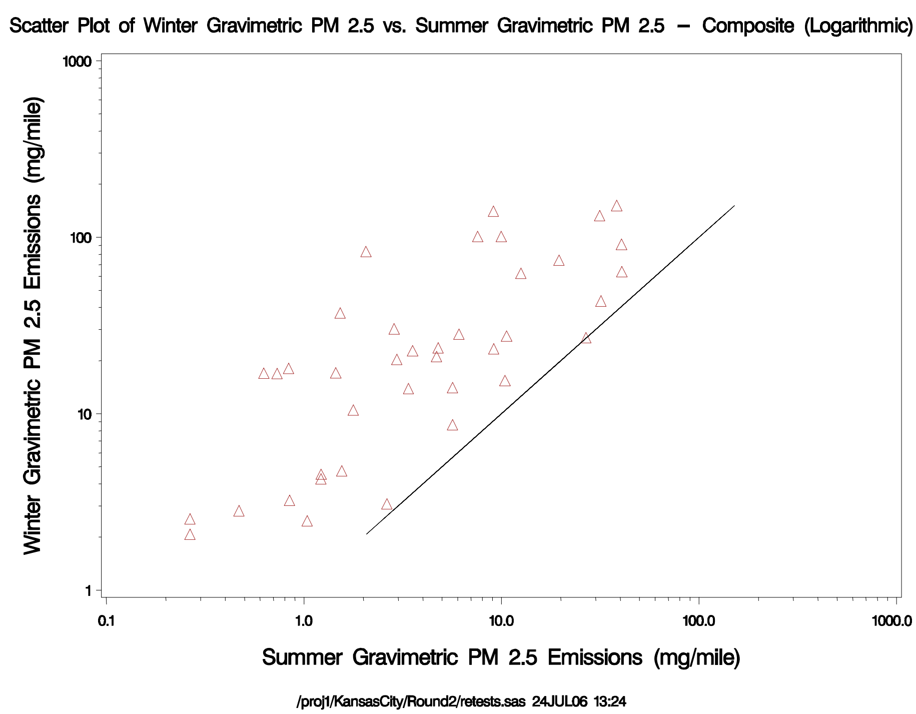


Figure 4-21. Winter vs. Summer Gravimetric PM 2.5 - Logarithmic

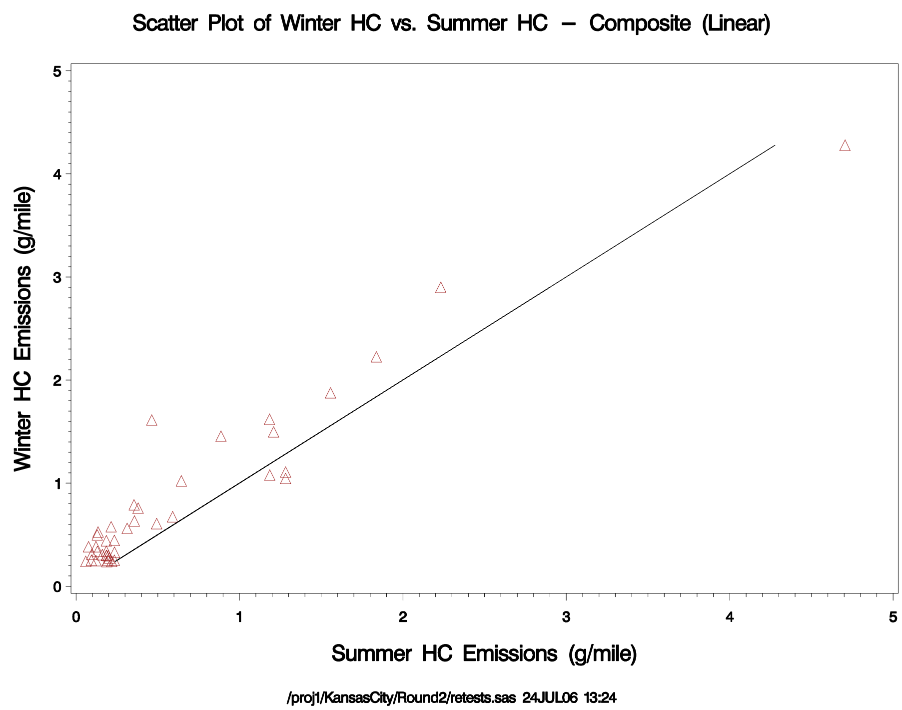


Figure 4-22. Winter vs. Summer HC – Linear

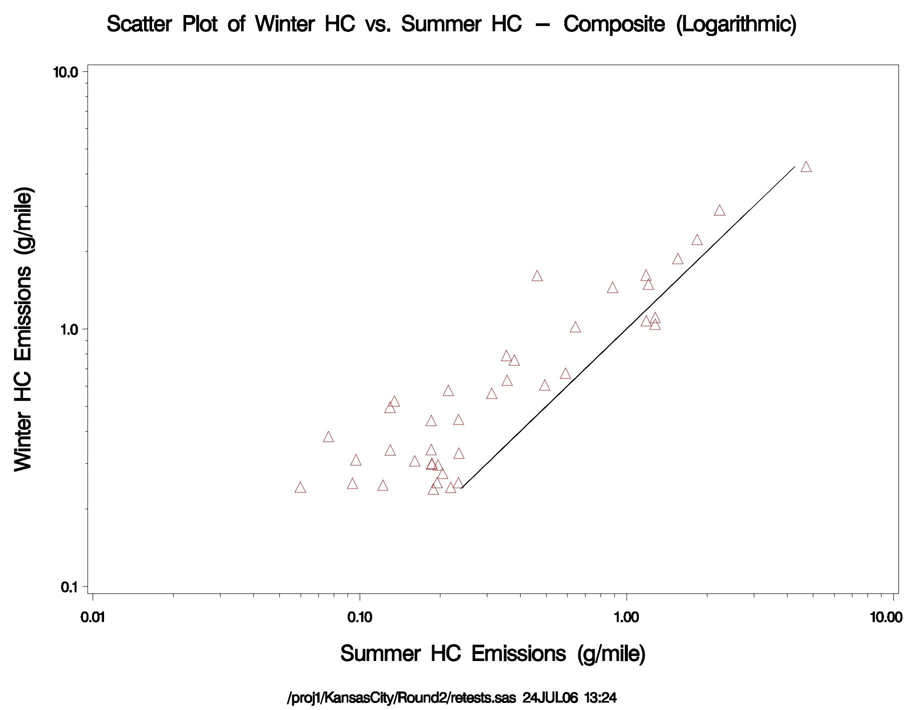


Figure 4-23. Winter vs. Summer HC - Logarithmic

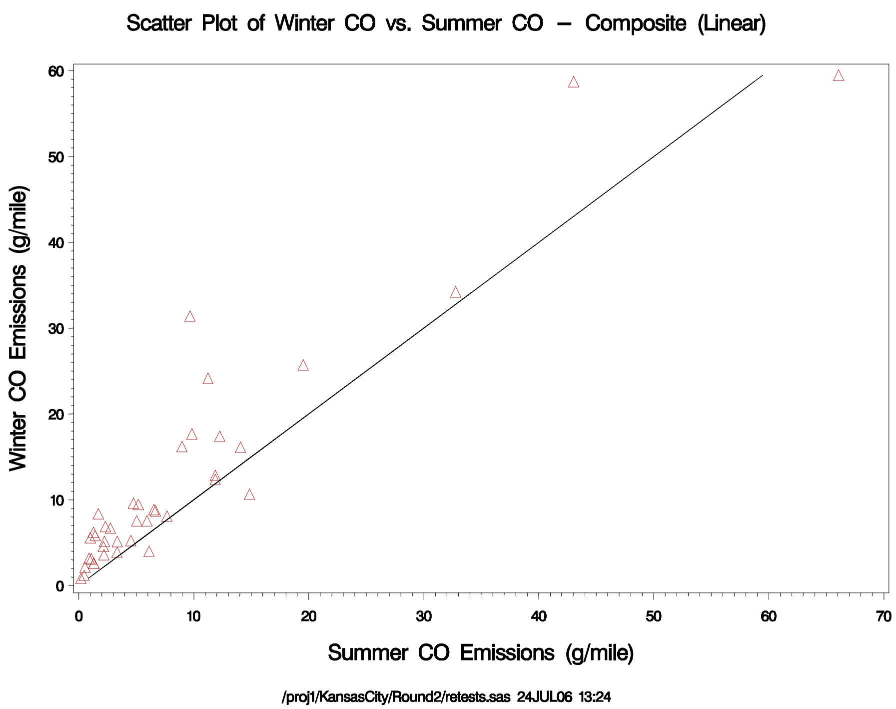


Figure 4-24. Winter vs. Summer CO – Linear

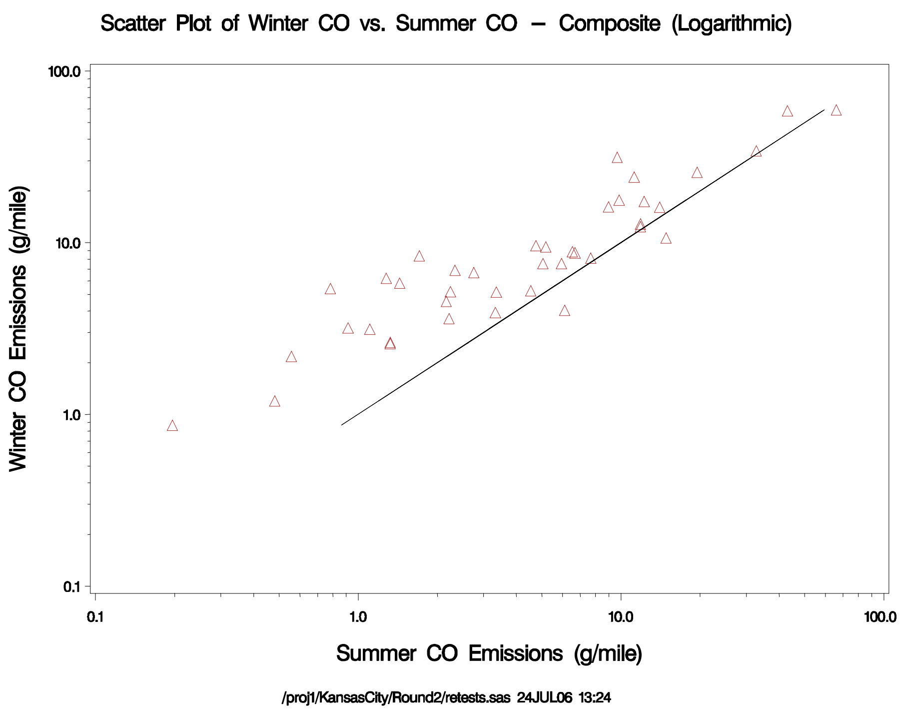


Figure 4-25. Winter vs. Summer CO - Logarithmic

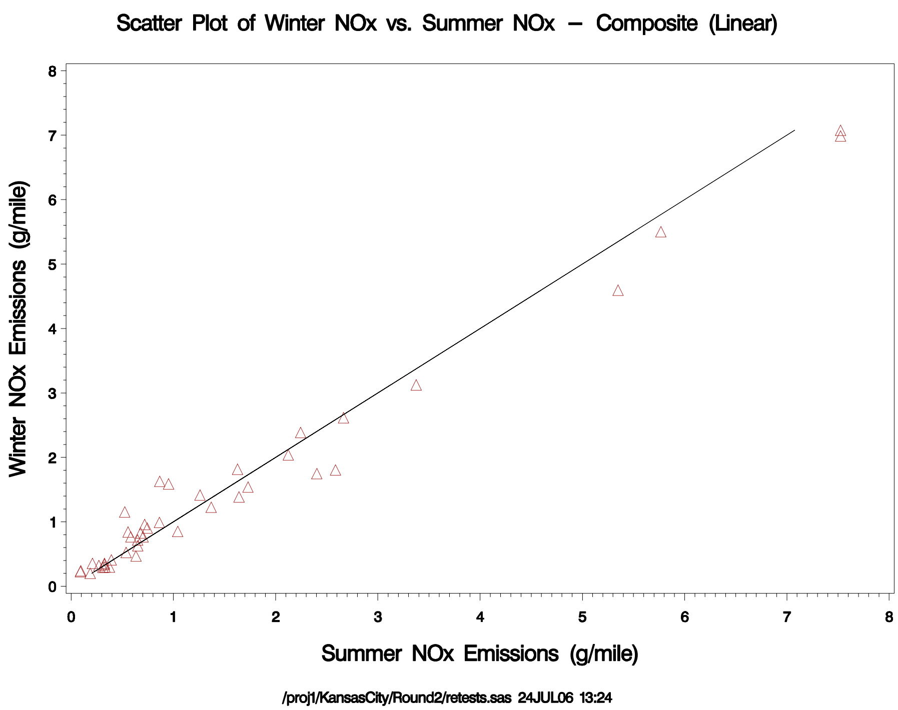


Figure 4-26. Winter vs. Summer NOx – Linear

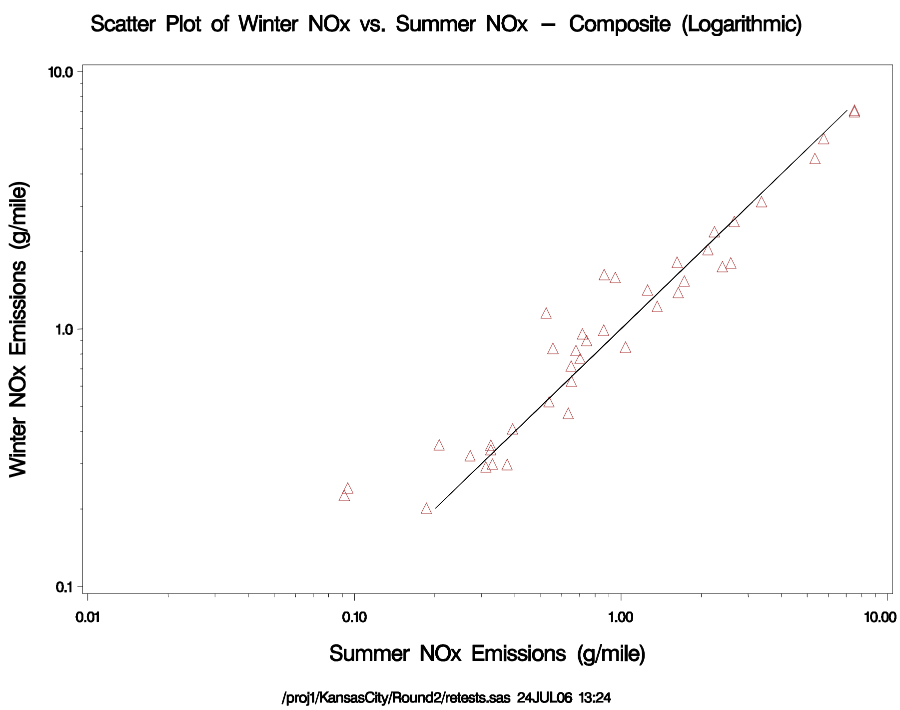


Figure 4-27. Winter vs. Summer NOx - Logarithmic

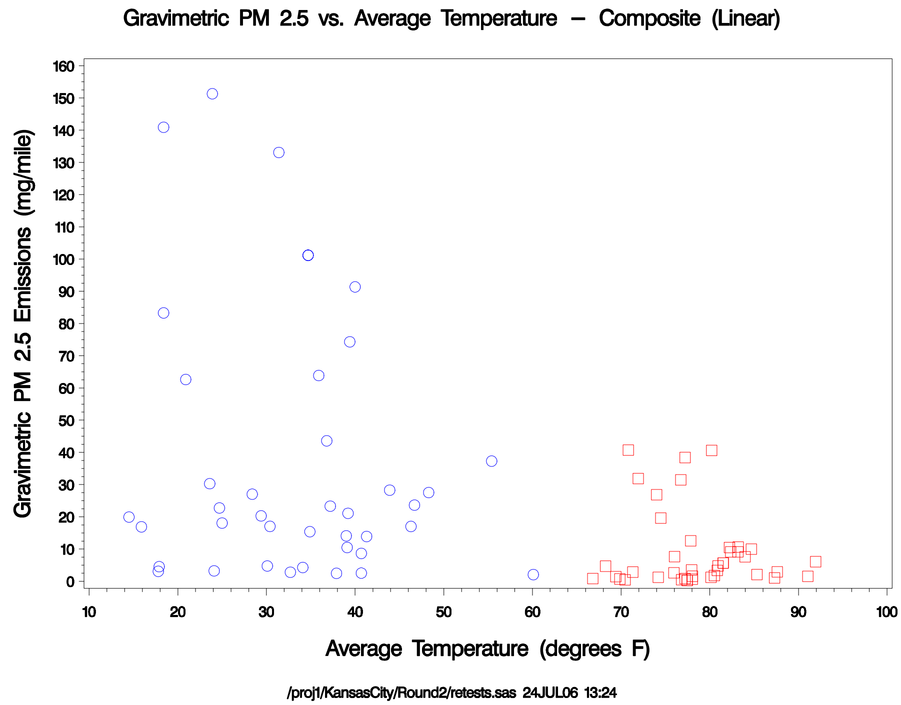


Figure 4-28. Gravimetric PM 2.5 vs. Average Temperature

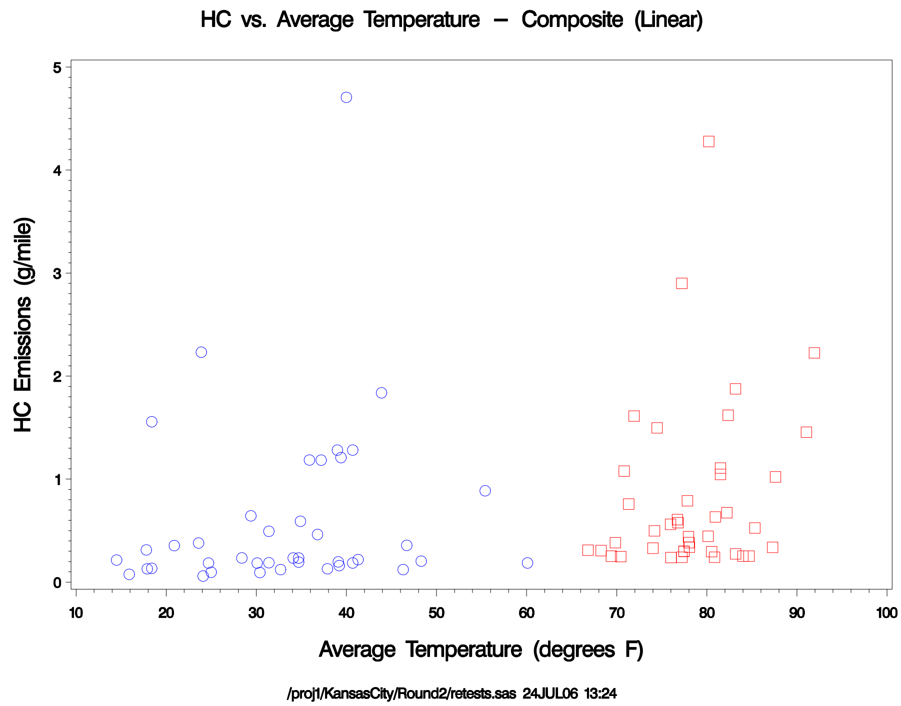


Figure 4-29. HC vs. Average Temperature

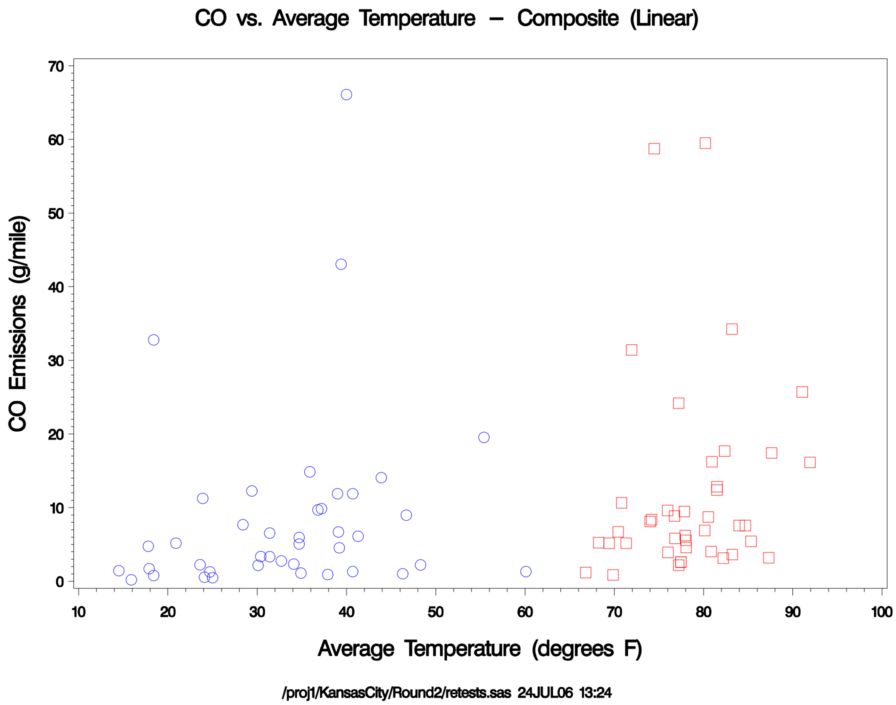


Figure 4-30. CO vs. Average Temperature

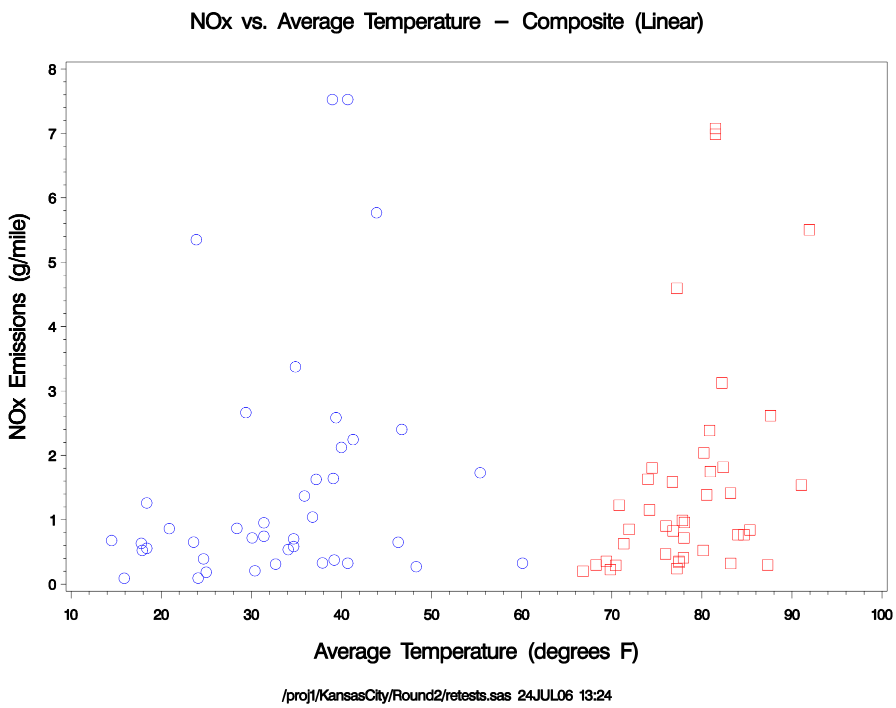


Figure 4-31. NOx vs. Average Temperature

4.4.5 Review of In-Round Duplicate Test Results

4.4.5.1 Round 1 Duplicate Testing

Sixteen vehicles were subject to duplicate testing in Round 1. One of these vehicles was tested three times, for a total of eighteen duplicate test pairs. Table 4-22 presents test run numbers, test conditions, and composite emissions for the Round 1 duplicate testing. Figures 4-32 through 4-39 present linear and logarithmic plots comparing composite gravimetric $PM_{2.5}$, HC, CO, and NOx across the first and second tests, with 1:1 lines for reference. Appendices G and H contains by-phase plots for all pollutants of interest.

Table 4-22. Round 1 Duplicate Testing Composite Emissions

		First Test							Second Test					
Duplicate #	Run #	Temp (F)	RH (%)	Grav PM (mg/mi)	HC (g/mi)	CO (g/mi)	NOx (g/mi)	Run #	Temp (F)	RH (%)	Grav PM (mg/mi)	HC (g/mi)	CO (g/mi)	NOx (g/mi)
1	84258	70.8	1.5	4.798	0.29	4.248	1.498	84262	71.8	50.2	3.321	0.437	8.355	1.576
2	84111	88.4	51.6	4.068	0.172	2.342	0.91	84116	87.6	49.5	1.787	0.201	2.435	0.916
3	84166	71.5	39.2	0.604	0.34	7.136	1.25	84169	70.7	44	0.043	0.269	4.825	1.288
4	84110	84.7	56.8	10.006	0.195	5.063	0.585	84115	84	57.1	7.597	0.234	5.948	0.704
5	84060	90.3	63.8	0.994	0.097	1.013	0.937	84062	83.9	80.3	1.236	0.066	0.638	0.93
6	84198	65.8	63.2	2.072	0.421	4.931	0.585	84200	65.2	68.8	3.687	0.481	6.285	0.663
7	84104	78.1	55.7	1.556	0.185	2.168	0.719	84109	83	59.1	1.069	0.173	1.965	0.751
8	84132	80.3	38.3	4.334	1.09	11.5	2.488	84137	76.9	34.9	4.413	1.049	10.222	2.394
9	84175	70.1	47.8	3.644	1.261	7.782	1.713	84180	74.6	44.4	9.257	1.338	9.151	2.017
10	84332	76.8	39.7	2.24	0.155	1.922	0.577	84341	76	54.3	7.647	0.189	3.335	0.744
11	84151	69.4	46.8	1.452	0.094	3.361	0.208	84156	65.4	59.4	2.022	0.107	4.69	0.223
12	84120	93.6	44.4	5.467	0.991	27.563	1.292	84123	85.1	56.2	3.428	0.918	26.13	1.047
13	84388	59.1	4.8		0.009	0.037	0.056	84389	60.2	5.4		0.001	0.01	0.001
14	84388	59.1	4.8		0.009	0.037	0.056	84390	60.9	6.8		0.001	0.003	
15	84388	59.1	4.8		0.009	0.037	0.056	84391	63.2	7.9		0.017	0.101	0
16	84321	80.5	33.3	1.366	0.197	0.972	0.482	84328	82	40.7	0.391	0.207	0.943	0.471
17	84345	74.1	42.5	0.327	0.183	1.954	0.654	84350	70.7	49.5	0.444	0.175	2.048	0.661
18	84308	77.4	42.3	3.914	0.266	8.071	2.044	84312	74.3	61.1	0.958	0.219	7.792	2.006

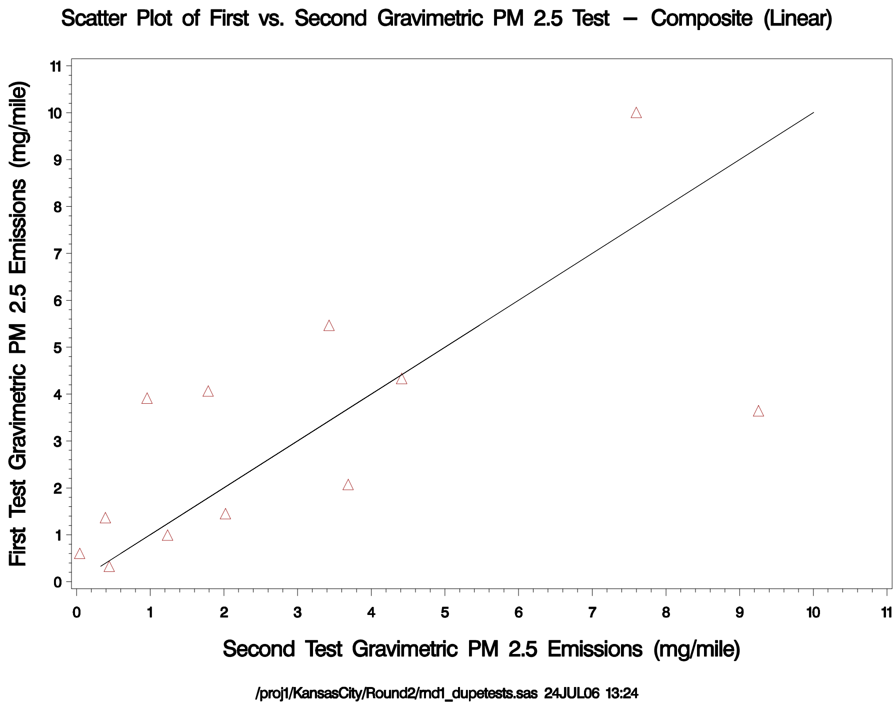


Figure 4-32. First vs. Second Round 1 Gravimetric PM 2.5 Tests - Linear

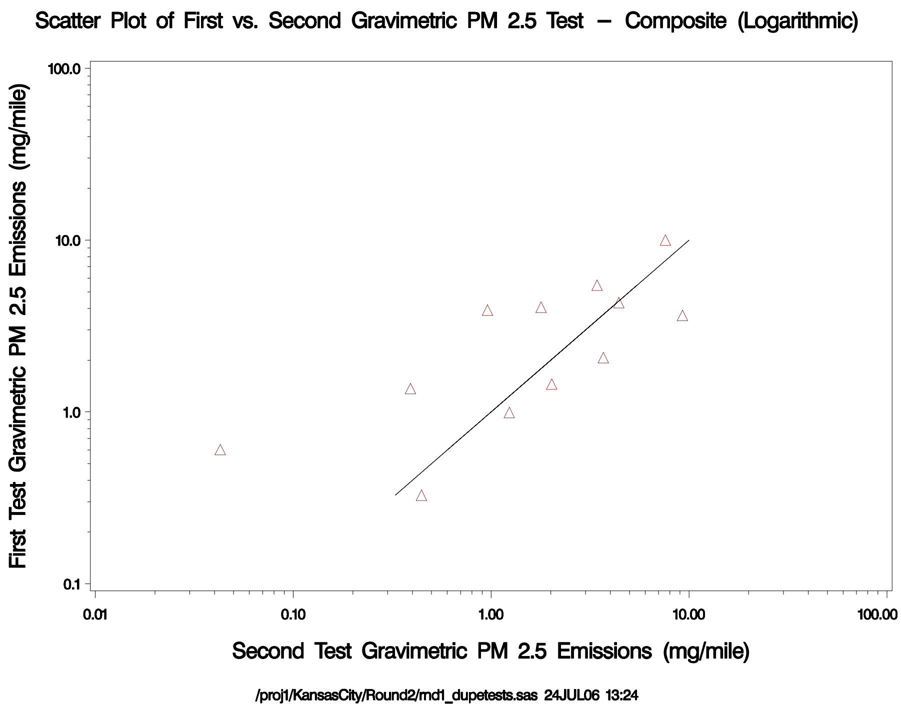


Figure 4-33. First vs. Second Round 1 Gravimetric PM 2.5 Tests - Logarithmic

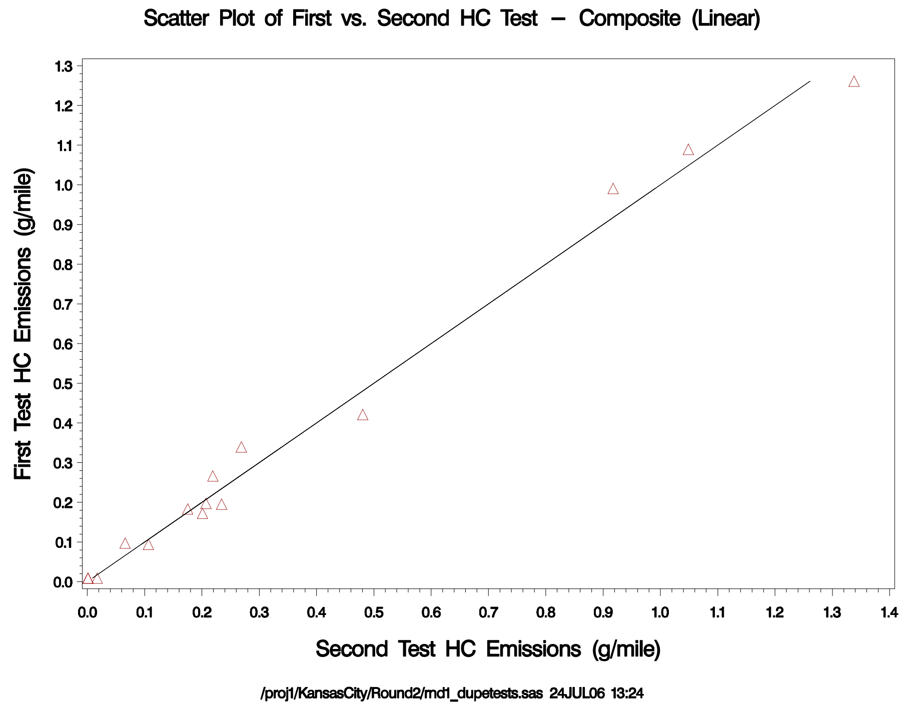


Figure 4-34. First vs. Second Round 1 HC Tests - Linear

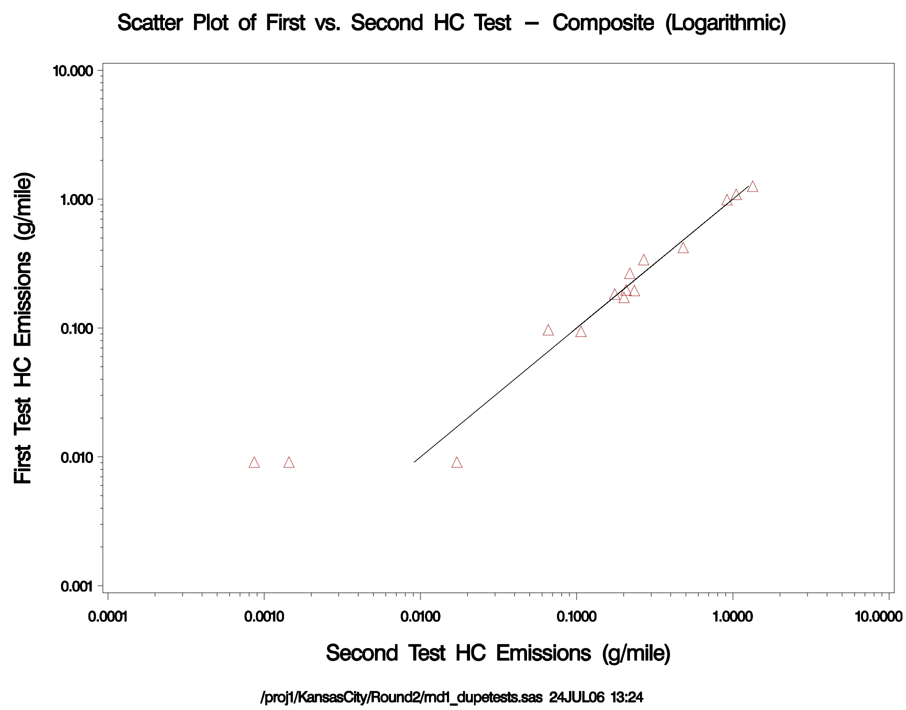


Figure 4-35. First vs. Second Round 1 HC Tests - Logarithmic

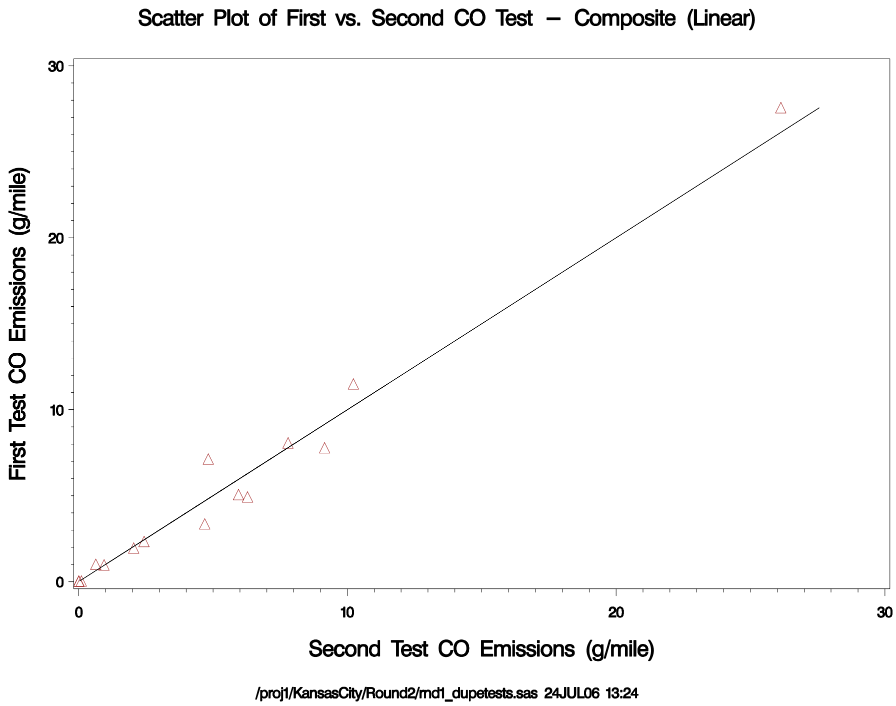


Figure 4-36. First vs. Second Round 1 CO Tests - Linear

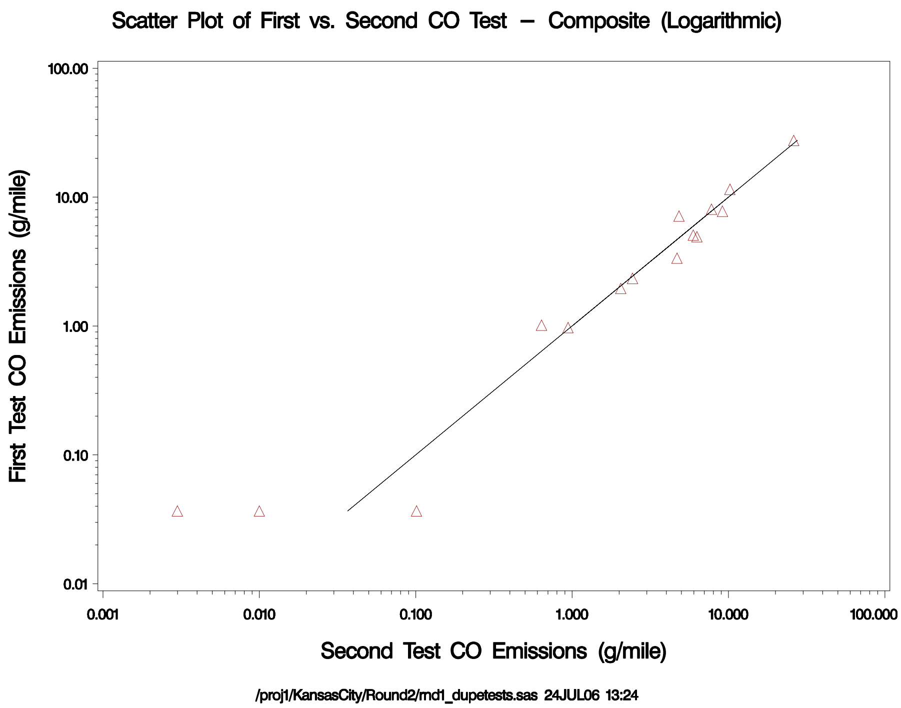


Figure 4-37. First vs. Second Round 1 CO Tests - Logarithmic

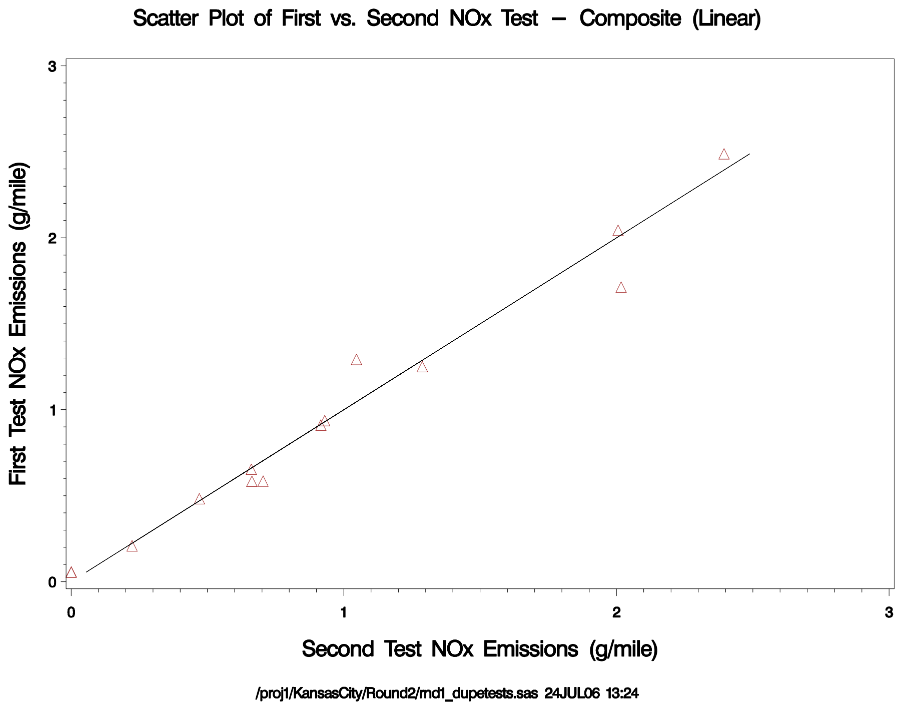


Figure 4-38. First vs. Second Round 1 NOx Tests - Linear

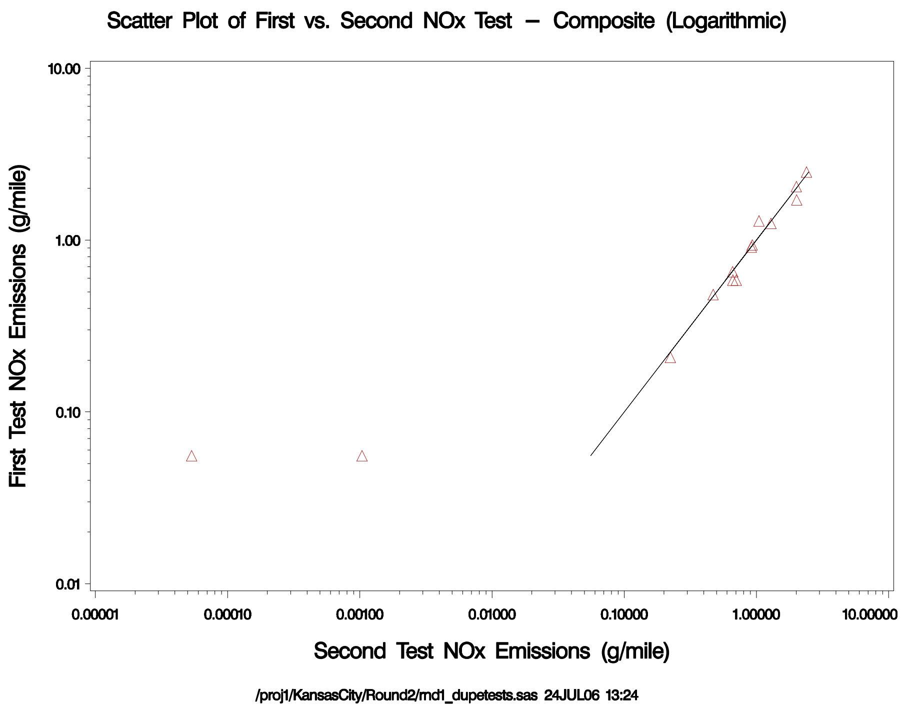


Figure 4-39. First vs. Second Round 1 NOx Tests - Logarithmic

4.4.5.2 Round 2 Duplicate Testing

Ten vehicles were subject to duplicate testing in Round 2. Table 4-23 presents test run numbers, test conditions, and composite emission results for the Round 2 duplicate testing. Figures 4-40 through 4-47 present linear and logarithmic plots comparing composite gravimetric $PM_{2.5}$, HC, CO, and NOx across the first and second tests, with 1:1 lines for reference. Appendices G and H contains by-phase plots for all pollutants of interest.

Table 4-23. Round 2 Duplicate Testing Composite Emissions

	First Test							Second Test						
Duplicate #	Run #	Temp (F)	RH (%)	Grav PM (mg/mi)	HC (g/mi)	CO (g/mi)	NOx (g/mi)	Run #	Temp (F)	RH (%)	Grav PM (mg/mi)	HC (g/mi)	CO (g/mi)	NOx (g/mi)
1	84537	40.900	63.8	3.178	0.304	4.495	0.740	84543	49.500	52.5	3.982	0.237	4.072	0.759
2	84482	39.000	70.1	14.104	1.109	12.847	6.988	84484	40.700	56.8	8.658	1.046	12.375	7.077
3	84437	60.100	47.0	2.078	0.299	2.587	0.340	84442	40.700	59.6	2.535	0.300	2.630	0.354
4	84690	55.200	38.3	2.005	0.684	9.336	1.268	84695	42.400	67.6	2.119	0.632	7.410	1.206
5	84465	37.900	56.0	188.706	0.227	3.337	0.920	84468	36.600	46.3	5.223	0.234	3.544	0.781
6	84627	47.000	34.9	232.116	14.917	69.159	3.776	84632	45.000	30.4	99.412	15.235	88.783	3.696
7	84675	52.900	28.9	4.114	0.342	4.899	2.001	84681	41.300	68.7		0.308	4.098	2.100
8	84541	49.800	68.3	6.332	0.705	13.630	1.059	84542	44.600	61.3	4.908	0.746	14.926	1.090
9	84449	25.800	39.0	10.153	0.441	7.926	1.136	84451	37.600	61.3	4.620	0.399	7.127	1.250
10	84485	38.900	59.2	20.047	1.099	25.170	1.027	84490	36.900	55.0	3.842	0.974	25.026	1.023

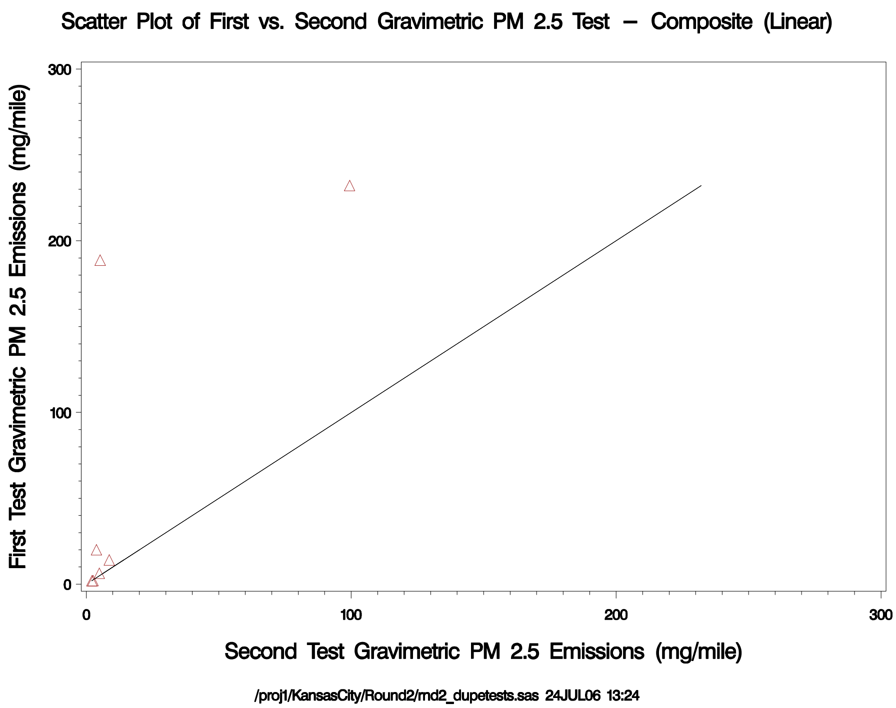


Figure 4-40. First vs. Second Round 2 Gravimetric PM 2.5 Tests - Linear

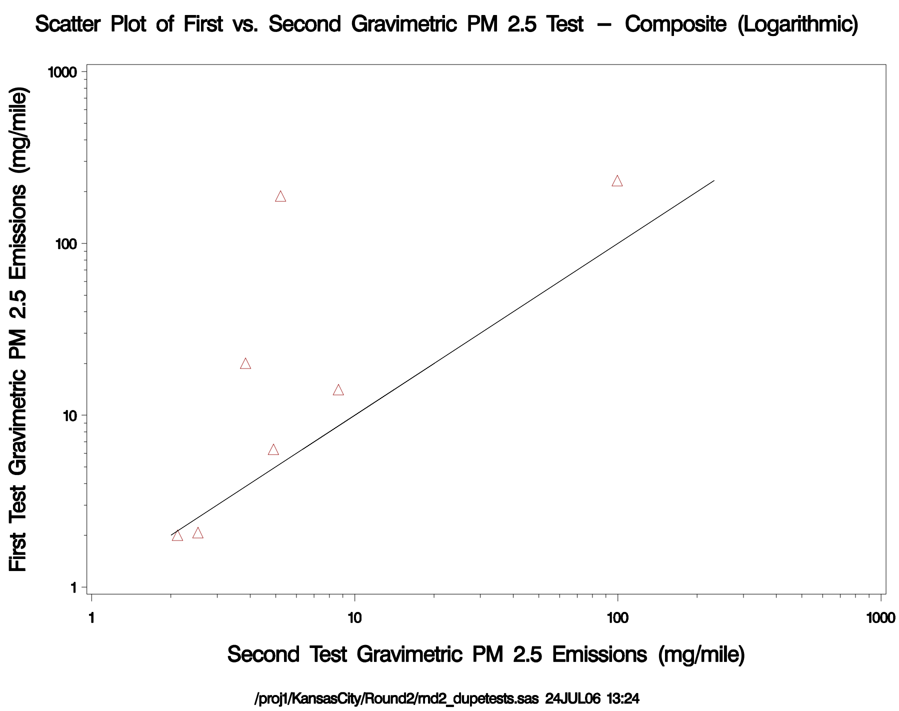


Figure 4-41. First vs. Second Round 2 Gravimetric PM 2.5 Tests - Logarithmic

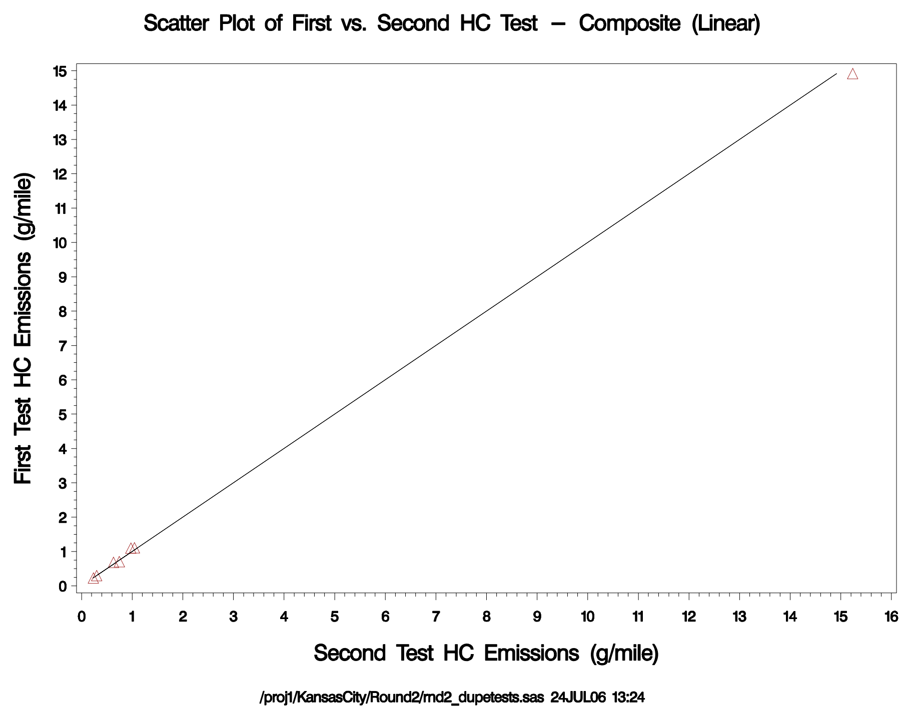


Figure 4-42. First vs. Second Round 2 HC Tests - Linear

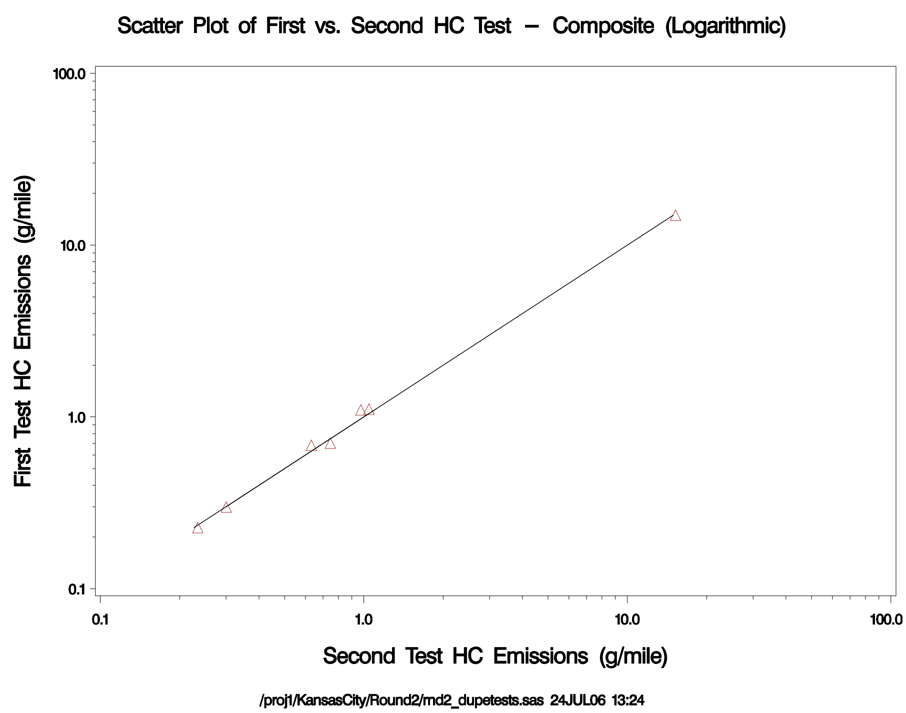


Figure 4-43. First vs. Second Round 2 HC Tests - Logarithmic

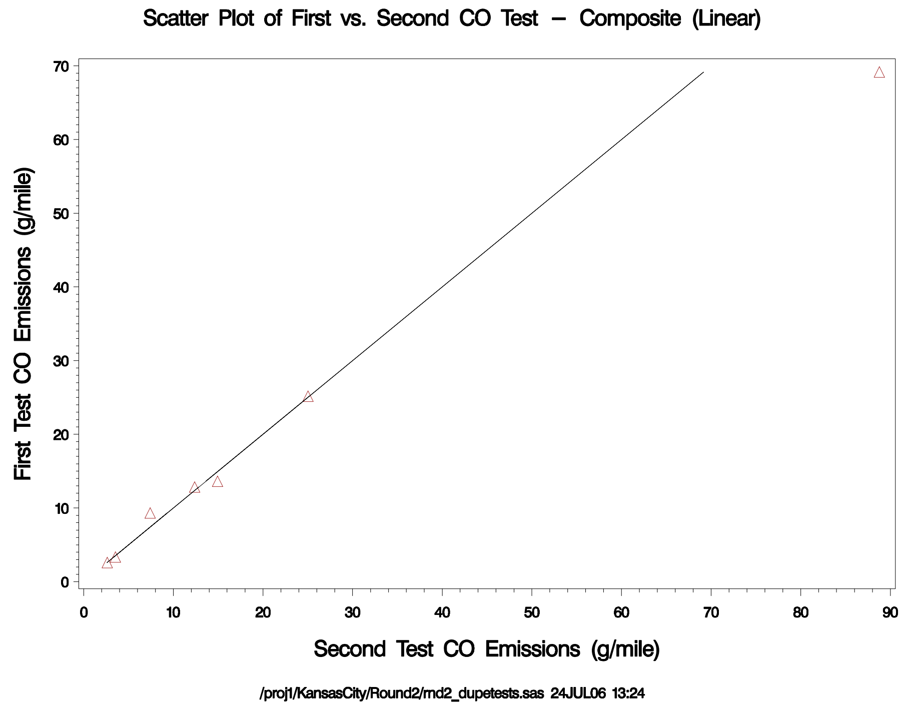


Figure 4-44. First vs. Second Round 2 CO Tests - Linear

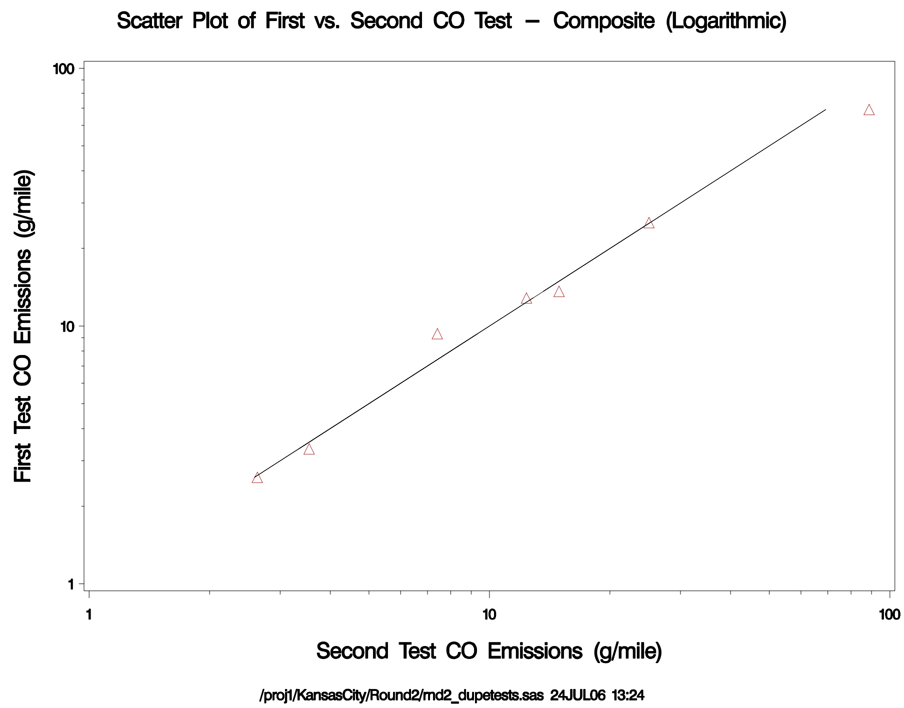


Figure 4-45. First vs. Second Round 2 CO Tests - Logarithmic

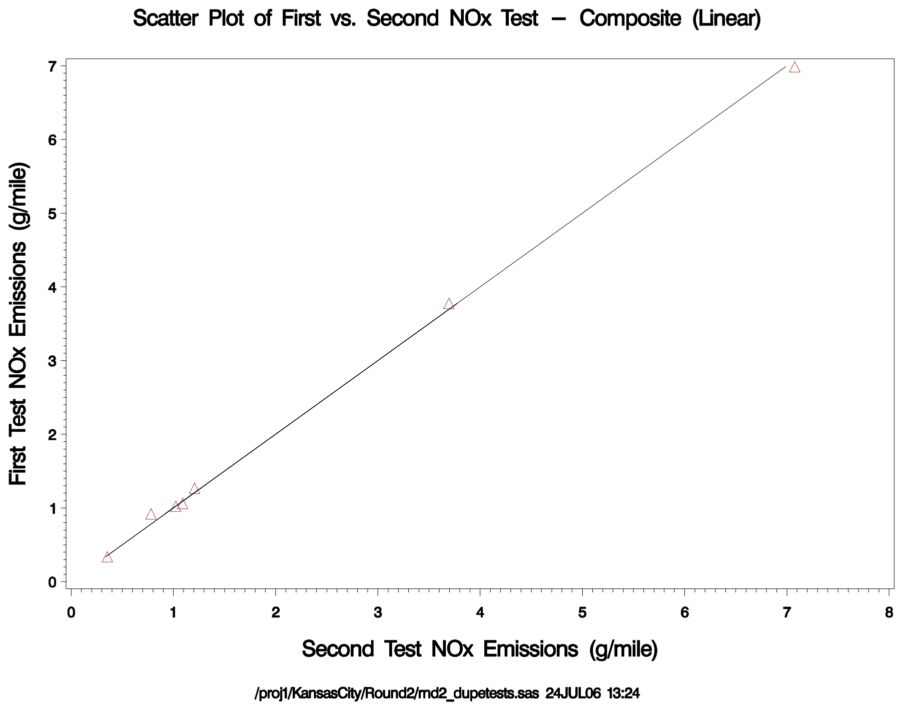


Figure 4-46. First vs. Second Round 2 NOx Tests - Linear

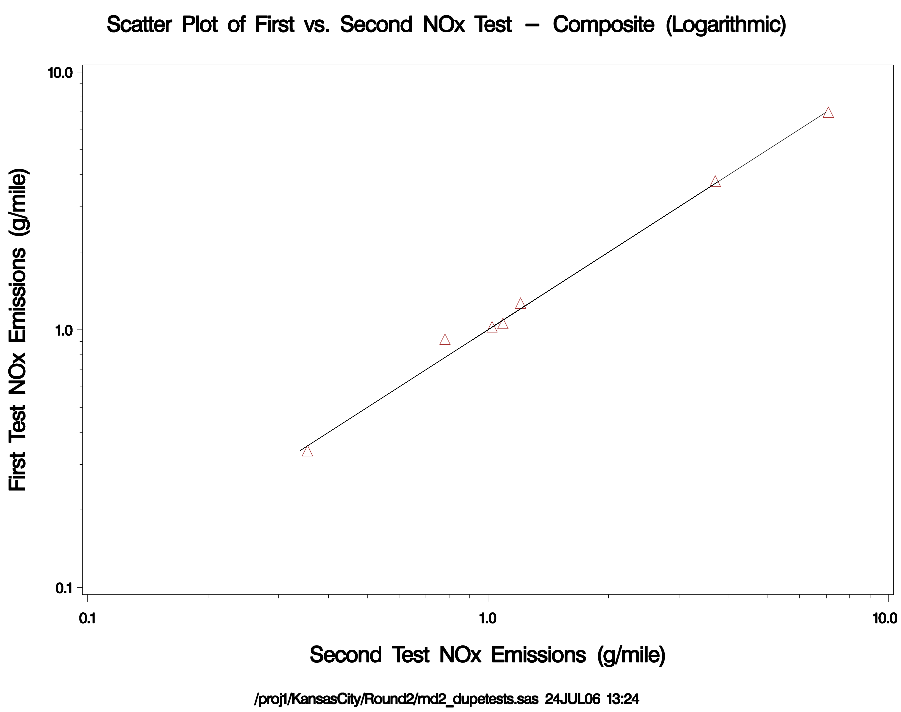


Figure 4-47. First vs. Second Round 2 NOx Tests – Logarithmic

Table 4-24 shows a statistical analysis on the duplicate measurements conducted during Round 1 and Round 2. A paired t-test is a sensitive test for evaluating repeat measurements. The table shows that random duplicate measurements were not significantly different. The relative humidity measurements were significantly different in Round 1 for the duplicates, but this does not appear to influence the NOx or other measurements in any meaningful way. We have also included the largest mean difference in the measurements in the far right column of the table. This column shows the threshold value for the mean difference beyond which the value would be called significant at the 95% confidence level for the number of paired measurements made. As shown, all the mean values for all the emissions and temperatures are well below this threshold. Even the relative humidity in Round 2 was below this value and hence not significantly different.

Table 4-24. Paired t-test Results for In-Round Duplicates

Round 1								
Variable	*Units*	*N*	*Mean*	*Std Error*	*t Value*	*Pr > |t|*	*t for 95% conf*	*Mean value needed for 95 % conf in diff*
PMdiff	mg/mi	15	0.03	0.66	0.05	0.96	2.15	1.41
HCdiff	g/mi	18	0.01	0.01	0.50	0.62	2.11	0.03
COdiff	g/mi	18	0.26	0.33	0.80	0.43	2.11	0.69
NXdiff	g/mi	17	0.02	0.03	0.70	0.49	2.12	0.06
tempdiff	deg. F	18	-0.76	0.85	-0.88	0.39	2.11	1.80
rhdiff	%	18	8.24	2.86	2.88	0.01	2.11	6.03
Round 2								
Variable	*Units*	*N*	*Mean*	*Std Error*	*t Value*	*Pr > |t|*	*t for 95% conf*	*Mean value needed for 95 % conf in diff*
PMdiff	mg/mi	9	-38.16	23.12	-1.65	0.14	2.31	53.32
HCdiff	g/mi	10	0.00	0.04	-0.04	0.97	2.26	0.09
COdiff	g/mi	10	1.66	2.01	0.82	0.43	2.26	4.55
NXdiff	g/mi	10	0.01	0.03	0.32	0.76	2.26	0.06
tempdiff	deg. F	10	-3.22	3.03	-1.06	0.31	2.26	6.84
rhdiff	%	10	5.40	6.05	0.89	0.40	2.26	13.68

4.4.6 Review of Miscellaneous Regulated Pollutant Emission Trends

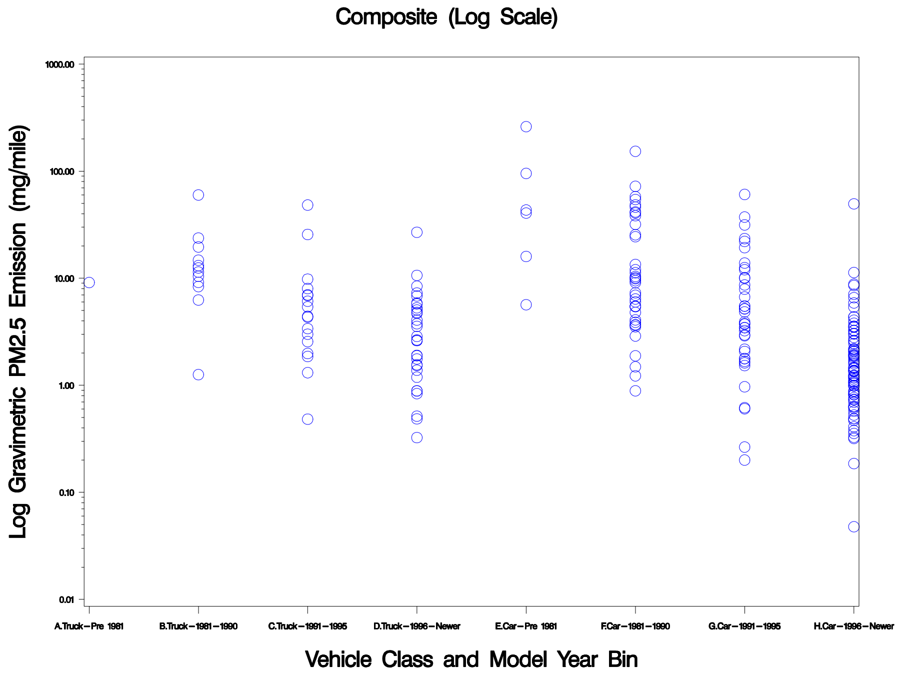
Figures 4-48 through 4-55 present composite $PM_{2.5}$, HC, CO, and NO_x measurements from the dynamometer classified by vehicle type and model year in both linear and log scale. All emissions show a negative relationship with model year, and vehicle type does not seem to have any influence on emission values. Plots of $PM_{2.5}$, HC, CO, and NO_x measurements from the dynamometer classified by vehicle type and model year for particular Phases are located in Appendices G and H (Note that the letters A through I present in the axis labels in the figures below are in place to sort the data appropriately for ease of reading; they serve no other purpose.)

Figures 4-56 through 4-59 present scatter plots of composite $PM_{2.5}$ vs. NO_x measurements from the dynamometer classified by vehicle type and model year in both linear and log scale. All plots show a positive relationship between $PM_{2.5}$ emissions and NO_x emissions, and the newest model year group shows the lowest amount of emissions. In these figures, Phase 1 emissions are depicted in red, phase 2 emissions in green, and phase 3 emissions in brown. Scatter plots of $PM_{2.5}$ against HC and CO measurements from the dynamometer can be found in Appendices G and H.

Figures 4-60 through 4-63 present plots of composite $PM_{2.5}$ emissions as a function of model year classified by vehicle type in both linear and log scale. All plots show lower emissions when the model year is newer. The dispersion within the model for each plot shows that newer model years have less variation than older ones. Plots of HC, CO and NO_x measurements from the dynamometer as a function of model year can be found in Appendices G and H.

Figures 4-64 through 4-71 present overlay plots of composite and Phase 1 $PM_{2.5}$, HC, CO, and NO_x emissions as a function of odometer in both linear and log scale. These plots reveal higher emissions under cold start conditions, as expected. Odometer readings do not seem to have a strong influence on emission levels. It should be noted that all odometer values shown in Figures 4-64 through 4-71 have not been corrected for odometer "turnover". For example, the mileage for a vehicle with a 5-digit odometer and 103,000 miles would be shown in these plots as 3,000 miles. Figures 4-72 through 4-79 present overlay plots of the percent projected-fleet distribution of composite $PM_{2.5}$, HC, CO, and NO_x emissions. A solid line represents cumulative percent projected-fleet distribution, while a dashed line represents percent projected-fleet distribution. The $PM_{2.5}$ distribution shows that more then 95% of the fleet has $PM_{2.5}$ emission rates lower than 80 mg/mile. The reference point is the Tier 1 vehicle certification standard for PM emissions (approximately model years 1996 – 2003).

For Round 1, 267 LA92 tests were performed, excluding correlation vehicle tests. Using both the Kansas City fleet distribution for each stratum and the actual Round 1 stratum distribution, Kansas City fleet simulation can be achieved as shown in Table 4-25. This simulation is applied here for QA/QC purposes only and not for modeling purposes. It provides some insight to the effectiveness of the recruitment process to acquire vehicles that emit high PM emissions.



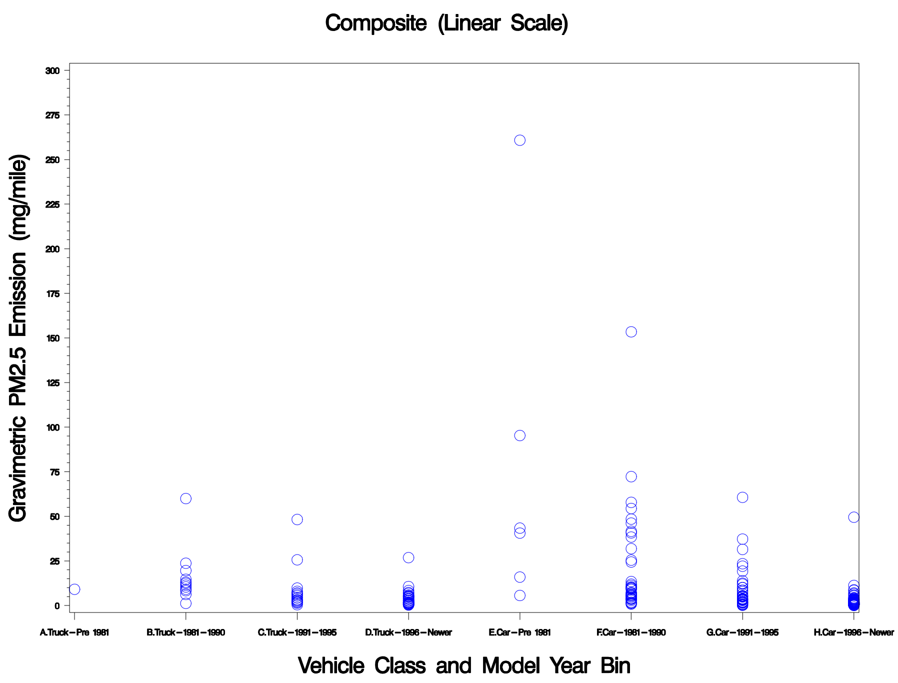
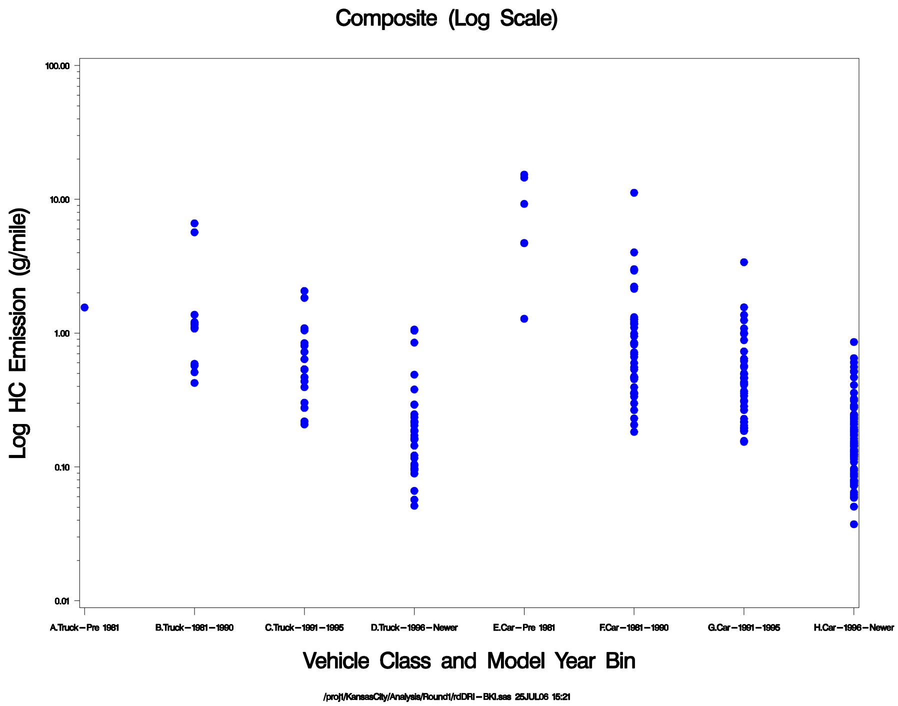


Figure 4-48. Round 1 Log/Linear Plots of $PM_{2.5}$ Emissions by Class-Year Bin



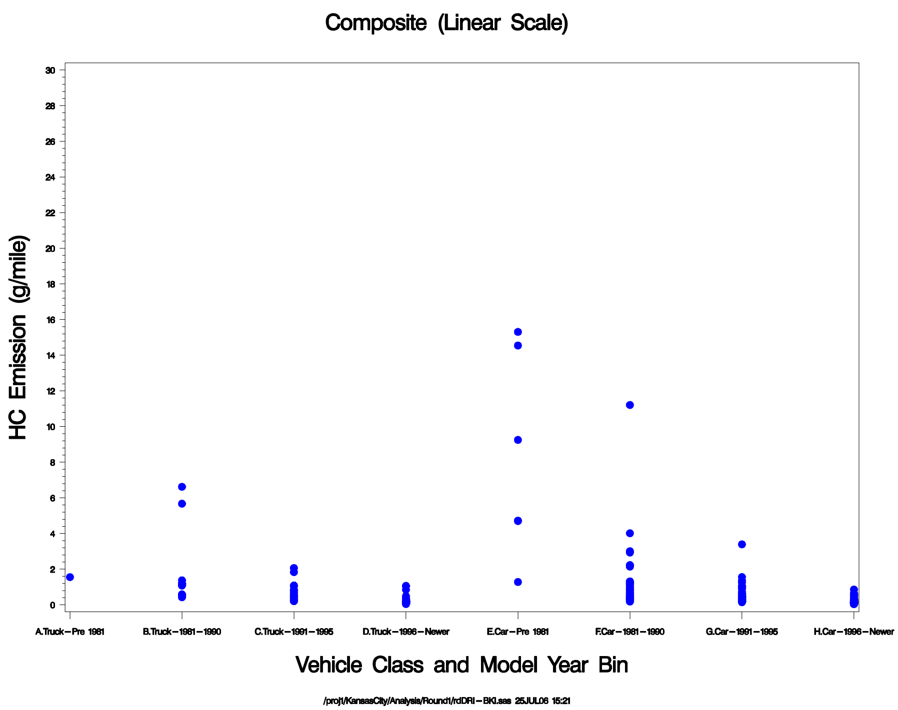
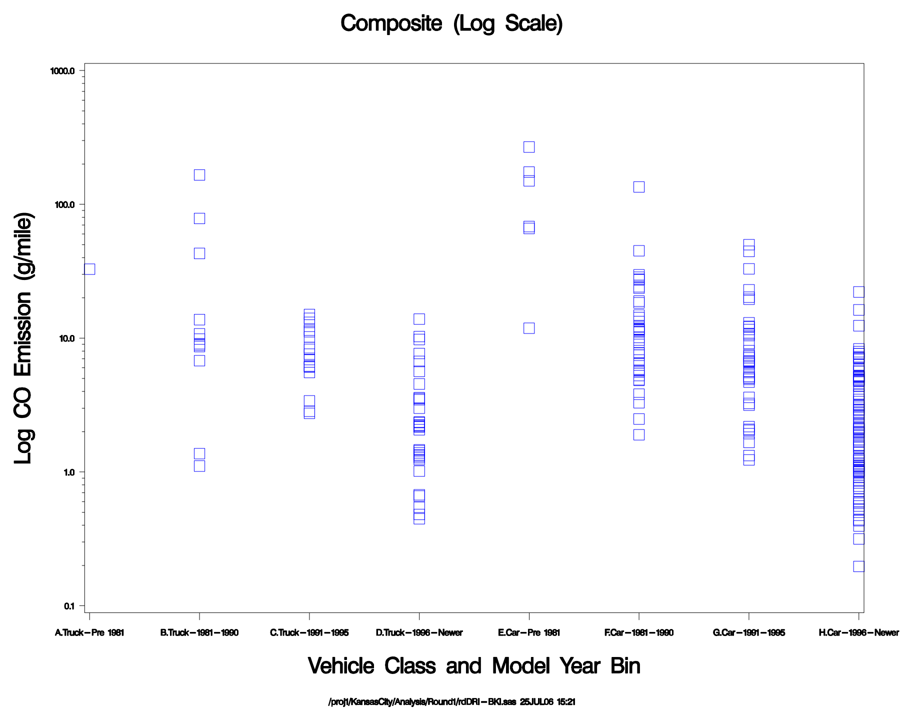


Figure 4-49. Round 1 Log/Linear Plots of HC Emissions by Class-Year Bin



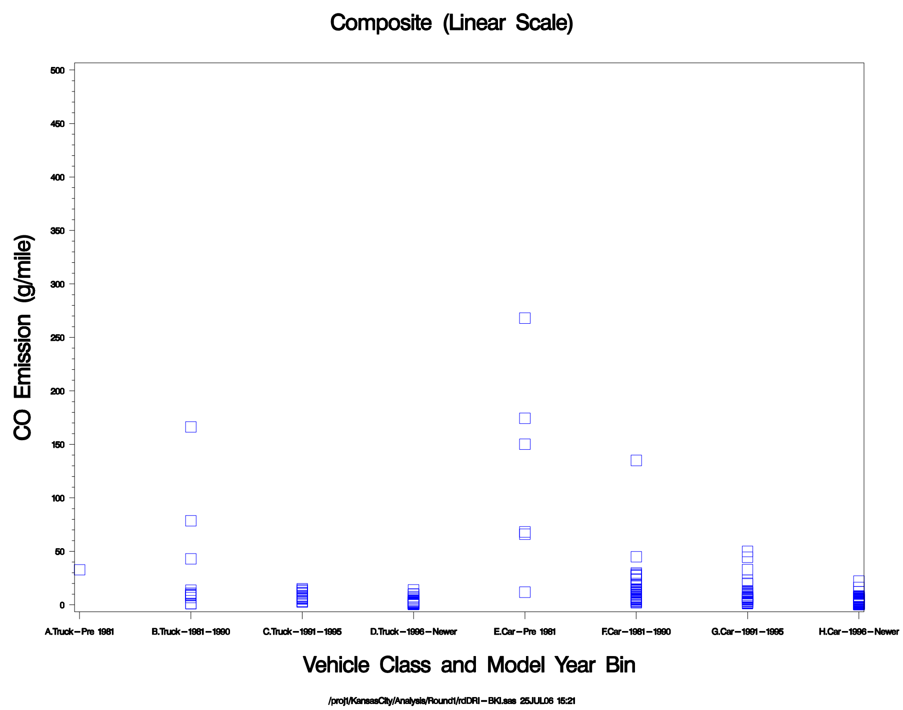


Figure 4-50. Round 1 Log/Linear Plots of CO Emissions by Class-Year Bin

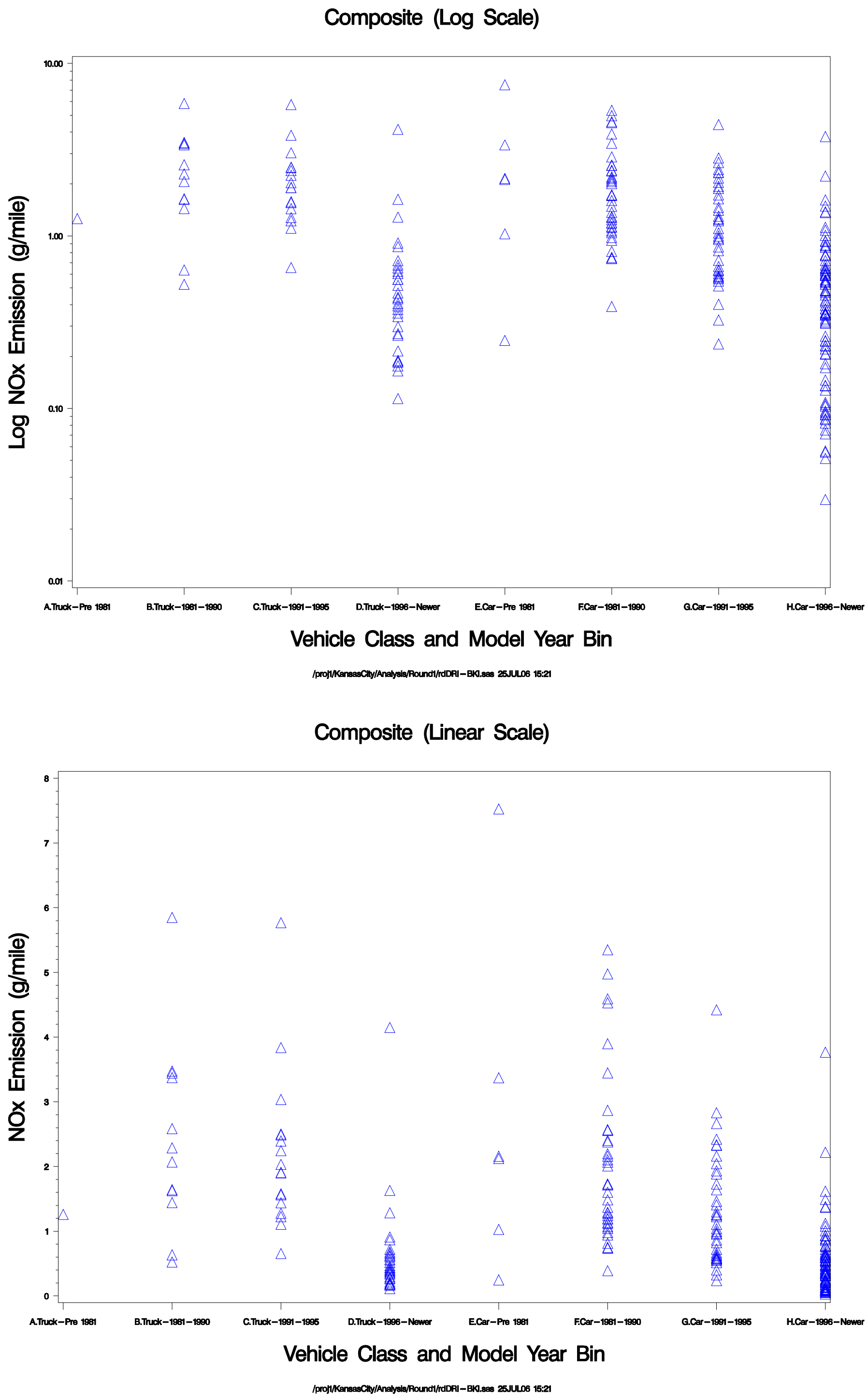
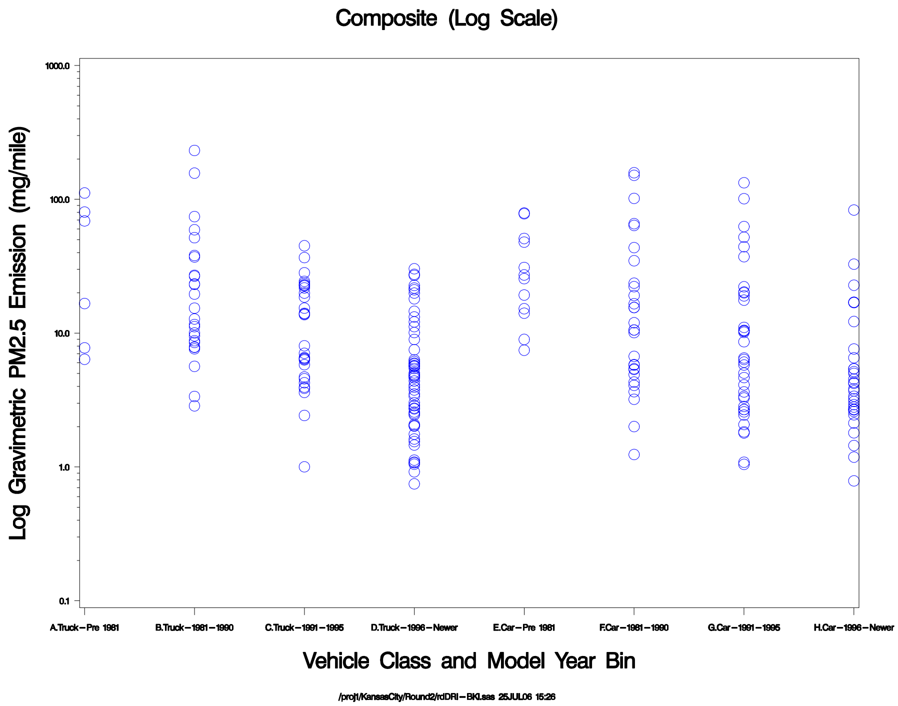


Figure 4-51. Round 1 Log/Linear Plots of NO_X Emissions by Class-Year Bin



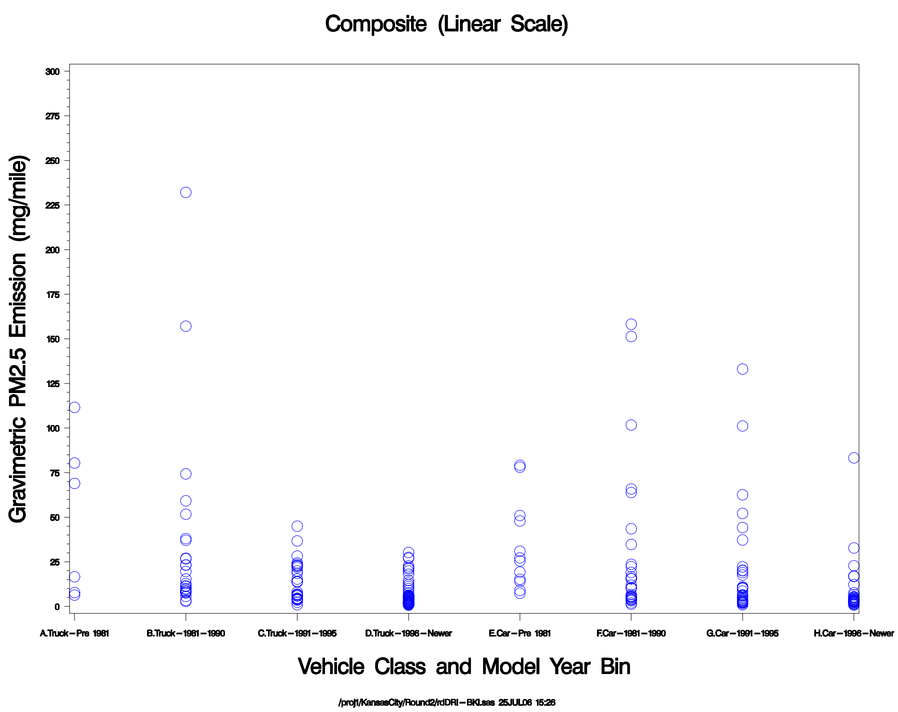


Figure 4-52. Round 2 Log/Linear Plots of $PM_{2.5}$ Emissions by Class-Year Bin

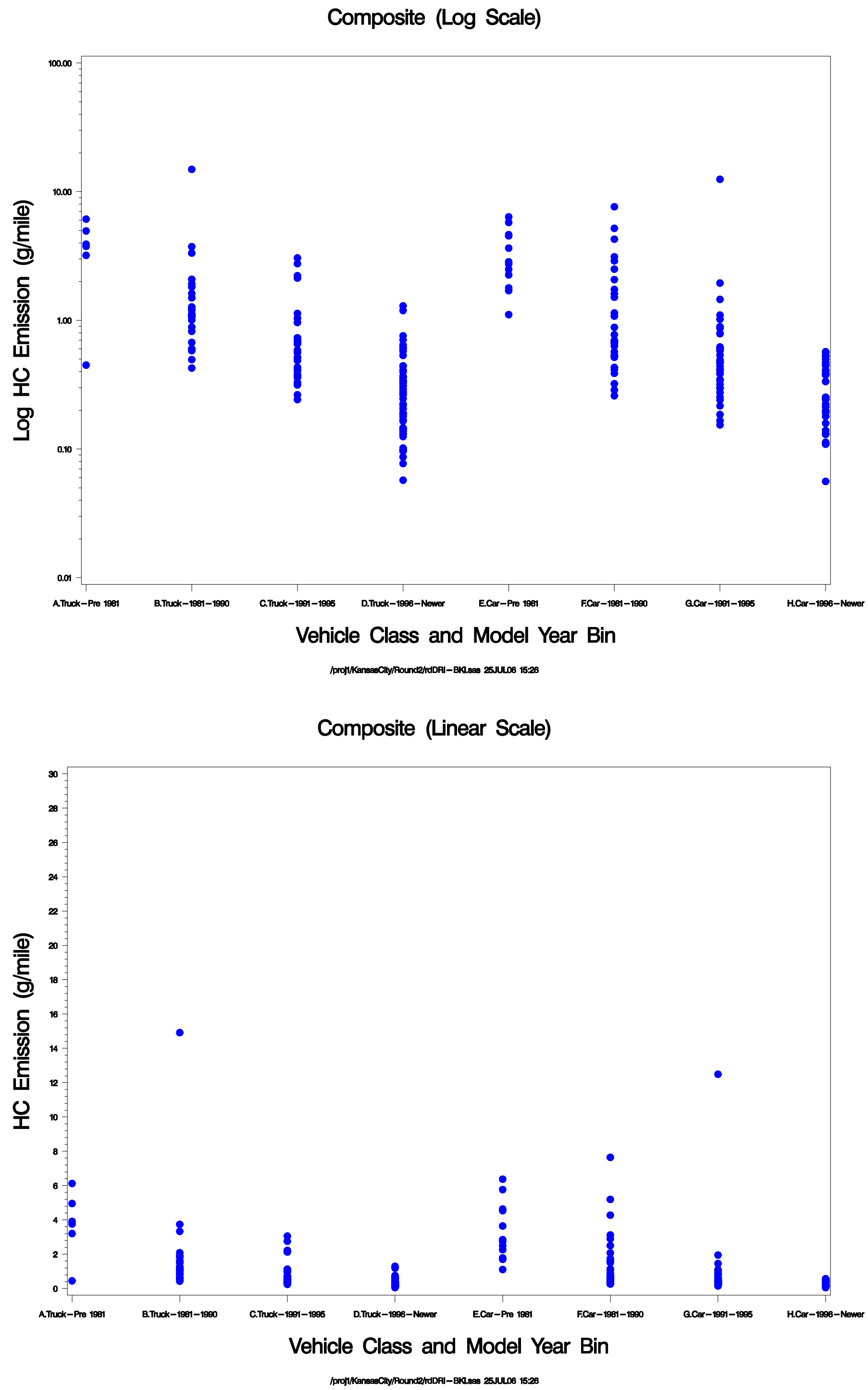
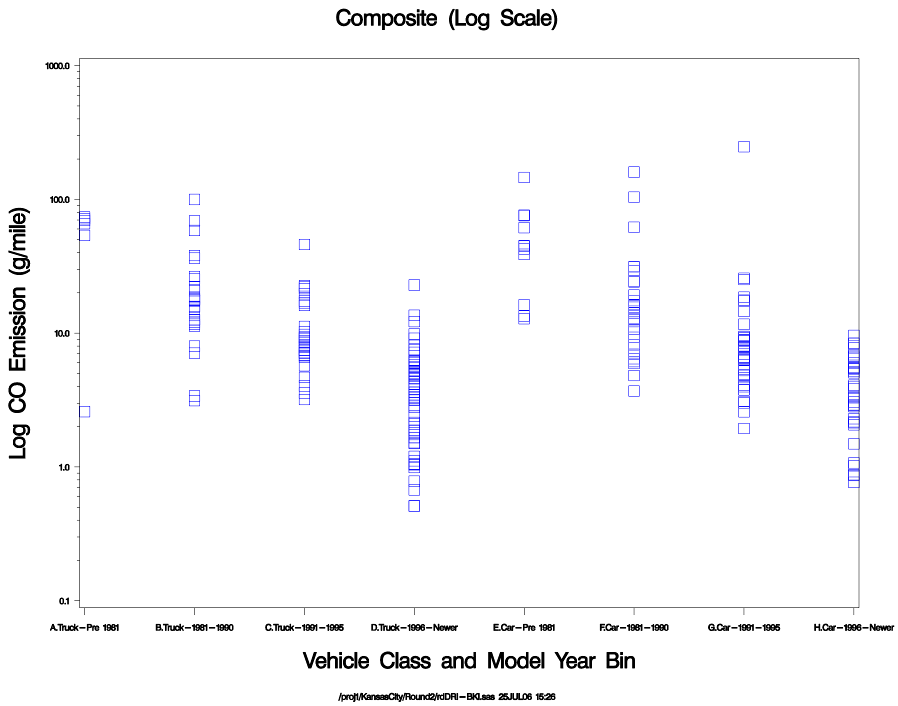


Figure 4-53. Round 2 Log/Linear Plots of HC Emissions by Class-Year Bin



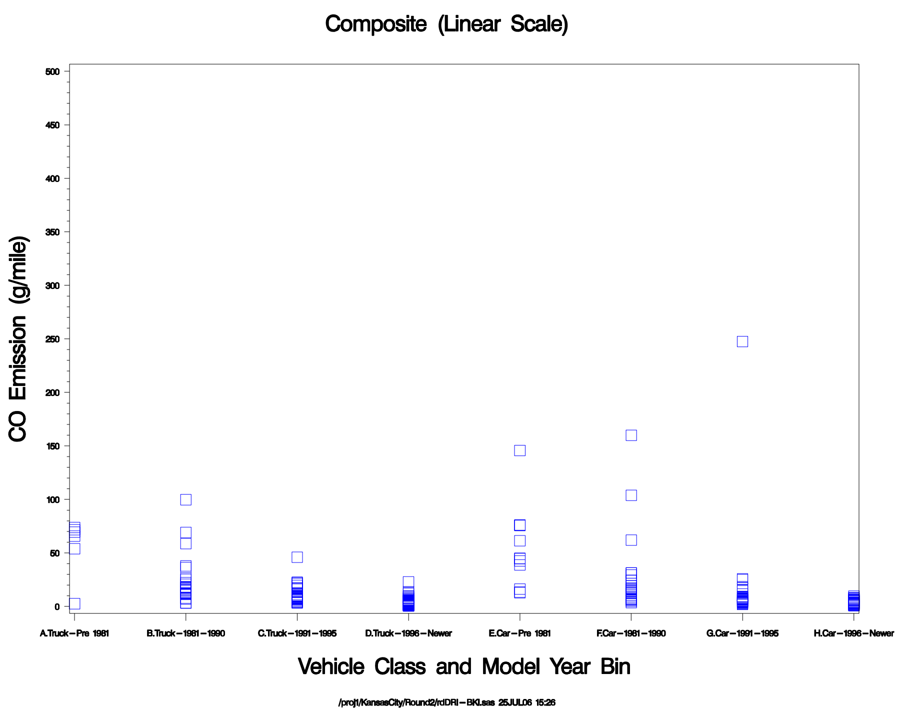


Figure 4-54. Round 2 Log/Linear Plots of CO Emissions by Class-Year Bin

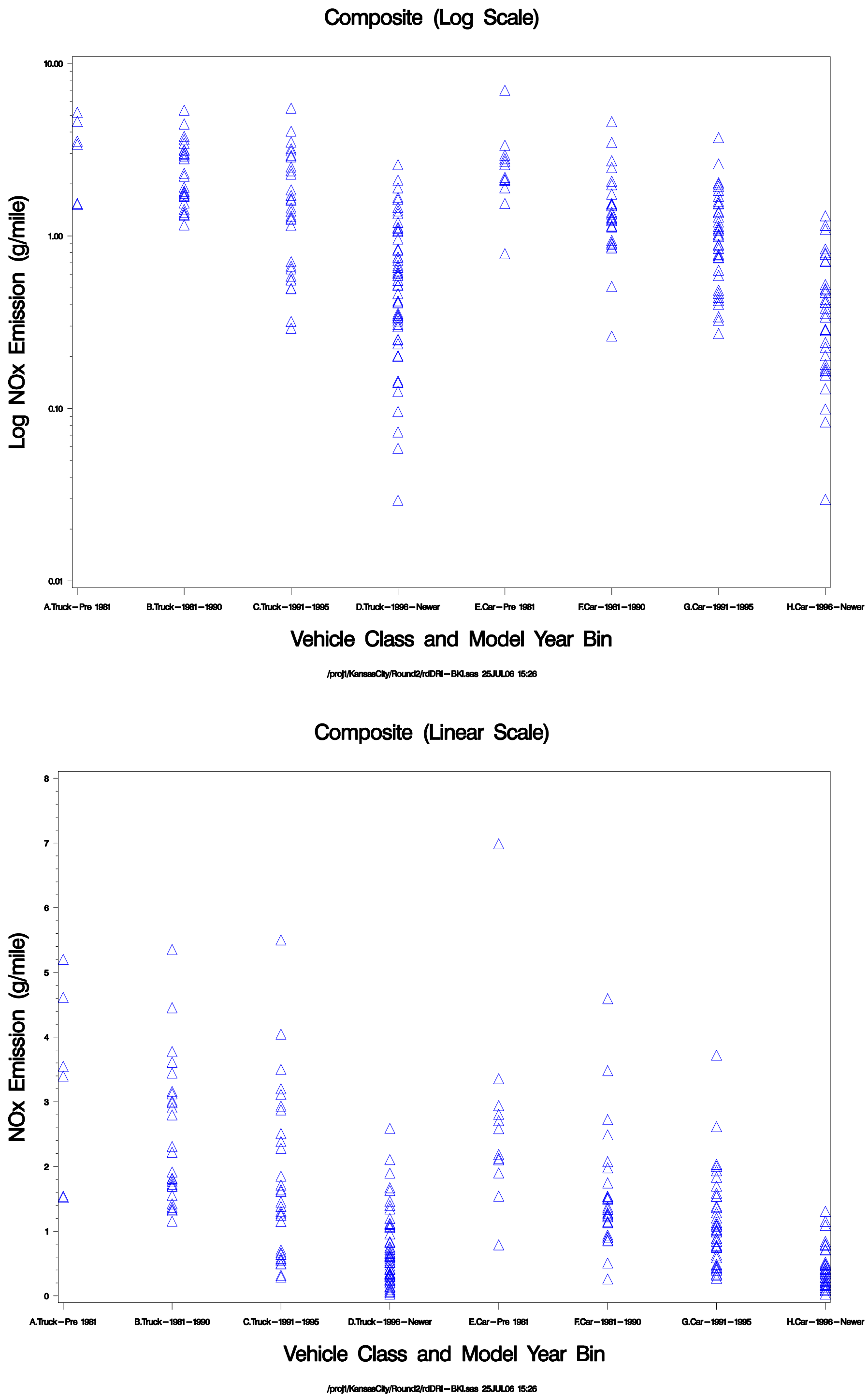
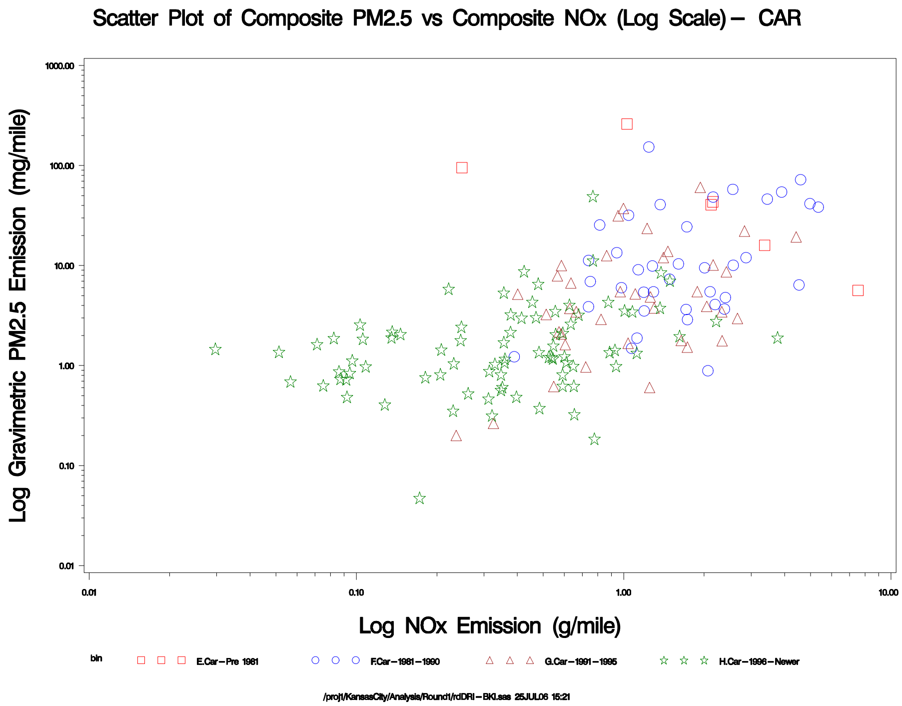


Figure 4-55. Round 2 Log/Linear Plots of NO_X Emissions by Class-Year Bin



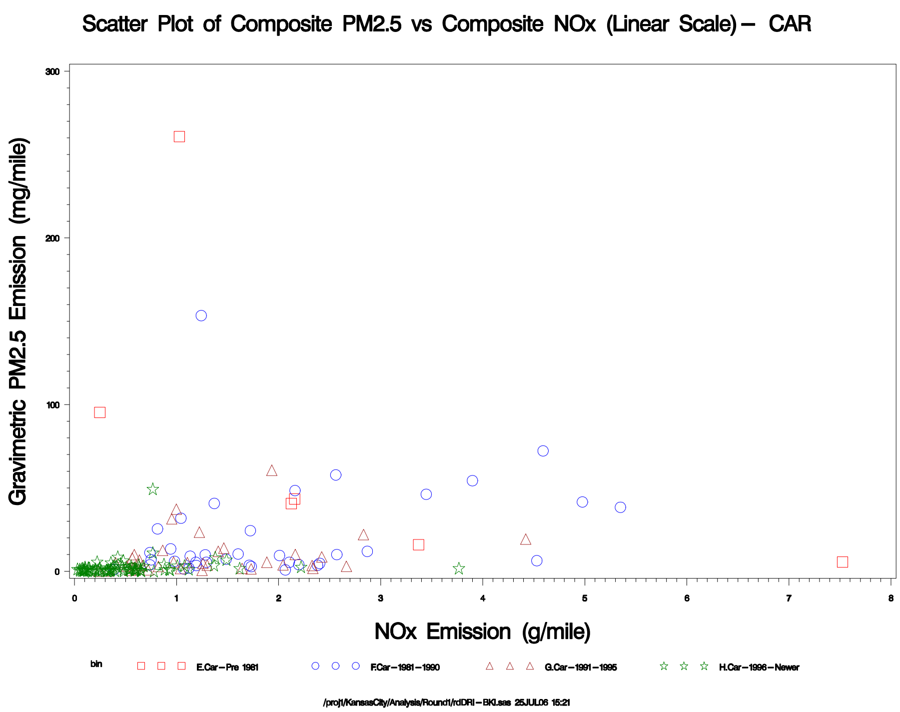
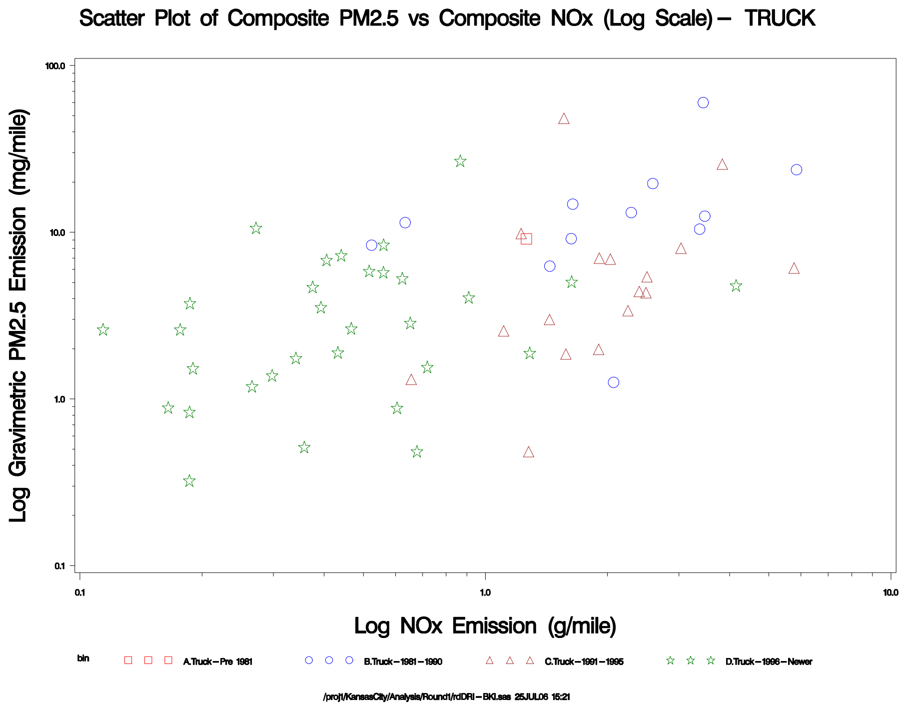


Figure 4-56. Round 1 Log/Linear Plots of $PM_{2.5}$ vs. NO_X by Vehicle Type-Year



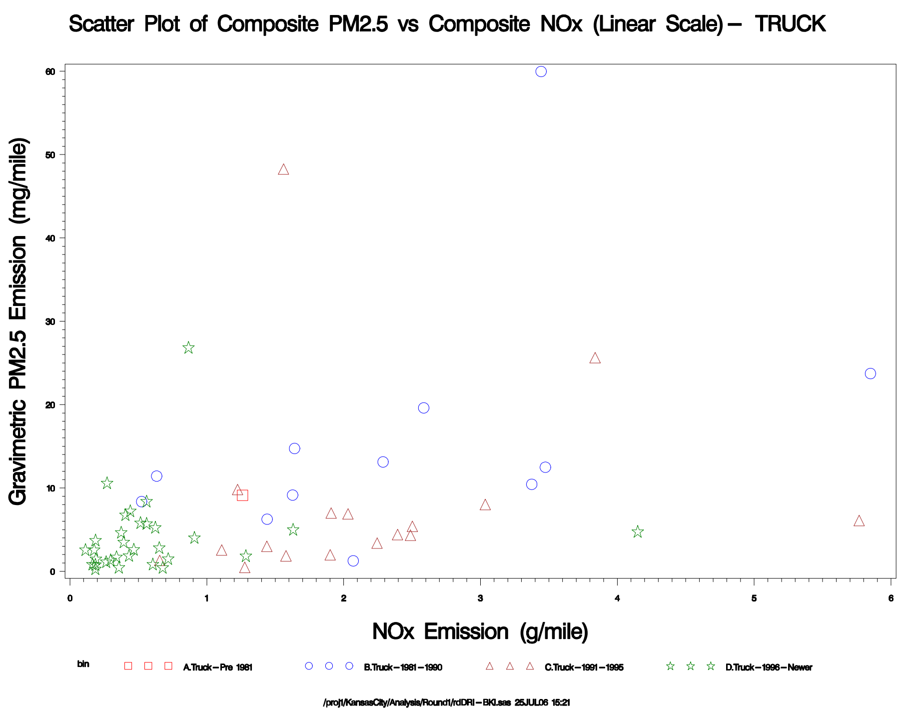
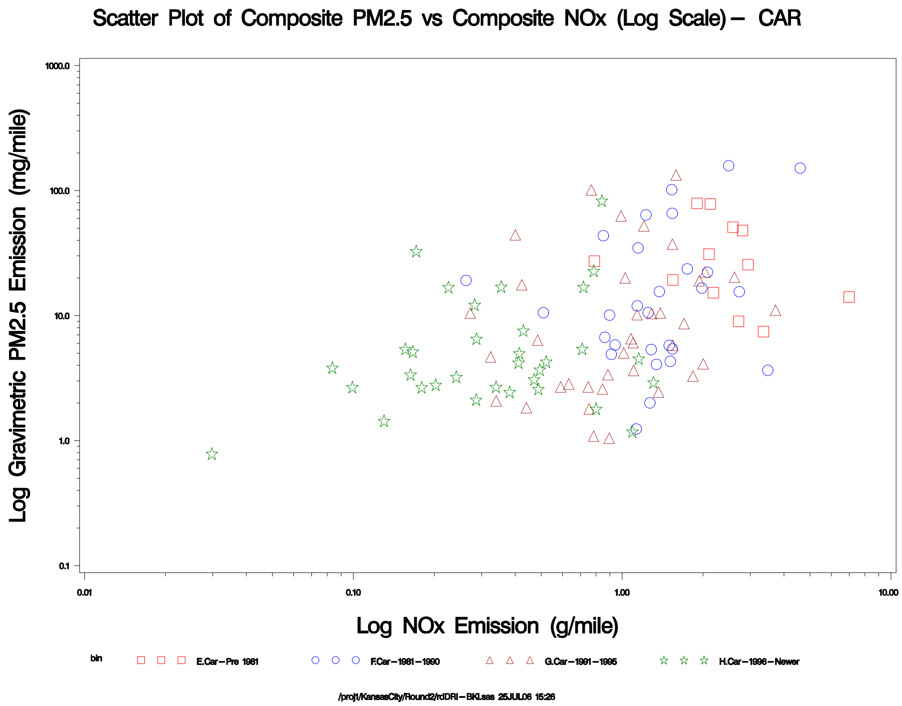


Figure 4-57. Round 1 Log/Linear Plots of $PM_{2.5}$ vs. NO_X by Vehicle Type-Year



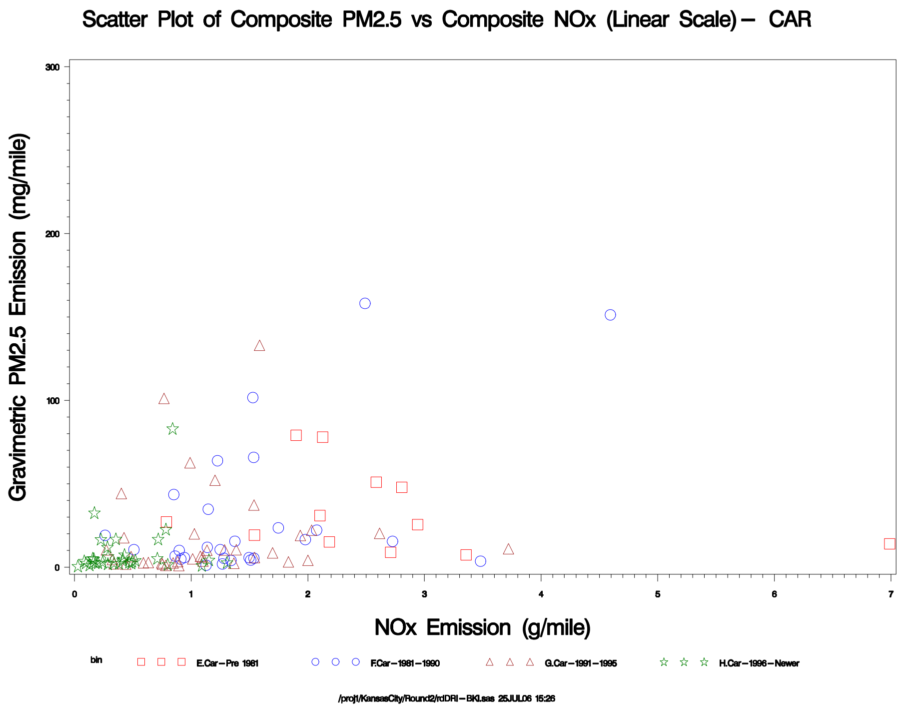
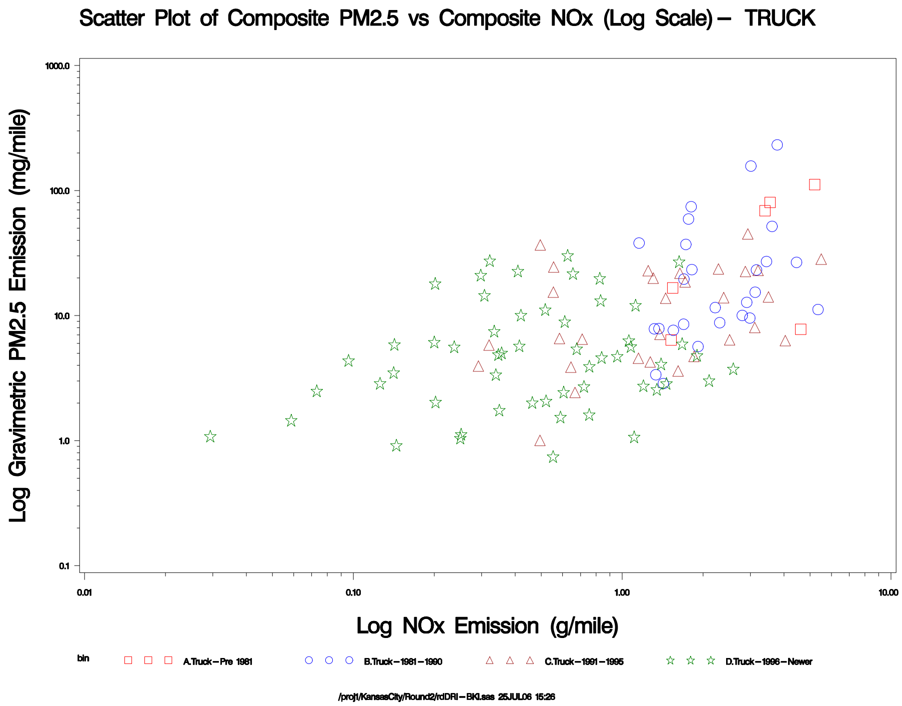


Figure 4-58. Round 2 Log/Linear Plots of $PM_{2.5}$ vs. NO_X by Vehicle Type-Year



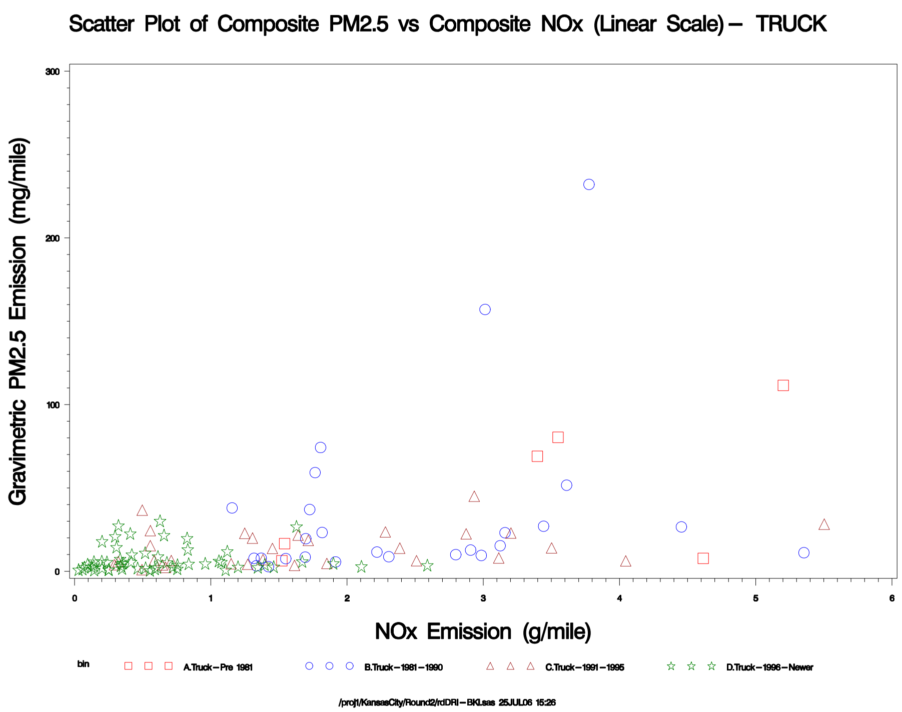
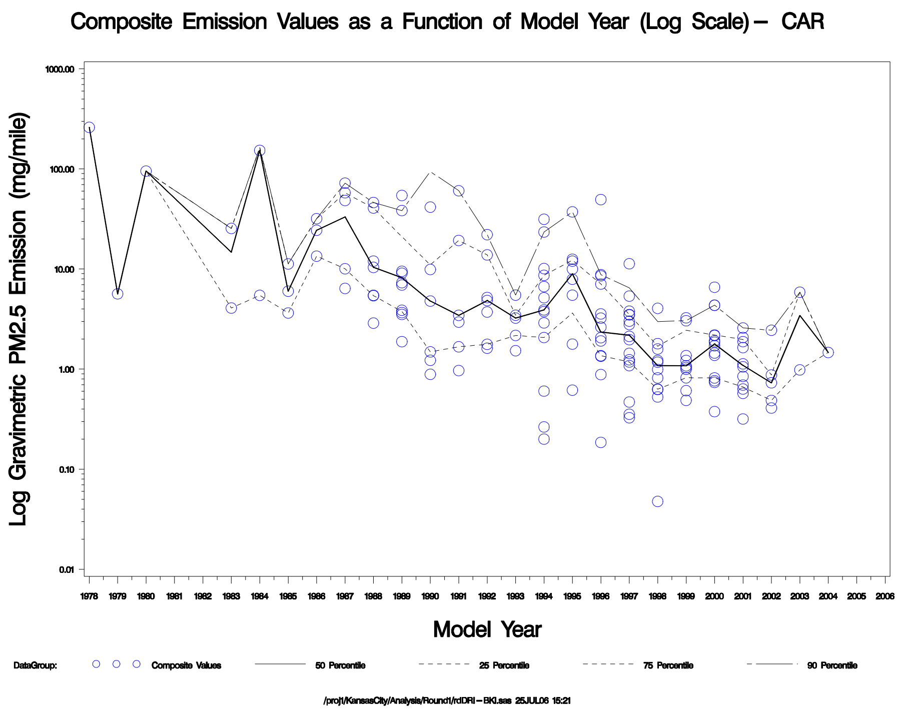


Figure 4-59. Round 2 Log/Linear Plots of $PM_{2.5}$ vs. NO_X by Vehicle Type-Year



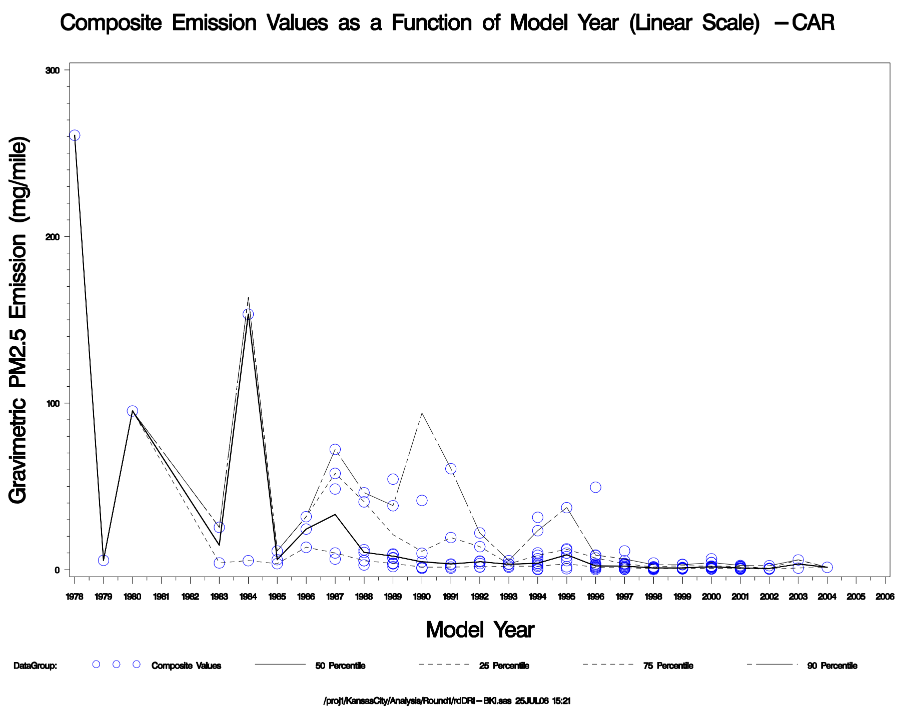
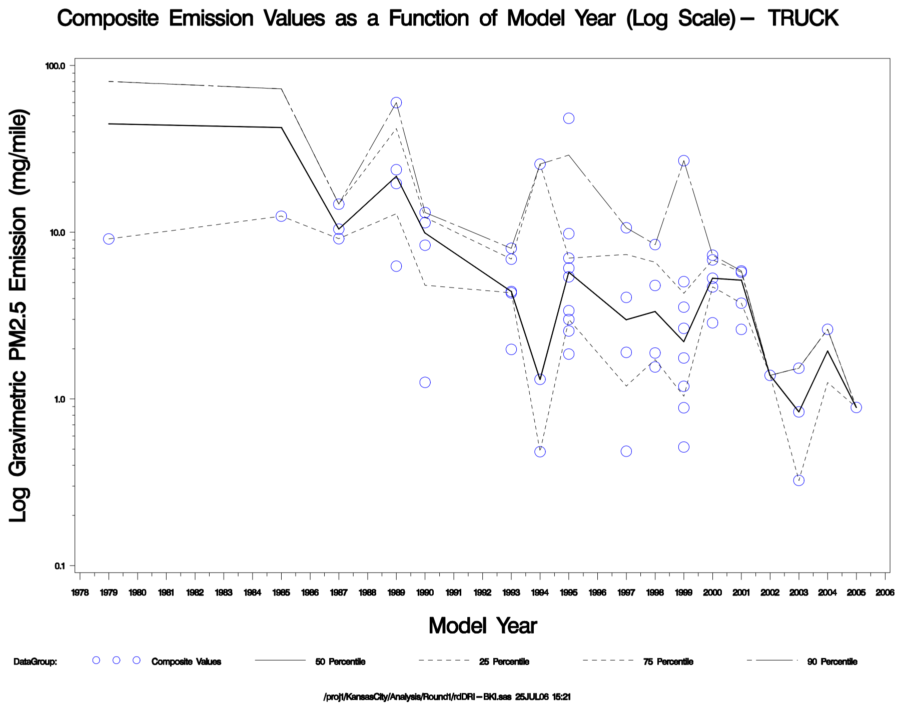


Figure 4-60. Round 1 Log/Linear Plots of $PM_{2.5}$ Emissions by Model Year



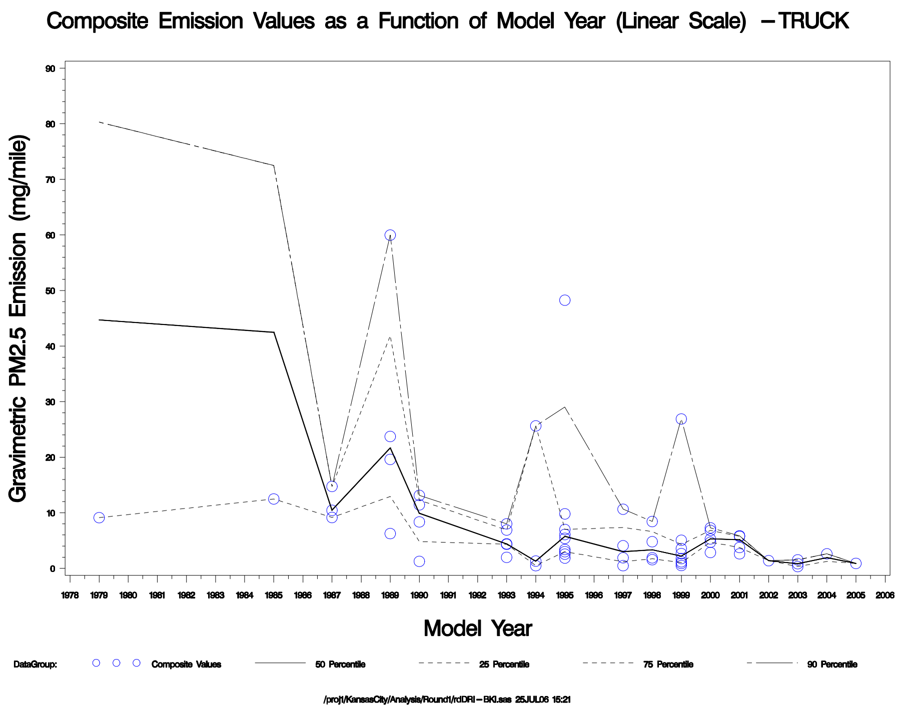
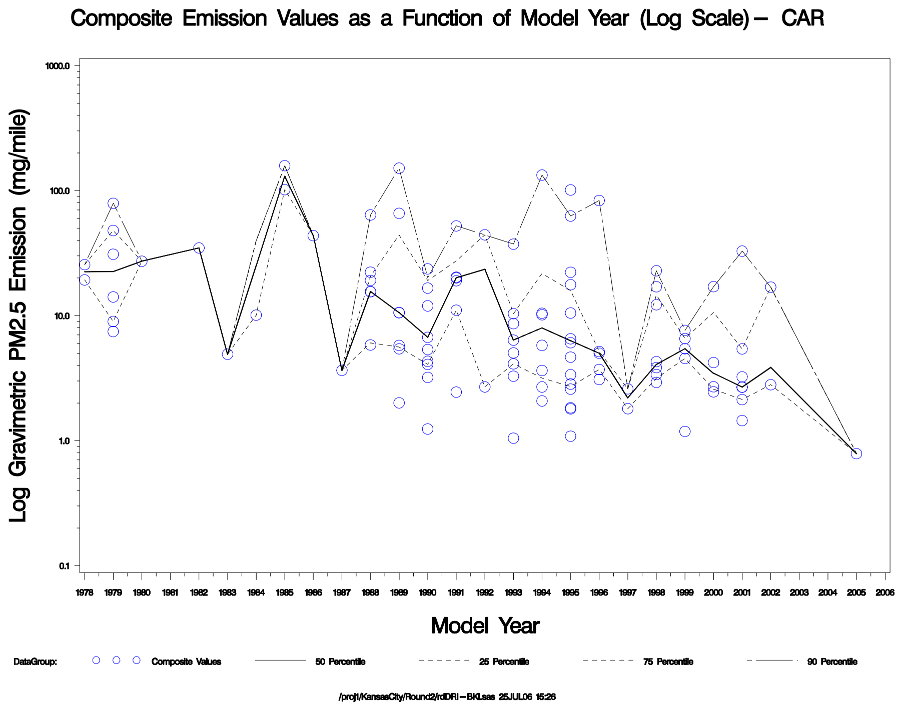


Figure 4-61. Round 1 Log/Linear Plots of $PM_{2.5}$ Emissions by Model Year



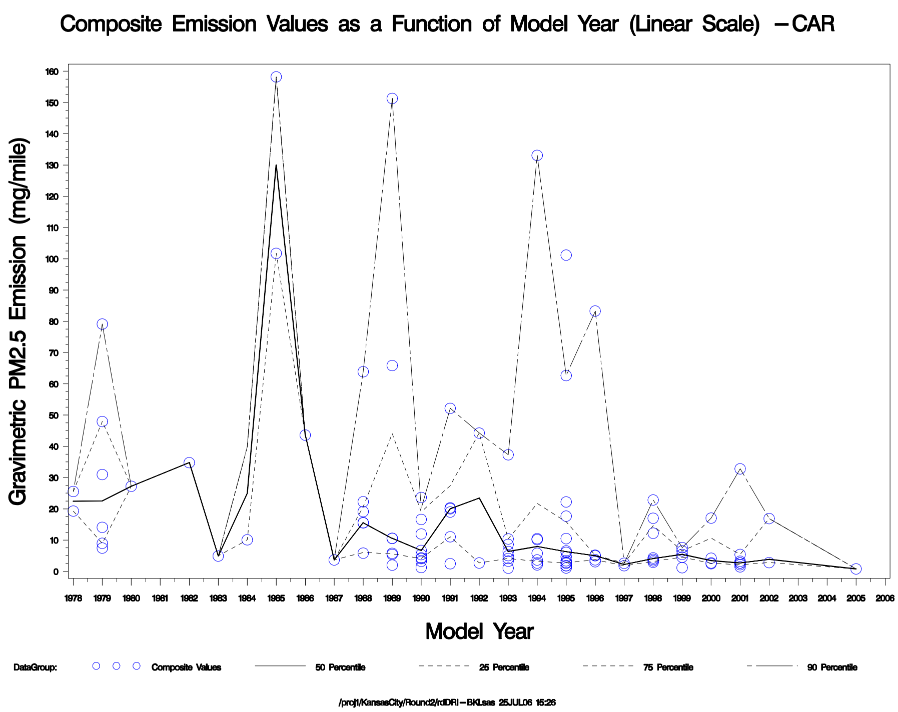
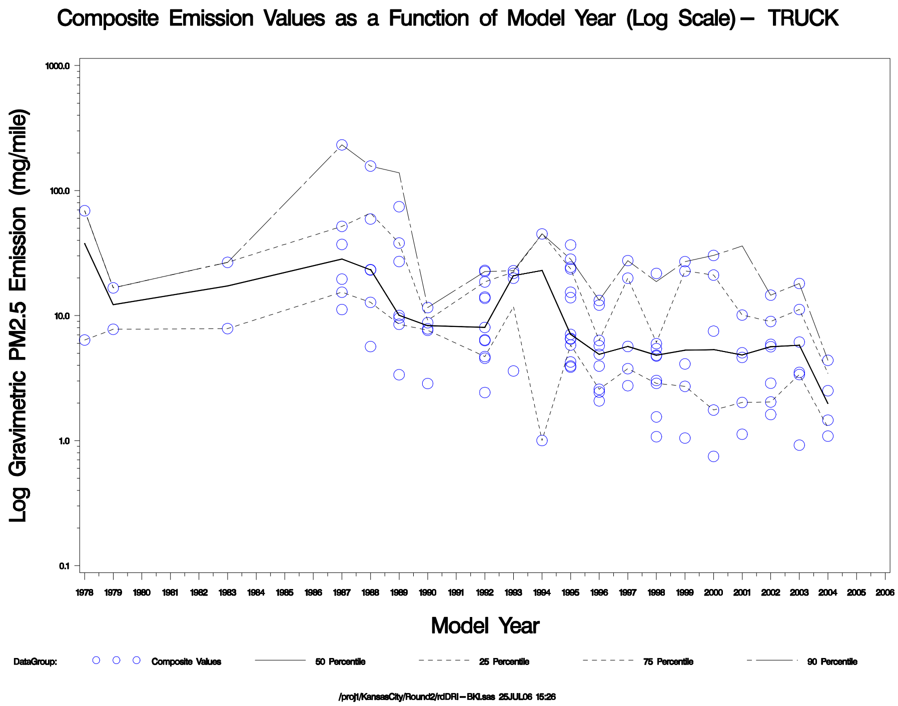


Figure 4-62. Round 2 Log/Linear Plots of $PM_{2.5}$ Emissions by Model Year



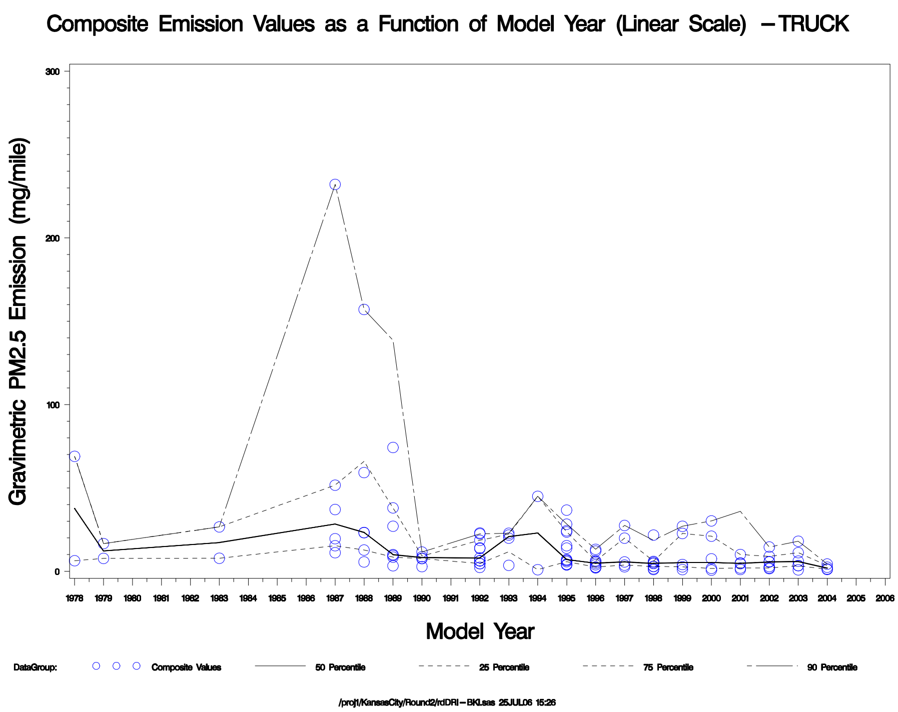
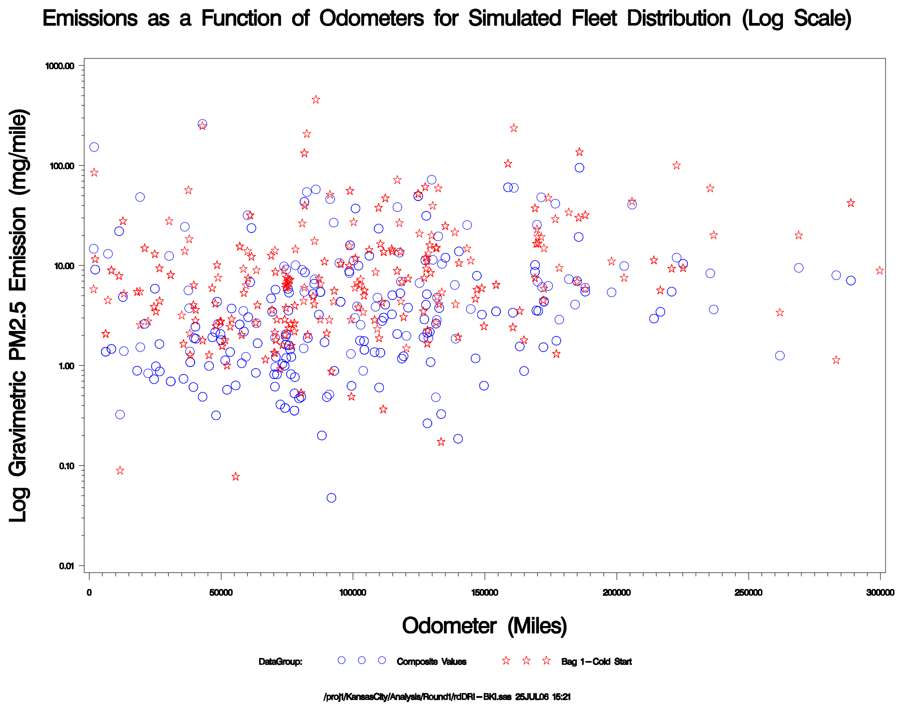


Figure 4-63. Round 2 Log/Linear Plots of $PM_{2.5}$ Emissions by Model Year



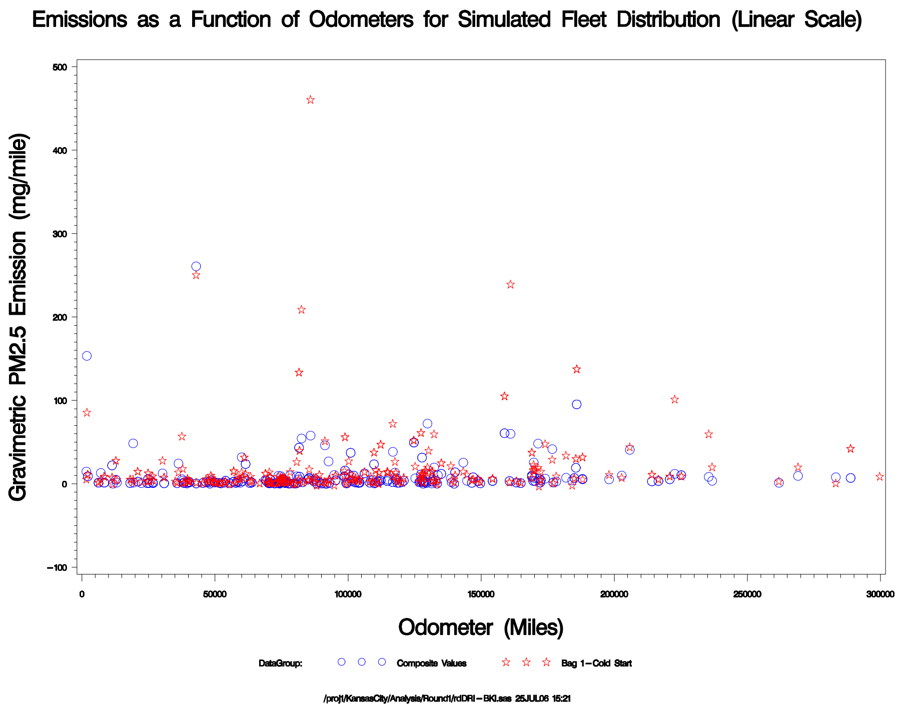
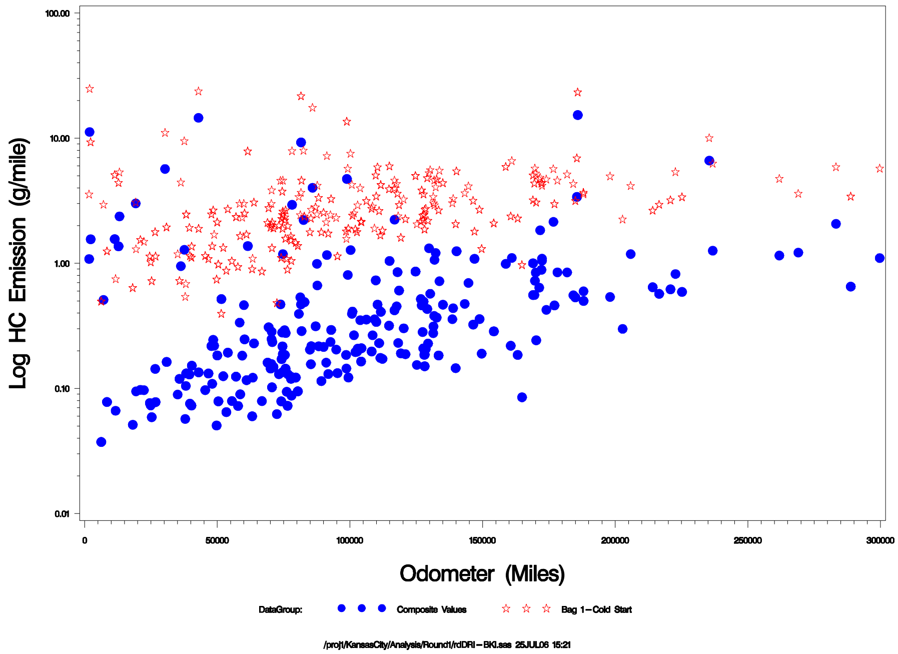


Figure 4-64. Round 1 Log/Linear Plots of $PM_{2.5}$ Emissions by Odometer Mileage

Emissions as a Function of Odometers for Simulated Fleet Distribution (Log Scale)



Emissions as a Function of Odometers for Simulated Fleet Distribution (Linear Scale)

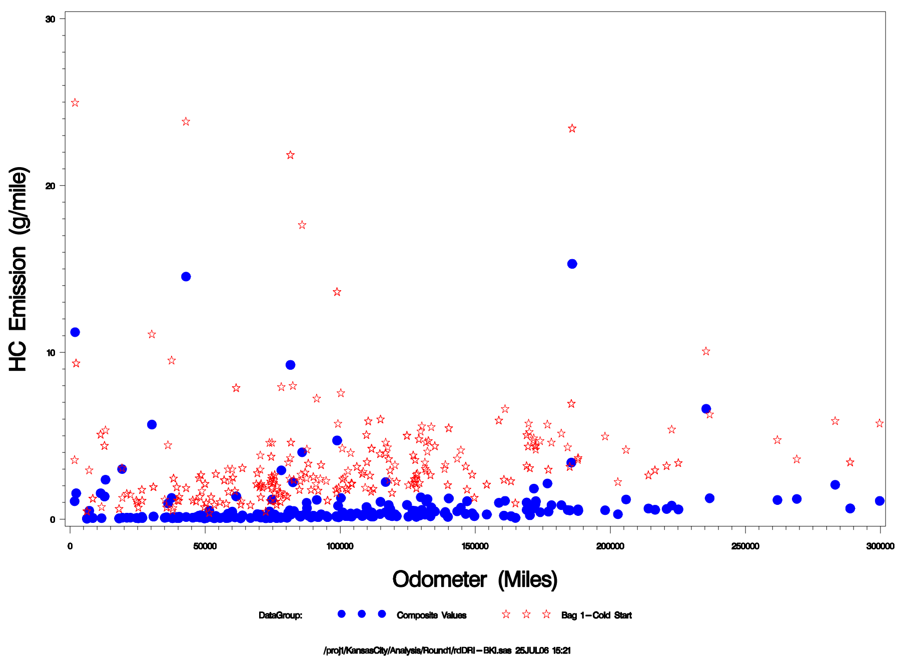
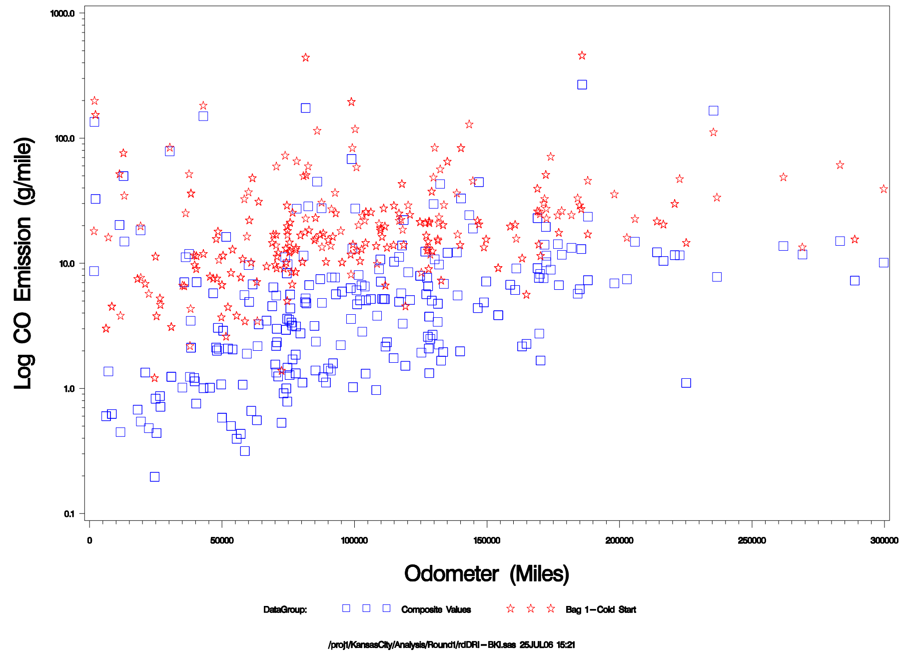


Figure 4-65. Round 1 Log/Linear Plots of HC Emissions by Odometer Mileage

Emissions as a Function of Odometers for Simulated Fleet Distribution (Log Scale)



Emissions as a Function of Odometers for Simulated Fleet Distribution (Linear Scale)

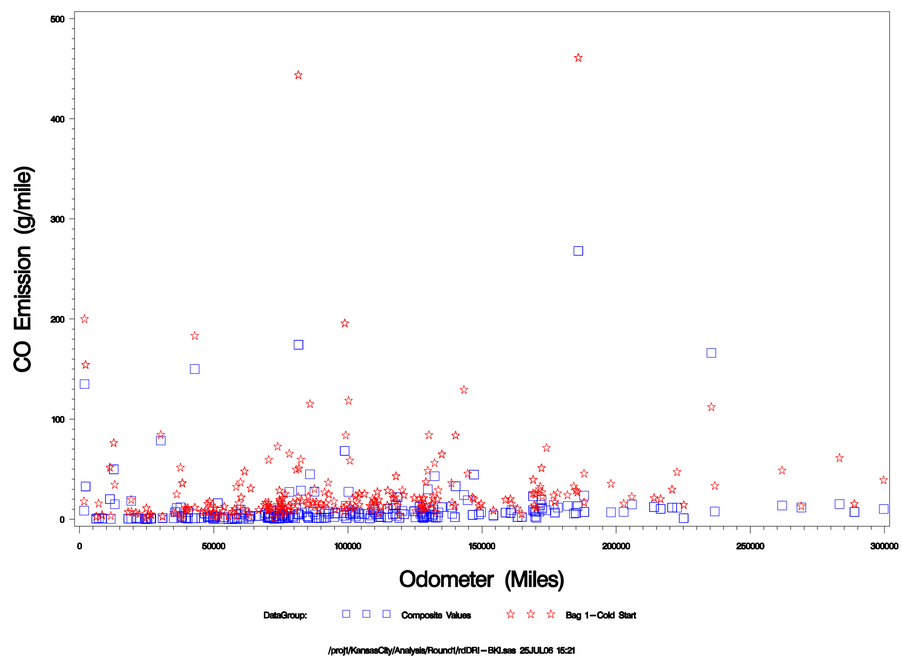
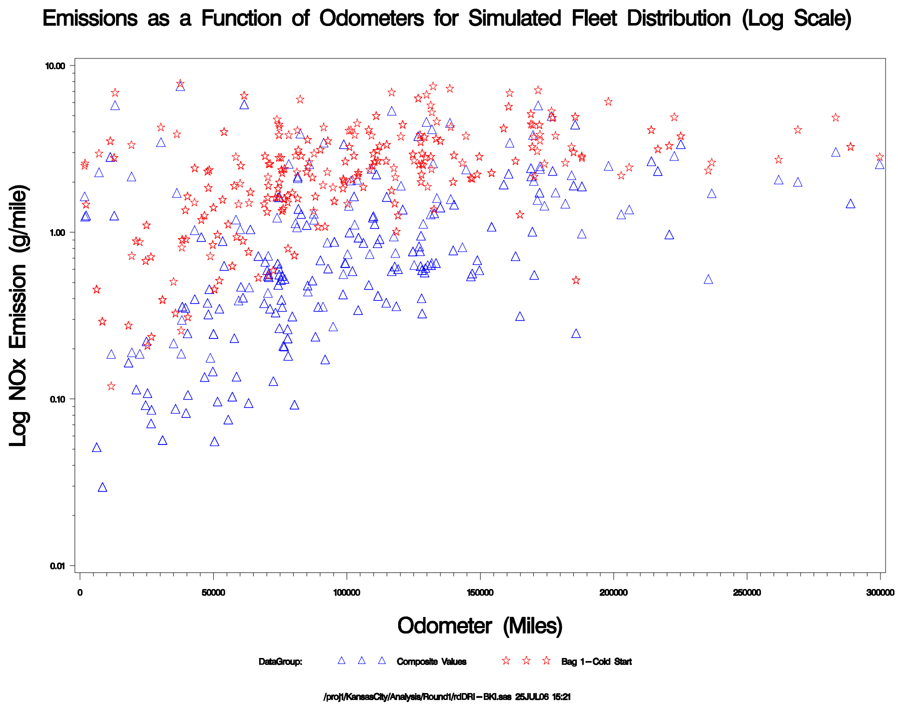


Figure 4-66. Round 1 Log/Linear Plots of CO Emissions by Odometer Mileage



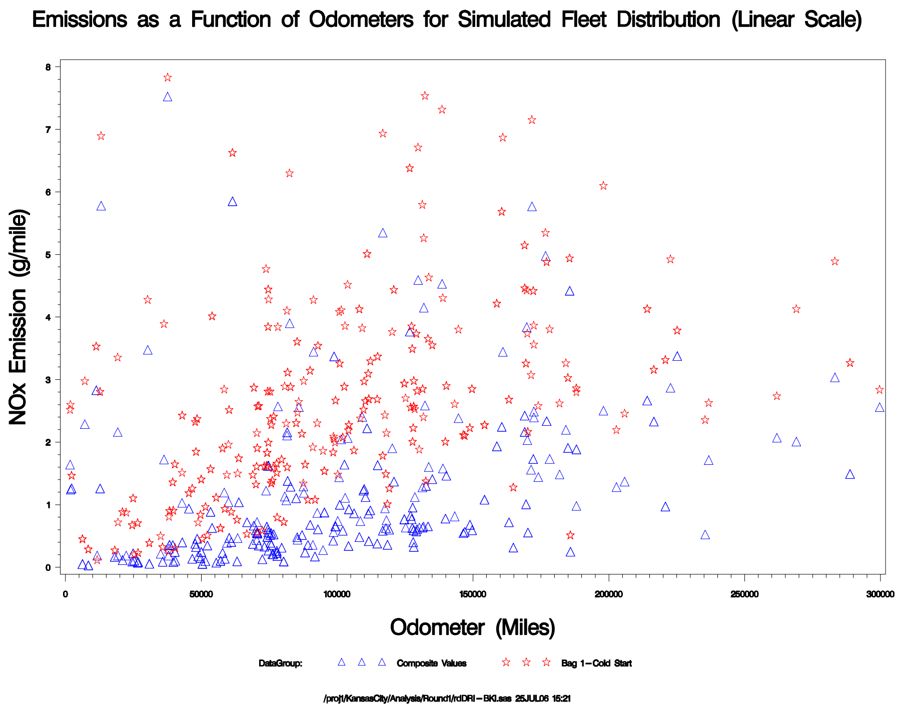
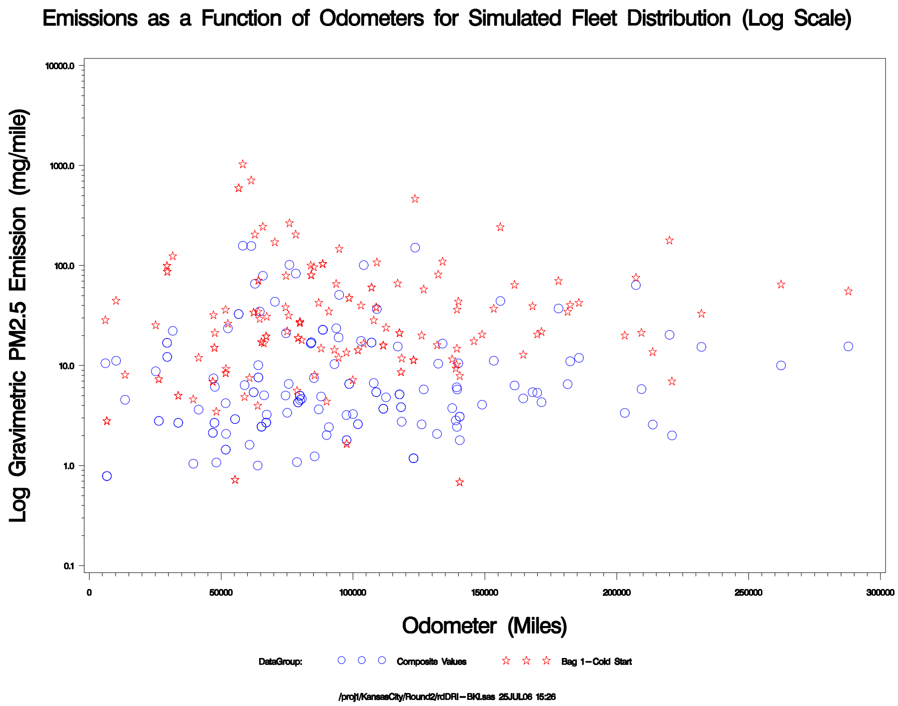


Figure 4-67. Round 1 Log/Linear Plots of NO_X Emissions by Odometer Mileage



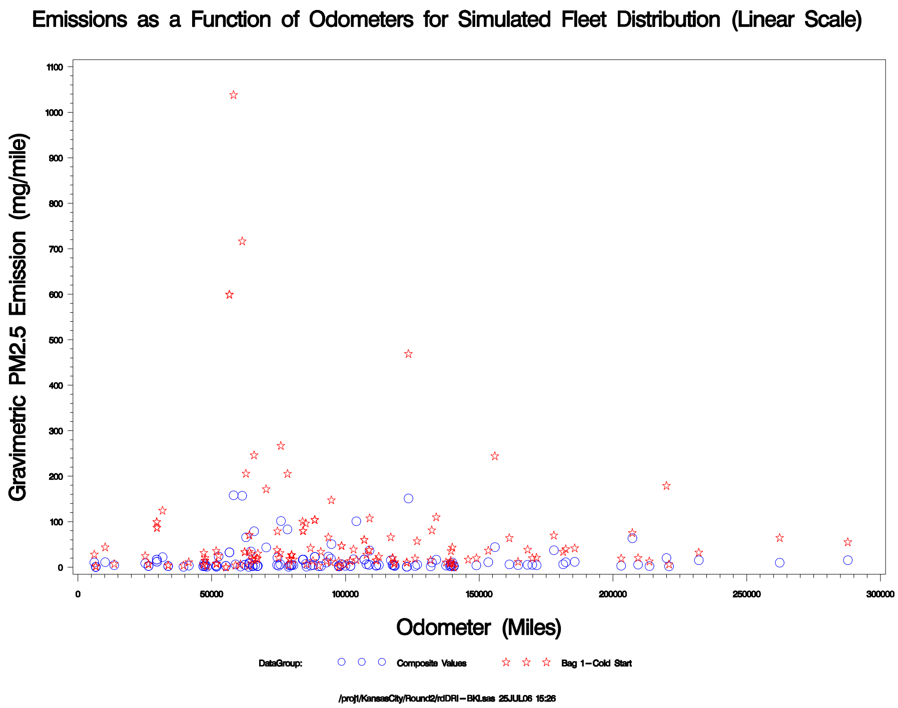
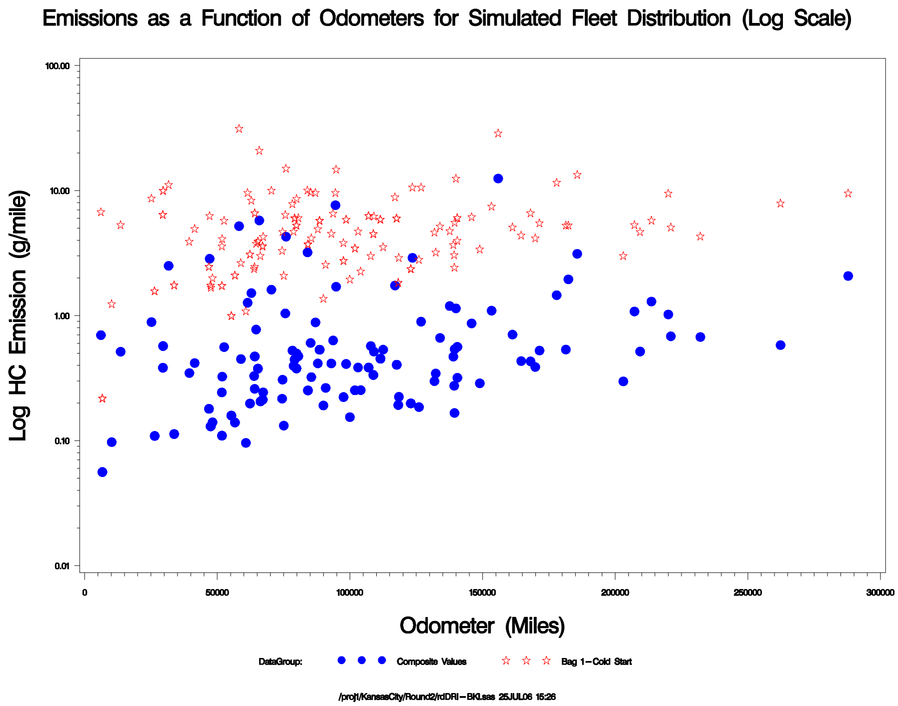


Figure 4-68. Round 2 Log/Linear Plots of $PM_{2.5}$ Emissions by Odometer Mileage



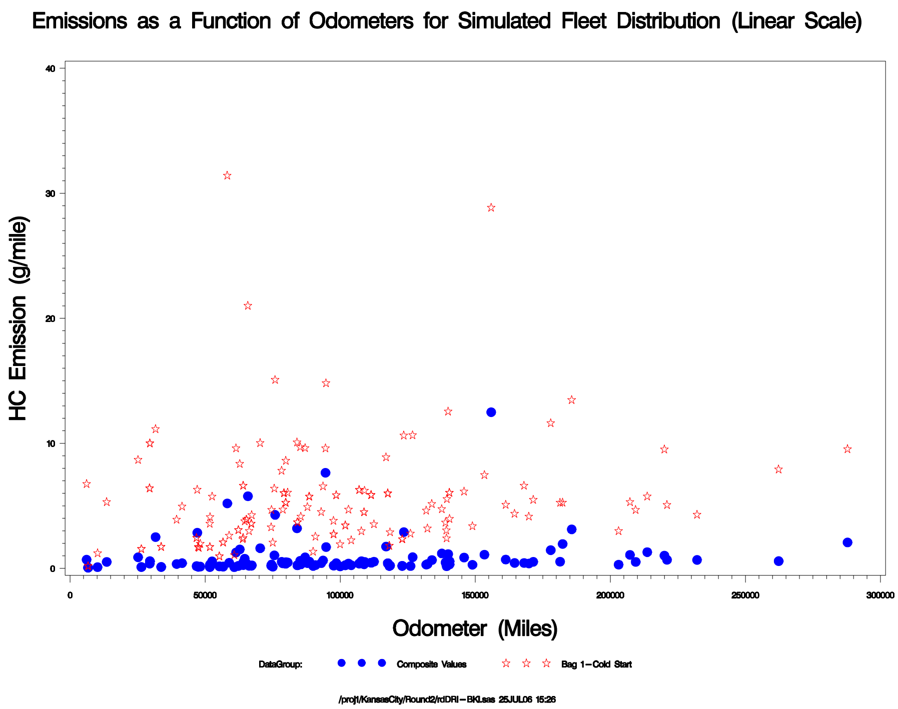
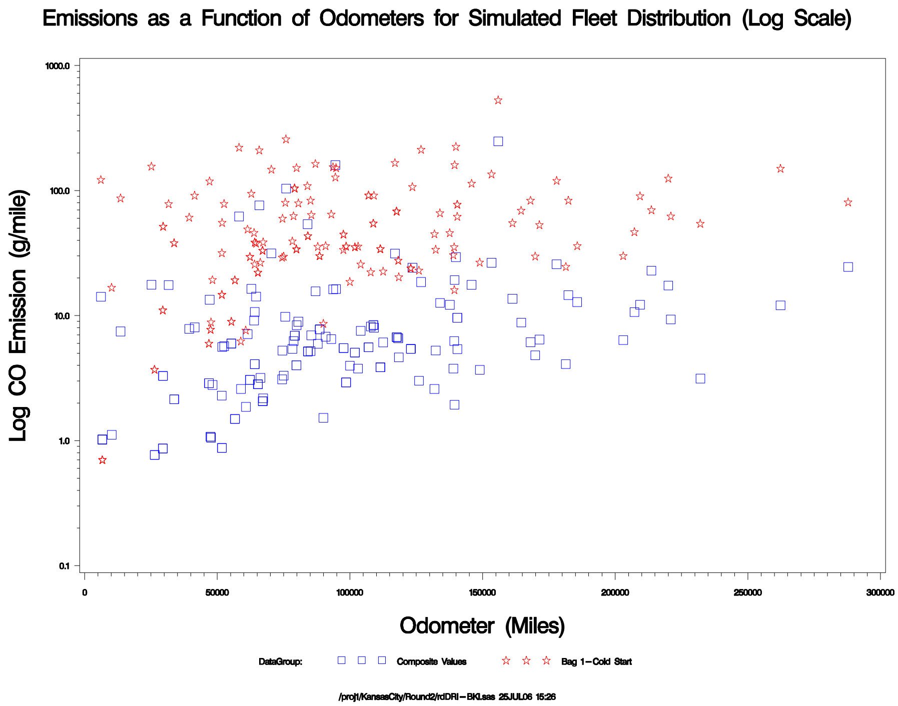


Figure 4-69. Round 2 Log/Linear Plots of HC Emissions by Odometer Mileage



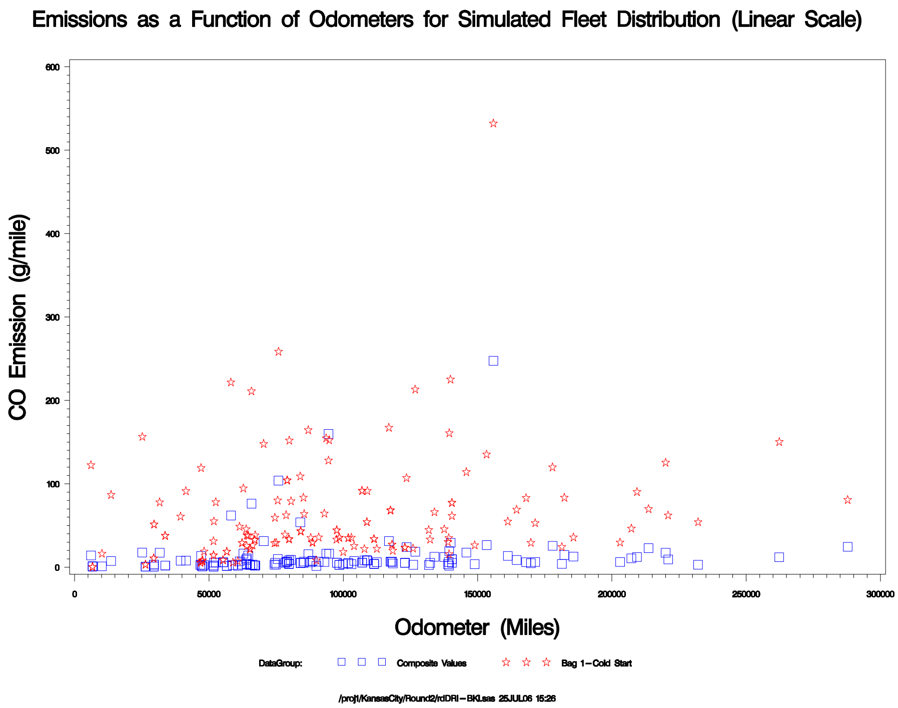
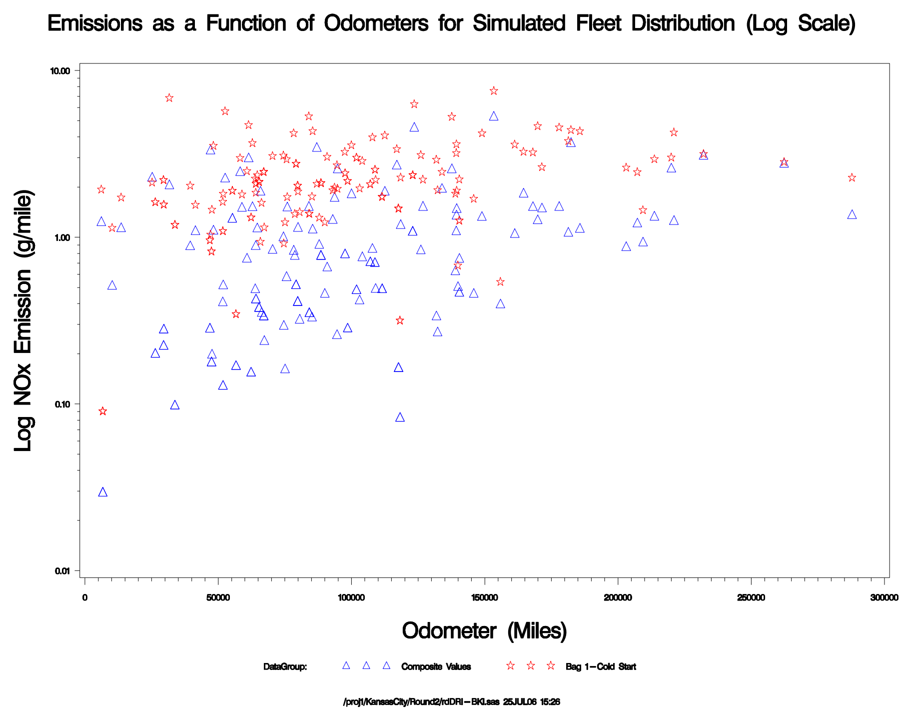


Figure 4-70. Round 2 Log/Linear Plots of CO Emissions by Odometer Mileage



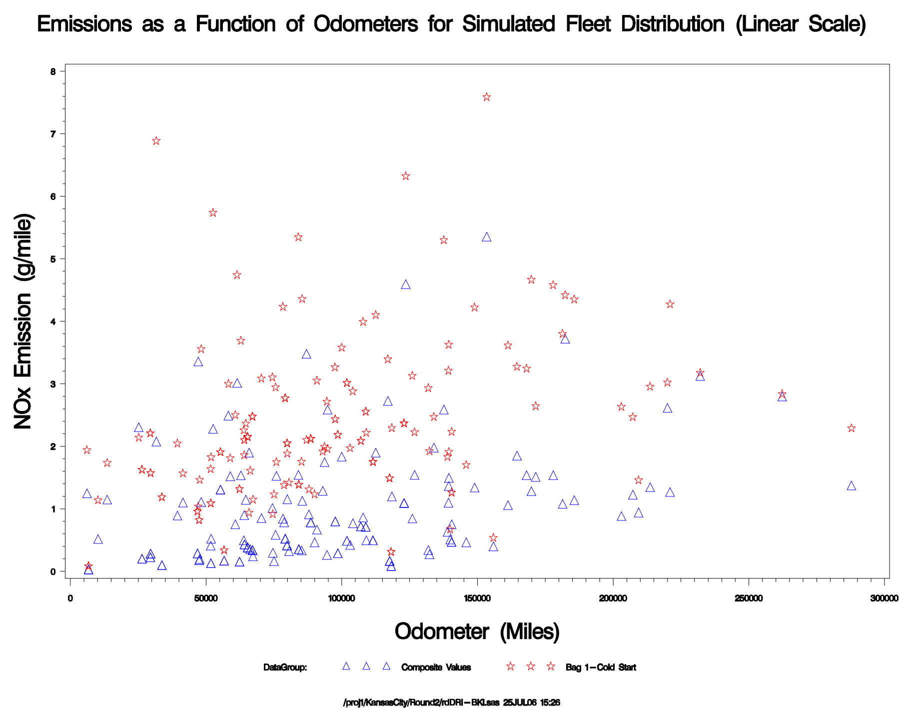
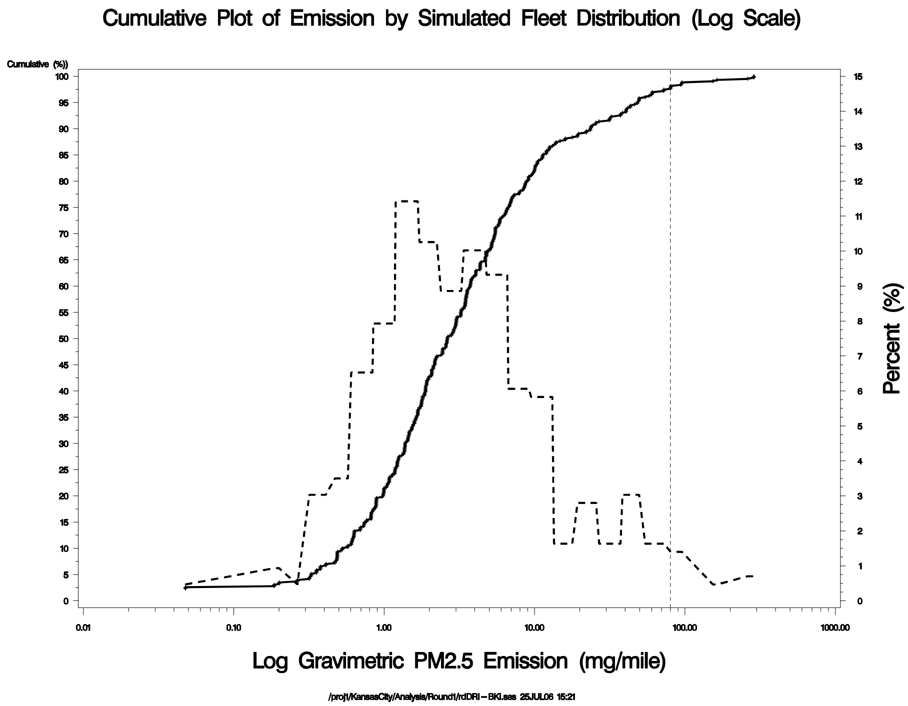


Figure 4-71. Round 2 Log/Linear Plots of NO_X Emissions by Odometer Mileage



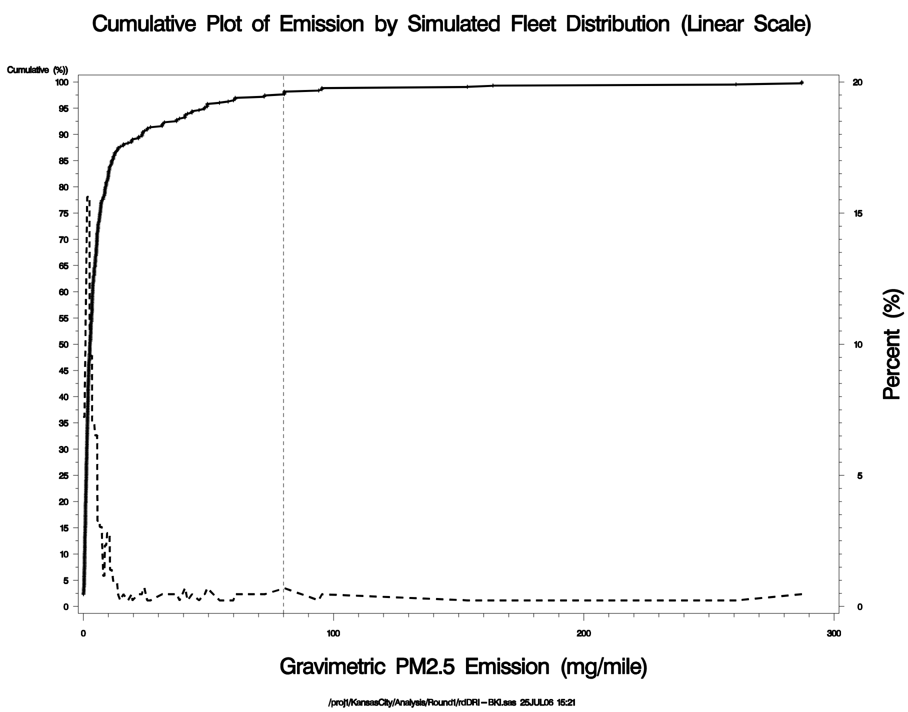
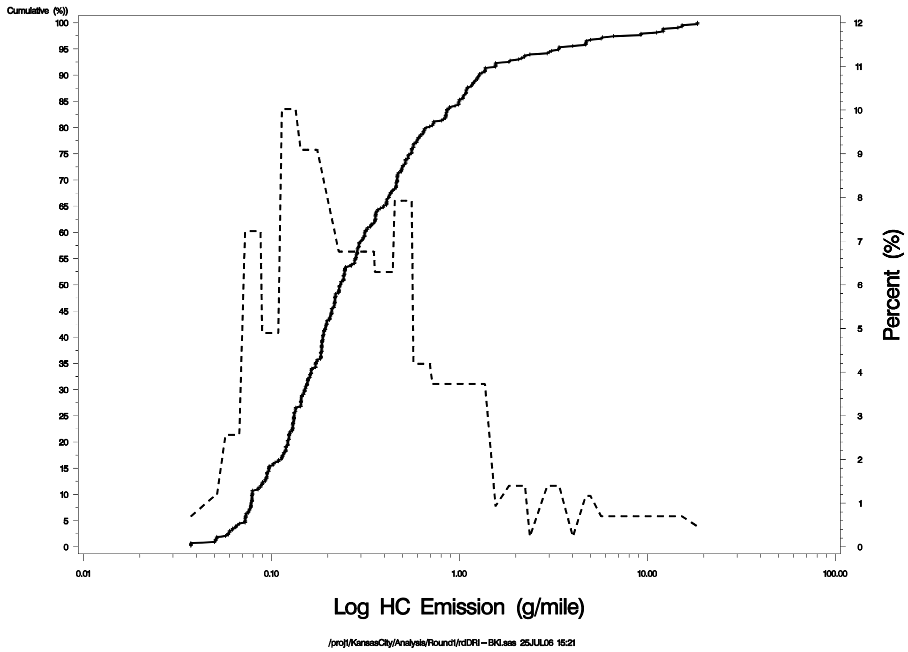


Figure 4-72. Round 1 Plots of % Projected-Fleet Distribution of Composite $PM_{2.5}$

Cumulative Plot of Emission by Simulated Fleet Distribution (Log Scale)



Cumulative Plot of Emission by Simulated Fleet Distribution (Linear Scale)

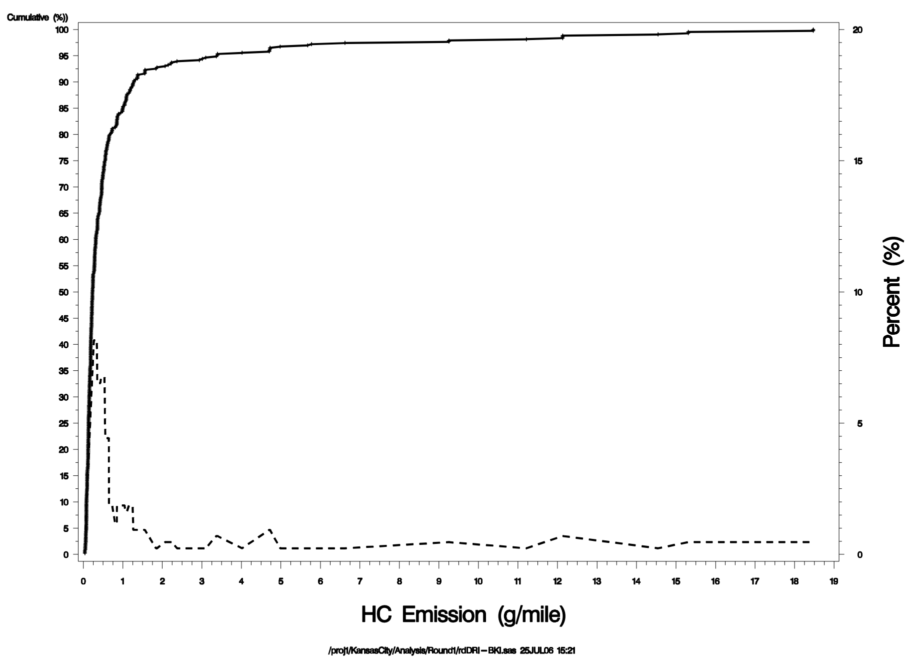
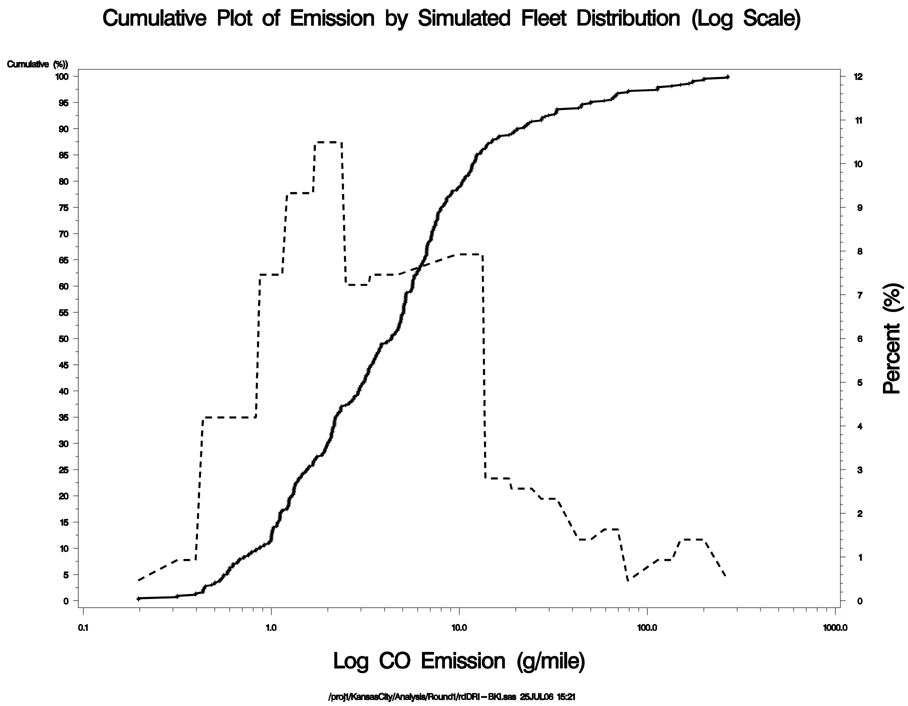


Figure 4-73. Round 1 Plots of % Projected-Fleet Distribution of Composite HC



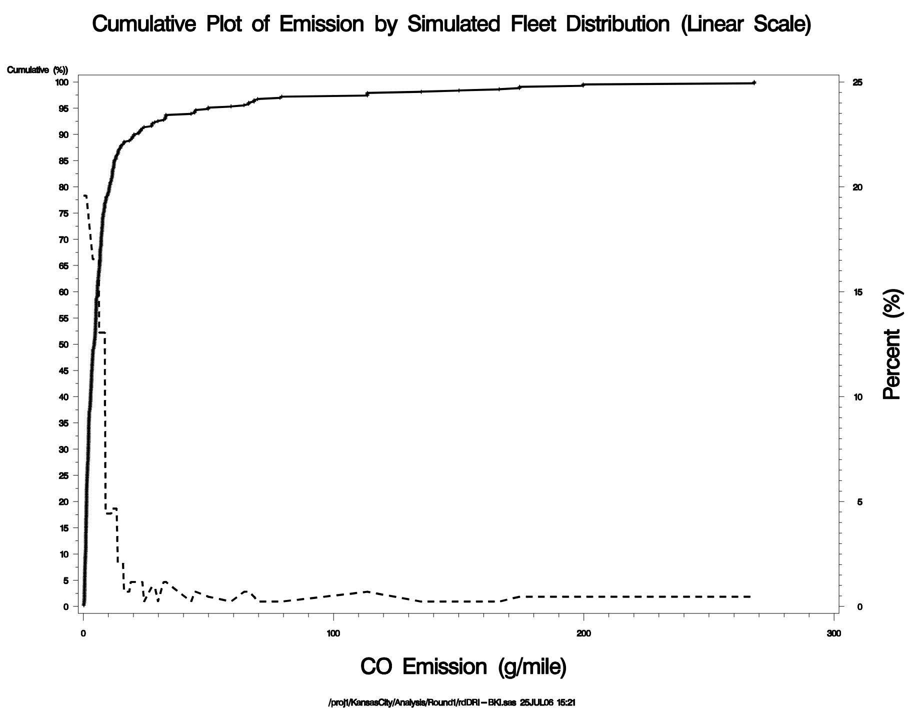
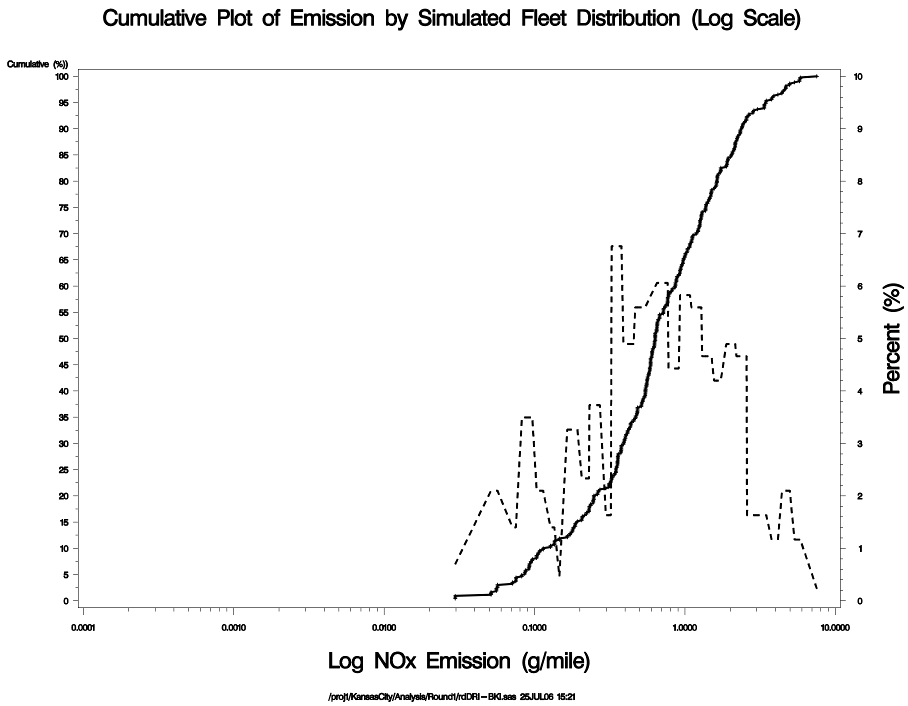


Figure 4-74. Round 1 Plots of % Projected-Fleet Distribution of Composite CO



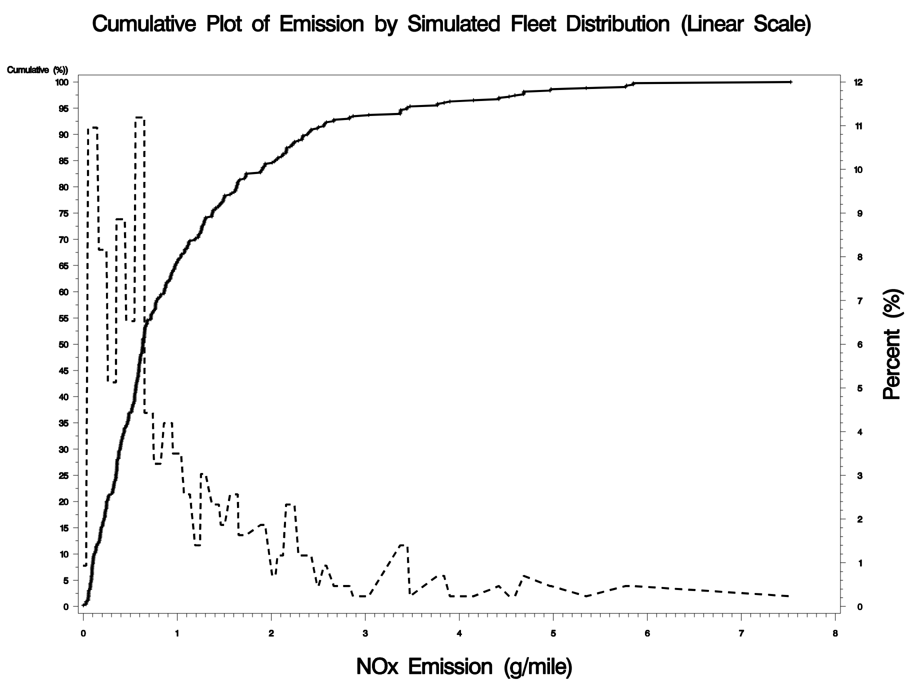
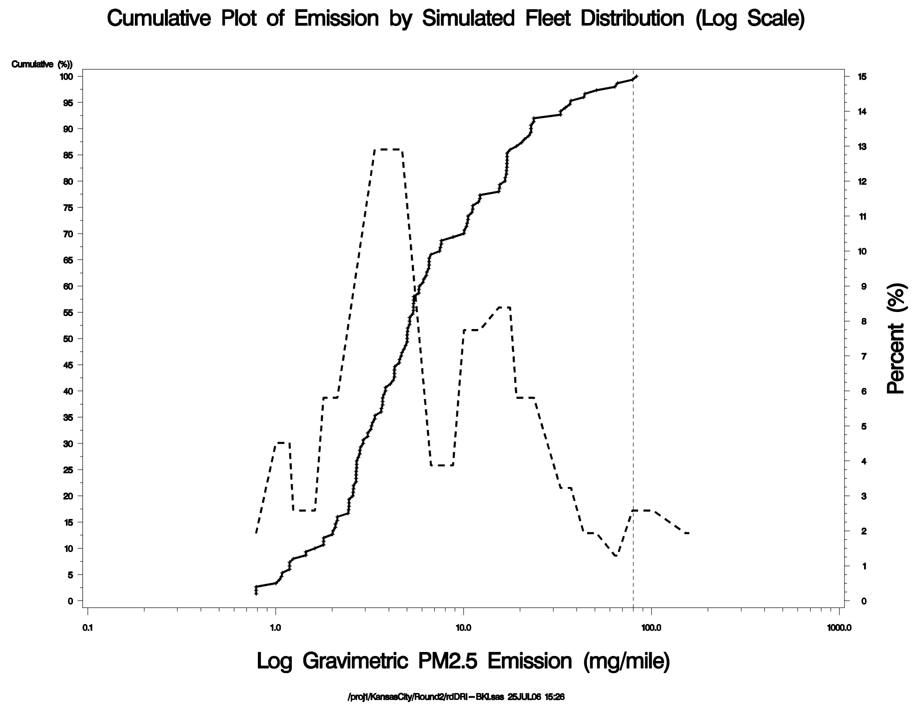


Figure 4-75. Round 1 Plots of % Projected-Fleet Distribution of Composite NO_x



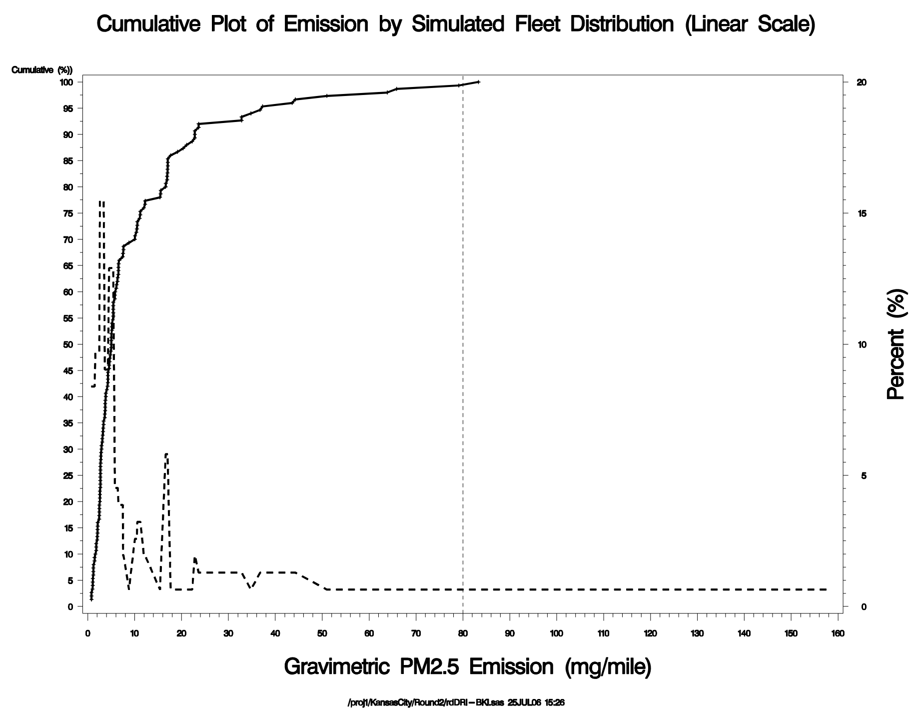
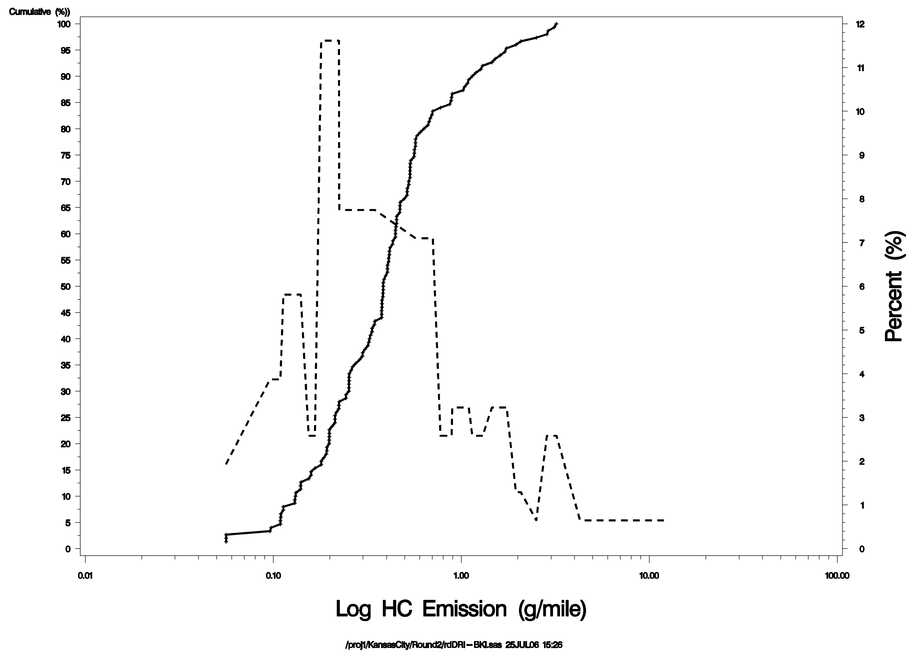


Figure 4-76. Round 2 Plots of % Projected-Fleet Distribution of Composite $PM_{2.5}$

Cumulative Plot of Emission by Simulated Fleet Distribution (Log Scale)



Cumulative Plot of Emission by Simulated Fleet Distribution (Linear Scale)

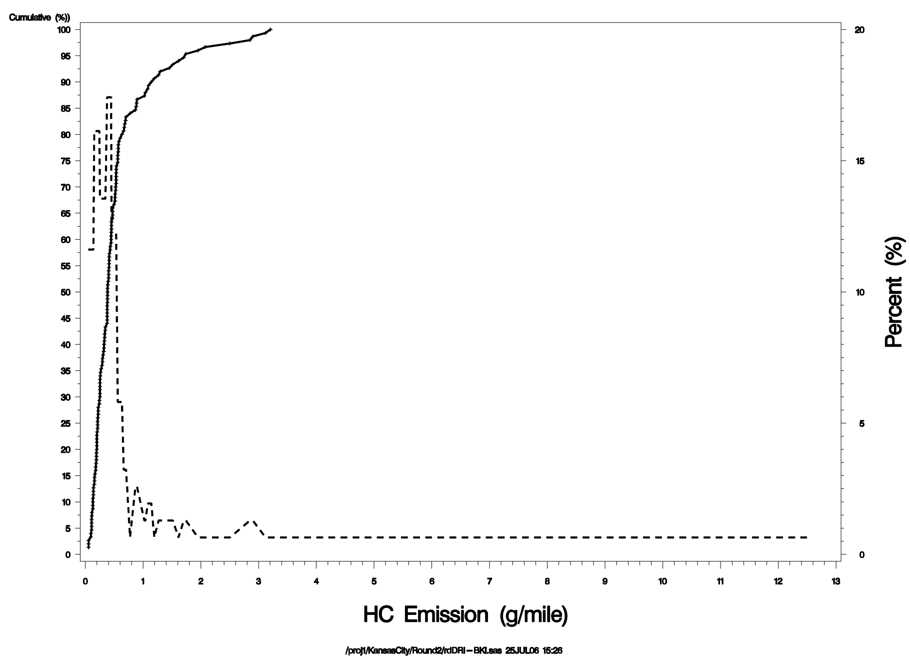
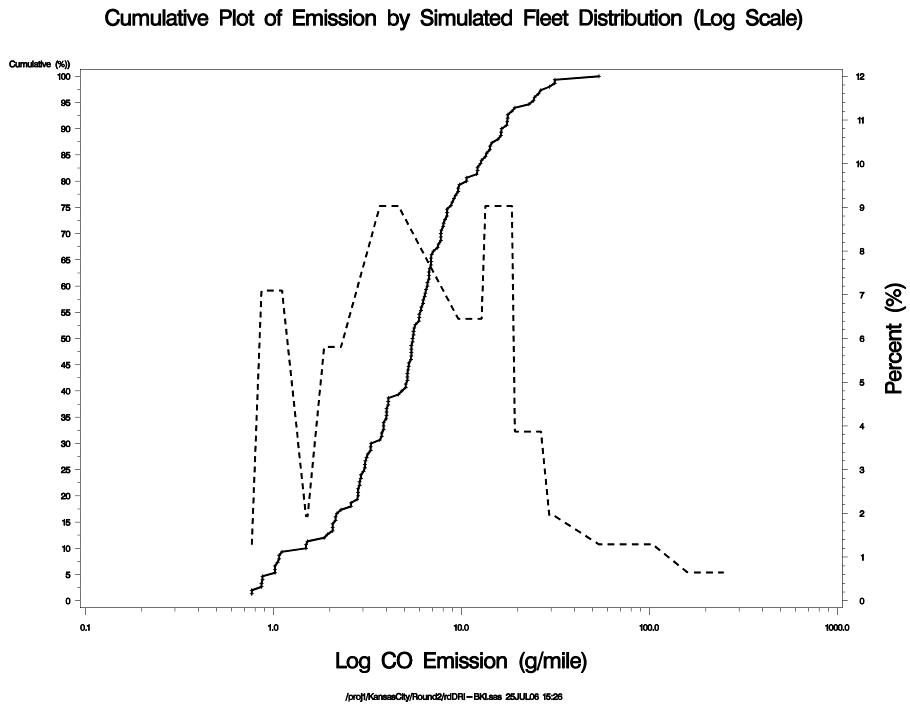


Figure 4-77. Round 2 Plots of % Projected-Fleet Distribution of Composite HC



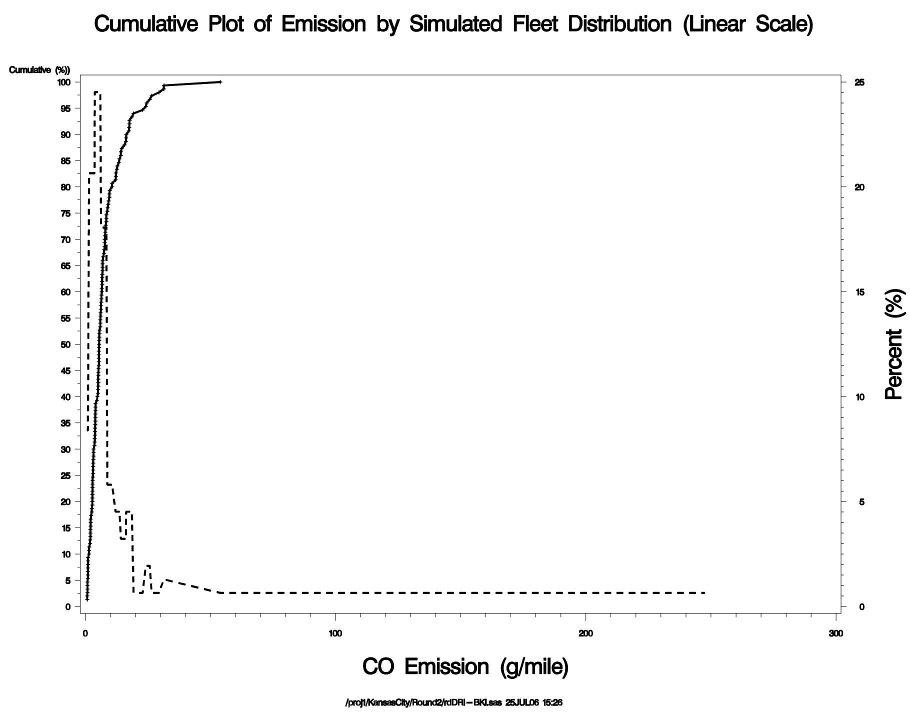
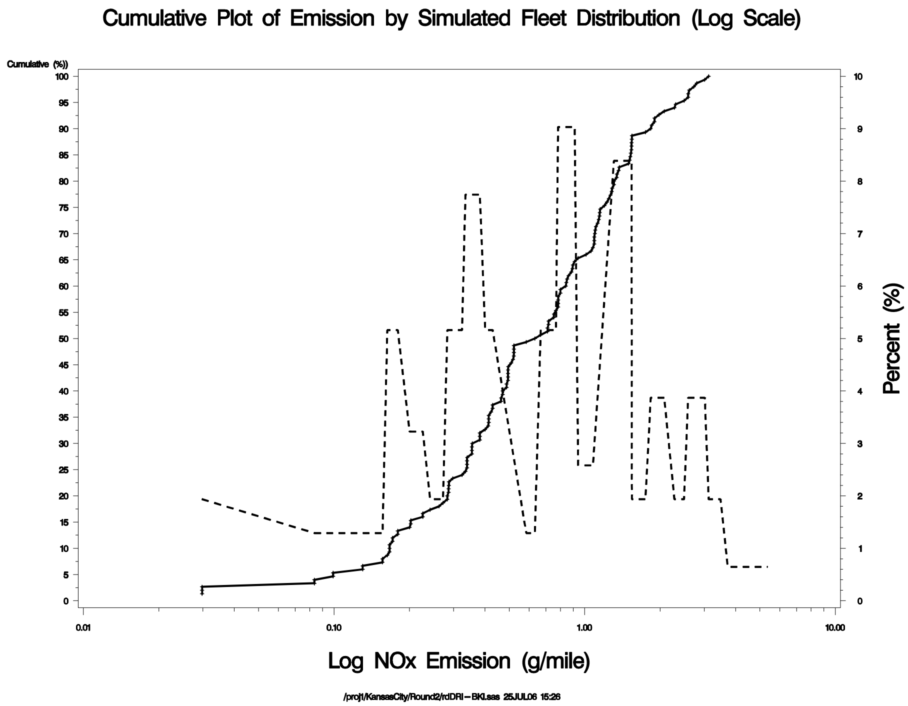


Figure 4-78. Round 2 Plots of % Projected-Fleet Distribution of Composite CO



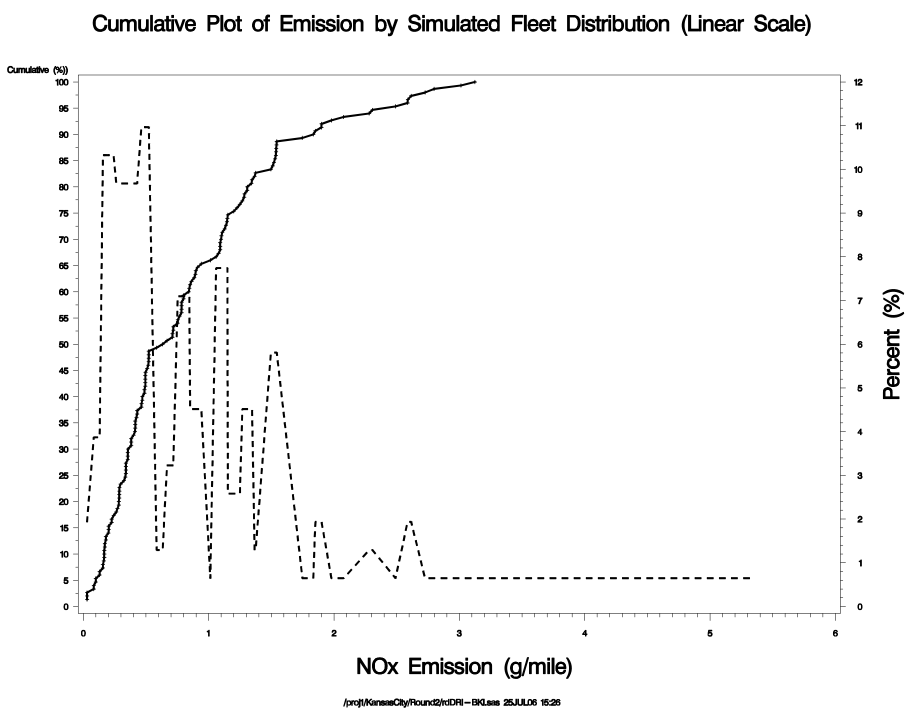


Figure 4-79. Round 2 Plots of % Projected-Fleet Distribution of Composite NO_x

Table 4-25. Round 1 Vehicle Distribution by Vehicle Type and Model Year Group

Stratum	Year of Make	VEHTYPE	KC DMV Vehicle %	Project Goals	Goal of Round 1	Round 1 Actual Tested	Round 1 and Its Duplication for Simulating of KC Fleet Distribution**
1	Pre-1981	TRUCK	1.20%	30	16	2	5(3)
2	1981-1990	TRUCK	3.70%	50	26	14	17(3)
3	1991-1995	TRUCK	4.40%	50	26	18	20(2)
4	1996 up	TRUCK	11.60%	75	39	36	52(16)
5	Pre-1981	CAR	2.20%	30	16	6	10(4)
6	1981-1990	CAR	10.70%	100	51	48	48(0)
7	1991-1995	CAR	18.00%	65	34	45	81(36)
8	1996 up	CAR	48.20%	80	42	98	216(118)
Total			100%	480	250	267	449(182)

** Number in parenthesis presents the duplicated records from that specific bin.

During Round 2, 291 LA92 tests were performed, excluding the 12 control vehicle tests. Using both the Kansas City fleet distribution for each stratum and the actual Round 2 stratum distribution, Kansas City fleet simulation can be achieved as shown in Table 4-26. Again, this simulation is applied here for QA/QC purposes only, not for modeling purposes.

Table 4-26. Round 2 Vehicle Distribution by Vehicle Type and Model Year Group

Stratum	Year of Make	VEHTYPE	KC DMV Vehicle %	Project Goals	Goal of Round 2	Round 2 Actual Tested	Round 2 and Its Duplication for Simulating of KC Fleet Distribution **
1	Pre-1981	TRUCK	1.20%	30	10	9	7(-2)
2	1981-1990	TRUCK	3.70%	50	37	29	21(-8)
3	1991-1995	TRUCK	4.40%	50	30	31	16(-15)
4	1996 up	TRUCK	11.60%	75	47	50	20(-30)
5	Pre-1981	CAR	2.20%	30	15	14	12(-2)
6	1981-1990	CAR	10.70%	100	34	36	36(0)
7	1991-1995	CAR	18.00%	65	36	37	36(-1)
8	1996 up	CAR	48.20%	80	27	29	72(43)
Total			100%	480	236	235	220(-15)

** Number in parenthesis presents the duplicated records from that specific bin.

4.5 Evaluation of Exhaust $PM_{2.5}$ Mass Measurements

DRI installed and operated a suite of instruments to provide continuous PM data during the Kansas City Light-Duty Gasoline Vehicle Emission Characterization Study. The instruments provided by EPA and operated by DRI included a Booker Systems Model RPM-101 Quartz Crystal Microbalance (QCM) manufactured by Sensor's, Inc. and a MIE, Inc. DataRAM4 nephelometer for PM mass. In addition, DRI operated a photoacoustic instrument for determination of BC mass concentrations (Arnott, Zielinska et al. 2004) and a TSI DustTrak. This section compares the continuous PM data to the corresponding time-integrated gravimetric mass data. Data from the real-time sensors were also used to examine PM emission rates under varying vehicle operating conditions and to monitor the blank levels in the dynamometer dilution tunnel during the purge cycle prior to each vehicle test.

4.5.1 Introduction

One objective of the study is to evaluate the performance of the Sensor's Inc. QCM as a component of a portable emission monitor. Although the QCM is a highly sensitive measure of cumulative mass, it has a limited dynamic range which requires adjustable dilution rates. In actual application, the dilution ratios would be continually adjusted as required. The dynamometer testing provided an opportunity to evaluate the QCM with other measurement methods under controlled conditions for a large range of emission rates.

Motor vehicle manufacturers have a long history of interest in measurement of BC emissions from vehicles with use of the photoacoustic method (Roessler 1984). A more recent study evaluated methods for continuous measurement of PM from light duty diesel vehicles tested on a dynamometer (Moosmüller, Arnott et al. 2001a; Moosmüller, Arnott et al. 2001b). The key findings of this work were that the time-averaged tapered-element oscillating microbalance (TEOM) data showed close correlation with $PM_{2.5}$ measurements using Teflon filters. The TEOM had considerably more noise than the DustTrak nephelometer also used for $PM_{2.5}$ measurement, though the DustTrak showed variable correlation with Teflon filter mass with the key dependence related to the amount of organic carbon in the exhaust and very likely, the change in particle size with vehicle model year. Photoacoustic (PA) measurements of BC were found to correlate well with elemental carbon measurements accomplished thermal optical reflectance analysis using the IMPROVE protocol (Chow, Watson et al. 1993) (TOR-IMPROVE) for the definitions of the various OC and EC stages as well as the correction for optical pyrolysis. An efficiency factor was obtained for converting aerosol light absorption measurements by the photoacoustic method to BC such that for light duty diesel vehicles, BC = EC. The instrument suite of TSI DustTrak and Thermo Electron Corporation DataRAM4 nephelometers for total PM, and DRI photoacoustic instrument for BC mass concentration were deployed during the study reported on here. DRI also was responsible for operation of the quartz crystal microbalance, though responsibility for final data analysis and reduction lies with the EPA.

4.5.2 Measurement Methods

DRI installed and operated a suite of instruments including the Photo-Acoustic BC Analyzer, QCM, TSI DustTrak, DataRAM4, and Filter Sample Holders to provide continuous

PM analysis and to collect batch samples of particle and gaseous exhaust components for later analysis in accordance with the methods and procedures specified in DRI's QAPP (June 23, 2004). These instruments collected sample air from the dynamometer dilution system via two isokinetic probes, provided by BKI and EPA, inserted within 5 cm of the center-line of the CVS dilution tunnel prior to a 90-degree bend in the dilution tunnel. Figure 2-4 illustrates the sample train as it was installed during the tests. Heated conductive lines carried air from the probes to the continuous instruments. Insulated copper tubing was used to carry sample air to the time-integrated samplers.

4.5.2.1 Gravimetric Mass Measurements

Unexposed and exposed Teflon-membrane filters were equilibrated at a temperature of 20 ± 5 °C and a relative humidity of 30 ± 5% for a minimum of 24 hours prior to weighing. Weighing was performed on a Sartorius SE2 electro microbalance with ± 0.0001 mg sensitivity. The charge on each filter is neutralized by exposure to a polonium source for 30 seconds prior to the filter being placed on the balance pan. The balance is calibrated with a 20 mg Class M weight and the tare is set prior to weighing each batch of filters. After every 10 filters are weighed, the calibration and tare are re-checked. If the results of these performance tests deviate from specifications by more than ± 5 mg, the balance is re-calibrated. If the difference exceeds ± 15 mg, the balance is recalibrated and the previous 10 samples are re-weighed. At least 30% of the weights are checked by an independent technician and samples are re-weighed if these check-weights do not agree with the original weights within ± 0.015 mg. Pre- and post-weights, check weights, and re-weights (if required) are recorded on data sheets as well as being directly entered into a data base via an RS232 connection. All $PM_{2.5}$ and PM_{10} Teflon filters were analyzed for mass and all weights entered by filter number into the DRI aerosol data base.

4.5.2.2 Continuous PM Measurements

The Quartz Crystal Monitor has had extensive use in monitoring atmospheric aerosol (Daley and Lundgren, 1975). More recently this monitoring concept has been adapted for use in measuring particulate emissions in real-time from vehicles (Dickens and Booker, 1998, Booker, 2001). For the Kansas City Project, a sampling system and QCM optimized for real-time vehicle particulate mass emissions were integrated in a cart at Sensors, Inc. A general description of the cart components and their use in the KC vehicle sampling system is found in Section 2.3.1.

Figure 4-80 provides a schematic of the QCM sensors used in the cart system. Sample air derived trough the FCS valve system is drawn through the QCM by a flow controlled sample pump at a nominal rate of 1 lpm. Sample air is passed through a high voltage corona where charge is deposited on the sample air particulates. These are then precipitated on a metal clad quartz piezoelectric crystal where they are collected. The crystal is excited to vibrate at its resonant frequency that is a function of collected mass. The greater the mass, the lower the resonant frequency. The frequency to mass relationship is:

$$d(-\Delta f)/d(\Delta m/A) = 2f^2/\delta_q c = S$$

where f is the crystal resonant frequency, Δf the change in frequency due to a change in mass per unit area on the crystal $\Delta m/A$, δ_q is the density of the quartz, c is the shear wave velocity perpendicular to the crystal surface and S is the sensitivity. The mass sensitivity for the QCM is typically 150 Hz/ug. Using the change in frequency, deposited mass can be determined in real-time and, with the measured sample flow, the measured mass concentration can be determined.

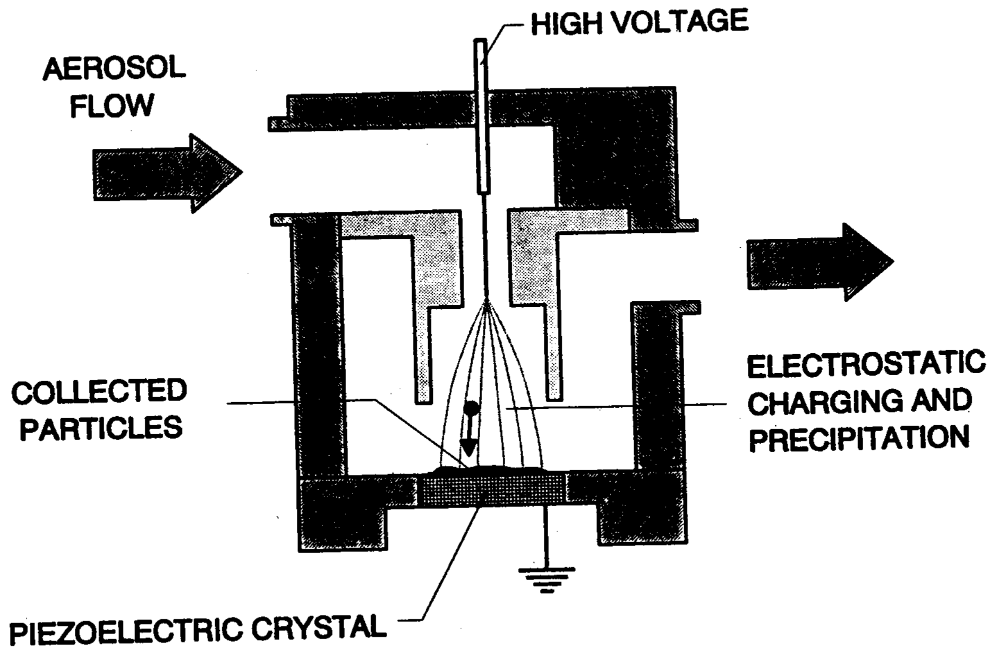


Figure 4-80. Schematic of the QCM.

The Kansas City Project consisted of two Rounds of measurements. For Round 1, 355 separate tests were conducted during which the QCM was used to measure vehicle particulate emissions. For Round 2, 384 separate tests were conducted. Figure 4-81 depicts an example trace of particulate mass collected by the QCM during one of these tests. The trace illustrates the three parts of each test: Phase 1, Phase 2, Hot Soak, and Phase 3. The procedures used in obtaining each part of this trace are indicated on the figure by letters and described below:

A. The quartz crystal is removed from the QCM and cleaned using ethanol. The crystal is then placed back in the QCM. The operator initiates a recording cycle and filtered air is supplied to the QCM through the FCS valve unit. During this period the excess moisture evaporates and the crystal temperature equilibrates. Usually a period of 15 min. is required for complete drying and equilibration.

B. Filtered sample air from the CVS is supplied to the QCM through the FCS valve unit. Quite often not enough time was permitted to remove moisture and permit the crystal to reach thermal equilibrium so the settling of the mass trace was not complete before the test was started. To correct for this, the following functional form is fitted to the trace of part B during data reduction and extrapolated values are used to correct QCM mass in part C, Phase 1 and Phase 2:

$$\text{Correction Mass} = a\,(\text{Time})^2 + b\,(\text{Time})$$

C. During Phase 1 and Phase 2 of the test, sample air from the CVA is supplied to the QCM through the FCS. Under computer control, the cart operator has the option of providing diluted or undiluted sample air to the QCM.

D. Part D of the trace is the Hot Soak. Here the same functional form is used to fit the mass trace. The result is then used to correct QCM mass trace in part E, Phase 3.

E. This is the mass trace for Phase 3. The same level of dilution is used here as that for Phase 1 and Phase 2.

F. Filtered sample air from the CVS is again supplied to the QCM through the FCS valve unit.

G. During this part of the test, the FCS unit switches filtered ambient air to the QCM in preparation for the next test.

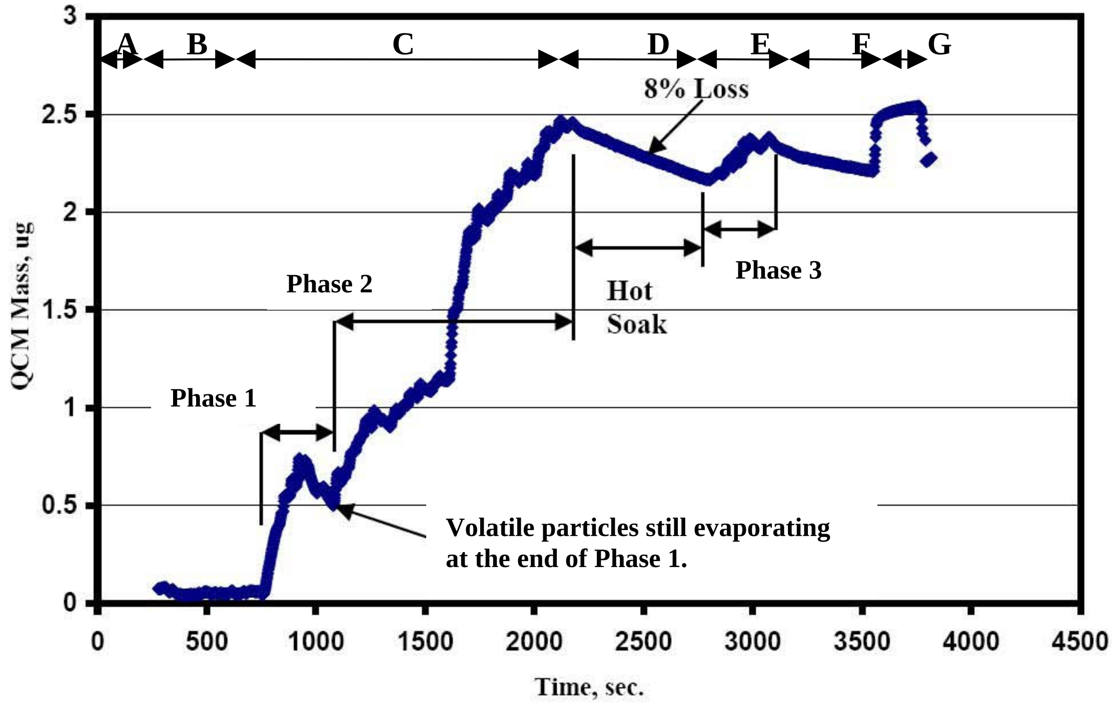


Figure 4-81. Example mass trace from the QCM analyzer.

Note that the trace shows definite loss of mass from the QCM due to loss of volatile particle constituents. This is as much as 8% from the particulate collected during Phases 1 and 2.

During each test, the Computer Control/Data Acquisition System records several parameters from the QCM Cart system. These are recorded in a data file and are listed for Round 1 in Table 4-27. During Round 1, dew point was recorded by the Viasala in a separate file.

Table 4-27. Parameters Recorded by the QCM System Computer Control/Data Acquisition System During Round 1 Tests.

Parameter	Unit	Parameter	Unit	Parameter	Unit
Date	mm/dd/yyyy	Inlet Temp.	°C	Diution Ratio	num.
Start Time	hr:min:sec	Block Temp.	°C	StDEV Dilution Ratio	num.
Time	sec.	Ref Crystal Temp.	°C	Heated Line 1 (opt.)	°C
Mass	µg	Baseline Logic (opt.)	num.	Heated Line 2 (opy.)	°C
QCM Flow	lpm	Tare Freq	Hz	Pressure Temp 1 (C)	°C
Corona Current	µA	Frequency	Hz	Pressure Temp 2 (C)	°C
StDEV Corona Current	µA	Pressure zone 4	psi	Inlet Temp (C)	°C
HV Volt	kV	Pressure zone 5	psi	QCM Pump Status	on (1), off(0)
StDev HV Volts	kV	Time	sec.	QCM Corona Status	on (1), off(0)
Raw Conc.	mg/m^3	MPS Major Flow	lpm	FCS Position	num.
Conc.	mg/m^3	MPS Minor Flow	lpm	TTL 1 (from BKI)	mv
Crystal Holder Temp.	°C	MPS Needle Flow	cc/sec.	TTL 2 (from BKI)	mv

Raw Conc. and Conc. are nominal concentrations using the QCM flow and mass results. The other parameters are used to monitor internal QCM operation and provide information during instrument trouble-shooting. During Round 2, additional parameters were recorded. These are summarized in Table 4-28. Added to the parameter list are the relative humidity (RH) and the RH temperature. For both Rounds 1 and 2 the QCM recorded data with a time resolution of 1.5 sec.

Table 4-28. Parameters Recorded by the QCM System Computer Control/Data Acquisition System During Round 2 Tests.

Parameter	Unit	Parameter	Unit	Parameter	Unit
Date	mm/dd/yyyy	Block Temp.	°C	FCS Position	num.
Start Time	hr:min:sec	Ref. Crystal Temp.	°C	Time	sec.
Time	sec.	Baseline Logic (opt.)	num.	MPS Major Flow	lpm
Mass	µg	Tare Freq	Hz	MPS Minor Flow	lpm
QCM Flow	lpm	Frequency	Hz	MPS Needle Flow	cc/sec.
Corona Current	µA	Pressure Zone 4	psi	Diution Ratio	num.
StDEV Corona Current	µA	Pressure Zone 5	psi	StDEV Dilution Ratio	num.
HV Volt	kV	RH	%	Heated Line 1(opt.)	°C
StDev HV Volts	kV	RH Temp	°C	Heated Line 2 (opt.)	°C
Raw Conc	mg/m^3	TTL 1	mv	Pressure Temp. 1	°C
Conc	mg/m^3	TTL 2	mv	Pressure Temp. 2	°C
Crystal Holder Temp.	°C	QCM PUMP Status	on (1), off(0)	Inlet Temp.	°C
Inlet Temp.	°C	QCM Corona	on (1), off(0)		

The Photo-Acoustic BC Analyzer, TSI DustTrak, DataRAM4, and Filter Sample Holder part of this instrument suite was previously evaluated in an earlier study of the emissions from light duty diesel trucks on a dynamometer (Moosmüller, Arnott et al. 2001a; Moosmüller, Arnott et al. 2001b). In brief, the findings of this previous work were derived from the comparison of traditional filter samples of PM and EC with time averages obtained from these real-time instruments. The DustTrak, being an optical measurement method, had sensitivity to both particle composition and size. Photoacoustic measurements of BC agreed quite favorably with EC measurements obtained from the Improve Protocol Thermal Optical Reflectance (TOR) measurement obtained from samples collected on quartz filters. TOR analysis is described in (Chow, Watson et al. 1993). With 1-second time constants the precision of the DustTrak and photoacoustic instrument are 1 µg m^{-3}.

Nephelometers like the DustTrak are designed to measure the light scattered by particles. While these instruments in general have performance issues associated with angular truncation and non-ideality in the detectors (Anderson and Ogren 1998), the angular response of the nephelometers used in this study has not been reported in the literature. Figure 4-82 indicates the mass-weighted scattering efficiency as a function of particle size for a wavelength of 760 nm, pertinent to the DustTrak nephelometer. Note that if the DustTrak were a perfect instrument for measuring particle mass the mass scattering efficiency curve would be a constant value and there would be no composition dependence. The DustTrak mass calibration factor is determined by the manufacturer using an ISO standard Arizona Road Dust having particle size distribution peak near 2 microns. However, typical combustion particles have mass weighted sizes near 0.3 microns, but because this size is about at the same value of mass scattering efficiency as the Arizona road dust value, and to the left of the peak of the curve shown in Figure 4-82, the DustTrak produces mass concentrations typically accurate to within a factor of 2. It should be noted that nephelometers are very sensitive to particles of sizes larger than about 0.1 to 0.3

microns, depending on composition, but that their calibration as a mass standard is dependent especially on particle size as well as composition to a lesser extent (Sioutas, Kim et al. 2000).

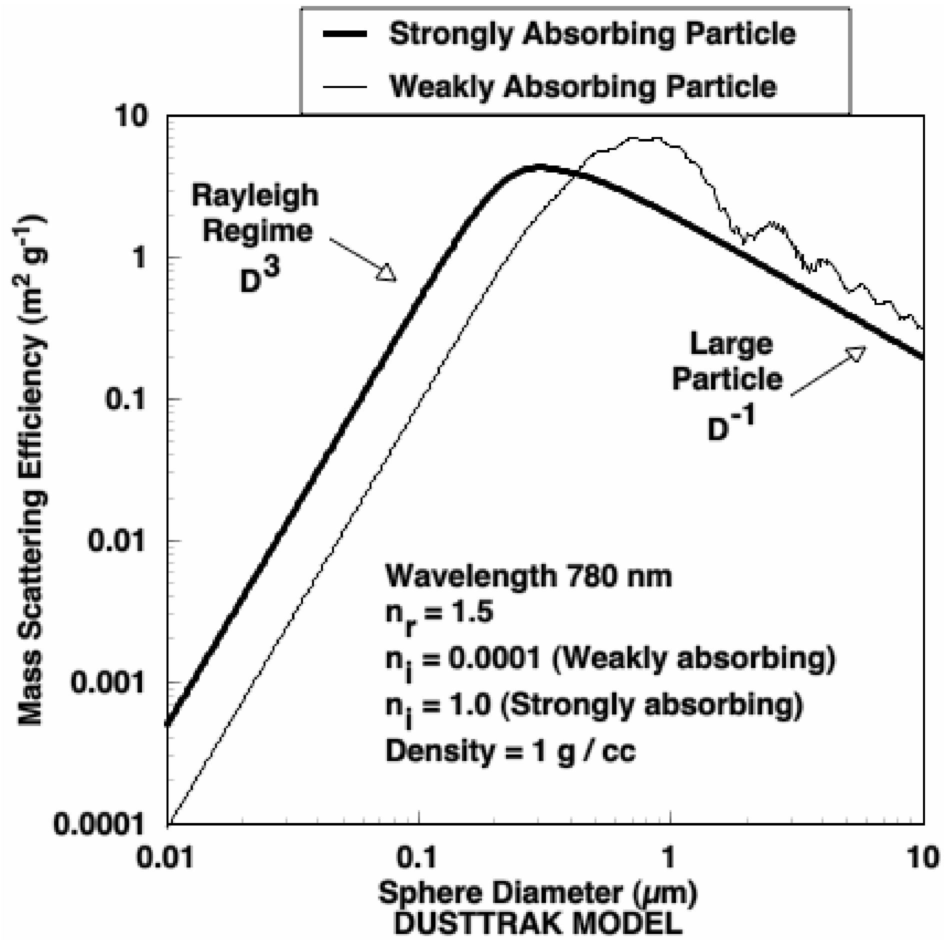


Figure 4-82. Theoretical mass scattering efficiency for a perfect nephelometer.

(Strongly absorbing particles such as BC are given by the thick curve and weakly absorbing particles such as organic carbon are given by the other curve.)

The Mie DataRAM4 (DR) manufactured by Thermo Electron Inc is a more sophisticated instrument than the TSI DustTrak (DT). The DR measures light scattering at two wavelengths, such as 880 nm and 760 nm. The use of two wavelengths allows for better knowledge of particle size as it relates to the mass scattering efficiency factor shown in Figure 4-82. The curves in Figure 4-82 were computed for a wavelength of 760 nm. If they were computed for a wavelength of 880 nm, the peak in the curves would be shifted to the right, so that for combustion size particles, the 880 nm scattering amount would be less than the 760 nm amount. The ratio of these two values would give a measure of particle size.

Photoacoustic instruments have been used in source sampling of BC aerosol. Sample air is pulled continuously through an acoustical resonator and is illuminated by laser light that is periodically modulated at the acoustical resonance frequency. Light absorption is manifested in particle heating and this heat transfers rapidly to the surrounding air, inducing pressure fluctuations that are picked up with a microphone on the resonator. Microphones have a very large dynamic range (at least 6 orders of magnitude), so BC measurements can be made over a large dynamic range with these instruments. The advancement that has been very important for the continued success of these instruments is the ability to measure very low levels of light absorption. Aerosol light absorption at visible and near IR wavelengths occurs throughout the entire particle volume for typically submicron combustion particles, so BC aerosol mass concentration is found to vary in direct proportion with light absorption. Vehicle manufactures pursued these methods in the 1970's and 1980's using bulky Argon Ion lasers and dye lasers (Terhune and Anderson 1977; Japar and Killinger 1979; Japar and Szkarlat 1981a; Japar and Szkarlat 1981; Japar, Szkarlat et al. 1984; Roessler 1984), and a resurgence of interest has emerged in research laboratories that coincides with technological developments in compact, efficient laser sources (Petzold and Niessner 1994; Petzold and Niessner 1995; Arnott, Moosmüller et al. 1999; Moosmüller, Arnott et al. 2000).

The photoacoustic instrument developed for this work operates at a convenient wavelength of 1047 nm where gaseous interference is not a problem and where a laser source is available that allows for direct electronic modulation of the power at the resonator frequency. The acoustical resonator, shown schematically in Figure 4-83, was designed for compactness, ease of reproducibility in manufacture, and robustness with respect to use of the instrument in very noisy, dirty sampling environments (Arnott, Moosmüller et al. 2003). The instrument comprises two identical coupling sections, and a third resonator section. These parts are manufactured out of aluminum. The coupling sections allow the laser beam to enter the instrument through windows well separated from the resonator section. The sample inlets and outlets are followed by cavities that are tuned to reduce the coupling of noise into the resonator section. The resonator section has a horizontal tube that is 1/2 of an acoustic wavelength long, and two vertical tubes that are 1/4 of an acoustic wavelength long. In previous designs (Arnott, Moosmüller et al. 1999), the vertical tubes were at an angle of 45 degrees to the horizontal instead of 90 degrees as they are now, and the tubes were formed from pipe rather than machined with precision. The 90 degree angles allow for symmetry when deciding where the holes in the resonator are placed to allow for laser beam and sample air passage. The piezoelectric transducer is used as a sound source to occasionally scan the resonator resonance frequency and quality factor for use in calibrating the instrument from an acoustical perspective. The microphone and piezoelectric transducer sit at pressure antinodes of the acoustic standing wave, and the holes in the resonator are at pressure nodes. The instrument is bolted together in three parts for easy disassembly in case it needs to be cleaned. The laser beam passes through the windows and the holes in the resonator section. The laser beam pumps the acoustic wave through light absorption, and the transfer of the associated heat to the surrounding air, in the resonator section.

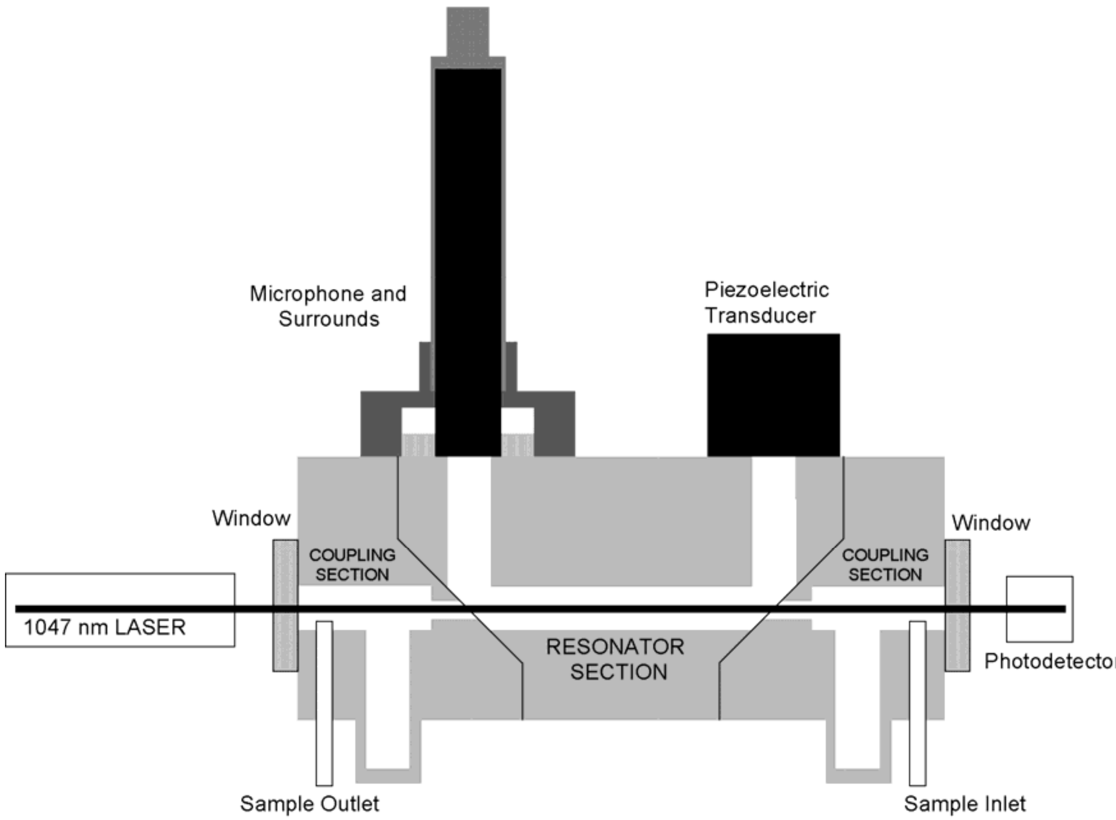


Figure 4-83. Schematic of the photoacoustic instrument.

The photoacoustic instrument measures the aerosol light absorption coefficient (Arnott, Moosmüller et al. 1999; Arnott, Moosmüller et al. 2000), and then a quantity defined as BC is computed from the absorption coefficient. The EC part of the exhaust absorbs light at 1047 nm much more strongly than any other common particulate aerosol in exhaust and in the atmosphere so that it is reasonable to associate elemental carbon with aerosol light absorption. Why is it reasonable to associate aerosol light absorption with a BC mass concentration (BC)? Because aerosol light absorption occurs throughout the entire particle volume for sufficiently small particles and large wavelengths of light, giving rise to a direct proportionality between the absorption measurement and the aerosol mass for typical combustion particle of typical size, and for the 1047 nm wavelength used in the instrument. It is perhaps inevitable to speculate that the aerosol complex refractive index could vary with combustion source (Dalzell and Sarofim 1969) (Fuller, Malm et al. 1999), so that the BC measured values could be different for particles actually having the same numbers of carbon atoms in them. It is also possible to postulate that aerosol coatings or adsorbents, or particle morphology, could also give rise to different absorption coefficients than one would observe for uncoated particles. Experiences to date have shown that for an emission source such as a late model diesel that is rich in EC, the IMPROVE protocol method of quantifying EC (Chow, Watson et al. 1993) correlates well with the aerosol light absorption measurement at 1047 nm.

The following relationship is used to obtain BC concentration from the aerosol light absorption measurement at 1047 nm:

$$BC\ (\mu g\ m^{-3}) = 5\ (m^2\ g^{-1})\ B_{abs}\ (Mm^{-1})\ \{\text{measured at 1047 nm}\}\ . \quad (1)$$

This relationship represents diesel emissions. EC from diesels provide a relatively unambiguous measurement from the various protocols and methods that have been developed though ambient and wood smoke samples have substantial differences (Watson, Chow et al. 1994; Chow, Watson et al. 2001). The relationship of these measurements to spark-ignition engines is discussed in Section 4.4.3.5, Evaluation of Continuous Optical Mass Measurements.

4.5.3 Results

4.5.3.1 Evaluation of Gravimetric Mass Measurements

The gravimetric mass data were corrected for transport field blanks only (i.e., dilution tunnel blanks have not been applied). The field blanks were collected weekly. In each case, the filters were installed in the sampler and immediately removed and placed back in their sealed storage bags. The field blanks are shown in Figure 4-84 in the sequence that they were collected during Round 1. They range from 1.1 to 9.9 μg/filter with an average of 5.4 and standard deviation of 3.4 μg/filter. This compares to the measurement uncertainty for these filters of 4.6 μg/filter, which is determined by replicate measurement by a second technician of 30% of the pre-weights and 100% of the post weights. The relatively large tare weight of the Teflon filter (~150 mg/filter) is a limiting factor in the measurement uncertainty. Since the average field blank is comparable to the measurement uncertainty, we subtracted the mean value of the transport field blanks to all samples rather than apply week-specific blanks. The loadings on the sampled Teflon filter prior to subtraction of the average transport field blank value are substantially higher than the field blanks with the exception of Strata 4 and 8 during Phase 3 of the test cycle.

EPA pointed out an apparent temporal pattern in the gravimetric mass results for the weekly field blanks collected during Round 1 (shown in Figure 4-84) which indicates that it may not be appropriate to use an average of all field blank masses to correct the test data. The vertical dashed lines divide the filters into three groups corresponding to how the filters were packaged for transport to and from the sampling site (a fourth group of three field blanks were collected but were damaged by flooding of the test facility). The third group exhibits consistently higher mass gain than the other two. Although this appears to suggest that some change in sampling conditions occurred during that 3 week period, the mass gains for the three filters are too uniform (9.3 ± 0.7 ug) to be explained by contamination of the media and there is no corresponding increase in any of the elements measured by XRF or in the carbon fractions on the corresponding quartz filters. Note that despite the noticeable increase in mass for the last three blanks, the differences from the rest of the blanks are not significant (bars indicate the 1 sigma uncertainty).

On further investigation we determined that the post-sampling weighing of that group of filters was performed 2 months after gravimetric analysis had been completed on all other samples from Round 1. This occurred due to a clerical error (the filters were mistakenly identified as void by the lab because they had originally been tagged for a vehicle test that was cancelled). The filter packs were packaged in sets of three pairs of Teflon and quartz filters for the three Phases of the test. The three pairs from this pack were used for the three successive field blanks at the end of Round 1. A change in weighing conditions is an alternative explanation that would need to be considered under this situation.

In order to monitor changes in weighing conditions, a media blank is selected from each group of 50 filters during pre-sampling analysis and is post-weighed along with the field samples using the same conditioning protocols. The resulting net gravimetric mass data for the media blanks during Round 1 are presented in Figure 4-85 both chronologically and sorted to show the distribution of values. The changes in mass on the media blanks are comparable in range to the field blanks.

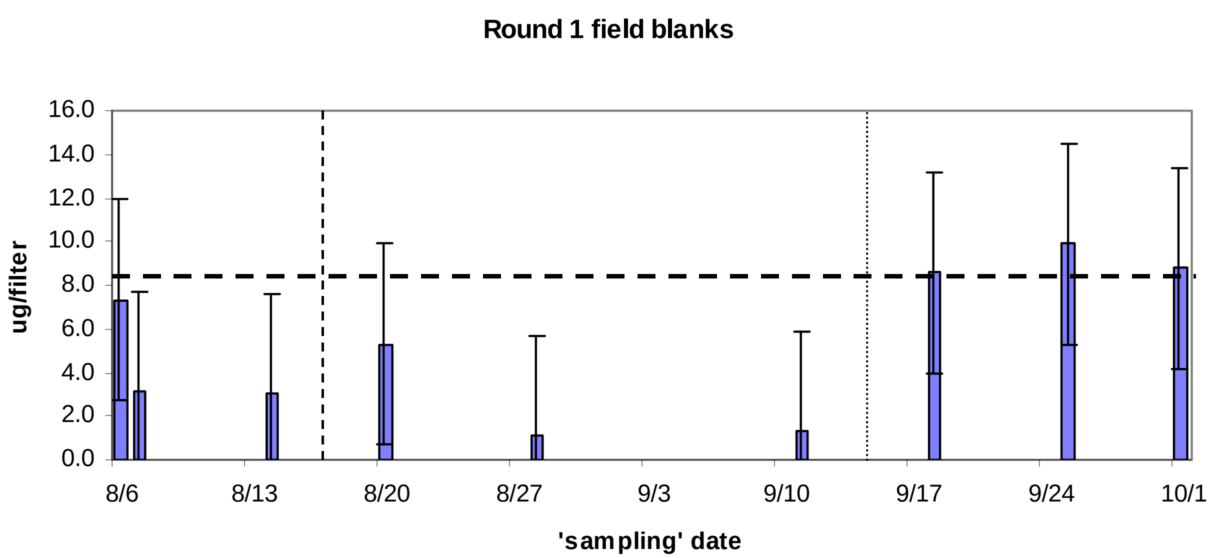
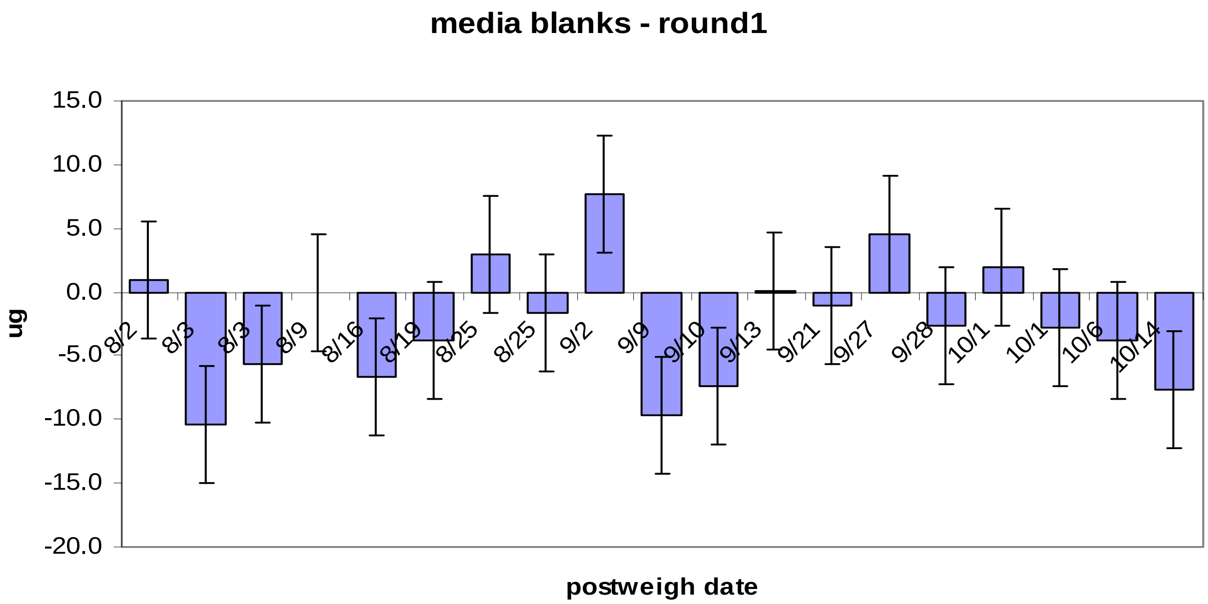


Figure 4-84. Field blanks for gravimetric mass during Round 1 of the Kansas City Study in µg/filter.



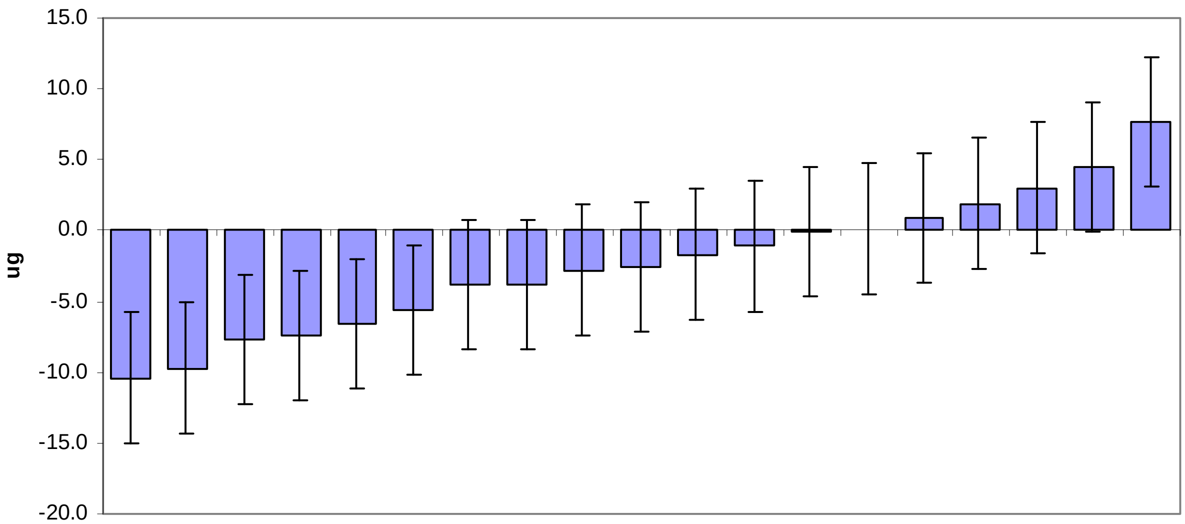


Figure 4-85. Round 1 Media Blanks.

(Net gravimetric mass data (µg/filter) for media blanks during Round 1 are shown chronologically in the top plot and sorted to show the distribution of values in the bottom plot. Note that the changes in mass on the media blanks are comparable in range to the field blanks.)

Unless we can discover some correctable discrepancy in the analysis procedures used for the three high field blanks (group 3) relative to that employed for the rest of the samples, the field blank data from group 3 should be considered invalid. Since there is no significant difference between the other two groups of field blanks, and all are below the "MDL" of the gravimetric analysis (twice the standard deviation of the control weights) indicated by the horizontal dashed line, we feel it is more appropriate to use the average mass of these six blanks to correct all of the test samples and dilution tunnel blanks. Eliminating the three suspect field blanks reduces the correction from 5.4 to 3.5 μg (equivalent to about 0.6 mg/mi for a Phase1 sample). This approach is consistent with the standard procedures used by DRI's Environmental Analysis Facility for other projects. However, many of the samples have measured mass below this average field blank value as shown in the histogram in Figure 4-86 of the uncorrected gravimetric mass for all Phase 3 filter samples.

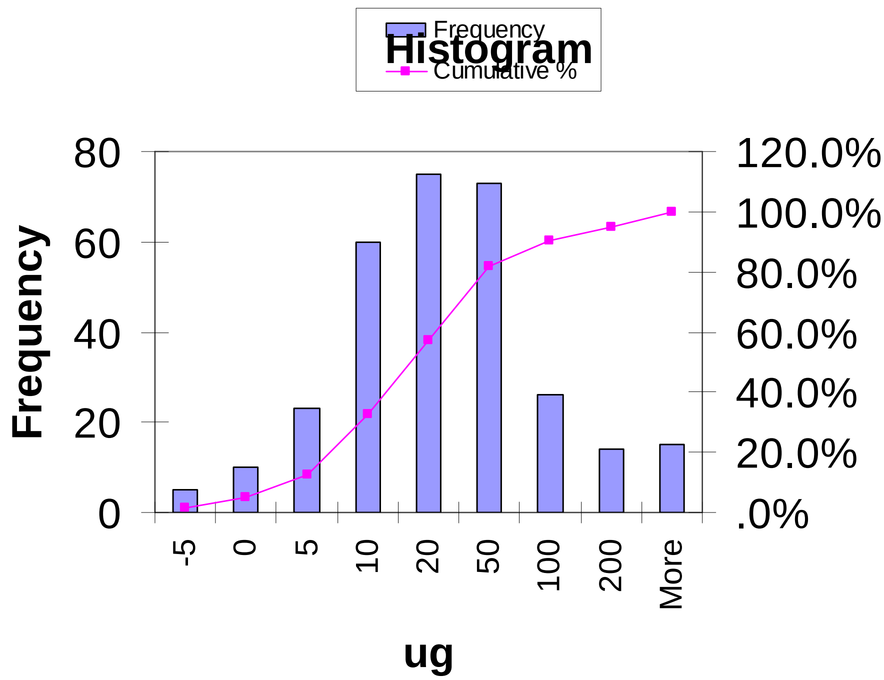
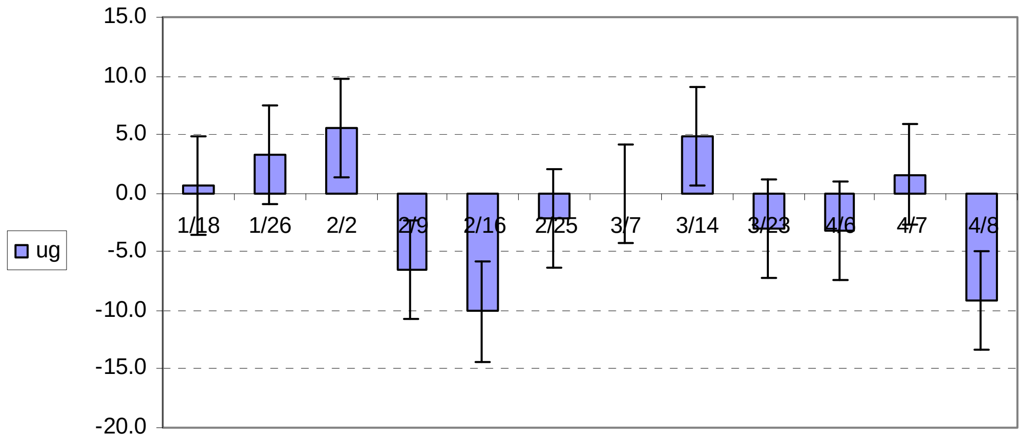


Figure 4-86. Histogram of uncorrected gravimetric mass for Phase 3 filter samples from Round 1.

Alternatively, we could have eliminated the field blank correction to gravimetric mass altogether, since the field blank masses are consistent with the range of mass measured for media blanks and therefore indistinguishable from the random measurement error. Field blanks for Round 2 are also very similar to the media blanks, with an average value of -1.5 ± 1.2 ug. They are shown in Figure 4-87 chronologically and sorted. Not correcting for field blanks would be consistent with what is done in the Speciation Trends Network (STN) and IMPROVE aerosol monitoring networks.



field blanks - round 2

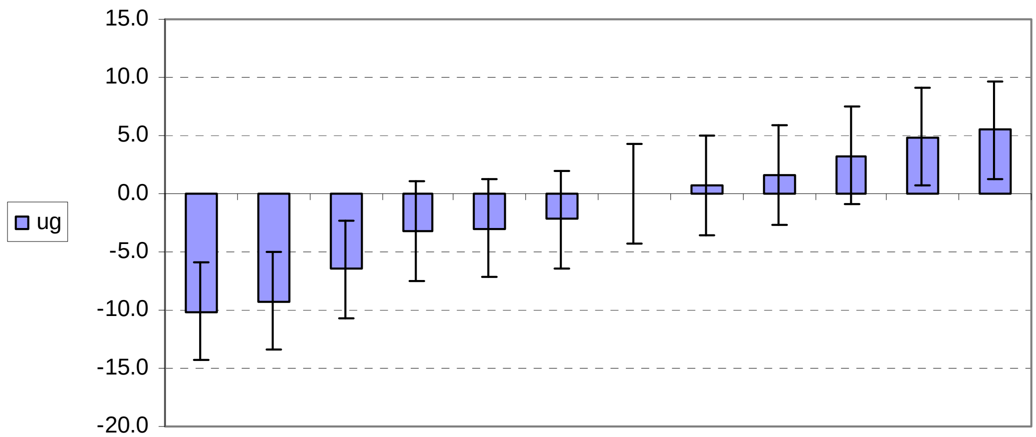


Figure 4-87. Round 2 Media Blanks.

(Net gravimetric mass data (ug/filter) for field blanks during Round 2 are shown chronologically in the top plot and sorted to show the distribution of values in the bottom plot. Note that the changes in mass on the field blanks are comparable in range to the media blanks shown in Fig. 4-13.)

DRI's gravimetric mass measurements were compared to those made by EPA's laboratory in Ann Arbor as part of quality assurance for the study. A batch of 21 Teflon filters were sent to EPA for pre-weights and returned to DRI for determination of the pre-weights. The filters were then sent to Kansas City and 15 of the filters were sampled during the week of 2/14. Five sets of three Teflon filters (one for each phase) were collected for this comparison study: twice for the correlation vehicle (Ford Taurus) and three other vehicles with varying particulate emission rates. Six samples were treated as field/transport blanks. From three of the blanks, DRI removed a tiny portion from each filter ring that is comparable to the magnitude of weight changes from actual sampling. Unlike an actual sample, this change in weight would not be subject to variations that might result from potential desorption of SVOCs. DRI determined post weights for the 21 comparison filters and sent the filters to EPA for post weights. Mass measurements were sent to an independent third party. Upon receipt of data from both groups, both data sets were sent to EPA and DRI simultaneously. The scatter plot of gravimetric mass measurements by EPA and DRI and absolute differences in Figure 4-88 again show that these differences are mostly below the limit of detection.

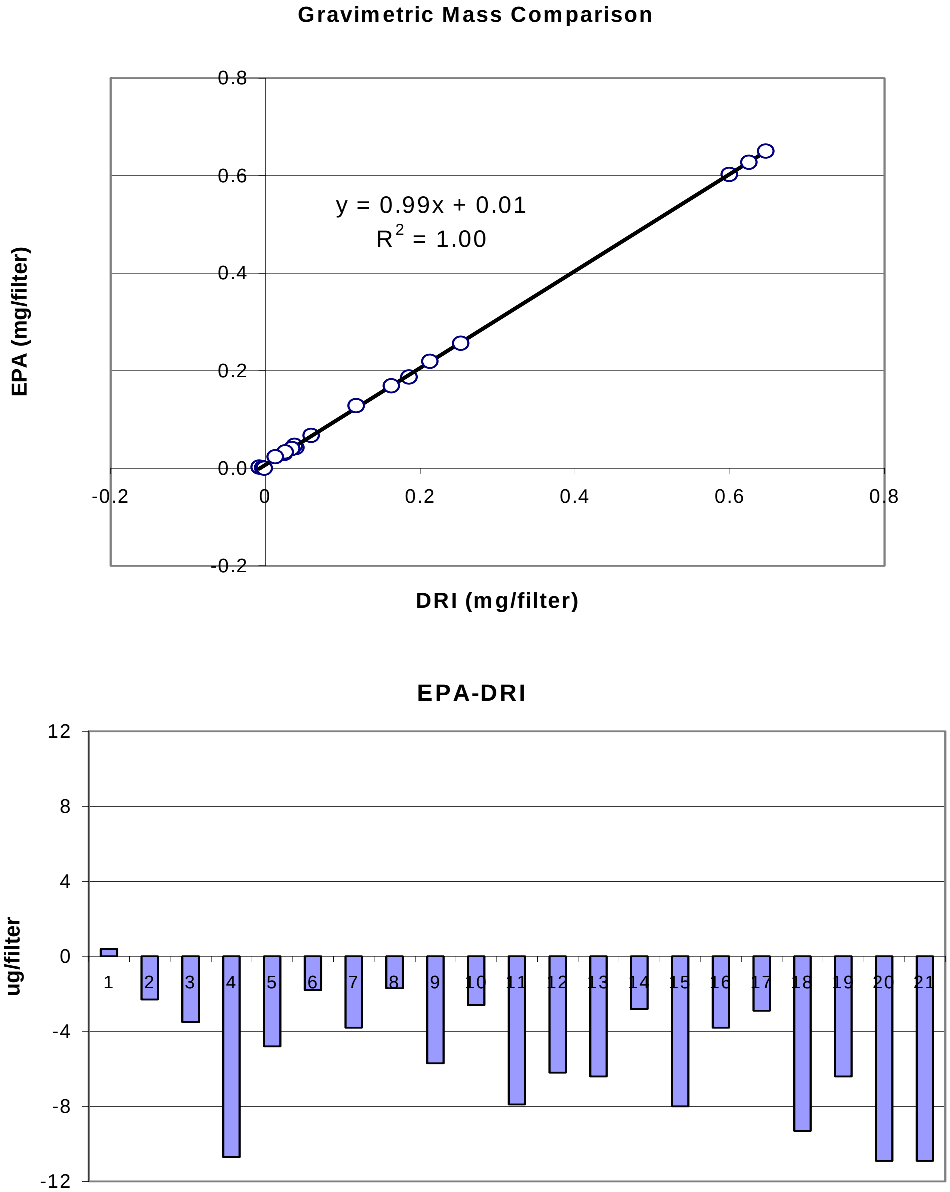


Figure 4-88. Gravimetric Mass Comparison.

(Scatterplot of gravimetric mass measurements by EPA and DRI (top panel) and absolute differences in ug/filter (lower panel). Differences are mostly below the limit of detection of 8 μg/filter)

A second round of interlaboratory gravimetric mass measurement comparisons was done during Round 2, due to an error in handling the data from the first comparison that invalidated the "double blind" nature of the experiment. In the second comparison; five unused Teflon filters were weighed by each lab, then a small punch was removed from the support ring of 3 of the filters and they were re-weighed by each lab. The results, shown in Table 4-29 and Figure 4-89, again indicate that there is no significant bias in the gravimetric mass measurements, and all differences in measured mass fall within the range of analytical uncertainty.

Table 4-29. Results of second gravimetric mass measurement interlaboratory comparison.

Pre DRI-EPA		Post DRI-EPA		Pre-Post			
Diff	**RPD**	**Diff**	**RPD**	**DRI**	**EPA**	**DRI-EPA**	**RPD**
0.0150	0.009%	0.0155	0.009%	-0.0002	0.0003	-0.0005	
0.0174	0.010%	0.0189	0.011%	-0.0013	0.0002	-0.0015	
0.0184	0.011%	0.0197	0.012%	0.7069	0.7082	-0.0013	-0.18%
0.0166	0.010%	0.0220	0.013%	0.9637	0.9691	-0.0054	-0.56%
0.0177	0.011%	0.0224	0.014%	0.7459	0.7506	-0.0047	-0.63%

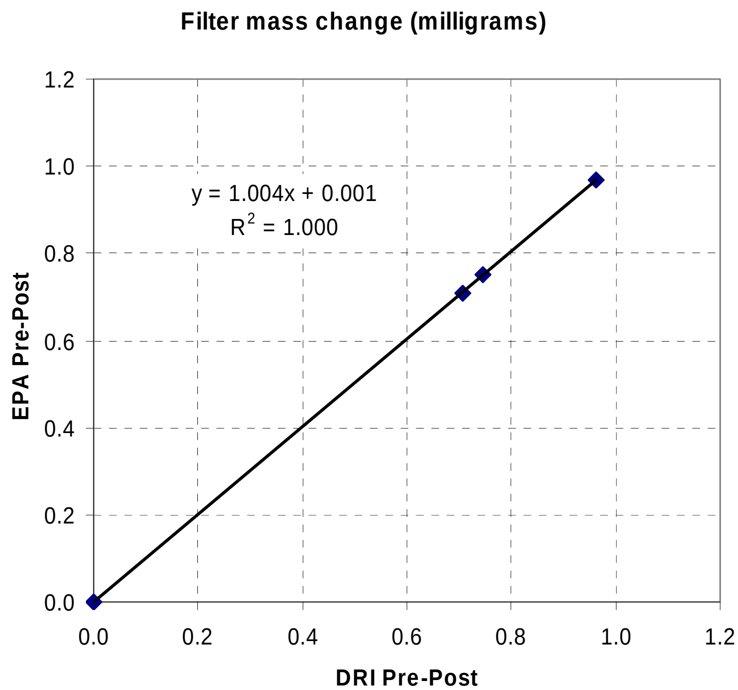


Figure 4-89. Results of second gravimetric mass measurement interlaboratory comparison.

4.5.3.2 Evaluation of QCM Mass Measurements

Analysis of the QCM data record for each test proceeded in steps. The first was correction of the QCM mass for volatile loss as mentioned in Section 4.4.2. The next was correction of the QCM mass for collection of water on the quartz crystal during the test. This was done using humidity measured in the QCM sample stream using the Vaisala, model M170 and applying a correction factor determined during the pre-test evaluation and calibration of the QCM.

After the QCM mass record is corrected, the measured particulate concentrations are calculated using moving a 10 second linear fit to the mass and sample flow data. This is a smoothing technique that is advanced in one second intervals. At this time continuous data recorded by the Photo-Acoustic instrument, DustTrak, DataRAM4, BKI Dynamometer (Dyno), and for the DRI integral filter measurements is imported by the QCM analysis program. Time alignment of these records is done using the TTL signals provided by BKI and recorded by the QCM and Photo-Acoustic systems and nominal time delays determined from sample flow through the CVS and the sample transport system for the continuous instruments.

Using the total dilute volume (Vmix) and distance traveled from BKI's integral Dyno summary record and vehicle speed and torque from the continuous Dyno record, both integral and continuous particulate mass emissions are determined. The results of this analysis for each test are recorded in two files. The first is a summary file containing the integral filter data and the reduced integral results from the continuous particulate instruments. The parameters reported in this file are summarized in Table 4-30. The second file, summarized in Table 4-31, contains the converted and time aligned data from all the continuous instruments. This includes both measured concentrations and vehicle emissions and is reported by test phase; ie. Phase 1, Phase 2, Hot Soak, and Phase 3. In addition, the FTP composite is reported for the instruments that measure particulate.

Table 4-30. Summary of Integral Parameters Reported for Each Test in both Round 1 and Round 2.

Parameter	Unit	Parameter	Unit	Parameter	Unit
File No		Dust Trak Bag 3 ave. conc.	Hg/m^3	model	
QCM Bag 1 ave. conc.	Hg/m^3	Data Ram Bag 1ave. conc.	Hg/m^3	Vehicle Type	car/truck
QCM Bag 2 ave. conc.	Hg/m^3	Data Ram Bag 2 ave. conc.	Hg/m^3	odometer	mi.
QCM Bag 3 ave. conc.	Hg/m^3	Data Ram Bag 3 ave. conc.	Hg/m^3	Bin No.	num.
QCM Bag 1 emissions	mg/mi	BC Bag 1 ave. conc.	Hg/m^3	replicate?	yes/no
QCM Bag 2 emissions	mg/mi	BC Bag 2 ave. conc.	Hg/m^3	Humidity Time Corr.	sec.
QCM Bag 3 emissions	mg/mi	BC Bag 3 ave. conc.	Hg/m^3	Humidity Correction	num.
QCM FTP Composite	mg/mi	Bag 1 DR	num.	QCM DELAY (No dilution)	num.
Volatile Fraction Bag1 and 2	num.	Bag 2 DR	num.	QCM Delay (With Dilution)	num.
Grav Bag1 emissions	mg/mi	Hot Soak DR	num.	PA Delay	sec.
Grav Bag2 emissions	mg/mi	Bag 3 DR	num.	Average Time (sec)	sec.
Grav Bag3 emissions	mg/mi	Grav Bag 1 ave. conc.	Hg/m^3	QC Code	*
Grav FTP Composite	mg/mi	Grav Bag 2 ave. conc.	Hg/m^3	Comment	*
Dust Trak Bag 1 ave. conc.	Hg/m^3	Grav Bag 3 ave. conc.	Hg/m^3		
Dust Trak Bag 2 ave. conc.	Hg/m^3	Model Year	yyyy		

Table 4-31. Summary of Reduced Data Reported for Each Test in Both Round1 and Round 2.

Parameter	Unit	Parameter	Unit	Parameter	Unit
Time All	sec.	Time Bag 1	sec.	Time PA	sec.
Mass All	µg	Conc. Bag 1	µg/m^3	Conc. PA	µg/m^3
Time Bag 1	sec.	Time Bag 2	sec.	Time Dust Trak	sec.
Mass Bag 1	µg	Conc. Bag 2	µg/m^3	Dust Trak Conc.	µg/m^3
Time Bag 2	sec.	Time HS	sec.	Time Data Ram	sec.
Mass Bag 2	µg	Conc. HS	µg/m^3	Data Ram Conc.	µg/m^3
Time HS	sec.	Time Bag 3	sec.	Time - Torque	sec.
Mass HS	µg	Conc. Bag 3	µg/m^3	Torque	Ft-Lbs/sec.
Time Bag 3	sec.	Time All	sec.	Time - Speed	sec.
Mass Bag 3	µg	Conc. All	µg/m^3	Speed	mph

In Table 4-30 a QC parameter is included as well as a comment field. The general intent is to indicate which files and parts of files should be voided, indicated by a prefix V, due to problems encountered during a test. A problem flag, indicated by a prefix F, was also used for the various instrument records. This is intended to signal that the data should be reviewed and analyzed to determine if it is valid before proceeding to use it. Table 4-32 summarizes the QC codes used in both Round 1 and Round 2 summary files

Tables 4-32. A Summary of QC Codes Used in the Integral Summary File.

Round 1

QC Codes	
FDP	DewPoint Problem Flag
VDP	Dewpoint Void
VD	Total Dyno Void
VD1,2,HS,3	Partial Dyno Void Phase(s)
FD1,2,HS,3	Dyno Problem Flag Phase(s)
VV	Vehicle Void
VQ1,2,HS,3	QCM Void Phase(s)
FQ1,2,HS,3	QCM Problem Flag Phase(s)
FPA	PA Problem Flag
FQPAD	QCM PA Dyno Flag
FTA	Time Alignment Flag
NAN	Not a Number
Cv	Control Vehicle (REFERENCE)

Round 2

QC Codes	
FDP	DewPoint Problem Flag
VDP	Dewpoint Void
VD	Total Dyno Void
VD1,2,HS,3	Partial Dyno Void Phase(s)
FD1,2,HS,3	Dyno Problem Flag Phase(s)
VV	Vehicle Void
VQ1,2,HS,3	QCM Void Phase(s)
FQ1,2,HS,3	QCM Problem Flag Phase(s)
VPA	PA Void
FPA	PA Problem Flag
FQPAD	QCM PA Dyno Flag
FTA	Time Alignment Flag
NAN	Not a Number
RDM	Raw Data Modified
VG	Gravimetric Void
FG	Gravimetric Problem Flag

The reduced data files containing all of the continuous PM instrument files can be used to provide displays of the results of the data reduction process for the QCM. Figures 4-90 and 4-91 provide an example of this for QCM and BC mass concentrations compared with Dyno Torque. The figures result from tests of the same vehicle in Round 1 and Round 2. They display the general differences noted between tests conducted in the summer (Round 1) and winter (Round 2).

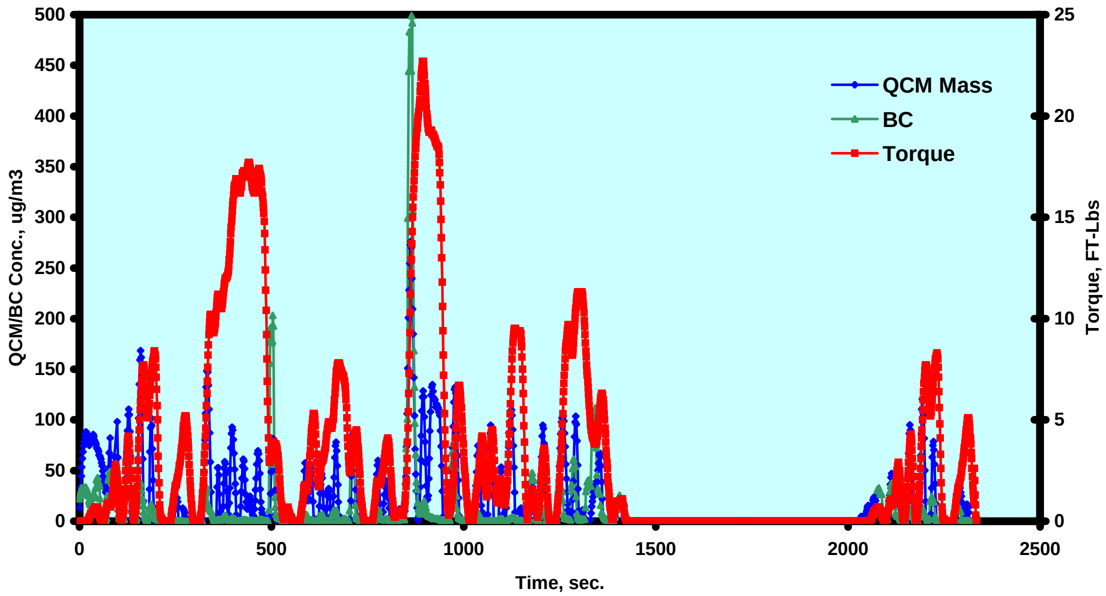


Figure 4-90. Example of Reduced Data for Round 1.

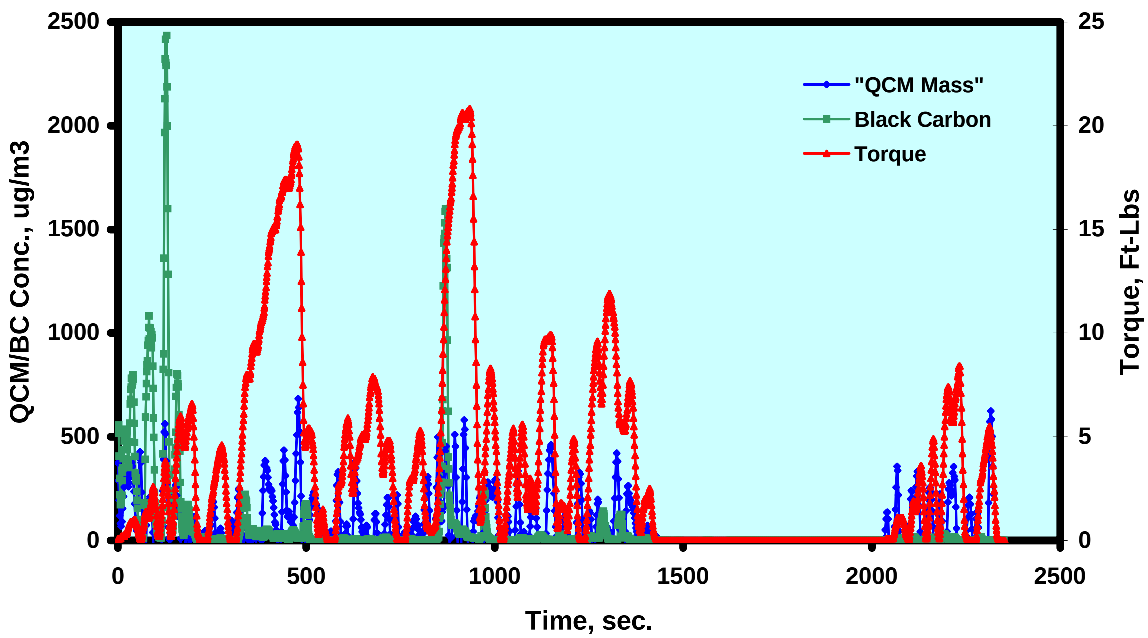


Figure 4-91. Example of Reduced Data for Round 2.

One of the principle differences that can be noted in these examples is the increase in particulate emissions during the winter months. This is particularly true for the cold start (Phase 1) portion of the tests.

4.5.3.3 Comparison of QCM Versus Time-Integrated Gravimetric Mass Measurements

4.5.3.3.1 Round 1 Comparison

Averages of the integral emission rate data from the summary file are presented in Table 4-33. These results reflect the systematic reduction of emissions for the newer categories of vehicles. The table provides a summary of emission rates for each phase of the Unified Test Cycle for both the QCM and the Gravimetric Filter results. The table also lists the composite emission rate from the same calculation as that used for the FTP Cycle. It should be noted that, with the exception of Pre-1981 Cars, the QCM reports a higher emission rate than the gravimetric filter. Also the emission rate for the Pre-1981 Trucks are also shown to be less than the Pre-1981 Cars.

Table 4-33. Average Emission Rates for Round 1 in mg/mile Derived from QCM and Gravimetric Filter Measurements for all Test Phases.

Vehicle	QCM Emission Rates (mg/mi)			Grav Emission Rates (mg/mi)		
Year	Phase 1	Phase 2	Phase 3	Phase 1	Phase 2	Phase 3
TRUCKS						
1970-1980	62.03	50.65	22.58	87.80	45.05	9.14
1981-1990	44.23	16.74	17.20	93.80	37.65	51.05
1991-1995	18.92	8.09	11.89	14.48	11.13	14.41
1996-2005	13.20	4.53	3.44	9.58	4.01	2.33
CARS						
1970-1980	202.96	15.16	33.18	160.77	73.09	63.73
1981-1990	32.95	23.87	18.18	35.02	18.94	8.79
1991-1995	16.28	6.94	7.02	11.43	7.54	5.08
1996-2005	14.98	3.29	2.96	7.40	2.48	1.80

4.5.3.3.2 Round 2 Comparison

Averages of the integral emission rate data from the summary file for Round 2 are presented in Table 4-34. These results reflect the systematic reduction of emissions for the newer categories of vehicles. The table provides a summary of emission rates for each phase of the Unified Test Cycle for both the QCM and the Gravimetric Filter results. The table also lists the composite emission rate from the same calculation as that used for the FTP Cycle.

Table 4-34. Average Emission Rates for Round 2 in mg/mile Derived from QCM and Gravimetric Filter Measurements for all Test Phases.

Vehicle	QCM Emission Rates (mg/mi)			Grav Emission Rates (mg/mi)		
Year	Phase 1	Phase 2	Phase 3	Phase 1	Phase 2	Phase 3
TRUCKS						
1970-1980	139.04	39.79	22.27	281.33	101.70	28.12
1981-1990	104.91	20.83	21.37	210.94	31.43	22.16
1991-1995	38.25	16.28	10.95	40.05	19.13	5.22
1996-2005	33.33	8.38	7.51	40.84	6.02	3.26
CARS						
1970-1980	74.95	9.71	9.52	361.73	42.34	14.31
1981-1990	71.68	16.01	14.07	114.81	23.86	13.68
1991-1995	42.20	16.00	7.67	55.06	16.25	6.70
1996-2005	29.67	9.31	3.92	46.88	6.20	4.21

4.5.3.4 Average QCM-measured concentrations relative to vehicle speed emissions

4.5.3.4.1 Round 1

Figures 4-92 through 4-97 display the average continuous Round 1 CVS concentrations measured using the QCM for four categories (BINS) each of trucks and cars tested for Phases 1, 3, and 2 of the test cycle. A nominal dynamometer speed trace is included in each figure for reference. Only vehicle tests for which no void or partial void was noted during reduction of the data were included in the averages. Consequently, these results should be considered as censured.

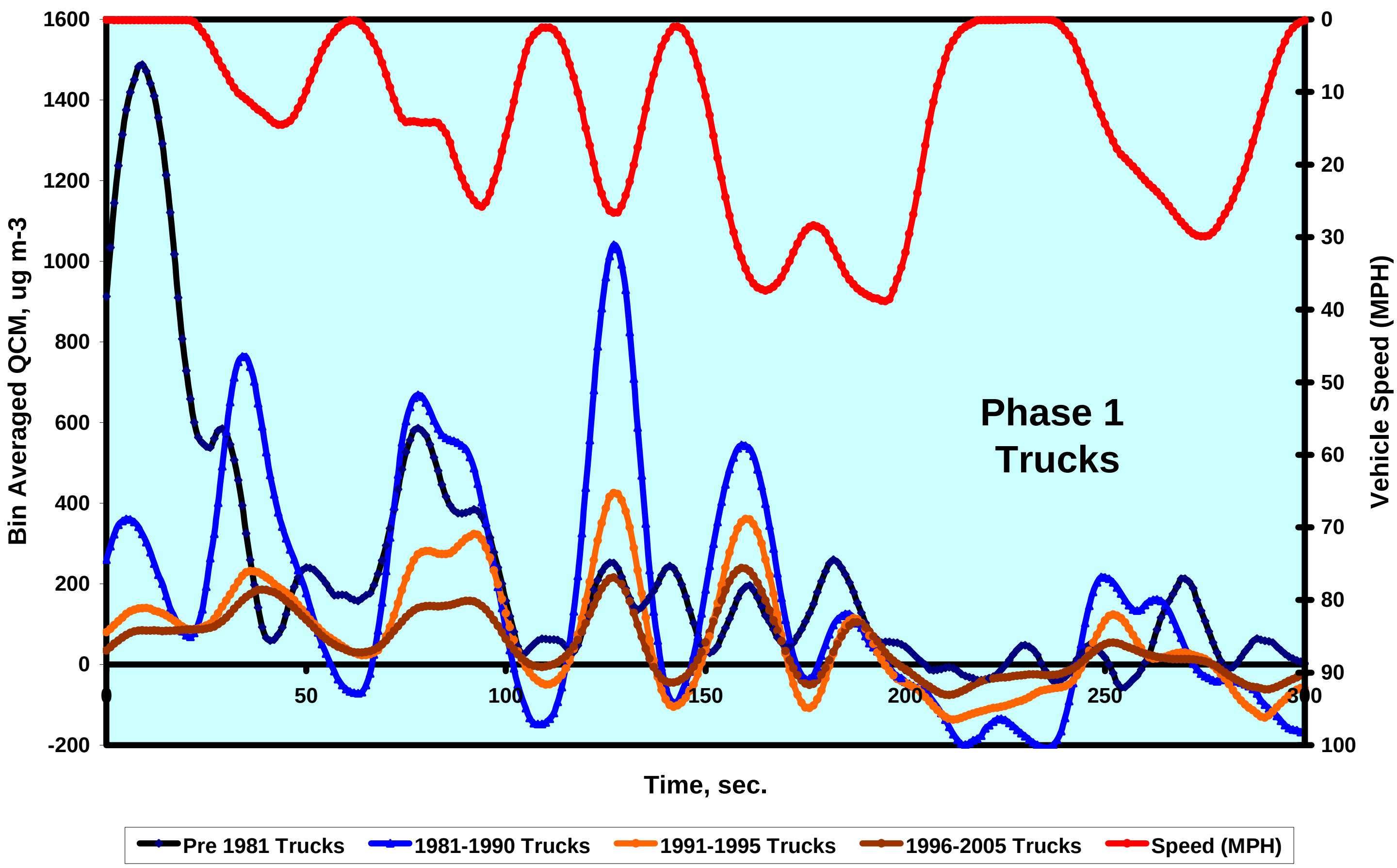


Figure 4-92 Round 1 Averaged CVS Particulate Mass Concentrations - QCM Phase 1 Trucks.

It will be noticed in this and subsequent figures that the QCM consistently reports negative concentrations during parts of the various test cycle components. This should not be considered a flaw in the instrument but rather an indication that volatile components of particulate collected during accelerations and high-speed portions of the test cycle are desorbing from the collected particulate. This is a phenomena that is common to collected vehicle emissions particulate but not accounted for in integral filter measurements.

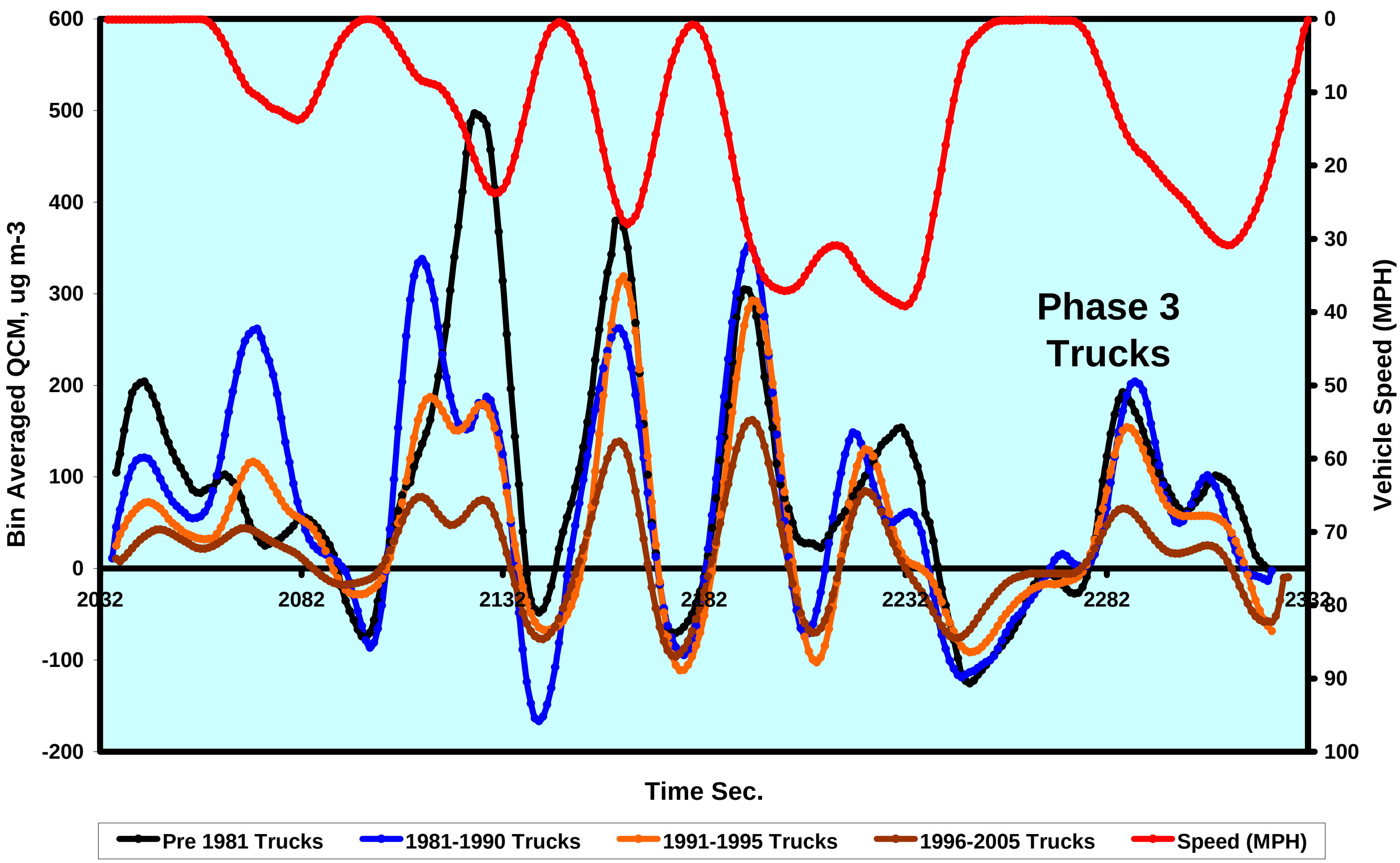


Figure 4-93 Round 1 Averaged CVS Particulate Mass Concentrations - QCM Phase 3 Trucks.

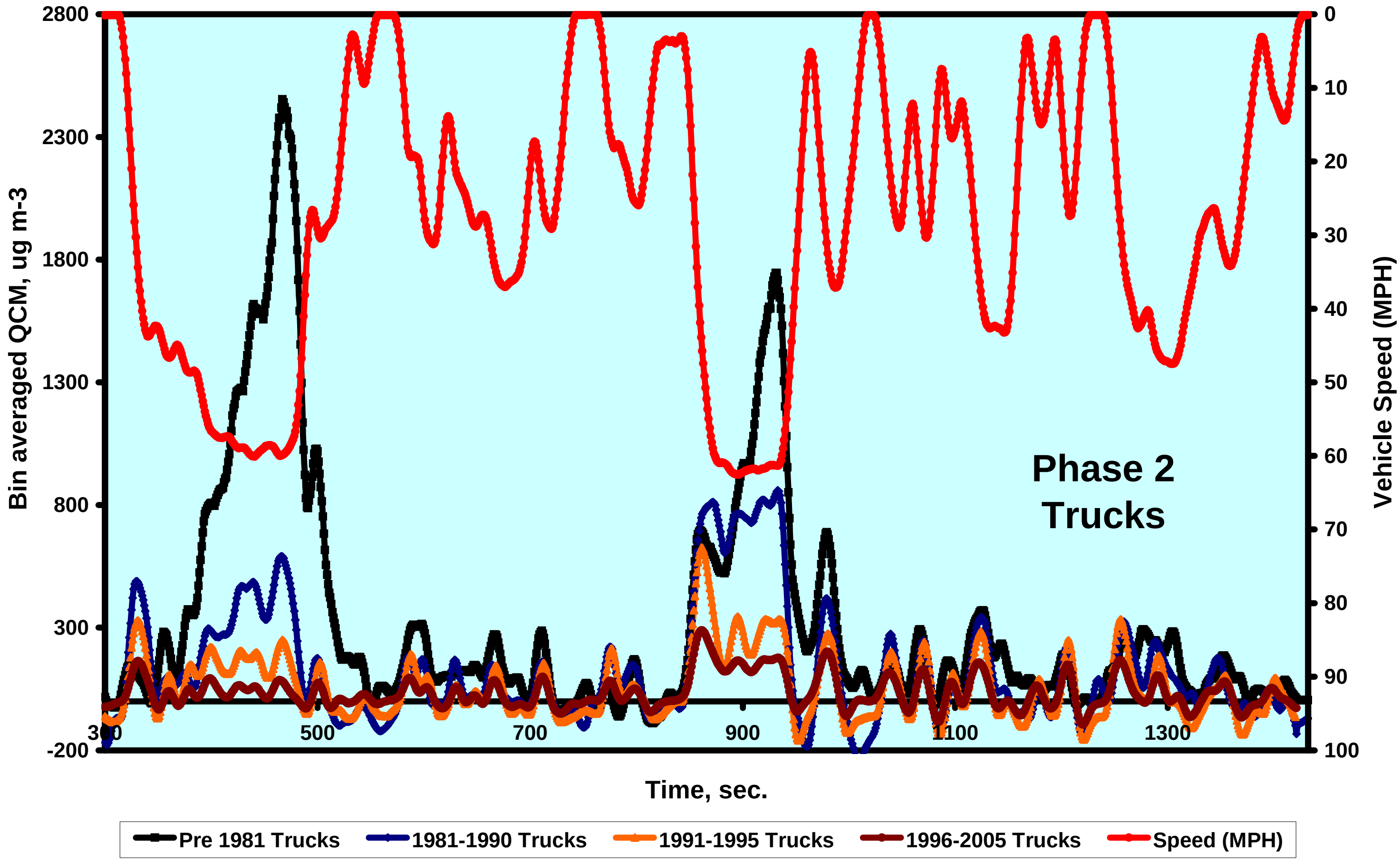


Figure 4-94 Round 1 Averaged CVS Particulate Mass Concentrations - QCM Phase 2 Trucks.

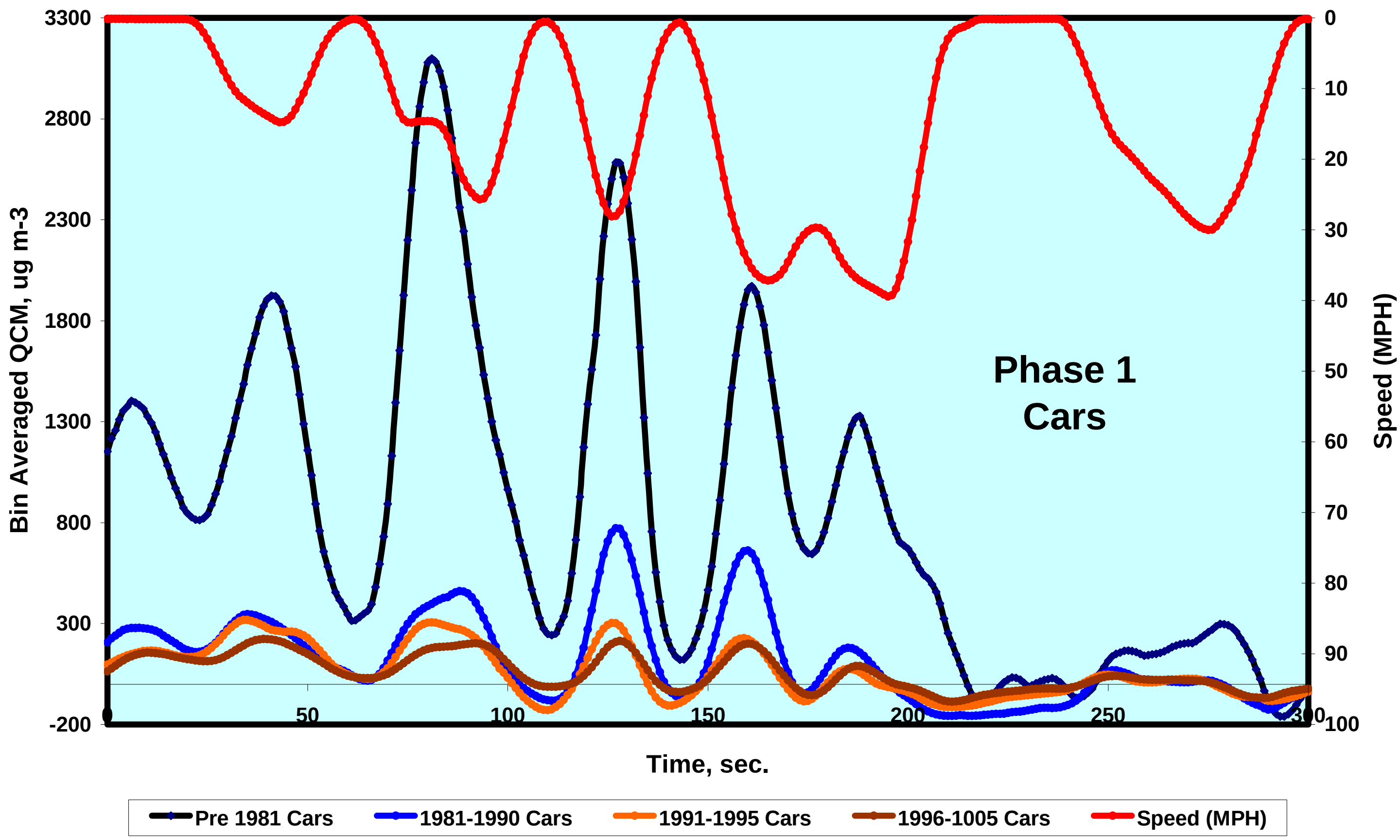


Figure 4-95 Round 1 Averaged CVS Particulate Mass Concentrations - QCM Phase 1 Cars.

It should be noted that the Pre-1981 Car concentrations are much higher than the comparable results for Pre-1981 Trucks. Even though only two trucks were tested in this category, it would seem that the older trucks are better taken care of than older cars.

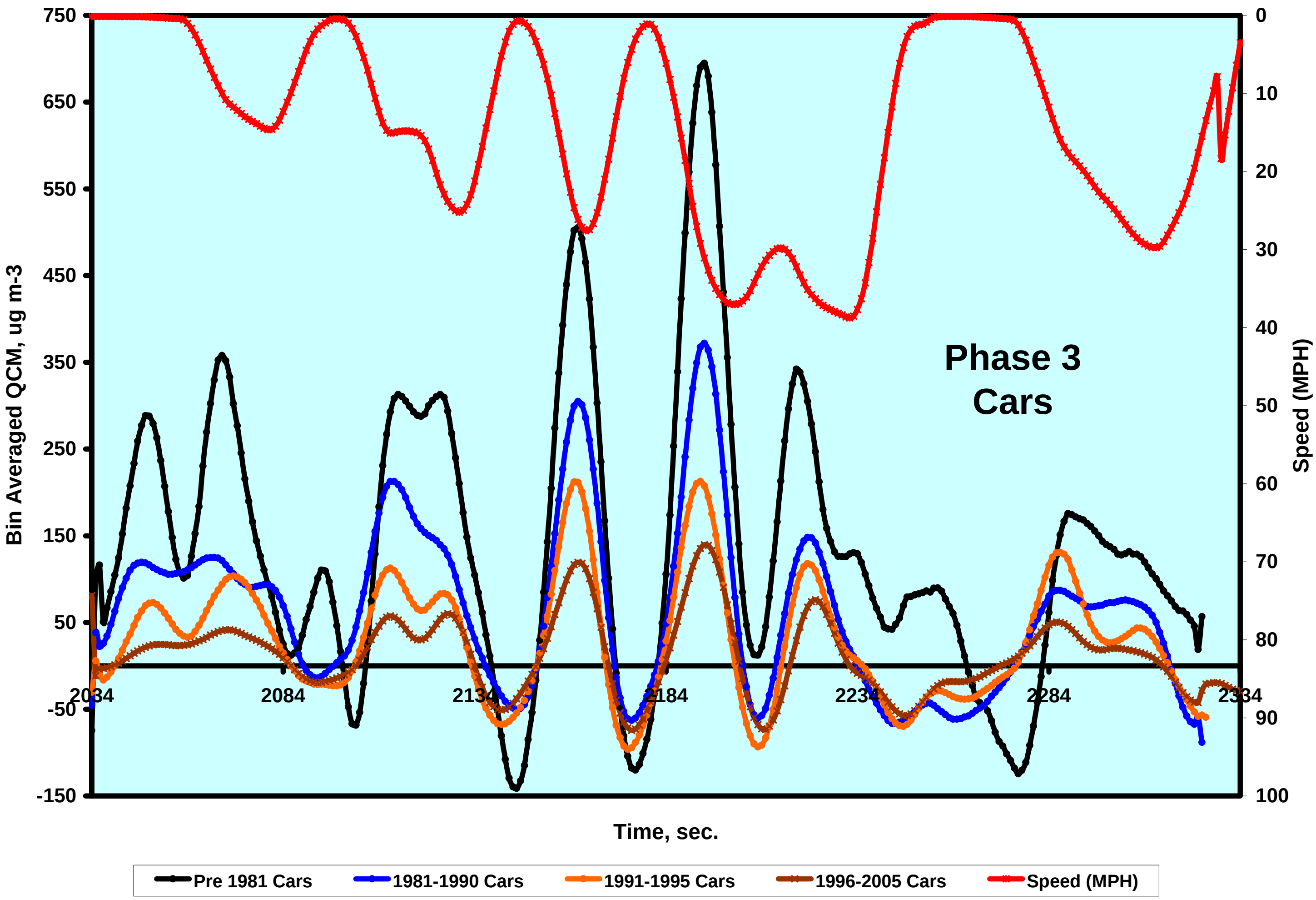


Figure 4-96 Round 1 Averaged CVS Particulate Mass Concentrations - QCM Phase 3 Cars.

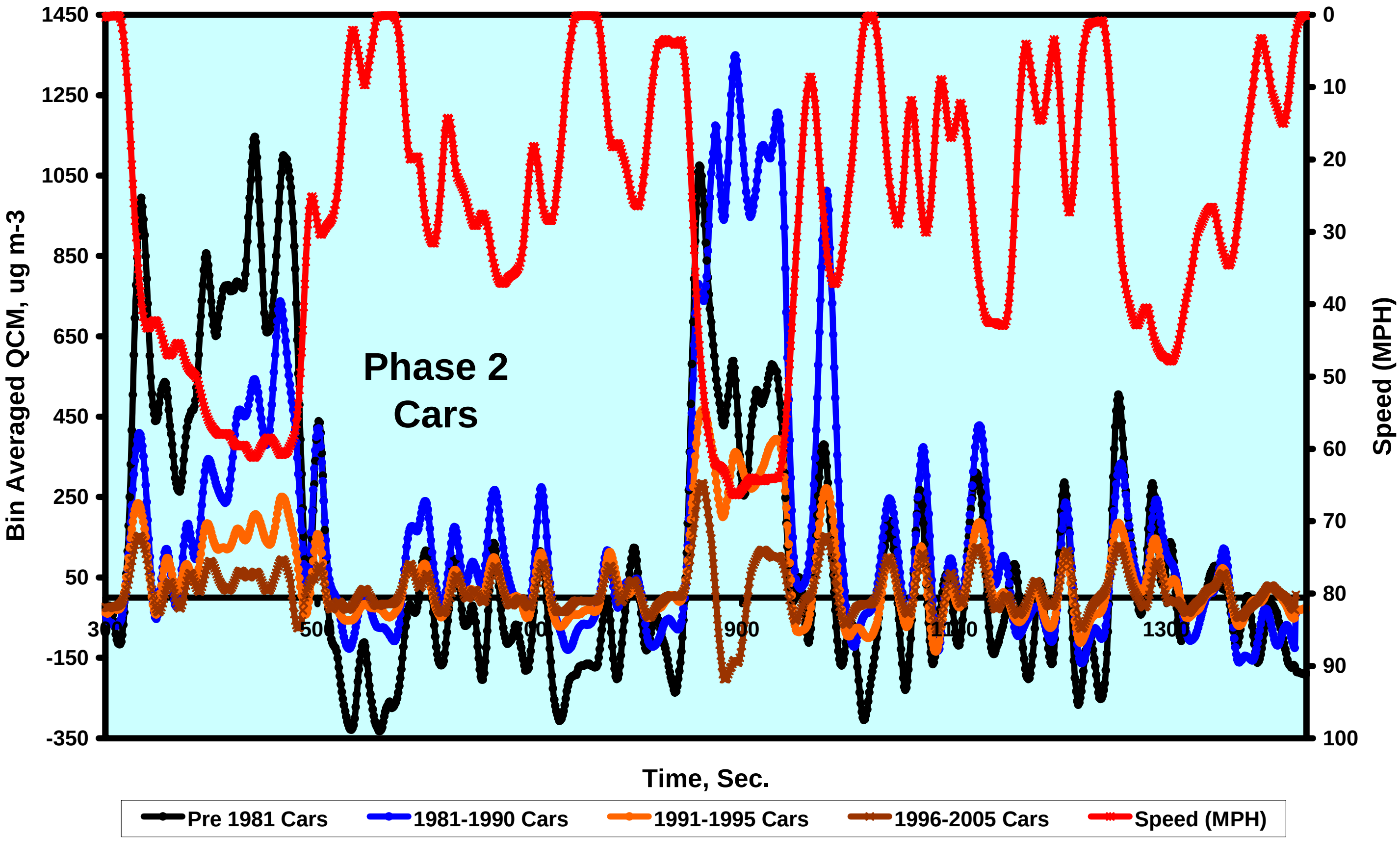


Figure 4-97. Round 1 Averaged CVS Particulate Mass Concentrations - QCM Phase 2 Cars.

In all the figures, a systematic reduction in measured concentrations can be noted for the newer categories of vehicles.

4.5.3.4.2 Round 2

Figures 4-98 through 4-103 display the average continuous Round 2 CVS concentrations measured using the QCM for four categories (BINS) each of Trucks and Cars tested for Phases 1, 3, and 2 of the test cycle. Only vehicle tests for which no void or partial void was noted during reduction of the data were included in the averages. Consequently, these results should be considered as censured.

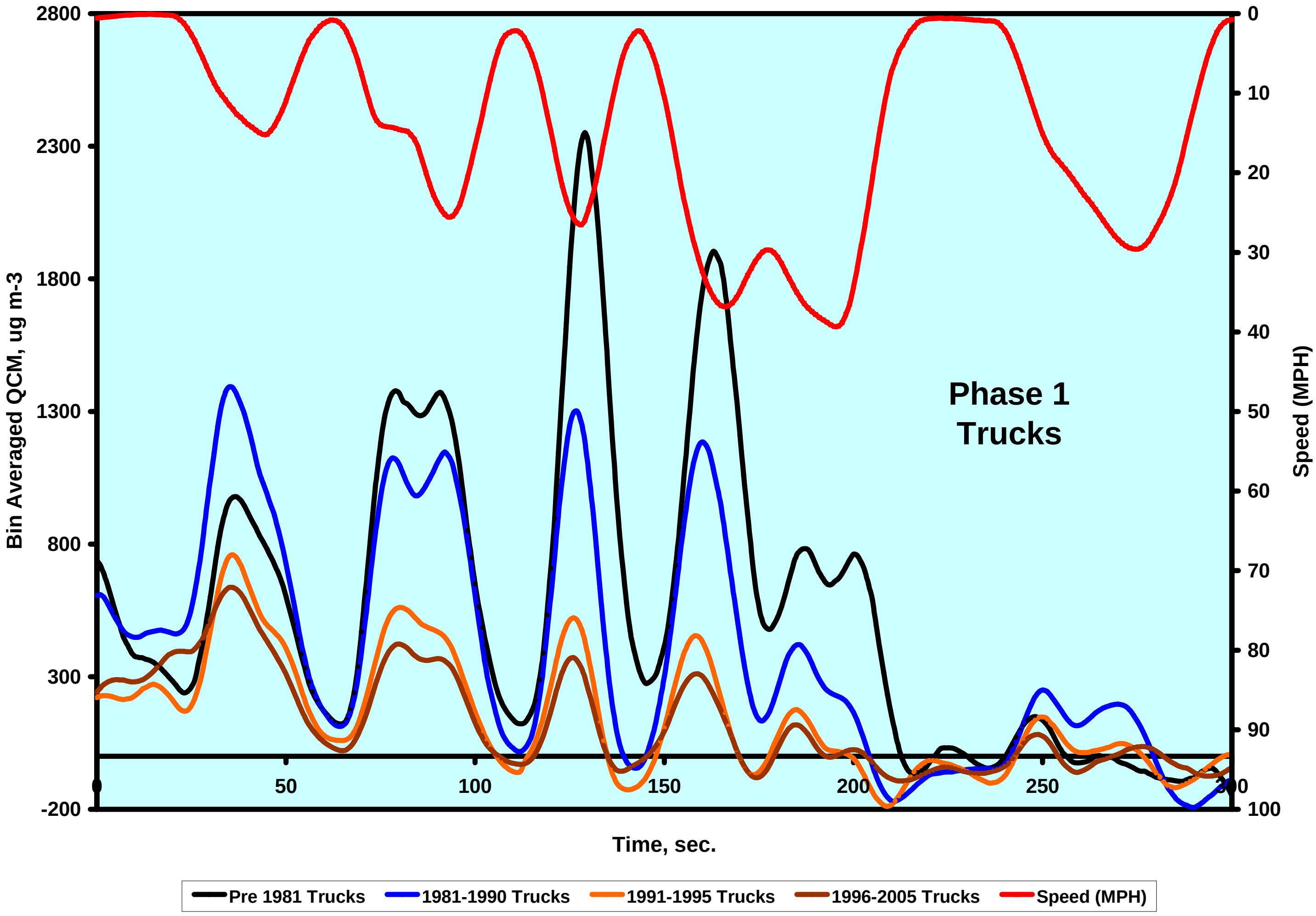


Figure 4-98 Round 2 Averaged CVS Particulate Mass Concentrations - QCM Phase 1 Trucks.

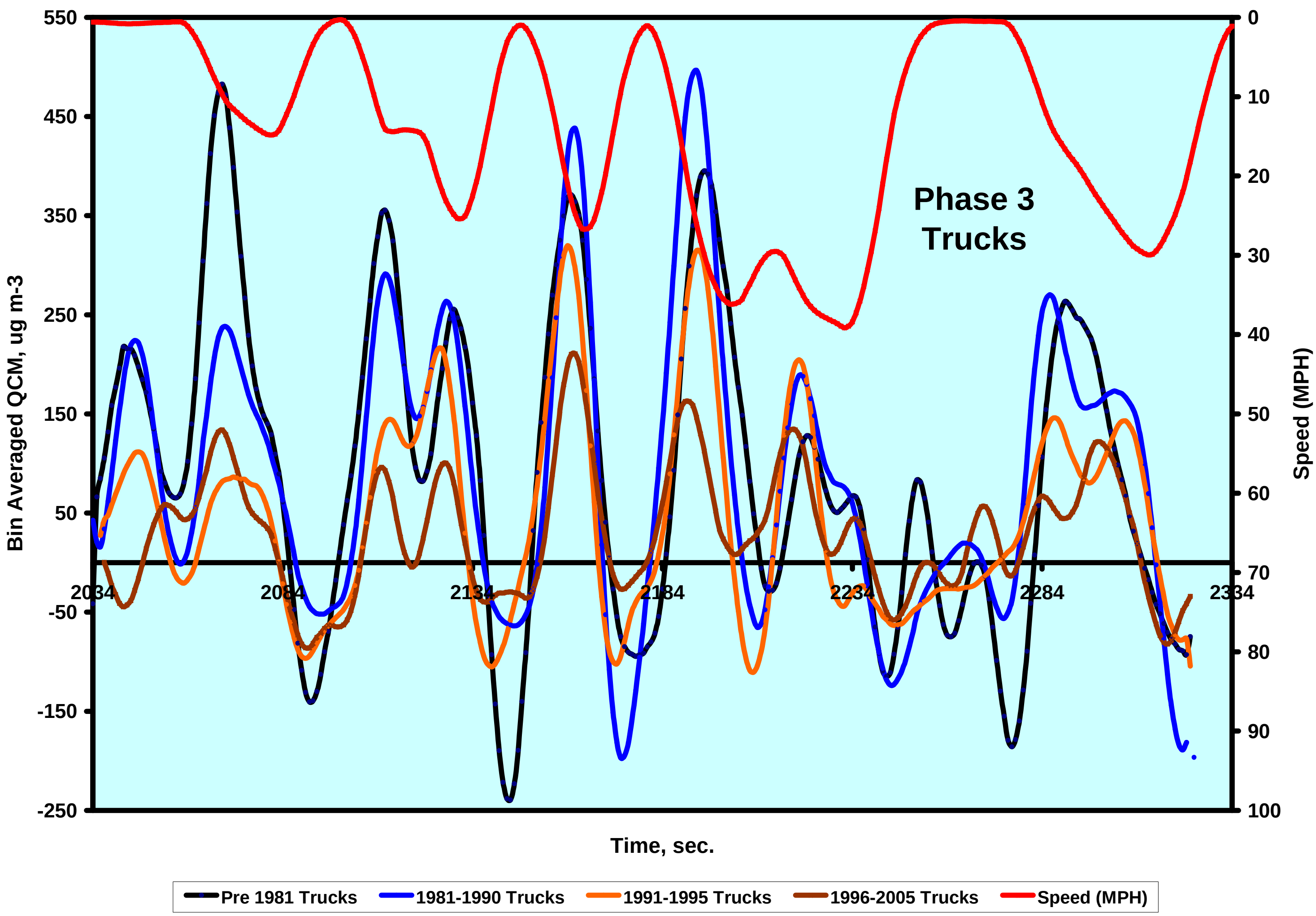


Figure 4-99 Round 2 Averaged CVS Particulate Mass Concentrations - QCM Phase 3 Trucks.

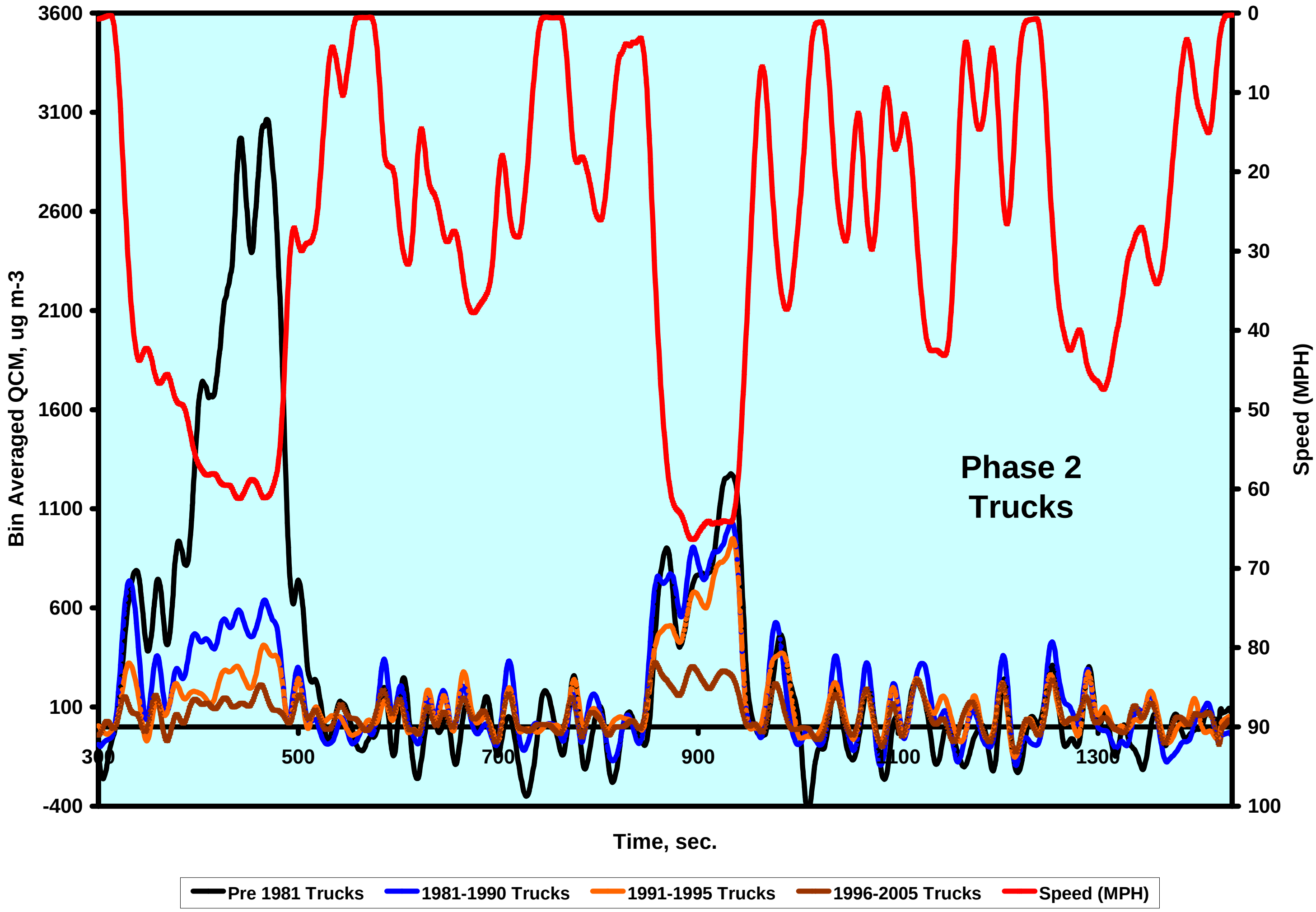


Figure 4-100 Round 2 Averaged CVS Particulate Mass Concentrations - QCM Phase 2 Trucks.

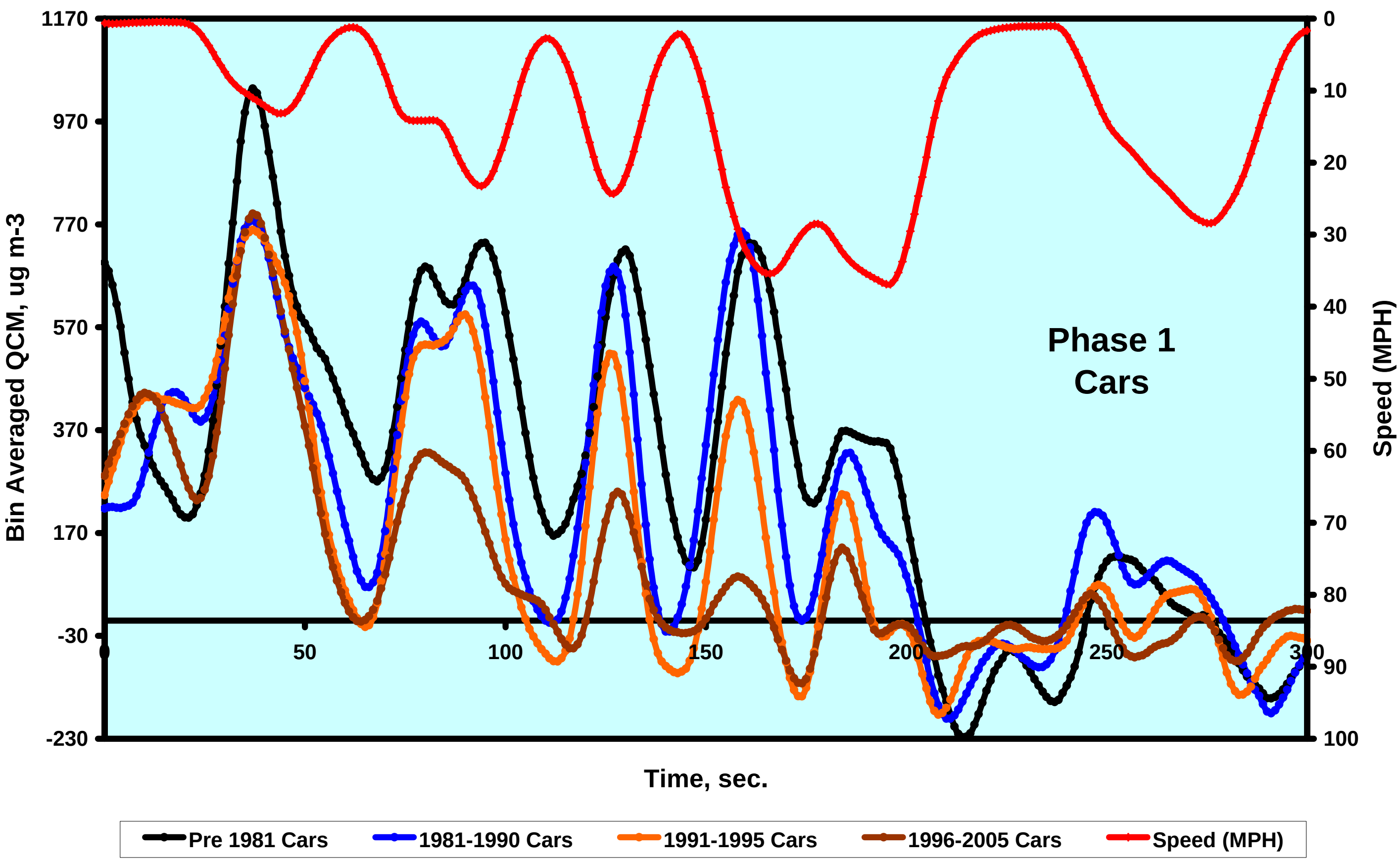


Figure 4-101 Round 2 Averaged CVS Particulate Mass Concentrations - QCM Phase 1 Cars.

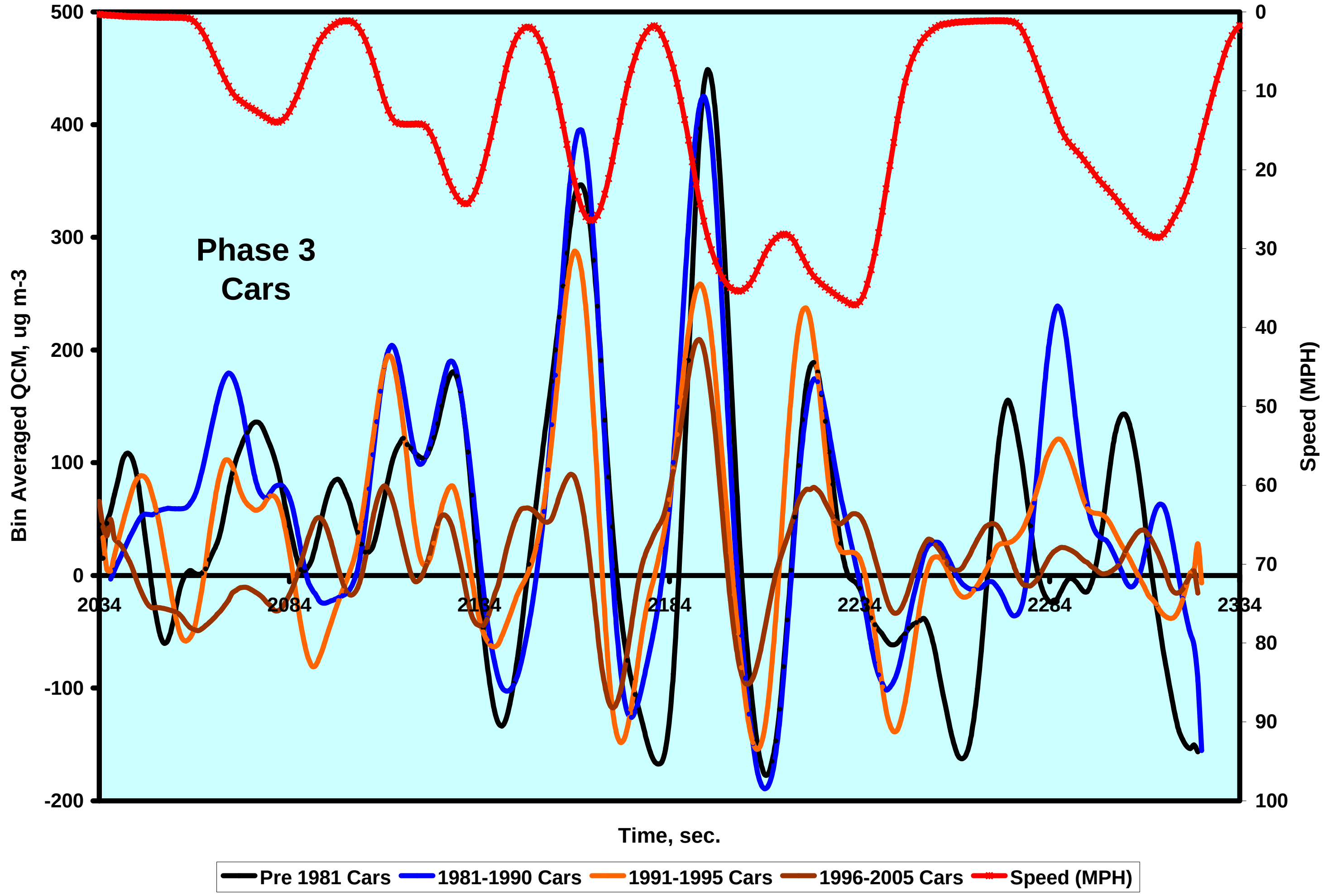


Figure 4-102 Round 2 Averaged CVS Particulate Mass Concentrations - QCM Phase 3 Cars.

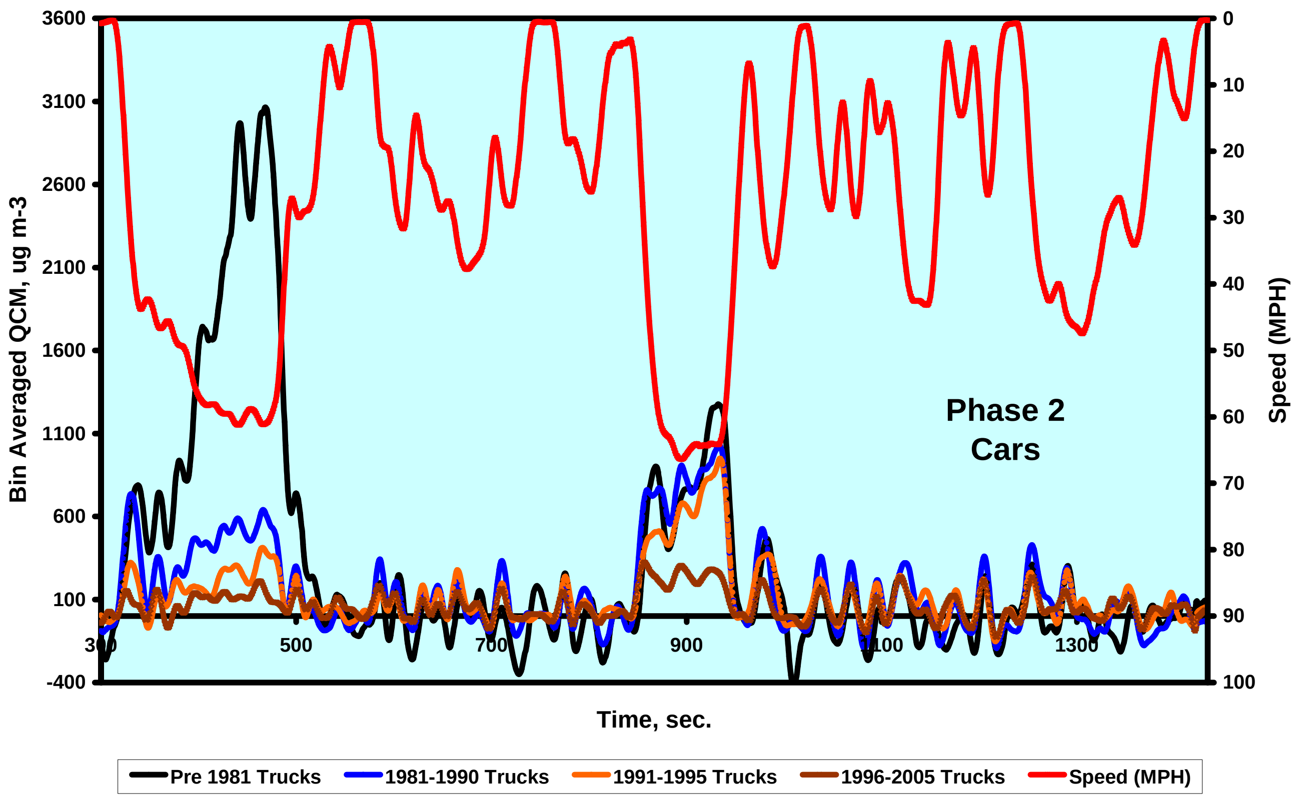


Figure 4-103 Round 2 Averaged CVS Particulate Mass Concentrations - QCM Phase 2 Cars.

4.5.3.5 Evaluation of Continuous Optical Mass Measurements

Figure 4-104 shows scatter plots of time averaged DustTrak and Mie DataRAM4 phase averaged data (i.e. each point represents a time average from phase 1, 2, or 3 of the unified cycle). Note that for mass concentrations below 250 µg m^{-3} relative agreement is found among these instruments as illustrated in Figure 4-104a. However, much more scatter occurs for high mass concentrations as shown in Figure 4-104b. Finally, Figure 4-104b shows that the DataRAM4 values are much in excess of those of the DustTrak. The DataRAM4 manufacturer states an upper range for the instrument of 400,000 µg m^{-3}, though a recent email correspondence with an expert (Wayne Harmon, 2004) on the instrument from the company that manufactures it is quoted here: "For vehicles with high emission, it may be necessary to dilute the air sample. The background will become slightly elevated due to contamination if high concentrations (above 20 mg m^{-3}) are sampled for an hour or more." Notice that 20 mg m^{-3} is 20,000 ug m^{-3}, well below the stated upper range of the instrument.

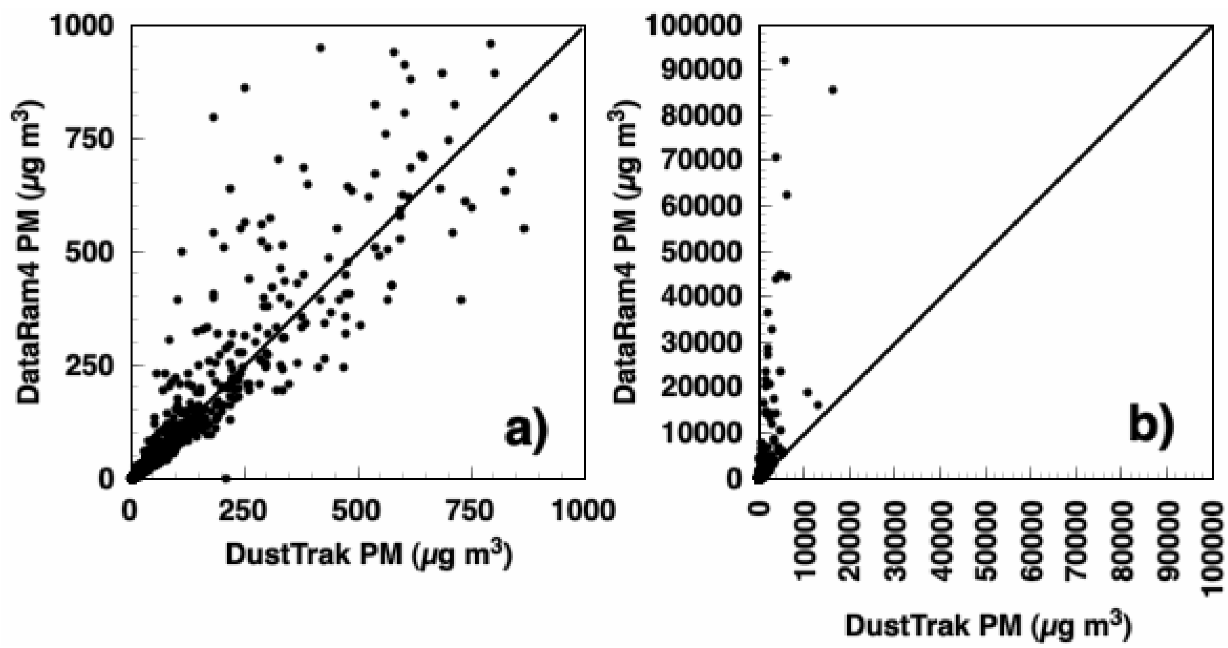


Figure 4-104. PM data from the DustTrak and DataRAM4 for a) low and b) high range.

Which nephelometer is closer to the "actual value" of aerosol-mass concentration? To answer this question one needs to keep in mind that aerosol mass concentration is a fleeting quantity. Change the air temperature or gaseous composition and the gas to particle phase partition is upset. When we capture particles on a filter and gases may also adsorb onto the particles and filter. Figure 4-105 shows the comparison of gravimetric mass with nephelometer mass for phase averaged data. Note in Figures 4-105a and 4-105b that both nephelometers produce values much larger than gravimetric mass for very high values of mass, though the DustTrak is closer to gravimetric mass than is the DataRAM4. Over the lower range shown in Figures 4-105c and Figure 4-105d much scatter is noted between nephelometer mass and gravimetric mass, and that the DT and DR have about the same amount of scatter. It is likely that variations in particle size and composition, and uncertainty in gravimetric mass give rise to the scattering seen in Figure 4-105.

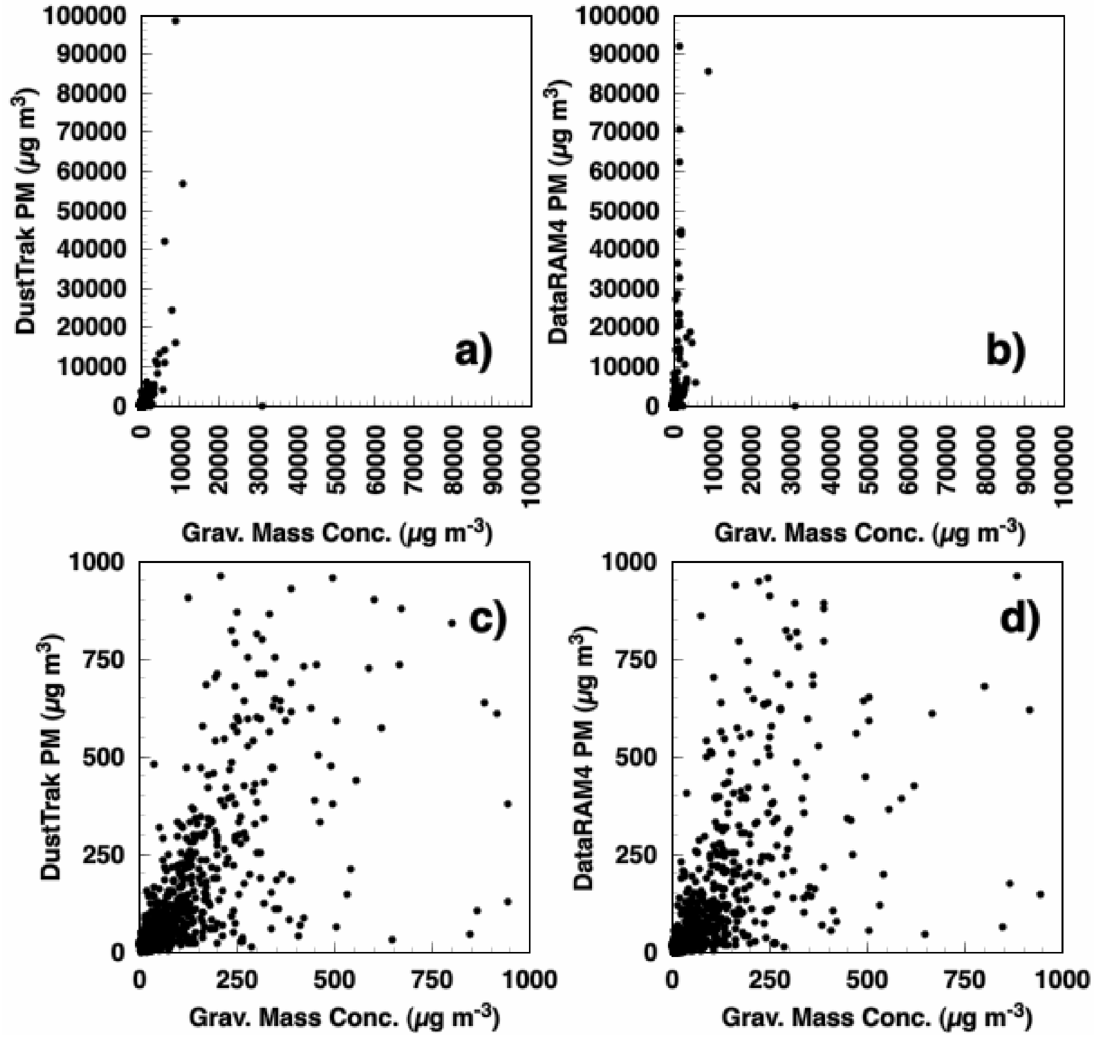


Figure 4-105. Scatter plots of gravimetric mass and nephelometer mass for the DustTrak and DataRAM4. Wide range in a) and b) and a lower narrower range in c) and d).

Figure 4-106 shows histograms of emission rates computed from DustTrak and DataRAM4 nephelometer measurements of PM averaged over Phases 1 through 3 of the unified cycle. It was necessary to use a logarithmic plot because the emission rates in the smallest bin, 0-20 mg/mile, dominate all other measurements. Note that the DataRAM4 indicates considerably more instances of very large emission rates than does the DustTrak. The gross shapes of the distributions are similar.

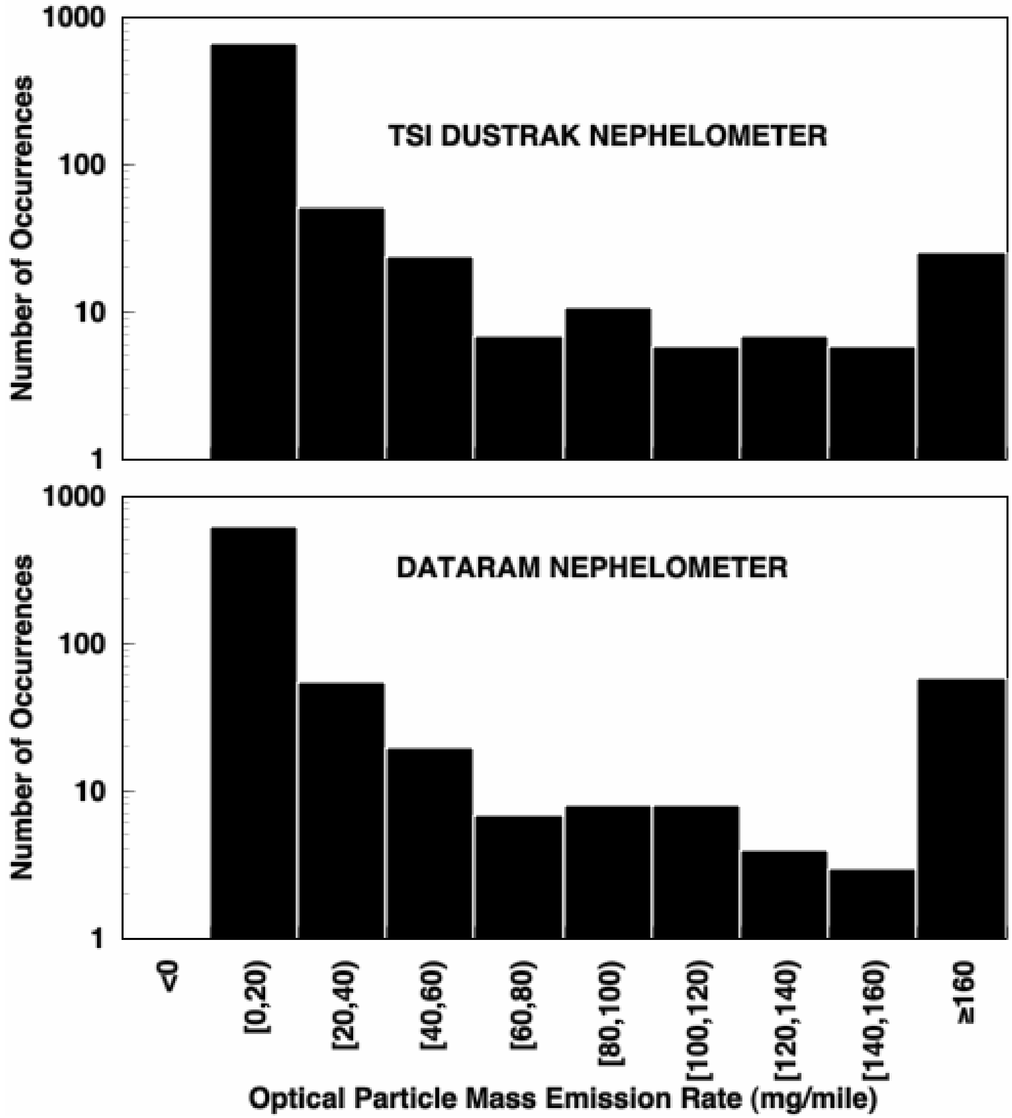


Figure 4-106. Histograms of optical PM obtained with the TSI DustTrak and DataRAM4 nephelometers.

(The DataRAM4 histogram has more cases of very high emitters than does the DustTrak or other samplers. Each car and each phase are counted as a single occurrence of data for a total of 250 cars times 3 Phases per car.)

Figure 4-107 shows a histogram of the number of occurrences of different BC emission rates. It has a form similar to the DT and DR emission rate histograms shown in Figure 4-106. The average BC emission rate was 4 mg/mile, and the average PM emission rate computed from the DustTrak data was 34 mg/mile. If all of the DustTrak PM is considered to be carbonaceous, then the ratio of BC to PM is around 1/9. The inset table shows average BC and PM emission rates from the phase 1 data set. Figure 4-108 shows histograms of the ratio of BC to PM, with PM obtained from the DT and DR nephelometers, and with gravimetric mass. Figure 4-108a is the most reasonable representation of this ratio. Most spark ignition PM is known to be OC and most PM is associated with total carbon (TC=OC + BC). The DataRAM4 produces too many large values of this ratio as shown in Figure 4-108c. The gravimetric mass in Figure 4-108c when used to compute the ratio BC to PM has a very broad unrealistic histogram, with many values greater than unity, and some less than zero. The uncertainty in the gravimetric mass is much greater than that of all the other PM measures. It should be noted that in general, continuous PM measurements (with the exception of the QCM) were primarily used to monitor the state of the dilution tunnel and provide an assessment of the reasonableness of QCM data. These systems were primarily used to assess system and test condition changes, rather than to provide a quantitative assessment of continuous emission rates (as was the intent of using the QCM).

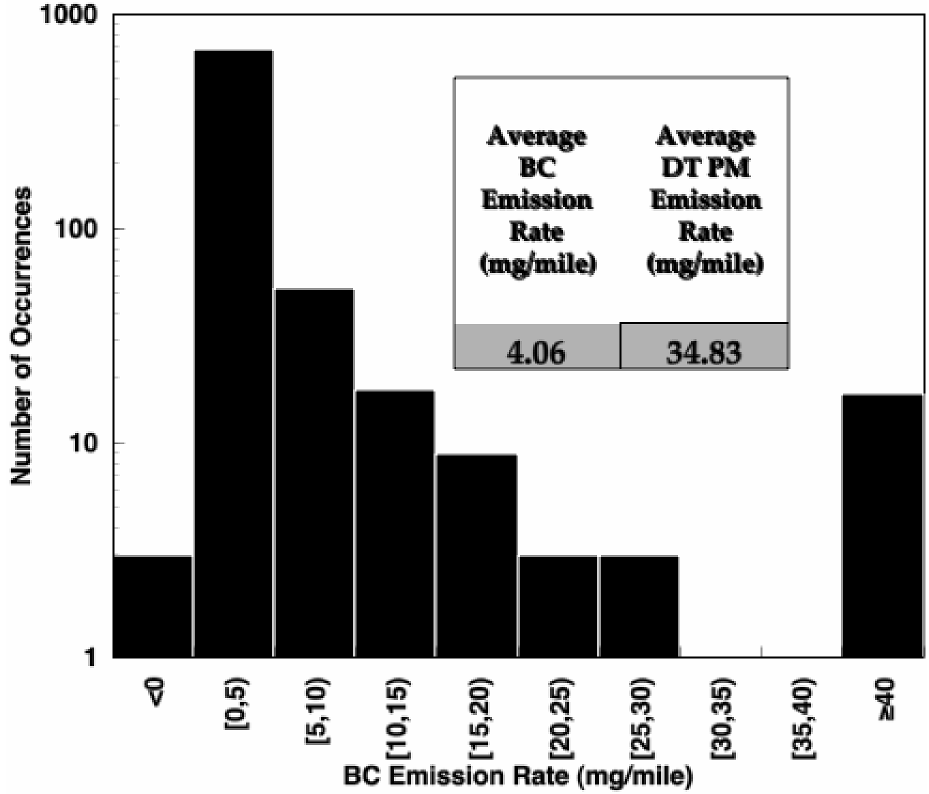


Figure 4-107. Histogram of BC mass emission rate obtained with the DRI photoacoustic instrument.

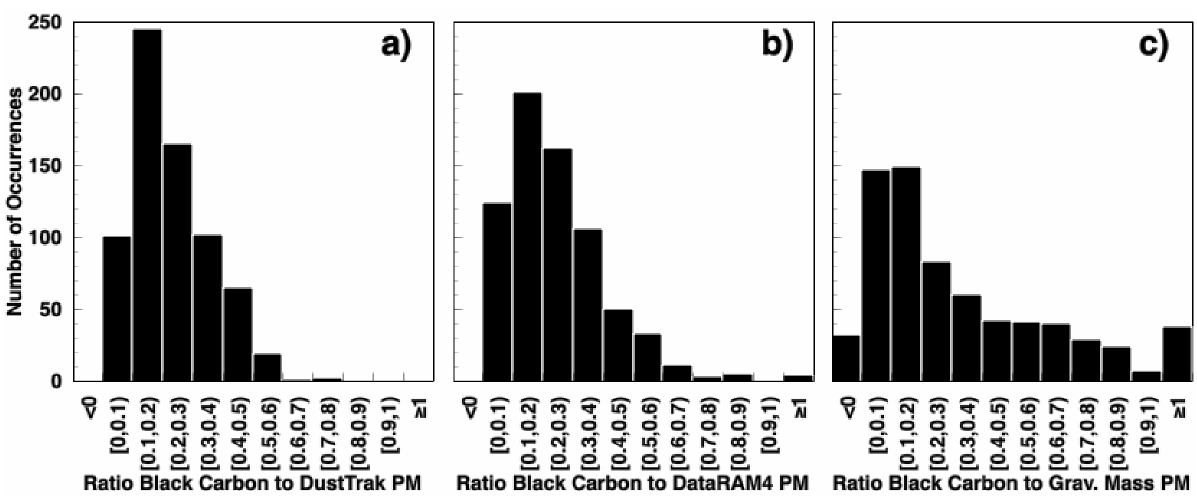


Figure 4-108. Histograms of the ratio BC to total PM

(Total PM from the DustTrak in a), from the DataRAM4 in b), and from the gravimetric mass in c). The vertical scale is the same in each plot. Histograms were developed from phase averaged data, excluding cases where the BC average is less than 2 µg m^{-3}.)

4.5.3.6 Average BC and PM concentrations in each stratum as related to vehicle speed

The utility of continuous measurements of BC and PM are most evident in evaluating the driving conditions that give rise to the bulk of the emissions. Figures 4-109 through 4-116 illustrate the emissions of BC as measured by the photoacoustic instrument, and PM as measured by the DustTrak nephelometer as a function of time. The data are from Round 1 and are averaged by model-year strata for cars and trucks. The vehicle speed profile is also overlain on these plots, and this trace is inverted so that the emissions can readily be seen. To produce the data shown in Figures 4-109 through 4-116, all data were aligned in time to the start of the unified cycle, and interpolated to 1-second steps. The captions document the data in detail, though some highlights are given here. Figure 4-109 is typical of the comparison of Phases 1 and 3 of the unified cycle. Phase 1 commences after a cold start of the vehicle, and phase 3 after a warm start. The vehicle speed profile is the same for these phases. Since Figures 4-109 through 4-116 are only intended to illustrate relative emission rate changes as measured by these different systems, they are only provided for Round 1. However, continuous emission rate measurement results as measured using the different instruments are provided in Tables 4-35 though 4-37 for both Rounds of the study.

Phase 1 emission rates are generally higher than those of phase 3 for all classes of vehicles, though the older vehicles have more emissions at all times. Phase 1 emissions from newer vehicles are associated with accelerations, decelerations, as well as higher speed driving, whereas phase 3 emissions from newer vehicles are mostly closely associated with accelerations. Phase 2 emissions from both cars (Figure 4-111) and trucks (Figure 4-112) are dominant during the high acceleration portion of the driving cycle before time 900 seconds.

Emission rates for each phase of the unified cycle, for each stratum of vehicles model year ranges, for BC and total particle mass (PM) are given in Tables 4-35 through 4-37. PM obtained from the DustTrak nephelometer are indicated by "DT" and those from the DataRAM4 are given by "DR". Note that BC emission rates generally decrease from older to newer vehicles, though because the class of older trucks (pre 1980) was only represented by 2 vehicles the averages are highly uncertain. Note that BC and DT PM emission rates were highest (for cars) during phase 1, though phase 2 and 3 values were similar. Note that emission rates computed from the DataRAM4 (DR) are usually way in excess of those obtained with the DustTrak, except for those cases of low emission rates. The DataRAM4 seems to have a problem with high concentrations where it seems some optics get dirty, and this adds a scattering amount that gets interpreted erroneously as PM.

Note the interesting truck values for the 1970-1980 stratum. The BC emission rates were very high for this category in phase 1, though were much lower once the vehicles warmed up in Phases 2 and 3. Since this supplemental analysis was only performed as a cross-check, emission rates were computed based on nominal miles driven, on the average, during each phase, and from the nominal sample volume pulled through the constant volume sampler. The uncertainty introduced by using nominal values is likely around 20%. Phase 1, 2, and 3 miles driven were taken to be 1.18 miles, 8.6 miles, and 1.18 miles. The flow volume was 71.75 m^3 for Phases 1 and 3, and 267.8 m^3 for phase 2.

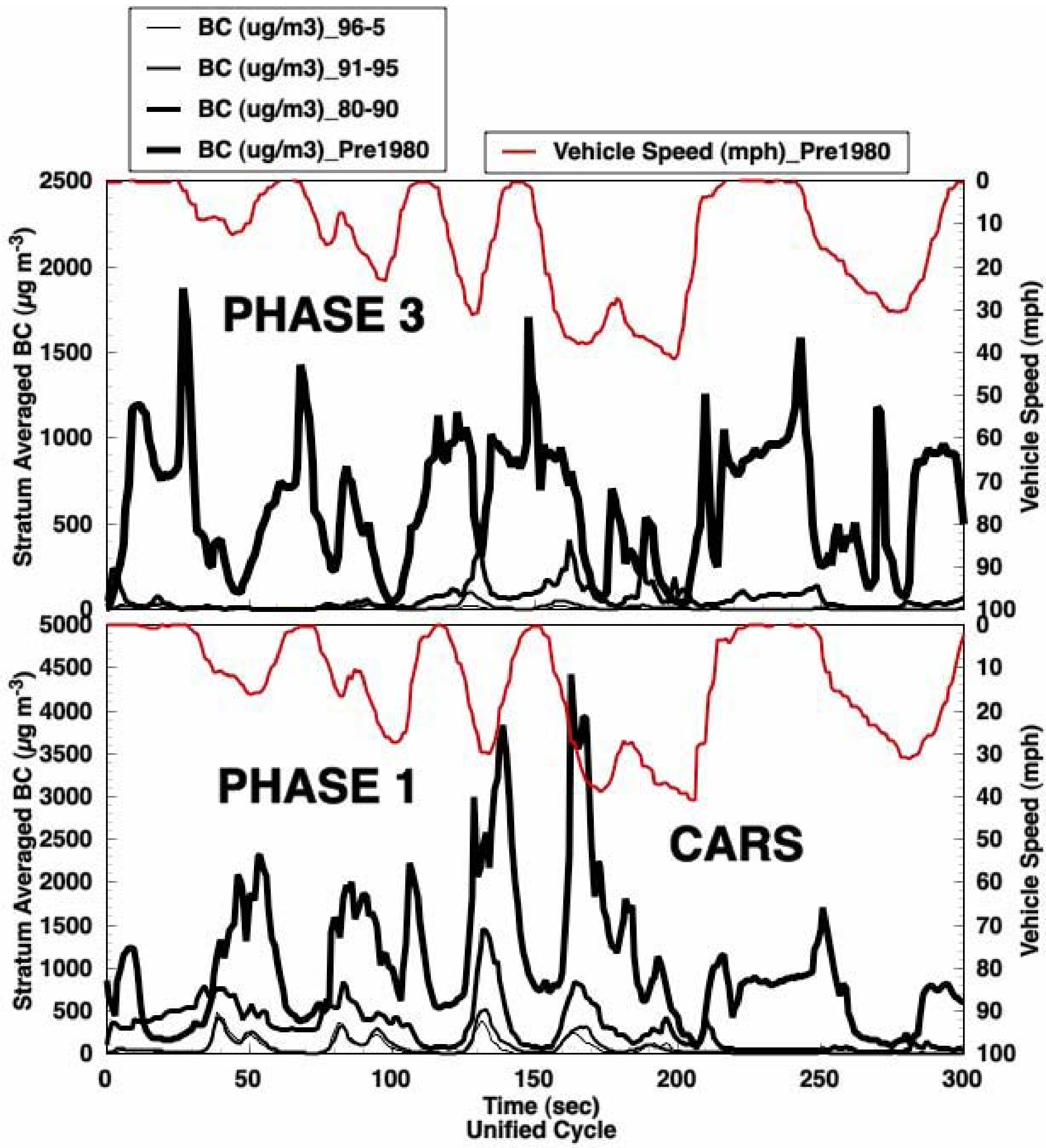


Figure 4-109. Stratum averaged BC emission for passenger cars as it relates to vehicle speed.

(Phase 1 is associated with a cold start of the vehicles, and Phase 3 is an identical driving cycle but one that follows a warm start after an 8 minute soak period. Note that newer cars have much less emission in Phase 3.)

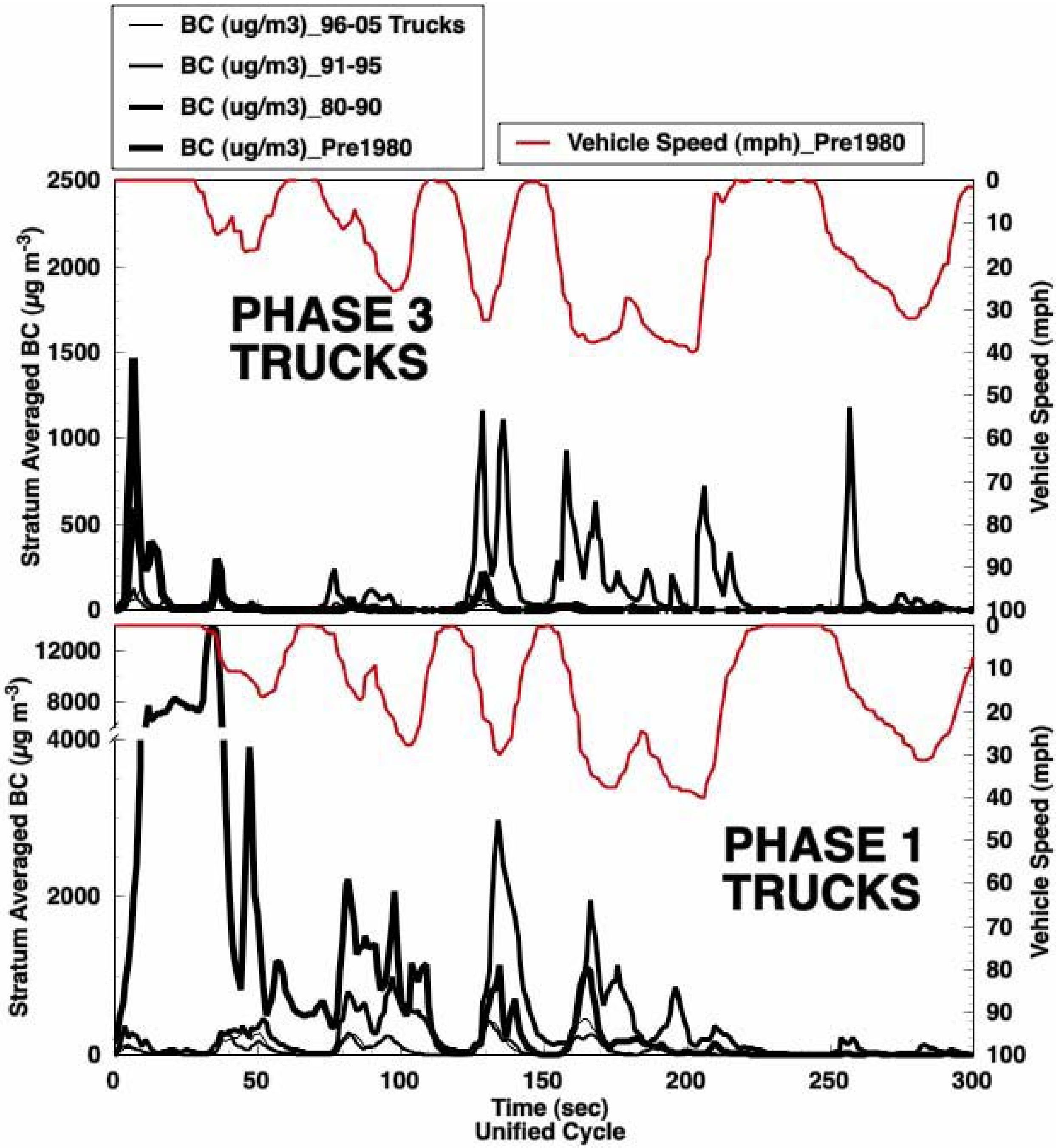


Figure 4-110. Stratum averaged BC emission for trucks as it relates to vehicle speed.

(Note the high emissions during Phase 1 of the oldest truck, and that it is much less in phase 3, illustrating that the warm vehicle emission rates are much lower. Note that there were only 2 trucks in that category. Cleaner trucks behave as cleaner cars.)

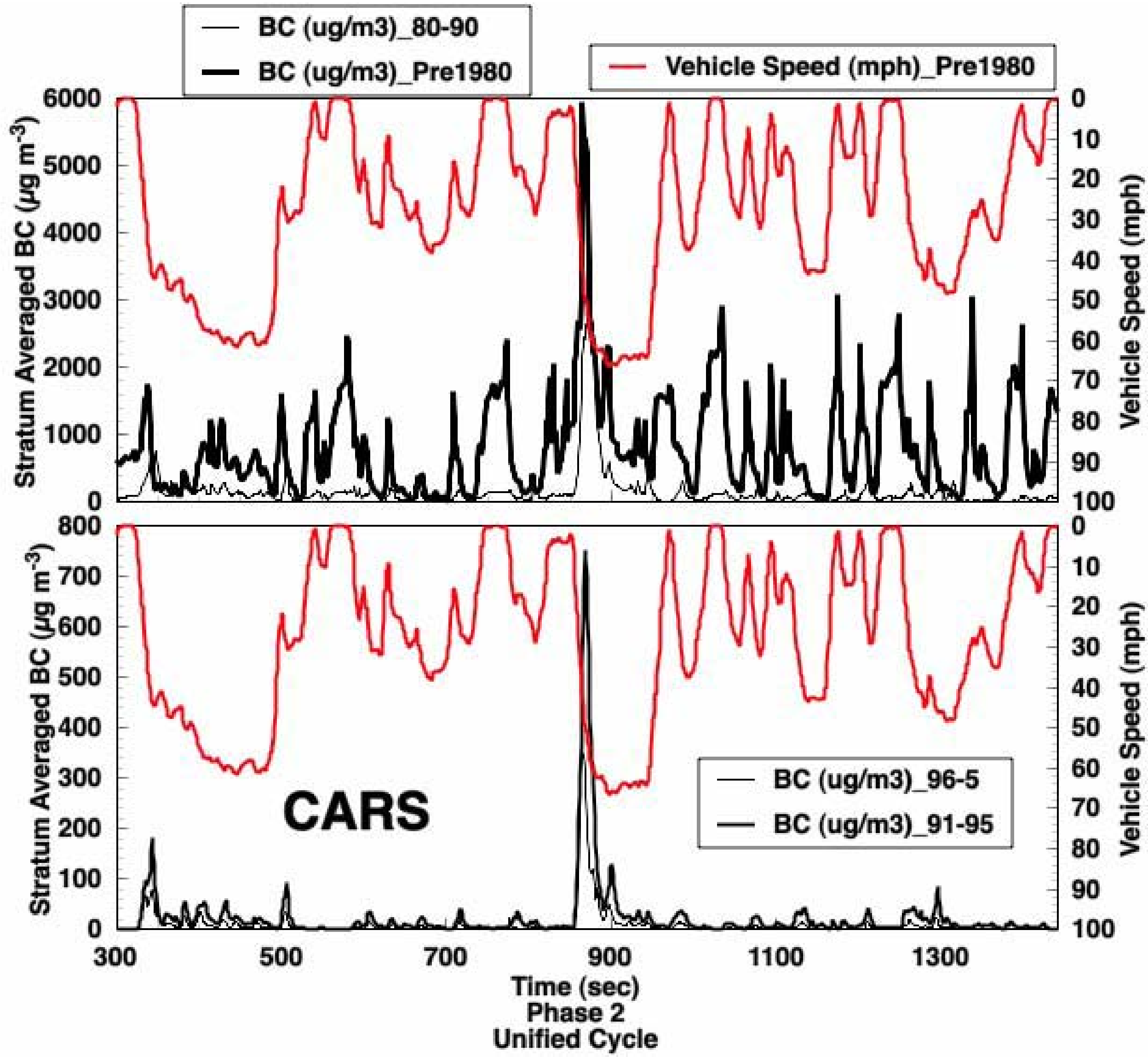


Figure 4-111. BC emissions during phase 2 of the unified cycle for passenger cars

(For newer (lower graph) and older (upper graph) vehicles. Note that BC emissions peak during the aggressive acceleration in about the middle portion of the cycle right before 900 seconds. Note in the upper graph that the oldest category of vehicles had high emission on both accelerations as well as decelerations.)

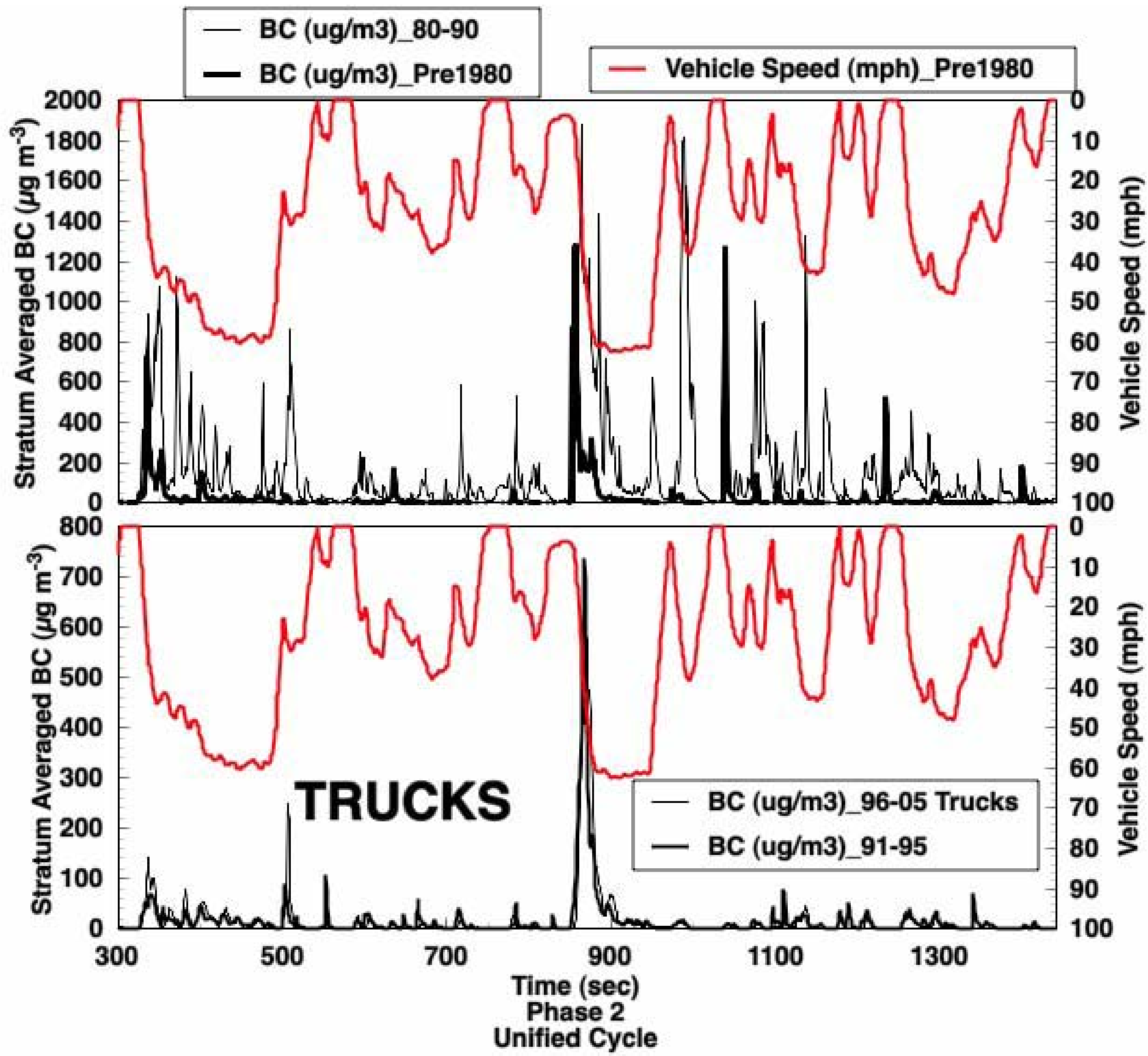


Figure 4-112. BC emissions during phase 2 of the unified cycle for trucks

(Note that in comparing the older cars and trucks that the older trucks had less emission during Phase 2 than did the cars. This could be an artifact of the sample size, though it does point out that older vehicles, when warmed up, can have modest emission rates.)

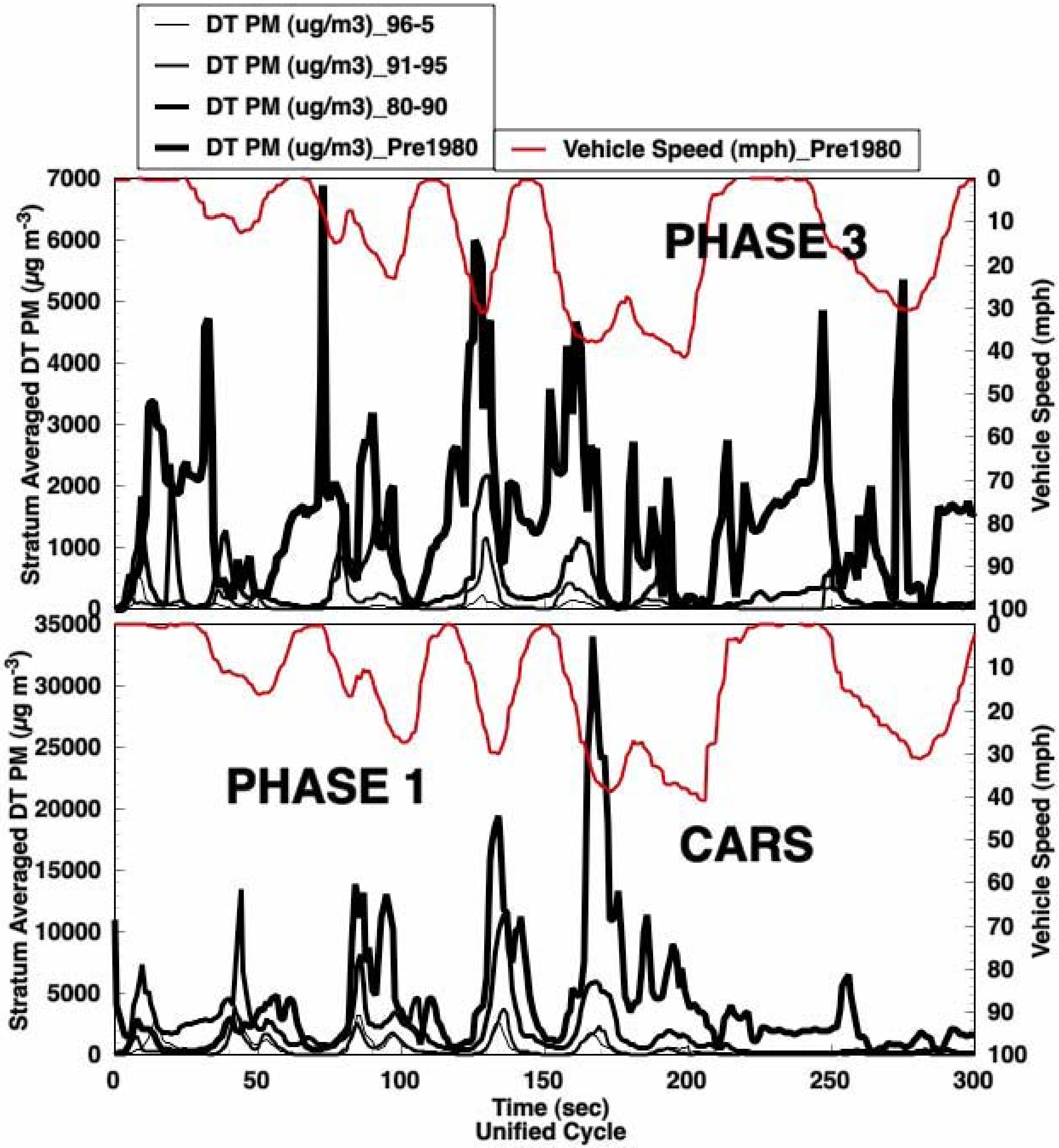


Figure 4-113. Stratum averaged DustTrak PM emission for passenger cars as it relates to vehicle speed.

(Phase 1 is associated with a cold start of the vehicles, and Phase 3 is an identical driving cycle but one that follows a warm start after an 8 minute soak period. Note that newer cars have much less emission in Phase 3.)

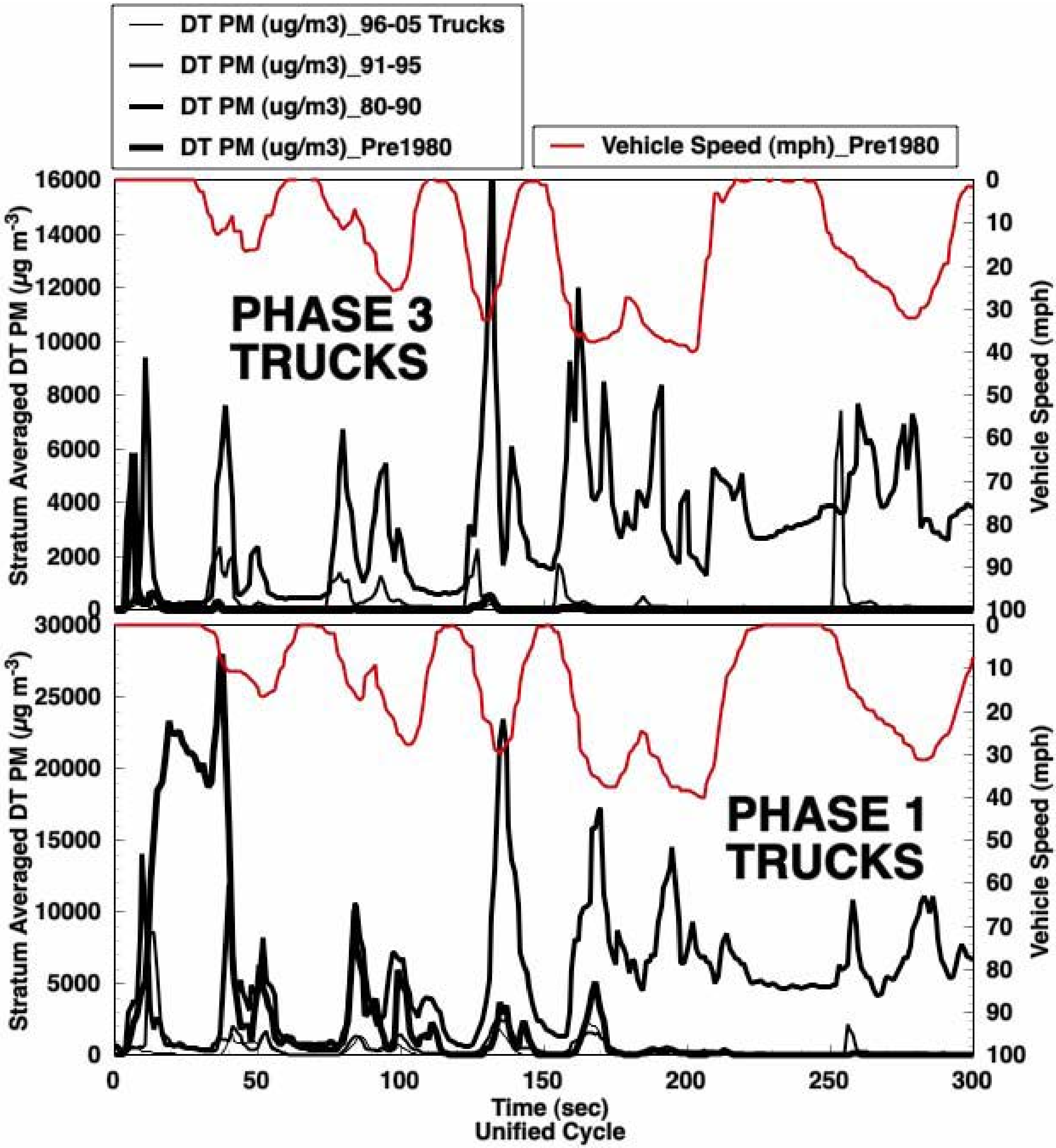


Figure 4-114. Stratum averaged DustTrak PM emission for trucks as it relates to vehicle speed.

(Note the high emissions during phase 1 of the oldest truck, and that it is much less in Phase 3, illustrating that the warm vehicle emission rates are much lower. Note that there were only 2 trucks in that category. Cleaner trucks behave as cleaner cars. Note that PM emission rates of the model year 80-90 vehicles during Phase 3 are high and seem to have little relation with the driving cycle.)

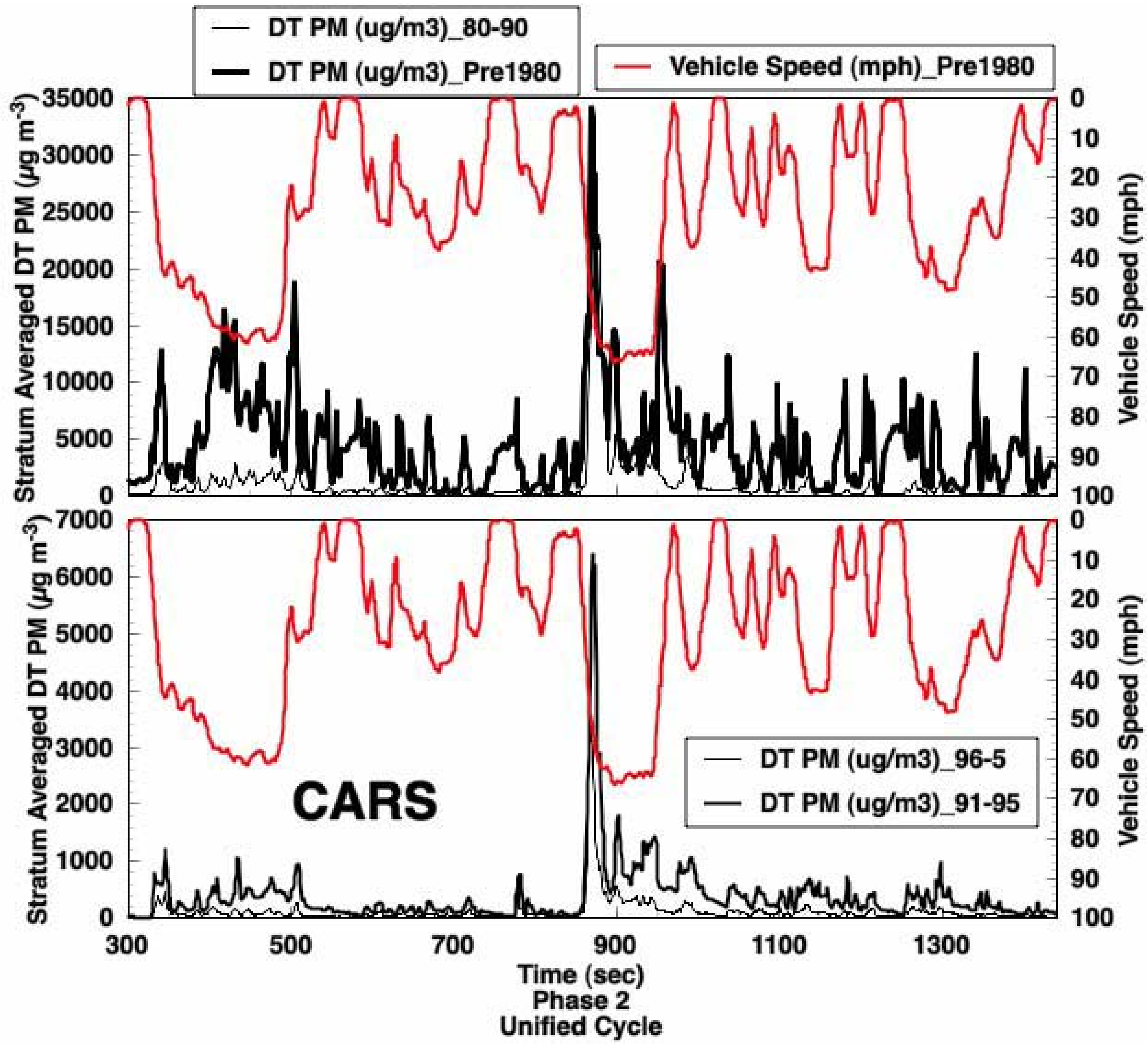


Figure 4-115. DustTrak PM emissions during phase 2 of the unified cycle for passenger cars

(For newer (lower graph) and older (upper graph) vehicles. Note that PM emissions peak during the aggressive acceleration in about the middle portion of the cycle right before 900 seconds. Note in the upper graph that the oldest category of vehicles had high emission on both accelerations as well as decelerations. Note that the older vehicles shown in the upper graph had about a factor of 5 more emission during the high acceleration portion of the cycle before 900 seconds.)

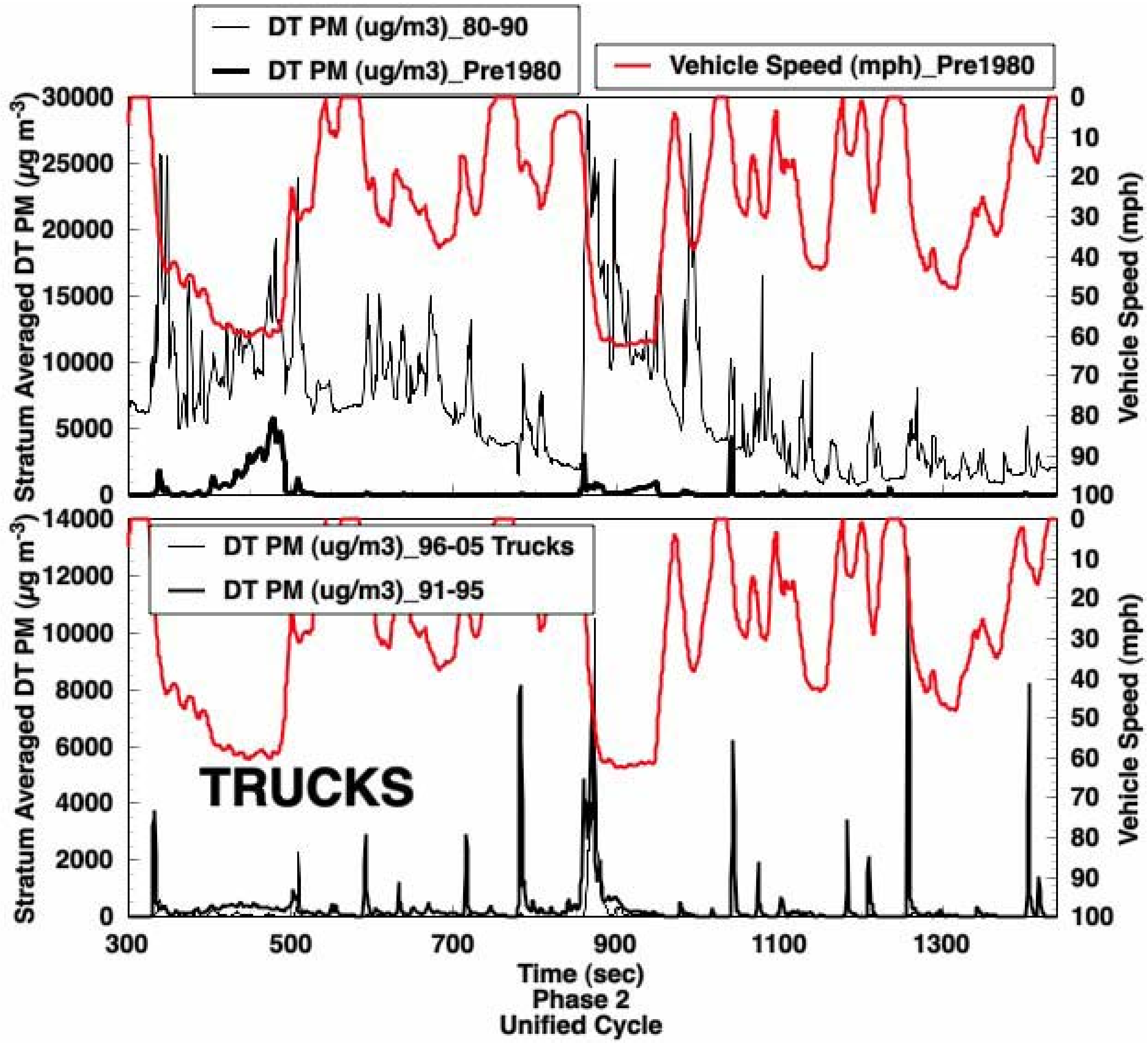


Figure 4-116. DustTrak PM emissions during phase 2 of the unified cycle for trucks

(Newer cars (see the lower graph in Fig. 4-28) have about 1/2 the emissions as newer trucks (lower graph above) and both have peaks during accelerations.)

Table 4-35. Emission rates in mg/mile for Phase 1 of the unified cycle for cars and trucks.

Phase 1		Car			Truck	
Model Year	BC	DustTrak	DataRam	BC	DustTrak	DataRam
Round 1						
1971-1980	63.9	249.2	396.7	72.5	171.5	194.2
1981-1990	18.1	112.7	781.8	19.7	324.8	4557.9
1991-2000	4.4	26.1	73.4	3.4	33.1	171.1
2001-2010	3.6	27.2	167.5	4.1	14.9	14.0
Round 2						
1971-1980	168.4	630.9	2285.7	57.3	422.0	2401.7
1981-1990	35.6	207.2	1026.5	68.1	364.3	1771.7
1991-2000	20.4	103.8	259.5	15.6	67.5	165.4
2001-2010	12.8	89.1	137.3	12.6	54.9	58.7

Table 4-36. Emission rates in mg/mile for Phase 2 of the unified cycle for cars and trucks.

Phase 2		Car			Truck	
Model Year	BC	DustTrak	DataRam	BC	DustTrak	DataRam
Round 1						
1971-1980	25.5	138.4	677.8	0.9	9.2	69.6
1981-1990	4.9	33.2	213.7	4.8	214.2	3800.6
1991-2000	0.7	11.8	70.6	0.5	10.9	78.4
2001-2010	0.3	3.8	32.0	0.5	3.2	2.8
Round 2						
1971-1980	20.0	50.8	82.4	3.2	41.8	129.8
1981-1990	3.1	31.3	186.0	10.4	39.4	91.3
1991-2000	1.2	20.8	111.3	0.6	15.2	32.8
2001-2010	0.4	2.5	2.9	0.3	1.5	2.0

Table 4-37. Emission rates in mg/mile for Phase 3 of the unified cycle for cars and trucks.

Phase 3		Car			Truck	
Model Year	BC	DustTrak	DataRam	BC	DustTrak	DataRam
Round 1						
1971-1980	37.5	92.1	105.6	1.9	4.8	4.7
1981-1990	3.8	22.2	142.7	7.3	192.0	2086.8
1991-2000	0.8	7.2	13.3	0.8	18.9	78.7
2001-2010	0.3	2.3	3.8	0.4	1.8	2.1
Round 2						
1971-1980	28.7	52.4	93.6	3.0	22.9	21.2
1981-1990	1.7	15.2	131.8	3.0	19.1	92.9
1991-2000	0.7	4.2	7.6	0.5	2.7	4.7
2001-2010	0.1	0.5	0.5	0.2	0.8	0.9

4.5.4 Conclusions

- Gravimetric mass measurements of field blanks ranged from 1.1 to 9.9 μg/filter with an average of 5.4 and standard deviation of 3.4 μg/filter for Round 1, and -1.5 ± 1.2 μg /filter for Round 2. This compares to the measurement uncertainty for these filters of 4.6 μg/filter, which is determined by replicate measurement.
- Interlaboratory comparisons of gravimetric mass measurements by DRI and EPA show agreement to within the analytical uncertainty of the method and no systematic bias.
- Continuous methods show large variations in PM emissions with vehicle speed. They can be useful for characterizing the effect of driving patterns on emissions and phase-specific emission rates.
- Photoacoustic BC is consistent with EC measured by TOR analysis of quartz filters. BC is a viable method for measuring inorganic carbon emissions with high time resolution, even when concentrations are low.
- Nephelometer based methods for continuous PM measurements agree well at lower concentrations, but show significant overestimation at higher concentrations. This problem is particularly severe for the DataRAM4and can result in over-emphasis of the emissions for high emitters.
- $PM_{2.5}$ concentrations for the 5-minute test cycle Phases are difficult to measure by gravimetric analysis of filter samples when the vehicle emission rates are low,

especially Phase 3. Continuous methods, if properly calibrated, may be more useful in those cases.

4.6 Speciated Emissions of Particulate Matter

4.6.1 Background

Receptor models have been widely used to estimate the contributions of various sources of measured ambient particulate matter concentrations (Hopke, 1997; Henry, 1997; Watson et al., 2001). This approach requires knowledge of the number of sources contributing to the observed airborne concentration of particle mass and chemical species, but also the composition of the particles emitted from each source. The emission rate and chemical composition of gaseous and particulate pollutants from motor vehicles depend upon many factors, which include vehicle age and mileage, fuel, lubricating oil, emission control technology, vehicle operating mode (cold start, hot stabilized), load, ambient temperature, and state of maintenance. Most gasoline vehicles are relatively clean, especially in hot-stabilized mode. Virtually all of the PM emissions from "normal emitters" come from the first few minutes during a cold start and from hard accelerations with relatively higher amounts of elemental carbon during both cold starts and hard accelerations (see Section 4.5). In contrast, high emitters have cumulative PM emissions that are more linear with time than normal emitters with higher OC/TC ratios. Because of the variability of OC/EC splits, gasoline and diesel vehicles are difficult to apportion by carbon analysis alone, and EC is not a unique tracer for diesel exhaust.

More recent applications of the chemical mass balance (CMB) receptor model utilized particulate organic markers (Schauer et al., 1996; Watson et al., 1998; Fujita et al., 1998) as well as combination of particulate and gaseous markers (Schauer et al., 2002). Polycyclic aromatic hydrocarbons (PAH) are present in emissions from all combustion sources and the relative proportions of different PAH compounds in emissions from a given source may vary over several orders of magnitude. PAH exhibit a wide range of volatility with naphthalene existing almost entirely in the gas phase, while benzo(a)pyrene, other five-ring PAH, and higher ring PAH are predominantly adsorbed on particles. The intermediate three- and four-ring PAH (semi-volatile PAH) are distributed between the two Phases. Gasoline vehicles, whether low or high emitter, emit greater relative amounts of high molecular-weight particulate PAHs (e.g., benzo(b+j+k)fluoranthene, benzo(ghi)perylene, ideno(1,2,3-cd)pyrene, and coronene) (Zielinska and Sagebiel, 2001; Fujita et al., 2005) than diesel vehicles. These PAHs have been found in used gasoline motor oil but not in fresh oil nor in diesel engine oil. Diesel vehicles also emit particulate PAHs, but in lower relative proportions to other PAHs, especially the semi-volatile methylated PAHs. Diesel emissions contained higher proportions of dimethylnaphthalenes, methyl- and dimethylphenanthrenes, and methylfluorenes. Gasoline vehicles, even normal emitters, emit volatile PAH's (e.g., naphthalene and methylnaphthalenes) in amounts per unit of fuel that equals or exceeds that of diesel vehicles. These semi-volatile PAH and other organic compounds (e.g., alkanes) in motor vehicle emissions contribute to the formation of secondary organic aerosols.

Hopanes and steranes have also been identified as potential molecular markers for PM emission from motor vehicles. These organic compounds are present in lubricating oil with similar composition for both gasoline and diesel vehicles and are not present in gasoline or diesel fuels. Emission rates of hopanes and steranes are the highest for both gasoline and diesel “high emitting” vehicles. While hopanes and steranes are useful markers for internal combustion engines, the composition of various individual hopanes and steranes are similar in the exhaust from both gasoline and diesel engines. However, the relative abundances of hopanes and steranes to emissions of elemental carbon differ substantially for the diesel and gasoline vehicles. The differences in the ratios of hopanes plus steranes to elemental carbon could be used to quantify the contribution of gasoline-powered and diesel-powered vehicles (Schauer, 2002).

A major goal of the vehicle test program in Kansas City is to obtain up-to-date gasoline-powered vehicle exhaust composition profiles for application in developing speciated emissions inventories and ambient source apportionment studies. An important issue in the general applicability of these profiles is whether gas-particle partitioning of certain organic compounds with the high-volume source sampling used in Kansas City differs substantially from the low-flow, ambient sampling techniques used in some source apportionment studies. To address this issue, organic samples were also collected during Round 2 with ambient, low-flow samplers to compare with source, high-volume organic samples collected in the Kansas City Light Duty Vehicle Emissions Study.

4.6.2 Experimental Methods

BKI conducted the vehicle emissions tests on their transportable Clayton Model CTE-50-0 chassis dynamometer over the LA92 Unified Driving Cycle. The test site and dynamometer setup are described in Chapter 2. The vehicle emissions tests were conducted in Kansas City during July to September 2004 (summer/Round 1) and January to March 2005 (winter/Round 2). The cycle consists of a cold start Phase 1 (first 310 seconds), a stabilized Phase 2 (311-1427 second), a 600-second engine off soak, and a warm start Phase 3 (repeat of Phase 1 of the LA92). Cars and light-duty trucks were recruited for testing in four model year groups (Pre-1981, 1981-90, 1991-95 and 1996 and newer). The vehicle groupings for trucks and cars are designated strata 1-4 and 5-8, respectively. The strata are ordered from to older to newer model years. Details of the vehicle recruitment aspects of the study are given in Chapter 2. Tables 4-38 and 4-39 summarize the numbers of samples collected and subsequently selected for chemical analysis in Rounds 1 and 2, respectively. Pairs of Teflon and quartz filters were collected for each of the three phases of the cold start LA92 driving cycle, and integrated samples were collected over the entire cycle for organic speciation samples. Full sets of sampling media were also collected for daily 60-minute tunnel blanks and weekly (approximate) field/transport blanks. Teflon and quartz filters were collected during weekly tests of the calibration vehicle and for 15 replicate tests in Round 1 and 10 in Round 2.

Table 4-38. Summary of sample selection for chemical analysis during Round 1.

Week	Week Ending	STRATUM 1	2	3	4	5	6	7	8	Weekly Total	Dilution Blanks	Transit Blanks	Corr. Vehicle	Replicate Tests
Vehicles Tested														
1	17-Jul	1	0	0	3	0	0	3	2	9	4	0	0	0
2	24-Jul	0	1	5	4	1	3	1	8	23	6	0	0	1
3	31-Jul	0	0	1	4	0	2	3	15	25	6	0	1	0
4	7-Aug	0	0	4	4	0	2	5	7	22	6	2	2	4
5	14-Aug	1	1	2	4	0	5	5	6	24	6	1	1	1
6	21-Aug	0	2	1	3	1	0	3	6	16	6	1	1	2
7	28-Aug	0	0	2	2	0	6	7	5	22	6	1	1	0
8	4-Sep	0	2	0	1	0	5	5	4	17	4	0	0	0
9	11-Sep	0	1	2	0	2	5	2	2	14	4	1	1	1
10	18-Sep	0	1	3	1	1	7	4	13	30	6	1	1	1
11	25-Sep	0	2	0	6	0	1	5	13	27	6	1	1	4
12	2-Oct	0	0	1	2	1	1	8	12	25	5	1	3	0
	Actual	2	10	21	34	6	37	51	93	254	65	9	12	14
	Planned	16	26	26	39	16	51	34	42	250	60	12	12	15
Samples Selected for Chemical Analysis														
1	17-Jul	1	0	0	1	0	0	0	1	3	2	0		
2	24-Jul	0	1	3	2	1	1	0	3	11	4	0		
3	31-Jul	0	0	0	0	0	1	2	1	4	1	0		
4	7-Aug	0	0	0	0	0	0	0	0	0	0	2		
5	14-Aug	1	0	0	0	0	1	3	0	5	5	1		
6	21-Aug	0	1	0	0	1	0	0	5	7	4	1		
7	28-Aug	0	0	0	0	0	0	0	0	0	0	1		
8	4-Sep	0	0	0	0	0	0	0	0	0	1	0		
9	11-Sep	0	1	1	0	2	1	1	0	6	2	1		
10	18-Sep	0	1	2	0	0	0	1	5	9	5	1		
11	25-Sep	0	0	0	5	0	0	0	0	5	0	1		
12	2-Oct	0	0	0	0	1	0	0	0	1	0	1		
	Actual	2	4	6	8	5	4	7	15	51	24	9		
	Planned	4	4	6	10	5	4	9	10	52	30	12		
	% of Total (a)	100%	40%	29%	24%	83%	11%	14%	16%	20%				
Individual/Composites Samples Analyzed														
1	17-Jul	0	0	0	0	0	0	0	0	0				
2	24-Jul	1	1	1	1	1	2	0	1	8				
3	31-Jul	0	0	0	0	0	1	1	0	2				
4	7-Aug	0	0	0	0	0	0	0	0	0				
5	14-Aug	1	0	0	0	0	0	1	0	2				
6	21-Aug	0	1	0	0	1	0	0	1	3				
7	28-Aug	0	0	0	0	0	0	0	0	0				
8	4-Sep	0	0	0	0	0	0	0	0	0				
9	11-Sep	0	1	0	0	2	1	1	0	5				
10	18-Sep	0	1	1	0	0	0	1	1	4				
11	25-Sep	0	0	0	1	0	0	0	0	1				
12	2-Oct	0	0	0	0	1	0	0	0	1				
	ACTUAL	2	4	2	2	5	4	4	3	26	6	3		
	PLANNED	4	4	2	2	5	4	3	2	26	6	3		
	No./Comp (b)	1	1	3	4	1	1	1.75	5		4	3		

a. The percentage of total vehicles tested in each stratum that is reflected in the chemical analysis.
b. The average number of vehicles included in each chemical composite by strata. The targets were no compositing for Strata 1, 2, 5, and 6, three vehicles for Strata 3 and 7, and five vehicles in Strata 4 and 8.

Table 4-39. Summary of sample selection for chemical analysis during Round 2.

Week	Week Ending	STRATUM 1	2	3	4	5	6	7	8	Weekly Total	Dilution Blanks	Transit Blanks	Corr. Vehicle	Replicate Tests
Vehicles Tested														
1	15-Jan	2	0	0	4	0	1	3	7	17	4	1	0	0
2	22-Jan	0	0	3	6	0	1	6	12	28	6	1	1	1
3	29-Jan	0	4	3	1	2	2	7	0	19	5	1	1	2
4	5-Feb	0	2	2	6	1	0	4	4	19	6	1	2	2
5	12-Feb	0	0	6	8	0	1	6	4	25	6	1	1	0
6	19-Feb	0	0	3	10	0	1	5	1	20	6	1	1	2
7	26-Feb	0	0	2	3	2	1	5	2	15	6	1	1	0
8	5-Mar	0	0	1	2	5	3	1	2	14	6	1	1	0
9	12-Mar	0	5	4	5	1	6	2	2	25	6	1	1	1
10	19-Mar	3	13	1	0	1	11	2	0	31	6	1	1	1
11	26-Mar	1	9	1	2	4	5	2	0	24	6	1	1	1
12	2-Apr	1	1	2	2	1	6	1	4	18	6	1	1	0
13	9-Apr	2	0	5	13	0	2	0	2	24	5	1	0	0
	Actual	9	34	33	62	17	40	44	40	279	74	13	12	10
	Planned	11	42	32	56	18	39	43	38	279	68	12	12	10
Samples Selected for Chemical Analysis														
1	15-Jan	0	0	0	0	0	0	0	0	0	0			
2	22-Jan	0	0	0	0	0	0	0	0	0	0			
3	29-Jan	0	1	0	0	0	1	2	0	4	1			
4	5-Feb	0	1	2	5	2	0	3	4	17	4			
5	12-Feb	0	0	1	0	0	0	0	0	1	0			
6	19-Feb	0	0	0	0	0	0	0	0	0	0			
7	26-Feb	0	0	2	3	0	1	1	2	9	5			
8	5-Mar	0	0	1	1	2	2	1	2	9	5			
9	12-Mar	0	1	1	2	0	1	2	1	8	6			
10	19-Mar	2	0	0	0	0	0	0	0	2	2			
11	26-Mar	1	0	0	0	0	0	0	0	1	0			
12	9-Apr	0	0	0	0	0	0	0	0	0	0			
	Actual	3	3	7	11	4	5	9	9	51	23	14		
	Planned	3	3	9	15	3	4	12	15	64	30	12		
	% of Total (a)	33%	9%	21%	18%	24%	13%	20%	23%	18%				
Individual/Composites Samples Analyzed														
1	15-Jan	0	0	0	0	0	0	0	0	0	0			
2	22-Jan	0	0	0	0	0	0	0	0	0	0			
3	29-Jan	0	1	0	0	0	1	1	0	3	0			
4	5-Feb	0	1	1	1	1	0	1	1	6	1			
5	12-Feb	0	0	0	0	0	0	0	0	0	0			
6	19-Feb	0	0	0	0	0	0	0	0	0	0			
7	26-Feb	0	0	1	0	0	1	1	1	4	1			
8	5-Mar	0	0	0	2	2	1	0	1	6	2			
9	12-Mar	1	1	1	0	0	1	1	0	5	2			
10	19-Mar	1	0	0	0	0	0	0	0	1	0			
11	26-Mar	1	0	0	0	0	0	0	0	1	0			
12	9-Apr	0	0	0	0	0	0	0	0	0	0			
	Actual	3	3	3	3	3	4	4	3	26	6		58	
	Planned	3	3	3	3	3	4	4	3	26	6	3	61	
	No./Comp (b)	1	1	2.33	3.67	1.33	1.25	2.25	3	4				
	EPA Add-on (c)		1	1		1	1			4				

a. The percentage of total vehicles tested in each stratum that is reflected in the chemical analysis.
b. The average number of vehicles included in each chemical composite by strata. The targets were no compositing for Strata 1, 2, 5, and 6, three vehicles for Strata 3 and 7, and five vehicles in Strata 4 and 8.
c. Additional composites developed for low-flow sampling experiment.

4.6.2.1 Sampling Methods

DRI installed and operated a suite of instruments and samplers to provide continuous PM analysis and to collect batch samples of particle and gaseous exhaust components for later analysis in accordance with the methods and procedures specified in the project QAPP. Samples were collected from the dynamometer dilution system via two isokinetic probes, provided by BKI, inserted prior to a 90-degree bend in the dilution tunnel. Figure 4-117 illustrates the sample train as it was installed during the study. Heated conductive lines carried air from the probes to the continuous instruments. Sample air was drawn from the CVS via ½" insulated copper tubing to a small heated stainless steel chamber. The sample air exited via a $PM_{2.5}$ cyclone contained in the chamber to a heated diffusing chamber approximately 50 cm tall, containing a temperature and RH probe. From this chamber, the sample air exited through two filter cartridges. Up to eight cartridges could be installed in the base of the diffusing chamber, allowing four successive pairs of filters to sample without changing cartridges. Airflow thru the cartridges was switched by means of microprocessor controlled relays and solenoid valves, that responded to TTL line signals from the dynamometer control. Flow rates for each filter were set to 56 lpm by adjustable valves to give a combined flow of approximately 113 lpm as required by the inlet cyclone, and monitored by TSI 4000 flowmeters with serial data outputs. A single oil-less pump was used to draw air through the sampler.

Filter samples were collected during each phase of the unified cycle tests. Pre-weighed Gelman polymethylpentane ringed, 2.0 mm pore size, 47 mm diameter PTFE Teflon-membrane Teflo filters (No. RPJ047) collected particles for measurement of gravimetric mass and elements. Pallflex 47 mm diameter pre-fired quartz-fiber filters (No. 2500 QAT-UP) were used for water-soluble chloride, nitrate and sulfate and for organic and elemental carbon measurements. Samples were collected by a separate sampler for determination of particulate and semi-volatile organic compounds on Pallflex TX40HI20-WW 102 mm diameter Teflon-impregnated glass fiber (TIGF) filters followed by glass cartridges containing Aldrich Chemical Company, Inc. 20-60 mesh Amberlite XAD-4 (polystyrene-divinylbenzene) adsorbent resins at a flow rate of 112 lpm. A single filter and adsorbent pair were collected for each unified cycle, combining Phases 1, 2 and 3. Sampling was suspended during the 10-minute soak period by turning off the pump.

Prior to the start of Round1 and Round 2, all samplers were checked for leaks and the in-line flow meters were cross-calibrated using reference flow measurement devices. Leak testing was performed by capping the inlet lines leading to each sampler and turning on the pumps. If the flow meter readings decreased to less than 10% of the nominal sampling flow rate in a reasonably short time, the system was passed. If not, the leak was fixed and the test repeated. With the exception of the Teflon/Quartz filter sampler, all units achieved near-zero flow rates during the leak test. Due to the friable nature of the pre-fired quartz filters, it is not possible to obtain a perfect seal in the filter holders without damaging the media, but the <10% criteria was still met for each filter individually and for the system as a whole. In addition to the vacuum test, the sum of flows through each of the two filter cartridges was compared to the total flow entering the inlet and found to agree within 5%.

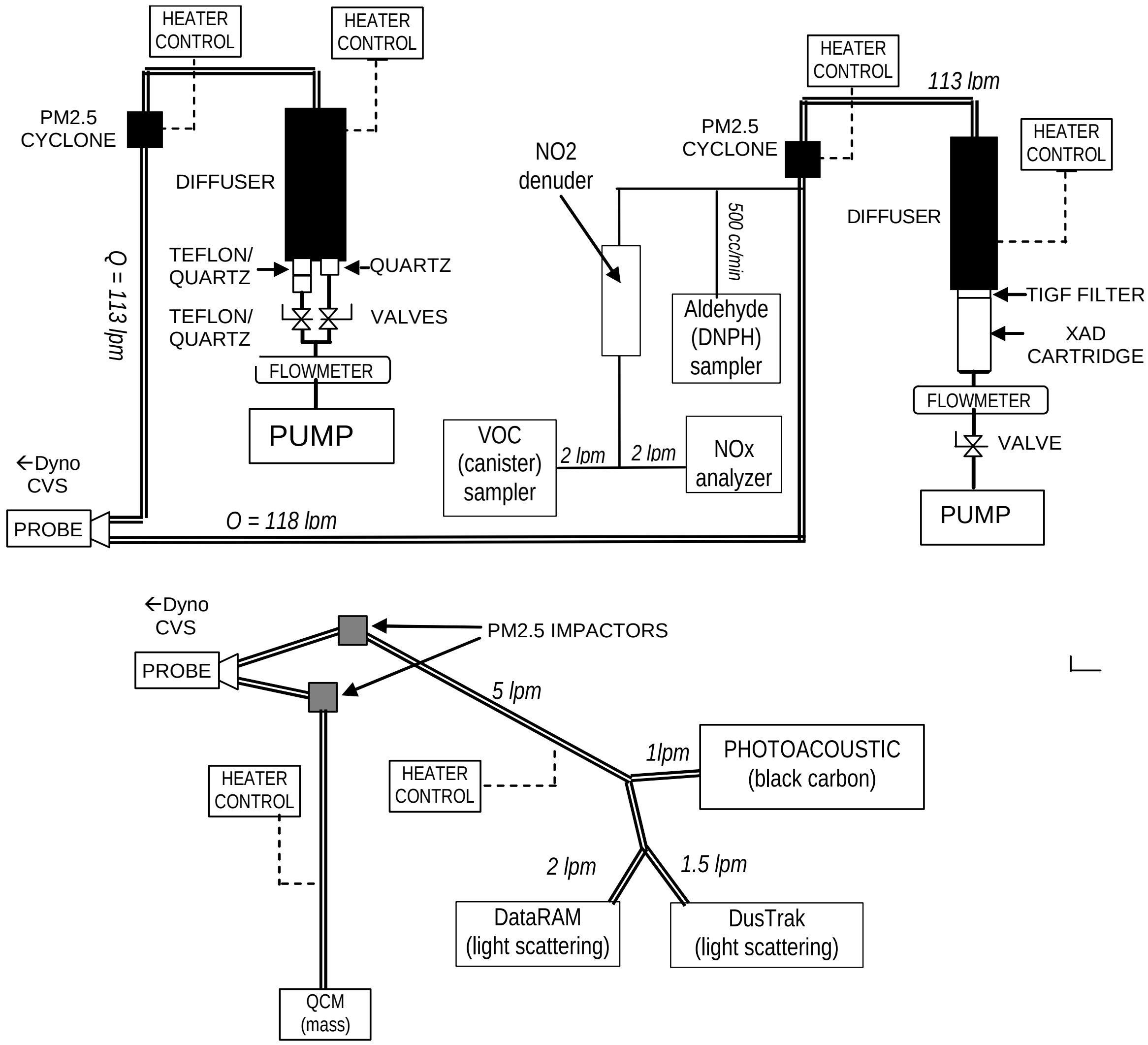


Figure 4-117. Schematic of sampling train with flow rates. (Heated tubing is shown as double lines.)

All flowmeters were calibrated using either a Gillibrator electronic bubble meter or a rotameter that had been cross-calibrated with a Roots meter at DRI. Calibration flows were measured at the inlet point of each sampler (or outlet for the canister sampler) with appropriate sampling media installed. The resulting calibrations were used to determine the desired nominal flow rates, and these were marked on a label on each flowmeter so that the operator could observe any deviations during testing. Variations in nominal flow rate due to sampler problems were recorded in a logbook. For each integrated sample, the run number, start and stop time, elapsed time, initial and final flow rate, and any exceptional occurrences were recorded on log sheets which were kept with the media at all times. Bar coded stickers with unique media IDs were attached to all media and their corresponding log sheets for tracking. Immediately after the conclusion of each test cycle, the media were repacked with the log sheets and stored in a refrigerator, except for the canisters, which were packed and shipped via 2-day express to DRI each day. All media were packed into coolers with ice packs and shipped overnight back to DRI where they were logged in and placed in cold storage until analysis. Media were shipped near weekly basis. Run number, date, time, and vehicle license plate number were attached to all files to identify the data.

The low-volume samples were collected in parallel with the higher-volume TIGF/XAD samples collected for the main study. The high-volume flow was split into two channels, one at 103 lpm and the other at 10 lpm. Seventy-two (72) low-volume (10 lpm) samples were collected during a contiguous three-week period at the mid-point of the main Kansas City Study from 2/15 to 3/8. These samples were collected on Teflon filters (Gelman 37 mm Teflo) using a dual stage 37 mm Teflon filter pack (EPA custom design with ¼" FNPT with quick release) using filter holders supplied by EPA. Eight field/transport blanks were included using the same media loading/unloading and transport procedure and tunnel blanks were collected daily.

4.6.2.2 Sample Selection for Chemical Analyses

Based upon previous studies (e.g., Gasoline/Diesel PM Split Study), PM loadings were expected to be sufficient for chemical analysis for most vehicles in the two older model year strata. In contrast, the need for compositing was anticipated for the two new model year categories in order to obtain adequate analytical sensitivity for organic analysis. Because the study design called for testing the vehicles in random order, no media composites were possible (i.e., sampling multiple vehicles on the same media). Rather an appropriate number of samples were extracted and analyzed together for analytical methods that allow compositing prior to the chemical analysis (e.g., elements by ICP-MS, ions by IC, organic speciation by GC/MS, carbonyl compounds by HPLC-UV, and volatile organics by GC-FID).

Sufficient numbers of samples were collected weekly to create composites in all categories except for the 1996 and newer categories. Timely decisions were required to either analyze the sample set, hold them for subsequent compositing with other samples, or remove the sample from further consideration by either archiving the sample or, in the case of canisters, to discard the sample and recycle the clean evacuated canister back to the field. DRI made these decisions on a weekly basis. The target mass loading for each composite was a minimum of 1 mg of organic carbon, which was estimated by the differences of the continuous mass measurements (average of the QCM and DustTrak) minus the continuous BC measurements by PA. Composites consisted of samples with similar OC to PM ratios. Some composites containing high BC to PM ratios (i.e., black smokers) were also selected for analysis. The remaining samples not selected for analysis were sent to EPA in Research Triangle Park to be archived.

All field and tunnel blanks and samples for replicate and calibration vehicle test were analyzed for gravimetric mass and OC and EC. Complete speciation was obtained for dilution tunnel blanks, field/transport blanks and for subsets of vehicle test samples from each round. The test samples were selected for chemical analysis and grouped into composites according to the protocol developed in consultation with EPA. A total of 26 individual/composite chemical profiles were obtained from 51 of 254 vehicles tested in Round 1 and another 26 composites from 51 of 230 vehicles tested in Round 2 (excludes repeat vehicles from Round 1). Tables 4-40 and 4-41 lists the samples selected for chemical analysis in Rounds 1 and 2, respectively. Dilution tunnel blanks were also combined into several composites as shown in Table 4-42. The composites are identified according to the following convention: Xa-b, where X= season/round

(S for summer/Round 1 and W for winter /Round 2); a is the stratum (1 through 8) and 0 for tunnel blank composites; and b is the composite number within each stratum. The test samples for the later model-year strata (3, 4, 7 and 8) were analyzed as composites of multiple samples. The samples within each composite were extracted together or otherwise combined prior to the chemical analysis (e.g., elements by ICP-MS, ions by IC, organic speciation by GC/MS, carbonyl compounds by HPLC-UV, and volatile organics by GC-FID). Samples for the older vehicle strata (1, 2, 5, and 6) were analyzed without compositing. The odometer readings shown in Tables 4-40 and 4-41 are uncorrected for odometer malfunctions or turnovers.

4.6.2.3 Analytical Methods

The relevant analytical methods and procedures are described in the project QAPP and references cited therein. Selected Teflon filters were analyzed by a combination of XRF (40 elements) using DRI protocol A (Watson et al., 1999) and ICP-MS (Pb, Hg, As, Cr, Cu, Zn and Mn). Following gravimetric mass and XRF analysis of the Teflon filters for the separate phases of the LA92 test cycle, the three filters were extracted together and the composite sample analyzed by ICP-MS. Selected quartz filter were analyzed for OC/EC by thermal optical reflectance (TOR) method using the IMPROVE (Interagency Monitoring of Protected Visual Environment) temperature/oxygen cycle (IMPROVE-TOR) (Chow et al., 1993; Chow et al., 2001). It should be noted that because EC and OC are operationally defined, the specific instrument used and details of its operation and choice of thermal evolution protocol can influence the split between EC and OC (Watson et al. 2005). Each half of the quartz filter for the three phases of the LA92 test cycle was extracted together and analyzed for chloride, nitrate, and sulfate by ion chromatography. No cations analysis was budgeted for this project.

The TIGF/XAD samples were extracted and analyzed together for the two older model year groups (pre-1980 and 1980–1990). TIGF and XAD extracts were analyzed separately for the two newer model year groups (1991-1995 and 1996 and newer) and for the tunnel and field/transport blanks. Samples selected for analysis were extracted and the extracts combined according to the composite decisions. The extracts were analyzed on a Varian 1200 triple quadruple gas chromatograph/mass spectrometer (GC/MS/MS) system or a Varian coupled to a Saturn 2000 ion trap mass spectrometer system with MS/MS and chemical ionization capabilities. Species identification and quantitation include 95 semi-volatile and particulate PAH, 19 hopanes, 18 steranes, 49 alkanes, 99 polar organic compounds, and 25 nitro-PAH. Method detection limits are 0.01-0.03 ng/μl for PAH, hopanes and steranes, and alkane compounds, and 0.03-0.04 ng/μl for polar compounds.

Table 4-40. Vehicle test samples selected for chemical analysis in Round 1 and composite identification.

Sample Composite	Run #	Sample Date	Time	Model Year	Make	Model	Vehicle Type	Odometer	Stratum
S1-1	84037	7/15	10:50	1979	Ford	F250	Truck	102264	1
S1-2	84154	8/10	15:21	1979	Ford	F150	Truck	53493	1
S2-1	84048	7/19	11:00	1989	Dodge	Caravan	Truck	161017	2
S2-2	84201	8/21	9:42	1985	Chevrolet	S10	Truck	30295	2
S2-3	84263	9/9	10:57	1989	Dodge	Ram	Truck	132325	2
S2-4	84283	9/13	13:48	1985	Dodge	Ram	Truck	47582	2
S3-1	84066	7/22	14:08	1995	Jeep	Wrangler	Truck	74158	3
S3-1	84067	7/22	15:44	1995	Dodge	Caravan	Truck	113890	3
S3-1	84073	7/24	10:09	1995	Chevrolet	S10 Blazer	Truck	100758	3
S3-2	84278	9/11	15:22	1990	GMC	Jimmy	Truck	130254	2
S3-2	84281	9/13	11:15	1995	Chevy	Suburban	Truck	73848	3
S3-2	84287	9/14	11:02	1995	GMC	Sierra	Truck	171370	3
S4-1	84034	7/14	14:16	1999	Isuzu	Trooper	Truck	63375	4
S4-1	84055	7/20	15:36	1998	Jeep	Cherokee	Truck	131875	4
S4-1	84072	7/24	8:34	2003	Chevrolet	S10 Pickup	Truck	19366	4
S4-2	84337	9/23	8:08	2003	Ford	Ranger	Truck	11678	4
S4-2	84339	9/23	10:34	1999	Plymouth	Voyager	Truck	75489	4
S4-2	84343	9/24	8:23	2004	KIA	Sedona	Truck	na	4
S4-2	84344	9/24	9:43	2000	Toyota	Sienna	Truck	na	4
S4-2	84349	9/25	8:11	2003	Chevy	Tracker	Truck	na	4
S5-1	84076	7/24	14:28	1968	Ford	Mustang	Car	98852	5
S5-2	84188	8/18	9:40	1977	Chevrolet	Monte Carlo	Car	135545	5
S5-3	84271	9/10	14:41	1979	Buick	LeSabre	Car	37608	5
S5-4	84277	9/11	13:45	1978	MG	MGB	Car	42926	5
S5-5	84367	9/28	16:11	1980	Mercedes	450SEL	Car	na	5
S6-1	84071	7/23	12:42	1989	Pontiac	Grand Am	Car	116806	6
S6-2	84079	7/26	11:08	1989	Honda	Accord	Car	209972	6
S6-3	84180	8/16	10:39	1985	Pontiac	Bonneville	Car	236759	6
S6-4	84270	9/10	13:21	1986	Mercury	Grand Marquis	Car	36277	6
S7-1	84101	7/30	13:22	1994	Toyota	Camry	Car	169034	7
S7-1	84108	7/31	14:59	1991	Honda	Civic	Car	214131	7
S7-2	84157	8/11	10:54	1994	Nissan	Sentra	Car	127045	7
S7-2	84165	8/12	15:05	1991	Mazda	Protégé	Car	185565	7
S7-2	84174	8/14	9:37	1994	Mercury	Topaz	Car	32686	7
S7-3	84308	9/17	14:36	1994	Pontiac	GrandAM	Car	101526	7
S7-4	84258	9/8	8:46	1991	Olds	Delta	Car	226269	7
S8-1	84042	7/17	9:20	1996	Honda	Civic	Car	131483	8
S8-1	84060	7/21	14:06	1998	Buick	LeSabre	Car	45444	8
S8-1	84062	7/22	8:19	1998	Buick	LeSabre	Car	45444	8
S8-1	84063	7/22	9:47	1996	Saturn	0	Car	74620	8
S8-1	84078	7/26	9:34	1997	Honda	Accord LX	Car	79584	8
S8-2	84178	8/16	8:12	1997	Toyota	Camry	Car	129415	8
S8-2	84183	8/17	8:12	2000	Toyota	Corolla	Car	70118	8
S8-2	84184	8/17	9:37	2000	Honda	Civic	Car	40402	8
S8-2	84185	8/17	10:56	1996	Toyota	Corolla	Car	148857	8
S8-2	84191	8/19	8:13	2000	Toyota	Camry	Car	47771	8
S8-3	84279	9/13	8:39	2001	Toyota	Camry	Car	61415	8
S8-3	84297	9/16	9:45	1996	Dodge	Stratus	Car	146579	8
S8-3	84303	9/17	8:05	2002	Olds	Silhouette	Car	40271	8
S8-3	84304	9/17	9:24	2001	Honda	Civic	Car	49751	8
S8-3	84310	9/18	8:02	2003	Chevy	Venture	Car	24915	8

Table 4-41. Vehicle test samples selected for chemical analysis in Round 2 and composite identification.

Analysis Code	Run #	Sample Date	Time	Model Year	Model	Vehicle Type	Odometer	Stratum
W1-1	84653	3/14	13:21	1977	C-20 Pu	truck	37697	1
W1-2	84687	3/19	15:16	1976	El Camino	truck	61809	1
W1-3	84700	3/22	14:06	1978	Pu	truck	73447	1
W2-1	84462	1/26	14:26	1989	Voyager	truck	145307	2
W2-2	84489	2/2	9:33	1987	Pu	truck	232098	2
W2-3	84634	3/10	9:27	1988	Voyager	truck	162874	2
W2-E	84632	3/9	13:33	1987	F150 Pu	truck	428	2
W3-1	84487	2/1	13:40	1992	B2200	truck	101090	3
W3-1	84497	2/3	13:44	1995	4 Runner	truck	85898	3
W3-1	84510	2/7	10:55	1994	Suburban	truck	187410	3
W3-2	84584	2/24	8:18	1995	Pu	truck	86705	3
W3-2	84591	2/26	8:13	1993	4Runner	truck	178462	3
W3-2	84600	3/1	9:27	1993	Explorer	truck	47980	3
W3-3	84618	3/7	10:39	1992	Voyager	truck	154297	3
W3-E	84621	3/7	14:11	1992	Ranger	truck	13586	3
W4-1	84479	1/31	9:22	1996	Caravan	truck	118369	4
W4-1	84493	2/3	8:38	2004	Freestar Minivan	truck	14714	4
W4-1	84495	2/3	11:13	1996	Sonoma Pu	truck	51863	4
W4-1	84498	2/4	8:24	2001	Sienna Minivan	truck	59734	4
W4-1	84500	2/4	10:58	1998	Frontier Pu	truck	112521	4
W4-2	84577	2/22	8:20	1998	Aerostar	truck	0	4
W4-2	84580	2/23	8:21	2002	Town & Country	truck	84580	4
W4-2	84616	3/7	8:07	1999	Voyager	truck	113389	4
W4-3	84587	2/25	8:56	1996	Villager	truck	166799	4
W4-3	84608	3/4	8:10	1996	Quest	truck	125651	4
W4-3	84617	3/7	9:25	1997	Suburban	truck	145147	4
W5-1	84482	1/31	13:32	1979	Lasabre	car	40364	5
W5-1	84484	2/1	9:25	1979	Lesabre	car	40385	5
W5-2	84601	3/1	10:41	1979	Regal	car	5864	5
W5-3	84605	3/3	10:15	1977	280Z	car	94782	5
W5-E	84637	3/10	13:07	1980	Cutlass Supreme	car	79420	5
W6-1	84474	1/29	9:35	1988	Civic	car	207265	6
W6-2	84582	2/23	11:14	1988	528E	car	287806	6
W6-3	84611	3/4	11:49	1989	Camry	car	168091	6
W6-3	84613	3/5	9:24	1990	Delta 88	car	185694	6
W6-4	84635	3/10	10:36	1989	Crown Vic	car	62847	6
W6-E	84630	3/9	10:38	1989	Accord	car	139963	6
W7-1	84453	1/25	10:59	1995	Maxima	car	181395	7
W7-1	84455	1/25	13:15	1995	Mustang	car	146289	7
W7-2	84485	2/1	11:03	1991	Fleetwood	car	97124	7
W7-2	84499	2/4	9:43	1995	Integra	car	80579	7
W7-2	84505	2/5	10:53	1993	Intrepid	car	210298	7
W7-3	84581	2/23	9:44	1995	Corsica	car	78767	7
W7-3	84597	2/28	11:10	1994	Sunbird	car	145869	7
W7-4	84639	3/11	9:19	1995	Cavalier	car	140500	7
W7-4	84645	3/12	9:15	1993	960	car	197094	7
W8-1	84483	2/1	8:11	1996	Neon	car	79848	8
W8-1	84502	2/4	13:41	1996	Concorde	car	111502	8
W8-1	84503	2/5	8:19	2002	Taurus	car	26406	8
W8-1	84504	2/5	9:37	2000	Concorde	car	65330	8
W8-2	84596	2/28	9:50	1997	Taurus	car	97601	8
W8-2	84599	3/1	8:11	1998	Avalon	car	29575	8
W8-3	84589	2/25	11:28	2001	Sedan	car	56662	8
W8-3	84593	2/26	10:45	1998	Accord	car	75067	8
W8-3	84622	3/8	8:00	1999	Camry	car	64134	8

Note: Identifications ending in “E” are additional composites samples analyzed for the low-flow sampler comparisons.

Table 4-42. Chemical speciation composites of dilution blanks.

Summer/Round1				Winter/Round2			
Composite ID	Run #	Date	Time	Composite ID	Run #	Date	Time
S0-1	84038	7/15	12:32	W0-1	84454	1/25	11:36
S0-1	84044	7/17	12:02	W0-1	84481	1/31	11:51
S0-1	84059	7/21	12:12	W0-1	84486	2/1	12:09
S0-1	84065	7/22	12:23	W0-1	84501	2/4	12:05
S0-1	84075	7/24	12:52	W0-1	84506	2/5	12:01
S0-2	84049	7/19	11:34	W0-2	84579	2/22	10:42
S0-2	84080	7/26	12:20	W0-2	84607	3/3	12:42
S0-3	84147	8/9	11:54	W0-3	84586	2/24	10:41
S0-3	84152	8/10	12:11	W0-3	84590	2/25	12:42
S0-3	84158	8/11	12:04	W0-3	84594	2/26	11:52
S0-3	84170	8/13	12:03	W0-3	84604	3/2	9:42
S0-3	84176	8/14	11:58	W0-4	84583	2/23	12:21
S0-4	84181	8/16	11:55	W0-4	84602	3/1	11:50
S0-4	84186	8/17	12:19	W0-4	84610	3/4	10:31
S0-4	84194	8/19	12:11	W0-4	84615	3/5	11:51
S0-4	84199	8/20	11:12	W0-5	84619	3/7	11:45
S0-5	84255	9/2	11:58	W0-5	84625	3/8	11:47
S0-5	84260	9/8	11:12	W0-5	84631	3/9	11:54
S0-5	84275	9/11	0:00	W0-5	84636	3/10	11:42
S0-6	84282	9/13	12:22	W0-6	84641	3/11	11:36
S0-6	84288	9/14	12:08	W0-6	84647	3/12	11:36
S0-6	84294	9/15	11:56	W0-6	84652	3/14	11:49
S0-6	84306	9/17	11:48	W0-6	84657	3/15	11:31
S0-6	84313	9/18	11:47				

Each sample is reported initially in terms of mass per sample (μg/sample). Ambient concentrations in terms of mass per volume (i.e., ng/m^3 or other units if requested) are reported based upon the sample volume adjusted for ambient temperature and pressure, or reported as "standard" volume. The measurement uncertainties associated with each individual compound are reported as the combined root mean square of the replicate precision for analytical uncertainty, which is defined by the following equation:

$$\sqrt{(\text{replicate precision} * \text{analyte concentration})^2 + (\text{analyte detection limit})^2}$$

This equation incorporates the analyte detection limit for each compound so when concentrations approach zero, the error is reported as the analyte detection limit.

4.6.2.4 Field Blank Subtraction

Analytical results for composite field blanks were divided by the number of media combined for each analysis and the results in μg/sample were compared to each other for consistency. Any obvious outliers were compared to dilution tunnel blanks and exhaust samples for indications of contamination. If outliers appear to be contaminated or substantially different in composition relative to the other field blanks, they were removed from the field blank set. All remaining field blank results are summed and divided by the total number of media represented.

$$\overline{M}_{fb} = \frac{\sum_1^j N_j M_j}{n}$$

where n is the total number of field blank media used in average, N_j is the number of field blank media combined in analysis j, and M_j is the measured mass in μg for analysis j.

For each composite exhaust sample or dilution tunnel blank, the average field blank mass is multiplied by the number of media combined in the exhaust or dilution sample composite and subtracted from the composite sample mass, M_c.

$$M_s = M_c - N_j \overline{M}_{fb}$$

If the result is negative for a species, the composite mass M_s is set to zero for that species. In cases where backup media were sampled and analyzed separately from the primary filter, as for some of the TIGF filters and XAD adsorbent cartridges, blank subtraction is performed before combining the primary and backup media analysis results, using the field blanks of corresponding type.

The uncertainty of the field blank subtracted mass is calculated as:

$$U = \sqrt{U_m^2 + S_{fb}^2}$$

where $U_m \equiv$ the analytical uncertainty of the composite sample mass, in μg and S_{fb} is the standard deviation of the field blanks, weighted by number of media combined in each field blank analysis.

$$S_{fb} = \sqrt{\frac{n\sum_1^j N_j M_j^{\ 2} - \left(\sum_1^j N_j M_j\right)^2}{n(n-1)}}$$

4.6.2.5 Calculation of Composite Speciated Profiles

For a composite profile consisting of *i* sample analyses (each analysis may represent 1 to 5 vehicle tests or dilution tunnel blanks), the mean concentration in μg /m^3 of species *x* for composite *s* is calculated as:

$$\frac{\sum_1^i M_i^x}{\sum_1^i V_i} = C_s^x$$

where $M_i^x \equiv$ mass of species *x* on filter *i*, corrected for the mean field blank value, in μg, and $V_i \equiv$ sample volume for filter *i*, in m^3.

The uncertainty of the composite concentration is:

$$c_s^x = C_s^x \sqrt{\left(\frac{\sum_1^i m_i^x}{\sum_1^i M_i^x}\right)^2 + \left(\frac{\sum_1^i v_i^x}{\sum_1^i V_i^x}\right)^2}$$

where $m_i^x \equiv$ uncertainty of the mass of species *x* on filter *i*, corrected for the mean field blank value, in μg and $v_i \equiv$ uncertainty of the sample volume for filter *i*, in m^3. Uncertainties for DRI sample volumes were estimated as 5% of measured value, based on the results of periodic flow audits. No uncertainties for the CVS volume or mileage were reported, but these are assumed to be small relative to the analytical errors. This method was used in order to be consistent with the sample compositing for speciated organic analysis, in which filter extracts for each composite group were combined before analysis. Analytical and volumetric uncertainties are propagated throughout the calculation to provide an overall uncertainty for each concentration and emission rate.

The composite emission rate in mg/mi of species *x* for composite *s* is calculated as:

$$\left(0.001\frac{mg}{\mu g}\right)\frac{\sum_1^i D_i}{\sum_1^i d_i} C_s^x = E_s^x$$

where D_i = CVS total diluted volume (V_{mix}) for sample i, in m^3 and d_i = total mileage driven during sample i, in miles. Analytical and volumetric uncertainties* are propagated throughout the calculation to provide an overall uncertainty for each emission rate.

4.6.3 Results and Conclusions

Full chemical speciation was determined for 26 individual/composite samples and 6 composite dilution tunnel blanks samples in each test round. Tables 4-40 and 4-41 list the vehicle exhaust samples that were combined together for chemical analysis in Rounds 1 and 2, respectively, and Table 4-42 lists the dilution tunnel blanks that were combined into composites. All data are field-blank corrected. Appendix A shows the range (minimum, maximum, and the 10th, 50th, and 90th percentile) of concentrations for each chemical species normalized to either the mean field blank or minimum detection limit, whichever is larger. This table shows that the chemical data that were obtained in Round 1 are well above the analytical sensitivities for most species. The chemical composition data for dilution tunnel blanks and exhaust samples are presented in Appendix B. The summaries of the PM data for composite exhaust and dilution blank samples in Tables 4-43 and 4-44 for Rounds 1 and 2, respectively, show that emissions levels are well above the ranges of values for dilution tunnel blanks with the exception of hopanes and steranes emissions for the newer model-year strata. Summary data include gravimetric mass, OC, and EC are in mg/mile and PAH, hopanes, and steranes are in ug/mile. The three PAHs that are potential markers for gasoline exhaust are indeno[123-cd]pyrene, benzo(ghi)perylene and coronene.

Comparisons of co-pollutants can provide validation checks for assessing the overall accuracy and validity of the measurements. Species emitted from the same source type should correlate and exhibit average ratios of species that reflect the nature of the source. Figure 4-118 shows gravimetric mass versus total carbon by IMPROVE-TOR in ug/m^3 of diluted exhaust for Round 1 dynamometer test filters by test phase. PM mass and TC are strongly correlated for the phase 1 samples and poorly correlated for the lightly loaded phase 3 samples. Similar results are shown in Figure 4-119 for the correlation of elemental carbon by TOR versus average BC by the photoacoustic instrument. As we have seen in prior studies (e.g., Gasoline/Diesel PM Split Study) for highly loaded samples, PM mass is typically well correlated with TC and EC obtained by IMPROVE-TOR or STN-TOT agree with photoacoustic BC. That is not the case at lower sample loading where sampling artifacts associated with adsorbed organic compounds on the quartz filter may be relatively more important. The correlations of the sum of elements by XRF analysis (Figure 4-120) show the similar correlations to PM mass as TC, which again reflects the lower mass loadings for the phase 3 samples. Figure 4-121 shows that sulfur by XRF analysis is strongly correlated to sulfate by ion chromatography. Figure 4-122 shows that benzo(ghi)perylene, indeno[123-cd]pyrene and coronene all correlate well with TC emissions and Figure 4-123 shows that the sum of hopanes and steranes also correlated well with TC.

Figures 4-124 through 4-143 show the abundances of various chemical species in the dilution blank and composite exhaust samples during each round of testing. OC and EC are the most abundant species in motor vehicle exhaust, accounting for over 95% of the total PM mass. For SI vehicles, BC and PM emission rates can be several times larger during the cold start phase than during hot stabilized operation. Relatively clean SI vehicles produce BC emissions during the more aggressive portions of the driving cycle and during cold starts. Therefore, the emission profiles for clean SI vehicles from dynamometer tests may contain higher fractions of EC than would be produced in congested urban driving conditions. PM emissions from SI high-emitter contain predominantly OC. Variability of emissions from a vehicle may be as great as the difference between vehicles, particularly for the high emitters. The abundances of individual organic species relative to total mass or carbon are consistent from profile to profile for organic and elemental carbon, PAH, Hopanes, steranes, and nitroPAH. Alkanes and polars appear too variable to be useful for receptor modeling. Gasoline vehicles, whether low or high emitters, emit higher proportions of high molecular-weight particulate PAHs (e.g., benzo(b+j+k)fluoranthene, benzo(ghi)perylene, indeno(1,2,3-cd)pyrene, and coronene). Hopanes and steranes are markers for lubricating oil from internal combustion engines and their emission rates were highest for high emitting vehicles.

Table 4-43. Summary of PM data for Round 1 composite exhaust samples[1].

Composites	PM Mass	OC	EC	EC/TC	PAH gas markers	Sum of Hopanes	Sum of Steranes
Dilution Tunnel Blanks							
S0-1	0.39	0.256	0.154	0.38	0.00	0.73	0.45
S0-2	0.53	0.129	0.020	0.13	0.16	0.73	0.48
S0-3	0.19	0.268	0.031	0.10	0.04	1.17	0.48
S0-4	0.24	0.293	0.030	0.09	0.00	0.73	0.35
S0-5	0.95	0.940	0.235	0.20	0.19	2.16	1.09
S0-6	0.70	0.588	0.142	0.19	0.18	2.42	1.90
Trucks							
S1-1	9.13	2.204	1.516	0.41	12.07	1.56	0.03
S1-2	81.73	26.070	17.884	0.41	373.42	31.36	5.79
S2-1	73.07	59.132	4.510	0.07	13.09	164.02	44.50
S2-2	20.11	11.332	6.588	0.37	113.03	8.32	3.52
S2-3	22.02	16.212	4.030	0.20	30.93	59.78	48.31
S2-4	76.16	28.193	25.780	0.48	254.90	36.02	14.42
S3-1	3.76	1.097	0.933	0.46	1.43	0.91	0.76
S3-2	22.36	8.186	5.641	0.41	39.02	22.74	6.07
S4-1	3.31	1.438	0.582	0.29	1.15	1.30	0.48
S4-2	2.12	1.801	1.178	0.40	2.28	2.82	1.73
Cars							
S5-1	18.14	9.029	9.929	0.52	128.83	120.60	0.00
S5-2	60.91	46.521	9.412	0.17	263.07	292.58	63.74
S5-3	9.46	7.177	2.549	0.26	4.62	29.35	5.18
S5-4	207.43	101.649	77.566	0.43	1031.44	405.41	63.62
S5-5	99.63	33.934	50.871	0.60	480.44	175.76	46.40
S6-1	41.62	35.609	0.639	0.02	4.01	52.49	12.35
S6-2	49.04	9.079	36.603	0.80	345.07	16.52	6.04
S6-3	10.10	3.738	4.739	0.56	19.03	5.24	0.67
S6-4	22.84	13.998	2.682	0.16	24.25	26.04	8.70
S7-1	7.66	3.856	2.316	0.38	8.04	10.84	7.25
S7-2	8.81	5.258	1.808	0.26	13.08	25.45	8.62
S7-3	4.12	1.666	0.994	0.37	11.97	11.46	0.45
S7-4	4.78	1.155	1.537	0.57	7.54	7.80	0.36
S8-1	1.81	0.983	0.544	0.36	0.34	1.01	0.57
S8-2	2.08	1.488	0.906	0.38	2.22	3.52	1.19
S8-3	3.48	2.346	1.339	0.36	2.27	3.45	1.29

[1] Gravimetric mass, OC, and EC are in mg/mile and PAH, hopanes, and steranes are in ug/mile. The three PAHs that are potential markers for gasoline exhaust are indeno[123-cd]pyrene, benzo(ghi)perylene, and coronene.

Table 4-44. Summary of PM data for Round 2 composite exhaust samples[1].

Composites	PM2.5 Mass	Organic Carbon	Elemental Carbon	EC/TC ratio	PAH gas markers	Sum of Hopanes	Sum of Steranes
Dilution Tunnel Blanks							
W0-1	0.85	0.68	0.14	0.17	0.31	0.97	0.31
W0-2	0.27	0.66	0.03	0.05	0.00	0.29	0.20
W0-3	0.50	0.65	0.16	0.20	0.09	0.44	0.13
W0-4	0.39	0.71	0.08	0.10	0.13	0.49	0.18
W0-5	0.90	0.90	0.17	0.16	0.07	0.65	0.13
W0-6	0.45	0.70	0.10	0.13	0.09	0.48	0.25
Trucks							
W1-1	113.12	74.96	14.09	0.16	364.44	290.43	80.48
W1-2	43.21	31.26	10.01	0.24	87.72	93.86	5.61
W1-3	59.60	34.09	11.59	0.25	251.27	66.64	8.49
W2-1	52.30	25.69	22.84	0.47	319.34	173.27	15.77
W2-2	15.30	4.79	3.58	0.43	7.14	15.00	2.74
W3-1	5.98	2.50	2.66	0.52	128.18	23.96	1.63
W3-2	29.38	10.21	16.25	0.61	71.84	12.80	2.54
W3-3	23.57	7.94	9.00	0.53	21.35	12.01	1.29
W4-1	15.21	5.11	4.23	0.45	16.23	3.01	0.13
W2-3	6.89	2.09	3.35	0.62	9.79	1.98	0.71
W4-2	6.02	2.56	3.07	0.55	19.08	1.90	0.92
W4-3	11.65	5.30	5.24	0.50	26.19	7.96	0.87
Cars							
W5-1	16.82	8.54	7.39	0.46	14.78	6.85	0.57
W5-2	47.47	16.45	28.13	0.63	170.79	12.92	1.84
W5-3	45.26	15.57	15.66	0.50	252.19	18.94	11.78
W6-1	56.31	32.13	20.39	0.39	206.65	170.82	50.03
W6-2	17.14	7.33	9.59	0.57	24.79	5.72	3.35
W6-3	9.97	5.00	3.22	0.39	18.07	7.69	4.02
W6-4	73.13	49.20	4.27	0.08	51.57	216.55	98.98
W7-1	5.08	2.70	2.82	0.51	10.43	1.17	0.34
W7-2	12.44	6.68	3.84	0.36	34.37	6.43	2.23
W7-3	3.45	2.69	1.29	0.32	8.52	3.05	1.75
W7-4	4.65	2.58	1.49	0.37	11.31	0.75	0.46
W8-1	4.21	2.60	1.50	0.37	9.40	2.06	1.08
W8-2	8.46	2.95	4.53	0.61	14.39	2.13	1.47
W8-3	27.78	2.52	3.34	0.57	18.11	2.06	0.52

[1] Gravimetric mass, OC, and EC are in mg/mile and PAH, hopanes, and steranes are in ug/mile. The three PAHs that are potential markers for gasoline exhaust are indeno[123-cd]pyrene, benzo(ghi)perylene, and coronene.

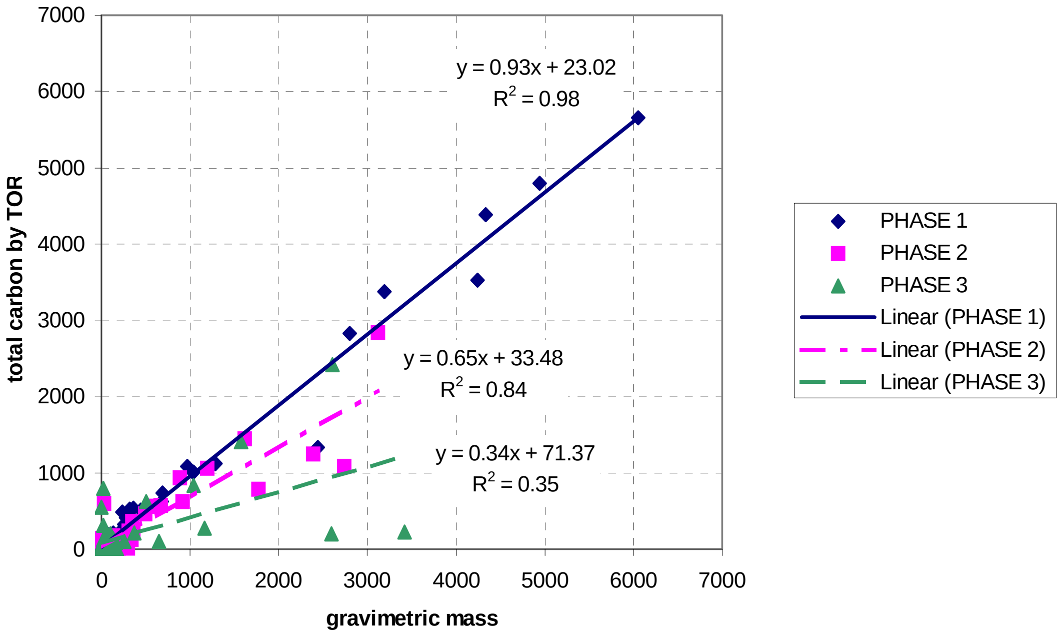


Figure 4-118. Gravimetric mass versus total carbon by TOR

For all dynamometer test filters, separated by test phase. Concentrations are in ug/m3 of diluted exhaust.

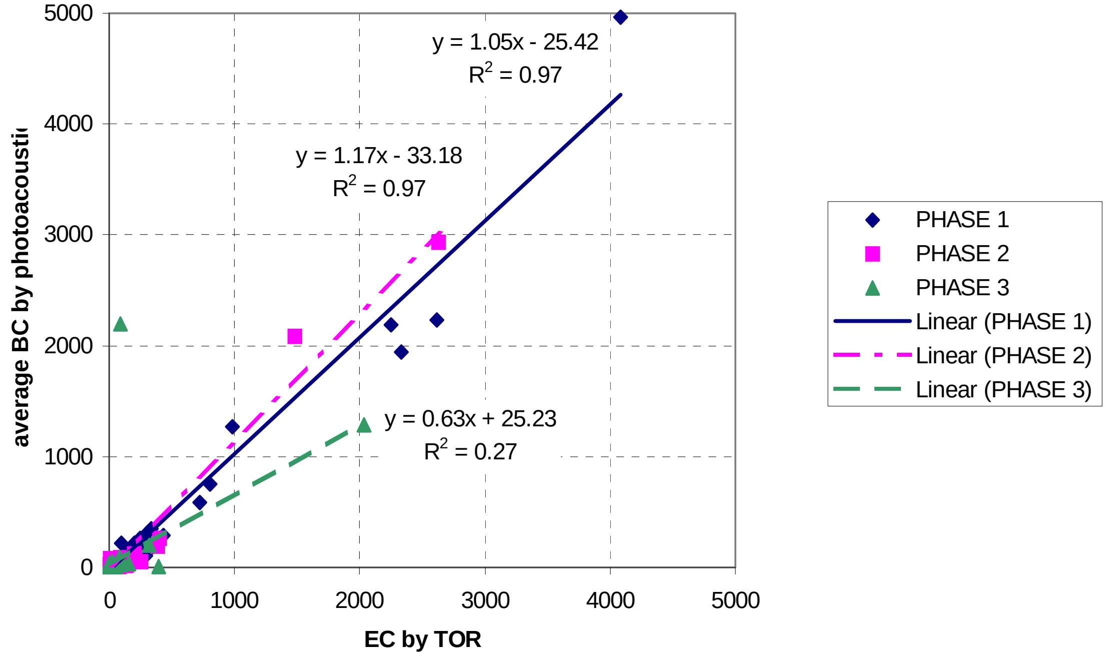


Figure 4-119. Elemental Carbon by TOR versus average BC by photoacoustic method

For all dynamometer tests, separated by test phase. Concentrations are in ug/m3 of diluted exhaust.

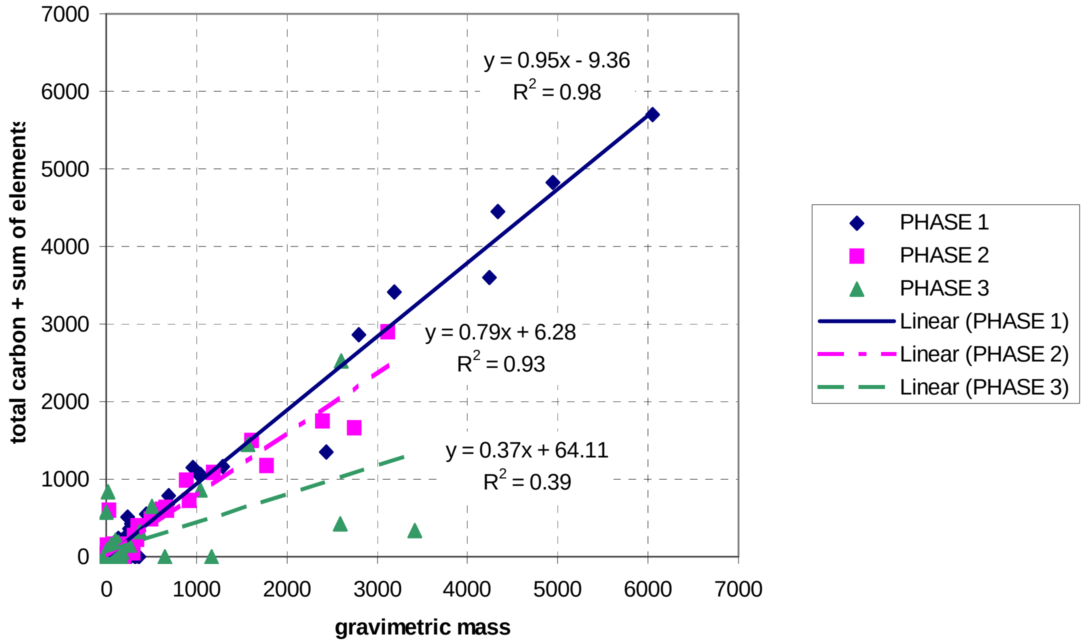


Figure 4-120. Gravimetric mass versus sum of XRF elements and total carbon by TOR

For all dynamometer tests, separated by test phase. Concentrations are in ug/m3 of diluted exhaust.

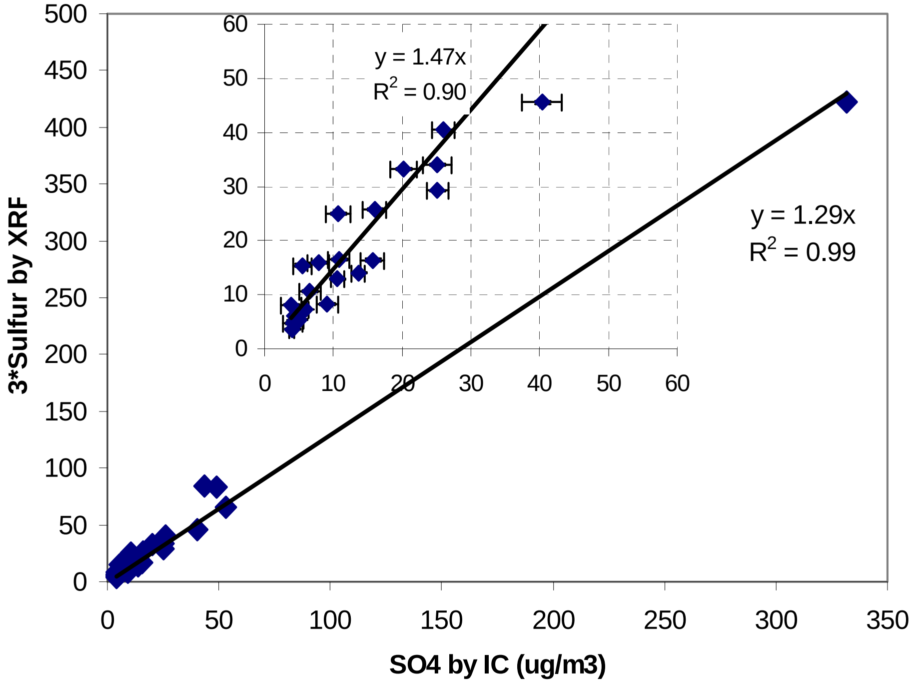


Figure 4-121. Sulfur by XRF *3 versus Sulfate by IC for all exhaust composites.

The inset shows the data without the significant outlier at SO_4=330 ug/m3. Concentrations are in ug/m3 of diluted exhaust.

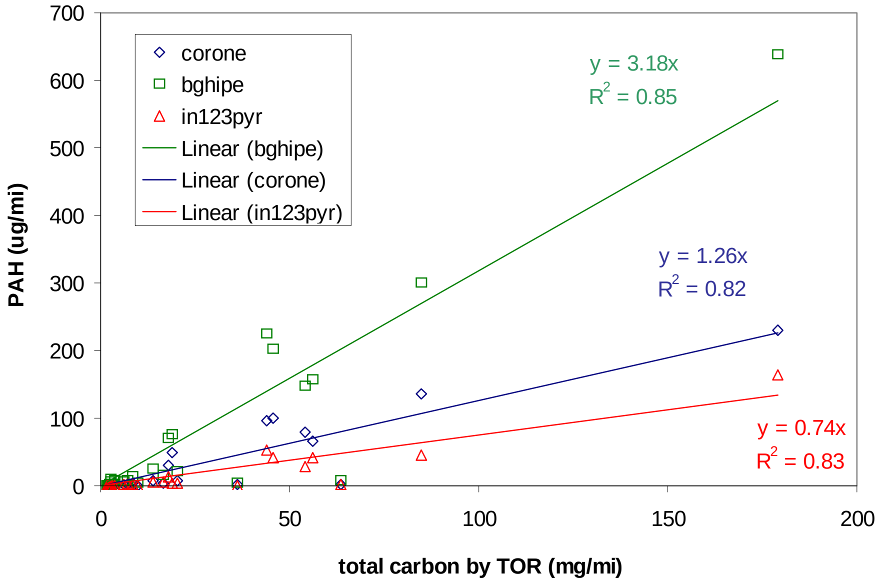


Figure 4-122. Total organic carbon by TOR versus indeno[123-cd]pyrene, benzo(ghi)perylene and coronene in mg/mile.

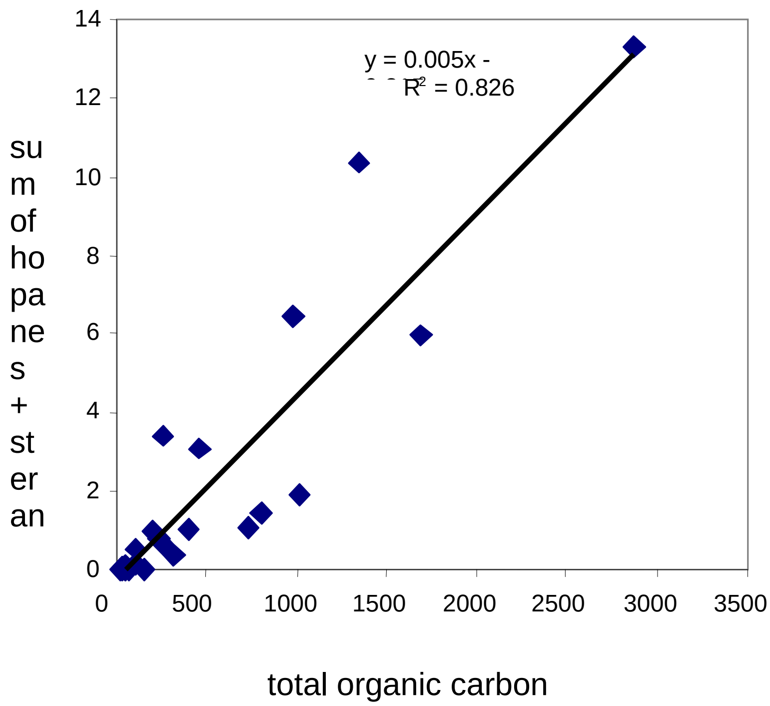


Figure 4-123. Total organic carbon by TOR versus sum of hopanes and steranes for exhaust composites.

Concentrations are in ug/m3 of diluted exhaust.

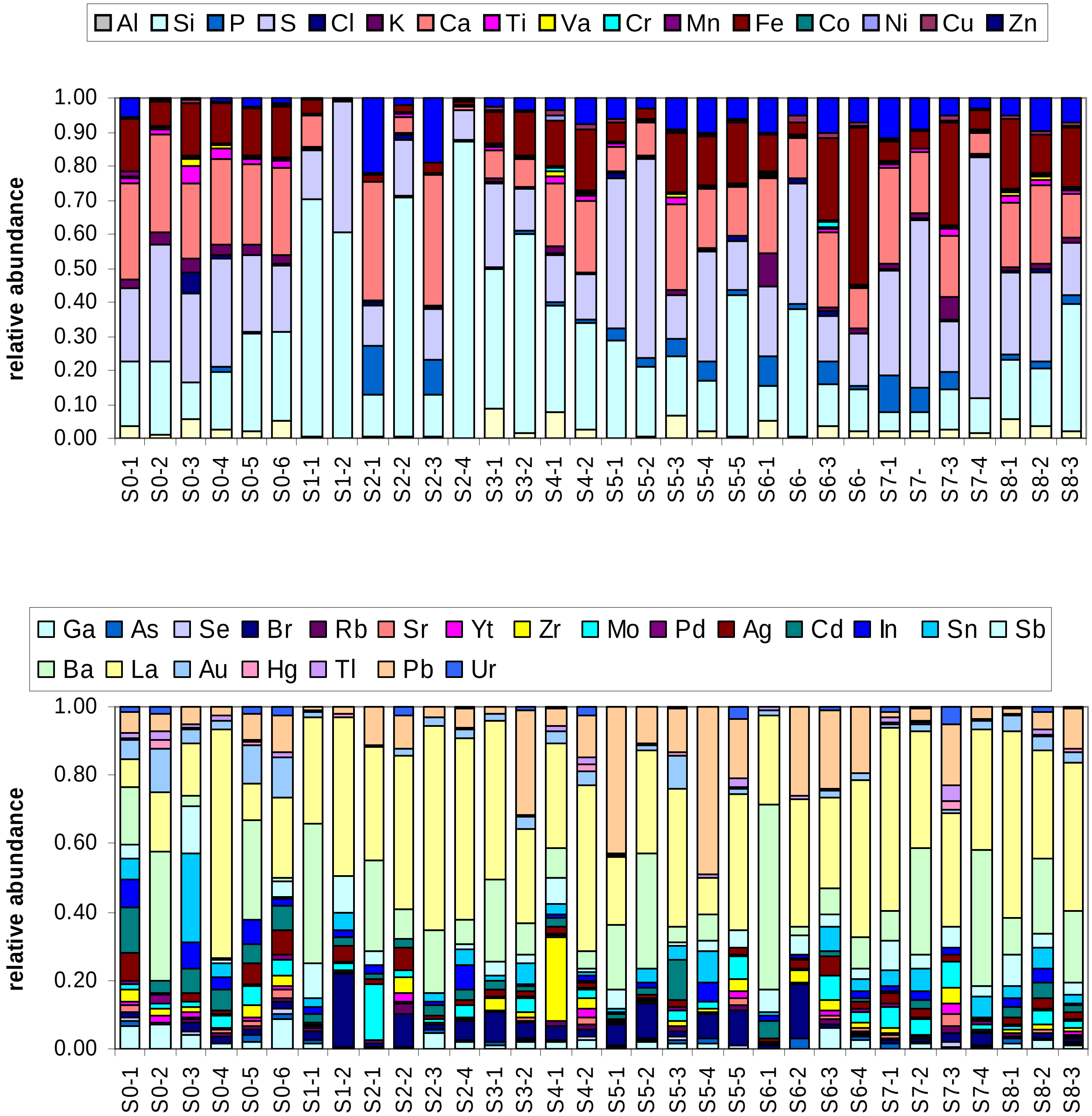


Figure 4-124. Abundances of elements and ions from XRF and IC analysis of all exhaust and dilution blank composites during Round 1.

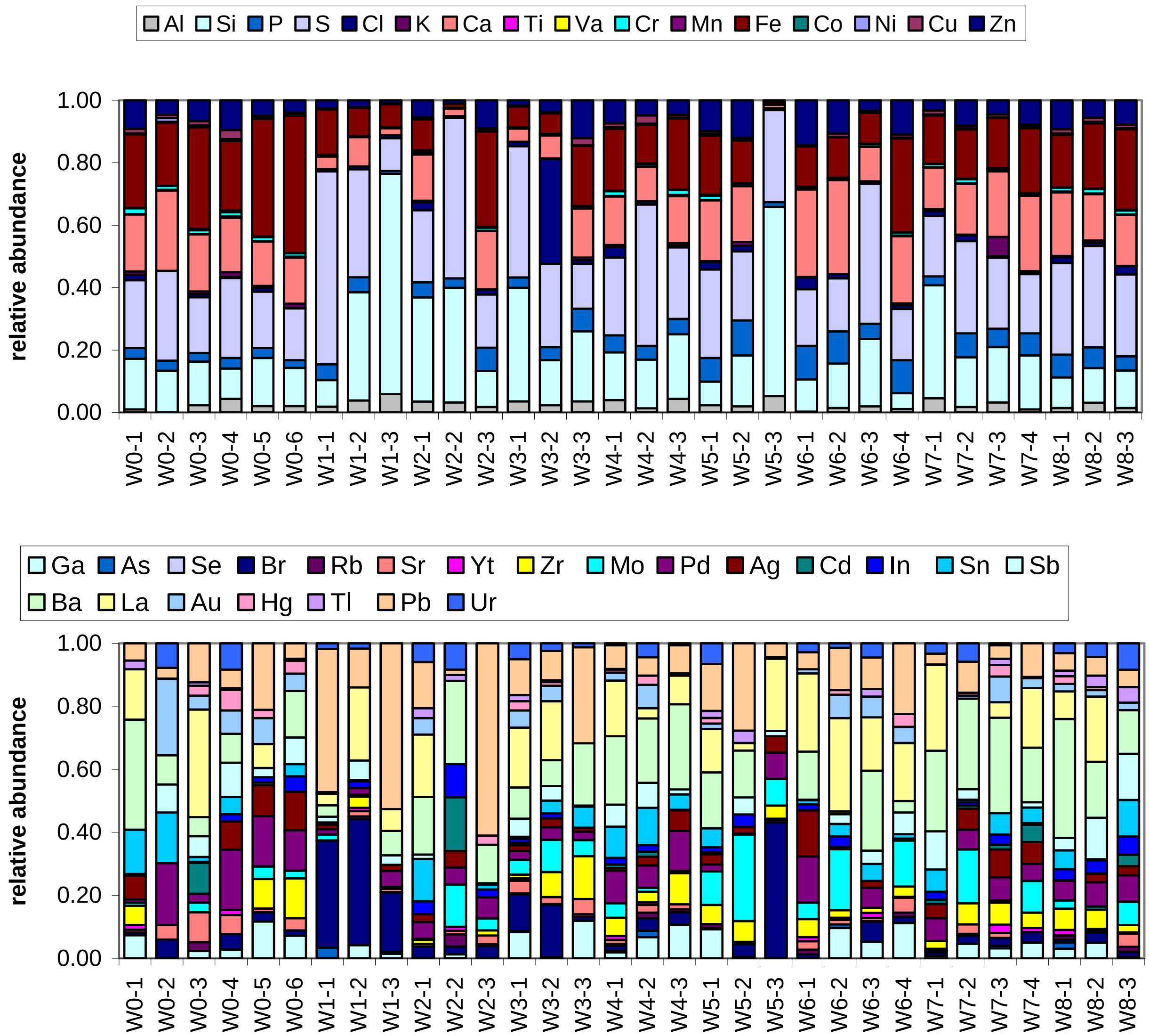


Figure 4-125. Abundances of elements and ions from XRF and IC analysis of all exhaust and dilution blank composites during Round 2.

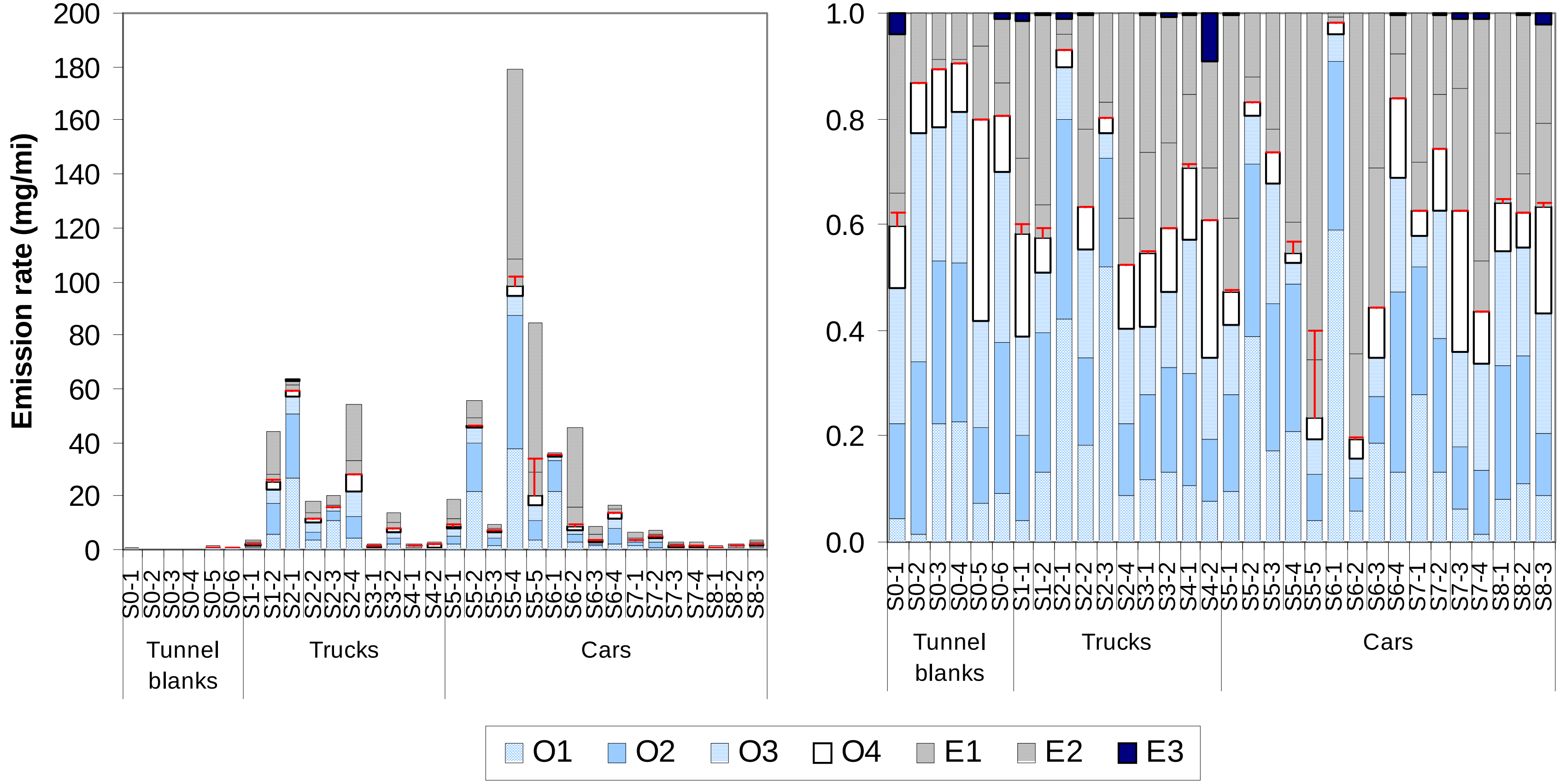


Figure 4-126. Abundances of carbon fractions from IMPROVE-TOR analysis of all exhaust and dilution blank composites during Round 1.

The error bars indicate the pyrolysis correction to OC.

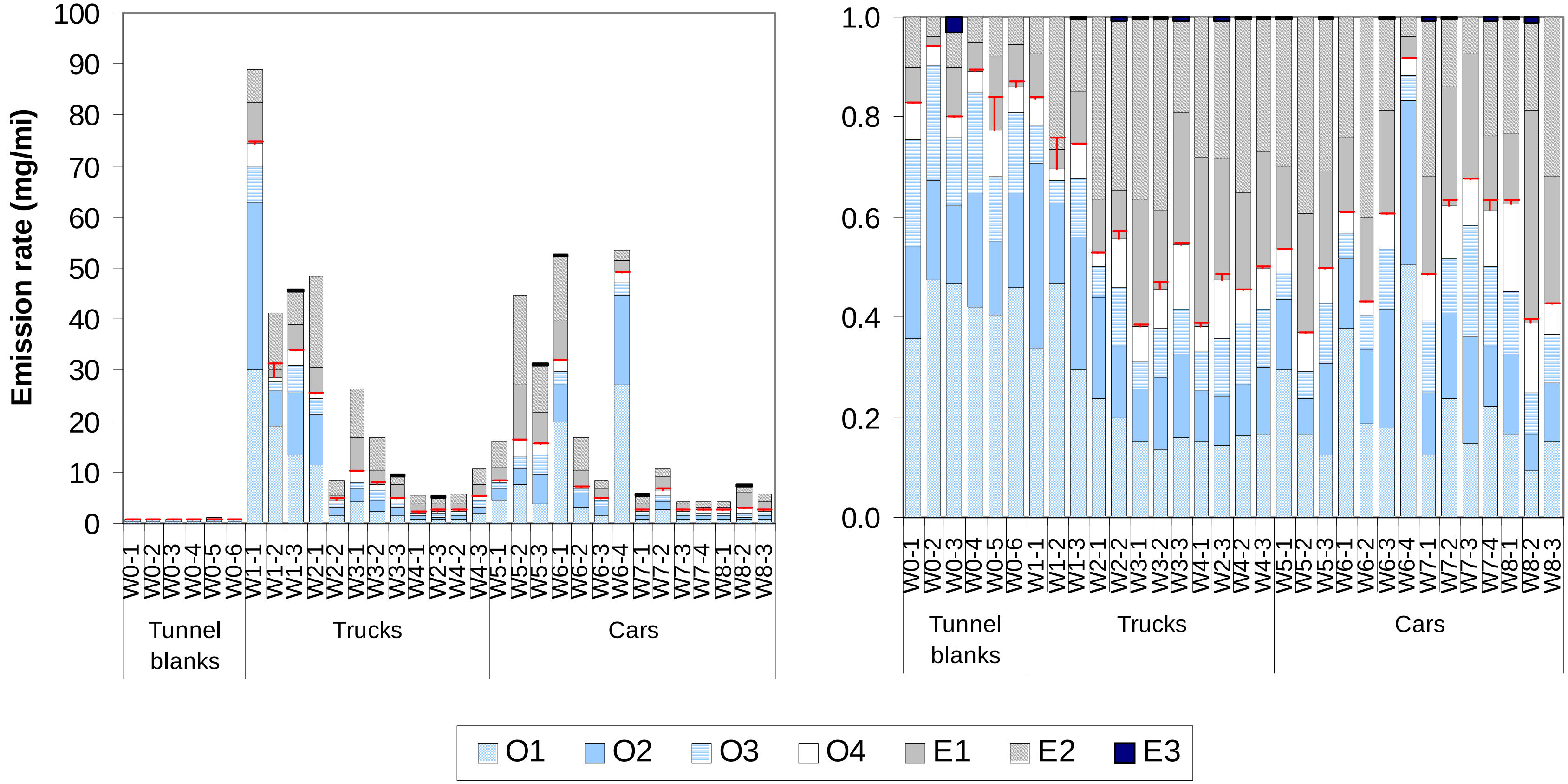


Figure 4-127. Abundance of carbon fractions from IMPROVE-TOR analysis of all exhaust and dilution blank composites during Round 2.

The error bars indicate the pyrolysis correction to OC.

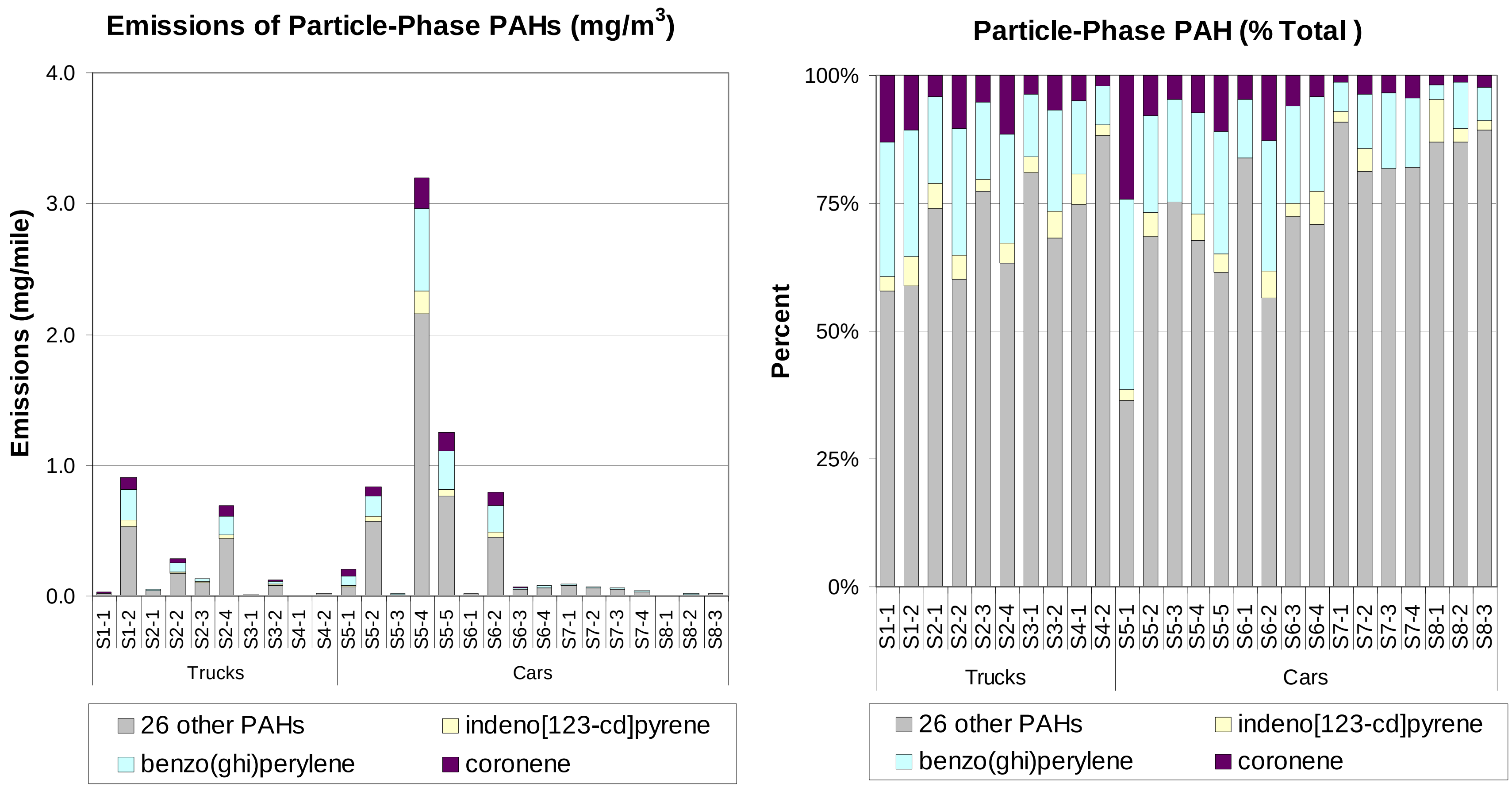


Figure 4-128. Abundances of benzo(ghi)perylene, indeno[123-cd]pyrene, coronene and sum of 26 other particulate PAH for exhaust and dilution blank composites during Round 1.

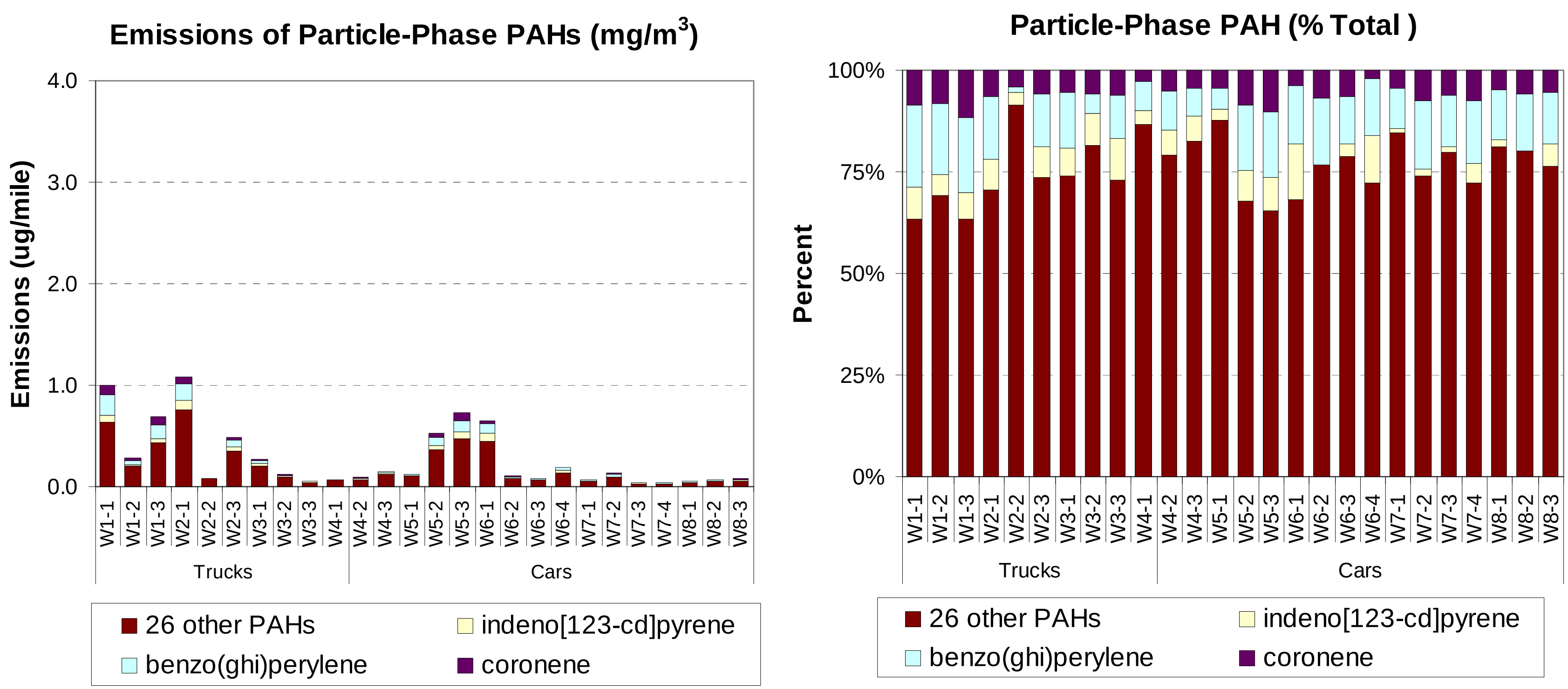


Figure 4-129. Abundances of benzo(ghi)perylene, indeno[123-cd]pyrene, coronene and sum of 26 other particulate PAH for exhaust and dilution blank composites during Round 2.

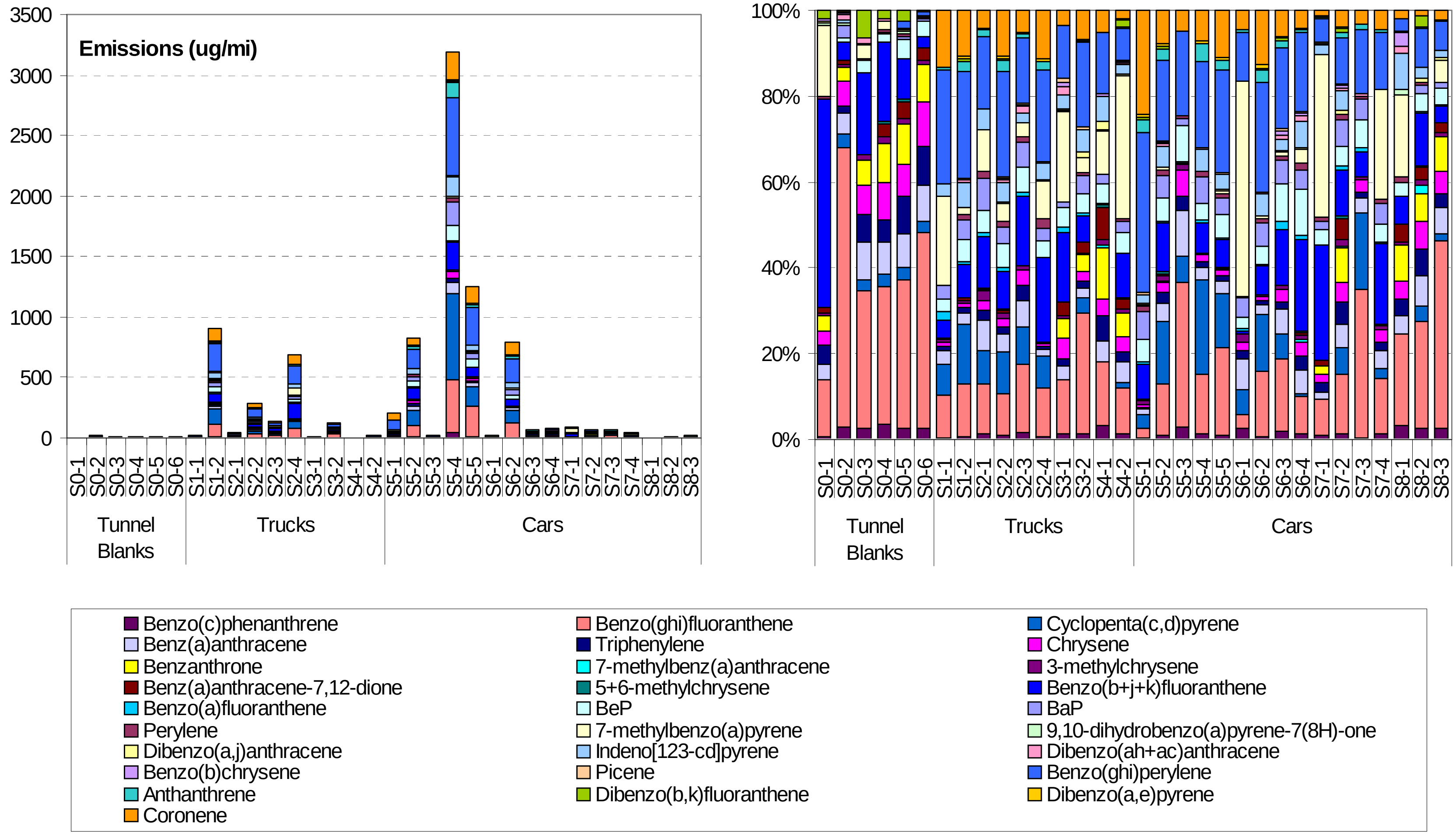


Figure 4-130. Abundances of particulate PAHs for exhaust and dilution blank composites during Round 1.

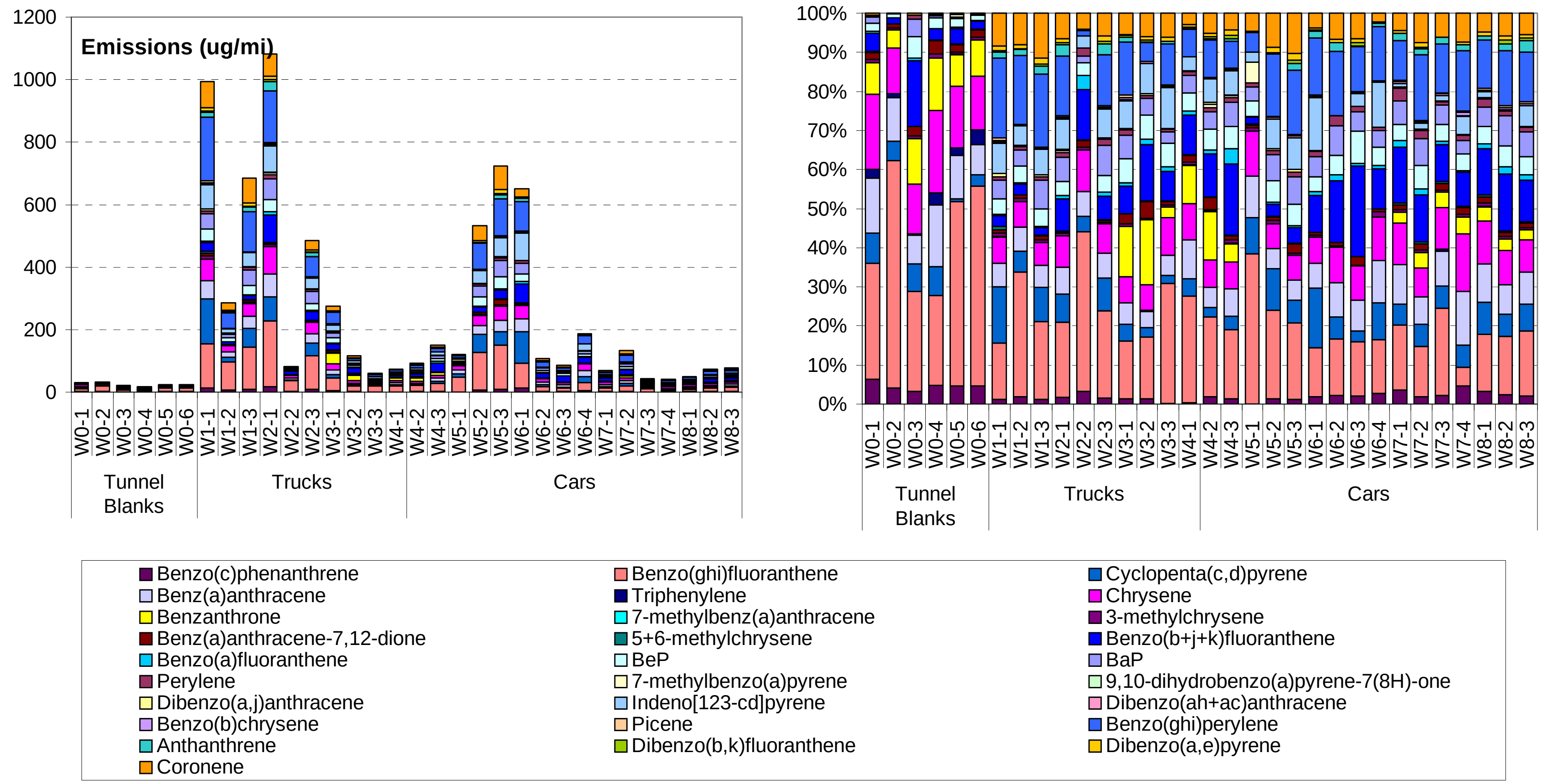


Figure 4-131. Abundances of particulate PAHs for exhaust and dilution blank composites during Round 2.

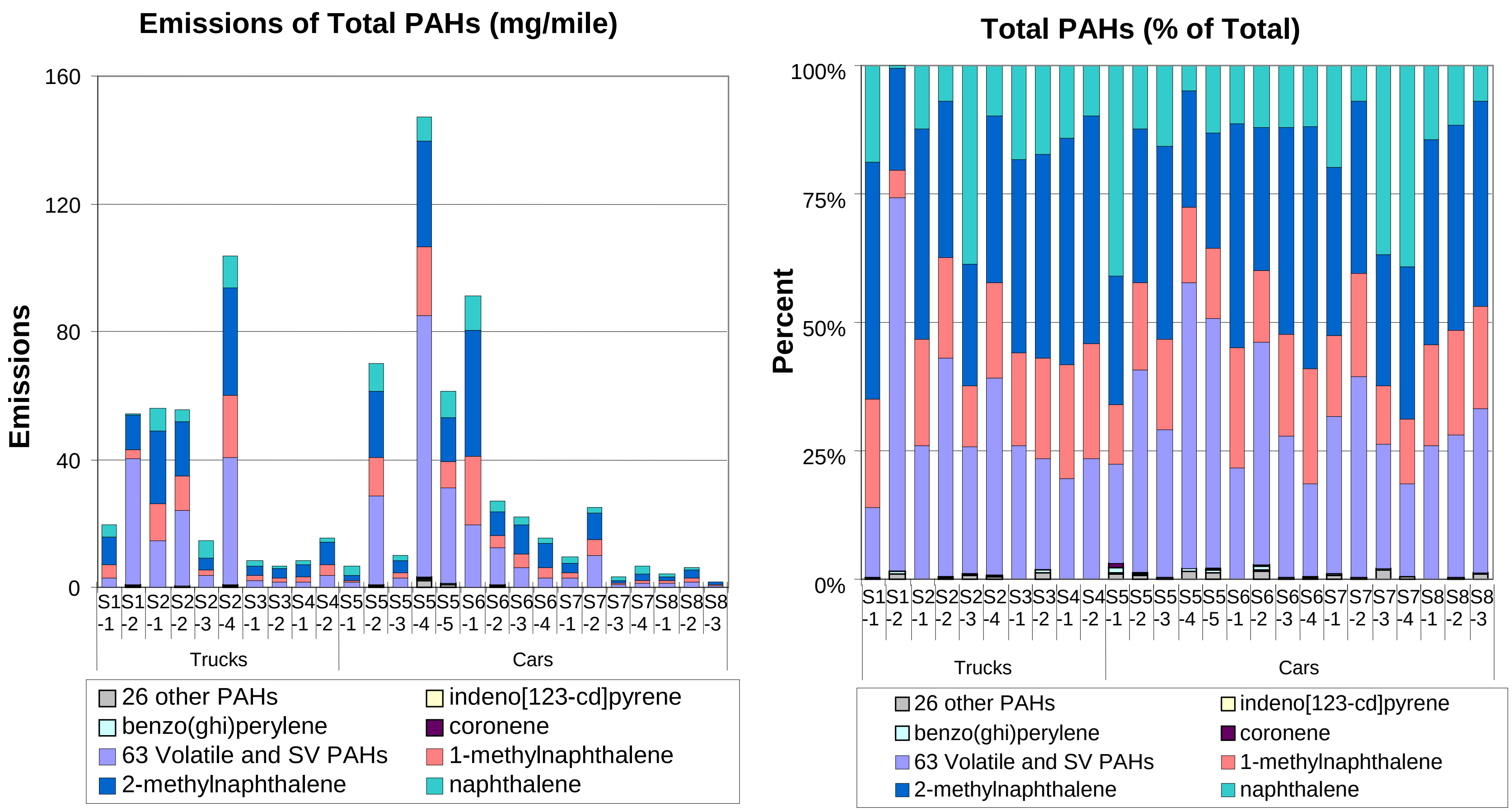


Figure 4-132. Abundances of naphthalene, 1-methylnaphthalene and 2-methylnapthalene for exhaust and dilution blank composites during Round 1 in comparison to other volatile, semi-volatile and particulate PAHs.

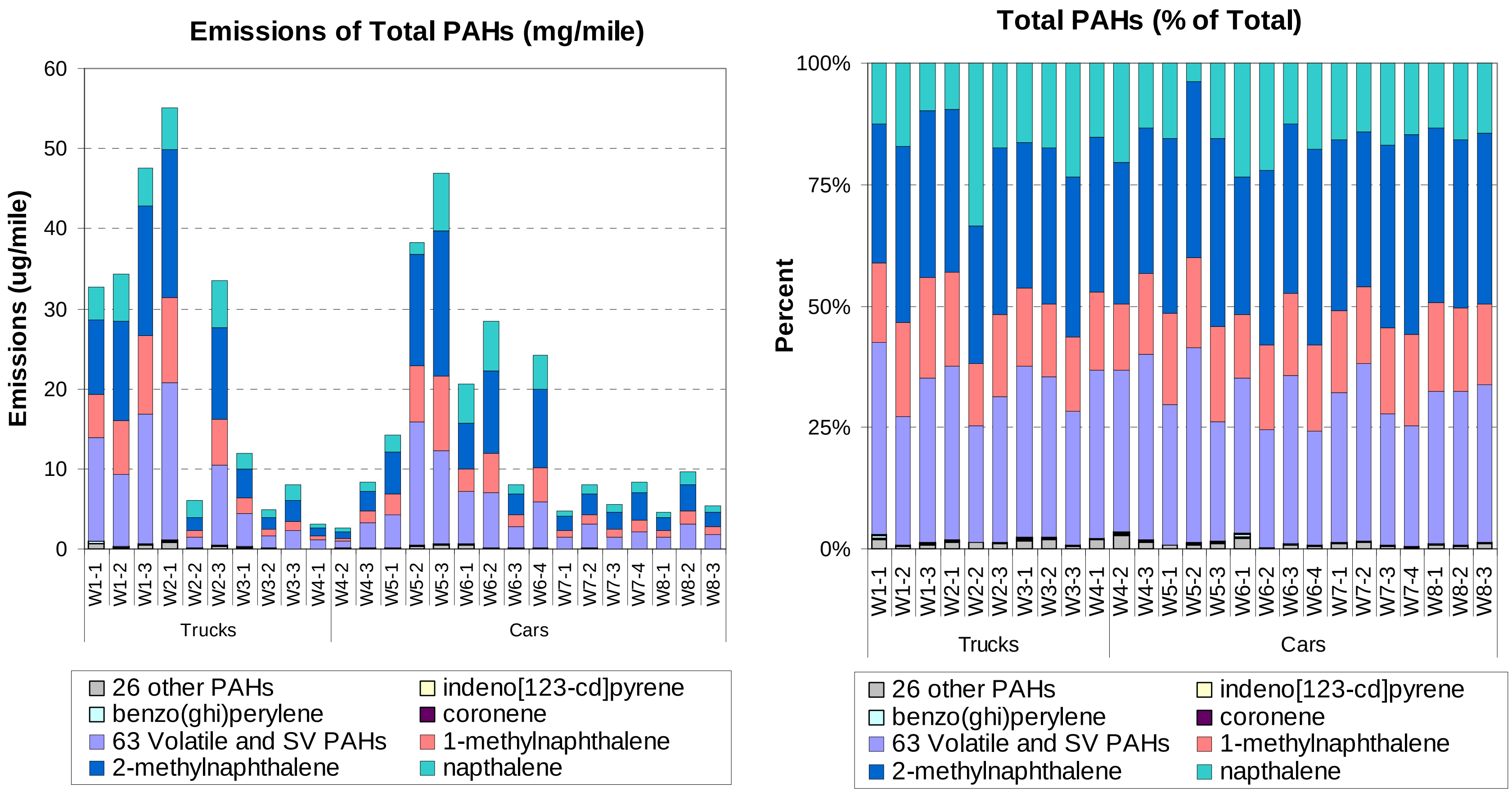


Figure 4-133. Abundances of naphthalene, 1-methylnaphthalene and 2-methylnapthalene for exhaust and dilution blank composites during Round 2 in comparison to other volatile, semi-volatile and particulate PAHs.

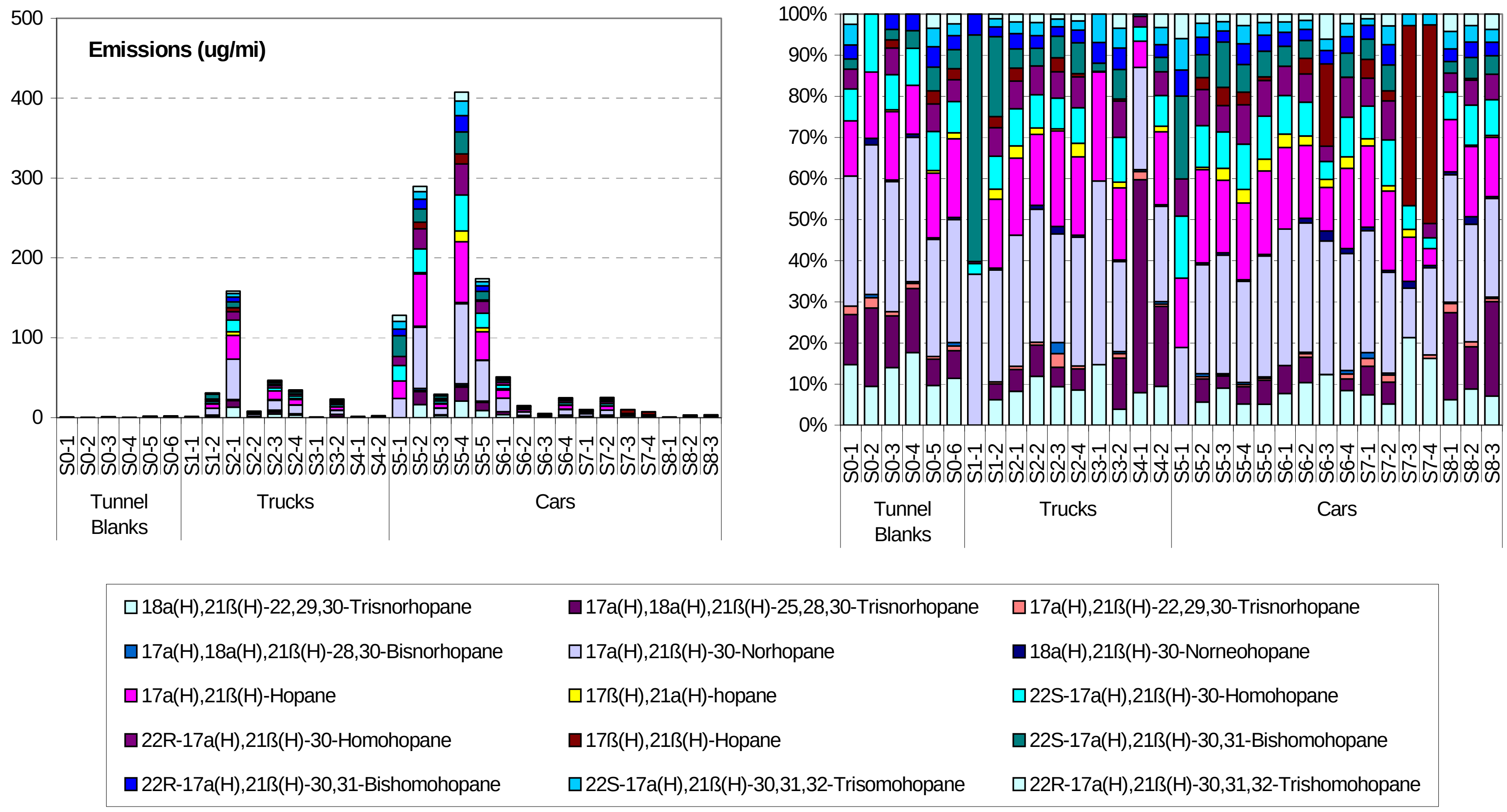


Figure 4-134. Abundances of hopanes for exhaust and dilution blank composites during Round 1.

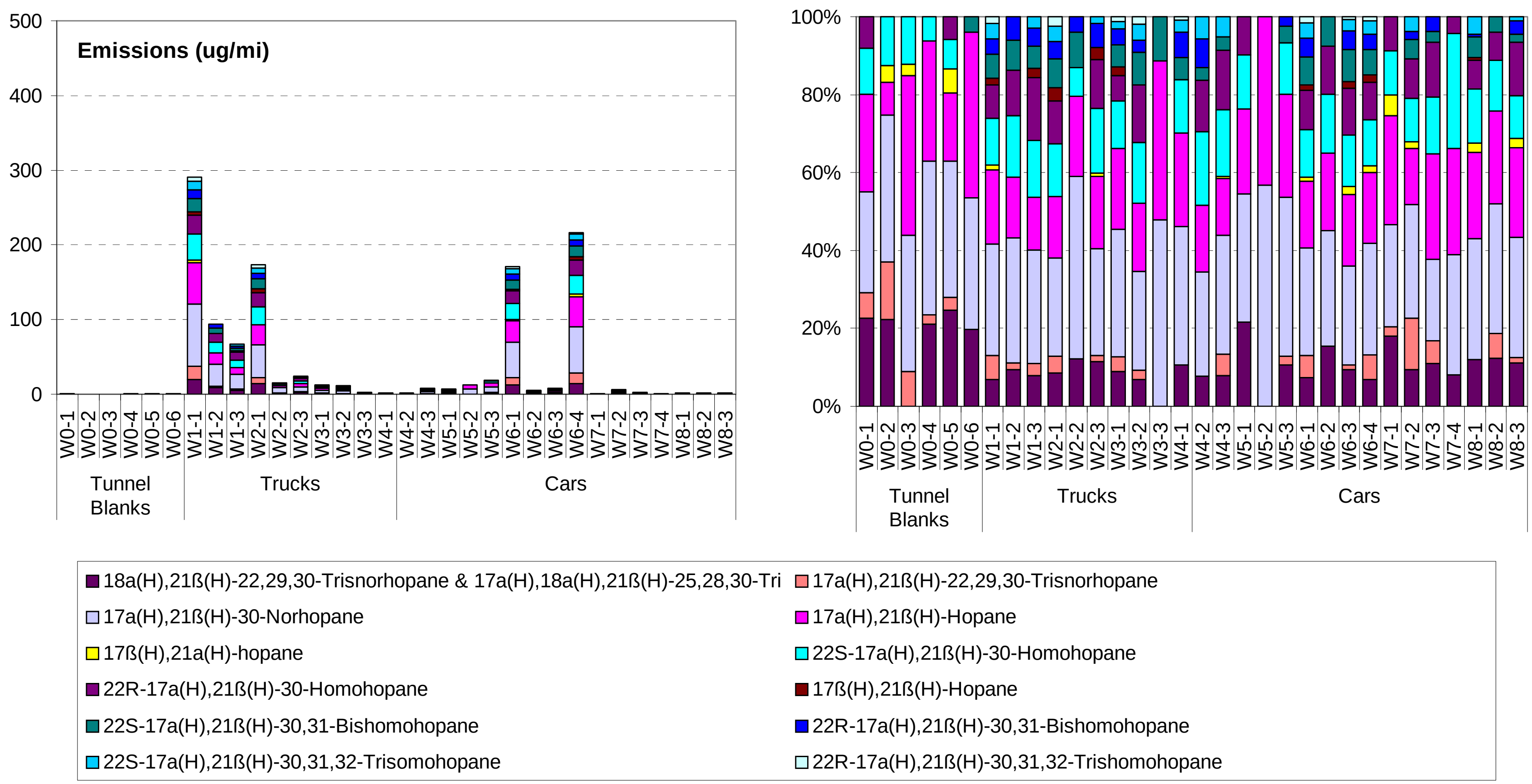


Figure 4-135. Abundances of hopanes for exhaust and dilution blank composites during Round 2.

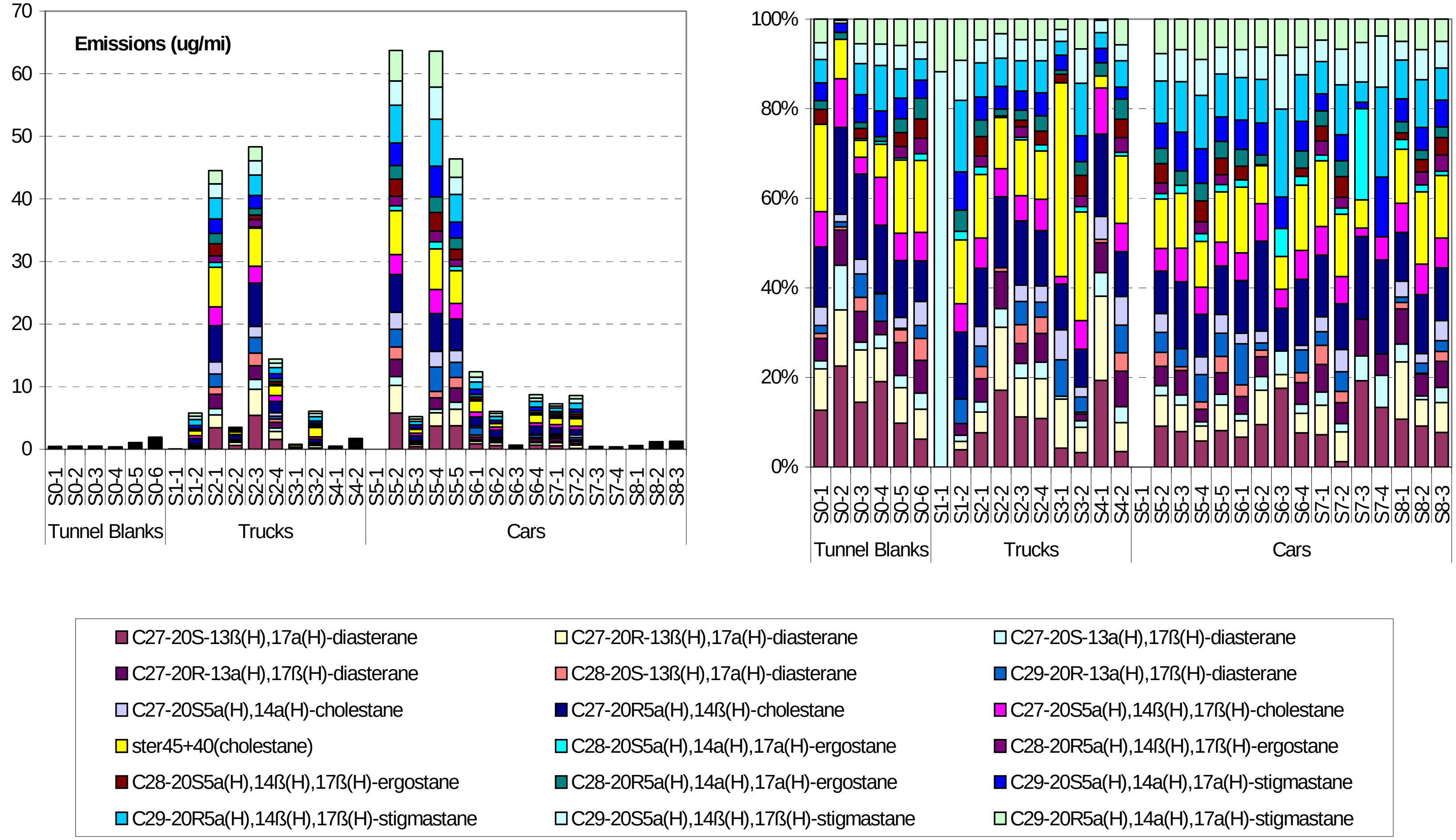


Figure 4-136. Abundances of steranes for exhaust and dilution blank composites during Round 1.

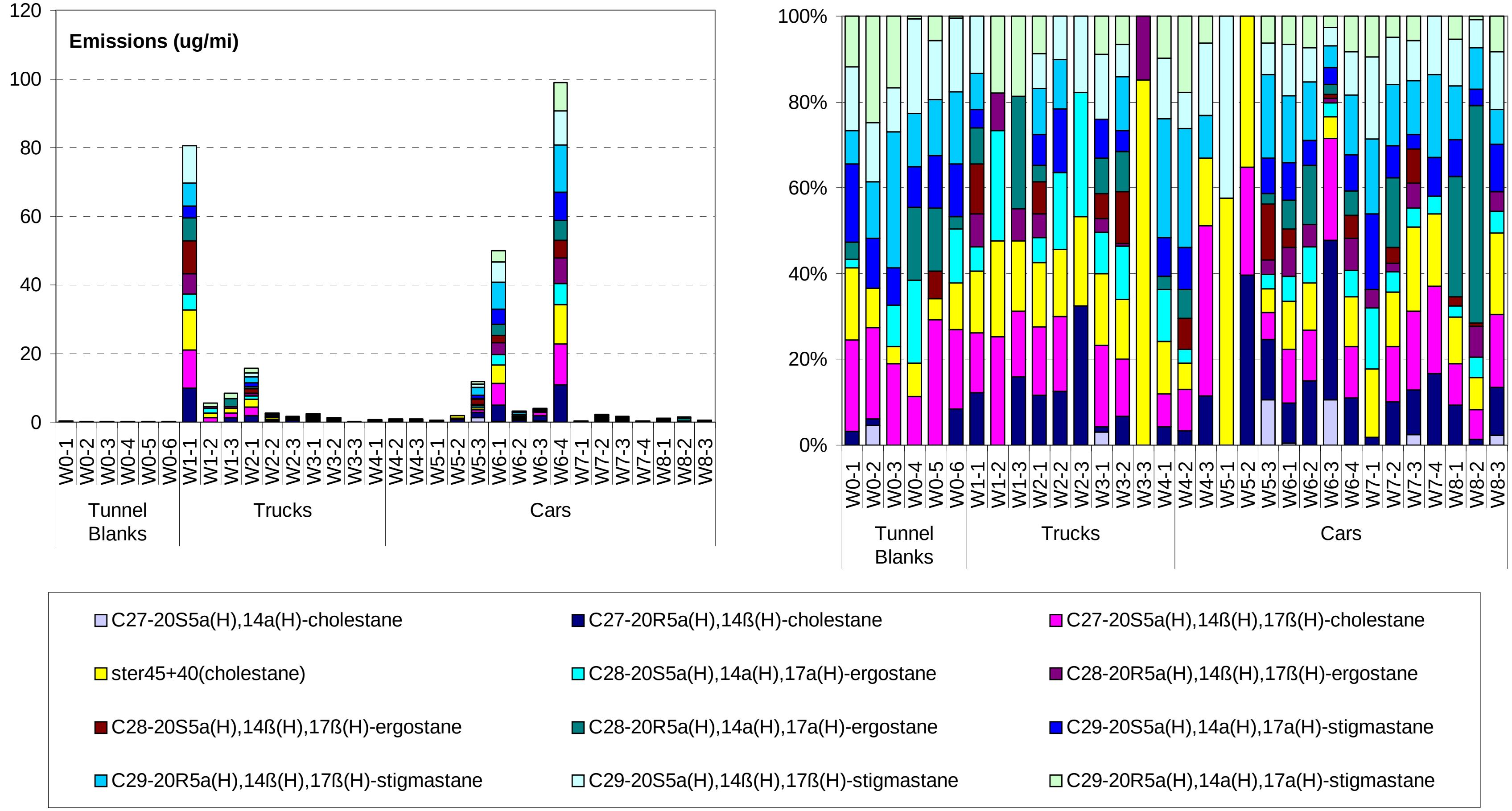


Figure 4-137. Abundances of steranes for exhaust and dilution blank composites during Round 2.

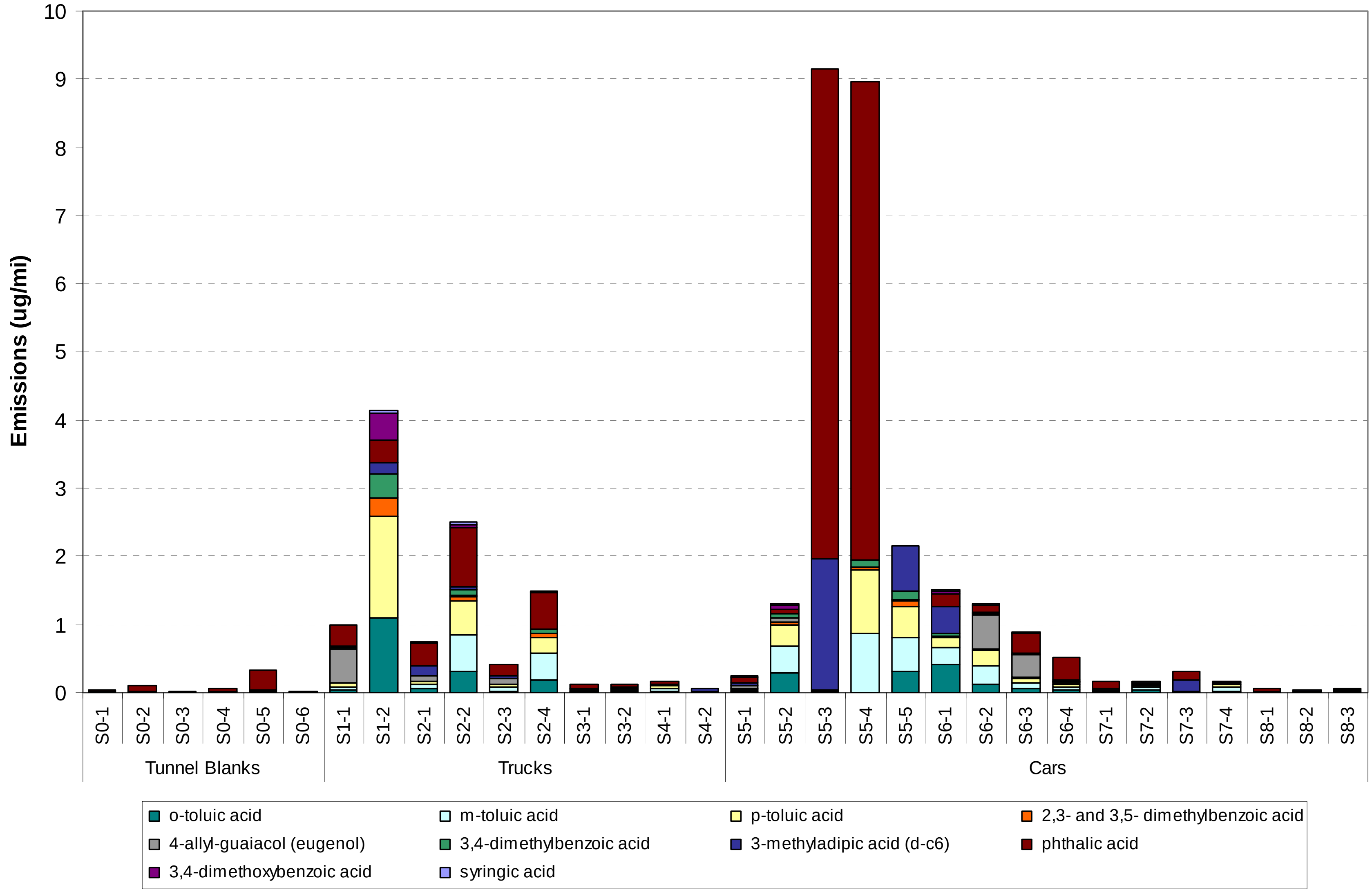


Figure 4-138. Abundances of polar compounds for exhaust and dilution blank composites during Round 1.

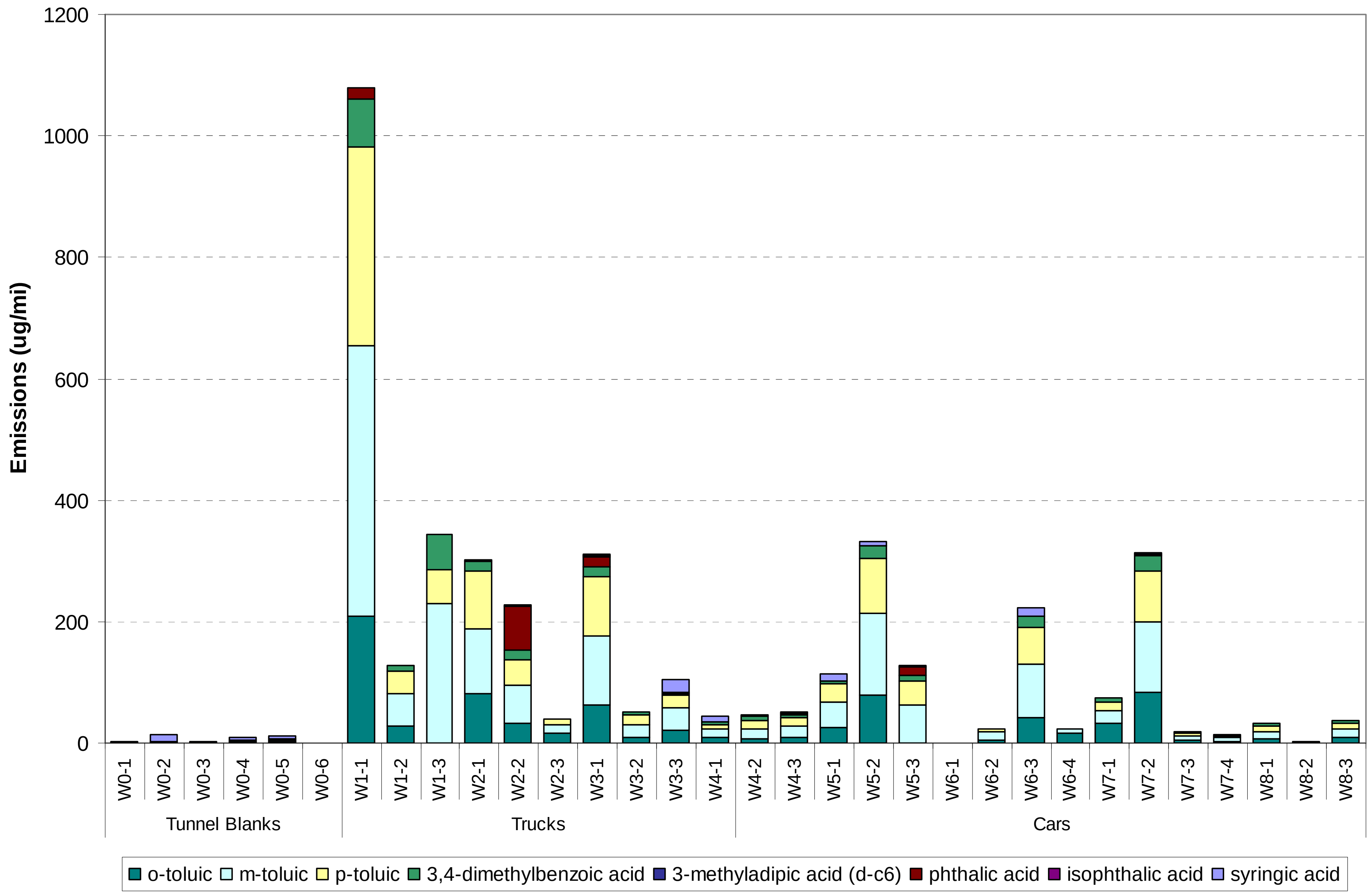


Figure 4-139. Abundances of polar compounds for exhaust and dilution blank composites during Round 2.

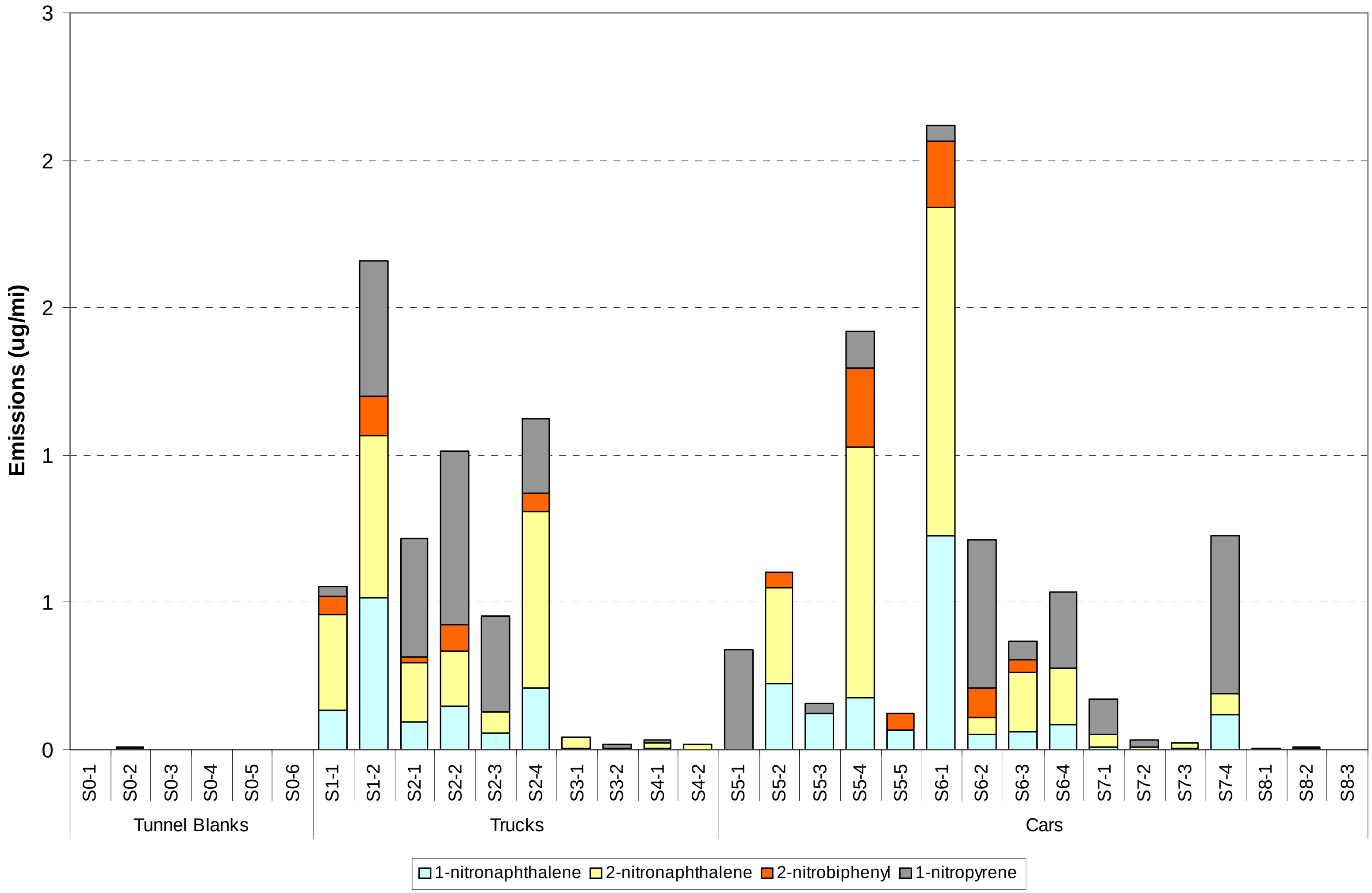


Figure 4-140. Abundances of nitro-PAHs for exhaust and dilution blank composites during Round 1.

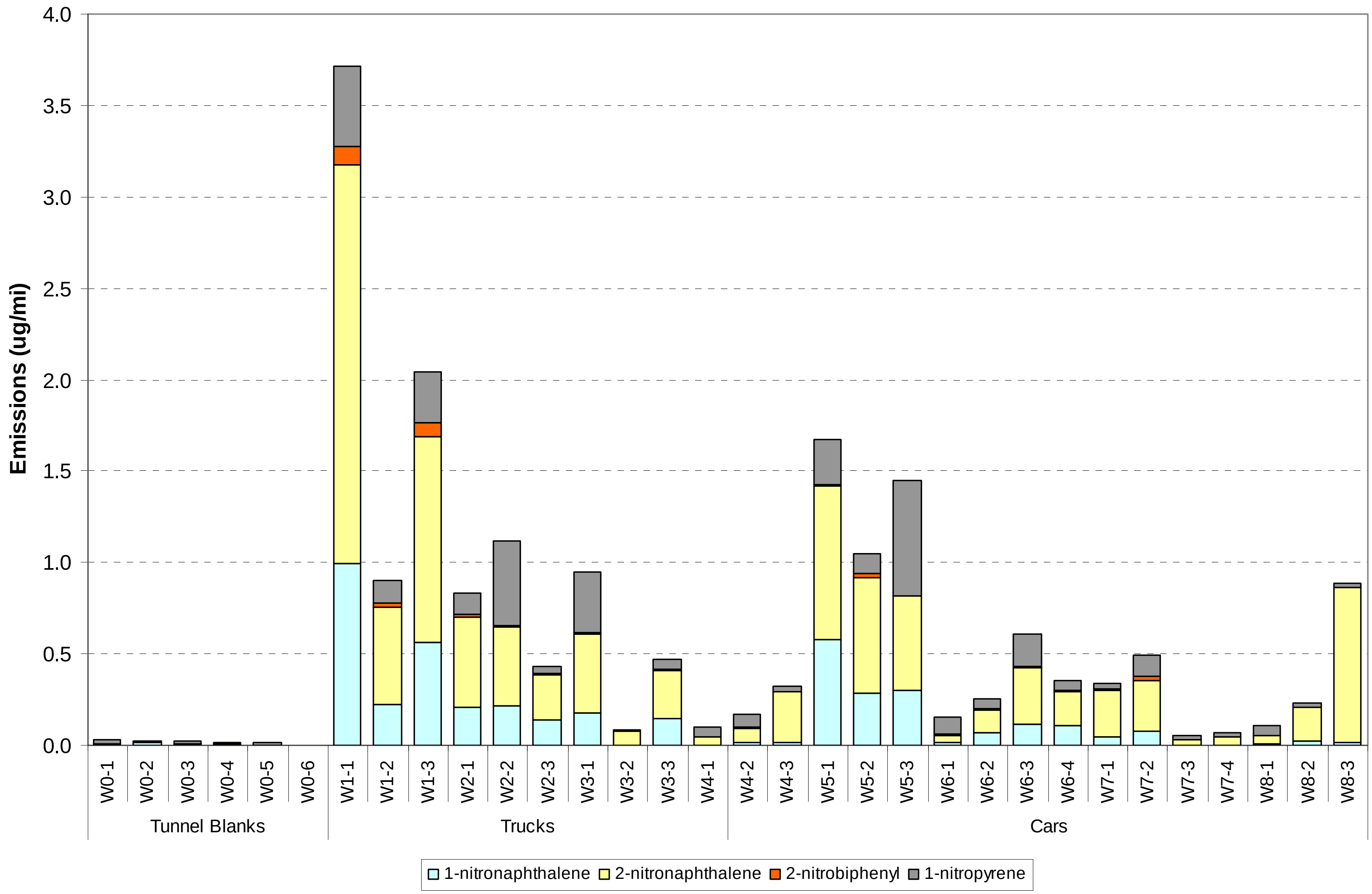


Figure 4-141. Abundances of nitro-PAHs for exhaust and dilution blank composites during Round 2.

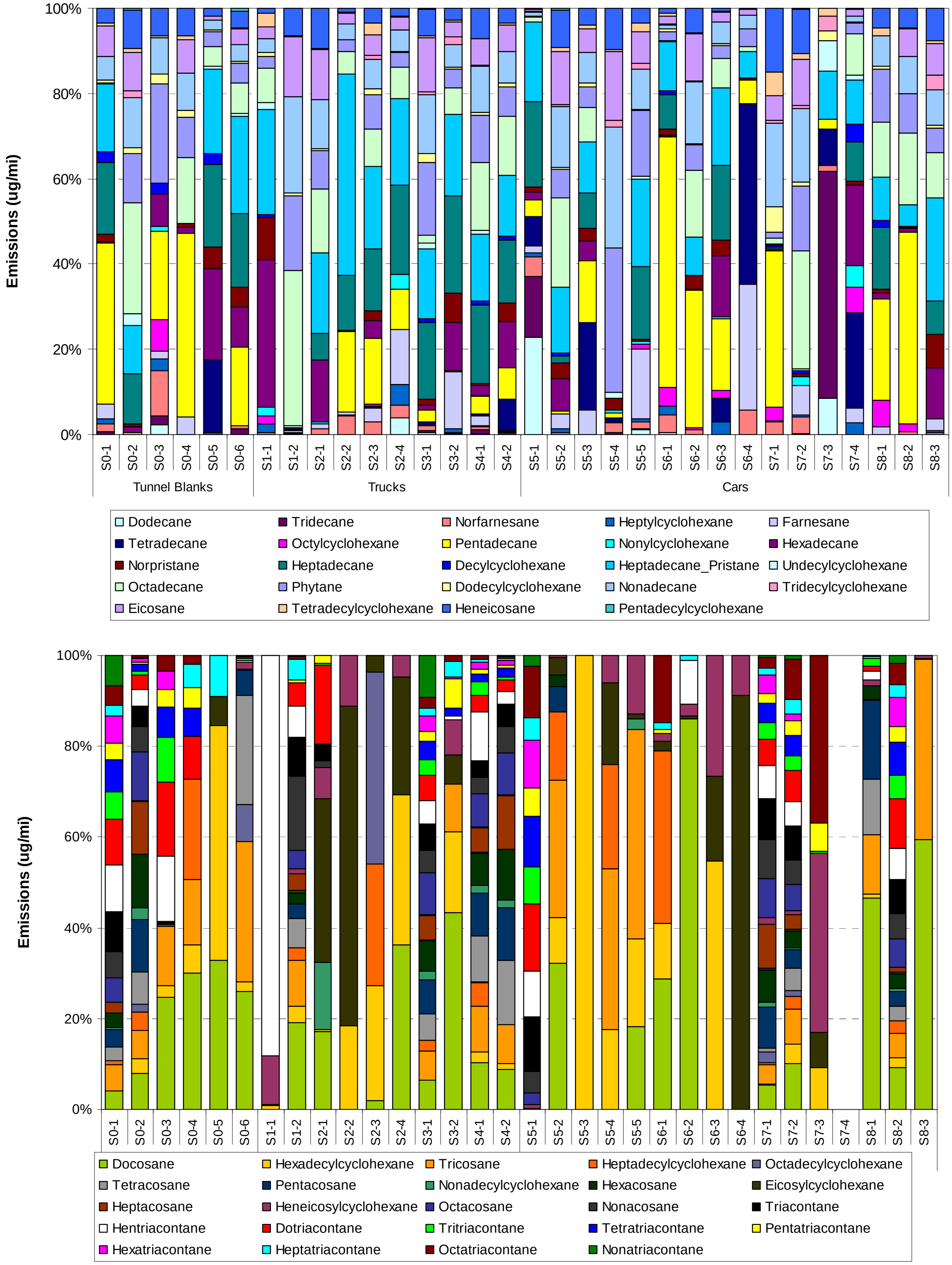
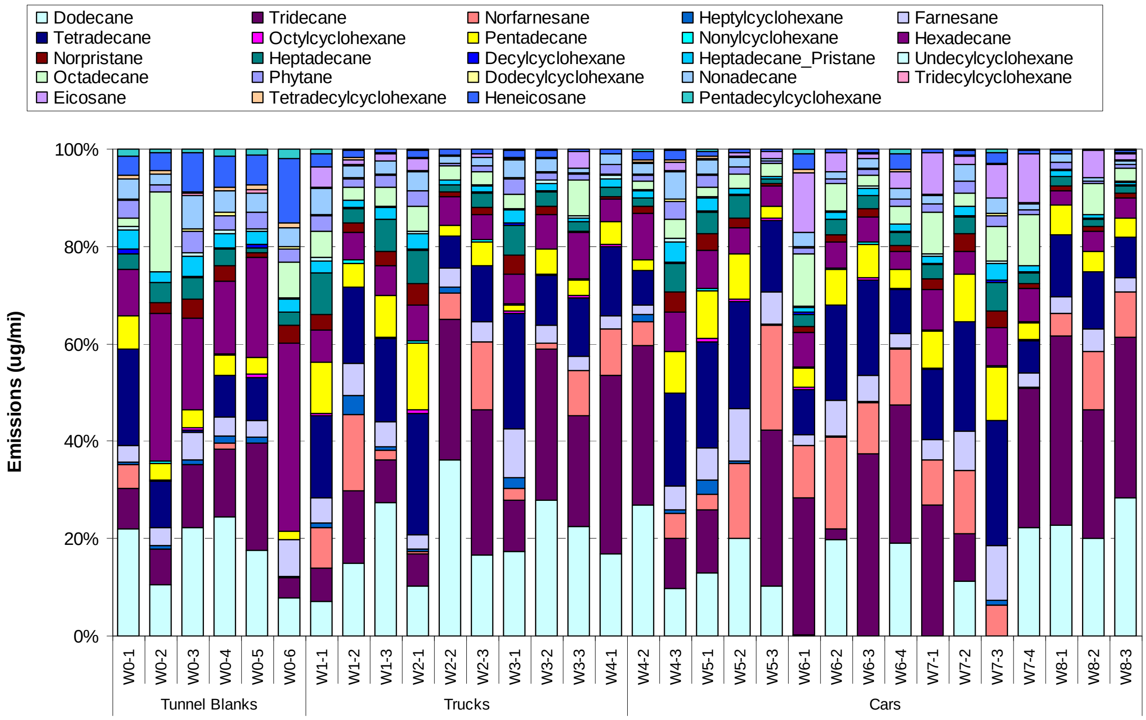


Figure 4-142. Relative abundance of alkanes in exhaust and dilution blank composites during Round 1.



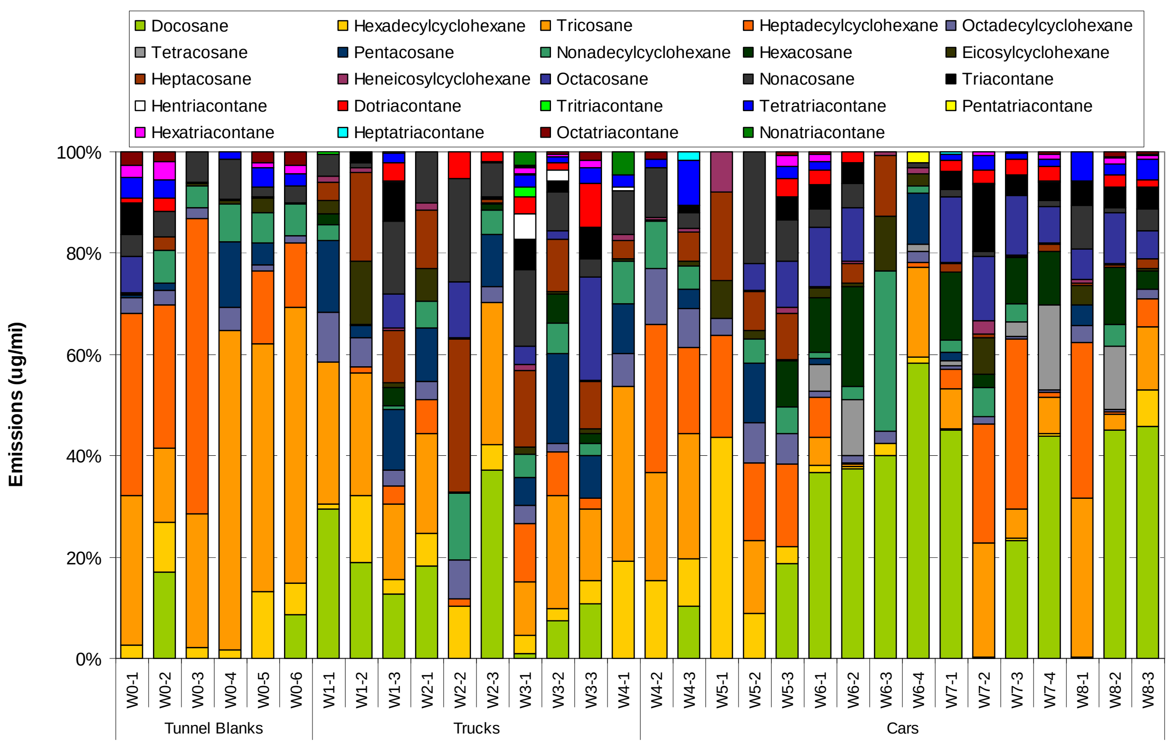


Figure 4-143. Relative abundance of alkanes in exhaust and dilution blank composites during Round 2.

4.7 Speciated VOC Emissions and Gas-Phase Mobile Source Air Toxics

4.7.1 Background

Motor vehicles are a major source of volatile organic compounds. VOCs are involved in photochemical reactions leading to the formation and accumulation of ozone in the troposphere. VOCs also include several compounds that have been identified by EPA as hazardous air pollutants (HAPs). Of the 33 HAPs identified by EPA as important urban air toxics, 21 are associated with motor vehicles. The gas-phase mobile source air toxics (MSAT) of most concern include benzene, toluene, ethyl benzene, xylenes, formaldehyde, acetaldehyde, 1,3-butadiene and acrolein. Methods for sampling and analysis of speciated VOCs are generally well developed for both ambient and source measurements. However, certain compounds are unstable and decay rapidly after sample collection. Methods were developed and applied to address these measurement issues.

1,3-butadiene is known to be unstable in canister samples in the presences of NOx. Prior work by DRI for the Gasoline/Diesel PM Split Study included dynamometer studies where a GC/MS system was installed on site to perform VOC analysis within minutes of sample collection to prevent loss of 1,3-butadiene. However there is considerable cost associated with installing and operating a GC/MS on site for the length of time involved in vehicle testing for this study. As an alternative to on-site analysis, DRI examined the feasibility of stabilizing 1,3-butadiene in canister samples by removing NO and NO_2 from the exhaust samples. The development and evaluation of a NOx denuder was funded separately by the National Renewable Energy Laboratory (NREL) of the U.S. Department of Energy and carried out during the pilot phase of the study. The methods and results are described in a separate report for NREL by Fujita et al. (2004) and briefly summarized here.

Acrolein is known to rearrange on DNPH cartridges to an unknown degradation product (acrolein-X) (Tejada, 1986). This rearrangement is sufficiently rapid that most of the acrolein may convert to acrolein-X, unless the sample is analyzed within a few hours. The problem is compounded by the fact that acrolein-X co-elutes in the HPLC analysis with butyraldehyde. A procedure was developed in a separate project conducted by the DRI for the Health Effects Institute (Fujita et al., 2006) and applied after the initial analyses to more accurately quantify acrolein and butyraldehyde.

4.7.2 Experimental Methods

BKI conducted the vehicle emissions tests on their transportable Clayton Model CTE-50-0 chassis dynamometer over the LA92 Unified Driving Cycle. The test site and dynamometer setup is described in Chapter 2. The vehicle emissions tests were conducted in Kansas City during July to September 2004 (summer/Round 1) and January to March 2005 (winter/Round 2). The cycle consists of a cold start Phase 1 (first 310 seconds), a stabilized Phase 2 (311-1427 second), a 600-second engine off soak, and a warm start Phase 3 (repeat of Phase 1 of the LA92). Cars and light-duty trucks were recruited for testing in four model year groups (Pre-1981, 1981-90, 1991-95 and 1996 and newer). The vehicle groupings for trucks and cars are designated strata 1-4 and 5-8, respectively, with the strata in each vehicle type ordered from older to newer model years. Details of the vehicle recruitment for the study are given in Chapter 2. Samples were collected for speciation of VOC and gas-phase MSATs over the entire driving cycle. Full sets of sampling media were also collected for daily 60-minute tunnel blanks and weekly (approximate) field/transport blanks. Tables 4-38 and 4-39 in Section 4.6 summarize the numbers of samples collected and subsequently selected for chemical analysis in Rounds 1 and 2, respectively.

4.7.2.1 Sampling Methods for Speciated VOC

Sampling for VOC included collection of whole air samples in canisters for analysis of speciated hydrocarbons (benzene, toluene, ethylbenzene, m-& p-,o-xylene, i.e. BTEX, styrene, n-hexane, naphthalene,1,3-butadiene, MTBE), and DNPH-coated Sep Pak cartridges sampling for carbonyl compounds (formaldehyde, acetaldehyde, acrolein). DRI installed and operated the samplers in accordance with the methods and procedures specified in the project QAPP.

During the planning phase of the study, we estimated the decay rate of 1,3-butadiene according to the chemical mechanism described by Atkinson et al. (1984). They showed that a mixture of NO and NO_2 will produce a series of reactions that will result in •OH being formed in the dark. Hydroxyl radical reacts rapidly with 1,3-butadiene resulting in its removal from a canister sample. Theoretical calculations by our colleague at DRI, Dr. William Stockwell, indicated that the loss of 1,3-butadiene would be rapid in a canister sample of diluted exhaust. At NO_2 mixing ratio of 1 ppm, 1,3-butadiene was projected to decay linearly at a rate of 25% over three days. NO at 10 ppm results in a loss of 52% in the first 24 hours and about 92% loss after three days. These simulated loss rates are also compared in Table 4-45 to loss rates of 1,3-butadiene for ambient NOx levels typically found in high exposure microenvironments and at central monitoring locations.

DRI fabricated a NOx denuder following the method of Braman et. al, (1986). Stainless steel tubes (3/8” o.d.) were coated with a saturated solution of $CO(NO_3)_2$ in water and dried. The tubes were packed inside a larger stainless steel pipe of approximately 2.5” i.d. and capped with tapped end-caps with ¼” fittings. The entire package was heated to approximately 400^{o}C with a flow of approximately 300 ml/min of air through it and left for 8 to 10 hours. The oxidation of the cobalt was confirmed by the elution of NO_2 from the denuder. The denuder was tested by challenging it with a standard of 50 ppm NO in nitrogen. The effluent was analyzed by a chemiluminescence NOx analyzer and we found approximately 30 ppb in the effluent, which was about the same as the zero at that time.

The newly constructed NOx denuder was tested during the pilot study phase of the Kansas City Study with funding provided by the U.S. Department of Energy through the Natinonal Renewable Energy Laboratory. Results of these tests were reported by Fujita et al. (2004) and are summarized in Figure 4-144. Both synthetic mixtures and vehicle exhaust samples from Kansas City were used to evaluate the stability of 1,3-butadiene in canister samples. Two sets of three synthetic samples were prepared - one containing 1,3-butadiene with purified zero air and a second and third with addition of NO and NO_2, respectively. NO and NO_2 levels were selected to correspond to the highest LDGV NOx emitter in DOE’s Gas/Diesel PM Split Study. Aliquots were analyzed by gas chromatography within the first hour, after three days, one week and three weeks.

Table 4-45. Simulated loss rate of 1,3-butadiene with varying levels of 1,3-butadiene, NO and NO_2.

	Initial Conditions					Loss Rate of 1,3-BD		
	1,3-BD ppbv	VOC ppbC	NO ppb	NO2 ppb	CO ppb	6 Hrs	24 Hrs	72 Hrs
Control								
Zero	43	0	0	0	0	0	0	0
High NO (Typical Dyno)	43	0	10,000	0	0	11.4%	52.4%	92.5%
High NO2	43	0	0	1,000	0	2.4%	9.3%	25.3%
High Exposure ME								
Underground Garage	5	3,000	1,000	100	40,000	0.5%	3.9%	17.0%
Congested Freeway	2	750	300	30	8,000	0.1%	0.7%	3.4%
Central Monitoring								
Summer	1	250	75	30	1,000	0.1%	0.3%	1.1%
Winter	1	500	200	40	3,000	0.1%	0.6%	2.4%

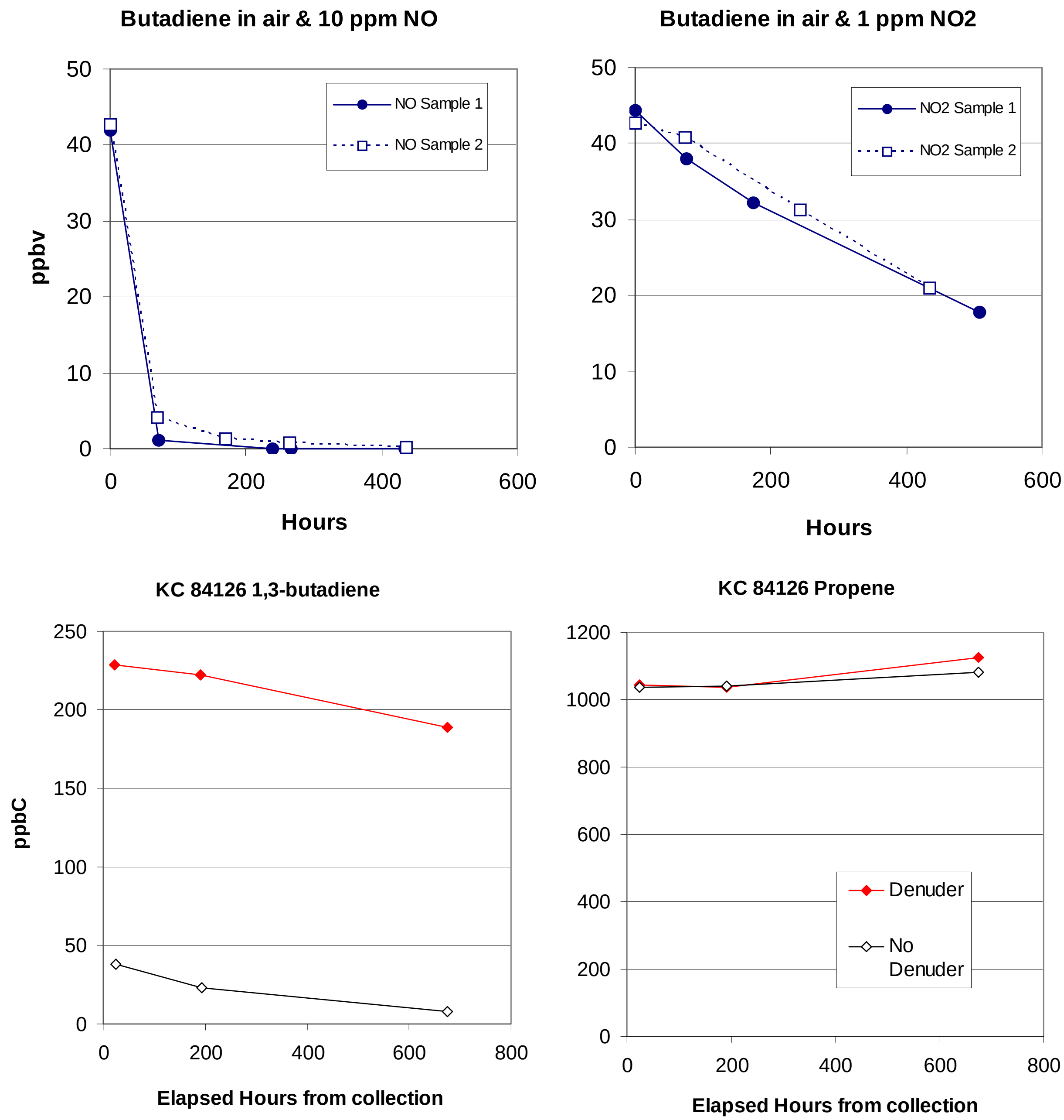


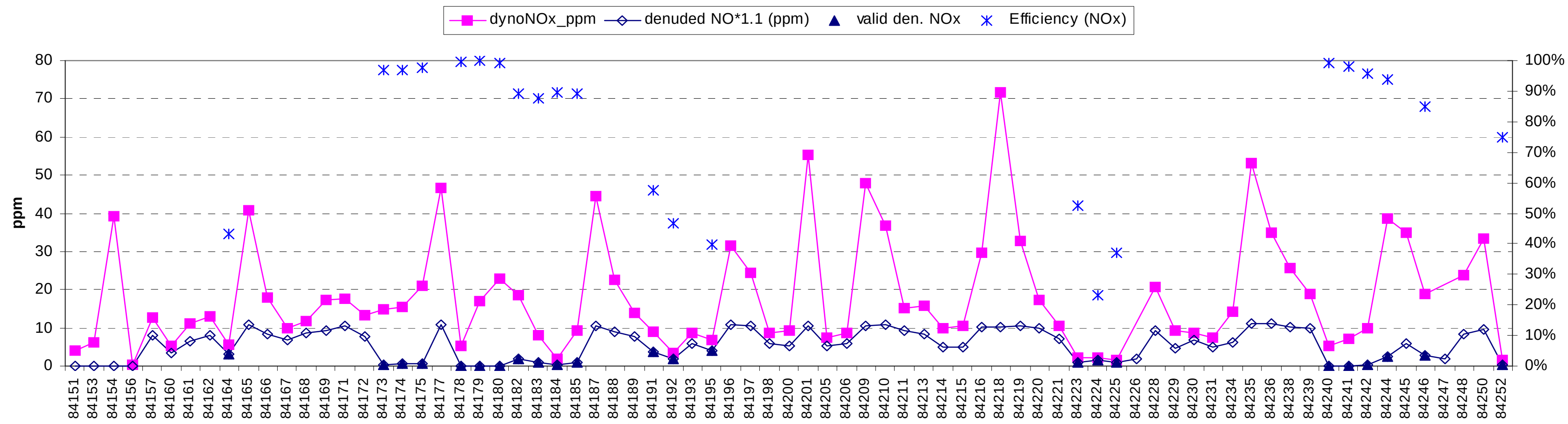
Figure 4-144. Stability of 1,3-butadiene in canister samples.

Upper two plots show loss rate for replicate laboratory test samples with 10 ppm NO (left) and 1 ppm NO2 (right). Lower two plots show loss rates of 1,3-butadiene (left) and propene (right) vehicle test samples collected in Kansas City with and without a NOx denuder (Fujita et al., 2004).

The samples with NO showed exponential decay of 1,3-butadiene. By three days, butadiene was reduced to 2.5% (first sample) and 9.8% (second sample) of the initial values. At the one-week point, both samples had nearly undetectable levels of 1,3-butadiene. The 1,3-butadiene with NO_2 samples showed a linear decay but was not as rapid as that with NO. This comparatively slower reaction reduced the concentration of 1,3-butadiene to 39.9% and 49.2% of the initial concentration after three weeks. These observations are consistent with aforementioned theoretical calculations. Exhaust from an in-use high-mileage automobile were collected during the pilot phase of the Kansas City Study in two sets of two canisters, one with an upstream NOx denuder and one without the denuder. After three weeks, the non-denuded sample had .04 as much 1,3-butadiene in the denuded sample. The three-week analysis of the denuded sample was approximately 83% of the initial analysis or a loss of 17% of the 1,3-butadiene. This suggests it is likely the denuder was not 100% efficient and some NO and possibly some NO_2 got into the canister, but clearly much less than in the non-denuded sample. A second sample showed greater loss of 1,3-butadiene, possibly due to reduced denuder efficiency. In contrast, the presence of NOx in the canister sample had no effect on the stability of propene, which served as the control.

The NOx denuder that was used during Round 1 was fitted with a heater. The denuder was regenerated once a week during the weekend by heating for several hours at 400 ^{o}C. During sample collection, the concentration of NOx was continuously measured downstream of the denuder to monitor the efficiency of NOx removal (compared to NOx concentrations in the dilution tunnel measured by BKI). Figure 4-145 shows the time-series plot of the NOx concentrations in the dilution tunnel versus downstream of the denuder for each test during Round 1. The denuded NOx concentrations are estimated from NO by applying a factor of 1.1 and are not valid above the maximum instrument range of 10 ppm. NOx removal efficiencies are given for valid (i.e., under 10 ppm) denuded NOx concentrations. These results show that while a fresh denuder was effective in removing NOx, the denuder efficiency was typically degraded after the first day of testing. The lack of backup denuders was a limitation during Round 1, which was not addressed until additional denuders could be built prior to start of Round 2. Consequently, we expected substantial loss of 1,3-butadiene in most Round 1 canister samples. Even with multiple denuders during Round 2, breakthrough of NOx was evident in many samples due to high exhaust NOx concentrations that quickly saturated the denuder.

Alternatively, we estimated 1,3-butadiene from the data for propene and the average ratio of propene to 1,3-butadiene measured in the Gas/Diesel PM Split Study (GDPMS). Canister samples were collected in that study in a similar manner to the present study. But, the samples were analyzed with an on-site GC/MS within a relatively short time after collecting the sample. Figure 4-146 shows that ethene and propene are both strongly correlated with 1,3-butadiene. Because of its long-term storage stability in canisters, the Kansas City propene values times the GDPMS 1,3-butadiene/propene ratio provide reasonable estimates of the 1,3-butadiene levels in the canister samples prior to its decay. The 1,3-butadiene/propene ratios in the Kansas City samples generally increase with decreasing post-denuder NOx concentrations and approach the mean GDPMS ratio at the lower end of the NOx distribution.



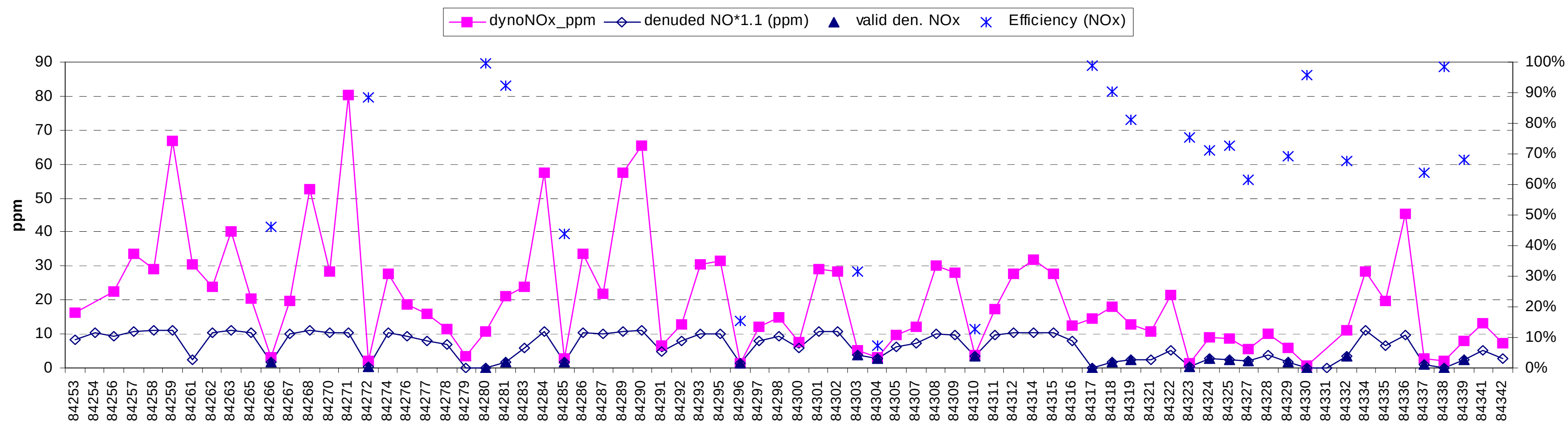


Figure 4-145. Time-series plot of the dilution tunnel versus denuded NOx concentrations for each test during Round 1.

Denuded NOx concentrations are estimated from NO by applying a factor of 1.1 and are not valid above the maximum instrument range of 10 ppm. NOx removal efficiencies are given for valid denuded NOx concentrations. While a fresh denuder was effective in removing NOx, it is clear that the denuder efficiency degrades rapidly.

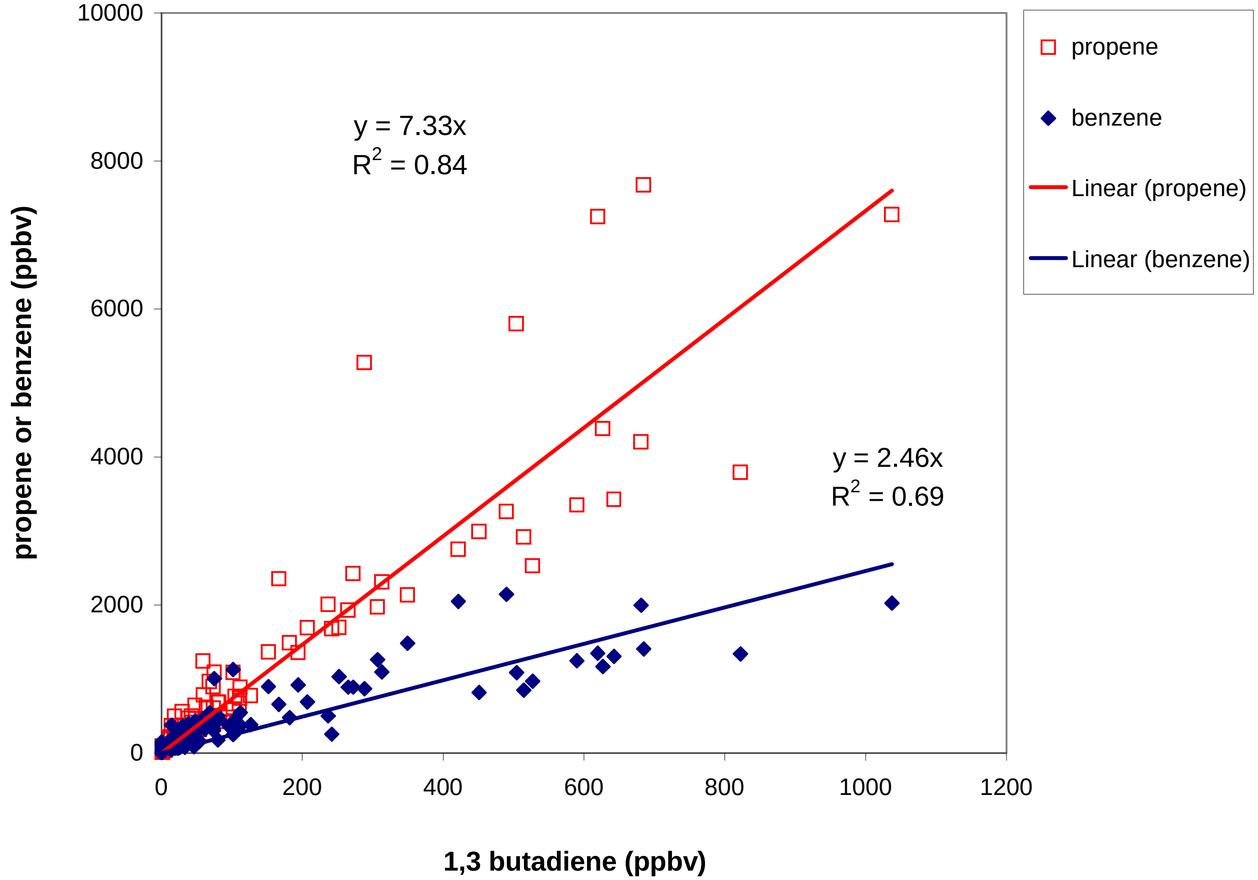


Figure 4-146. Correlations of 1,3-butadiene with propene and benzene.

(Exhaust samples from 57 light-duty gasoline vehicles tested on the LA92 cycle (Phases 1 and 2) during the Gasoline/Diesel PM Split Study. Canister samples were analyzed on site by gas chromatography with mass spectrometry soon after sample collection.)

Results from our study for the Health Effects Institute of in-vehicle exposures to air toxics in the South Coast Air Basin lends further support to this approach. Integrated canister samples were collected inside a moving vehicle over a period of one hour along freeway routes throughout the basin. The same NOx denuder that was used in the Kansas City sampling was also used to remove ambient NOx from the in-cabin samples. Saturation of the denuder was not a problem in this case since typical ambient NOx levels were at least 3 orders of magnitude lower than the typical concentrations in the dynamometer dilution tunnel. Consequently, NOx concentrations were reduced to inconsequential levels and 1,3-butadiene was stable in the HEI canister samples. A scatter plot of the propene against 1,3-butadiene for about 50 in-cabin samples yields a slope of 7.30 (R^2 = 0.92) (Figure 4-147), which is essentially identical to the regression results from GDPMS of 7.32 (R^2 = 0.84). The correlation for the ambient measurements is tighter than for dynamometer data because in-cabin measurements combine the exhaust from thousands of vehicles. Figure 4-147 also shows the scatter plot of 1,3-butadiene and propene for 24-hour samples from near-road sampling locations at Long Beach, Lynwood and Diamond Bar with a slope similar to the correlations for on-road and dynamometer samples. This empirical adjustment factor provides a way to assess the effectiveness of NOx removal during the sampling in Kansas City and adjustments of the data, if necessary.

4.7.2.2 Analysis Methods

Selected canisters were combined according to the compositing decisions and analyzed for 111 identified C_1 to C_{11} hydrocarbons with a Hewlett-Packard 5890 Series II gas chromatograph or Varian 3400 GC both equipped with a flame ionization detector. A separate analysis of the C_2 hydrocarbons was not performed since the emphasis of this analysis was volatile air toxics. Thus, ethane, ethylene and acetylene are reported as the sum of C_2 hydrocarbons. Selected DNPH cartridges were analyzed for carbonyl compounds by Waters high performance liquid chromatography (HPLC) equipped with Waters 2695 Alliance separation module, Waters 996 photodiode array detector and Empower chromatography software. Cartridge extracts were combined according to the compositing decisions and analyzed for 14 specific C_1-C_7 carbonyl compounds. The analysis methods and procedures are described in the project QAPP.

Acrolein is known to rearrange on DNPH cartridges to an unknown degradation product (acrolein-x) (Tejada, 1986). Disappearance of the acrolein hydrazone in the analytical sample matrix correlates quantitatively almost on a mole for mole basis with the growth of acrolein-x, and the sum of acrolein and acrolein-x appears to be invariant with time (Tejada, 1986). The rearrangement of acrolein occurs over time periods of days, so it was not logistically possible to avoid the effect of this artifact in this study. The sum of acrolein and acrolein-x provides an estimate of total acrolein that was originally present in the samples. However, the UV spectra from the photodiode array detector show that there is substantial overlap in the chromatographic retention time of acrolein-x with butyraldehyde. A procedure was developed in a separate project conducted by the DRI for the Health Effects Institute (Fujita et al., 2006). This procedure was applied after the initial analyses to more accurately quantify acrolein and butyraldehyde. The response factor for DNPH-acrolein-X was first determined by preparing a dilution of a known amount of acrolein in a Tedlar bag and to sample it through a DNPH cartridge. Several mixtures of DNPH-butyraldehyde and DNPH-acrolein-X with different proportion of both compounds were analyzed. The UV-VIS spectra of co-eluting compounds were recorded and a linear least squares method was used to relate the proportion of both compounds to the appearance of spectrum maxima for each compound. The correction procedure was applied to the stored UV-VIS spectra for the project samples, but for some samples the resolution of the butyraldehyde/acrolein-X peak was not sufficient to perform the re-integration due to low sample concentrations. For those samples the original, upper-bound estimates were retained for both acrolein and butyraldehyde and are reported with a "<" symbol in the data set.

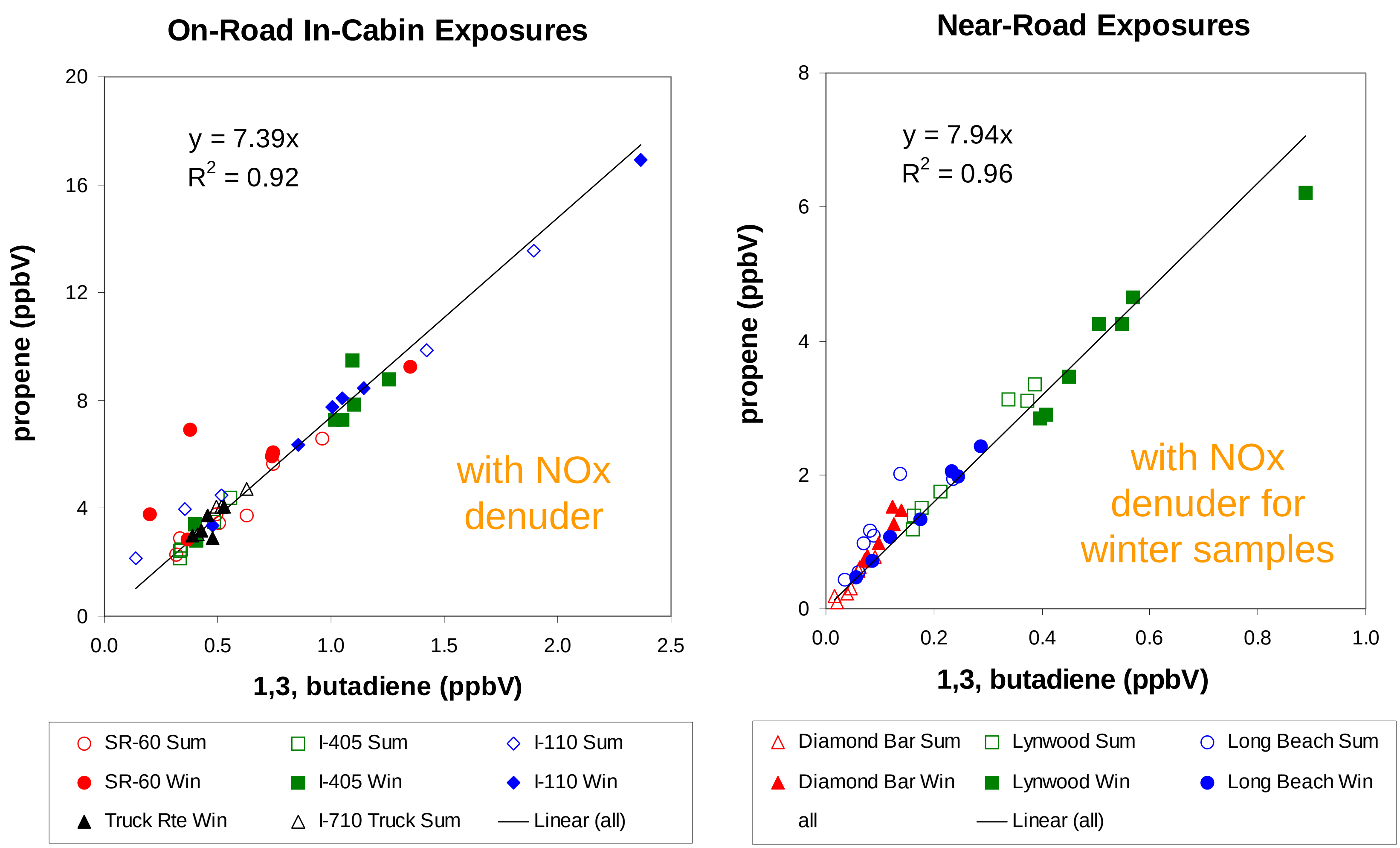


Figure 4-147. Correlations of 1,3-butadiene and propene

One-hour in-cabin (left) and 24-hour near road (right) samples collected in the Los Angeles basin during the Health Effects Institute Study of the exposures to air toxics in mobile source dominated microenvironments. (Fujita et al., 2005)

4.7.3 Results and Conclusions

VOC chemical speciation was determined for the individual/composite samples and composite dilution tunnel blanks samples shown in Tables 4-40 and 4-41 for Rounds 1 and 2, respectively. Table 4-42 lists the dilution tunnel blanks that were combined into composites. All data are field-blank corrected. The chemical composition data for dilution tunnel blanks and exhaust samples are presented in Appendix B.

The total nonmethane hydrocarbon (NMHC) values from the DRI VOC speciation samples were compared to corresponding data obtained by BKI. With the exception of two obvious outliers (S1-2 and S5-4), Figure 4-148 shows good agreement for the uncomposited samples from Round 1. However, Figure 4-149 shows that there are two distinct groups of data in Round 2; one with better agreement between DRI and BKI and a second group with DRI values consistently near zero compared to widely varying values for BKI. A chronological plot of the ratios of DRI to BKI TNMHC values for Round 2 shows that DRI consistently obtained low values during the second half of Round 2. Sampling for VOC speciation was suspended for two weeks in mid-February during the NREL experiments on the effects of sampling temperature on measured PM emission rates. The appearance of consistently low DRI/BKI ratios for TNMHC coincides with the resumption of VOC sampling on February 22. The aldehyde data also show a similar chronological pattern with consistently lower values in the second half of Round 2, though not as sharply lower as the hydrocarbon data. As shown in Figure 4-101, the aldehyde sampler was connected to the same branch of the sampling train as the canister sampler. This branch of the sampling train was disconnected from the main sampling line and capped off during the temperature experiments. A leak somewhere in this part of the sampling train, which allowed room air to mix with vehicle exhaust, is the most probable explanation for the near-zero ratios after the mid point in Round 2. Accordingly, the data for VOC and carbonyl compounds for the second half of Round 2 must be considered invalid. Figure 4-150 presents a chronological figure of the ratio of TMNHC measured by DKI and BKI. Of the 57 canisters collected and analyzed for VOC speciation in Round 2, 32 were affected.

We examined the flow check records and discussed the details of the sampling with our field technician to investigate the possible source of the leak. Flow audits were performed near the end of Round 2, and the results did not indicate any serious leaks, but due to the configuration of the interconnected samplers it would not have shown all possible leaks. Flow checks of the can sampler were made on the line that fills the cans, so they would not indicate leaks external to the sampler. Since the denuder and water filter (which were part of the inlet line to the can sampler) were changed daily there seemed to be little value to periodic leak testing of the inlet system. The NOx analyzer that was used to monitor the removal efficiency of the NOx denuder presented another source for leaks. The analyzer was connected to the inlet system in such a way that a leak there would have resulted in backflow into the can sampler and, to a lesser extent, the DNPH sampler (the NOx analyzer flow is less than the can sampler, but greater than DNPH so there is less likelihood of flow back to DNPH). Since the auto-calibrator was also connected to the inlet of the NOx analyzer using Teflon or nylon fittings, and the connections on the analyzers are also plastic, there was a potential for leaks to develop at that point. DRI field personnel visually examined all lines each day to check for disconnected or broken hoses so it is not likely that there was a major leak of that sort. One potential explanation is that a leak occurred at the connection point to the NOx analyzer due to stress on the connectors either when the system was reconnected or while it was not in use (some of the tubing was still connected during the February break), resulting in backflow to the VOC samplers. Another possibility is that an internal valve in the auto-calibrator stuck open during the audits that was done by DRI in mid-February allowing air to flow into the NOx analyzer inlet. When the NOx analyzer was returned to DRI at the end of the study and tested, it showed very low response to a gas standard, as it did during the latter part of round 2. After tightening the connections and repairing a cracked internal filter holder it worked properly, so this seems a likely possibility.

The distributions in emission rates in Figures 4-151 through 4-154 for BTEX and formaldehyde show that newer model year vehicles are generally clean and that emissions of older vehicles are highly variable with some vehicles emitting BTEX and formaldehyde at rates exceeding that of normal emitters by more than two orders of magnitude. The figures also illustrate the sampling problems that occurred during the second half of Round 2. Although unfortunate, the partial loss of VOC speciation data should be viewed in context of the two main project objectives, which are to establish the distribution of emissions for the in-use vehicles in Kansas City and chemical profiles for VOC and PM emissions. Even without the partial loss of data, the speciated emissions data alone would have not been sufficient to fully characterize the distribution of emissions of specific VOC or volatile MSAT. Rather it is the bulk hydrocarbons and PM emissions data for the larger set of test vehicles that provide the emissions distributions of the in-use vehicle fleet. The speciation profiles, averaged by appropriate factors such as season, region, or high versus normal emitters, provide the means for disaggregating total emissions to specific species.

The missing VOC speciation data were reconstructed by first calculating the ratios of reported concentration of each hydrocarbon compound to the total HC reported for each run. These ratios were then averaged for all valid canister samples and the resulting average and standard deviation of the ratios were used to estimate the hydrocarbon speciation for the invalid samples based on the total HC from BKI's bag samples. This reconstructed data are included with the data set for completeness in a separate table. The previous plots for BTEX emissions are shown in Figures 4-155 and 4-156 as fractions of individual species to the sum of BTEX. The abundances of benzene, toluene, ethylbenzene and xylenes are similar among the samples and between Rounds 1 and 2. Figure 4-157 shows the strong correlations among related aromatic hydrocarbon species for all exhaust composites.

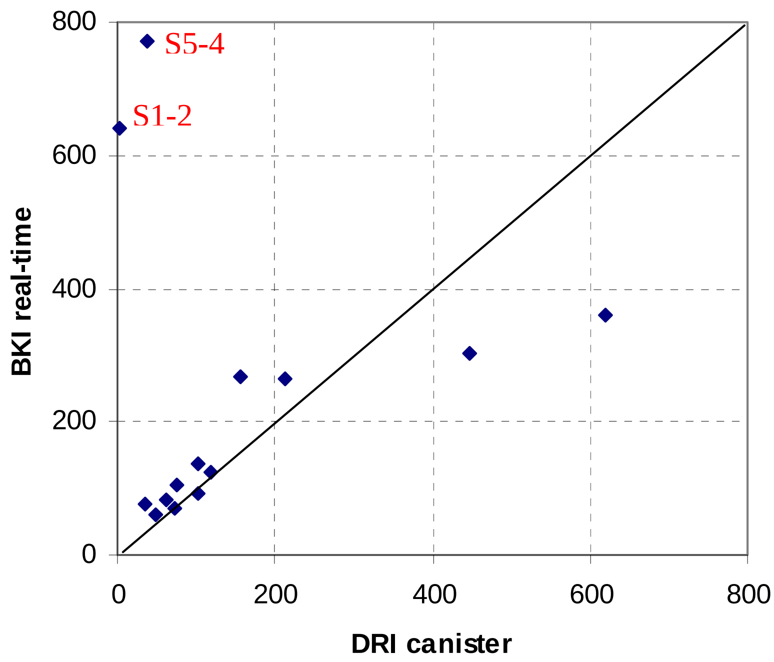


Figure 4-148. Correlation plot of BKI total TNMHC (ppmC) and DRI NMHC (ppmC) for Round 1.

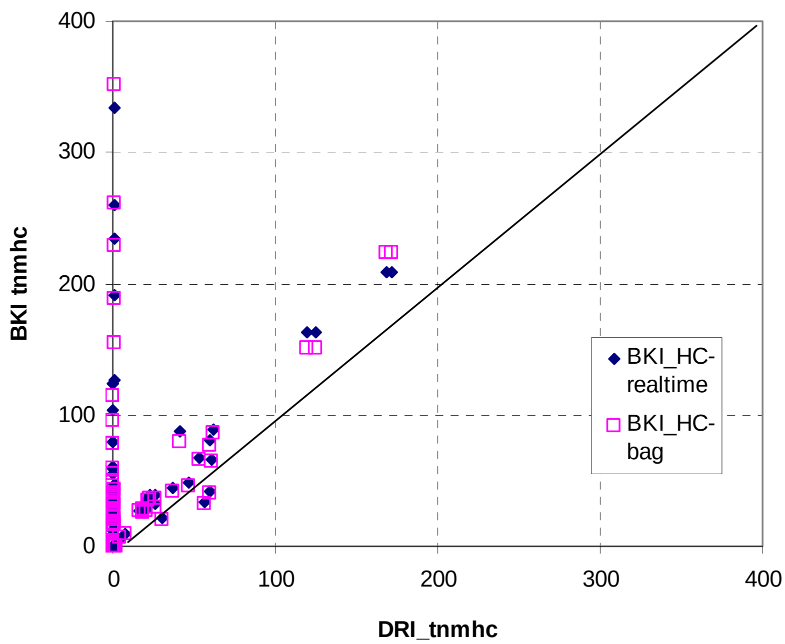


Figure 4-149. Correlation plots of BKI total TNMHC (ppmC) and DRI NMHC (ppmC) for Round 2.

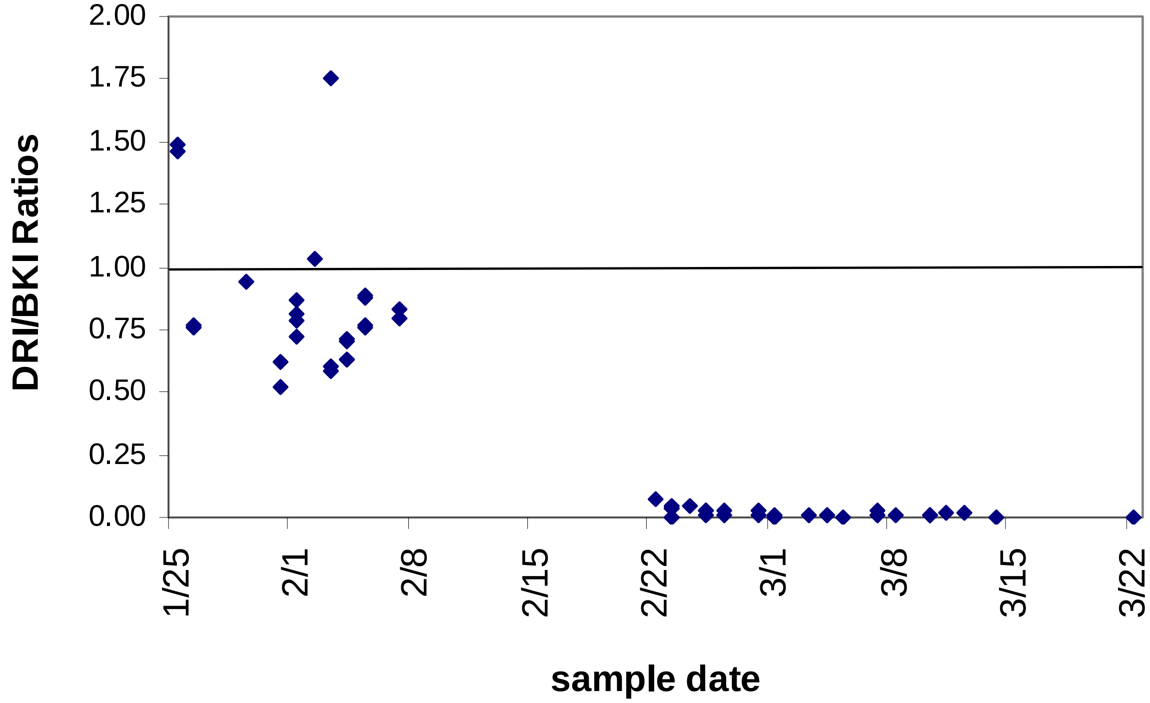


Figure 4-150. Ratios of the TNMHC measured by DRI to BKI during Round 2 shown chronologically.

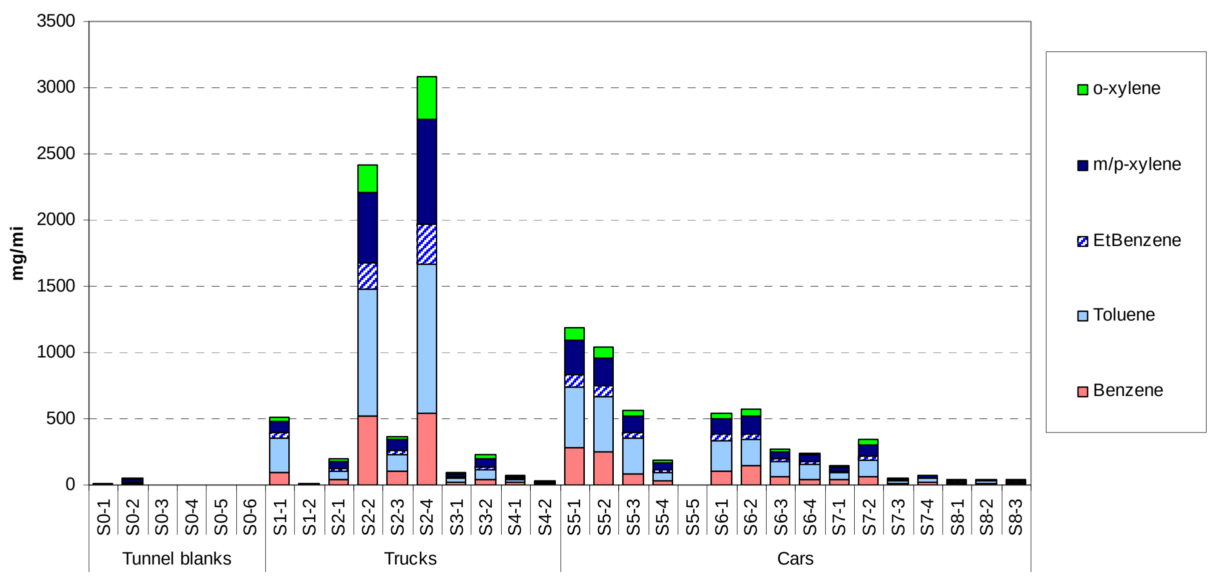


Figure 4-151. Emission rates (mg/mile) of BTEX for individual/composite samples from Round 1.

(Data for S1-2, S5-4 and S5-5 are suspect.)

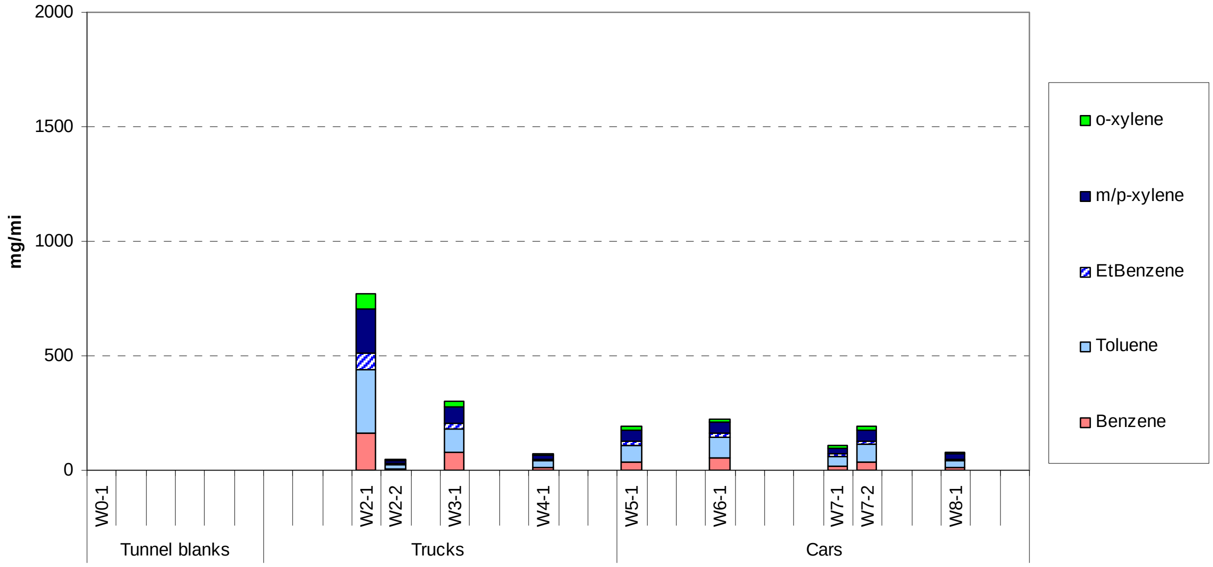


Figure 4-152. Emission rates (mg/mile) of BTEX for individual/composite samples from Round 2.

(Samples collected after mid-February 2005 are invalid and are not shown in the figures.)

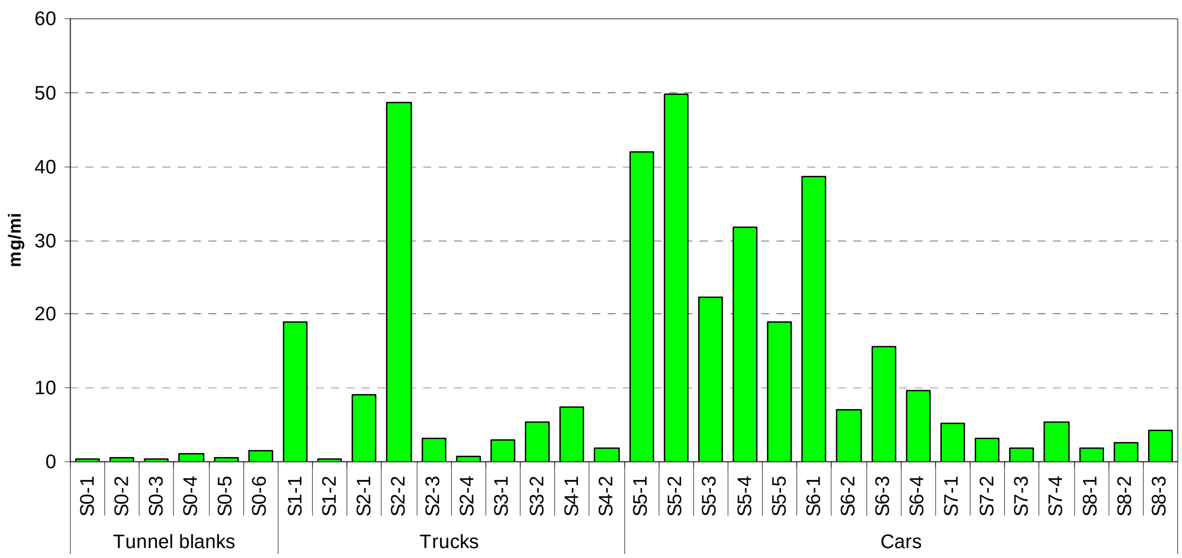


Figure 4-153. Emission rates (mg/mile) of formaldehyde for individual/composite samples from Round 1.

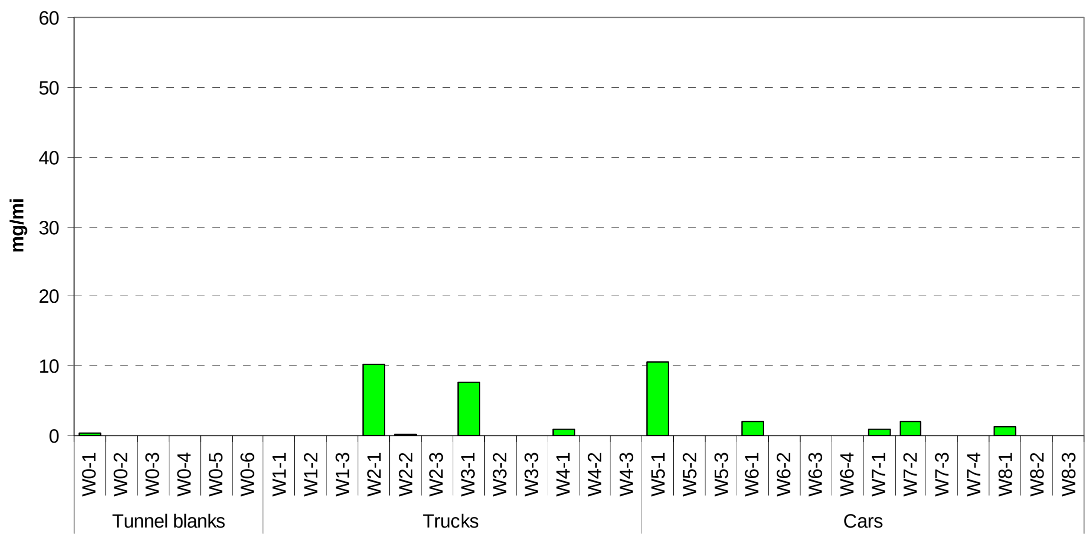


Figure 4-154. Emission rates (mg/mile) of formaldehyde for individual/composite samples from Round 2

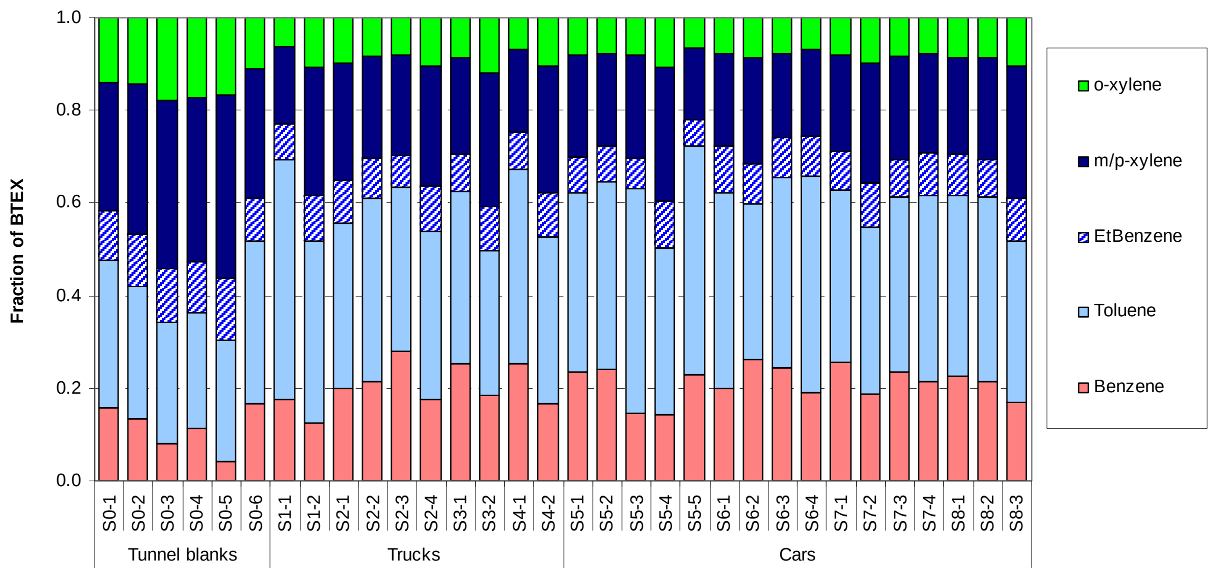


Figure 4-155. Fraction of BTEX for individual/composite samples from Round 1.

(Data for S1-2, S5-4 and S5-5 are suspect.)

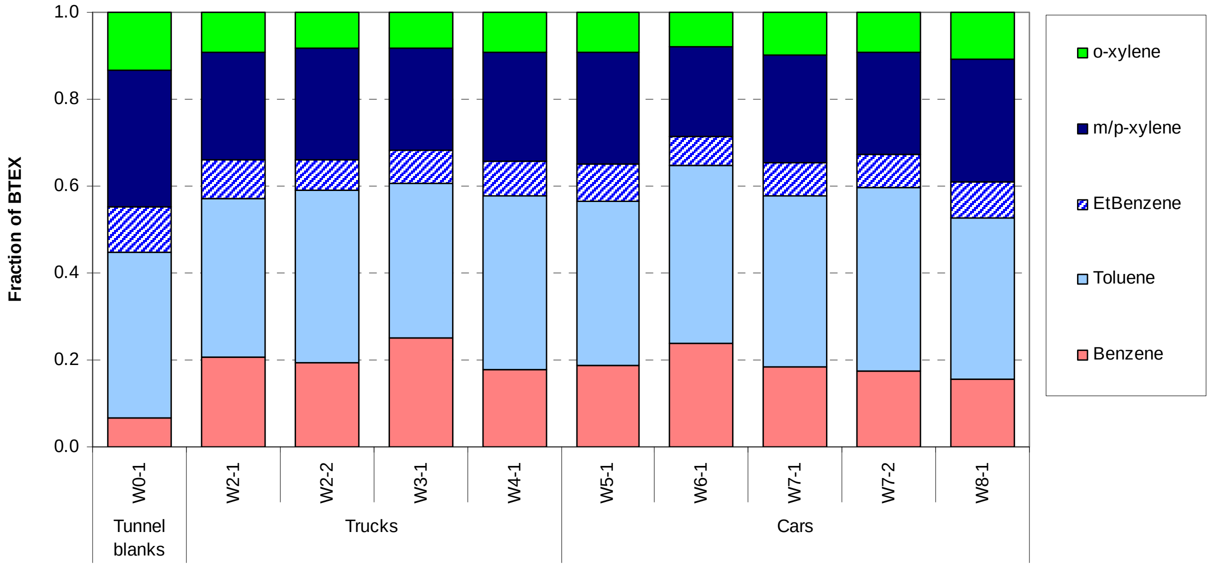


Figure 4-156. Fraction of BTEX for valid individual/composite samples from Round 2.

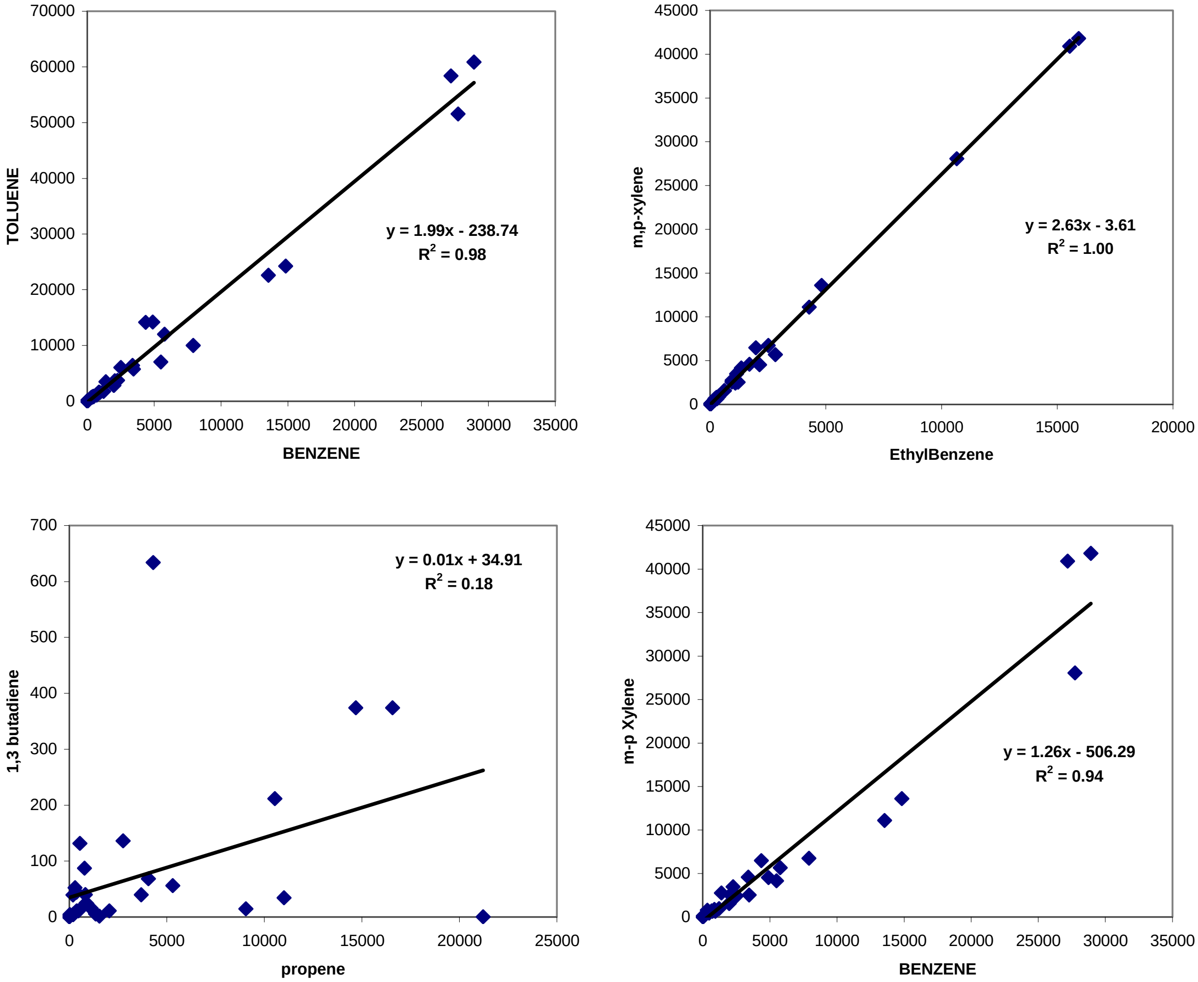


Figure 4-157. Correlation plots of related VOC species for all exhaust composites.

Concentrations shown are ppbC of diluted exhaust.

The lack of correlation and the low 1,3-butadiene/propene ratios shown in Figure 4-157 indicate that a substantial fraction of the 1,3-butadiene had been lost in most of the samples due to reaction with NOx. As previously mentioned, the true values are estimated by multiplying the propene values by the 1,3-butadiene/propene ratio from the DOE/NREL Gasoline/Diesel PM Split Study. Figures 4-158 through 4-161 show the measured and adjusted 1,3-butadiene emissions rates for individual/composite samples The corrected emission rates for acrolein are shown in Figures 4-162 through 4-163. As previously discussed, acrolein transforms into an unknown rearrangement product which coelutes with butyraldehyde, so a re-calculation of the sample concentrations using specially prepared standards was required to derive the total acrolein emission rate.

In summary, the VOC profiles are very consistent across all categories for major air toxics (BTEX). Emission rates were highly variable, but higher for strata 1, 2, 5, and 6. Tunnel blanks showed very low concentrations relative to exhaust samples.

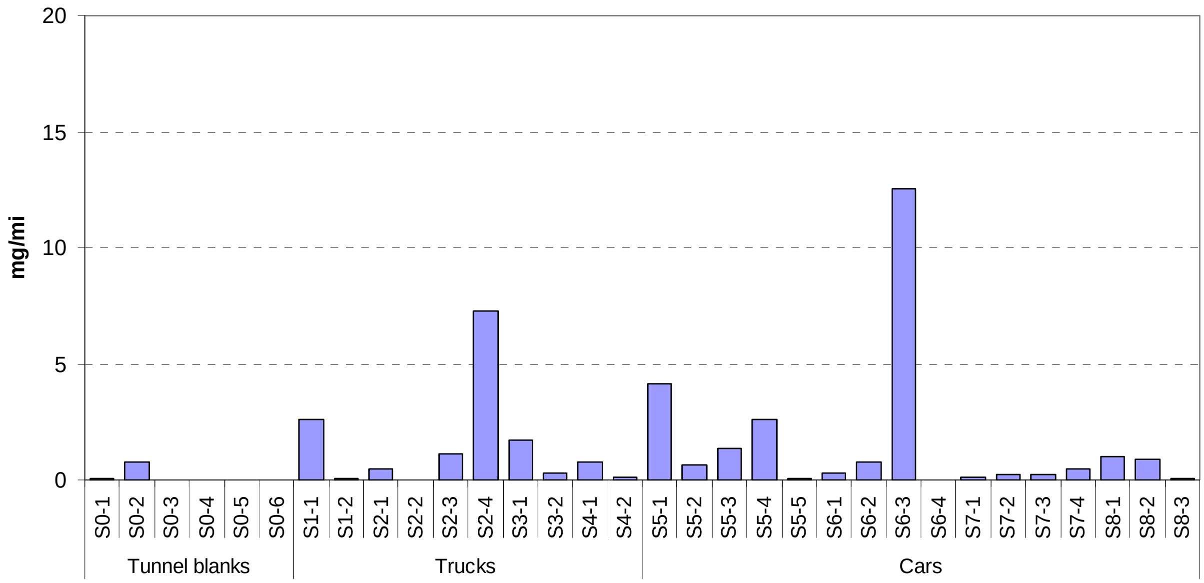


Figure 4-158. Emission rates (mg/mile) of 1,3-butadiene (measured) for individual/composite samples from Round 1.

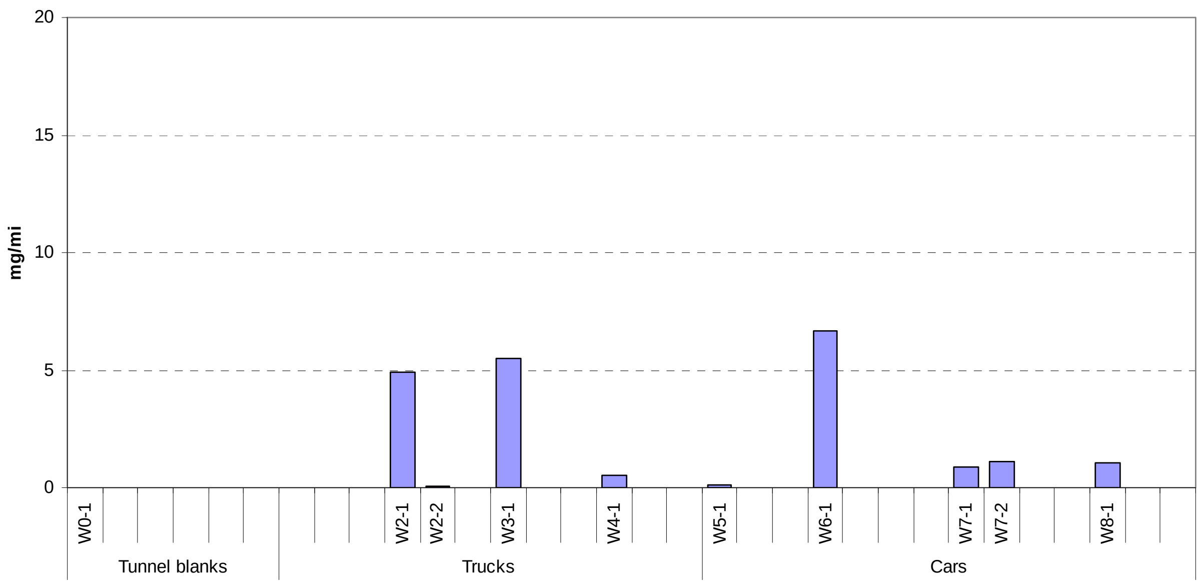


Figure 4-159. Emission rates (mg/mile) of 1,3-butadiene (measured) for individual/composite samples from Round 2

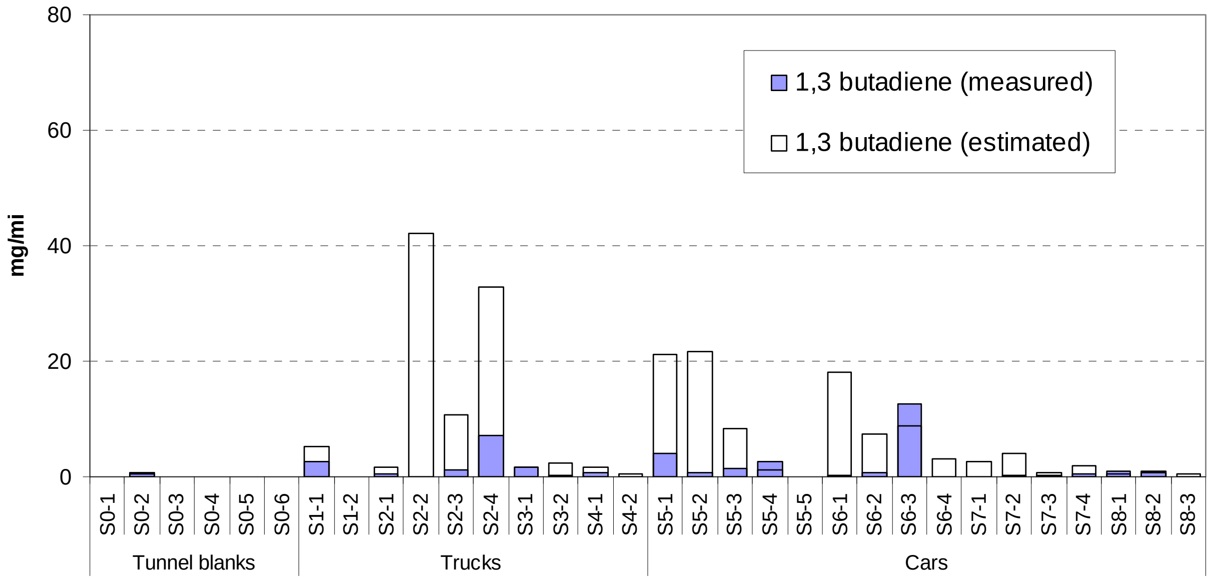


Figure 4-160. Emission rates (mg/mile) of 1,3-butadiene (measured) for individual/composite samples from Round 1 and estimated from regression with propene.

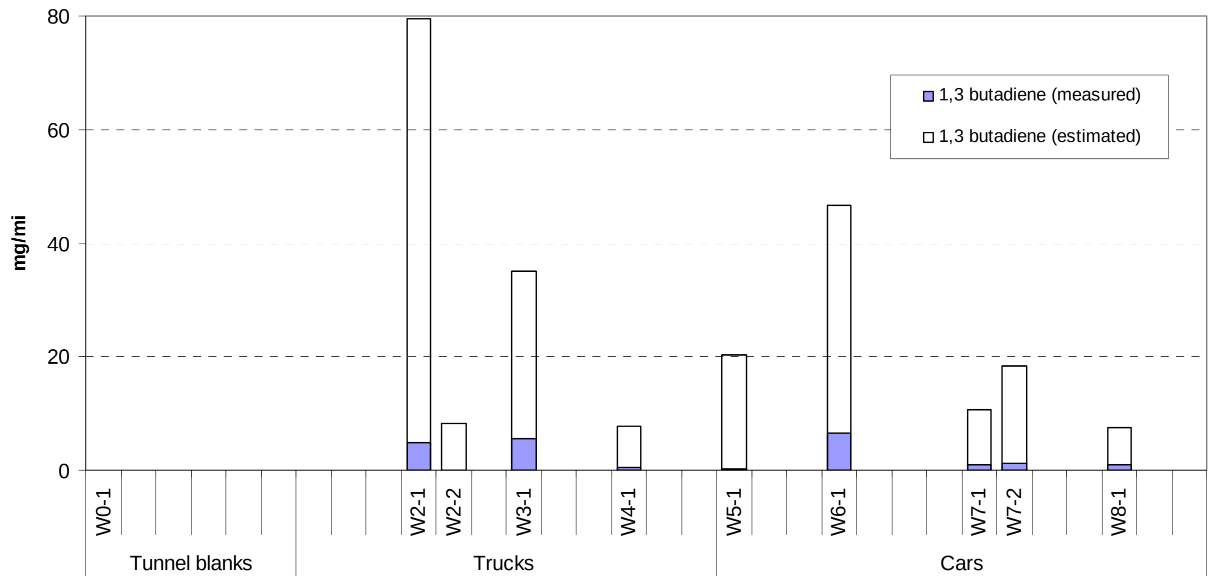


Figure 4-161. Emission rates (mg/mile) of 1,3-butadiene (measured) for individual/composite samples from Round 2 and estimated from regression with propene.

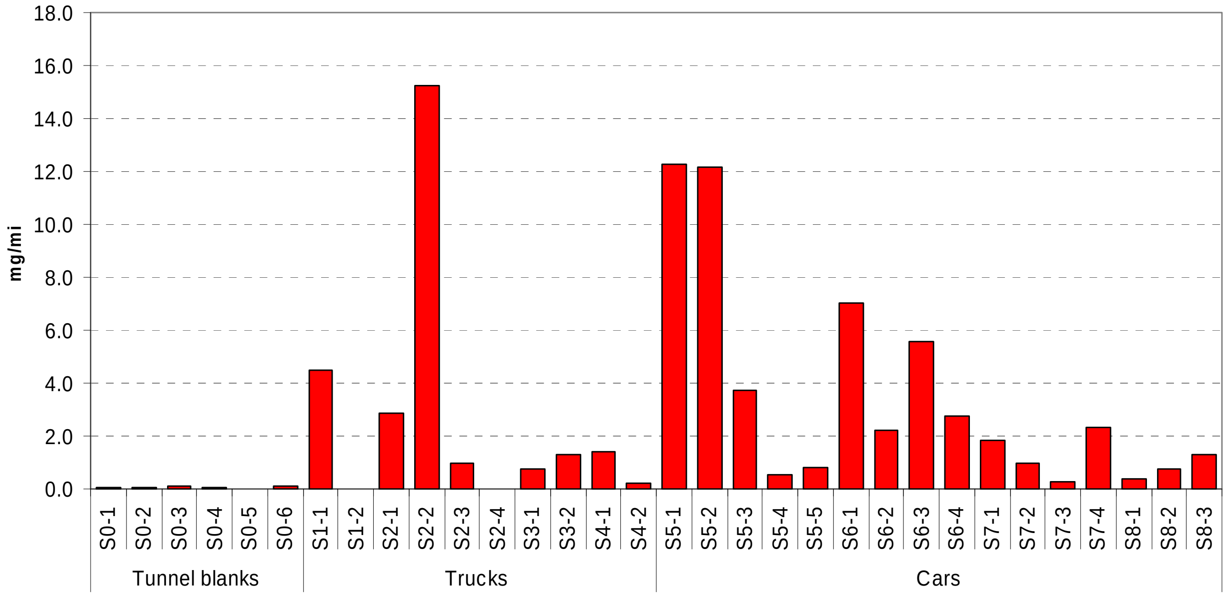


Figure 4-162. Emission rates (mg/mile) of acrolein for individual/composite samples from Round 1.

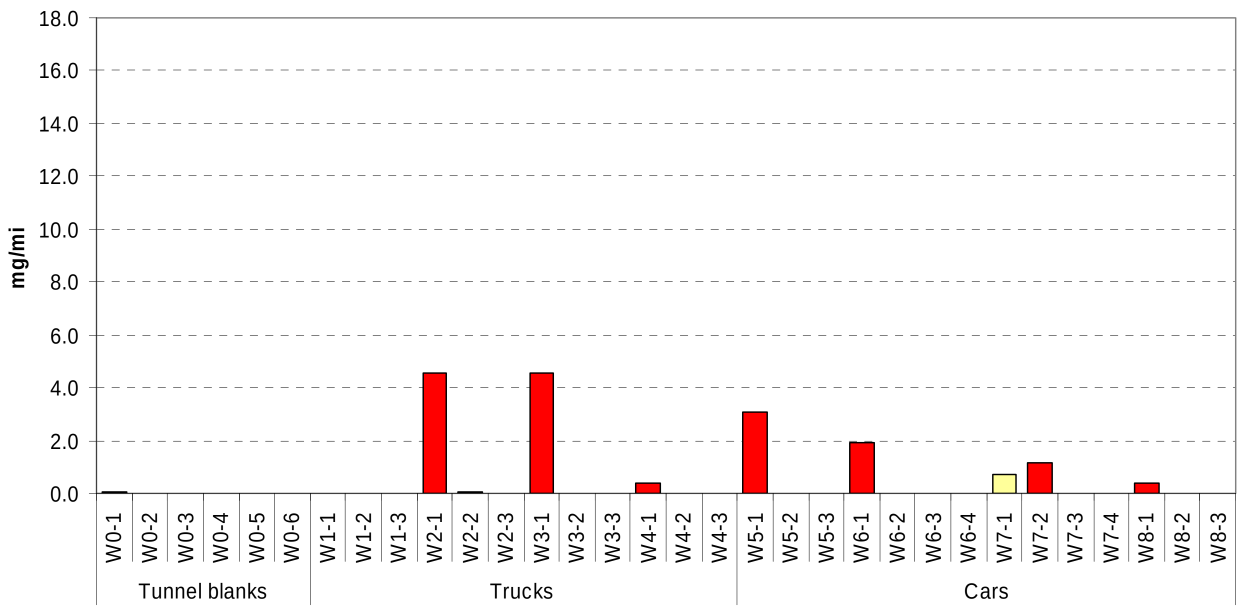


Figure 4-163. Emission rates (mg/mile) of acrolein for individual/composite samples from Round 2. Lighter bars are upper bound estimates.

4.8 RSD Data Collection Process and Data Summary

During Rounds 1 and 2 of the project, on-road data were collected using Remote Sensing Devices (RSD). The purpose of these deployments was to document the on-road fleet in the Kansas City area and to measure on-road emissions. ERG subcontracted with Environmental Systems Products (ESP) to collect RSD data for this project. ESP used RSD equipment and personnel from the Saint Louis Clean Screen program. They also deployed a newer generation of RSD equipment (RSD 4000, as opposed to the older generation RSD 3000) in parallel to the equipment from their St. Louis program, so side-by-side data were collected using both generations of equipment. Note that for Round 2, only RSD 4000 equipment was used.

4.8.1 Site Selection

During Round 1, ESP had surveyed approximately 57 potential sites in the Kansas City area. They were evaluated for safety, physical layout, traffic volume, and geographical coverage of the area. During Round 2, ERG asked ESP to look at another site, nearer to the area where vehicles were being tested. The intent of using the additional site was to obtain RSD measurements on a bigger subset of the vehicles being tested using other methods than was obtained during Round 1. The new site chosen for use during Round 2 is labeled as "21" in Figure 4-164. The "Top 10" best sites chosen during Round 1 are also shown in Figure 4-148 They are labeled with numbers "1" through "10." The EPA test site is labeled with the number "0". The blue line estimates a 20-minute drive-time from the EPA test facility.

Sites 1 through 8 of the "Top-10" sites were used during Round 1 testing. The ESP team collected data during 5-consecutive days in each of July, August, and September 2004. During the July deployment, data were collected at five of the most promising sites to help select the single site that would be used during the August deployment. In August, RSD data were collected only at site 2 (Johnson Drive onto I-35 South). This was done to replicate the technique used in the Coordinating Research Council's Project E-23.

Sites 2, 4, 6, and 7 of the "Top-10" sites and site 21 were used during Round 2 testing. The ESP team collected data during 5-consecutive days in each of January, February, and March of 2005. In January, RSD data was collected only at site 2 (Johnson Drive onto I-35 South). As with Round 1 testing, this was done to replicate the technique used in the Coordinating Research Council's E-23 studies. In February, data was collected only at site 21. Although the site proved not to be a good location for obtaining RSD measurements and had very low traffic volumes, it was the only acceptable site for obtaining RSD readings on the vehicles tested using other methods at the EPA facility. Details for all RSD sites listed used during the study are provided in Appendix Y.

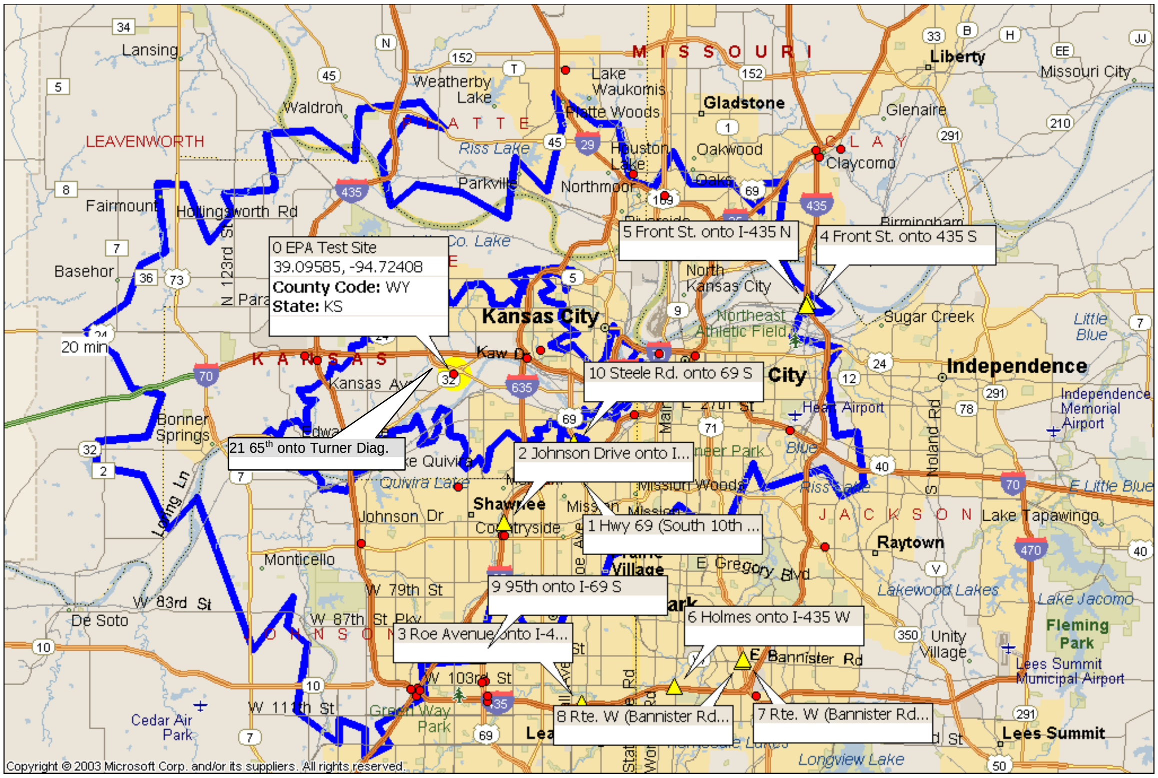


Figure 4-164. RSD Sites Chosen in the Kansas City Area

4.8.2 Summary of RSD Data from Rounds 1 and 2

In this section, we summarize the data collected by the most recent RSD technology deployed, named RSD-4000.

When RSD data are collected, they are automatically screened in the field for validity, and a digital photograph of the vehicle's license plate is linked to the results for that vehicle. During post processing, the license plate number in each photograph is transcribed and appended to the RSD measurement results in the database. For various reasons some license plate numbers are not readable, so the measurement results cannot be linked to a specific vehicle. After license plate numbers are appended to the database, it is merged with local registration records, typically obtained from the Department of Motor Vehicles. In this project, both Kansas and Missouri provided their registration databases for this purpose. When a license plate from the measurement database is successfully merged with registration information, the RSD measurements have been uniquely linked to a specific vehicle. At that point, the vehicle make, model, model year, and other important information are linked to the measurements taken by the RSD equipment, and the data are ready for meaningful analysis. Approximately 48,400 of the Round 1 RSD-4000 records, and 23,300 of the Round 2 RSD 4000 records, made it to this point in post-processing.

The pie charts in Figures 4-165 and 4-166 show the number of RSD-4000 records taken at each site during Rounds 1 and 2, respectively. Almost two-thirds of the RSD data were collected from sites in Kansas, with almost half coming from the site used to collect data in a manner similar to that used in CRC's Project E-23. Site 21 produced relatively few data points because it had very low traffic volume. Site 7 produced few data points because it was only used on one occasion (March 15). Location information for all RSD sites listed in Figures 4-165 and 4-166 is provided in Appendix Y.

The bar charts in Figures 4-167 and 4-168 show the distribution of vehicle model years in the RSD data. This is the distribution of vehicles for which RSD data was collected (vehicles that drove past the RSD site). According to the data, the Kansas City area fleet has an average model year of 1998 and a median model year of 1999. The modal range of model years was from 2000 to 2002, with 2001 having slightly fewer observations than either 2000 or 2002.

The scatter charts in Figures 4-169 and 4-170 show the average speed observed by RSD-4000 for each model year. Site selection guidelines dictate that a moderate speed be the norm. The average speed observed was 26.9 mi/hr for Round 1, and 25.5 mi/hour for Round 2. As expected, the average speed increased with model year.

Figures 4-171 through 4-176 show the average emissions measurement results by vehicle model year for CO, HC, and NO, for both Rounds of testing. The average Round 2 CO results are nearly identical to those observed during Round 1, but the HC results are much higher during Round 2 and NO results are slightly higher. These changes could be due to differences the weather and in the driving patterns observed during Round 1 and during Round 2.

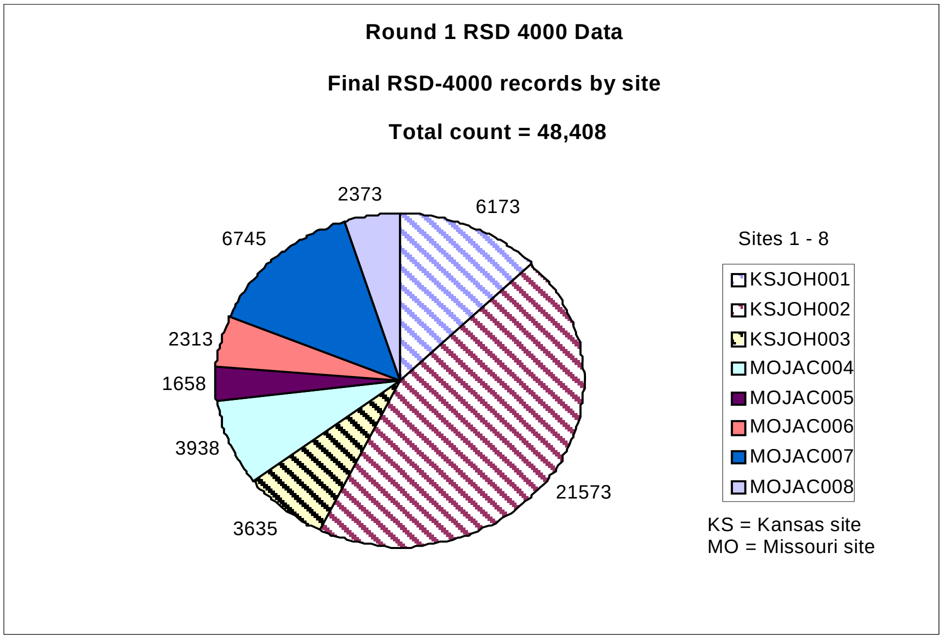


Figure 4-165. RSD-4000 Data Counts at each Round-1 Site

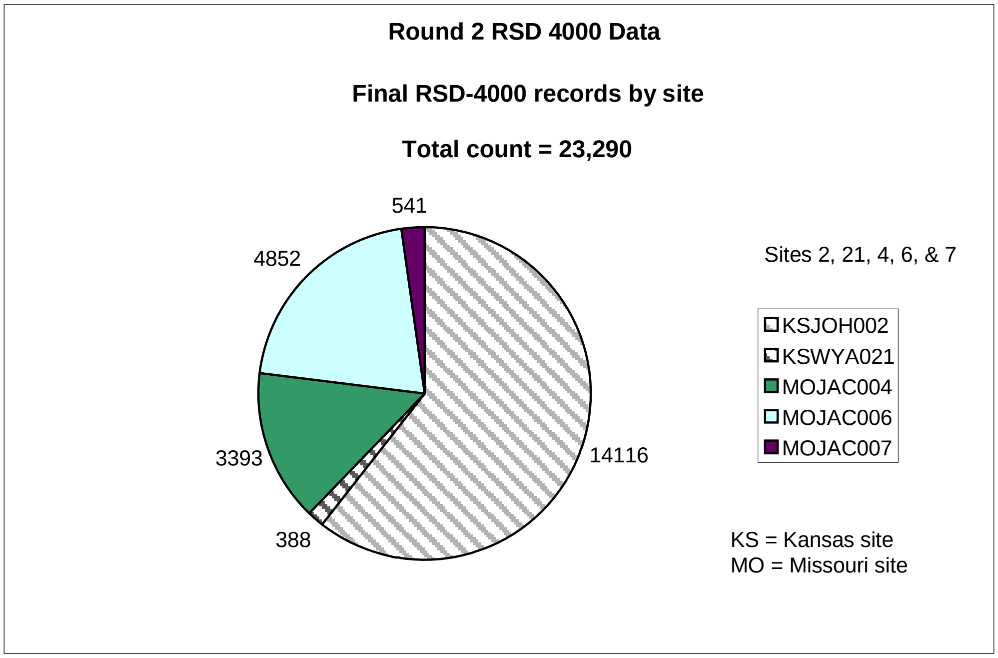


Figure 4-166. RSD-4000 Data Counts at each Round-2 Site

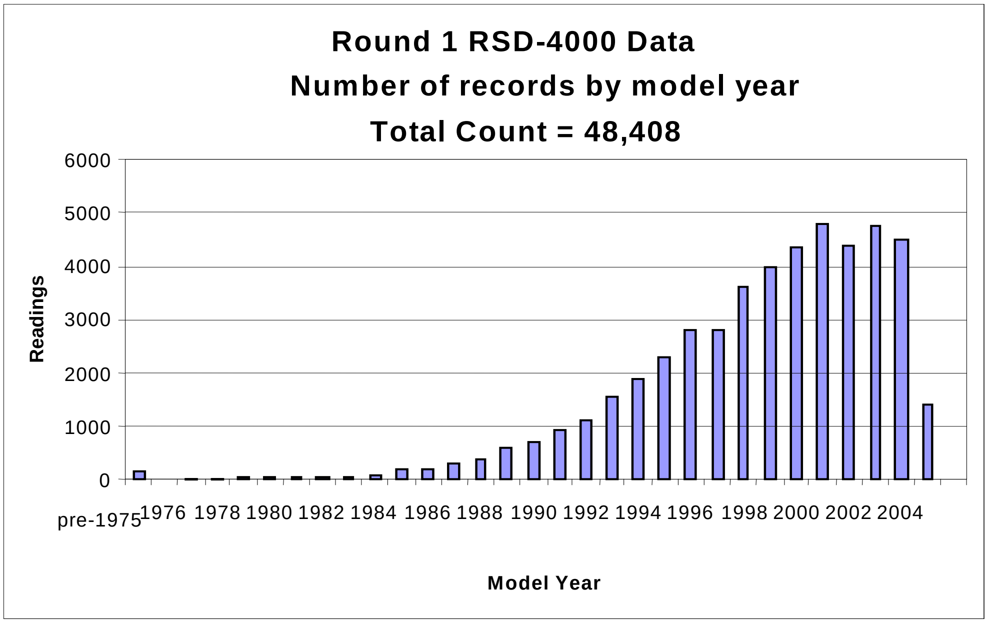


Figure 4-167. Round 1 RSD-4000 Vehicle Counts, by Model Year

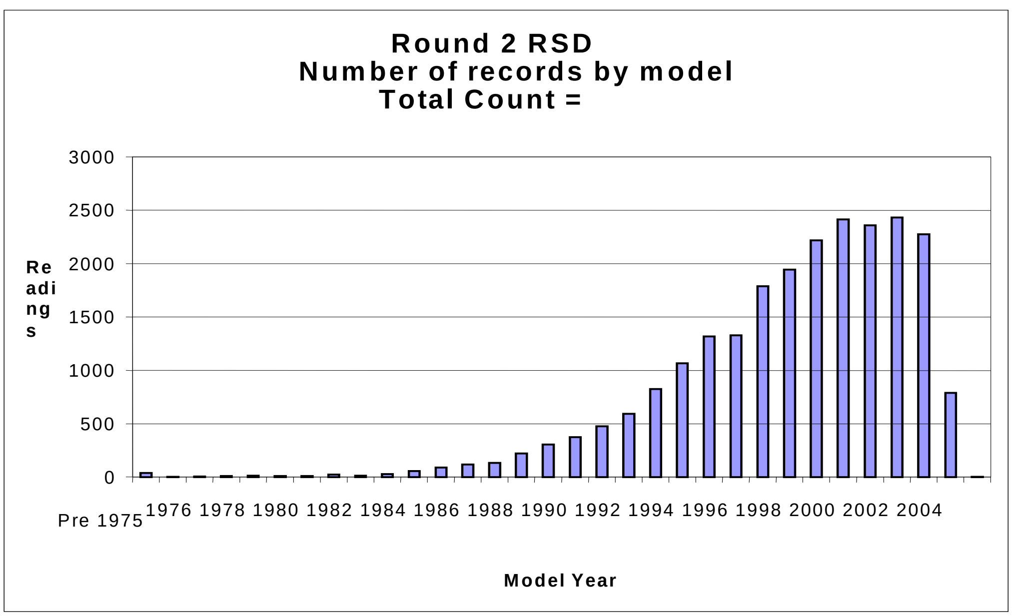


Figure 4-168. Round 2 RSD-4000 Vehicle Counts, by Model Year

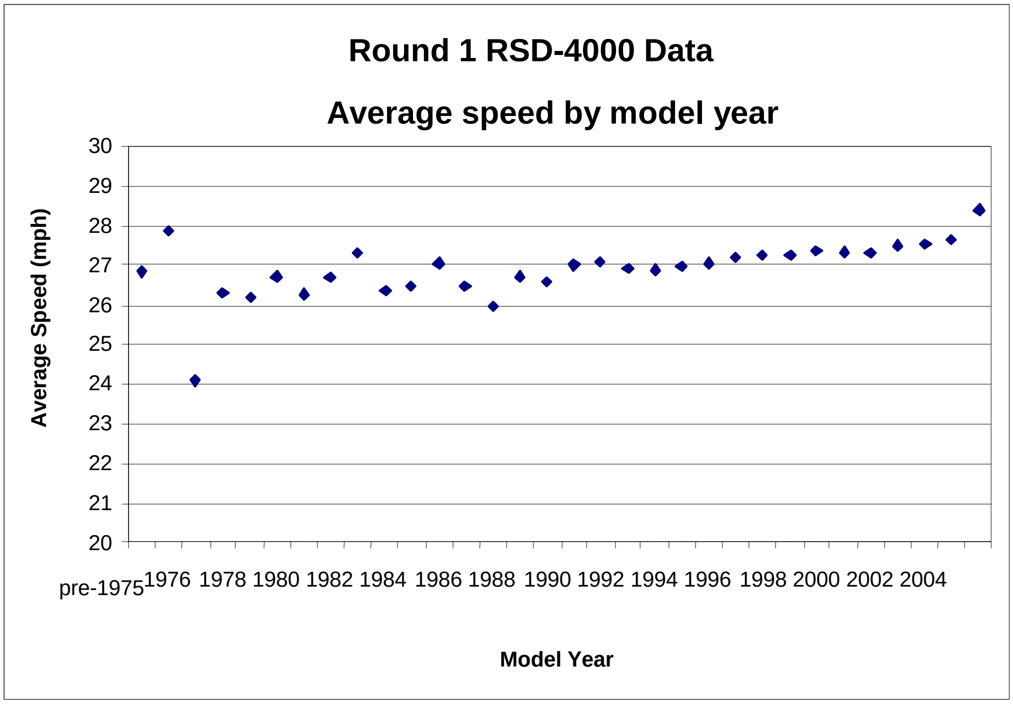


Figure 4-169. RSD-4000 Average Vehicle Speed, by Model Year, of Round-1 Data

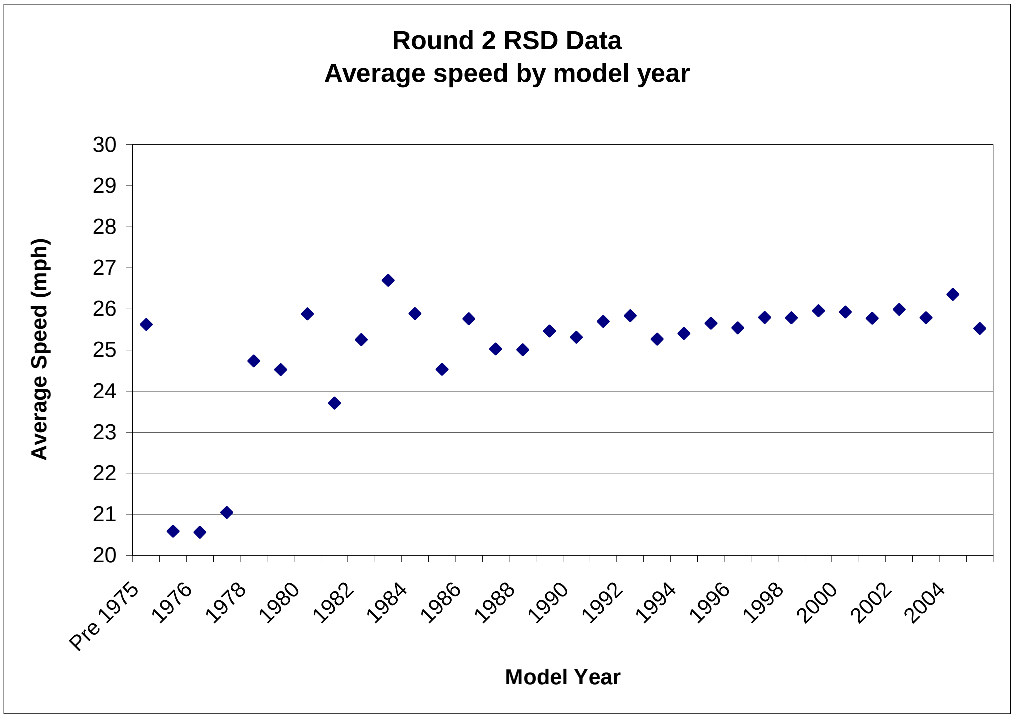


Figure 4-170. RSD-4000 Average Vehicle Speed, by Model Year, of Round-2 Data

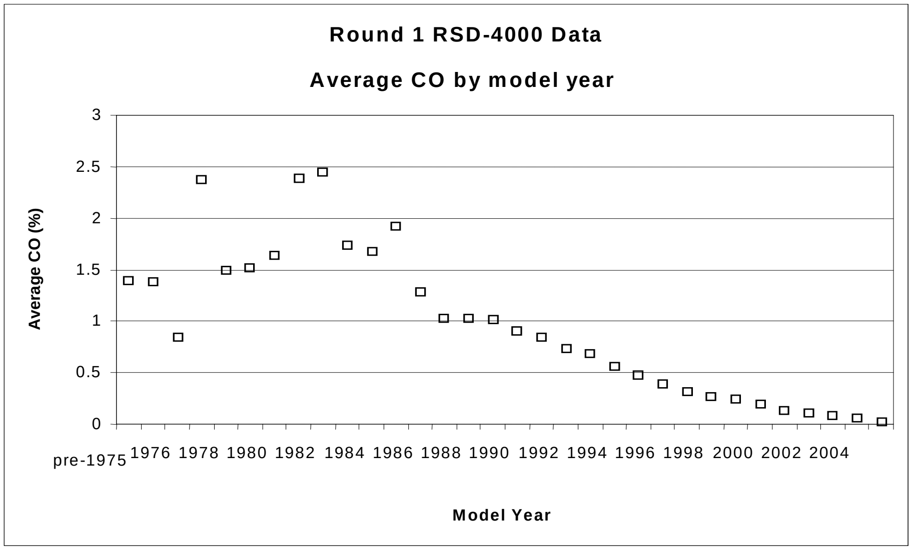


Figure 4-171. RSD-4000 Average CO Percentage, by Model Year, of Round-1 Data

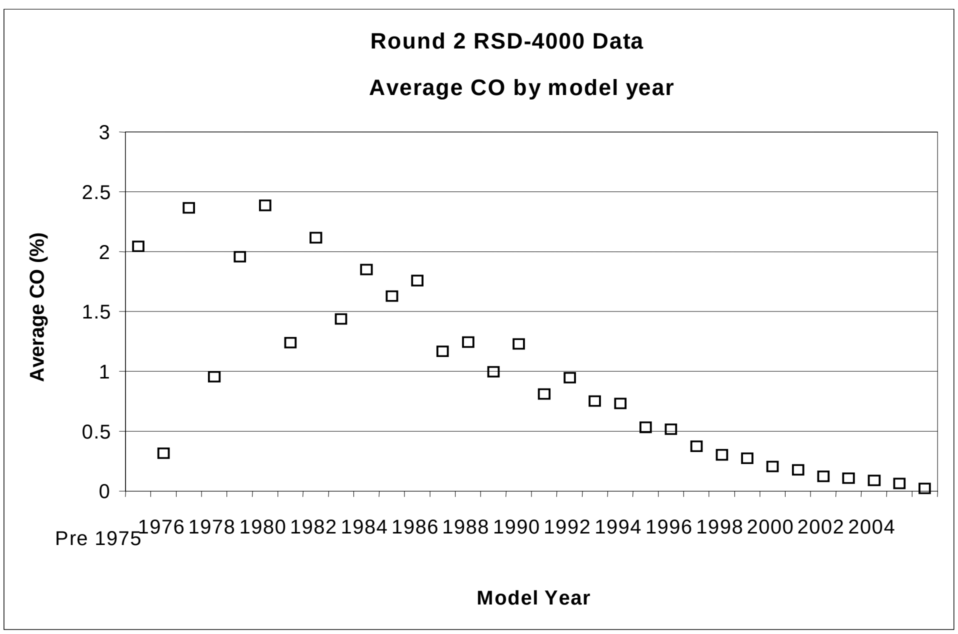


Figure 4-172. RSD-4000 Average CO Percentage, by Model Year, of Round-2 Data

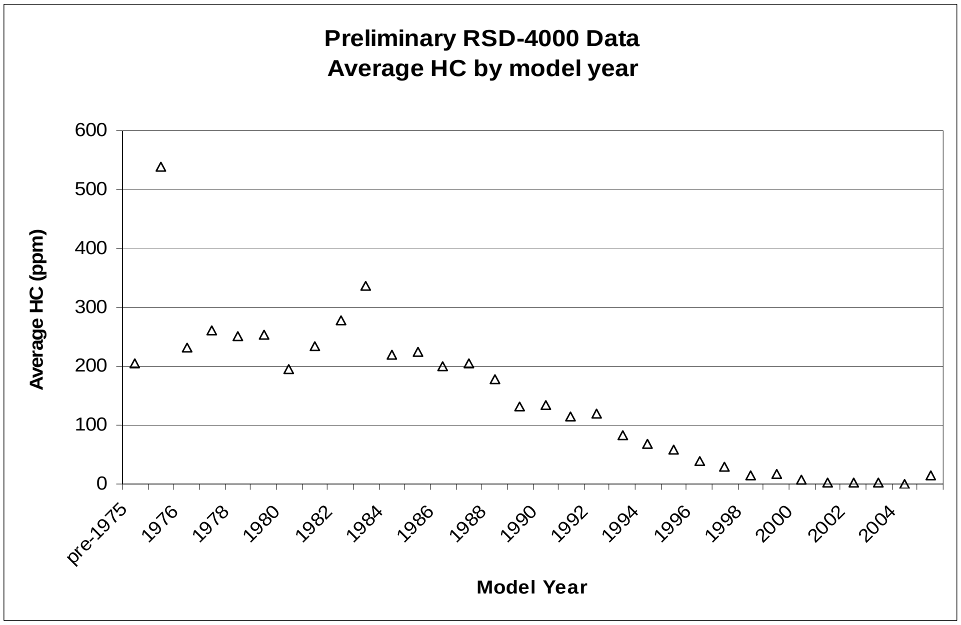


Figure 4-173. RSD-4000 Average HC Concentration, by Model Year, of Round-1 Data

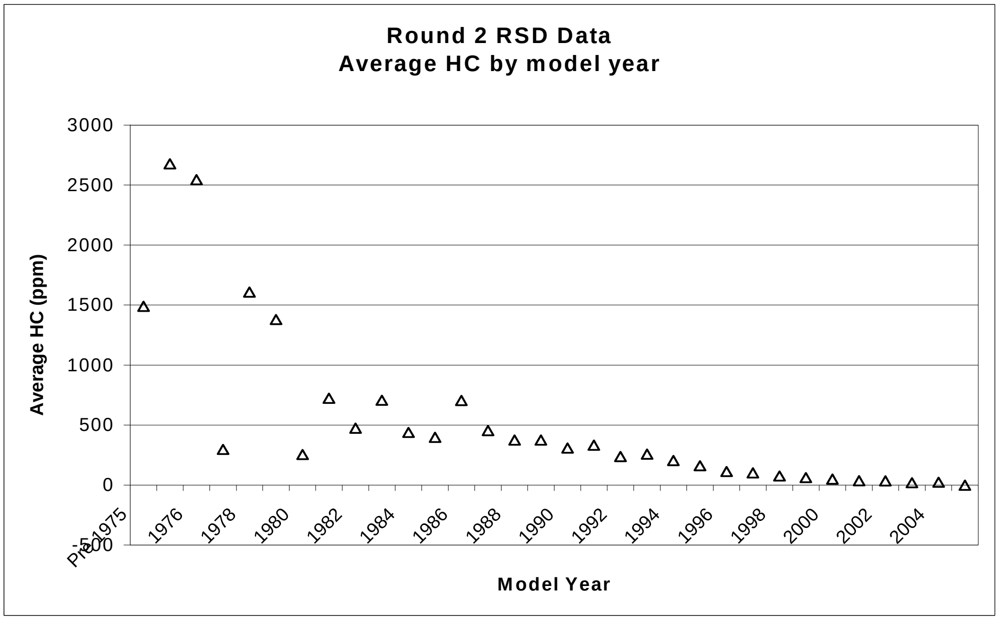


Figure 4-174. RSD-4000 Average HC Concentration, by Model Year, of Round-2 Data

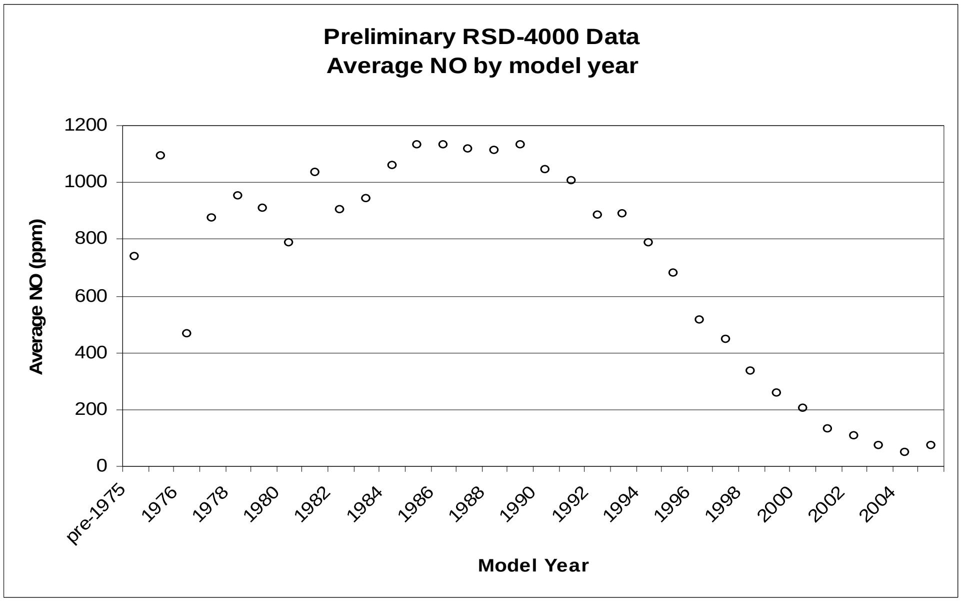


Figure 4-175. RSD-4000 Average NO Concentration, by Model Year, of Round-1 Data

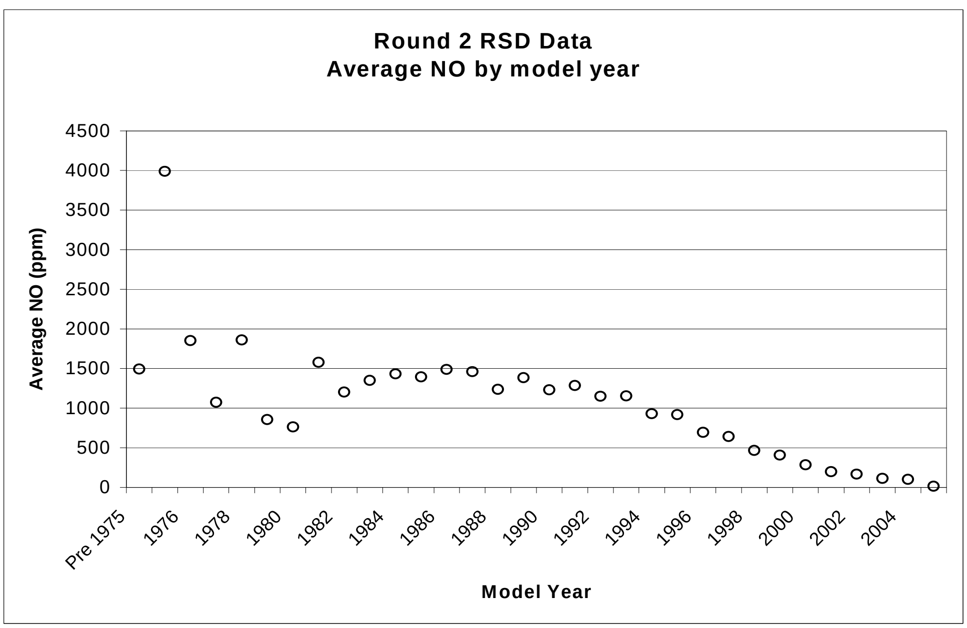


Figure 4-176. RSD-4000 Average NO Concentration, by Model Year, of Round-2 Data

4.8.3 Comparison of RSD Observations with PEMS Data

ERG performed a comparison of RSD data collected in the Kansas City area with second-by-second (SBS) observations from the PEMS unit connected to the dynamometer.

Thousands of RSD observations yielded VINs, speed, acceleration, and concentrations of HC, CO, and NOx for a wide variety of vehicles in the Kansas City fleet. This data, along with measured RSD site grades and vehicle weights from the ERG VIN Decoder, were used to calculate vehicle specific power (VSP) for each instantaneous observation. The calculation was based on equations used by EPA in MOVES2004, using SAS code provided by Jim Warila.

The same calculations were performed on second-by-second observations obtained from a PEMS unit on the dynamometer. Having determined VSP for each instantaneous observation, the data were segregated into by model year VSP bins for further analysis. Since the valid VSP range for RSD is 5 to 20 kW/tonne, only those measurements were retained. The VSP bins were created using ranges of 6 – 9, 9 – 12, and 12 – 18 kW/tonne. All observations gathered during Phase 1 of the LA92 test were dropped, since these would represent cold-start emissions, a scenario unlikely at the RSD sites selected for this study.

For each **model year -VSP** bin combination, the mean and variance of HC, CO, and NOx were calculated for both RSD and SBS data sets. For the SBS data, for a given bin, a test vehicle's measurements were averaged first, then the average of the averages were calculated to produce the cell average.

Summary tables of the data, for both Rounds 1 and 2, is provided in Appendices W and X. Graphs of pollutant concentrations of RSD versus Dyno SBS for CO, CO_2 and NO_x for Rounds 1 and 2 are provided in Figures 4-177 through 4-182.

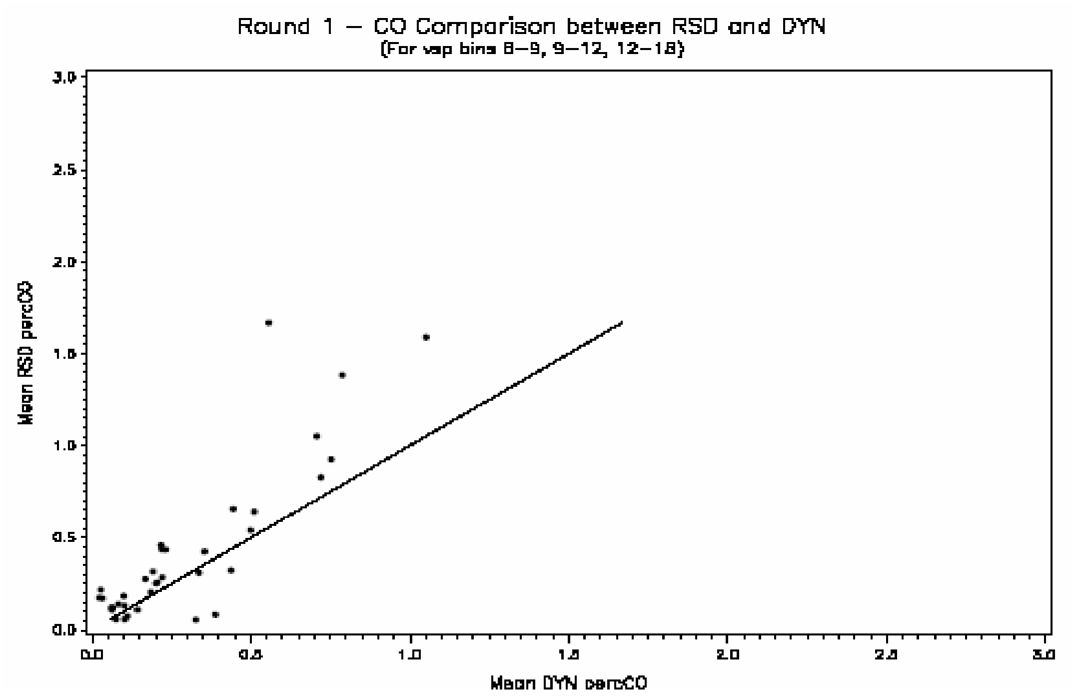


Figure 4-177. Round 1 RSD vs. Dynamometer CO Comparison

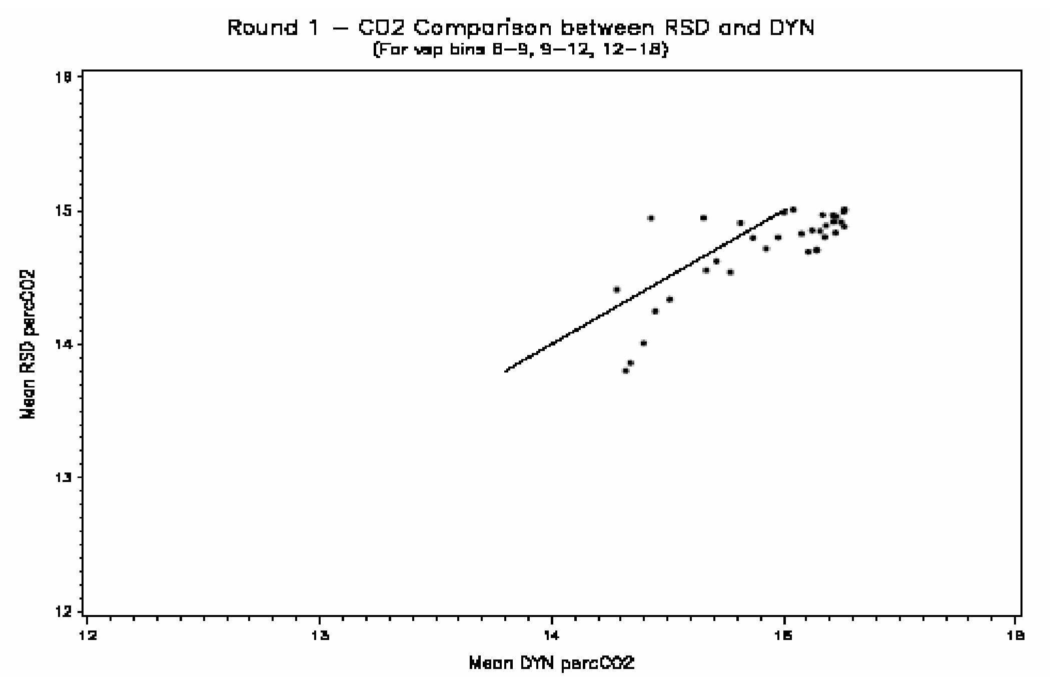


Figure 4-178. Round 1 RSD vs. Dynamometer CO_2 Comparison

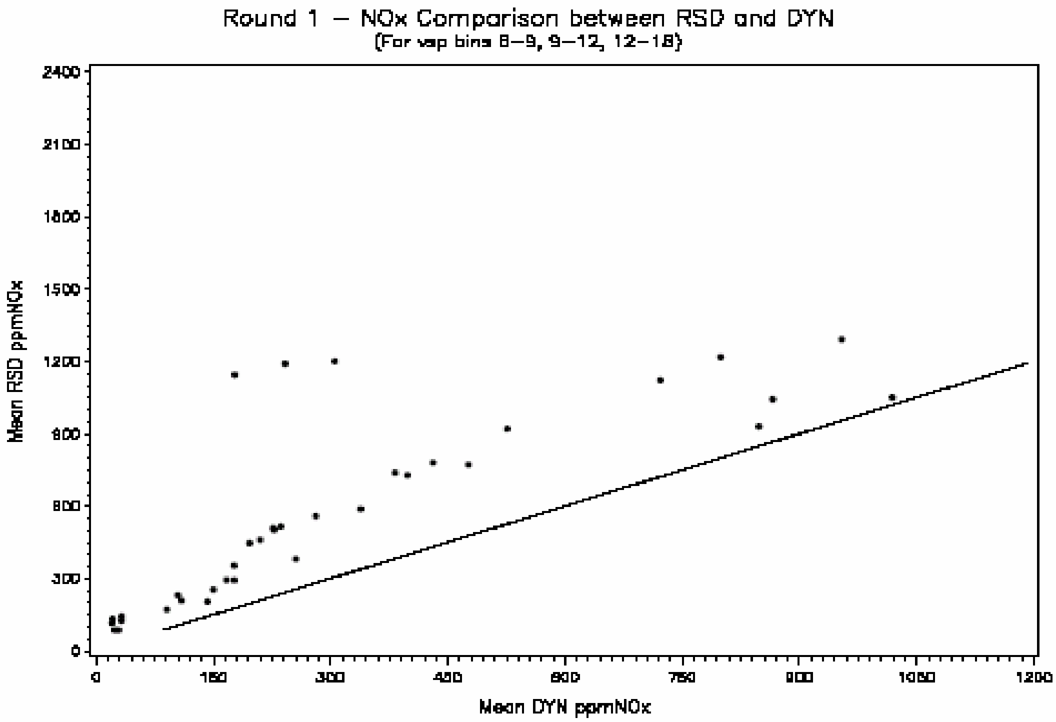


Figure 4-179. Round 1 RSD vs. Dynamometer NO_x Comparison

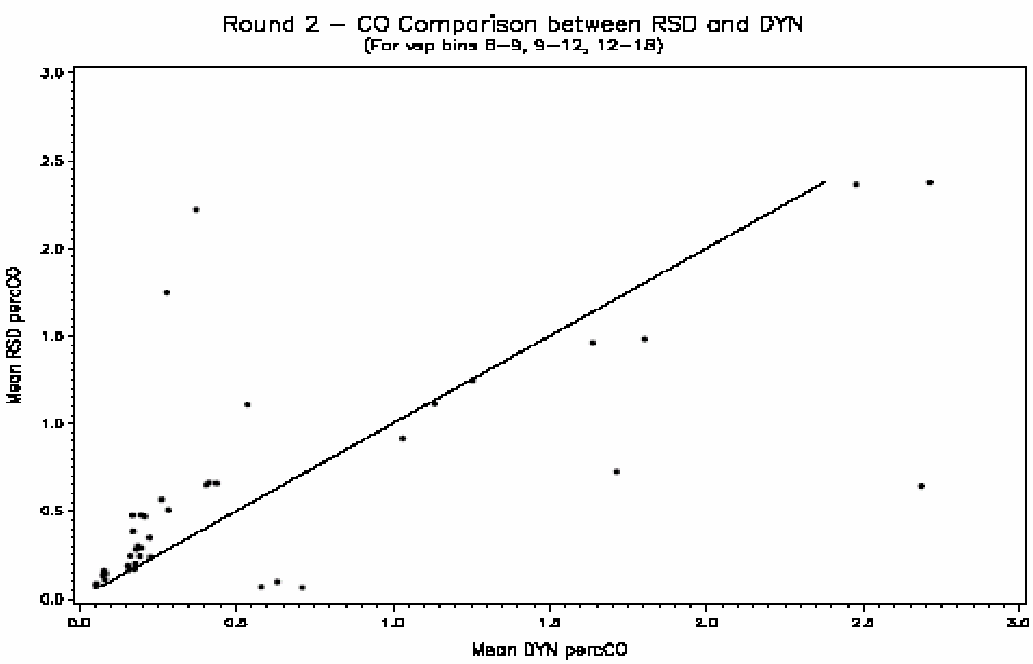


Figure 4-180. Round 2 RSD vs. Dynamometer CO Comparison

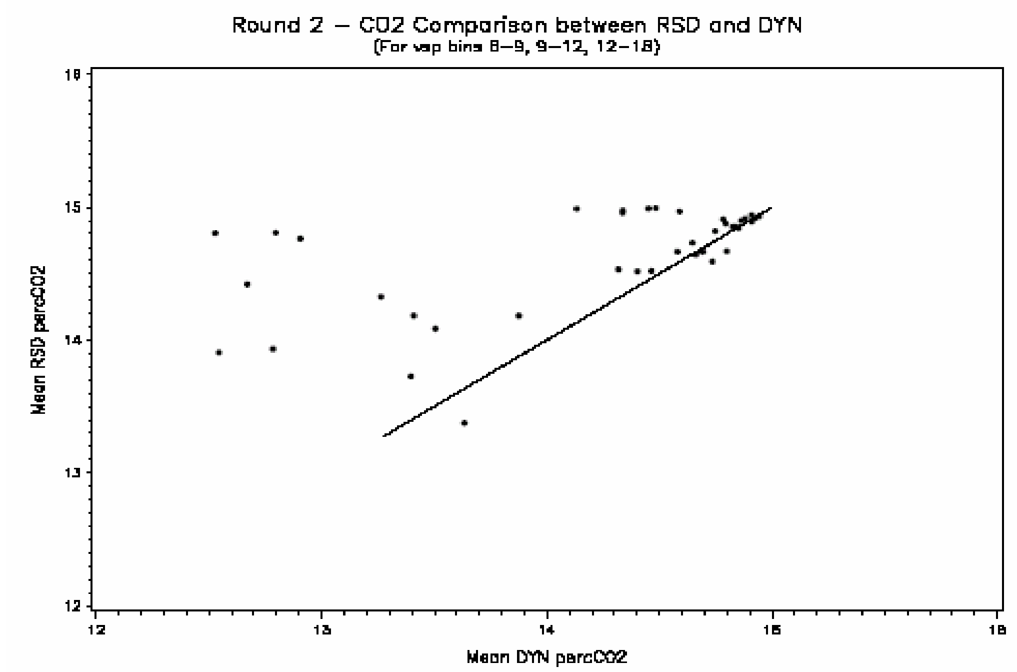


Figure 4-181. Round 2 RSD vs. Dynamometer CO_2 Comparison

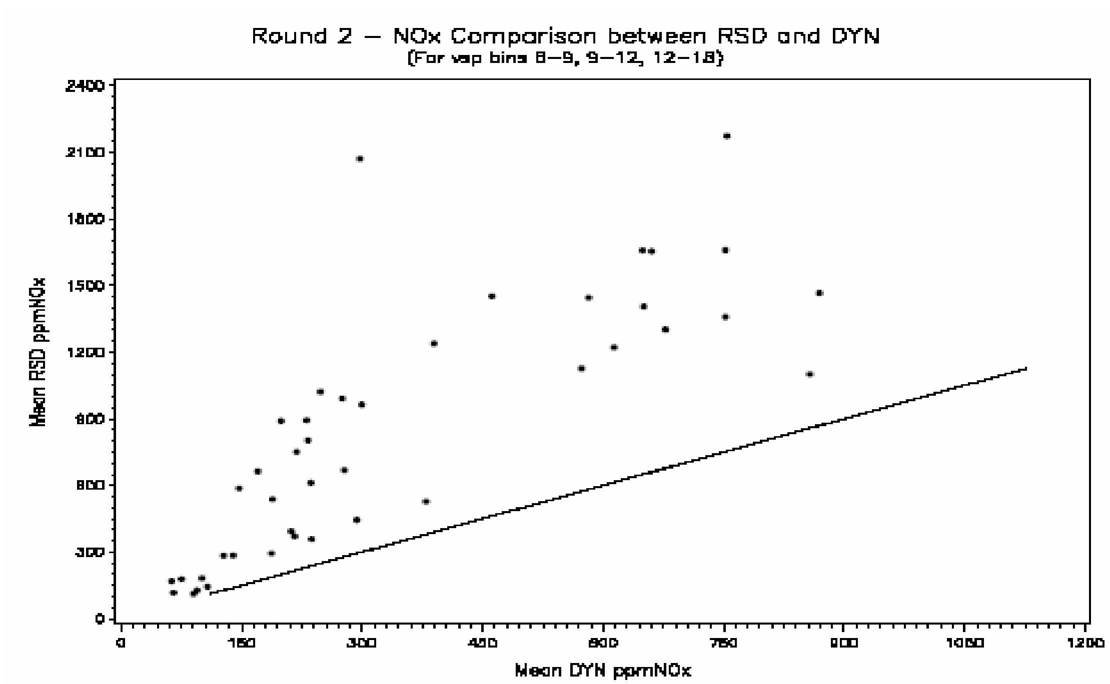


Figure 4-182. Round 2 RSD vs. Dynamometer NO_x Comparison

Comparisons of emissions measured by the PEMS unit as a vehicle passed RSD Site 21 with that measured by the RSD system was also performed. In order to perform this comparison, PEMS files were reviewed to identify second-by-second observations when vehicles were within the GPS coordinate range of the RSD unit, with similar speed readings for PEMS vs. RSD and with similar time stamps (time stamps alone were insufficient for identifying matches because the RSD timestamps were inconsistent with the PEMS timestamps). In order to confirm good readings were obtained, occasionally the test vehicle was driven through the RSD site two or more times (prior to beginning the vehicle conditioning run). In this situation, multiple RSD readings were available for a single vehicle.

In order to perform a PEMS to RSD comparison using this data, the RSD reading (or average of multiple readings) for each vehicle was compared with an average of PEMS readings (generally 4 readings) as the vehicle passed through the RSD site. Because of the GPS and exhaust transport delays, and because of the consistency of the PEMS readings as the vehicle passed through the RSD site, taking an average of PEMS readings was felt to be more representative of its emissions at the RSD site rather trying to identify the specific second the vehicle received the RSD reading. Second-by-second PEMS results and RSD readings are provided at the end of Appendix X, and a summary of comparison of average readings for PEMS vs. RSD is provided in Table 4-46, and also is shown graphically in Figures 4-183 through 4-186 (along with a 1:1 reference line).

Table 4-46. Summary of RSD vs. PEMS results at RSD Site 21

Test Date	Veh ID #		RSD Speed (mph)	PEMS GPS Speed (mph)	RSD HC (ppm)	PEMS HC (PPM)	RSD CO (%)	PEMS CO (%)	RSD CO2 (%)	PEMS CO2 (%)	RSD NOx (ppm)	PEMS NOx (ppm)
2/22/2005	729	**Avg**	25.2	24.55	14.94	279.83	0.26	0.03	14.85	13.05	230.16	1073.30
		Median	25.2	24.50	14.94	280.46	0.26	0.04	14.85	13.06	230.16	983.40
		StdDev	N/A	1.43	N/A	14.29	N/A	0.00	N/A	0.03	N/A	362.34
		N	1.0	4.00	1.00	4.00	1.00	4.00	1.00	4.00	1.00	4.00
2/22/2005	728	**Avg**	27.4	27.03	-67.35	106.03	0.06	0.05	14.99	12.96	580.28	508.83
		Median	27.4	28.55	-67.35	104.23	0.06	0.03	14.99	12.94	580.28	432.09
		StdDev	3.1	3.12	49.55	38.70	0.01	0.04	0.04	0.18	686.11	228.43
		N	2.0	8.00	2.00	8.00	2.00	8.00	2.00	8.00	2.00	8.00
2/23/2005	731	**Avg**	29.4	28.03	-34.70	105.92	0.27	0.21	14.83	13.01	695.36	819.61
		Median	29.2	27.90	-25.32	105.45	0.16	0.21	14.90	13.02	685.49	831.36
		StdDev	0.3	1.40	22.21	5.21	0.19	0.02	0.13	0.02	194.21	45.57
		N	3.0	4.00	3.00	4.00	3.00	4.00	3.00	4.00	3.00	4.00
2/24/2005	737	**Avg**	31.1	30.08	123.10	1268.51	1.02	4.52	14.29	10.30	496.48	195.46
		Median	31.1	30.10	123.10	1274.04	1.02	4.71	14.29	10.31	496.48	191.26
		StdDev	N/A	0.15	N/A	349.27	N/A	2.77	N/A	1.70	N/A	73.31
		N	1.0	4.00	1.00	4.00	1.00	4.00	1.00	4.00	1.00	4.00
2/25/2005	747	**Avg**	28.3	31.90	-29.42	176.20	0.17	0.13	14.91	13.09	610.92	967.78
		Median	30.0	31.65	-31.10	175.95	0.13	0.12	14.93	13.08	612.23	1036.04
		StdDev	5.7	1.35	29.81	9.91	0.09	0.03	0.07	0.02	560.86	264.72
		N	4.0	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00
2/25/2005	744	**Avg**	34.6	30.05	-30.57	32.62	0.61	0.10	14.61	9.37	93.67	77.50
		Median	35.1	30.10	-38.29	32.75	0.19	0.11	14.91	9.37	52.34	77.68
		StdDev	2.5	1.22	33.78	2.02	0.90	0.02	0.65	0.01	121.23	22.36
		N	4.0	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00

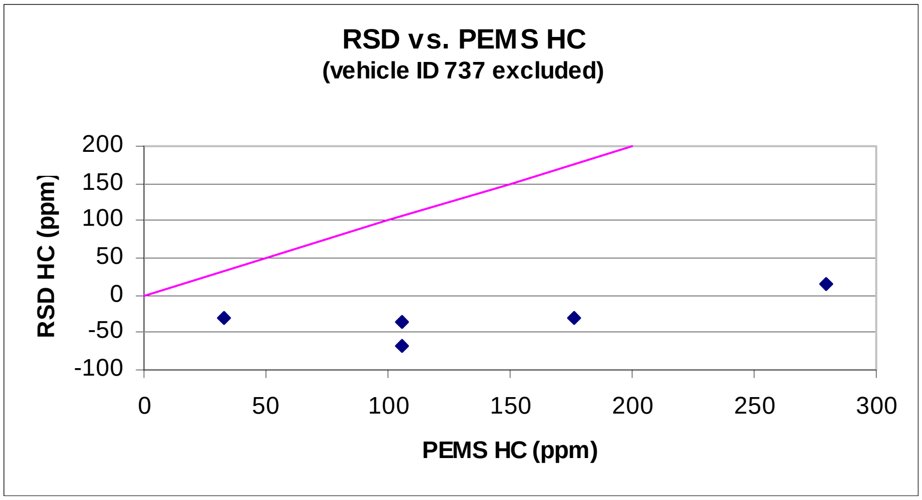


Figure 4-183. RSD vs. PEMS HC readings at RSD Site 21

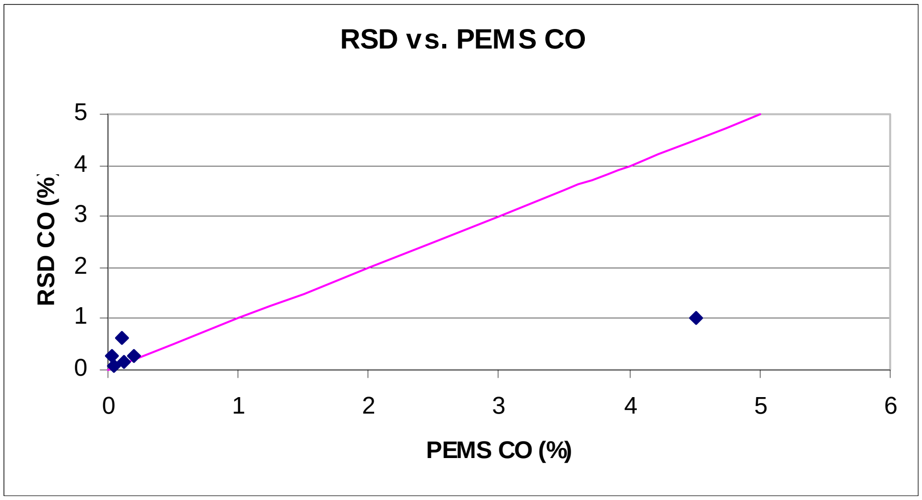


Figure 4-184. RSD vs. PEMS CO readings RSD Site 21

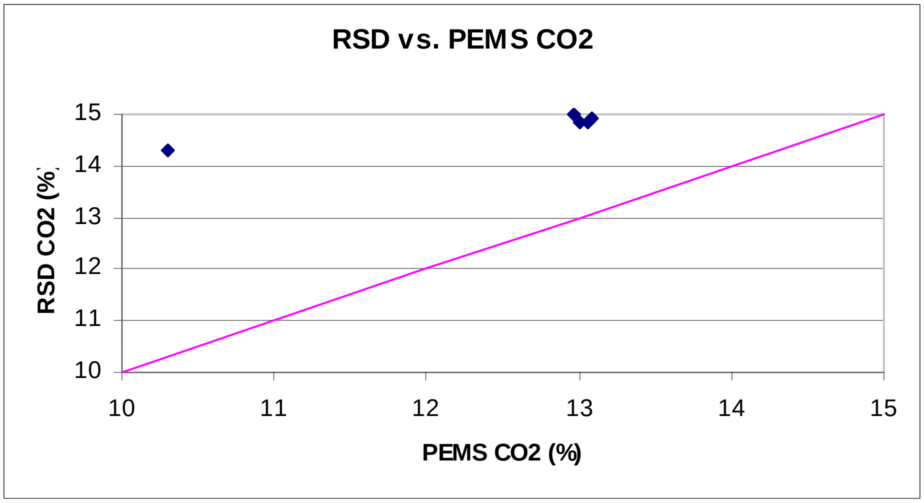


Figure 4-185. RSD vs. PEMS CO_2 readings RSD Site 21

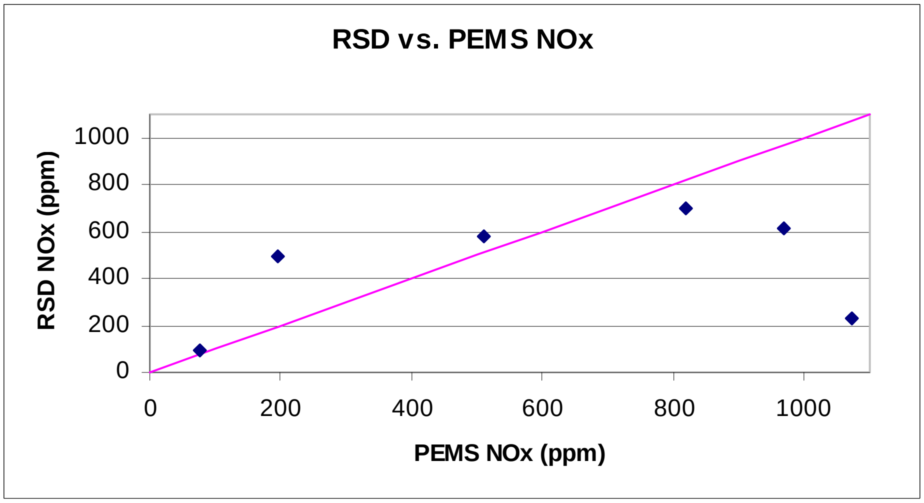


Figure 4-186. RSD vs. PEMS NO_x readings RSD Site 21

4.9 PAMS testing

PAMS testing was commenced near the end of Round 2. Six PAMS units, Ease OBDII dataloggers, were provided to ERG by the USEPA. New software and batteries were purchased for these units, and all units were configured for auto activation for driveaway testing. One unit was found to be malfunctioning, and was returned to Ease for warranty repair. This unit was repaired and returned, but not until after the end of Round 2 field activities.

Since PAMS testing didn't begin until the end of Round 2, only eight vehicles received PAMS tests, as listed in Table 4-47.

Table 4-47. PAMS Vehicle Summary

Veh ID	Mfr	Model	MY	Odo	Install Date	PAMS ID	Notes
694	Oldsmobile	Silhouette	2002	61190	2/16/05	P1	No data were available on datalogger when it was removed. Acquired software and configured unit.
696	Dodge	Durango	2002	28730	2/16/05	P4	unit sparked and participant pulled it out along with DLC, paid $1800 in repairs. No data were recorded, datalogger required configuration. Acquired software and configured unit.
755	Toyota	Avalon	1998	29610	3/2/05	P5	No data werte recorded on datalogger when it was removed. Acquired software and configured unit for future testing.
740	Ford	Escape	2002	44901	3/22/05	P3	Data available and downloaded.
724	Chevrolet	Blazer	1996	94372	3/25/05	P1	No data on this datalogger for some reason (unit had been configured but still didn't acquire data).
909	Honda	Civic	2002	30600	3/29/05	P2	Data available and downloaded. However, data appears to have been configured as "Visible Grid Parameters" (rather than "Sensors"), so data has no VSS field (vehicle speed). Also, data exported as one large datafile (rather than small datasets).
905	Toyota	Camry	2001	46891	3/29/05	P5	Data available and downloaded.
906	Ford	Escape	2002	36230	3/29/05	P4	Data available and downloaded.

As can be seen in the table, three PAMS units were installed prior to the purchase of software and operating batteries, and no data were available on these units. Once the software and batteries were received, the PAMS units were configured to acquired the following data: elapsed time, engine RPM, calculated load, air flow rate, vehicle speed, absolute throttle position, engine coolant temp, and emission related DTC count. One unit was apparently configured to acquire different parameters, and therefore didn't obtain vehicle speed, a necessary parameter in activity data logging. The data that were gathered with the other units will be included in the MSOD data tables provided for this study.

5.0 MSOD

In accordance with the requirements set forth in the original Scope of Work, data procured over the course of the project was processed and delivered in the EPA's MSOD format. Field data collection procedures were designed with MSOD data collection requirements in mind.

After collecting and compiling data from the vehicle test program, datasets were prepared for import into the EPA MSOD. Data integrity and accuracy are of the utmost importance, and in order to ensure that the data prepared for the MSOD accurately represents the data that was originally received, the following four step approach for electronic data handling and manipulation was developed.

- Import raw data into SAS dataset(s);
- Review and convert data to match MSOD format and export to text files;
- Import text files into the final MSOD .DBF format using Foxpro; and
- Verify the validity of the output database and files.

This approach separates raw import and data cleanup issues from project-specific issues of data format conversion and validation. In the first three stages, emphasis was placed on automation. Scripts and programs were used as much as possible, to provide repeatable steps for the verification stage and documentation. Appendix Z presents a detailed data map of raw input files imported, SAS programs used for aggregation and analysis, intermediate SAS datasets used in data cleanup and conversion, and final output text files imported into .DBF format for Rounds 1 and 2 of the study.

In the first import stage, the raw input data, which was generally in comma-separated variable (CSV) format, was loaded into SAS datasets. The data was imported into datasets that mimicked, to the extent possible, the design of the original files. In this way, each raw input file mapped to one or more specific SAS datasets, with close agreement in table content and layout. While some data cleanup was needed for a successful data import, no data manipulation (such as unit conversions or factor manipulation) was performed at this stage. Minor data cleanup was required in some cases because of conflicts between file types, such as end-of-record or end-of-data discrepancies, differences in character sets, conflicting numeric formats, or data types that did not convert directly. After the data was loaded into SAS datasets, it was reviewed for data integrity and completeness. SAS programs used during this stage included the following:

- rdBKI_Aligned.sas. This program reads in both second-by second dynamometer observations for each vehicle, as well as a summary of total bag readings for each phase of the dynamometer testing. Both datasets were provided by BKI. Although the bag data presented in this dataset is suspect for reasons discussed in Section 4.2, it was important to record and preserve the bag data in MSOD, which may be used to provide a rough comparison with modal data. Cumulative by-phase modal observations can be derived from the second-by-second data if required. The program returns two output SAS datasets:

- ✧ bki_bag_aligned, containing by-phase dynamometer bag observations, and
- ✧ bki_sbs_aligned, containing second-by-second dynamometer modal readings.

- rdSEMTECH.sas. This program reads in raw files from the PEMS units, encompassing all dyne PEMS, conditioning, and driveaway files. It also incorporates the bki_sbs_aligned SAS dataset described above to provide second-by-second speed readings where those observations were missing in the PEMS data. This program returns several SAS datasets:

  - ✧ *semtech_sbs_dyno*, containing second-by-second data for the dyne PEMS,
  - ✧ *semtech_bag_dyno*, containing PEMS data at the phase level for comparison with observations taken on dynamometer itself, for QC purposes,
  - ✧ *semtech_veh_short*, containing summary data from the headers of all dyne PEMS records,
  - ✧ *semtech_precond_sbs*, containing second-by-second data for the PEMS conditioning runs,
  - ✧ *semtech_precond_veh*, containing summary data from the headers of all PEMS conditioning run records,
  - ✧ *semtech_driveaway_sbs*, containing second-by-second data for the PEMS driveaway runs, and
  - ✧ *semtech_driveaway_veh*, containing summary data from the headers of all PEMS driveaway records.

- rdDRI.sas. This program reads in by-phase particulate measurements from all PM instruments, obtained from a QC'ed dataset provided by EPA. It also reads in mass, EC, OC, and elements data, as well as speciated VOC observations from vehicle composites, both provided by DRI. The program returns a single SAS dataset:

  - ✧ *dri_all_baglevel*, containing all of the by-phase information detailed above.

- Rdveh.sas. This program reads in vehicle information gathered from onsite logs, along with several of the datasets described above. The program assigns flags to vehicle records that describe what tests were performed on each vehicle, and whether those tests were sufficiently valid for later inclusion in MSOD. The program returns 2 datasets:

  - ✧ *vehID_dyn_pre_drw*, containing basic vehicle information and flags identifying valid tests, and
  - ✧ *vehround1_2*, containing more detailed information on each vehicle that is specifically required for MSOD.

- rdDRI_SbS.sas. This program reads in second-by-second PM observations for each vehicle tested, as provided by DRI. It returns two datasets:

  - ✧ *top_file,* containing summary information on the data file read in for each vehicle, later used for QC purposes, and

- ✧ *sbs_file*, containing the actual second-by-second observations for each PM instrument used.

- Rdfuel.sas. This file reads in data from laboratory fuel analysis, as provided by EPA. It returns a single dataset:

  Fuel¸ containing all available fuel parameters required for the MSOD.

Figure 5-1 depicts data flow during the first import stage of the process during Round 1. Round 2 followed a very similar process, with slight differences in filenames.

Once the data were imported into SAS datasets and reviewed , the datasets were remapped from a format similar to the original raw data files, to a scheme more closely resembling that needed for import to MSOD. All required conversions and data manipulation were performed in SAS at this point, and the datasets were converted from an intermediate form into final output text files. SAS programs used during this stage generally took datasets prepared as described above as inputs, and returned text files ready for import into Foxpro as output. These output files were named according to standard MSOD nomenclature, and each output file generally corresponds to an individual MSOD table. Figure 5-2 depicts data flow during the review and conversion stages of the process.

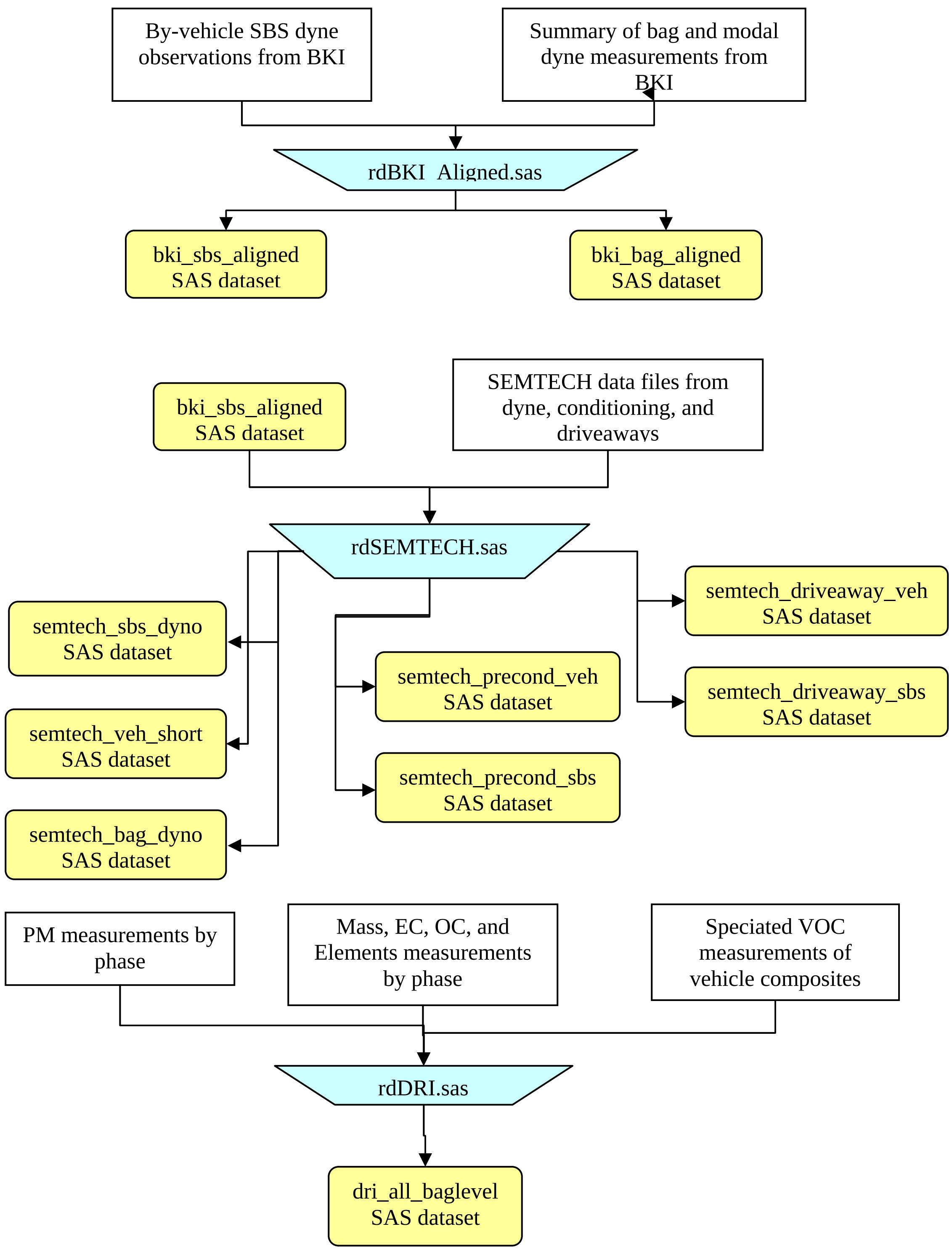


Figure 5-1. Data Flow During First (Raw Data) Import Phase

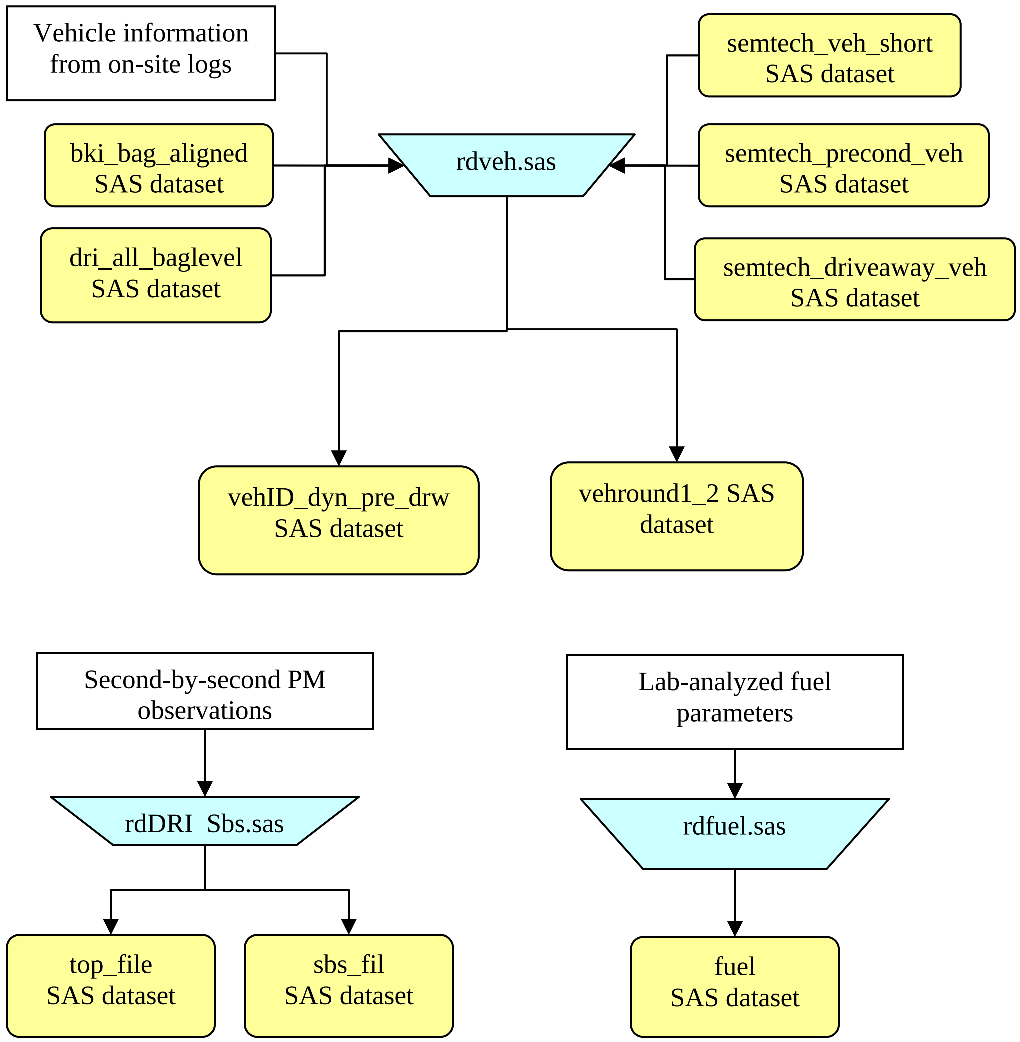


Figure 5-1. Data Flow During First (Raw Data) Import Phase (continued)

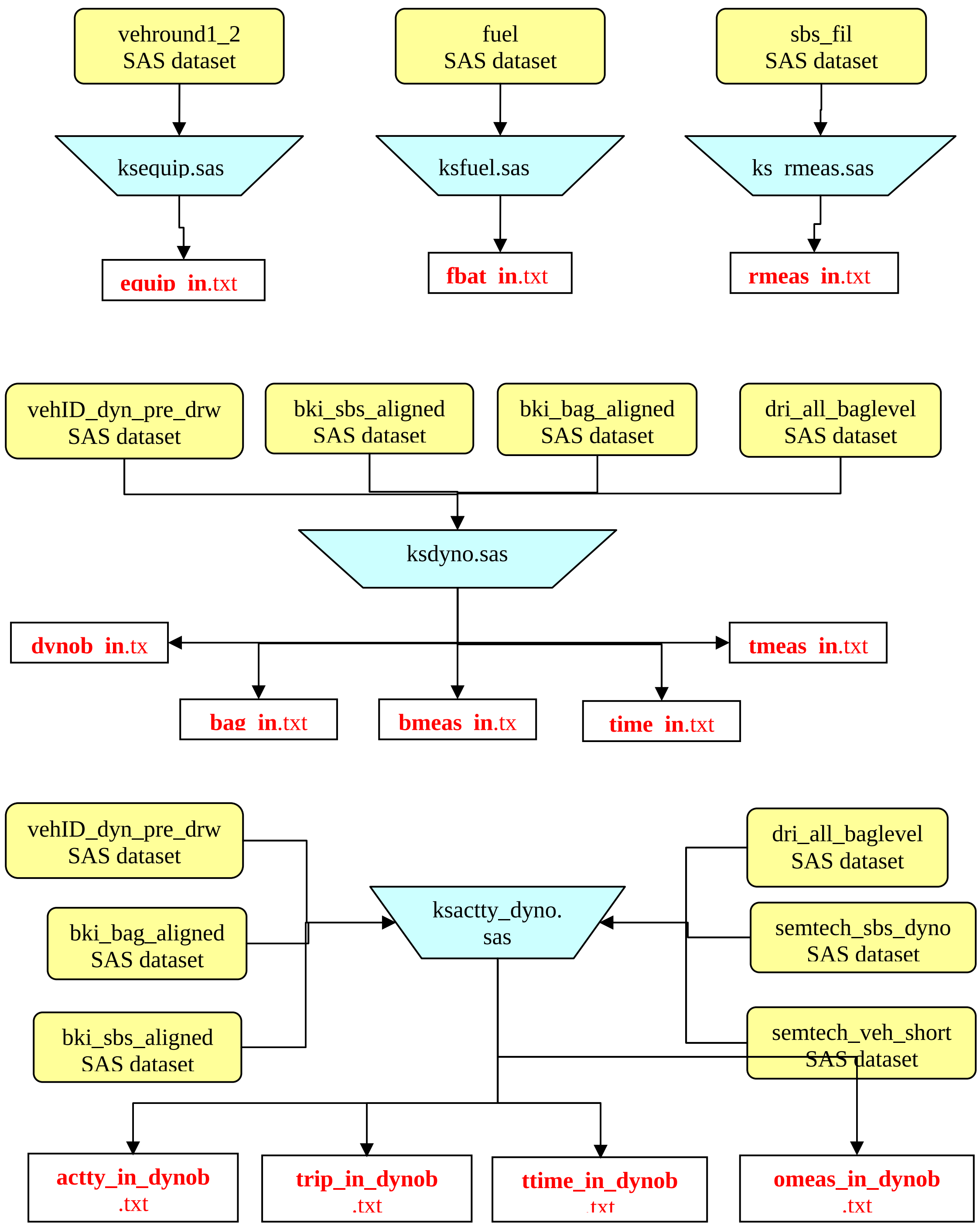


Figure 5-2. Data Flow During Review and Conversion Phase

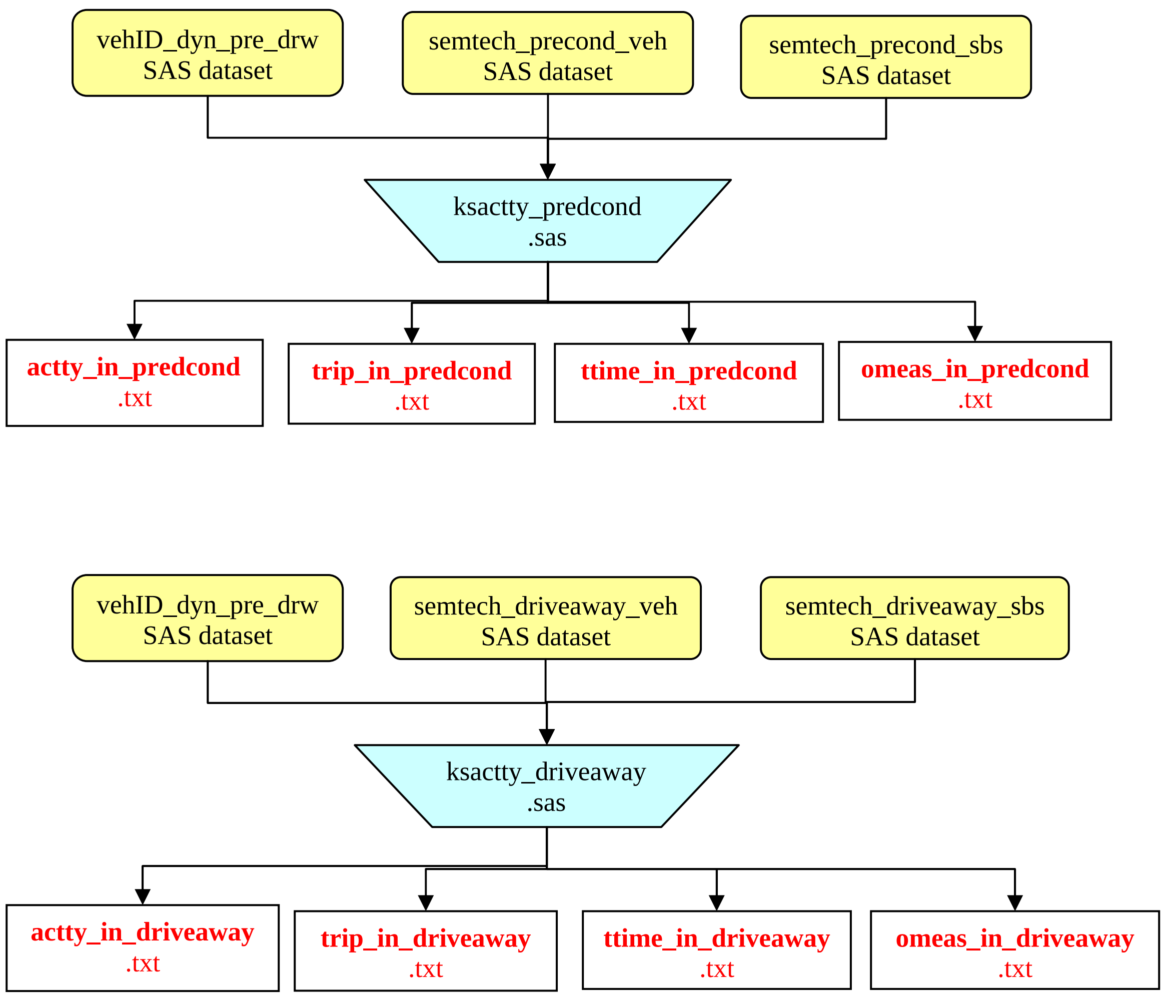


Figure 5-2. Data Flow During Review and Conversion Phase (continued)

These text files were then loaded into DBF format with scripts developed using Foxpro version 8.0. The scripts incorporated some basic validity and range checks for the data, and converted the final text files into individual database tables required for MSOD and checkable by EPA's validation software. Note that during this stage, the actty_in, trip_in, and ttime_in files generated for each of the dyne PEMS, conditioning run, and driveaway datasets (and PAMS data during Round 2) were merged into one Foxpro database file for import into MSOD. Also, in lieu of generating a database table for pmeas_in, EPA approved the creation of compact omeas_in text files containing a wide array of non-emission related second-by-second measurements from the PEMS units. These omeas_in tables will be converted to MSOD format by EPA staff at a later date.

It is important to mention a problem that arose during processing of second-by-second observations in the rmeas_in table. Specifically, the dynosecs field in the MSOD rmeas_in table is defined as an integer. Many of the observations recorded in rmeas_in have a time resolution of tenths of hundredths of a second, and Foxpro was rounding these seconds to the nearest whole integer. Apart from the obvious problem of the unacceptable loss of time resolution in the data, this also caused some otherwise separate measurements to be recorded in the database as having duplicate dynosecs values. Because the dynosecs field is defined as a primary key in the database, these duplicate observations were not passing validation tests. In order to preserve the original time resolution in the data, a separate table, rmeas_in_adjusted, was created. This table was identical to rmeas_in, except that it contained an additional field, secs_adj, in which a non-rounded time measurement was recorded.

The final step in the data management process involved running EPA's EPAVALDATA program against each of the DBF import tables. This program quality assures each of the tables and log all errors encountered. Each of the errors were reviewed and addressed accordingly. Once the automated review of the tables for each dataset were complete they were delivered to EPA for further verification and loading into the MSOD.

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Index of Appendices

Appendices will be provided electronically. The following is a list of the appendices, their filename, and their contents.

AppendixA&B_DRI_Data.pdf

Appendix A. Concentration of Species Normalized to Larger of Mean Field Blank Value or MDL – Analytical sensitivity Relative to Emission Levels Based Upon Round 1 Data.

Appendix B1. Chemical Composition of Dilution Tunnel Blanks and Vehicle Exhaust Samples for Round1.

Appendix B2. Chemical Composition of Dilution Tunnel Blanks and Vehicle Exhaust Samples for Round2.

AppendixC_Round_1_Recruitment.doc
AppendixD_Round_2_Recruitment.doc

AppendixE_Dyne_QA_Checks.doc
Monthly CVS Propane Injection Tables
Periodic Multipoint Calibration for Dyne Instruments Tables
Daily PDP and Dyne QA Checks

AppendixF_Dyne_Calculations.doc
Calculations for the Dynamometer Determined Regulated Emissions
Table of Data Fields for the Regulated Emission Calculation Spreadsheet

AppendixG_Other_Round_1_Data.doc
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Round 1 SEMTECH vs. Dyno Comparison Table
Round 1 By Bag Plots of SEMTECH vs. Dyne
Round 1 By Bag, By Bin Plots of HC/CO/NOx/Grav PM emissions
Round 1 Scatter Plots of Dyne HC/CO/NOx vs. Grav PM
Round 1 Plots of HC/CO/NOx/Grav PM as a function of model year

AppendixH_Other_Round_2_Data.doc
Round 2 (All Vehicles) - Weighted Emissions and Fuel Economy
Round 2 SEMTECH vs. Dyno Comparison Table
Round 2 By Bag Plots of SEMTECH vs. Dyne
Round 2 By Bag, By Bin Plots of HC/CO/NOx/Grav PM emissions
Round 2 Scatter Plots of Dyne HC/CO/NOx vs. Grav PM
Round 2 Plots of HC/CO/NOx/Grav PM as a function of model year

Appendix_I_Install_Guidelines.doc
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Kansas City PM Characterization Study

Final Report

Appendix A & B
DRI Data

Assessment and Standards Division
Office of Transportation and Air Quality
U.S. Environmental Protection Agency

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	Field Blanks			Dilution Blanks			All Vehicle Composites				
Parameter	**Min**	**Avg**	**Max**	**Min**	**Avg**	**Max**	**Min**	**10th%**	**50th%**	**90th%**	**Max**
Gravimetric mass	0.4	1.5	3.6	14.3	26.7	46.7	39.5	87.4	178.1	672.4	1009.2
Carbon fractions by TOR (IMPROVE)											
Organic Carbon Fraction 1	0.7	1.5	3.1	1.1	9.7	13.9	3.2	13.8	51.4	441.5	712.4
Organic Carbon Fraction 2	0.8	1.5	3.7	3.0	11.1	20.3	6.4	10.7	40.5	174.6	537.7
Organic Carbon Fraction 3	0.5	1.5	4.2	2.8	7.3	11.9	5.0	5.8	18.9	32.9	45.4
Organic Carbon Fraction 4	0.5	1.5	4.5	3.0	20.2	59.6	10.9	22.3	43.5	134.0	202.4
Pyrolyzed Organic Carbon	0.0	0.0	0.0	0.0	1.0	5.6	0.1	0.2	0.4	34.1	901.5
Organic Carbon	0.7	1.5	4.0	2.6	9.5	14.7	5.8	10.3	34.3	108.0	245.9
Elemental Carbon Fraction 1	0.0	0.4	2.2	0.3	18.1	56.7	23.4	42.4	148.3	586.1	847.1
Elemental Carbon Fraction 2	0.0	0.1	0.3	3.9	27.7	73.8	21.5	68.6	234.7	1790.3	4902.8
Elemental Carbon Fraction 3	0.0	0.0	0.0	0.0	6.5	29.0	0.0	0.0	9.5	68.4	296.7
Elemental Carbon	0.0	0.3	1.6	3.3	34.4	72.7	36.4	87.4	263.9	1741.7	4205.4
Total Carbon	0.7	1.5	4.0	2.8	10.9	17.0	9.5	17.9	50.6	151.2	427.7
Elements by XRF											
Sodium (qualitative only)	0.0	0.6	1.0	0.0	3.3	6.6	0.3	2.0	4.6	11.0	16.9
Magnesium (qualitative only)	0.5	1.5	2.8	1.6	5.0	7.3	1.1	2.0	5.7	16.6	24.2
Aluminum	0.0	1.4	3.5	1.2	5.1	11.4	1.1	1.8	5.8	19.8	35.1
Silicon	0.0	1.5	3.4	9.8	24.7	55.6	11.6	16.7	56.4	746.8	1605.1
Phosphorous	0.2	1.5	2.1	0.6	2.8	5.1	1.0	3.9	15.2	47.3	76.7
Sulfur	0.0	0.9	2.4	43.9	76.9	128.9	35.6	69.3	193.4	591.4	2836.0
Chlorine	0.0	0.6	2.3	0.2	2.2	7.8	0.9	1.3	4.7	10.5	24.4
Potassium	0.0	0.5	2.4	5.3	12.3	24.5	1.8	4.3	8.7	32.2	50.4
Calcium	0.3	1.5	4.3	28.0	63.0	125.4	16.8	26.6	106.7	195.7	425.7
Titanium	0.0	0.0	0.1	0.2	0.5	1.2	0.0	0.0	0.4	0.6	1.9
Vanadium	0.0	0.0	0.1	0.1	0.4	0.9	0.0	0.0	0.3	1.1	5.6
Chromium	0.0	0.2	0.5	0.4	1.4	3.2	0.2	1.0	4.1	20.5	41.1
Manganese	0.0	0.1	0.2	1.2	6.4	20.7	0.0	0.6	3.8	15.7	33.0
Iron	0.0	0.5	1.9	13.2	65.2	143.0	22.0	25.5	107.6	381.0	1367.7
Cobalt	0.0	0.4	1.0	0.0	1.3	2.9	0.0	0.6	1.9	9.7	25.4
Nickel	0.0	0.5	2.5	1.2	2.2	3.0	1.2	1.8	6.0	27.9	74.0
Copper	0.0	1.2	3.3	3.6	12.5	24.4	5.8	9.1	40.9	97.9	209.5
Zinc	0.0	1.1	2.4	1.8	7.5	17.3	7.4	11.3	34.7	89.7	168.9
Gallium	0.0	0.4	2.1	0.2	1.4	3.4	0.0	0.0	1.0	3.8	4.4
Arsenic	0.0	0.1	0.3	0.0	0.4	0.9	0.0	0.0	0.7	1.8	3.3
Selenium	0.1	0.4	1.1	0.2	1.3	2.7	0.0	0.0	1.1	3.4	11.3
Bromine	0.0	0.0	0.1	0.0	1.0	1.7	0.2	0.3	4.7	29.8	47.7
Rubidium	0.0	0.1	0.3	0.0	0.2	0.5	0.0	0.0	0.6	2.1	5.9
Strontium	0.0	0.3	0.6	0.2	1.6	3.1	0.0	0.2	0.9	4.4	13.5
Yttrium	0.0	0.4	0.9	0.0	1.2	2.1	0.0	0.0	0.5	2.9	13.2
Zirconium	0.0	0.2	0.8	0.6	1.6	2.6	0.0	0.5	2.3	7.6	39.4
Molybdenum	0.0	0.3	0.5	0.4	1.4	2.4	0.0	0.2	1.9	7.9	10.6
Palladium	0.2	0.6	0.9	0.0	0.8	1.3	0.0	0.1	1.0	2.9	4.0
Silver	0.0	0.2	0.8	0.1	1.2	2.4	0.1	0.4	1.0	2.9	3.9
Cadmium	0.0	0.2	0.9	0.2	1.3	2.8	0.0	0.0	0.6	2.0	3.5
Indium	0.0	0.3	1.5	0.0	1.1	2.1	0.0	0.0	0.8	2.9	4.4
Tin	0.0	0.3	1.4	0.0	1.1	4.0	0.0	0.1	1.4	4.3	6.0
Antimony	0.0	0.3	0.6	0.1	0.7	2.0	0.0	0.1	1.3	3.0	6.6
Barium	0.0	0.6	1.1	0.2	0.5	0.8	0.0	0.1	1.2	3.6	5.2
Lanthanum	0.0	0.1	0.4	0.0	0.1	0.6	0.0	0.0	0.6	1.8	2.2
Gold	0.0	0.3	0.8	0.2	1.4	3.1	0.0	0.0	0.5	3.4	5.6
Mercury	0.0	0.5	1.2	0.7	1.1	1.4	0.0	0.0	0.6	3.5	10.4
Thallium	0.0	0.1	0.3	0.0	0.3	0.6	0.0	0.0	0.2	2.3	5.8
Lead	0.0	0.3	0.8	0.9	2.1	4.5	0.0	1.3	5.4	27.2	63.4
Uranium	0.0	0.3	0.7	0.2	0.7	1.4	0.0	0.0	0.5	3.0	9.1
PAH by GC/MS											
Naphthalene	0.3	1.0	2.0	1.4	2.9	4.3	2.8	8.7	21.8	48.1	59.8
2-methylnaphthalene	0.4	1.0	1.9	4.8	12.2	19.1	52.5	170.7	593.8	1925.4	2499.9
1-methylnaphthalene	0.4	1.0	1.7	4.6	11.2	17.3	44.4	150.3	513.0	2089.9	2517.8
Biphenyl	0.1	1.0	1.9	1.9	2.9	3.8	4.2	11.0	34.5	186.2	280.9
1+2ethylnaphthalene	0.1	1.0	2.3	2.0	3.3	4.3	2.1	6.4	21.5	72.5	92.0
2,6+2,7-dimethylnaphthalene	0.2	1.0	1.6	5.3	13.8	23.1	31.1	88.4	315.5	1603.0	2633.1
1,3+1,6+1,7dimethylnaphth	0.4	1.0	1.4	4.9	11.0	16.6	24.8	73.5	279.5	1389.2	2205.4
1,4+1,5+2,3-dimethylnaphth	0.4	1.0	1.5	0.4	1.2	3.7	4.0	11.3	121.3	1294.8	2716.6
1,2-dimethylnaphthalene	0.5	1.0	1.6	3.4	9.0	14.0	25.5	64.7	415.8	5264.7	15666.2
2-Methylbiphenyl	0.0	1.0	2.9	1.1	2.4	4.8	0.2	0.3	0.7	2.0	2.4
3-Methylbiphenyl	0.1	1.0	2.9	1.0	2.6	5.1	0.5	0.8	3.1	6.7	11.0
4-Methylbiphenyl	0.1	1.0	2.7	1.0	2.3	4.0	0.6	0.9	2.7	8.1	13.9
Dibenzofuran	0.3	1.0	1.6	4.2	14.6	27.6	14.7	24.2	67.5	288.0	523.5
Bibenzyl	0.0	1.0	2.3	1.0	4.4	7.4	0.0	0.5	1.5	5.2	6.2
A-trimethylnaphthalene	0.3	1.0	1.7	3.7	8.2	12.6	11.9	25.4	78.3	587.1	2005.2
1-ethyl-2-methylnaphthalene	0.1	1.0	1.8	2.3	3.9	6.0	4.1	9.8	39.1	224.0	796.1
B-trimethylnaphthalene	0.3	1.0	1.8	3.8	4.9	6.3	5.9	17.6	52.6	401.4	1327.1

Appendix A1. Concentrations of Organic Species Normalized to Larger of Mean Field Blank Value or MDL - Round 1

	Field Blanks			Dilution Blanks			All Vehicle Composites				
Parameter	**Min**	**Avg**	**Max**	**Min**	**Avg**	**Max**	**Min**	**10th%**	**50th%**	**90th%**	**Max**
C-trimethylnaphthalene	0.2	1.0	2.0	3.8	7.7	12.2	6.7	15.6	48.3	388.3	1408.8
2-ethyl-1-methylnaphthalene	0.1	1.0	1.6	0.7	3.8	17.3	0.8	1.5	5.1	36.9	119.1
E-trimethylnaphthalene	0.2	1.0	2.2	3.1	6.9	12.0	4.0	9.2	30.9	242.7	847.8
F-trimethylnaphthalene	0.3	1.0	1.7	3.9	6.6	10.7	5.6	11.9	36.7	299.4	1403.4
2,3,5+I-trimethylnaphthalene	0.2	1.0	2.0	3.0	6.9	14.5	4.3	7.5	27.9	188.9	838.3
2,4,5-trimethylnaphthalene	0.3	1.0	2.1	2.2	3.7	5.9	0.3	3.5	13.7	143.0	651.8
J-trimethylnaphthalene	0.1	1.0	2.2	1.0	2.0	3.1	2.2	3.2	11.4	104.8	399.4
1,4,5-trimethylnaphthalene	0.0	1.0	2.6	1.2	11.6	30.5	2.8	8.9	36.9	311.1	969.3
Acenaphthylene	0.4	1.0	1.7	3.8	9.6	18.6	50.8	69.0	218.6	1291.4	8409.5
Acenaphthene	0.3	1.0	1.6	1.0	3.1	11.2	2.3	6.0	15.4	89.5	297.5
Fluorene	0.0	1.0	4.3	1.5	6.8	16.2	5.1	19.8	70.9	562.3	2402.6
Dibenzothiophene	0.3	1.0	1.9	2.3	4.7	7.4	2.7	3.5	15.8	41.5	117.8
Phenanthrene	0.3	1.0	1.3	3.9	6.7	9.4	11.4	16.5	50.9	217.3	707.9
Anthracene	0.2	1.0	2.1	0.2	2.6	7.0	4.2	13.3	67.8	803.2	2535.0
A-methylfluorene	0.1	1.0	1.9	3.0	5.5	7.8	5.9	10.4	31.3	284.5	460.3
1-methylfluorene	0.2	1.0	1.6	3.1	6.4	9.9	7.7	11.7	33.4	207.2	277.2
B-methylfluorene	0.1	1.0	1.9	1.9	3.7	5.0	5.0	9.0	29.5	181.9	334.0
9-fluorenone	0.3	1.0	1.7	1.7	3.6	8.6	0.8	2.7	22.0	83.4	166.1
Xanthone	0.1	1.0	2.0	0.6	1.6	2.9	0.0	0.1	1.6	5.3	19.5
Acenaphthenequinone	0.1	1.0	1.9	0.9	4.1	8.1	1.5	2.1	7.0	36.5	64.5
Perinaphthenone	0.1	1.0	2.6	0.1	2.3	3.3	0.4	1.2	3.1	10.6	18.1
2-methylanthracene	0.3	1.0	1.3	6.6	15.8	34.8	10.3	12.6	57.5	404.8	864.9
3-methylphenanthrene	0.4	1.0	1.4	4.8	8.2	11.2	8.6	15.2	44.5	243.1	380.7
2-methylphenanthrene	0.4	1.0	1.3	4.1	6.9	9.5	7.6	11.7	33.8	171.0	249.8
9-methylphenanthrene	0.2	1.0	1.5	4.6	7.1	9.9	6.0	11.4	41.4	274.1	681.3
4,5-methylenephenanthrene	0.1	1.0	1.5	8.8	26.1	44.4	7.4	12.0	41.2	290.3	688.2
1-methylphenanthrene	0.3	1.0	1.6	3.4	5.9	8.8	5.3	9.7	27.1	124.6	210.8
Anthrone	0.0	0.7	2.2	0.8	4.4	8.8	0.0	0.9	4.2	25.8	61.3
Anthraquinone	0.0	1.0	2.3	0.6	3.8	8.3	0.0	0.0	0.6	7.4	21.2
3,6-dimethylphenanthrene	0.0	1.0	2.6	1.0	1.9	2.4	0.6	1.3	3.0	11.4	20.7
A-dimethylphenanthrene	0.6	1.0	1.7	6.4	8.5	10.8	2.0	8.0	34.5	190.0	287.7
B-dimethylphenanthrene	0.2	0.7	1.1	4.3	5.4	6.3	4.2	6.5	17.8	94.1	146.5
C-dimethylphenanthrene	0.4	1.0	1.5	6.8	10.0	12.8	5.6	10.9	36.9	208.1	361.3
D-dimethylphenanthrene	0.2	0.4	0.5	3.7	5.4	7.5	2.9	5.3	15.4	69.8	122.2
1,7-dimethylphenanthrene	0.3	0.8	1.2	6.6	9.3	12.0	6.1	10.4	36.4	230.7	412.8
E-dimethylphenanthrene	0.2	0.5	1.0	4.6	6.3	8.4	3.5	6.7	20.0	117.1	191.7
9-methylanthracene	0.0	1.0	4.9	0.5	10.0	27.5	0.1	1.2	11.9	70.3	133.4
Fluoranthene	0.2	1.0	2.4	4.9	8.7	11.7	6.7	9.3	29.1	165.7	500.1
Pyrene	0.3	1.0	2.6	4.3	9.1	16.5	4.9	7.6	22.1	191.5	588.6
9-Anthraaldehyde	0.0	0.3	1.1	0.2	1.6	5.7	0.0	0.0	5.7	33.9	76.1
Retene	0.0	0.1	0.1	0.1	0.1	0.2	0.0	0.0	0.1	0.3	0.7
Benzonaphthothiophene	0.0	0.3	0.6	1.1	1.8	2.5	0.0	0.5	2.0	4.4	16.4
1+3-methylfluoranthene	0.2	0.6	1.2	2.8	4.8	10.8	1.9	2.5	18.9	102.9	283.4
1-MeFl+C-MeFl/Py	0.2	0.6	0.8	7.2	10.6	12.7	1.2	4.0	19.3	72.2	125.1
B-MePy/MeFl	0.0	1.0	3.5	2.9	10.7	15.0	4.0	5.8	21.2	101.4	281.0
C-MePy/MeFl	0.3	0.8	1.8	1.6	9.3	13.9	3.1	4.3	18.2	82.3	254.6
D-MePy/MeFl	0.2	0.7	2.1	4.4	9.8	13.2	1.7	4.6	14.4	61.0	147.0
4-methylpyrene	0.0	0.8	2.1	5.4	9.5	11.9	2.7	3.7	10.2	56.6	216.4
1-methylpyrene	0.1	1.0	3.1	0.0	7.9	11.6	0.1	1.0	9.2	37.6	124.1
Benzo(c)phenanthrene	0.0	0.1	0.5	0.9	7.0	10.2	0.7	1.9	7.1	36.8	196.1
Benzo(ghi)fluoranthene	0.0	1.0	4.7	2.9	13.9	22.0	1.5	2.8	12.5	68.0	248.3
Cyclopenta(c,d)pyrene	0.0	0.8	3.2	0.0	7.4	10.9	0.0	0.8	20.2	603.9	3149.3
Benz(a)anthracene	0.2	1.0	2.7	3.4	12.1	18.5	2.7	3.5	15.0	82.9	238.0
Triphenylene	0.5	0.9	1.7	5.3	16.8	33.6	2.3	3.3	17.1	65.1	191.1
Chrysene	0.5	1.0	2.0	3.2	12.8	23.6	1.9	2.6	11.2	38.6	128.8
Benzanthrone	0.0	0.2	0.5	4.5	18.1	31.5	0.0	0.0	0.0	34.9	82.4
7-methylbenz(a)anthracene	0.0	0.5	1.6	0.1	0.4	1.0	0.0	0.0	0.3	3.1	8.8
3-methylchrysene	0.1	0.2	0.4	0.6	2.8	4.7	0.7	1.0	5.4	22.8	64.2
Benz(a)anthracene-7,12-dione	0.0	0.3	0.9	0.3	5.5	10.1	0.0	0.1	4.5	20.2	52.4
5+6-methylchrysene	0.0	0.4	1.1	0.1	0.9	2.2	0.0	0.0	1.0	5.4	21.9
Benzo(b+j+k)fluoranthene	0.0	1.0	2.7	1.6	3.3	4.9	0.5	1.2	5.4	28.5	65.9
Benzo(a)fluoranthene	0.2	0.4	0.6	0.1	0.4	1.0	0.6	0.9	3.9	14.4	72.6
BeP	0.0	0.4	2.5	0.1	7.0	13.1	2.4	4.1	30.1	233.3	576.5
BaP	0.0	1.0	2.5	0.0	2.6	7.5	1.2	2.5	17.3	177.5	768.7
Perylene	0.1	0.5	0.8	0.3	1.5	2.9	0.0	0.6	6.2	58.4	160.5
7-methylbenzo(a)pyrene	0.2	1.0	3.6	0.3	1.2	2.8	0.5	0.8	3.1	11.9	32.4
9,10-dihydrobenzo(a)pyrene-7(8H)-one	0.0	0.2	0.7	0.0	0.8	1.6	0.0	0.0	0.3	1.0	4.2
Dibenzo(a,j)anthracene	0.0	0.0	0.0	0.0	0.2	0.4	0.0	0.0	1.3	9.8	21.9
Indeno[123-cd]pyrene	0.0	0.0	0.0	0.0	0.7	1.8	0.0	0.0	13.4	205.3	726.9
Dibenzo(ah+ac)anthracene	0.0	0.2	0.9	0.0	1.5	3.4	0.0	0.0	2.2	14.6	21.9
Benzo(b)chrysene	0.0	0.0	0.2	0.0	0.4	1.2	0.0	0.0	1.7	6.1	10.3
Picene	0.1	0.4	1.2	0.1	0.3	0.6	0.0	0.0	1.7	11.3	17.3

Appendix A1. Concentrations of Organic Species Normalized to Larger of Mean Field Blank Value or MDL - Round 1

	Field Blanks			Dilution Blanks			All Vehicle Composites				
Parameter	**Min**	**Avg**	**Max**	**Min**	**Avg**	**Max**	**Min**	**10th%**	**50th%**	**90th%**	**Max**
Benzo(ghi)perylene	0.0	1.0	5.8	0.0	1.0	3.0	2.0	8.4	31.3	518.6	1507.1
Anthanthrene	0.0	0.2	0.7	0.0	0.2	0.7	0.0	0.0	4.0	99.4	594.1
Dibenzo(b,k)fluoranthene	0.6	1.0	1.2	0.5	2.0	5.2	0.2	0.3	1.2	3.6	7.4
Dibenzo(a,e)pyrene	0.0	0.1	0.3	0.0	0.2	0.8	0.0	0.0	1.2	30.4	68.7
Coronene	0.0	0.5	2.2	0.2	0.7	1.4	1.8	4.8	19.1	446.9	1021.0
Dibenzo(a,h)pyrene	0.0	0.1	0.2	0.0	0.1	0.3	0.0	0.0	0.2	5.1	12.2
HOPANES by GC/MS											
C27-tetracyclic terpane	0.00	0.19	0.65	0.25	1.40	4.20	0.00	0.00	1.92	16.30	24.85
C28-tetracyclic terpane	0.00	0.66	1.50	0.60	1.76	3.55	0.00	0.00	1.98	10.45	13.30
C28-tetracyclic terpane	0.00	0.13	0.40	0.05	0.48	1.35	0.00	0.17	1.23	5.90	11.10
18a(H),21ß(H)-22,29,30-Trisnorhopane	0.00	1.00	2.24	1.73	4.59	8.07	0.00	2.18	7.88	44.51	79.27
17a(H),18a(H),21ß(H)-25,28,30-Trisnorhopane	0.00	0.00	0.00	1.75	3.34	4.95	0.00	0.00	7.55	44.23	82.45
17a(H),21ß(H)-22,29,30-Trisnorhopane	0.00	0.03	0.15	0.25	0.44	0.85	0.00	0.00	0.65	6.93	9.50
17a(H),18a(H),21ß(H)-28,30-Bisnorhopane	0.00	0.03	0.15	0.00	0.14	0.65	0.00	0.00	0.10	4.77	10.60
17a(H),21ß(H)-30-Norhopane	0.58	1.00	1.91	2.75	6.54	12.50	2.41	4.01	18.24	125.48	233.56
18a(H),21ß(H)-30-Norneohopane	0.00	0.01	0.05	0.00	0.16	0.35	0.00	0.00	0.72	3.85	6.95
17a(H),21ß(H)-Hopane	0.36	1.00	2.72	2.17	5.44	12.08	0.63	2.68	18.35	120.33	267.78
17ß(H),21a(H)-hopane	0.00	0.13	0.40	0.00	0.33	1.25	0.00	0.00	1.43	16.00	59.60
22S-17a(H),21ß(H)-30-Homohopane	0.00	1.00	1.70	2.07	3.42	5.59	0.74	1.66	9.17	75.89	165.76
22R-17a(H),21ß(H)-30-Homohopane	0.00	0.97	1.70	0.00	2.51	4.85	0.00	1.23	9.00	64.70	173.55
17ß(H),21ß(H)-Hopane	0.00	0.17	0.40	0.00	0.75	2.15	0.00	0.00	2.35	23.17	57.00
22S-17a(H),21ß(H)-30,31-Bishomohopane	0.00	0.15	0.90	0.00	1.48	3.55	0.00	0.13	6.35	65.75	133.25
22R-17a(H),21ß(H)-30,31-Bishomohopane	0.00	0.28	1.10	0.00	1.48	2.75	0.00	0.45	3.67	36.53	91.20
22S-17a(H),21ß(H)-30,31,32-Trisomohopane	0.00	0.24	1.45	0.00	1.08	2.35	0.00	1.03	3.25	37.28	80.00
22R-17a(H),21ß(H)-30,31,32-Trishomohopane	0.00	0.05	0.15	0.00	0.67	1.80	0.00	0.00	2.53	24.60	50.70
C27-tetracyclic terpane	0.00	0.19	0.50	0.00	0.68	2.30	0.00	0.00	1.28	10.20	16.85
STERANES by GC/MS											
C27-20S-13ß(H),17a(H)-diasterane	0.00	0.32	0.50	1.85	2.64	4.25	0.00	0.65	2.83	17.05	29.75
C27-20R-13ß(H),17a(H)-diasterane	0.00	0.25	0.85	0.95	2.08	4.45	0.00	0.20	2.35	11.23	22.60
C27-20S-13a(H),17ß(H)-diasterane	0.00	0.07	0.25	0.35	0.81	2.35	0.00	0.20	0.93	5.03	7.55
C27-20R-13a(H),17ß(H)-diasterane	0.00	0.22	0.75	0.50	1.73	4.85	0.00	0.17	1.65	10.52	14.20
C28-20S-13ß(H),17a(H)-diasterane	0.00	0.15	0.50	0.00	0.87	3.25	0.00	0.00	0.52	6.82	10.25
C29-20R-13a(H),17ß(H)-diasterane	0.00	0.07	0.25	0.15	0.69	1.90	0.00	0.00	1.33	11.52	17.30
C27-20S5a(H),14a(H)-cholestane	0.00	0.23	0.90	0.25	1.12	3.60	0.00	0.00	0.98	9.33	13.90
C27-20R5a(H),14ß(H)-cholestane	0.05	0.38	0.75	1.70	3.17	6.15	0.00	0.72	4.55	27.87	33.65
C27-20S5a(H),14ß(H),17ß(H)-cholestane	0.00	0.26	0.80	0.85	1.77	4.25	0.00	0.32	2.45	14.00	17.30
ster45+40(cholestane)	0.33	1.00	2.65	1.56	4.01	10.58	0.00	0.97	5.57	28.30	34.68
C28-20S5a(H),14a(H),17a(H)-ergostane	0.00	0.04	0.25	0.00	0.22	0.95	0.00	0.00	0.50	3.53	5.05
C28-20R5a(H),14ß(H),17ß(H)-ergostane	0.00	0.61	1.15	0.15	0.93	2.85	0.00	0.00	0.58	5.95	8.40
C28-20S5a(H),14ß(H),17ß(H)-ergostane	0.00	0.23	0.90	0.10	0.93	2.95	0.00	0.00	1.05	8.73	13.95
C28-20R5a(H),14a(H),17a(H)-ergostane	0.00	0.19	0.75	0.30	0.92	3.10	0.00	0.00	1.23	8.15	11.45
C29-20S5a(H),14a(H),17a(H)-stigmastane	0.00	0.12	0.50	0.25	1.10	2.65	0.00	0.25	2.18	11.40	21.85
C29-20R5a(H),14ß(H),17ß(H)-stigmastane	0.00	0.15	0.45	0.15	1.38	3.15	0.00	0.33	3.15	18.38	33.70
C29-20S5a(H),14ß(H),17ß(H)-stigmastane	0.00	0.10	0.25	0.15	0.99	2.45	0.00	0.30	2.05	11.80	22.80
C29-20R5a(H),14a(H),17a(H)-stigmastane	0.00	0.13	0.45	0.15	1.28	3.40	0.00	0.17	2.37	12.05	25.50
ALKANES by GC/MS											
Undecane	0.1	1.0	2.0	0.2	1.3	2.6	0.1	0.2	0.8	3.8	11.4
Dodecane	0.4	1.0	2.1	0.1	0.6	1.3	0.0	0.1	0.5	1.6	12.2
Tridecane	0.3	1.0	2.7	0.3	1.4	2.3	0.0	0.0	0.9	4.4	24.7
Norfarnesane	0.4	1.0	1.7	1.0	3.7	10.2	0.2	0.9	2.8	10.0	28.7
Heptylcyclohexane	0.3	1.0	2.5	0.3	2.3	6.0	0.2	0.6	1.9	6.7	22.4
Farnesane	0.1	1.0	3.0	0.1	2.1	7.1	0.1	0.5	2.3	11.1	23.0
Tetradecane	0.2	1.0	2.8	0.2	1.0	3.8	0.0	0.1	0.9	2.7	4.1
Octylcyclohexane	0.2	1.0	2.3	0.2	1.1	3.1	0.0	0.3	0.8	3.3	10.4
Pentadecane	0.1	1.0	2.3	0.5	6.4	19.7	0.0	0.4	2.6	14.6	70.2
Nonylcyclohexane	0.0	1.0	3.5	0.2	0.7	1.4	0.0	0.2	1.1	2.2	4.4
Hexadecane	0.3	1.0	1.9	0.5	1.9	4.2	0.2	0.5	1.3	3.4	4.4
Norpristane	0.4	1.0	1.7	0.8	2.8	4.8	0.4	1.1	2.1	6.2	9.4
Heptadecane	0.7	1.0	1.7	0.6	3.3	6.0	0.1	0.8	2.0	7.1	18.1
Decylcyclohexane	0.1	1.0	3.5	0.4	2.5	7.0	0.0	0.2	1.0	5.4	8.7
Heptadecane_Pristane	0.1	1.0	2.1	0.7	5.0	8.6	0.1	0.9	4.9	15.7	25.9
Undecylcyclohexane	0.6	1.0	1.4	0.6	1.8	5.4	0.0	0.1	0.9	2.3	8.7
Octadecane	0.5	1.0	1.7	0.5	4.7	16.8	0.0	0.9	4.1	14.0	47.7
Phytane	0.4	1.0	1.6	1.5	7.3	17.1	0.8	2.1	6.6	34.3	84.3
Dodecylcyclohexane	0.1	1.0	1.9	2.8	5.9	12.2	0.4	1.3	3.0	14.3	52.6
Nonadecane	0.5	1.0	1.5	2.5	6.2	14.7	0.7	2.0	6.9	26.6	57.6
Tridecylcyclohexane	0.3	1.0	2.6	0.5	1.9	7.7	0.2	0.4	1.9	5.8	12.8
Eicosane	0.3	1.0	1.6	0.7	4.7	10.4	0.6	1.4	4.9	15.6	46.7
Tetradecylcyclohexane	0.7	0.9	1.3	3.9	11.2	24.0	1.3	3.3	8.8	40.4	113.1
Heneicosane	0.2	1.0	1.5	2.0	4.5	10.4	0.3	1.1	4.1	14.5	23.5
Pentadecylcyclohexane	0.1	1.0	3.6	0.2	0.7	1.6	0.1	0.2	0.5	1.2	2.0
Docosane	0.1	1.0	2.6	1.1	2.3	4.9	0.3	0.4	1.8	5.4	10.3

Appendix A1. Concentrations of Organic Species Normalized to Larger of Mean Field Blank Value or MDL - Round 1

	Field Blanks			Dilution Blanks			All Vehicle Composites				
Parameter	**Min**	**Avg**	**Max**	**Min**	**Avg**	**Max**	**Min**	**10th%**	**50th%**	**90th%**	**Max**
Hexadecylcyclohexane	0.6	1.0	2.0	1.5	7.4	31.3	0.1	0.8	4.2	20.8	31.0
Tricosane	0.2	1.0	2.3	0.9	1.7	2.9	0.0	0.3	1.1	2.9	6.9
Heptadecylcyclohexane	0.1	1.0	2.9	0.5	1.7	4.7	0.0	0.1	0.8	3.1	7.6
Octadecylcyclohexane	0.1	1.0	3.1	0.2	1.2	3.1	0.1	0.1	0.3	1.5	4.5
Tetracosane	0.1	1.0	3.1	0.6	1.4	2.9	0.1	0.1	0.6	2.1	5.5
Pentacosane	0.1	1.0	3.1	0.5	1.5	3.8	0.1	0.1	0.5	2.9	6.5
Nonadecylcyclohexane	0.1	1.0	2.9	0.4	1.2	3.5	0.1	0.1	0.5	2.6	6.4
Hexacosane	0.1	1.0	3.2	0.4	1.3	3.6	0.0	0.1	0.4	2.4	5.4
Eicosylcyclohexane	0.2	0.5	1.1	0.4	1.2	3.6	0.0	0.4	2.8	17.7	164.0
Heptacosane	0.1	1.0	3.3	0.3	1.2	3.7	0.0	0.0	0.3	2.4	4.8
Heneicosylcyclohexane	0.1	0.8	2.2	0.4	2.5	7.2	0.3	0.9	3.2	25.4	51.0
Octacosane	0.0	1.0	3.5	0.4	1.4	3.8	0.0	0.0	0.5	2.7	8.1
Nonacosane	0.0	1.0	3.4	0.3	1.2	3.1	0.0	0.0	0.1	3.7	6.4
Triacontane	0.0	1.0	3.5	0.3	1.5	3.7	0.0	0.0	0.4	3.3	8.8
Hentriacontane	0.0	1.0	2.6	0.5	1.9	5.1	0.0	0.0	0.8	5.0	10.3
Dotriacontane	0.2	1.0	3.1	0.6	2.4	6.5	0.0	0.0	0.6	5.5	14.3
Tritriacontane	0.0	1.0	3.8	0.7	3.6	12.8	0.0	0.0	0.1	11.5	29.9
Tetratriacontane	0.1	1.0	3.4	0.8	3.5	12.1	0.0	0.0	0.0	9.1	28.4
Pentatriacontane	0.0	1.0	3.6	0.8	4.8	17.8	0.0	0.0	0.5	14.8	48.3
Hexatriacontane	0.0	1.0	3.3	0.7	5.4	22.9	0.0	0.0	0.0	18.6	53.6
Heptatriacontane	0.0	1.0	3.1	0.0	6.8	26.6	0.0	0.0	0.2	32.6	84.1
Octatriacontane	0.0	1.0	3.5	0.9	7.2	31.3	0.0	0.0	0.0	40.5	77.6
Nonatriacontane	0.0	0.8	2.7	0.0	19.7	116.5	0.0	0.0	0.0	16.0	701.7
Tetracontane	0.0	0.6	2.9	0.0	8.4	42.7	0.0	0.0	0.0	66.4	120.1
CARBONYLS by DNPH - HPLC/UV											
formaldehyde	0.0	1.0	3.8	33.4	107.8	251.3	9.8	66.5	305.5	1045.6	1321.1
acetaldehyde	0.2	1.0	2.3	0.2	1.4	3.6	0.0	0.9	4.8	11.8	13.3
acetone	0.1	1.0	2.2	0.2	1.2	2.7	0.0	0.0	1.6	3.0	3.5
acrolein	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.2	9.2	19.6
propionaldehyde	0.0	1.0	2.7	5.0	8.1	11.7	1.3	5.7	18.5	52.3	62.7
crotonaldehyde	0.0	0.0	0.0	0.0	0.3	2.0	0.0	0.0	4.0	24.6	44.4
methyl ethyl ketone	0.0	1.0	3.8	3.4	8.4	14.1	0.9	2.3	9.6	15.3	16.7
Methacrolein	0.0	0.0	0.0	0.0	0.7	4.0	0.0	3.4	14.8	59.6	76.4
butyraldehyde	0.0	1.0	3.1	2.7	9.0	21.1	0.0	4.7	42.2	131.2	218.7
benzaldehyde	0.0	0.0	0.0	4.0	14.3	36.0	0.4	30.2	92.4	308.7	387.1
glyoxal	0.0	0.0	0.0	0.0	2.5	4.8	0.0	0.0	1.6	10.2	16.0
valeraldehyde	0.0	0.3	1.6	0.8	3.3	6.0	0.4	0.6	2.4	7.2	12.0
tolualdehyde	0.0	0.3	1.6	1.6	7.9	20.0	0.4	17.4	53.6	191.9	241.5
hexanal	0.0	0.0	0.0	0.0	3.5	12.0	0.0	0.0	3.8	22.6	34.4

Appendix B1. Chemical Composition of Dilution Blanks and Vehicle Exhaust Samples from Round1

Species Description	S0-1	S0-2	S0-3	S0-4	S0-5	S0-6	S1-1	S1-2	S2-1	S2-2	S2-3	S2-4	S3-1
Gravimetric mass (mg/mi)	0.39 ± 0.07	0.53 ± 0.11	0.19 ± 0.05	0.24 ± 0.06	0.95 ± 0.16	0.70 ± 0.12	9.13 ± 1.46	81.73 ± 12.93	73.07 ± 11.56	20.11 ± 3.19	22.02 ± 3.49	76.16 ± 12.04	3.76 ± 0.61
Carbon fractions by TOR (mg/mi)													
Organic Carbon Fraction 1	0.018 ± 0.010	0.002 ± 0.015	0.067 ± 0.020	0.073 ± 0.022	0.085 ± 0.028	0.068 ± 0.019	0.146 ± 0.104	5.721 ± 1.614	26.889 ± 9.418	3.293 ± 0.982	10.521 ± 2.688	4.681 ± 1.148	0.245 ± 0.087
Organic Carbon Fraction 2	0.073 ± 0.019	0.050 ± 0.027	0.093 ± 0.024	0.098 ± 0.026	0.169 ± 0.040	0.207 ± 0.042	0.624 ± 0.158	11.741 ± 2.639	23.844 ± 4.481	2.957 ± 0.651	4.153 ± 0.840	7.440 ± 1.489	0.332 ± 0.074
Organic Carbon Fraction 3	0.105 ± 0.040	0.066 ± 0.068	0.076 ± 0.045	0.093 ± 0.051	0.235 ± 0.074	0.236 ± 0.062	0.710 ± 0.335	4.985 ± 1.083	6.430 ± 1.642	3.662 ± 0.818	0.992 ± 0.314	9.719 ± 2.004	0.267 ± 0.154
Organic Carbon Fraction 4	0.049 ± 0.016	0.015 ± 0.019	0.033 ± 0.015	0.029 ± 0.015	0.450 ± 0.161	0.077 ± 0.023	0.732 ± 0.240	2.753 ± 0.870	1.966 ± 0.542	1.416 ± 0.455	0.544 ± 0.185	6.344 ± 2.112	0.281 ± 0.075
Pyrolyzed Organic Carbon	0.010 ± 0.007	0.000 ± 0.011	0.000 ± 0.007	0.000 ± 0.008	0.001 ± 0.009	0.000 ± 0.007	0.064 ± 0.128	0.869 ± 0.247	0.004 ± 0.038	0.004 ± 0.036	0.001 ± 0.037	0.010 ± 0.036	0.009 ± 0.025
Total Organic Carbon	0.256 ± 0.065	0.129 ± 0.090	0.268 ± 0.074	0.293 ± 0.082	0.940 ± 0.197	0.588 ± 0.118	2.204 ± 0.501	26.070 ± 5.077	59.132 ± 10.130	11.332 ± 2.238	16.212 ± 3.036	28.193 ± 5.271	1.097 ± 0.245
Elemental Carbon Fraction 1	0.025 ± 0.009	0.000 ± 0.008	0.005 ± 0.006	0.003 ± 0.006	0.162 ± 0.070	0.047 ± 0.015	0.539 ± 0.157	2.839 ± 0.973	1.955 ± 0.604	2.676 ± 0.958	0.619 ± 0.246	4.882 ± 1.647	0.394 ± 0.087
Elemental Carbon Fraction 2	0.124 ± 0.026	0.020 ± 0.011	0.027 ± 0.008	0.028 ± 0.009	0.074 ± 0.017	0.089 ± 0.018	0.983 ± 0.382	15.778 ± 3.456	1.769 ± 0.725	3.840 ± 0.742	3.378 ± 0.675	20.854 ± 4.140	0.541 ± 0.155
Elemental Carbon Fraction 3	0.016 ± 0.009	0.000 ± 0.003	0.000 ± 0.002	0.000 ± 0.002	0.000 ± 0.003	0.007 ± 0.004	0.061 ± 0.017	0.140 ± 0.060	0.791 ± 0.152	0.077 ± 0.045	0.037 ± 0.024	0.055 ± 0.033	0.008 ± 0.007
Total Elemental Carbon	0.154 ± 0.036	0.020 ± 0.014	0.031 ± 0.011	0.030 ± 0.011	0.235 ± 0.060	0.142 ± 0.030	1.516 ± 0.244	17.884 ± 4.524	4.510 ± 0.715	6.588 ± 1.483	4.030 ± 0.921	25.780 ± 5.804	0.933 ± 0.150
Total Carbon	0.410 ± 0.088	0.150 ± 0.096	0.298 ± 0.080	0.323 ± 0.088	1.175 ± 0.239	0.731 ± 0.141	3.719 ± 0.748	43.955 ± 8.031	63.645 ± 11.023	17.921 ± 3.386	20.238 ± 3.732	53.974 ± 9.734	2.030 ± 0.383
Elements by XRF (mg/mi)													
Sodium (qualitative only)	0.3761 ± 0.0303	0.0000 ± 0.0744	0.0736 ± 0.0413	0.0214 ± 0.0503	0.0760 ± 0.0444	0.0152 ± 0.0464	0.4612 ± 0.2117	0.2853 ± 0.4197	0.2533 ± 0.3213	0.4555 ± 0.1947	0.2630 ± 0.2848	0.3355 ± 0.2622	0.4438 ± 0.1306
Magnesium (qualitative only)	0.0062 ± 0.0045	0.0068 ± 0.0109	0.0042 ± 0.0072	0.0086 ± 0.0072	0.0000 ± 0.0103	0.0047 ± 0.0069	0.0498 ± 0.0373	0.0043 ± 0.0765	0.0071 ± 0.0488	0.0063 ± 0.0469	0.0334 ± 0.0418	0.0134 ± 0.0574	0.0445 ± 0.0197
Aluminum	0.0028 ± 0.0019	0.0010 ± 0.0058	0.0021 ± 0.0031	0.0020 ± 0.0036	0.0025 ± 0.0044	0.0078 ± 0.0035	0.0138 ± 0.0179	0.0014 ± 0.0464	0.0058 ± 0.0198	0.0053 ± 0.0203	0.0055 ± 0.0191	0.0000 ± 0.0471	0.0577 ± 0.0132
Silicon	0.0156 ± 0.0027	0.0163 ± 0.0034	0.0042 ± 0.0015	0.0129 ± 0.0025	0.0361 ± 0.0060	0.0417 ± 0.0068	1.3756 ± 0.2178	7.8762 ± 1.2456	0.1919 ± 0.0315	0.8379 ± 0.1329	0.1531 ± 0.0255	9.6254 ± 1.5221	0.2761 ± 0.0439
Phosphorous	0.0000 ± 0.0007	0.0000 ± 0.0017	0.0001 ± 0.0010	0.0008 ± 0.0010	0.0004 ± 0.0011	0.0000 ± 0.0011	0.0000 ± 0.0071	0.0035 ± 0.0329	0.2224 ± 0.0356	0.0068 ± 0.0068	0.1309 ± 0.0214	0.0083 ± 0.0139	0.0051 ± 0.0033
Sulfur	0.0178 ± 0.0029	0.0264 ± 0.0043	0.0102 ± 0.0017	0.0243 ± 0.0039	0.0281 ± 0.0045	0.0308 ± 0.0049	0.2942 ± 0.0467	5.0119 ± 0.7925	0.1804 ± 0.0288	0.1926 ± 0.0307	0.1866 ± 0.0298	0.9767 ± 0.1546	0.1660 ± 0.0263
Chlorine	0.0003 ± 0.0008	0.0000 ± 0.0018	0.0023 ± 0.0011	0.0006 ± 0.0013	0.0000 ± 0.0015	0.0003 ± 0.0012	0.0089 ± 0.0055	0.0458 ± 0.0813	0.0113 ± 0.0056	0.0170 ± 0.0057	0.0060 ± 0.0070	0.0095 ± 0.0163	0.0011 ± 0.0038
Potassium	0.0020 ± 0.0005	0.0024 ± 0.0010	0.0015 ± 0.0006	0.0024 ± 0.0007	0.0036 ± 0.0008	0.0045 ± 0.0009	0.0120 ± 0.0031	0.0029 ± 0.0036	0.0076 ± 0.0035	0.0048 ± 0.0032	0.0062 ± 0.0036	0.0079 ± 0.0035	0.0068 ± 0.0020
Calcium	0.0233 ± 0.0037	0.0221 ± 0.0037	0.0086 ± 0.0015	0.0190 ± 0.0031	0.0297 ± 0.0048	0.0404 ± 0.0064	0.1785 ± 0.0285	0.0367 ± 0.0068	0.5333 ± 0.0845	0.0582 ± 0.0098	0.4863 ± 0.0770	0.1270 ± 0.0204	0.0566 ± 0.0092
Titanium	0.0012 ± 0.0025	0.0013 ± 0.0055	0.0021 ± 0.0036	0.0022 ± 0.0040	0.0021 ± 0.0044	0.0031 ± 0.0035	0.0039 ± 0.0186	0.0084 ± 0.0211	0.0038 ± 0.0203	0.0083 ± 0.0190	0.0044 ± 0.0191	0.0085 ± 0.0198	0.0046 ± 0.0110
Vanadium	0.0004 ± 0.0011	0.0004 ± 0.0024	0.0008 ± 0.0015	0.0009 ± 0.0017	0.0006 ± 0.0019	0.0011 ± 0.0015	0.0009 ± 0.0087	0.0025 ± 0.0099	0.0015 ± 0.0087	0.0035 ± 0.0082	0.0014 ± 0.0095	0.0024 ± 0.0092	0.0022 ± 0.0052
Chromium	0.0001 ± 0.0002	0.0001 ± 0.0005	0.0001 ± 0.0003	0.0002 ± 0.0003	0.0003 ± 0.0004	0.0004 ± 0.0003	0.0010 ± 0.0019	0.0015 ± 0.0021	0.0007 ± 0.0016	0.0019 ± 0.0013	0.0003 ± 0.0023	0.0010 ± 0.0019	0.0037 ± 0.0013
Manganese	0.0011 ± 0.0002	0.0002 ± 0.0003	0.0002 ± 0.0002	0.0003 ± 0.0002	0.0004 ± 0.0002	0.0005 ± 0.0002	0.0013 ± 0.0009	0.0004 ± 0.0012	0.0001 ± 0.0010	0.0003 ± 0.0010	0.0000 ± 0.0012	0.0017 ± 0.0011	0.0010 ± 0.0006
Iron	0.0127 ± 0.0020	0.0055 ± 0.0011	0.0061 ± 0.0010	0.0087 ± 0.0014	0.0167 ± 0.0027	0.0234 ± 0.0037	0.0796 ± 0.0127	0.0306 ± 0.0053	0.0300 ± 0.0052	0.0246 ± 0.0044	0.0376 ± 0.0063	0.1504 ± 0.0239	0.0653 ± 0.0104
Cobalt	0.0001 ± 0.0002	0.0000 ± 0.0003	0.0000 ± 0.0002	0.0000 ± 0.0002	0.0000 ± 0.0003	0.0001 ± 0.0003	0.0004 ± 0.0012	0.0001 ± 0.0010	0.0001 ± 0.0009	0.0001 ± 0.0009	0.0001 ± 0.0009	0.0005 ± 0.0020	0.0005 ± 0.0008
Nickel	0.0000 ± 0.0001	0.0001 ± 0.0002	0.0000 ± 0.0001	0.0001 ± 0.0002	0.0001 ± 0.0001	0.0001 ± 0.0001	0.0002 ± 0.0006	0.0006 ± 0.0007	0.0006 ± 0.0006	0.0002 ± 0.0007	0.0003 ± 0.0007	0.0006 ± 0.0007	0.0021 ± 0.0005
Copper	0.0006 ± 0.0001	0.0002 ± 0.0002	0.0002 ± 0.0001	0.0003 ± 0.0001	0.0007 ± 0.0002	0.0009 ± 0.0002	0.0010 ± 0.0006	0.0044 ± 0.0009	0.0041 ± 0.0010	0.0016 ± 0.0007	0.0025 ± 0.0007	0.0069 ± 0.0012	0.0060 ± 0.0010
Zinc	0.0045 ± 0.0010	0.0004 ± 0.0014	0.0003 ± 0.0009	0.0009 ± 0.0010	0.0033 ± 0.0012	0.0027 ± 0.0010	0.0133 ± 0.0049	0.0192 ± 0.0057	0.3394 ± 0.0539	0.0251 ± 0.0060	0.2395 ± 0.0382	0.0845 ± 0.0142	0.0174 ± 0.0038
Gallium	0.0003 ± 0.0003	0.0004 ± 0.0006	0.0002 ± 0.0004	0.0001 ± 0.0004	0.0001 ± 0.0005	0.0005 ± 0.0003	0.0009 ± 0.0018	0.0000 ± 0.0022	0.0000 ± 0.0023	0.0000 ± 0.0020	0.0034 ± 0.0017	0.0014 ± 0.0019	0.0004 ± 0.0012
Arsenic	0.0001 ± 0.0002	0.0000 ± 0.0005	0.0000 ± 0.0003	0.0000 ± 0.0004	0.0001 ± 0.0004	0.0001 ± 0.0003	0.0005 ± 0.0018	0.0003 ± 0.0020	0.0003 ± 0.0022	0.0001 ± 0.0018	0.0006 ± 0.0017	0.0000 ± 0.0018	0.0006 ± 0.0010
Selenium	0.0000 ± 0.0001	0.0000 ± 0.0002	0.0000 ± 0.0002	0.0000 ± 0.0002	0.0000 ± 0.0002	0.0001 ± 0.0001	0.0000 ± 0.0008	0.0000 ± 0.0009	0.0000 ± 0.0009	0.0000 ± 0.0008	0.0002 ± 0.0008	0.0002 ± 0.0008	0.0000 ± 0.0005
Bromine	0.0001 ± 0.0001	0.0000 ± 0.0002	0.0001 ± 0.0001	0.0001 ± 0.0001	0.0001 ± 0.0002	0.0001 ± 0.0001	0.0015 ± 0.0006	0.0137 ± 0.0023	0.0003 ± 0.0008	0.0015 ± 0.0007	0.0008 ± 0.0006	0.0034 ± 0.0008	0.0037 ± 0.0007
Rubidium	0.0000 ± 0.0001	0.0000 ± 0.0002	0.0000 ± 0.0002	0.0001 ± 0.0002	0.0001 ± 0.0002	0.0000 ± 0.0002	0.0004 ± 0.0008	0.0001 ± 0.0011	0.0003 ± 0.0010	0.0005 ± 0.0009	0.0002 ± 0.0008	0.0001 ± 0.0009	0.0003 ± 0.0005
Strontium	0.0001 ± 0.0001	0.0000 ± 0.0003	0.0000 ± 0.0002	0.0001 ± 0.0002	0.0001 ± 0.0002	0.0001 ± 0.0002	0.0003 ± 0.0010	0.0001 ± 0.0011	0.0000 ± 0.0011	0.0001 ± 0.0010	0.0001 ± 0.0009	0.0002 ± 0.0010	0.0001 ± 0.0006
Yttrium	0.0000 ± 0.0002	0.0001 ± 0.0004	0.0001 ± 0.0002	0.0000 ± 0.0003	0.0001 ± 0.0003	0.0001 ± 0.0002	0.0001 ± 0.0012	0.0002 ± 0.0015	0.0000 ± 0.0014	0.0004 ± 0.0013	0.0000 ± 0.0012	0.0002 ± 0.0013	0.0000 ± 0.0007
Zirconium	0.0001 ± 0.0002	0.0001 ± 0.0004	0.0001 ± 0.0003	0.0000 ± 0.0003	0.0002 ± 0.0003	0.0002 ± 0.0003	0.0003 ± 0.0014	0.0001 ± 0.0017	0.0000 ± 0.0016	0.0007 ± 0.0015	0.0004 ± 0.0014	0.0003 ± 0.0015	0.0014 ± 0.0008
Molybdenum	0.0001 ± 0.0003	0.0001 ± 0.0006	0.0001 ± 0.0004	0.0003 ± 0.0004	0.0003 ± 0.0005	0.0002 ± 0.0004	0.0002 ± 0.0020	0.0013 ± 0.0022	0.0059 ± 0.0023	0.0003 ± 0.0022	0.0005 ± 0.0020	0.0020 ± 0.0019	0.0000 ± 0.0012
Palladium	0.0000 ± 0.0004	0.0002 ± 0.0008	0.0000 ± 0.0005	0.0000 ± 0.0006	0.0000 ± 0.0006	0.0001 ± 0.0005	0.0000 ± 0.0027	0.0003 ± 0.0029	0.0000 ± 0.0029	0.0000 ± 0.0027	0.0000 ± 0.0026	0.0000 ± 0.0028	0.0002 ± 0.0015
Silver	0.0004 ± 0.0004	0.0000 ± 0.0010	0.0001 ± 0.0007	0.0001 ± 0.0007	0.0004 ± 0.0008	0.0004 ± 0.0007	0.0000 ± 0.0034	0.0029 ± 0.0036	0.0006 ± 0.0038	0.0011 ± 0.0036	0.0007 ± 0.0035	0.0010 ± 0.0037	0.0010 ± 0.0020
Cadmium	0.0005 ± 0.0004	0.0002 ± 0.0010	0.0004 ± 0.0006	0.0004 ± 0.0007	0.0003 ± 0.0008	0.0004 ± 0.0006	0.0013 ± 0.0033	0.0018 ± 0.0038	0.0007 ± 0.0037	0.0004 ± 0.0035	0.0023 ± 0.0034	0.0020 ± 0.0036	0.0010 ± 0.0020
Indium	0.0004 ± 0.0006	0.0000 ± 0.0012	0.0004 ± 0.0008	0.0002 ± 0.0009	0.0004 ± 0.0010	0.0001 ± 0.0008	0.0013 ± 0.0041	0.0013 ± 0.0046	0.0009 ± 0.0046	0.0000 ± 0.0043	0.0010 ± 0.0040	0.0044 ± 0.0045	0.0001 ± 0.0024
Tin	0.0002 ± 0.0009	0.0000 ± 0.0019	0.0013 ± 0.0011	0.0003 ± 0.0014	0.0000 ± 0.0015	0.0000 ± 0.0012	0.0015 ± 0.0062	0.0032 ± 0.0071	0.0000 ± 0.0069	0.0000 ± 0.0066	0.0018 ± 0.0063	0.0029 ± 0.0068	0.0005 ± 0.0036
Antimony	0.0002 ± 0.0009	0.0000 ± 0.0021	0.0007 ± 0.0013	0.0001 ± 0.0015	0.0000 ± 0.0016	0.0003 ± 0.0013	0.0056 ± 0.0064	0.0066 ± 0.0074	0.0014 ± 0.0078	0.0000 ± 0.0074	0.0000 ± 0.0069	0.0010 ± 0.0075	0.0020 ± 0.0041
Barium	0.0007 ± 0.0044	0.0022 ± 0.0097	0.0001 ± 0.0063	0.0000 ± 0.0071	0.0017 ± 0.0078	0.0000 ± 0.0061	0.0226 ± 0.0296	0.0000 ± 0.0369	0.0097 ± 0.0363	0.0013 ± 0.0339	0.0136 ± 0.0299	0.0045 ± 0.0346	0.0104 ± 0.0187
Lanthanum	0.0003 ± 0.0057	0.0010 ± 0.0127	0.0008 ± 0.0082	0.0047 ± 0.0093	0.0006 ± 0.0101	0.0013 ± 0.0080	0.0171 ± 0.0422	0.0295 ± 0.0486	0.0122 ± 0.0477	0.0071 ± 0.0443	0.0437 ± 0.0432	0.0335 ± 0.0454	0.0206 ± 0.0253
Gold	0.0002 ± 0.0003	0.0007 ± 0.0007	0.0002 ± 0.0004	0.0002 ± 0.0005	0.0006 ± 0.0005	0.0006 ± 0.0004	0.0009 ± 0.0023	0.0000 ± 0.0026	0.0000 ± 0.0096	0.0003 ± 0.0024	0.0019 ± 0.0063	0.0017 ± 0.0031	0.0008 ± 0.0014
Mercury	0.0000 ± 0.0002	0.0002 ± 0.0004	0.0000 ± 0.0003	0.0000 ± 0.0003	0.0001 ± 0.0003	0.0000 ± 0.0003	0.0000 ± 0.0014	0.0006 ± 0.0017	0.0000 ± 0.0016	0.0000 ± 0.0015	0.0000 ± 0.0014	0.0002 ± 0.0015	0.0000 ± 0.0008
Thallium	0.0001 ± 0.0002	0.0001 ± 0.0004	0.0001 ± 0.0002	0.0001 ± 0.0003	0.0000 ± 0.0003	0.0001 ± 0.0002	0.0001 ± 0.0013	0.0002 ± 0.0015	0.0001 ± 0.0015	0.0000 ± 0.0014	0.0000 ± 0.0013	0.0003 ± 0.0014	0.0000 ± 0.0008
Lead	0.0003 ± 0.0003	0.0003 ± 0.0007	0.0002 ± 0.0005	0.0002 ± 0.0005	0.0005 ± 0.0005	0.0006 ± 0.0004	0.0007 ± 0.0026	0.0012 ± 0.0029	0.0040 ± 0.0028	0.0016 ± 0.0027	0.0024 ± 0.0021	0.0036 ± 0.0022	0.0009 ± 0.0015
Uranium	0.0001 ± 0.0003	0.0001 ± 0.0006	0.0000 ± 0.0004	0.0000 ± 0.0005	0.0001 ± 0.0005	0.0001 ± 0.0004	0.0000 ± 0.0021	0.0000 ± 0.0025	0.0001 ± 0.0024	0.0004 ± 0.0022	0.0000 ± 0.0020	0.0003 ± 0.0022	0.0001 ± 0.0012
Anions by IC (mg/mi)													
Nitrate Ion	0.02 ± 0.00	0.01 ± 0.01	0.00 ± 0.00	0.01 ± 0.01	0.01 ± 0.01	0.01 ± 0.00	0.12 ± 0.03	0.04 ± 0.03	0.02 ± 0.03	0.05 ± 0.03	0.02 ± 0.03	0.02 ± 0.03	0.02 ± 0.01
Sulfate Ion	0.04 ± 0.01	0.05 ± 0.02	0.03 ± 0.01	0.06 ± 0.01	0.07 ± 0.01	0.07 ± 0.01	0.55 ± 0.06	11.80 ± 0.72	0.19 ± 0.05	0.38 ± 0.06	0.28 ± 0.05	1.72 ± 0.12	0.48 ± 0.03
Polycyclic aromatic hydrocarbons (ug/mile)													
Naphthalene	51.97 ± 13.99	30.34 ± 38.25	86.30 ± 18.33	63.24 ± 21.33	16.87 ± 27.34	72.77 ± 17.71	3668.07 ± 315.58	344.59 ± 121.20	6930.77 ± 562.74	3860.42 ± 331.21	5643.17 ± 465.49	10067.38 ± 805.41	1494.87 ± 125.73
2-methylnaphthalene	11.79 ± 1.52	21.11 ± 3.75	42.88 ± 3.88	44.65 ± 4.17	32.83 ± 3.71	36.76 ± 3.42	9057.12 ± 719.74	10694.90 ± 849.77	22937.43 ± 1820.50	16855.38 ± 1338.17	3466.37 ± 276.58	33748.20 ± 2677.93	3058.24 ± 243.11
1-methylnaphthalene	6.10 ± 0.71	10.67 ± 1.77	20.69 ± 1.68	21.72 ± 1.82	16.17 ± 1.68	17.49 ± 1.47	4128.15 ± 286.96	2909.88 ± 202.57	11646.48 ± 808.31	10901.23 ± 756.62	1721.31 ± 120.14	19453.82 ± 1349.76	1462.77 ± 101.72
Biphenyl	1.11 ± 0.54	4.69 ± 1.62	2.56 ± 0.70	2.61 ± 0.86	1.42 ± 1.13	1.91 ± 0.68	173.89 ± 12.15	1601.99 ± 101.76	143.47 ± 10.48	943.96 ± 60.20	156.34 ± 11.24	836.63 ± 53.53	64.37 ± 4.48
1+2ethylnaphthalene	14.45 ± 4.10	13.09 ± 11.35	17.25 ± 5.13	21.59 ± 6.37	17.76 ± 8.29	7.80 ± 4.85	450.46 ± 50.54	1143.49 ± 103.49	2151.09 ± 183.89	1495.73 ± 130.64	228.92 ± 39.36	2848.04 ± 241.50	216.82 ± 21.66
2,6+2,7-dimethylnaphthalene	4.11 ± 0.50	4.72 ± 0.99	10.48 ± 1.02	10.76 ± 1.08	6.05 ± 0.86	6.43 ± 0.71	398.51 ± 32.61	3866.59 ± 313.40	3056.97 ± 247.83	3394.15 ± 275.12	385.60 ± 31.59	7363.69 ± 596.57	321.83 ± 26.34
1,3+1,6+1,7dimethylnaphth	6.45 ± 0.73	8.09 ± 1.37	13.88 ± 1.36	14.78 ± 1.49	9.88 ± 1.25	10.15 ± 1.07	825.00 ± 67.97	5103.07 ± 417.51	5014.37 ± 410.24	5527.81 ± 452.17	665.76 ± 55.00	12006.78 ± 981.57	518.14 ± 42.75
1,4+1,5+2,3-dimethylnaphth	0.00 ± 0.28	0.00 ± 0.82	0.00 ± 0.35	0.62 ± 0.45	0.00 ± 0.58	0.00 ± 0.35	12.19 ± 2.08	1901.46 ± 222.34	1067.76 ± 124.94	1393.00 ± 162.92	172.71 ± 20.40	2799.25 ± 327.23	10.02 ± 1.65
1,2-dimethylnaphthalene	0.64 ± 0.20	0.63 ± 0.52	1.45 ± 0.31	1.40 ± 0.34	0.94 ± 0.39	1.13 ± 0.27	151.52 ± 16.56	3042.99 ± 330.61	1343.09 ± 145.97	2365.94 ± 257.06	323.50 ± 35.24	5682.79 ± 617.33	63.76 ± 7.17
2-Methylbiphenyl	179.69 ± 51.10	15.19 ± 140.98	85.19 ± 61.21	76.21 ± 75.59	37.70 ± 101.25	118.72 ± 61.22	0.00 ± 386.55	115.97 ± 427.81	0.00 ± 407.34	0.00 ± 398.85	0.00 ± 411.15	0.00 ± 442.46	188.74 ± 134.53
3-Methylbiphenyl	56.70 ± 14.36	1.84 ± 40.13	28.07 ± 17.39	24.50 ± 21.48	12.93 ± 28.82	38.15 ± 17.35	13.96 ± 110.37	1221.95 ± 149.21	41.99 ± 116.55	338.35 ± 117.39	2.02 ± 117.43	477.88 ± 131.94	136.46 ± 39.32
4-Methylbiphenyl	13.71 ± 4.27	0.55 ± 12.39	6.30 ± 5.32	5.63 ± 6.59	4.42 ± 8.89	13.83 ± 5.30	12.73 ± 34.07	510.81 ± 43.06	26.62 ± 35.96	153.00 ± 35.89	10.83 ± 36.26	211.29 ± 40.14	37.25 ± 11.80
Dibenzofuran	1.93 ± 0.16	0.81 ± 0.16	2.90 ± 0.24	2.42 ± 0.21	0.78 ± 0.12	0.82 ± 0.09	35.23 ± 2.61	403.69 ± 29.15	39.98 ± 2.96	47.76 ± 3.51	43.96 ± 3.24	156.12 ± 11.32	8.90 ± 0.70
A-trimethylnaphthalene	2.14 ± 0.18	1.75 ± 0.37	3.20 ± 0.24	2.96 ± 0.26	1.69 ± 0.27	1.96 ± 0.19	37.47 ± 2.30	3921.42 ± 210.70	209.19 ± 11.38	995.58 ± 53.57	81.53 ± 4.59	1070.32 ± 57.60	30.29 ± 1.72
1-ethyl-2-methylnaphthalene	0.48 ± 0.13	0.79 ± 0.38	1.16 ± 0.18	1.40 ± 0.22	0.52 ± 0.27	0.51 ± 0.16	28.18 ± 1.74	1322.89 ± 63.72	63.76 ± 3.31	415.41 ± 20.09	28.37 ± 1.79	282.57 ± 13.72	14.74 ± 0.84
B-trimethylnaphthalene	0.85 ± 0.16	1.72 ± 0.44	1.16 ± 0.21	1.30 ± 0.25	1.28 ± 0.31	1.38 ± 0.22	23.14 ± 2.51	2454.01 ± 227.47	122.65 ± 11.59	653.79 ± 60.73	59.56 ± 5.79	694.72 ± 64.54	22.67 ± 2.21
C-trimethylnaphthalene	1.94 ± 0.22	1.48 ± 0.39	2.42 ± 0.27	1.93 ± 0.26	1.03 ± 0.27	1.09 ± 0.19	16.62 ± 1.75	2175.20 ± 179.32	94.60 ± 7.99	521.91 ± 43.13	48.74 ± 4.26	549.29 ± 45.41	15.99 ± 1.42
2-ethyl-1-methylnaphthalene	0.07 ± 0.07	0.00 ± 0.19	2.15 ± 0.30	0.04 ± 0.10	0.03 ± 0.14	0.00 ± 0.08	0.55 ± 0.50	106.39 ± 12.82	5.72 ± 0.93	28.42 ± 3.53	4.02 ± 0.77	25.39 ± 3.19	0.71 ± 0.22
E-trimethylnaphthalene	1.59 ± 0.19	1.06 ± 0.35	1.81 ± 0.22	1.35 ± 0.22	0.64 ± 0.25	0.67 ± 0.16	7.90 ± 1.14	1086.34 ± 87.45	50.02 ± 4.22	270.10 ± 21.84	25.53 ± 2.35	312.17 ± 25.23	9.80 ± 0.90
F-trimethylnaphthalene	0.88 ± 0.11	0.89 ± 0.22	1.30 ± 0.15	0.89 ± 0.14	0.65 ± 0.15	0.55 ± 0.10	5.19 ± 0.67	1325.33 ± 103.59	44.36 ± 3.58	273.23 ± 21.42	23.73 ± 2.00	282.00 ± 22.11	6.51 ± 0.59
2,3,5+I-trimethylnaphthalene	1.64 ± 0.30	1.17 ± 0.45	3.13 ± 0.52	1.73 ± 0.36	0.78 ± 0.32	0.60 ± 0.20	8.68 ± 1.78	1374.98 ± 201.59	49.34 ± 7.52	304.76 ± 44.87	25.89 ± 4.16	302.81 ± 44.61	9.18 ± 1.48

Appendix B1. Chemical Composition of Dilution Blanks and Vehicle Exhaust Samples from Round1

Species Description	S0-1	S0-2	S0-3	S0-4	S0-5	S0-6	S1-1	S1-2	S2-1	S2-2	S2-3	S2-4	S3-1
2,4,5-trimethylnaphthalene	0.41 ± 0.08	0.35 ± 0.20	0.46 ± 0.10	0.30 ± 0.11	0.22 ± 0.14	0.16 ± 0.09	1.16 ± 0.53	481.76 ± 41.74	17.09 ± 1.63	98.41 ± 8.59	6.04 ± 0.79	89.63 ± 7.84	2.09 ± 0.29
J-trimethylnaphthalene	0.00 ± 0.08	0.47 ± 0.25	0.05 ± 0.10	0.09 ± 0.12	0.19 ± 0.17	0.23 ± 0.11	3.84 ± 0.86	202.90 ± 28.12	14.37 ± 2.19	72.46 ± 10.12	6.37 ± 1.17	86.92 ± 12.14	0.29 ± 0.23
1,4,5-trimethylnaphthalene	0.83 ± 0.07	0.27 ± 0.11	0.66 ± 0.07	0.52 ± 0.07	0.01 ± 0.07	0.01 ± 0.04	1.88 ± 0.26	241.81 ± 13.86	12.55 ± 0.77	71.36 ± 4.10	8.26 ± 0.55	56.66 ± 3.27	2.25 ± 0.18
Acenaphthylene	0.28 ± 0.17	1.73 ± 0.54	1.40 ± 0.26	1.41 ± 0.30	0.95 ± 0.37	2.16 ± 0.30	147.18 ± 10.78	70.56 ± 5.28	231.10 ± 16.86	592.56 ± 43.05	443.68 ± 32.26	834.99 ± 60.63	34.41 ± 2.75
Acenaphthene	3.23 ± 0.34	0.05 ± 0.55	0.33 ± 0.24	0.25 ± 0.30	0.01 ± 0.39	0.46 ± 0.24	57.53 ± 4.57	87.11 ± 6.70	30.66 ± 2.83	195.72 ± 14.44	41.65 ± 3.55	292.04 ± 21.42	6.99 ± 0.82
Fluorene	1.06 ± 0.26	0.17 ± 0.62	2.35 ± 0.41	0.69 ± 0.35	0.41 ± 0.45	0.81 ± 0.29	35.69 ± 4.62	514.66 ± 58.92	82.27 ± 9.78	504.84 ± 57.78	109.53 ± 12.85	429.36 ± 49.21	19.65 ± 2.41
Dibenzothiophene	0.37 ± 0.07	0.36 ± 0.14	0.47 ± 0.08	0.35 ± 0.08	0.16 ± 0.10	0.15 ± 0.06	1.03 ± 0.33	3.34 ± 0.51	4.90 ± 0.62	10.22 ± 1.10	8.47 ± 0.94	12.76 ± 1.36	3.09 ± 0.37
Phenanthrene	3.19 ± 0.25	4.63 ± 0.66	5.72 ± 0.35	5.60 ± 0.40	3.83 ± 0.48	4.61 ± 0.32	94.47 ± 3.87	1074.76 ± 37.94	145.91 ± 5.58	661.48 ± 23.44	281.34 ± 10.20	660.84 ± 23.46	58.37 ± 2.20
Anthracene	0.00 ± 0.04	0.13 ± 0.12	0.00 ± 0.05	0.03 ± 0.06	0.25 ± 0.09	0.30 ± 0.06	9.54 ± 1.03	373.63 ± 37.72	28.61 ± 2.93	181.91 ± 18.38	47.82 ± 4.87	136.44 ± 13.80	1.65 ± 0.22
A-methylfluorene	0.87 ± 0.12	0.77 ± 0.26	0.61 ± 0.12	1.21 ± 0.17	0.86 ± 0.20	0.83 ± 0.13	12.97 ± 1.23	523.22 ± 39.37	49.86 ± 3.89	296.78 ± 22.37	31.85 ± 2.57	150.68 ± 11.43	8.67 ± 0.74
1-methylfluorene	0.82 ± 0.14	0.69 ± 0.23	1.22 ± 0.20	1.04 ± 0.19	0.74 ± 0.19	0.59 ± 0.13	15.75 ± 2.18	213.44 ± 27.33	34.94 ± 4.60	174.93 ± 22.42	26.53 ± 3.54	94.65 ± 12.21	8.06 ± 1.11
B-methylfluorene	0.17 ± 0.05	0.18 ± 0.13	0.05 ± 0.05	0.25 ± 0.09	0.22 ± 0.10	0.17 ± 0.07	2.37 ± 0.52	22.12 ± 3.90	13.13 ± 2.34	74.64 ± 12.97	9.87 ± 1.78	35.26 ± 6.17	1.97 ± 0.40
9-fluorenone	0.06 ± 0.05	0.13 ± 0.13	0.24 ± 0.07	0.73 ± 0.11	0.26 ± 0.10	0.08 ± 0.06	9.59 ± 1.05	62.66 ± 6.26	11.94 ± 1.27	85.28 ± 8.48	6.57 ± 0.77	25.07 ± 2.56	10.85 ± 1.12
Xanthone	0.03 ± 0.08	0.00 ± 0.20	0.14 ± 0.12	0.27 ± 0.17	0.01 ± 0.15	0.02 ± 0.09	0.00 ± 0.52	6.25 ± 2.37	0.00 ± 0.54	1.87 ± 1.00	0.00 ± 0.55	0.00 ± 0.54	0.05 ± 0.21
Acenaphthenequinone	0.18 ± 0.07	0.00 ± 0.12	0.28 ± 0.10	0.45 ± 0.15	0.16 ± 0.12	0.02 ± 0.06	0.68 ± 0.39	16.69 ± 4.45	0.19 ± 0.32	8.25 ± 2.27	1.11 ± 0.49	9.27 ± 2.54	0.76 ± 0.27
Perinaphthenone	0.05 ± 0.10	0.00 ± 0.28	0.27 ± 0.15	0.26 ± 0.17	0.50 ± 0.25	0.29 ± 0.16	1.71 ± 0.93	5.43 ± 1.63	1.83 ± 0.98	4.44 ± 1.40	1.49 ± 0.95	6.59 ± 1.87	0.08 ± 0.27
2-methylanthracene	0.36 ± 0.09	0.66 ± 0.19	1.70 ± 0.34	1.53 ± 0.31	0.49 ± 0.13	0.50 ± 0.12	3.57 ± 0.73	89.95 ± 16.61	20.52 ± 3.84	134.83 ± 24.86	11.65 ± 2.21	38.87 ± 7.22	4.42 ± 0.86
3-methylphenanthrene	0.66 ± 0.07	1.03 ± 0.16	1.19 ± 0.10	1.33 ± 0.12	0.96 ± 0.12	0.87 ± 0.08	8.94 ± 0.65	260.33 ± 15.57	33.02 ± 2.04	153.84 ± 9.22	25.86 ± 1.62	79.91 ± 4.82	8.02 ± 0.54
2-methylphenanthrene	0.81 ± 0.10	1.26 ± 0.23	1.50 ± 0.16	1.64 ± 0.18	1.19 ± 0.18	1.09 ± 0.13	10.38 ± 1.02	264.64 ± 21.52	37.29 ± 3.15	157.03 ± 12.81	31.23 ± 2.67	85.02 ± 7.01	9.29 ± 0.82
9-methylphenanthrene	0.43 ± 0.10	0.65 ± 0.20	0.69 ± 0.15	0.65 ± 0.15	0.49 ± 0.14	0.50 ± 0.11	3.81 ± 0.76	189.08 ± 31.14	22.22 ± 3.75	125.26 ± 20.66	17.38 ± 2.96	65.07 ± 10.79	3.40 ± 0.62
1-methylphenanthrene	0.38 ± 0.09	0.55 ± 0.19	0.66 ± 0.14	0.97 ± 0.19	0.48 ± 0.14	0.50 ± 0.11	4.70 ± 0.88	96.51 ± 14.99	17.55 ± 2.83	64.91 ± 10.11	13.57 ± 2.23	33.78 ± 5.34	3.85 ± 0.67
Anthrone	0.19 ± 0.08	0.08 ± 0.11	0.20 ± 0.09	0.18 ± 0.09	0.06 ± 0.08	0.00 ± 0.04	0.00 ± 0.19	13.08 ± 4.02	0.35 ± 0.25	4.85 ± 1.53	1.77 ± 0.62	3.30 ± 1.08	0.08 ± 0.10
Anthraquinone	0.00 ± 0.04	0.09 ± 0.13	0.04 ± 0.06	0.08 ± 0.07	0.50 ± 0.17	0.31 ± 0.10	0.00 ± 0.28	0.03 ± 0.32	0.00 ± 0.29	0.25 ± 0.32	0.00 ± 0.29	0.00 ± 0.32	0.00 ± 0.11
3,6-dimethylphenanthrene	0.38 ± 0.32	1.05 ± 0.93	0.58 ± 0.40	0.34 ± 0.49	0.80 ± 0.67	0.00 ± 0.38	0.00 ± 2.47	38.48 ± 5.21	3.06 ± 2.67	21.41 ± 3.64	2.33 ± 2.68	14.05 ± 3.37	0.75 ± 0.86
A-dimethylphenanthrene	0.14 ± 0.05	0.47 ± 0.16	0.32 ± 0.09	0.38 ± 0.11	0.33 ± 0.10	0.27 ± 0.08	1.30 ± 0.34	57.99 ± 11.98	7.50 ± 1.60	31.61 ± 6.54	4.62 ± 1.00	15.93 ± 3.33	1.44 ± 0.34
B-dimethylphenanthrene	0.09 ± 0.03	0.30 ± 0.08	0.17 ± 0.04	0.21 ± 0.05	0.18 ± 0.06	0.16 ± 0.04	0.87 ± 0.14	28.12 ± 1.83	3.54 ± 0.27	14.42 ± 0.95	2.26 ± 0.21	7.45 ± 0.51	0.81 ± 0.10
C-dimethylphenanthrene	0.33 ± 0.05	0.93 ± 0.14	0.58 ± 0.07	0.74 ± 0.09	0.50 ± 0.08	0.45 ± 0.06	1.70 ± 0.24	98.17 ± 8.16	14.00 ± 1.21	59.41 ± 4.95	7.66 ± 0.69	30.94 ± 2.60	2.17 ± 0.23
D-dimethylphenanthrene	0.10 ± 0.03	0.29 ± 0.10	0.19 ± 0.05	0.27 ± 0.06	0.17 ± 0.06	0.14 ± 0.04	0.60 ± 0.16	18.27 ± 2.61	3.01 ± 0.46	9.93 ± 1.43	2.16 ± 0.35	5.70 ± 0.83	0.68 ± 0.14
1,7-dimethylphenanthrene	0.16 ± 0.04	0.52 ± 0.11	0.34 ± 0.05	0.40 ± 0.07	0.30 ± 0.07	0.28 ± 0.05	1.18 ± 0.18	65.31 ± 6.37	8.69 ± 0.87	42.11 ± 4.11	4.80 ± 0.51	20.09 ± 1.98	1.19 ± 0.16
E-dimethylphenanthrene	0.10 ± 0.04	0.40 ± 0.13	0.24 ± 0.07	0.25 ± 0.07	0.22 ± 0.08	0.19 ± 0.06	0.62 ± 0.19	35.47 ± 6.88	4.37 ± 0.88	19.42 ± 3.78	2.84 ± 0.59	10.46 ± 2.05	0.76 ± 0.19
9-methylanthracene	0.32 ± 0.11	0.06 ± 0.17	0.49 ± 0.15	1.13 ± 0.30	0.00 ± 0.12	0.05 ± 0.08	0.21 ± 0.45	6.53 ± 1.65	1.75 ± 0.65	10.12 ± 2.45	0.98 ± 0.55	3.08 ± 0.93	0.73 ± 0.27
Fluoranthene	0.77 ± 0.18	6.11 ± 0.64	2.05 ± 0.25	2.41 ± 0.31	1.88 ± 0.38	2.57 ± 0.27	18.31 ± 1.69	277.25 ± 14.80	26.31 ± 2.03	111.82 ± 6.15	71.84 ± 4.13	182.01 ± 9.82	5.91 ± 0.61
Pyrene	0.89 ± 0.27	12.31 ± 1.57	2.69 ± 0.44	2.84 ± 0.51	2.40 ± 0.59	3.72 ± 0.52	19.66 ± 2.97	450.29 ± 47.23	24.33 ± 3.43	140.35 ± 15.00	62.84 ± 7.10	272.01 ± 28.71	5.89 ± 0.98
9-Anthraaldehyde	0.00 ± 0.03	0.01 ± 0.08	0.17 ± 0.06	0.03 ± 0.04	0.03 ± 0.06	0.03 ± 0.04	0.00 ± 0.14	5.43 ± 1.20	1.21 ± 0.34	7.44 ± 1.61	0.54 ± 0.23	1.95 ± 0.50	0.03 ± 0.08
Retene	0.00 ± 0.04	0.00 ± 0.11	0.00 ± 0.05	0.01 ± 0.06	0.00 ± 0.08	0.00 ± 0.05	0.01 ± 0.18	0.15 ± 0.20	0.01 ± 0.19	0.02 ± 0.18	0.00 ± 0.19	0.02 ± 0.20	0.00 ± 0.10
Benzonaphthothiophene	0.02 ± 0.05	0.10 ± 0.16	0.07 ± 0.07	0.07 ± 0.08	0.05 ± 0.11	0.06 ± 0.07	0.03 ± 0.25	0.70 ± 0.31	0.18 ± 0.27	0.43 ± 0.28	0.40 ± 0.29	0.43 ± 0.31	0.02 ± 0.14
1+3-methylfluoranthene	0.06 ± 0.04	0.25 ± 0.13	0.07 ± 0.04	0.15 ± 0.07	0.18 ± 0.09	0.31 ± 0.11	0.32 ± 0.18	26.55 ± 7.96	4.70 ± 1.45	13.32 ± 4.01	1.73 ± 0.57	8.01 ± 2.43	0.23 ± 0.12
1-MeFl+C-MeFl/Py	0.16 ± 0.04	0.71 ± 0.13	0.28 ± 0.05	0.45 ± 0.07	0.52 ± 0.09	0.37 ± 0.06	0.84 ± 0.17	16.94 ± 1.83	3.01 ± 0.36	9.82 ± 1.07	3.28 ± 0.39	5.92 ± 0.67	0.15 ± 0.08
B-MePy/MeFl	0.05 ± 0.04	0.83 ± 0.22	0.37 ± 0.10	0.43 ± 0.11	0.39 ± 0.12	0.43 ± 0.10	0.80 ± 0.33	26.43 ± 4.73	4.49 ± 0.89	13.22 ± 2.40	3.91 ± 0.79	7.93 ± 1.49	0.37 ± 0.15
C-MePy/MeFl	0.02 ± 0.03	0.73 ± 0.13	0.29 ± 0.05	0.38 ± 0.06	0.38 ± 0.07	0.39 ± 0.06	0.61 ± 0.17	22.17 ± 2.22	3.73 ± 0.42	10.60 ± 1.09	3.49 ± 0.39	6.85 ± 0.72	0.30 ± 0.09
D-MePy/MeFl	0.09 ± 0.03	0.69 ± 0.10	0.34 ± 0.04	0.40 ± 0.05	0.35 ± 0.06	0.38 ± 0.04	0.41 ± 0.17	13.82 ± 0.62	2.05 ± 0.20	7.30 ± 0.36	2.29 ± 0.20	5.47 ± 0.31	0.32 ± 0.08
4-methylpyrene	0.11 ± 0.04	0.72 ± 0.19	0.34 ± 0.08	0.38 ± 0.09	0.28 ± 0.09	0.31 ± 0.08	0.37 ± 0.19	12.71 ± 2.30	1.78 ± 0.40	5.96 ± 1.11	1.70 ± 0.38	6.88 ± 1.27	0.31 ± 0.12
1-methylpyrene	0.00 ± 0.05	0.92 ± 0.50	0.52 ± 0.26	0.67 ± 0.33	0.75 ± 0.39	0.26 ± 0.15	0.02 ± 0.41	11.26 ± 4.99	0.49 ± 0.55	3.14 ± 1.54	1.36 ± 0.84	3.89 ± 1.88	1.11 ± 0.57
Benzo(c)phenanthrene	0.02 ± 0.03	0.51 ± 0.12	0.24 ± 0.05	0.38 ± 0.08	0.28 ± 0.07	0.29 ± 0.06	0.11 ± 0.13	5.79 ± 0.82	0.71 ± 0.19	2.57 ± 0.40	2.04 ± 0.33	3.36 ± 0.51	0.09 ± 0.08
Benzo(ghi)fluoranthene	0.37 ± 0.36	11.70 ± 2.10	3.08 ± 0.67	3.40 ± 0.78	3.82 ± 0.96	4.91 ± 0.87	2.90 ± 2.92	109.92 ± 16.62	5.76 ± 3.20	27.54 ± 5.22	21.68 ± 4.60	79.87 ± 12.39	0.94 ± 1.00
Cyclopenta(c,d)pyrene	0.00 ± 0.04	0.59 ± 0.21	0.25 ± 0.09	0.29 ± 0.10	0.31 ± 0.13	0.31 ± 0.10	2.02 ± 0.60	128.03 ± 26.34	3.94 ± 0.98	27.42 ± 5.74	11.99 ± 2.60	50.35 ± 10.45	0.01 ± 0.12
Benz(a)anthracene	0.10 ± 0.08	0.86 ± 0.31	0.85 ± 0.19	0.81 ± 0.20	0.86 ± 0.24	0.88 ± 0.19	0.89 ± 0.46	24.18 ± 4.09	3.54 ± 0.79	12.29 ± 2.14	8.57 ± 1.55	10.58 ± 1.89	0.25 ± 0.23
Triphenylene	0.13 ± 0.04	0.31 ± 0.10	0.61 ± 0.11	0.54 ± 0.11	0.96 ± 0.17	0.99 ± 0.16	0.28 ± 0.15	9.81 ± 1.56	1.23 ± 0.26	4.75 ± 0.78	4.92 ± 0.81	5.42 ± 0.89	0.11 ± 0.08
Chrysene	0.09 ± 0.05	1.06 ± 0.21	0.67 ± 0.11	0.92 ± 0.14	0.81 ± 0.15	1.15 ± 0.15	0.31 ± 0.25	9.61 ± 1.23	1.14 ± 0.31	4.88 ± 0.68	4.77 ± 0.67	4.59 ± 0.67	0.37 ± 0.13
Benzanthrone	0.10 ± 0.03	0.58 ± 0.10	0.55 ± 0.07	0.96 ± 0.11	1.04 ± 0.13	0.94 ± 0.11	0.00 ± 0.13	0.00 ± 0.14	0.00 ± 0.13	0.00 ± 0.13	0.00 ± 0.13	0.00 ± 0.14	0.34 ± 0.09
7-methylbenz(a)anthracene	0.00 ± 0.03	0.00 ± 0.08	0.00 ± 0.04	0.02 ± 0.05	0.01 ± 0.06	0.00 ± 0.04	0.00 ± 0.15	0.29 ± 0.22	0.00 ± 0.16	0.30 ± 0.21	0.00 ± 0.16	0.00 ± 0.17	0.00 ± 0.08
3-methylchrysene	0.01 ± 0.03	0.08 ± 0.08	0.14 ± 0.04	0.15 ± 0.05	0.11 ± 0.06	0.10 ± 0.04	0.15 ± 0.13	4.96 ± 0.72	1.15 ± 0.21	3.44 ± 0.51	1.36 ± 0.24	1.63 ± 0.27	0.05 ± 0.07
Benz(a)anthracene-7,12-dione	0.04 ± 0.03	0.19 ± 0.08	0.00 ± 0.03	0.31 ± 0.05	0.45 ± 0.06	0.30 ± 0.04	0.14 ± 0.13	4.99 ± 0.30	0.19 ± 0.13	2.35 ± 0.18	0.00 ± 0.13	1.12 ± 0.16	0.24 ± 0.08
5+6-methylchrysene	0.00 ± 0.03	0.03 ± 0.09	0.00 ± 0.04	0.07 ± 0.06	0.07 ± 0.08	0.00 ± 0.03	0.00 ± 0.13	1.06 ± 0.57	0.12 ± 0.19	0.77 ± 0.43	0.11 ± 0.18	0.18 ± 0.21	0.00 ± 0.07
Benzo(b+j+k)fluoranthene	1.34 ± 0.43	0.74 ± 1.09	1.82 ± 0.54	1.95 ± 0.65	1.03 ± 0.80	0.30 ± 0.46	1.17 ± 2.96	71.70 ± 9.35	5.92 ± 3.28	24.79 ± 4.51	21.83 ± 4.34	134.84 ± 16.38	1.22 ± 1.04
Benzo(a)fluoranthene	0.00 ± 0.03	0.00 ± 0.08	0.02 ± 0.04	0.00 ± 0.04	0.00 ± 0.06	0.00 ± 0.03	0.62 ± 0.24	3.04 ± 0.87	0.57 ± 0.23	2.32 ± 0.67	1.65 ± 0.50	1.13 ± 0.37	0.09 ± 0.08
BeP	0.00 ± 0.04	0.18 ± 0.12	0.27 ± 0.06	0.22 ± 0.07	0.48 ± 0.10	0.38 ± 0.07	0.82 ± 0.28	48.73 ± 5.55	2.65 ± 0.45	15.91 ± 1.89	7.86 ± 1.00	26.32 ± 3.05	0.33 ± 0.12
BaP	0.00 ± 0.08	0.52 ± 0.29	0.01 ± 0.11	0.01 ± 0.13	0.09 ± 0.18	0.07 ± 0.11	0.93 ± 0.49	40.15 ± 7.54	3.77 ± 0.90	11.11 ± 2.19	7.76 ± 1.59	21.20 ± 4.05	0.12 ± 0.24
Perylene	0.01 ± 0.03	0.00 ± 0.08	0.02 ± 0.04	0.09 ± 0.07	0.09 ± 0.08	0.02 ± 0.04	0.00 ± 0.13	10.82 ± 4.31	0.74 ± 0.39	3.07 ± 1.29	1.70 ± 0.77	14.71 ± 5.84	0.00 ± 0.07
7-methylbenzo(a)pyrene	0.45 ± 0.36	0.00 ± 0.95	0.32 ± 0.43	0.20 ± 0.52	0.00 ± 0.68	0.00 ± 0.41	5.95 ± 3.05	14.61 ± 4.39	4.82 ± 3.08	12.19 ± 3.90	4.52 ± 3.08	60.02 ± 12.58	1.55 ± 1.00
9,10-dihydrobenzo(a)pyrene-7(8H)-one	0.02 ± 0.03	0.09 ± 0.10	0.00 ± 0.03	0.00 ± 0.04	0.07 ± 0.07	0.00 ± 0.03	0.00 ± 0.13	0.07 ± 0.16	0.00 ± 0.13	0.05 ± 0.14	0.00 ± 0.14	0.89 ± 0.46	0.03 ± 0.08
Dibenzo(a,j)anthracene	0.00 ± 0.03	0.02 ± 0.08	0.00 ± 0.03	0.00 ± 0.04	0.01 ± 0.06	0.01 ± 0.03	0.00 ± 0.13	1.93 ± 0.22	0.00 ± 0.13	0.68 ± 0.15	0.18 ± 0.13	0.38 ± 0.15	0.02 ± 0.07
Indeno[123-cd]pyrene	0.00 ± 0.03	0.12 ± 0.10	0.04 ± 0.04	0.00 ± 0.04	0.00 ± 0.06	0.04 ± 0.04	0.76 ± 0.28	52.25 ± 9.83	2.46 ± 0.58	13.36 ± 2.60	3.10 ± 0.70	28.45 ± 5.42	0.24 ± 0.10
Dibenzo(ah+ac)anthracene	0.00 ± 0.03	0.19 ± 0.11	0.10 ± 0.06	0.06 ± 0.05	0.03 ± 0.07	0.00 ± 0.03	0.07 ± 0.16	4.57 ± 1.23	0.00 ± 0.15	1.44 ± 0.46	2.12 ± 0.62	0.25 ± 0.21	0.15 ± 0.09
Benzo(b)chrysene	0.02 ± 0.03	0.08 ± 0.08	0.00 ± 0.03	0.01 ± 0.04	0.00 ± 0.06	0.00 ± 0.03	0.00 ± 0.13	1.68 ± 0.15	0.07 ± 0.13	0.57 ± 0.13	0.59 ± 0.13	0.40 ± 0.14	0.08 ± 0.07
Picene	0.00 ± 0.03	0.00 ± 0.08	0.00 ± 0.03	0.01 ± 0.05	0.00 ± 0.06	0.00 ± 0.03	0.00 ± 0.13	3.07 ± 1.21	0.00 ± 0.14	0.87 ± 0.43	0.27 ± 0.24	0.71 ± 0.39	0.07 ± 0.09
Benzo(ghi)perylene	0.00 ± 0.14	0.00 ± 0.40	0.00 ± 0.17	0.00 ± 0.21	0.19 ± 0.29	0.11 ± 0.17	7.54 ± 1.43	224.69 ± 27.28	8.47 ± 1.55	69.89 ± 8.66	20.59 ± 2.85	147.95 ± 18.06	0.91 ± 0.42
Anthanthrene	0.00 ± 0.03	0.03 ± 0.08	0.00 ± 0.03	0.00 ± 0.04	0.00 ± 0.06	0.00 ± 0.03	0.26 ± 0.15	20.83 ± 3.97	0.75 ± 0.21	7.49 ± 1.45	1.58 ± 0.35	12.75 ± 2.44	0.00 ± 0.07
Dibenzo(b,k)fluoranthene	0.06 ± 0.08	0.00 ± 0.12	0.62 ± 0.28	0.19 ± 0.15	0.28 ± 0.21	0.00 ± 0.05	0.00 ± 0.36	5.76 ± 2.46	0.00 ± 0.41	1.28 ± 0.86	0.00 ± 0.32	0.18 ± 0.54	0.00 ± 0.15
Dibenzo(a,e)pyrene	0.00 ± 0.03	0.05 ± 0.08	0.00 ± 0.03	0.00 ± 0.04	0.01 ± 0.06	0.00 ± 0.03	0.00 ± 0.13	5.83 ± 1.24	0.17 ± 0.14	1.87 ± 0.43	0.20 ± 0.14	4.38 ± 0.94	0.00 ± 0.07
Coronene	0.00 ± 0.03	0.04 ± 0.10	0.00 ± 0.04	0.00 ± 0.05	0.00 ± 0.07	0.03 ± 0.04	3.77 ± 0.68	96.48 ± 16.07	2.16 ± 0.44	29.78 ± 4.98	7.24 ± 1.24	78.50 ± 13.08	0.28 ± 0.11
Dibenzo(a,h)pyrene	0.00 ± 0.03	0.00 ± 0.08	0.00 ± 0.03	0.00 ± 0.04	0.00 ± 0.06	0.00 ± 0.03	0.00 ± 0.13	0.89 ± 0.25	0.00 ± 0.13	0.03 ± 0.13	0.03 ± 0.13	2.09 ± 0.51	0.02 ± 0.07
nitro-PAH (ug/mile)													
1-nitronaphthalene	0.0000 ± 0.0015	0.0033 ± 0.0045	0.0000 ± 0.0019	0.0000 ± 0.0024	0.0000 ± 0.0032	0.0000 ± 0.0019	0.1327 ± 0.0188	0.5163 ± 0.0348	0.0952 ± 0.0188	0.1487 ± 0.0197	0.0567 ± 0.0183	0.2111 ± 0.0232	0.0062 ± 0.0043
2-nitronaphthalene	0.0000 ± 0.0027	0.0016 ± 0.0078	0.0000 ± 0.0034	0.0000 ± 0.0042	0.0000 ± 0.0056	0.0000 ± 0.0033	0.3245 ± 0.0380	0.5477 ± 0.0570	0.1991 ± 0.0303	0.1881 ± 0.0292	0.0705 ± 0.0242	0.5949 ± 0.0614	0.0353 ± 0.0081
2-nitrobiphenyl	0.0000 ± 0.0007	0.0000 ± 0.0021	0.0000 ± 0.0009	0.0000 ± 0.0011	0.0000 ± 0.0015	0.0000 ± 0.0009	0.0625 ± 0.0089	0.1343 ± 0.0125	0.0222 ± 0.0082	0.0876 ± 0.0100	0.0000 ± 0.0080	0.0644 ± 0.0099	0.0000 ± 0.0020
3-nitrobiphenyl	0.0000 ± 0.0007	0.0000 ± 0.0021	0.0000 ± 0.0009	0.0000 ± 0.0011	0.0000 ± 0.0015	0.0000 ± 0.0009	0.0000 ± 0.0072	0.0215 ± 0.0136	0.0000 ± 0.0077	0.0393 ± 0.0188	0.0301 ± 0.0160	0.0491 ± 0.0227	0.0000 ± 0.0020
4-nitrobiphenyl	0.0000 ± 0.0020	0.0000 ± 0.0059	0.0000 ± 0.0025	0.0000 ± 0.0032	0.0000 ± 0.0043	0.0000 ± 0.0025	0.0000 ± 0.0245	0.0000 ± 0.0270	0.0000 ± 0.0259	0.0000 ± 0.0253	0.0282 ± 0.0263	0.0000 ± 0.0281	0.0000 ± 0.0056
2-nitrofluorene	0.0000 ± 0.0010	0.0052 ± 0.0030	0.0000 ± 0.0013	0.0000 ± 0.0016	0.0000 ± 0.0021	0.0001 ± 0.0013	0.0000 ± 0.0143	0.0000 ± 0.0158	0.0000 ± 0.0151	0.0000 ± 0.0148	0.0000 ± 0.0153	0.0000 ± 0.0164	0.0013 ± 0.0028
1,3-dinitronaphthalene	0.0000 ± 0.0476	0.0000 ± 0.1401	0.0000 ± 0.0599	0.0000 ± 0.0744	0.0000 ± 0.1004	0.0000 ± 0.0594	0.0000 ± 0.3734	0.0000 ± 0.4117	0.0000 ± 0.3939	0.0000 ± 0.3858	0.0000 ± 0.3975	0.0000 ± 0.4275	0.0000 ± 0.1317

Appendix B1. Chemical Composition of Dilution Blanks and Vehicle Exhaust Samples from Round1

Species Description	S0-1	S0-2	S0-3	S0-4	S0-5	S0-6	S1-1	S1-2	S2-1	S2-2	S2-3	S2-4	S3-1
1,5-dinitronaphthalene	0.0000 ± 0.0019	0.0000 ± 0.0056	0.0000 ± 0.0024	0.0000 ± 0.0030	0.0000 ± 0.0040	0.0000 ± 0.0024	0.0000 ± 0.0276	0.0000 ± 0.0306	0.0000 ± 0.0294	0.0000 ± 0.0285	0.0000 ± 0.0293	0.0000 ± 0.0316	0.0000 ± 0.0053
5-nitroacenaphthene	0.0000 ± 0.0007	0.0008 ± 0.0022	0.0000 ± 0.0009	0.0000 ± 0.0011	0.0000 ± 0.0016	0.0000 ± 0.0009	0.0000 ± 0.0086	0.0044 ± 0.0103	0.0000 ± 0.0091	0.0112 ± 0.0107	0.0000 ± 0.0091	0.0000 ± 0.0098	0.0000 ± 0.0020
9-nitroanthracene	0.0000 ± 0.0011	0.0082 ± 0.0032	0.0005 ± 0.0013	0.0000 ± 0.0017	0.0000 ± 0.0023	0.0002 ± 0.0013	0.0000 ± 0.0166	0.0000 ± 0.0183	0.0000 ± 0.0175	0.0000 ± 0.0172	0.0000 ± 0.0177	0.0000 ± 0.0190	0.0000 ± 0.0030
4-nitrophenanthrene	0.0000 ± 0.0013	0.0000 ± 0.0040	0.0000 ± 0.0017	0.0000 ± 0.0021	0.0000 ± 0.0028	0.0000 ± 0.0017	0.0000 ± 0.0205	0.0000 ± 0.0226	0.0000 ± 0.0216	0.0000 ± 0.0211	0.0000 ± 0.0218	0.0000 ± 0.0234	0.0000 ± 0.0037
9-nitrophenanthrene	0.0000 ± 0.0041	0.0005 ± 0.0121	0.0000 ± 0.0052	0.0000 ± 0.0064	0.0000 ± 0.0087	0.0000 ± 0.0051	0.0000 ± 0.0575	0.0000 ± 0.0634	0.0000 ± 0.0607	0.0000 ± 0.0594	0.0000 ± 0.0612	0.0000 ± 0.0658	0.0000 ± 0.0114
1,8-dinitronaphthalene	0.0000 ± 0.0012	0.0000 ± 0.0036	0.0000 ± 0.0016	0.0000 ± 0.0019	0.0000 ± 0.0026	0.0000 ± 0.0015	0.0000 ± 0.0141	0.0037 ± 0.0161	0.0000 ± 0.0150	0.0078 ± 0.0154	0.0044 ± 0.0156	0.0175 ± 0.0180	0.0000 ± 0.0034
2-nitrofluoranthene	0.0000 ± 0.0074	0.0019 ± 0.0220	0.0000 ± 0.0093	0.0000 ± 0.0116	0.0000 ± 0.0156	0.0000 ± 0.0092	0.0000 ± 0.0657	0.3450 ± 0.1281	0.0652 ± 0.0752	0.3308 ± 0.1217	0.2176 ± 0.0997	0.0000 ± 0.0742	0.0192 ± 0.0217
3-nitrofluoranthene	0.0000 ± 0.0032	0.0000 ± 0.0095	0.0000 ± 0.0040	0.0000 ± 0.0050	0.0000 ± 0.0068	0.0000 ± 0.0040	0.0000 ± 0.0314	0.1253 ± 0.0431	0.0847 ± 0.0380	0.2431 ± 0.0552	0.0306 ± 0.0348	0.0000 ± 0.0358	0.0034 ± 0.0090
1-nitropyrene	0.0000 ± 0.0019	0.0037 ± 0.0059	0.0006 ± 0.0025	0.0006 ± 0.0031	0.0013 ± 0.0041	0.0000 ± 0.0024	0.0352 ± 0.0244	0.4615 ± 0.1154	0.3999 ± 0.1010	0.5870 ± 0.1434	0.3262 ± 0.0845	0.2532 ± 0.0692	0.0016 ± 0.0054
7-nitrobenzo(a)anthracene	0.0000 ± 0.0003	0.0004 ± 0.0009	0.0000 ± 0.0004	0.0000 ± 0.0005	0.0002 ± 0.0007	0.0000 ± 0.0004	0.0000 ± 0.0029	0.0000 ± 0.0032	0.0000 ± 0.0031	0.0000 ± 0.0030	0.0255 ± 0.0034	0.0000 ± 0.0033	0.0001 ± 0.0009
6-nitrochrysene	0.0000 ± 0.0005	0.0000 ± 0.0016	0.0000 ± 0.0007	0.0000 ± 0.0008	0.0000 ± 0.0011	0.0000 ± 0.0007	0.0000 ± 0.0056	0.0000 ± 0.0062	0.0000 ± 0.0059	0.0000 ± 0.0058	0.0000 ± 0.0060	0.0000 ± 0.0064	0.0000 ± 0.0015
6-nitrobenz[a]pyrene	0.0000 ± 0.0026	0.0000 ± 0.0076	0.0000 ± 0.0032	0.0000 ± 0.0040	0.0000 ± 0.0054	0.0000 ± 0.0032	0.0000 ± 0.0226	0.0000 ± 0.0249	0.0000 ± 0.0238	0.0000 ± 0.0233	0.0000 ± 0.0240	0.0000 ± 0.0258	0.0000 ± 0.0071
Hopanes (ug/mile)													
18a(H),21ß(H)-22,29,30-Trisnorhopane &	0.20 ± 0.05	0.19 ± 0.13	0.28 ± 0.06	0.22 ± 0.07	0.33 ± 0.10	0.40 ± 0.07	0.00 ± 0.27	3.11 ± 0.42	21.48 ± 1.77	1.55 ± 0.32	6.59 ± 0.66	4.77 ± 0.54	0.12 ± 0.13
17a(H),21ß(H)-22,29,30-Trisnorhopane	0.02 ± 0.03	0.02 ± 0.08	0.01 ± 0.03	0.01 ± 0.04	0.01 ± 0.06	0.02 ± 0.03	0.00 ± 0.13	0.16 ± 0.15	1.20 ± 0.29	0.06 ± 0.13	1.56 ± 0.35	0.24 ± 0.15	0.00 ± 0.07
17a(H),21ß(H)-30-Norhopane	0.23 ± 0.06	0.24 ± 0.12	0.33 ± 0.07	0.23 ± 0.07	0.59 ± 0.13	0.66 ± 0.12	0.53 ± 0.27	8.42 ± 1.32	50.53 ± 7.18	2.57 ± 0.51	12.35 ± 1.84	10.87 ± 1.64	0.37 ± 0.13
17a(H),21ß(H)-Hopane	0.10 ± 0.04	0.11 ± 0.12	0.17 ± 0.06	0.08 ± 0.06	0.33 ± 0.10	0.42 ± 0.07	0.00 ± 0.26	5.17 ± 0.73	29.64 ± 3.46	1.37 ± 0.35	10.85 ± 1.34	6.62 ± 0.89	0.22 ± 0.12
17ß(H),21a(H)-hopane	0.00 ± 0.03	0.00 ± 0.08	0.01 ± 0.03	0.00 ± 0.04	0.01 ± 0.06	0.03 ± 0.03	0.00 ± 0.13	0.76 ± 0.15	4.71 ± 0.39	0.12 ± 0.13	0.22 ± 0.13	1.13 ± 0.17	0.00 ± 0.07
22S-17a(H),21ß(H)-30-Homohopane	0.06 ± 0.03	0.09 ± 0.09	0.09 ± 0.04	0.06 ± 0.05	0.20 ± 0.07	0.17 ± 0.04	0.04 ± 0.17	2.49 ± 0.26	14.34 ± 0.97	0.64 ± 0.19	3.50 ± 0.30	3.02 ± 0.29	0.00 ± 0.08
22R-17a(H),21ß(H)-30-Homohopane	0.03 ± 0.03	0.00 ± 0.08	0.07 ± 0.04	0.00 ± 0.04	0.14 ± 0.06	0.12 ± 0.04	0.01 ± 0.15	2.14 ± 0.24	10.67 ± 0.79	0.55 ± 0.16	3.01 ± 0.28	2.58 ± 0.27	0.00 ± 0.08
17ß(H),21ß(H)-Hopane	0.00 ± 0.03	0.00 ± 0.08	0.02 ± 0.03	0.00 ± 0.04	0.07 ± 0.06	0.06 ± 0.03	0.00 ± 0.13	0.84 ± 0.19	5.00 ± 0.67	0.00 ± 0.13	1.60 ± 0.25	0.29 ± 0.15	0.00 ± 0.07
22S-17a(H),21ß(H)-30,31-Bishomohopan	0.02 ± 0.03	0.00 ± 0.08	0.03 ± 0.03	0.03 ± 0.04	0.12 ± 0.06	0.10 ± 0.04	0.79 ± 0.18	6.00 ± 0.81	7.34 ± 0.97	0.34 ± 0.15	2.47 ± 0.37	2.62 ± 0.39	0.02 ± 0.07
22R-17a(H),21ß(H)-30,31-Bishomohopan	0.02 ± 0.03	0.00 ± 0.08	0.04 ± 0.04	0.03 ± 0.04	0.10 ± 0.06	0.07 ± 0.03	0.07 ± 0.13	0.75 ± 0.19	5.97 ± 0.74	0.25 ± 0.15	1.10 ± 0.21	1.07 ± 0.22	0.04 ± 0.07
22S-17a(H),21ß(H)-30,31,32-Trisomohop	0.04 ± 0.03	0.00 ± 0.08	0.00 ± 0.04	0.00 ± 0.04	0.09 ± 0.06	0.06 ± 0.04	0.00 ± 0.15	0.61 ± 0.19	4.44 ± 0.62	0.25 ± 0.16	0.86 ± 0.20	0.76 ± 0.21	0.06 ± 0.08
22R-17a(H),21ß(H)-30,31,32-Trishomoho	0.02 ± 0.03	0.00 ± 0.08	0.00 ± 0.03	0.00 ± 0.04	0.07 ± 0.06	0.05 ± 0.03	0.00 ± 0.13	0.36 ± 0.15	3.01 ± 0.43	0.16 ± 0.13	0.55 ± 0.15	0.58 ± 0.17	0.00 ± 0.07
Steranes (ug/mile)													
C27-20S5a(H),14a(H)-cholestane	0.02 ± 0.03	0.01 ± 0.08	0.02 ± 0.03	0.00 ± 0.04	0.03 ± 0.06	0.10 ± 0.04	0.00 ± 0.13	0.00 ± 0.15	1.95 ± 0.35	0.00 ± 0.14	1.75 ± 0.33	0.52 ± 0.19	0.05 ± 0.07
C27-20R5a(H),14ß(H)-cholestane	0.06 ± 0.03	0.09 ± 0.08	0.09 ± 0.04	0.05 ± 0.04	0.14 ± 0.06	0.17 ± 0.04	0.00 ± 0.13	0.87 ± 0.20	5.79 ± 0.87	0.56 ± 0.17	6.93 ± 1.02	1.78 ± 0.31	0.08 ± 0.07
C27-20S5a(H),14ß(H),17ß(H)-cholestane	0.03 ± 0.03	0.05 ± 0.08	0.02 ± 0.03	0.04 ± 0.04	0.07 ± 0.06	0.12 ± 0.03	0.00 ± 0.13	0.36 ± 0.14	2.99 ± 0.23	0.22 ± 0.13	2.70 ± 0.22	1.01 ± 0.16	0.01 ± 0.07
ster45+40(cholestane)	0.09 ± 0.04	0.04 ± 0.10	0.02 ± 0.04	0.03 ± 0.05	0.18 ± 0.07	0.31 ± 0.06	0.00 ± 0.21	0.83 ± 0.26	6.34 ± 0.80	0.40 ± 0.22	6.06 ± 0.77	1.55 ± 0.32	0.33 ± 0.11
C28-20S5a(H),14a(H),17a(H)-ergostane	0.00 ± 0.03	0.00 ± 0.08	0.00 ± 0.03	0.00 ± 0.04	0.01 ± 0.06	0.03 ± 0.03	0.00 ± 0.13	0.11 ± 0.14	0.75 ± 0.15	0.01 ± 0.13	0.24 ± 0.13	0.20 ± 0.14	0.00 ± 0.07
C28-20R5a(H),14ß(H),17ß(H)-ergostane	0.00 ± 0.03	0.00 ± 0.08	0.00 ± 0.03	0.00 ± 0.04	0.03 ± 0.06	0.07 ± 0.03	0.00 ± 0.13	0.00 ± 0.14	1.06 ± 0.15	0.00 ± 0.13	1.15 ± 0.16	0.00 ± 0.15	0.00 ± 0.07
C28-20S5a(H),14ß(H),17ß(H)-ergostane	0.01 ± 0.03	0.00 ± 0.08	0.01 ± 0.03	0.00 ± 0.04	0.03 ± 0.06	0.08 ± 0.04	0.00 ± 0.13	0.00 ± 0.15	1.94 ± 0.30	0.00 ± 0.13	0.71 ± 0.18	0.44 ± 0.17	0.01 ± 0.07
C28-20R5a(H),14a(H),17a(H)-ergostane	0.01 ± 0.03	0.01 ± 0.08	0.01 ± 0.03	0.00 ± 0.04	0.03 ± 0.06	0.09 ± 0.03	0.00 ± 0.13	0.27 ± 0.14	1.64 ± 0.19	0.05 ± 0.13	1.07 ± 0.16	0.49 ± 0.16	0.01 ± 0.07
C29-20S5a(H),14a(H),17a(H)-stigmastane	0.02 ± 0.03	0.01 ± 0.08	0.03 ± 0.03	0.02 ± 0.04	0.05 ± 0.06	0.08 ± 0.03	0.00 ± 0.13	0.49 ± 0.15	2.30 ± 0.28	0.18 ± 0.13	2.07 ± 0.26	0.73 ± 0.17	0.03 ± 0.07
C29-20R5a(H),14ß(H),17ß(H)-stigmastan	0.02 ± 0.03	0.00 ± 0.08	0.03 ± 0.04	0.04 ± 0.04	0.07 ± 0.06	0.09 ± 0.04	0.00 ± 0.13	0.93 ± 0.30	3.38 ± 0.90	0.22 ± 0.15	3.26 ± 0.85	1.03 ± 0.31	0.02 ± 0.08
C29-20S5a(H),14ß(H),17ß(H)-stigmastan	0.02 ± 0.03	0.00 ± 0.08	0.02 ± 0.03	0.02 ± 0.04	0.06 ± 0.06	0.07 ± 0.03	0.00 ± 0.13	0.52 ± 0.16	2.28 ± 0.35	0.19 ± 0.13	2.30 ± 0.35	0.68 ± 0.18	0.02 ± 0.07
C29-20R5a(H),14a(H),17a(H)-stigmastane	0.02 ± 0.03	0.00 ± 0.08	0.03 ± 0.03	0.02 ± 0.04	0.06 ± 0.06	0.10 ± 0.03	0.00 ± 0.13	0.53 ± 0.15	2.07 ± 0.24	0.11 ± 0.13	2.20 ± 0.24	0.66 ± 0.16	0.02 ± 0.07
Alkanes (ug/mile)													
Dodecane	0.00 ± 1.11	0.00 ± 2.98	0.58 ± 1.52	0.00 ± 1.59	0.00 ± 2.14	0.00 ± 1.40	0.00 ± 8.23	1.16 ± 10.25	0.00 ± 8.63	0.00 ± 9.14	0.00 ± 8.72	22.54 ± 15.58	2.23 ± 3.54
Tridecane	0.52 ± 0.48	0.00 ± 1.26	0.51 ± 0.59	0.00 ± 0.68	0.00 ± 0.91	0.69 ± 0.60	0.00 ± 3.45	1.04 ± 3.97	0.00 ± 3.64	0.42 ± 3.69	0.00 ± 3.67	0.00 ± 4.05	3.76 ± 1.65
Norfarnesane	1.18 ± 0.32	0.18 ± 0.44	2.65 ± 0.62	0.03 ± 0.23	0.00 ± 0.31	0.34 ± 0.21	0.92 ± 1.22	2.85 ± 1.55	3.46 ± 1.58	16.76 ± 3.93	3.40 ± 1.58	17.21 ± 4.11	5.80 ± 1.36
Heptylcyclohexane	0.80 ± 0.31	0.00 ± 0.39	0.70 ± 0.32	0.00 ± 0.21	0.30 ± 0.34	0.00 ± 0.17	3.55 ± 1.77	1.35 ± 1.42	0.00 ± 1.15	1.42 ± 1.35	0.02 ± 1.20	26.43 ± 8.22	0.34 ± 0.43
Farnesane	2.17 ± 1.08	0.00 ± 1.11	0.40 ± 0.59	1.07 ± 0.88	0.00 ± 0.80	0.00 ± 0.48	0.00 ± 3.05	4.27 ± 4.50	2.25 ± 3.85	2.90 ± 3.93	3.82 ± 4.26	72.99 ± 30.64	0.00 ± 1.09
Tetradecane	0.00 ± 2.07	0.00 ± 6.09	0.00 ± 2.63	0.00 ± 3.23	12.40 ± 5.57	0.00 ± 2.57	0.00 ± 16.66	5.85 ± 19.06	0.00 ± 17.58	0.00 ± 17.21	0.55 ± 18.15	0.00 ± 19.10	5.02 ± 6.12
Octylcyclohexane	0.00 ± 0.61	0.00 ± 1.80	1.88 ± 0.88	0.00 ± 0.97	0.03 ± 1.31	0.00 ± 0.76	3.43 ± 5.12	0.00 ± 5.44	0.00 ± 5.18	0.00 ± 5.08	0.46 ± 5.33	0.00 ± 5.64	0.00 ± 1.69
Pentadecane	24.95 ± 2.74	0.53 ± 3.10	5.16 ± 1.47	11.21 ± 2.08	0.00 ± 2.21	9.37 ± 1.69	0.00 ± 8.44	0.00 ± 9.31	0.00 ± 8.92	74.61 ± 11.98	17.59 ± 9.42	53.16 ± 11.57	16.71 ± 3.50
Nonylcyclohexane	0.14 ± 0.90	0.00 ± 2.59	0.30 ± 1.15	0.00 ± 1.37	0.00 ± 1.85	0.00 ± 1.10	3.63 ± 7.48	0.00 ± 7.88	1.13 ± 7.70	0.00 ± 7.45	0.00 ± 7.56	20.01 ± 10.60	0.60 ± 2.51
Hexadecane	0.00 ± 1.37	2.53 ± 4.07	1.89 ± 1.75	0.33 ± 2.15	15.59 ± 3.20	4.76 ± 1.78	63.11 ± 12.40	0.00 ± 12.17	33.78 ± 12.20	0.00 ± 11.44	4.78 ± 11.87	0.00 ± 12.69	6.46 ± 3.88
Norpristane	1.20 ± 0.46	1.23 ± 0.99	0.00 ± 0.35	0.23 ± 0.47	3.66 ± 1.18	2.26 ± 0.72	17.76 ± 5.25	2.78 ± 2.85	0.00 ± 2.31	1.59 ± 2.55	2.70 ± 2.75	0.57 ± 2.71	8.55 ± 2.30
Heptadecane	11.12 ± 1.62	21.19 ± 3.83	0.00 ± 1.12	0.00 ± 1.38	14.04 ± 2.66	8.76 ± 1.60	0.00 ± 7.28	0.00 ± 7.77	14.64 ± 8.18	51.15 ± 10.15	16.72 ± 8.35	118.24 ± 16.39	105.08 ± 11.63
Decylcyclohexane	1.64 ± 0.62	0.00 ± 1.10	0.63 ± 0.53	0.00 ± 0.58	1.85 ± 1.01	0.00 ± 0.46	1.31 ± 3.13	0.00 ± 3.33	0.00 ± 3.16	0.00 ± 3.14	0.00 ± 3.22	0.00 ± 3.44	5.84 ± 1.99
Heptadecane_Pristane	10.50 ± 1.43	20.40 ± 3.78	0.00 ± 1.42	0.00 ± 1.76	14.35 ± 2.70	11.52 ± 1.72	44.85 ± 10.02	0.00 ± 10.02	43.72 ± 10.44	187.94 ± 17.44	22.09 ± 10.00	115.12 ± 14.17	95.67 ± 8.04
Undecylcyclohexane	0.00 ± 0.15	5.27 ± 1.62	0.00 ± 0.18	0.00 ± 0.24	0.46 ± 0.42	0.39 ± 0.27	2.86 ± 1.82	5.24 ± 2.44	0.00 ± 1.08	0.00 ± 1.06	0.00 ± 1.09	0.00 ± 1.30	8.65 ± 2.41
Octadecane	0.00 ± 0.44	47.03 ± 3.79	0.00 ± 0.55	4.01 ± 0.79	3.34 ± 1.00	3.55 ± 0.65	14.75 ± 3.89	421.78 ± 31.30	34.87 ± 4.83	21.76 ± 4.21	10.22 ± 3.99	41.47 ± 5.44	10.10 ± 1.52
Phytane	0.22 ± 0.20	20.78 ± 1.99	5.80 ± 0.60	2.49 ± 0.41	2.53 ± 0.50	2.37 ± 0.35	5.08 ± 1.70	203.68 ± 18.04	21.08 ± 2.67	10.20 ± 1.97	9.21 ± 1.97	18.93 ± 2.65	101.28 ± 8.80
Dodecylcyclohexane	0.40 ± 0.15	2.66 ± 0.83	0.60 ± 0.22	0.42 ± 0.18	0.39 ± 0.20	0.18 ± 0.11	1.32 ± 0.69	6.25 ± 2.00	1.14 ± 0.67	0.00 ± 0.43	1.61 ± 0.78	1.46 ± 0.78	11.48 ± 3.28
Nonadecane	3.56 ± 0.47	20.94 ± 2.42	2.08 ± 0.36	2.29 ± 0.43	1.65 ± 0.47	2.06 ± 0.36	5.83 ± 1.74	262.95 ± 28.30	26.97 ± 3.61	15.57 ± 2.52	7.80 ± 1.95	28.83 ± 3.89	81.10 ± 8.67
Tridecylcyclohexane	0.00 ± 0.14	3.23 ± 0.98	0.00 ± 0.18	0.00 ± 0.22	0.00 ± 0.31	0.00 ± 0.18	0.00 ± 1.13	0.00 ± 1.28	0.00 ± 1.23	0.00 ± 1.19	1.13 ± 1.34	0.00 ± 1.29	5.41 ± 1.46
Eicosane	4.73 ± 0.40	16.07 ± 1.28	0.00 ± 0.34	2.02 ± 0.46	0.58 ± 0.58	1.83 ± 0.37	5.21 ± 2.26	162.05 ± 9.88	26.92 ± 2.91	9.29 ± 2.38	5.56 ± 2.40	17.33 ± 2.81	73.88 ± 4.29
Tetradecylcyclohexane	0.56 ± 0.14	1.52 ± 0.38	0.13 ± 0.05	0.26 ± 0.08	0.15 ± 0.08	0.10 ± 0.05	5.72 ± 1.34	3.38 ± 0.81	0.75 ± 0.25	1.26 ± 0.35	3.17 ± 0.76	0.76 ± 0.26	2.46 ± 0.57
Heneicosane	2.22 ± 0.34	16.28 ± 1.37	1.61 ± 0.39	1.66 ± 0.48	1.27 ± 0.63	1.97 ± 0.40	2.24 ± 2.38	75.22 ± 5.47	21.97 ± 2.93	3.71 ± 2.46	4.01 ± 2.55	10.64 ± 2.84	36.62 ± 2.38
Pentadecylcyclohexane	0.00 ± 0.82	1.00 ± 2.44	0.00 ± 1.04	0.00 ± 1.29	0.00 ± 1.74	0.37 ± 1.04	0.00 ± 6.66	0.00 ± 7.34	0.00 ± 7.02	0.00 ± 6.87	0.00 ± 7.09	0.00 ± 7.62	1.68 ± 2.31
Docosane	1.67 ± 1.29	14.51 ± 4.11	0.99 ± 1.60	1.03 ± 1.98	0.19 ± 2.66	1.68 ± 1.60	0.00 ± 10.17	61.26 ± 13.29	16.14 ± 11.03	0.00 ± 10.51	0.40 ± 10.86	3.89 ± 11.72	32.05 ± 4.92
Hexadecylcyclohexane	0.03 ± 0.04	5.77 ± 0.92	0.10 ± 0.06	0.21 ± 0.08	0.30 ± 0.12	0.14 ± 0.06	0.03 ± 0.30	11.64 ± 1.91	0.26 ± 0.33	0.13 ± 0.31	4.99 ± 0.91	3.55 ± 0.72	0.90 ± 0.21
Tricosane	2.37 ± 1.68	10.99 ± 4.99	0.53 ± 2.10	0.49 ± 2.60	0.00 ± 3.50	2.00 ± 2.09	0.00 ± 13.41	32.29 ± 15.11	0.00 ± 14.14	0.00 ± 13.87	0.00 ± 14.29	0.00 ± 15.35	32.53 ± 5.14
Heptadecylcyclohexane	0.38 ± 0.74	7.41 ± 3.03	0.00 ± 0.90	0.76 ± 1.18	0.00 ± 1.49	0.00 ± 0.90	0.00 ± 5.68	9.35 ± 7.23	0.00 ± 5.98	0.00 ± 5.85	5.32 ± 6.58	0.00 ± 6.48	11.58 ± 3.72
Octadecylcyclohexane	0.00 ± 0.63	3.12 ± 2.16	0.00 ± 0.80	0.00 ± 1.00	0.00 ± 1.32	0.52 ± 0.83	0.00 ± 5.07	0.00 ± 5.60	0.00 ± 5.44	0.00 ± 5.24	8.36 ± 6.22	0.00 ± 5.81	0.30 ± 1.78
Tetracosane	1.24 ± 2.89	12.95 ± 8.90	0.00 ± 3.60	0.00 ± 4.46	0.00 ± 6.00	1.56 ± 3.60	0.00 ± 22.93	20.43 ± 26.10	0.00 ± 24.18	0.00 ± 23.67	0.00 ± 24.47	0.00 ± 26.23	28.84 ± 9.59
Pentacosane	1.57 ± 3.18	20.76 ± 10.71	0.00 ± 3.92	0.00 ± 4.83	0.00 ± 6.49	0.36 ± 3.89	0.00 ± 24.82	10.57 ± 28.19	0.00 ± 26.49	0.00 ± 25.62	0.00 ± 26.46	0.00 ± 28.41	38.09 ± 12.51
Nonadecylcyclohexane	0.20 ± 0.78	4.74 ± 2.71	0.00 ± 0.96	0.00 ± 1.19	0.00 ± 1.60	0.00 ± 0.96	0.00 ± 6.11	0.00 ± 6.75	13.95 ± 7.88	0.00 ± 6.31	0.00 ± 6.52	0.00 ± 7.00	9.72 ± 3.40
Hexacosane	1.38 ± 3.58	21.23 ± 11.64	0.00 ± 4.42	0.00 ± 5.47	0.00 ± 7.36	0.00 ± 4.38	0.00 ± 28.21	7.50 ± 31.69	0.00 ± 29.78	0.00 ± 29.15	0.00 ± 30.10	0.00 ± 32.28	34.07 ± 12.39
Eicosylcyclohexane	0.00 ± 0.03	0.22 ± 0.10	0.00 ± 0.03	0.00 ± 0.04	0.04 ± 0.06	0.02 ± 0.03	0.01 ± 0.13	2.27 ± 0.61	33.72 ± 8.50	0.48 ± 0.19	0.70 ± 0.25	2.77 ± 0.74	0.51 ± 0.17
Heptacosane	0.92 ± 3.57	20.68 ± 11.67	0.00 ± 4.43	0.00 ± 5.48	0.00 ± 7.38	0.00 ± 4.37	0.00 ± 28.28	11.31 ± 31.92	0.00 ± 29.89	0.00 ± 29.21	0.00 ± 30.09	0.00 ± 32.35	27.42 ± 11.76
Heneicosylcyclohexane	0.03 ± 0.04	0.46 ± 0.21	0.02 ± 0.04	0.00 ± 0.05	0.00 ± 0.07	0.09 ± 0.06	0.48 ± 0.30	3.58 ± 1.36	6.24 ± 2.30	0.08 ± 0.22	0.01 ± 0.21	0.51 ± 0.33	1.52 ± 0.58
Octacosane	2.25 ± 3.47	19.34 ± 10.67	0.00 ± 4.31	0.00 ± 5.33	0.00 ± 7.18	0.00 ± 4.25	0.00 ± 27.53	13.28 ± 30.76	0.08 ± 29.19	0.00 ± 28.44	0.00 ± 29.30	0.00 ± 31.50	46.63 ± 11.93
Nonacosane	2.34 ± 2.51	10.28 ± 7.68	0.00 ± 2.96	0.00 ± 3.65	0.00 ± 4.91	0.00 ± 2.91	0.00 ± 18.82	52.40 ± 25.69	1.51 ± 20.22	0.00 ± 19.43	0.00 ± 20.01	0.00 ± 21.51	25.01 ± 9.22
Triacontane	3.66 ± 2.21	8.09 ± 6.29	0.03 ± 2.51	0.00 ± 3.09	0.00 ± 4.16	0.00 ± 2.46	0.00 ± 15.91	27.27 ± 19.26	3.35 ± 17.12	0.00 ± 16.44	0.00 ± 16.96	0.00 ± 18.21	29.12 ± 8.31
Hentriacontane	4.24 ± 1.73	6.79 ± 4.17	0.58 ± 1.52	0.00 ± 1.81	0.00 ± 2.41	0.00 ± 1.42	4.02 ± 9.79	22.33 ± 12.91	0.00 ± 9.99	0.00 ± 9.45	0.00 ± 9.73	0.00 ± 10.45	26.22 ± 7.67
Dotriacontane	4.20 ± 1.13	5.57 ± 2.84	0.65 ± 1.14	0.32 ± 1.40	0.00 ± 1.87	0.00 ± 1.11	0.00 ± 7.16	16.22 ± 8.56	16.19 ± 8.22	0.00 ± 7.39	0.00 ± 7.61	0.00 ± 8.19	28.03 ± 4.93

Appendix B1. Chemical Composition of Dilution Blanks and Vehicle Exhaust Samples from Round1

Species Description	S0-1	S0-2	S0-3	S0-4	S0-5	S0-6	S1-1	S1-2	S2-1	S2-2	S2-3	S2-4	S3-1
Tritriacontane	2.55 ± 1.10	1.79 ± 1.45	0.40 ± 0.53	0.00 ± 0.57	0.00 ± 0.72	0.00 ± 0.43	0.00 ± 2.75	0.00 ± 2.98	0.46 ± 3.18	0.00 ± 2.75	0.00 ± 2.82	0.00 ± 3.04	17.34 ± 6.59
Tetratriacontane	2.93 ± 1.06	2.43 ± 1.60	0.26 ± 0.55	0.21 ± 0.67	0.00 ± 0.82	0.00 ± 0.49	0.00 ± 3.07	0.00 ± 3.53	0.00 ± 3.22	0.00 ± 3.16	0.00 ± 3.25	0.00 ± 3.51	20.03 ± 6.19
Pentatriacontane	1.50 ± 0.57	0.86 ± 0.64	0.16 ± 0.23	0.15 ± 0.27	0.00 ± 0.30	0.03 ± 0.19	0.00 ± 1.12	2.55 ± 1.92	1.56 ± 1.63	0.00 ± 1.14	0.00 ± 1.20	0.00 ± 1.30	11.68 ± 3.96
Hexatriacontane	2.51 ± 0.33	1.43 ± 0.55	0.16 ± 0.22	0.00 ± 0.26	0.00 ± 0.35	0.00 ± 0.21	0.00 ± 1.32	0.00 ± 1.45	0.00 ± 1.40	0.00 ± 1.36	0.00 ± 1.40	0.00 ± 1.51	16.64 ± 1.80
Heptatriacontane	0.98 ± 0.39	0.66 ± 0.42	0.00 ± 0.08	0.18 ± 0.17	0.05 ± 0.16	0.03 ± 0.10	0.00 ± 0.51	14.29 ± 5.26	0.00 ± 0.56	0.00 ± 0.54	0.00 ± 0.54	0.00 ± 0.63	8.80 ± 3.09
Octatriacontane	1.70 ± 1.01	0.68 ± 0.76	0.14 ± 0.25	0.06 ± 0.26	0.00 ± 0.22	0.04 ± 0.14	0.00 ± 0.73	2.29 ± 2.39	0.00 ± 0.83	0.00 ± 0.73	0.00 ± 0.79	0.00 ± 0.92	11.92 ± 6.49
Nonatriacontane	2.80 ± 0.86	0.00 ± 0.12	0.00 ± 0.05	0.00 ± 0.07	0.00 ± 0.08	0.01 ± 0.05	0.00 ± 0.27	0.35 ± 0.42	0.00 ± 0.29	0.00 ± 0.28	0.00 ± 0.29	0.00 ± 0.31	46.88 ± 14.03
Polar compounds (ug/mile)													
heptanoic acid (c7)	10.32 ± 2.78	0.42 ± 3.06	1.41 ± 3.28	3.35 ± 3.29	8.47 ± 3.42	7.83 ± 3.35	11.24 ± 8.64	0.00 ± 9.28	8.66 ± 9.06	0.52 ± 8.78	0.00 ± 9.03	0.00 ± 9.63	22.85 ± 4.78
me-malonic (d-c3)	2.83 ± 1.08	15.03 ± 3.19	6.20 ± 1.89	4.58 ± 1.54	1.57 ± 1.06	0.00 ± 0.93	7.64 ± 2.77	8.04 ± 2.96	0.00 ± 1.58	0.00 ± 1.54	40.68 ± 10.68	0.00 ± 1.70	4.47 ± 1.57
guaiacol	0.15 ± 0.08	0.13 ± 0.10	0.23 ± 0.10	0.23 ± 0.10	0.20 ± 0.10	0.00 ± 0.08	0.26 ± 0.24	0.00 ± 0.17	0.59 ± 0.25	4.57 ± 0.89	0.21 ± 0.18	0.00 ± 0.17	0.77 ± 0.22
benzoic acid	0.00 ± 726.96	0.00 ± 849.55	0.00 ± 907.65	0.00 ± 905.79	249.59 ± 939.80	1445.35 ± 950.21	0.00 ± 2371.39	0.00 ± 2579.00	0.00 ± 2480.05	0.00 ± 2441.89	0.00 ± 2501.38	0.00 ± 2734.91	1936.46 ± 1274.21
octanoic acid (c8)	12.69 ± 6.28	1.84 ± 7.12	4.44 ± 7.59	5.69 ± 7.59	10.60 ± 7.82	0.00 ± 7.41	11.08 ± 16.09	133.25 ± 23.92	0.00 ± 16.62	0.00 ± 16.15	0.00 ± 16.68	0.00 ± 17.49	38.41 ± 11.19
phenylacetic acid	0.00 ± 15.02	0.00 ± 17.11	0.13 ± 18.48	0.02 ± 19.58	0.44 ± 19.01	0.02 ± 19.71	0.00 ± 35.61	0.00 ± 35.83	0.00 ± 40.68	58.00 ± 56.77	0.00 ± 34.54	8.82 ± 50.62	0.00 ± 25.66
maleic acid	4.25 ± 1.20	9.05 ± 1.86	96.43 ± 12.80	108.89 ± 13.63	0.00 ± 1.21	0.00 ± 1.20	82.38 ± 12.86	0.00 ± 1.79	120.60 ± 18.07	0.00 ± 1.68	0.00 ± 1.73	0.00 ± 1.86	50.65 ± 6.20
succinic acid (d-c4)	23.29 ± 7.19	44.88 ± 9.12	12.02 ± 8.26	9.73 ± 8.15	0.00 ± 8.10	0.00 ± 7.98	14.10 ± 19.67	0.00 ± 21.23	18.38 ± 20.84	0.00 ± 19.90	12.43 ± 20.86	9.74 ± 22.34	78.92 ± 13.98
4-me-guaiacol	0.29 ± 0.04	0.01 ± 0.07	0.35 ± 0.21	0.35 ± 0.30	0.10 ± 0.05	0.00 ± 0.04	1.61 ± 1.22	0.00 ± 0.12	0.20 ± 1.78	0.00 ± 0.11	0.19 ± 0.11	0.00 ± 0.12	1.11 ± 0.26
o-toluic	1.49 ± 2.24	1.65 ± 2.64	1.76 ± 2.82	1.95 ± 2.80	5.89 ± 3.03	6.38 ± 3.03	37.46 ± 8.21	1097.50 ± 164.88	58.06 ± 10.92	300.20 ± 45.67	22.42 ± 6.91	176.61 ± 27.87	28.98 ± 6.04
me-succinic acid (d-c4)	4.10 ± 1.07	11.45 ± 1.58	4.39 ± 1.30	2.97 ± 1.26	0.00 ± 1.22	0.00 ± 1.20	0.00 ± 2.89	0.00 ± 3.16	6.88 ± 3.38	0.00 ± 2.96	5.15 ± 3.33	0.00 ± 3.28	11.12 ± 1.95
m-toluic	2.50 ± 1.42	1.79 ± 1.66	1.73 ± 1.77	1.82 ± 1.76	6.37 ± 1.84	7.49 ± 1.83	48.89 ± 5.57	0.00 ± 4.88	52.93 ± 5.89	553.26 ± 33.99	55.00 ± 6.01	394.18 ± 25.38	47.90 ± 3.87
nonanoic acid (c9)	20.32 ± 8.60	13.17 ± 8.54	13.08 ± 8.64	16.60 ± 9.25	15.09 ± 9.13	1.25 ± 7.14	56.95 ± 27.71	78.50 ± 33.66	12.03 ± 21.04	3.21 ± 19.48	0.00 ± 19.37	0.00 ± 18.59	46.84 ± 17.06
p-toluic	3.37 ± 1.86	2.31 ± 2.14	2.91 ± 2.27	1.84 ± 2.21	7.88 ± 2.62	5.85 ± 2.42	43.16 ± 8.37	1476.73 ± 202.92	45.54 ± 8.82	493.37 ± 68.65	41.75 ± 8.43	235.24 ± 34.41	41.33 ± 6.82
2,6-dimethylbenzoic acid	0.38 ± 1.12	0.00 ± 1.32	0.71 ± 1.41	1.35 ± 1.42	0.58 ± 1.43	4.17 ± 1.48	0.00 ± 2.70	0.00 ± 23.22	0.00 ± 2.85	29.04 ± 8.03	0.00 ± 2.83	0.00 ± 4.83	5.69 ± 2.01
4-ethyl-guaiacol	0.00 ± 0.03	0.00 ± 0.09	0.13 ± 0.05	0.00 ± 0.10	0.00 ± 0.05	0.00 ± 0.04	0.00 ± 0.54	0.00 ± 0.12	0.00 ± 0.42	0.00 ± 0.11	0.00 ± 1.04	0.00 ± 0.12	0.04 ± 0.17
syringol	0.00 ± 0.03	0.00 ± 0.06	0.00 ± 0.04	0.00 ± 0.04	0.00 ± 0.05	0.00 ± 0.04	0.00 ± 0.11	0.00 ± 0.12	0.00 ± 0.11	0.00 ± 0.42	0.00 ± 0.11	0.00 ± 0.12	0.10 ± 0.07
glutaric acid (d-c5)	2.82 ± 0.17	11.78 ± 0.52	6.12 ± 0.27	4.96 ± 0.31	0.00 ± 0.07	0.00 ± 0.07	0.00 ± 0.13	0.00 ± 0.14	40.53 ± 2.42	0.00 ± 0.13	21.76 ± 1.32	0.00 ± 0.15	7.30 ± 0.33
2-methylglutaric (d-c5)	0.00 ± 0.03	1.53 ± 0.44	1.17 ± 0.33	0.00 ± 0.04	0.00 ± 0.05	0.00 ± 0.04	0.02 ± 0.12	0.00 ± 0.12	0.00 ± 0.11	0.00 ± 0.11	0.00 ± 0.11	0.00 ± 0.12	3.38 ± 0.95
2,5-dimethylbenzoic acid	0.00 ± 1.23	0.00 ± 1.45	0.85 ± 1.88	0.00 ± 1.53	0.00 ± 1.72	3.53 ± 2.37	6.84 ± 6.61	0.00 ± 3.92	0.00 ± 5.27	0.00 ± 3.67	0.00 ± 4.76	0.00 ± 4.07	9.48 ± 4.63
3-methylglutaric acid (d-c5)	9.67 ± 2.54	1.42 ± 2.28	0.00 ± 2.42	1.63 ± 2.42	0.00 ± 2.43	0.00 ± 2.40	0.00 ± 5.73	5.07 ± 6.44	56.38 ± 10.90	0.00 ± 5.92	90.84 ± 15.56	0.00 ± 6.56	6.16 ± 3.43
2,4-dimethylbenzoic acid	164.99 ± 126.45	0.00 ± 140.47	0.00 ± 148.55	0.00 ± 148.10	165.23 ± 159.84	327.61 ± 165.30	0.00 ± 359.82	710.66 ± 445.43	0.00 ± 377.93	0.00 ± 366.57	0.00 ± 378.43	0.00 ± 420.94	827.06 ± 256.80
2,3- and 3,5- dimethylbenzoic acid	0.00 ± 0.18	0.02 ± 0.26	0.00 ± 0.16	0.00 ± 0.16	0.01 ± 0.21	0.50 ± 0.33	0.00 ± 0.73	260.80 ± 37.69	0.00 ± 1.14	50.53 ± 8.38	0.00 ± 1.60	36.56 ± 6.65	3.70 ± 1.01
decanoic acid (c10)	0.00 ± 1.79	0.00 ± 2.07	0.00 ± 2.21	0.00 ± 2.20	1.32 ± 2.32	0.00 ± 2.30	1.36 ± 4.46	0.00 ± 12.12	0.00 ± 4.69	0.00 ± 4.58	0.00 ± 4.73	0.00 ± 5.07	0.02 ± 4.88
4-allyl-guaiacol (eugenol)	50.50 ± 4.23	45.38 ± 4.76	4.81 ± 0.54	79.53 ± 8.45	10.86 ± 1.19	9.59 ± 1.05	508.15 ± 56.03	6.91 ± 4.15	67.90 ± 7.45	6.13 ± 0.99	66.50 ± 7.30	0.00 ± 0.62	51.13 ± 4.70
4-methyl-syringol	0.41 ± 0.14	0.51 ± 0.18	0.00 ± 0.04	0.33 ± 0.11	0.30 ± 0.11	0.19 ± 0.07	0.00 ± 0.11	17.26 ± 5.58	0.00 ± 0.11	0.00 ± 0.11	0.12 ± 0.12	0.00 ± 0.12	1.16 ± 0.38
3,4-dimethylbenzoic acid	0.00 ± 1.29	0.51 ± 1.53	0.00 ± 1.61	0.00 ± 1.62	0.00 ± 1.62	0.00 ± 1.60	4.22 ± 8.12	338.28 ± 36.87	4.91 ± 3.53	87.37 ± 10.15	7.40 ± 3.63	61.96 ± 7.90	5.71 ± 2.25
hexanedioic (adipic) acid (d-c6)	1.59 ± 0.67	1.63 ± 0.79	0.84 ± 0.74	5.70 ± 1.37	0.00 ± 0.70	0.00 ± 0.69	0.00 ± 1.66	0.00 ± 1.85	8.65 ± 2.75	0.00 ± 1.72	0.00 ± 1.77	0.00 ± 1.90	0.77 ± 0.96
salcylic acid	0.33 ± 1.65	7.66 ± 2.34	7.98 ± 2.46	6.39 ± 2.33	16.53 ± 3.66	2.24 ± 2.10	9.16 ± 5.16	39.13 ± 10.26	20.47 ± 6.40	0.00 ± 4.96	15.24 ± 5.93	45.21 ± 9.79	13.79 ± 3.75
trans-2-decenoic acid	0.17 ± 0.28	0.00 ± 0.33	0.00 ± 0.35	0.13 ± 0.35	0.00 ± 0.35	0.27 ± 0.35	0.12 ± 0.53	0.00 ± 0.58	0.15 ± 0.58	0.00 ± 0.54	0.00 ± 0.56	0.00 ± 0.60	1.10 ± 0.48
cis-pinonic acid	0.00 ± 2.07	0.00 ± 2.44	0.00 ± 2.61	0.00 ± 2.59	0.00 ± 2.62	2.99 ± 2.71	0.00 ± 4.50	0.00 ± 4.95	0.00 ± 4.78	0.00 ± 4.60	0.00 ± 4.75	0.00 ± 5.16	0.00 ± 3.43
3-methyladipic acid (d-c6)	0.00 ± 0.15	0.16 ± 0.19	2.06 ± 0.43	1.66 ± 0.35	75.12 ± 13.11	0.51 ± 0.21	26.89 ± 4.80	174.66 ± 30.56	150.67 ± 26.30	50.35 ± 8.84	31.38 ± 5.57	0.00 ± 0.42	18.00 ± 3.18
4-formyl-guaiacol (vanillin)	0.34 ± 0.45	8.36 ± 2.04	8.94 ± 2.09	2.68 ± 0.89	19.27 ± 4.73	2.14 ± 0.82	38.47 ± 9.68	1.30 ± 1.04	7.66 ± 2.32	0.00 ± 0.75	11.73 ± 3.26	0.00 ± 0.84	12.21 ± 3.06
undecanoic acid (c11)	0.87 ± 0.86	0.88 ± 1.00	0.78 ± 1.06	1.08 ± 1.07	0.42 ± 1.09	0.00 ± 1.03	0.00 ± 2.31	5.72 ± 3.99	1.14 ± 3.34	0.62 ± 2.52	0.00 ± 2.51	4.05 ± 2.89	0.32 ± 1.39
isoeugenol	0.38 ± 0.23	0.22 ± 0.22	0.00 ± 0.21	0.00 ± 0.21	0.07 ± 0.23	1.39 ± 0.59	0.00 ± 0.65	0.00 ± 0.35	0.00 ± 0.35	0.00 ± 0.33	10.13 ± 4.12	0.00 ± 0.36	0.00 ± 0.29
heptanedioic (pimelic) acid (d-c7)	0.07 ± 0.61	2.32 ± 0.81	2.57 ± 0.86	2.33 ± 0.87	0.00 ± 0.76	1.42 ± 0.81	1.75 ± 1.22	35.77 ± 6.04	28.13 ± 4.82	0.00 ± 1.15	6.87 ± 1.76	0.00 ± 1.28	5.19 ± 1.30
2,3-dimethoxybenzoic acid	0.00 ± 0.03	0.00 ± 0.06	0.00 ± 0.04	0.00 ± 0.04	0.00 ± 0.05	0.00 ± 0.04	0.00 ± 0.11	0.00 ± 0.12	0.00 ± 0.11	0.00 ± 0.11	0.00 ± 0.19	0.00 ± 0.12	0.00 ± 0.06
acetovanillone	0.00 ± 2.35	0.21 ± 2.76	0.00 ± 2.95	13.08 ± 3.14	0.00 ± 2.97	10.48 ± 3.07	122.90 ± 10.60	0.00 ± 4.34	280.14 ± 22.25	0.00 ± 4.03	0.00 ± 4.16	0.00 ± 4.47	0.00 ± 3.89
2,6-dimethoxybenzoic acid	0.16 ± 0.06	0.15 ± 0.08	1.24 ± 0.44	0.23 ± 0.09	0.04 ± 0.05	0.29 ± 0.11	13.02 ± 4.65	0.00 ± 0.12	5.32 ± 1.91	0.00 ± 0.11	0.00 ± 0.11	0.00 ± 0.12	4.71 ± 1.68
dodecanoic (lauric) acid (c12)	0.50 ± 20.79	0.00 ± 24.41	0.00 ± 26.13	0.00 ± 25.97	19.80 ± 26.45	11.69 ± 26.01	0.00 ± 51.57	0.00 ± 56.75	5.70 ± 54.68	0.00 ± 53.14	0.00 ± 55.00	5.63 ± 59.18	43.67 ± 34.84
2,5-dimethoxybenzoic acid	2.68 ± 0.83	0.74 ± 0.58	1.11 ± 0.66	6.42 ± 1.70	0.30 ± 0.58	0.00 ± 0.54	8.24 ± 2.49	0.00 ± 1.41	1.02 ± 1.42	0.00 ± 1.32	0.00 ± 1.37	0.00 ± 1.47	6.62 ± 1.84
phthalic acid	184.38 ± 37.02	136.83 ± 31.78	75.34 ± 24.11	165.61 ± 37.39	869.47 ± 171.87	50.27 ± 20.98	287.25 ± 74.22	322.20 ± 82.74	305.98 ± 78.68	838.82 ± 174.36	154.36 ± 56.50	533.19 ± 120.29	179.77 ± 42.96
suberic acid (d-c8)	0.00 ± 11.39	0.00 ± 13.32	0.00 ± 14.25	0.00 ± 14.16	1.36 ± 14.80	0.00 ± 14.22	0.00 ± 24.99	0.00 ± 27.53	0.00 ± 26.74	0.00 ± 25.78	0.00 ± 26.60	0.00 ± 30.48	0.00 ± 18.80
levoglucosan	3.81 ± 1.59	0.63 ± 1.40	0.00 ± 1.14	0.10 ± 1.26	0.00 ± 3.37	1.62 ± 1.43	0.00 ± 4.51	0.00 ± 5.24	0.00 ± 4.78	0.00 ± 11.86	9.32 ± 5.01	0.00 ± 8.84	4.59 ± 2.53
3,5-dimethoxybenzoic acid	0.03 ± 0.25	0.04 ± 0.29	0.08 ± 0.31	0.06 ± 0.31	0.08 ± 0.31	0.02 ± 0.31	0.00 ± 0.77	0.00 ± 0.85	0.92 ± 0.82	0.00 ± 0.79	0.00 ± 0.82	8.77 ± 1.18	0.04 ± 0.41
syringaldehyde	0.34 ± 0.09	0.19 ± 0.08	0.20 ± 0.06	0.11 ± 0.05	0.00 ± 0.05	0.32 ± 0.09	0.00 ± 0.11	0.00 ± 0.12	0.00 ± 0.11	0.00 ± 0.11	0.00 ± 0.18	0.00 ± 0.12	0.91 ± 0.19
3,4-dimethoxybenzoic acid	0.00 ± 0.23	0.00 ± 0.27	0.48 ± 0.36	0.12 ± 0.30	0.00 ± 0.29	0.00 ± 0.29	2.77 ± 1.49	386.69 ± 137.17	10.90 ± 4.35	55.95 ± 20.22	3.62 ± 1.89	0.00 ± 0.55	4.28 ± 1.63
2,4-dimethoxybenzoic acid	0.00 ± 0.03	0.61 ± 0.07	0.59 ± 0.06	0.00 ± 0.04	0.00 ± 0.05	0.00 ± 0.04	0.00 ± 0.11	0.00 ± 0.12	6.87 ± 0.50	31.47 ± 2.20	2.58 ± 0.22	0.00 ± 0.12	2.26 ± 0.17
tridecanoic acid (c13)	0.00 ± 0.32	0.00 ± 0.39	0.39 ± 0.41	0.00 ± 0.40	0.00 ± 0.41	0.01 ± 0.42	1.71 ± 0.73	0.00 ± 6.06	1.87 ± 0.79	1.21 ± 1.04	0.00 ± 0.61	0.00 ± 0.59	1.67 ± 0.63
isophthalic acid	28.02 ± 47.40	2.84 ± 54.71	7.30 ± 58.68	44.45 ± 59.23	0.00 ± 58.80	65.29 ± 61.57	27.60 ± 88.38	252.18 ± 118.93	90.86 ± 97.37	0.00 ± 88.53	334.43 ± 127.57	401.60 ± 143.80	92.47 ± 80.21
vanillic acid	0.00 ± 3.23	2.91 ± 3.83	3.94 ± 4.11	8.35 ± 4.27	11.24 ± 4.50	0.54 ± 4.05	10.08 ± 6.31	127.13 ± 23.28	3.03 ± 6.27	84.21 ± 16.14	16.05 ± 7.11	0.00 ± 6.65	0.00 ± 5.35
homovanillic acid	0.00 ± 1.43	0.00 ± 1.70	0.80 ± 1.90	0.00 ± 1.79	0.00 ± 1.84	2.91 ± 2.18	0.00 ± 2.55	79.23 ± 25.26	59.00 ± 18.84	0.00 ± 2.60	29.61 ± 11.21	0.00 ± 7.17	0.00 ± 2.41
azelaic acid (d-c9)	0.98 ± 2.93	0.77 ± 3.45	0.29 ± 3.68	1.53 ± 3.66	0.00 ± 3.69	8.71 ± 3.79	4.44 ± 5.65	2.41 ± 6.50	9.87 ± 6.07	16.07 ± 6.25	0.00 ± 5.92	0.00 ± 6.35	1.92 ± 4.86
myristoleic acid	0.00 ± 0.13	18.26 ± 2.26	0.00 ± 0.16	0.00 ± 0.16	0.00 ± 0.16	0.00 ± 0.16	36.20 ± 4.69	0.00 ± 1.26	22.32 ± 3.11	35.89 ± 4.62	19.71 ± 2.79	0.00 ± 0.27	0.00 ± 0.21
myristic acid (c14)	8.66 ± 5.82	1.70 ± 5.65	4.30 ± 6.21	7.73 ± 6.79	627.05 ± 160.46	16.72 ± 8.34	64.38 ± 27.79	0.00 ± 11.28	55.27 ± 26.21	0.00 ± 9.83	34.73 ± 21.75	0.00 ± 7.91	57.72 ± 19.55
sebacic acid (d-c10)	0.21 ± 0.62	0.08 ± 0.73	0.00 ± 0.78	1.36 ± 0.78	0.00 ± 0.78	1.69 ± 0.80	0.00 ± 1.25	0.36 ± 1.25	0.00 ± 1.24	0.00 ± 1.27	0.00 ± 1.24	0.00 ± 1.29	0.00 ± 1.02
syringic acid	0.23 ± 0.30	0.00 ± 0.36	4.42 ± 0.63	3.02 ± 0.51	0.00 ± 2.30	0.12 ± 0.38	7.01 ± 1.40	31.53 ± 3.75	5.87 ± 1.25	33.51 ± 3.93	4.74 ± 1.00	11.96 ± 1.58	9.41 ± 1.23
pentadecanoic acid (c15)	0.00 ± 1.70	0.03 ± 2.03	0.00 ± 2.14	0.00 ± 2.12	0.00 ± 2.15	0.00 ± 2.14	2.57 ± 3.72	0.00 ± 3.86	0.00 ± 3.69	0.00 ± 3.58	0.00 ± 3.67	0.00 ± 3.97	1.50 ± 2.87
undecanedioic acid (d-c11)	0.09 ± 0.11	0.31 ± 0.23	0.10 ± 0.14	0.38 ± 0.30	0.00 ± 0.09	1.98 ± 1.28	0.83 ± 0.75	0.00 ± 0.51	1.21 ± 1.00	1.96 ± 1.52	0.00 ± 0.14	0.00 ± 0.24	0.73 ± 0.45
palmitoleic acid	0.25 ± 0.62	0.65 ± 0.83	0.00 ± 0.60	0.00 ± 0.56	0.00 ± 0.56	0.00 ± 0.56	3.21 ± 2.54	0.00 ± 1.01	2.62 ± 2.38	0.00 ± 0.94	0.17 ± 1.62	0.00 ± 1.05	0.76 ± 1.13
palmitic acid (c16)	2.29 ± 10.60	12.25 ± 16.03	0.00 ± 11.93	0.00 ± 11.61	116.79 ± 49.71	7.59 ± 14.13	106.45 ± 68.08	0.00 ± 27.62	48.77 ± 48.51	0.00 ± 25.55	0.00 ± 32.06	0.00 ± 12.03	52.01 ± 30.05
isostearic acid	0.00 ± 0.20	0.00 ± 0.24	0.00 ± 0.25	0.00 ± 0.25	0.00 ± 0.26	0.00 ± 0.25	0.00 ± 0.53	0.00 ± 0.58	0.00 ± 0.55	0.00 ± 0.54	0.00 ± 0.56	0.00 ± 0.60	0.00 ± 0.34
dodecanedioic acid (d-c12)	0.12 ± 0.20	0.00 ± 0.25	0.21 ± 0.25	0.15 ± 0.25	0.00 ± 0.49	1.24 ± 0.35	0.00 ± 1.61	0.00 ± 0.40	0.00 ± 0.82	0.00 ± 0.38	0.00 ± 0.39	0.00 ± 0.42	0.09 ± 0.41
traumatic acid	0.00 ± 0.03	0.00 ± 0.06	0.00 ± 0.04	0.00 ± 0.04	0.00 ± 0.05	0.00 ± 0.04	0.00 ± 0.11	0.00 ± 0.12	0.00 ± 0.11	0.00 ± 0.11	0.00 ± 0.11	0.00 ± 0.12	0.00 ± 0.06
heptadecanoic acid (c17)	0.00 ± 1.98	0.26 ± 2.39	0.00 ± 2.48	0.00 ± 2.47	19.65 ± 8.57	0.68 ± 2.61	0.55 ± 6.40	0.00 ± 6.81	0.00 ± 6.56	0.00 ± 6.31	0.00 ± 6.42	0.00 ± 6.82	0.00 ± 3.36
1,11-undecanedicarboxylic acid (d-c13)	0.00 ± 0.04	0.66 ± 0.19	0.00 ± 0.05	0.52 ± 0.14	0.00 ± 0.05	0.11 ± 0.06	0.00 ± 0.15	0.00 ± 0.12	0.00 ± 0.14	0.00 ± 0.11	0.00 ± 0.12	0.00 ± 0.13	0.00 ± 0.07
oleic acid	6.61 ± 6.39	0.25 ± 9.45	13.19 ± 10.06	9.11 ± 9.26	0.00 ± 3.90	0.00 ± 3.94	0.00 ± 17.43	0.00 ± 13.82	0.00 ± 17.44	0.00 ± 18.54	0.00 ± 15.19	0.00 ± 6.42	17.07 ± 15.71
elaidic acid	0.00 ± 0.48	0.00 ± 0.57	0.10 ± 0.61	0.41 ± 0.61	0.00 ± 0.61	0.00 ± 0.60	0.00 ± 0.72	0.00 ± 0.77	0.55 ± 0.80	0.00 ± 0.72	0.00 ± 0.75	0.00 ± 0.80	1.84 ± 0.82
stearic acid (c18)	0.00 ± 11.53	0.00 ± 13.80	0.00 ± 13.90	0.00 ± 13.87	448.50 ± 164.58	0.00 ± 14.51	0.00 ± 34.30	0.00 ± 41.43	0.00 ± 41.23	0.00 ± 36.00	0.00 ± 36.37	0.00 ± 36.23	0.00 ± 20.06
1,12-dodecanedicarboxylic acid (d-c14)	2.78 ± 0.87	0.36 ± 0.22	0.66 ± 0.24	5.44 ± 1.42	0.00 ± 0.16	2.00 ± 0.67	0.75 ± 0.44	0.00 ± 0.27	0.00 ± 0.26	0.18 ± 0.32	0.00 ± 0.26	0.00 ± 0.28	0.76 ± 0.32
8,15-pimaradien-18-oic acd	0.00 ± 0.23	0.00 ± 0.28	0.00 ± 0.29	0.00 ± 0.29	0.00 ± 1.66	0.25 ± 0.38	0.04 ± 0.35	0.00 ± 0.17	0.00 ± 0.24	0.00 ± 0.19	0.00 ± 0.19	0.00 ± 0.18	0.00 ± 0.38
pimaric acid	0.00 ± 0.30	0.03 ± 0.35	23.24 ± 3.06	0.00 ± 0.37	0.16 ± 0.38	0.41 ± 0.38	16.68 ± 2.42	57.77 ± 7.73	0.00 ± 0.91	9.43 ± 1.57	4.83 ± 1.15	0.00 ± 0.98	20.21 ± 2.69

Appendix B1. Chemical Composition of Dilution Blanks and Vehicle Exhaust Samples from Round1

Species Description	S0-1	S0-2	S0-3	S0-4	S0-5	S0-6	S1-1	S1-2	S2-1	S2-2	S2-3	S2-4	S3-1
sandaracopimaric acid	0.00 ± 0.10	0.07 ± 0.12	22.24 ± 1.58	0.01 ± 0.12	0.10 ± 0.13	0.33 ± 0.13	0.00 ± 0.27	0.00 ± 0.30	0.00 ± 0.29	0.00 ± 0.28	0.00 ± 0.29	0.00 ± 0.31	0.00 ± 0.17
nonadecanoic acid (c19)	0.00 ± 3.36	0.09 ± 3.95	0.00 ± 4.23	0.00 ± 4.20	0.00 ± 4.25	0.01 ± 4.19	0.00 ± 10.00	0.00 ± 11.05	0.00 ± 10.54	0.00 ± 10.32	0.00 ± 10.64	55.30 ± 12.23	0.00 ± 5.57
isopimaric acid	0.00 ± 0.35	0.00 ± 0.42	0.00 ± 0.44	0.00 ± 0.44	0.47 ± 0.59	1.68 ± 0.95	0.00 ± 0.96	0.00 ± 1.06	0.00 ± 1.02	0.00 ± 0.99	0.00 ± 1.07	0.00 ± 1.10	0.00 ± 0.58
palustric acid	0.16 ± 0.32	0.00 ± 0.38	0.00 ± 0.40	0.00 ± 0.40	0.00 ± 0.40	0.00 ± 0.40	1.35 ± 0.61	0.00 ± 0.65	2.01 ± 0.65	0.00 ± 0.61	0.68 ± 0.64	0.00 ± 1.13	1.20 ± 0.54
dihydroisopimaric acid	0.04 ± 0.14	0.28 ± 0.17	0.00 ± 0.17	0.00 ± 0.17	0.00 ± 0.17	0.00 ± 0.17	0.00 ± 0.26	0.00 ± 0.29	0.00 ± 0.28	0.00 ± 0.27	0.00 ± 0.28	0.00 ± 0.30	0.17 ± 0.23
8-abietic acid	0.00 ± 0.21	0.76 ± 0.41	0.00 ± 0.26	0.00 ± 0.26	0.00 ± 0.27	0.00 ± 0.26	0.00 ± 0.54	0.00 ± 0.28	0.00 ± 0.50	0.00 ± 0.30	0.00 ± 0.28	0.00 ± 0.29	0.12 ± 0.37
dehydroabietic acid	0.00 ± 4.67	2.30 ± 6.10	0.00 ± 5.86	0.00 ± 5.82	16.21 ± 9.88	0.00 ± 5.87	0.00 ± 9.83	0.00 ± 10.01	0.00 ± 9.62	0.00 ± 9.26	0.00 ± 9.64	0.00 ± 10.16	0.00 ± 8.05
8,14-abietenic acid	0.00 ± 0.03	0.00 ± 0.06	0.00 ± 0.04	0.00 ± 0.04	0.00 ± 0.05	0.00 ± 0.04	0.00 ± 0.11	0.00 ± 0.12	0.00 ± 0.11	0.00 ± 0.11	0.00 ± 0.11	0.00 ± 0.12	0.00 ± 0.06
abietic acid	0.00 ± 0.06	0.01 ± 0.08	0.00 ± 0.07	0.02 ± 0.07	0.00 ± 0.10	0.00 ± 0.07	0.00 ± 0.14	0.00 ± 0.15	0.00 ± 0.15	0.00 ± 0.14	0.00 ± 0.15	0.00 ± 0.16	0.00 ± 0.10
eicosanoic acid (c20)	0.00 ± 1.06	0.00 ± 1.25	0.00 ± 1.33	0.00 ± 1.32	0.00 ± 1.34	0.00 ± 1.32	0.00 ± 1.76	0.00 ± 1.94	0.00 ± 1.85	0.00 ± 1.81	0.00 ± 1.87	0.00 ± 2.01	0.00 ± 1.76
levopimaric acid	0.00 ± 0.03	0.00 ± 0.06	0.00 ± 0.04	0.00 ± 0.04	0.00 ± 0.05	0.00 ± 0.04	0.00 ± 0.11	0.00 ± 0.12	0.00 ± 0.11	0.00 ± 0.11	0.00 ± 0.11	0.00 ± 0.12	0.00 ± 0.06
heneicosanoic acid (c21)	0.00 ± 1.19	0.00 ± 1.40	0.00 ± 1.50	0.00 ± 1.49	0.00 ± 1.51	0.00 ± 1.48	0.32 ± 2.73	0.00 ± 2.90	0.00 ± 2.77	0.00 ± 2.72	0.00 ± 2.81	0.00 ± 3.01	1.99 ± 2.09
7-oxodehydroabietic acid	0.37 ± 0.09	1.19 ± 0.16	0.00 ± 0.10	0.00 ± 0.11	0.20 ± 0.11	0.31 ± 0.11	7.58 ± 1.04	0.00 ± 0.28	2.98 ± 0.65	0.00 ± 0.26	0.00 ± 0.27	0.00 ± 0.29	0.98 ± 0.18
docosanoic acid (c22)	0.00 ± 3.33	0.00 ± 3.94	0.00 ± 4.20	0.04 ± 4.18	0.00 ± 4.22	0.00 ± 4.16	0.00 ± 8.82	0.00 ± 9.62	0.00 ± 9.20	0.00 ± 9.07	0.00 ± 9.36	0.00 ± 9.98	1.58 ± 5.59
tricosanoic acid (c23)	0.00 ± 0.55	0.00 ± 0.67	0.00 ± 0.70	0.00 ± 0.69	0.65 ± 0.72	0.00 ± 0.69	0.24 ± 0.83	0.33 ± 0.93	0.00 ± 0.77	0.00 ± 0.81	0.00 ± 0.78	0.00 ± 0.84	0.00 ± 0.92
tetracosanoic acid (c24)	0.81 ± 0.49	3.75 ± 1.18	1.25 ± 0.66	0.00 ± 0.38	0.07 ± 0.43	0.38 ± 0.48	0.00 ± 0.89	0.00 ± 2.29	0.00 ± 0.94	0.00 ± 1.68	0.00 ± 3.07	0.00 ± 1.02	0.00 ± 0.41
cholesterol	0.00 ± 0.62	0.00 ± 0.77	0.00 ± 0.76	0.00 ± 0.75	0.00 ± 0.76	0.00 ± 0.75	0.00 ± 0.24	6.41 ± 2.26	0.00 ± 0.25	0.00 ± 0.25	0.00 ± 0.25	0.00 ± 0.27	1.47 ± 1.09
cholestanol	0.02 ± 4.18	0.15 ± 4.92	81.10 ± 10.95	0.08 ± 5.23	0.00 ± 5.29	0.00 ± 5.21	12.90 ± 8.22	102.59 ± 15.20	0.00 ± 8.43	0.00 ± 8.25	10.50 ± 8.67	0.00 ± 9.15	23.04 ± 7.55
ergosterol	0.00 ± 0.03	0.00 ± 0.06	0.00 ± 0.04	0.00 ± 0.04	0.00 ± 0.05	0.00 ± 0.04	0.00 ± 0.11	10.77 ± 0.79	0.00 ± 0.11	3.13 ± 0.24	0.00 ± 0.11	0.00 ± 0.12	5.46 ± 0.39
stigmasterol	0.00 ± 1.30	0.00 ± 1.53	0.00 ± 1.64	0.00 ± 1.62	0.00 ± 1.64	0.00 ± 1.62	0.00 ± 2.49	29.59 ± 3.86	0.00 ± 2.62	0.00 ± 2.56	0.00 ± 2.65	0.00 ± 2.84	0.00 ± 2.15
sitosterol	0.00 ± 0.03	0.00 ± 0.06	0.00 ± 0.04	0.00 ± 0.04	0.00 ± 0.05	0.00 ± 0.04	0.00 ± 0.11	0.00 ± 0.20	0.00 ± 0.11	0.00 ± 0.12	0.00 ± 0.11	0.00 ± 0.12	0.00 ± 0.07
Carbonyls (mg/mile)													
formaldehyde	0.34 ± 0.01	0.47 ± 0.02	0.45 ± 0.01	1.07 ± 0.01	0.57 ± 0.01	1.44 ± 0.01	19.03 ± 0.06	0.34 ± 0.06	9.13 ± 0.06	48.74 ± 0.06	3.21 ± 0.06	0.68 ± 0.06	3.06 ± 0.02
acetaldehyde	0.03 ± 0.12	0.00 ± 0.37	0.01 ± 0.15	0.14 ± 0.18	0.00 ± 0.24	0.41 ± 0.15	5.07 ± 0.96	0.00 ± 0.98	1.59 ± 1.02	12.21 ± 0.98	1.46 ± 0.98	0.00 ± 0.97	0.78 ± 0.33
acetone	0.29 ± 0.17	0.00 ± 0.52	0.02 ± 0.21	0.10 ± 0.26	0.00 ± 0.35	0.03 ± 0.21	1.41 ± 1.37	0.00 ± 1.41	0.00 ± 1.46	1.52 ± 1.40	0.00 ± 1.40	0.00 ± 1.38	0.46 ± 0.47
* acrolein	0.03 ± 0.01	0.04 ± 0.02	0.10 ± 0.03	0.06 ± 0.02	<0.24	0.11 ± 0.03	4.48 ± 1.12	<0.020	2.85 ± 0.71	15.26 ± 3.82	0.96 ± 0.24	0.02 ± 0.02	0.78 ± 0.19
propionaldehyde	0.04 ± 0.01	0.05 ± 0.01	0.04 ± 0.01	0.04 ± 0.01	0.03 ± 0.01	0.05 ± 0.01	0.60 ± 0.04	0.01 ± 0.04	0.51 ± 0.04	2.07 ± 0.04	0.41 ± 0.04	0.04 ± 0.04	0.13 ± 0.01
crotonaldehyde	0.00 ± 0.01	0.00 ± 0.01	0.01 ± 0.01	0.00 ± 0.01	0.00 ± 0.01	0.00 ± 0.01	0.00 ± 0.01	0.01 ± 0.01	0.25 ± 0.01	1.23 ± 0.01	0.00 ± 0.01	0.01 ± 0.01	0.05 ± 0.01
methyl ethyl ketone	0.11 ± 0.01	0.09 ± 0.04	0.11 ± 0.02	0.10 ± 0.02	0.04 ± 0.03	0.08 ± 0.02	0.91 ± 0.11	0.04 ± 0.11	0.34 ± 0.12	1.02 ± 0.11	0.15 ± 0.11	0.05 ± 0.11	0.20 ± 0.04
Methacrolein	0.00 ± 0.01	0.00 ± 0.01	0.00 ± 0.01	0.00 ± 0.01	0.00 ± 0.01	0.02 ± 0.01	0.55 ± 0.01	0.01 ± 0.01	0.44 ± 0.01	2.46 ± 0.01	0.22 ± 0.01	0.00 ± 0.01	0.10 ± 0.01
* n-butyraldehyde	0.05 ± 0.01	0.10 ± 0.02	0.03 ± 0.02	0.06 ± 0.02	<0.24	0.03 ± 0.02	0.32 ± 0.08	<0.020	0.65 ± 0.16	4.23 ± 1.06	0.38 ± 0.09	0.05 ± 0.02	0.13 ± 0.03
benzaldehyde	0.04 ± 0.01	0.06 ± 0.01	0.13 ± 0.01	0.06 ± 0.01	0.10 ± 0.01	0.23 ± 0.01	6.22 ± 0.02	0.02 ± 0.02	3.31 ± 0.02	16.54 ± 0.02	2.09 ± 0.02	0.03 ± 0.02	0.85 ± 0.01
glyoxal	0.01 ± 0.01	0.02 ± 0.01	0.00 ± 0.01	0.01 ± 0.01	0.00 ± 0.01	0.00 ± 0.01	0.08 ± 0.01	0.04 ± 0.01	0.00 ± 0.01	0.25 ± 0.01	0.04 ± 0.01	0.02 ± 0.01	0.01 ± 0.01
valeraldehyde	0.03 ± 0.01	0.01 ± 0.01	0.01 ± 0.01	0.02 ± 0.01	0.03 ± 0.01	0.02 ± 0.01	0.15 ± 0.02	0.02 ± 0.02	0.11 ± 0.03	0.44 ± 0.02	0.00 ± 0.02	0.03 ± 0.02	0.03 ± 0.01
tolualdehyde	0.00 ± 0.01	0.02 ± 0.01	0.00 ± 0.01	0.04 ± 0.01	0.02 ± 0.01	0.07 ± 0.01	0.36 ± 0.03	0.02 ± 0.03	0.10 ± 0.03	0.76 ± 0.03	0.00 ± 0.03	0.05 ± 0.03	0.02 ± 0.01
hexanal	0.00 ± 0.01	0.02 ± 0.01	0.00 ± 0.01	0.04 ± 0.01	0.02 ± 0.01	0.07 ± 0.01	0.36 ± 0.02	0.02 ± 0.02	0.10 ± 0.02	0.76 ± 0.02	0.00 ± 0.02	0.05 ± 0.02	0.02 ± 0.01
*** acrolein converts to an unknown rearrangement product that co-elutes with butyraldehyde. Where indicated, the sum of acrolein and butyraldehyde is given as an estimate of the upper limit of the true value for either compound.**													
VOC (mg/mi)													
1,3 butadiene (estimated)	0.063 ± 0.093	0.501 ± 0.742	0.016 ± 0.023	0.007 ± 0.010	0.007 ± 0.010	0.010 ± 0.015	7.313 ± 10.823	0.045 ± 0.066	2.325 ± 3.441	57.787 ± 85.525	14.497 ± 21.455	45.015 ± 66.622	2.136 ± 3.162
C2 compounds	1.634 ± 0.402	11.732 ± 2.889	0.371 ± 0.091	0.267 ± 0.066	0.340 ± 0.084	1.226 ± 0.302	339.430 ± 54.506	1.519 ± 0.374	15.445 ± 23.745	2141.071 ± 527.149	336.596 ± 82.873	2197.315 ± 540.997	39.293 ± 9.674
propene	0.467 ± 0.099	3.711 ± 0.785	0.116 ± 0.024	0.051 ± 0.011	0.049 ± 0.010	0.073 ± 0.016	54.117 ± 11.440	0.330 ± 0.070	17.203 ± 13.370	427.626 ± 90.396	107.275 ± 22.677	333.109 ± 70.416	15.810 ± 3.342
propane	0.130 ± 0.007	0.302 ± 0.017	0.054 ± 0.003	0.117 ± 0.007	0.145 ± 0.008	0.126 ± 0.007	2.471 ± 0.140	0.137 ± 0.008	0.744 ± 0.167	10.619 ± 0.602	4.203 ± 0.238	11.822 ± 0.670	0.794 ± 0.045
isoButane	0.173 ± 0.011	0.239 ± 0.016	0.037 ± 0.002	0.040 ± 0.002	0.078 ± 0.005	0.065 ± 0.004	2.809 ± 0.181	0.166 ± 0.011	1.254 ± 0.177	15.095 ± 0.972	3.790 ± 0.244	32.948 ± 2.121	1.156 ± 0.074
1Butene+iButylene	0.254 ± 0.030	2.145 ± 0.253	0.059 ± 0.007	0.056 ± 0.007	0.047 ± 0.006	0.055 ± 0.006	28.067 ± 3.306	0.263 ± 0.031	23.569 ± 4.398	131.100 ± 15.442	34.246 ± 4.034	161.281 ± 18.997	8.939 ± 1.053
n-Butane	0.055 ± 0.005	0.305 ± 0.029	0.008 ± 0.001	0.008 ± 0.001	0.016 ± 0.001	0.017 ± 0.002	4.647 ± 0.447	0.058 ± 0.006	3.652 ± 0.457	20.557 ± 1.975	5.667 ± 0.545	30.175 ± 2.900	1.353 ± 0.130
t-2-Butene	0.035 ± 0.006	0.238 ± 0.038	0.005 ± 0.001	0.009 ± 0.001	0.020 ± 0.003	0.021 ± 0.003	3.879 ± 0.612	0.067 ± 0.011	2.286 ± 0.583	16.241 ± 2.563	4.398 ± 0.694	23.708 ± 3.741	1.196 ± 0.189
c-2-Butene	0.015 ± 0.001	0.096 ± 0.006	0.005 ± 0.000	0.004 ± 0.000	0.004 ± 0.000	0.007 ± 0.001	1.595 ± 0.103	0.044 ± 0.003	1.163 ± 0.115	8.848 ± 0.572	1.850 ± 0.120	11.909 ± 0.770	0.451 ± 0.029
3-Me-1-Butene	3.043 ± 0.336	6.330 ± 0.700	10.018 ± 1.108	2.347 ± 0.259	0.688 ± 0.076	0.595 ± 0.066	104.996 ± 11.608	2.684 ± 0.297	39.545 ± 6.536	366.132 ± 40.478	63.335 ± 7.002	581.087 ± 64.243	25.448 ± 2.813
isopentane	0.041 ± 0.004	0.294 ± 0.031	0.051 ± 0.005	0.002 ± 0.000	0.002 ± 0.000	0.017 ± 0.002	3.156 ± 0.330	0.097 ± 0.010	2.097 ± 0.449	16.871 ± 1.761	4.392 ± 0.459	22.283 ± 2.327	0.992 ± 0.104
1-Pentene	0.077 ± 0.010	0.287 ± 0.036	0.005 ± 0.001	0.081 ± 0.010	0.032 ± 0.004	0.038 ± 0.005	4.283 ± 0.539	0.194 ± 0.025	2.459 ± 0.575	14.688 ± 1.848	2.293 ± 0.289	34.715 ± 4.368	1.433 ± 0.180
2-Me-1-Butene	0.525 ± 0.053	1.243 ± 0.126	0.085 ± 0.008	0.015 ± 0.002	0.152 ± 0.016	0.151 ± 0.016	17.158 ± 1.739	0.862 ± 0.088	11.696 ± 1.838	90.484 ± 9.172	13.103 ± 1.328	196.627 ± 19.931	8.772 ± 0.889
n-Pentane	0.060 ± 0.018	0.308 ± 0.091	0.034 ± 0.010	0.063 ± 0.019	0.019 ± 0.006	0.052 ± 0.016	0.000 ± 0.000	0.040 ± 0.012	0.145 ± 0.000	0.529 ± 0.157	0.000 ± 0.000	0.000 ± 0.000	0.626 ± 0.185
t-2-Pentene	0.059 ± 0.003	0.204 ± 0.012	0.013 ± 0.001	0.023 ± 0.001	0.040 ± 0.002	0.041 ± 0.002	4.194 ± 0.238	0.203 ± 0.011	2.179 ± 0.206	20.634 ± 1.171	3.973 ± 0.225	35.963 ± 2.042	1.329 ± 0.076
c-2-Pentene	0.046 ± 0.007	0.126 ± 0.019	0.008 ± 0.001	0.005 ± 0.001	0.018 ± 0.002	0.020 ± 0.003	2.441 ± 0.363	0.107 ± 0.016	1.137 ± 0.302	9.967 ± 1.484	1.746 ± 0.260	20.152 ± 3.000	0.716 ± 0.106
2-Me-2-Butene	0.099 ± 0.009	0.396 ± 0.037	0.013 ± 0.001	0.013 ± 0.001	0.047 ± 0.004	0.055 ± 0.005	6.178 ± 0.577	0.005 ± 0.001	1.226 ± 0.450	0.968 ± 0.090	0.171 ± 0.016	34.563 ± 3.226	2.284 ± 0.213
22DiMeButane	0.138 ± 0.015	0.587 ± 0.065	0.011 ± 0.001	0.016 ± 0.002	0.035 ± 0.004	0.041 ± 0.005	2.235 ± 0.245	0.251 ± 0.028	3.682 ± 0.635	30.092 ± 3.300	7.318 ± 0.803	71.102 ± 7.798	2.865 ± 0.314
CycloPentene	0.012 ± 0.001	0.074 ± 0.008	0.005 ± 0.001	0.003 ± 0.000	0.007 ± 0.001	0.010 ± 0.001	1.329 ± 0.146	0.049 ± 0.005	0.795 ± 0.146	5.861 ± 0.645	1.303 ± 0.143	10.767 ± 1.184	0.349 ± 0.038
CycloPentane	0.043 ± 0.002	0.136 ± 0.007	0.025 ± 0.001	0.009 ± 0.001	0.019 ± 0.001	0.018 ± 0.001	1.722 ± 0.086	0.113 ± 0.006	1.408 ± 0.104	11.962 ± 0.598	2.060 ± 0.103	21.893 ± 1.095	1.031 ± 0.052
23DiMeButane	0.171 ± 0.017	0.621 ± 0.063	0.037 ± 0.004	0.020 ± 0.002	0.050 ± 0.005	0.047 ± 0.005	9.674 ± 0.978	0.376 ± 0.038	5.962 ± 0.950	52.136 ± 5.270	9.465 ± 0.957	91.537 ± 9.253	3.854 ± 0.390
MTBE	0.001 ± 0.000	0.007 ± 0.001	0.000 ± 0.000	<0.07 ± 0.007	<0.16 ± 0.016	<0.16 ± 0.016	0.149 ± 0.013	<1.27 ± 0.000	0.381 ± 0.032	<199.86 ± 20.729	<29.75 ± 3.086	<314.10 ± 32.579	0.035 ± 0.003
2-MePentane	0.508 ± 0.049	1.888 ± 0.184	0.079 ± 0.008	<0.07 ± 0.007	<0.16 ± 0.016	<0.16 ± 0.015	32.240 ± 3.137	<1.27 ± 0.000	16.564 ± 2.624	<199.86 ± 19.445	<29.75 ± 2.895	<314.10 ± 30.560	11.017 ± 1.072
3-MePentane	0.342 ± 0.018	1.271 ± 0.067	0.061 ± 0.003	0.045 ± 0.002	0.098 ± 0.005	0.104 ± 0.005	19.408 ± 1.016	0.835 ± 0.044	10.980 ± 0.933	126.634 ± 6.633	20.721 ± 1.085	208.396 ± 10.915	7.363 ± 0.386
2-Me-1-Pentene	0.051 ± 0.002	0.110 ± 0.004	0.023 ± 0.001	0.012 ± 0.001	0.012 ± 0.001	0.011 ± 0.000	1.047 ± 0.038	0.068 ± 0.002	0.459 ± 0.025	3.159 ± 0.116	0.504 ± 0.018	10.499 ± 0.384	0.571 ± 0.021
1-Hexene	0.024 ± 0.002	0.204 ± 0.019	0.009 ± 0.001	0.008 ± 0.001	0.005 ± 0.001	0.005 ± 0.001	1.959 ± 0.182	0.041 ± 0.004	2.026 ± 0.414	9.453 ± 0.879	3.202 ± 0.298	13.574 ± 1.262	0.249 ± 0.023
n-Hexane	0.297 ± 0.025	1.218 ± 0.104	0.050 ± 0.004	0.047 ± 0.004	0.084 ± 0.007	0.083 ± 0.007	14.255 ± 1.216	0.709 ± 0.060	10.299 ± 1.457	113.525 ± 9.683	13.042 ± 1.113	183.683 ± 15.666	6.703 ± 0.572
t-2-Hexene	0.016 ± 0.001	0.079 ± 0.004	0.005 ± 0.000	0.005 ± 0.000	0.018 ± 0.001	0.009 ± 0.001	2.025 ± 0.103	0.087 ± 0.004	0.769 ± 0.071	7.537 ± 0.383	1.271 ± 0.065	14.583 ± 0.741	0.449 ± 0.023
2-Me-2-Pentene	0.020 ± 0.002	0.097 ± 0.009	0.005 ± 0.001	0.002 ± 0.000	0.017 ± 0.001	0.011 ± 0.001	1.839 ± 0.168	0.089 ± 0.008	0.147 ± 0.096	0.298 ± 0.027	0.070 ± 0.006	8.663 ± 0.793	0.493 ± 0.045
c-3-Me-2-Pentene	0.018 ± 0.001	0.095 ± 0.004	0.004 ± 0.000	0.004 ± 0.000	0.009 ± 0.000	0.003 ± 0.000	2.007 ± 0.087	0.055 ± 0.002	0.183 ± 0.061	0.542 ± 0.024	0.106 ± 0.005	6.962 ± 0.303	0.482 ± 0.021
c-3-Hexene	0.002 ± 0.000	0.011 ± 0.001	0.000 ± 0.000	0.000 ± 0.000	0.006 ± 0.000	0.005 ± 0.000	0.285 ± 0.015	0.012 ± 0.001	0.066 ± 0.010	0.842 ± 0.045	0.129 ± 0.007	1.916 ± 0.103	0.056 ± 0.003
c-2-Hexene	0.010 ± 0.001	0.051 ± 0.004	0.000 ± 0.000	0.001 ± 0.000	0.005 ± 0.000	0.005 ± 0.000	1.182 ± 0.088	0.046 ± 0.004	0.373 ± 0.070	3.754 ± 0.280	0.653 ± 0.049	7.980 ± 0.596	0.269 ± 0.020
t-3-Me-2-Pentene	0.015 ± 0.001	0.077 ± 0.005	0.003 ± 0.000	0.004 ± 0.000	0.007 ± 0.001	0.001 ± 0.000	1.844 ± 0.113	0.082 ± 0.005	0.354 ± 0.064	0.332 ± 0.020	0.081 ± 0.005	10.298 ± 0.631	0.443 ± 0.027
MeCyPentane	0.175 ± 0.017	0.677 ± 0.067	0.028 ± 0.003	0.029 ± 0.003	0.053 ± 0.005	0.064 ± 0.006	10.192 ± 1.013	0.535 ± 0.053	6.984 ± 1.065	79.972 ± 7.946	12.744 ± 1.266	125.004 ± 12.420	4.054 ± 0.403
2,4-DiMePentane	0.146 ± 0.007	0.673 ± 0.035	0.030 ± 0.001	0.024 ± 0.001	0.041 ± 0.002	0.030 ± 0.001	14.556 ± 0.747	0.300 ± 0.015	6.403 ± 0.557	42.773 ± 2.194	7.899 ± 0.405	69.676 ± 3.574	3.933 ± 0.202
223TriMeButane	0.006 ± 0.001	0.017 ± 0.002	0.006 ± 0.001	0.004 ± 0.000	0.004 ± 0.000	0.001 ± 0.000	0.356 ± 0.032	0.010 ± 0.001	0.208 ± 0.039	1.643 ± 0.148	0.233 ± 0.021	3.849 ± 0.347	0.133 ± 0.012
Benzene	1.139 ± 0.132	6.400 ± 0.743	0.137 ± 0.016	0.166 ± 0.019	0.121 ± 0.014	0.208 ± 0.024	89.233 ± 10.360	0.988 ± 0.115	38.465 ± 7.031	518.964 ± 60.254	103.300 ± 11.994	539.333 ± 62.618	22.921 ± 2.661
CycloHexane	0.062 ± 0.006	0.225 ± 0.023	0.011 ± 0.001	<0.05 ± 0.000	0.020 ± 0.002	0.027 ± 0.003	3.944 ± 0.396	0.196 ± 0.020	<14.63 ± 0.399	49.878 ± 5.003	3.660 ± 0.367	35.992 ± 3.611	1.470 ± 0.147
4MeHexane	0.017 ± 0.003	0.065 ± 0.011	0.000 ± 0.000	0.000 ± 0.000	0.001 ± 0.000	0.001 ± 0.000	0.444 ± 0.072	0.006 ± 0.001	0.359 ± 0.072	1.381 ± 0.225	0.263 ± 0.043	1.815 ± 0.296	0.101 ± 0.016
2MeHexane	0.257 ± 0.011	1.168 ± 0.048	0.037 ± 0.001	0.040 ± 0.002	0.057 ± 0.002	0.061 ± 0.002	16.104 ± 0.664	0.622 ± 0.026	9.050 ± 0.618	100.666 ± 4.153	14.598 ± 0.602	169.078 ± 6.975	5.607 ± 0.231
23DiMePentane	0.228 ± 0.008	1.064 ± 0.037	0.059 ± 0.002	0.047 ± 0.002	0.067 ± 0.002	0.049 ± 0.002	21.923 ± 0.773	0.464 ± 0.016	9.521 ± 0.561	63.841 ± 2.250	11.697 ± 0.412	114.575 ± 4.038	6.013 ± 0.212
3MeHexane	0.287 ± 0.012	1.304 ± 0.055	0.053 ± 0.002	<0.05 ± 0.002	0.064 ± 0.003	0.065 ± 0.003	17.165 ± 0.730	0.662 ± 0.028	<11.92 ± 0.718	110.406 ± 4.695	16.884 ± 0.718	193.532 ± 8.231	6.359 ± 0.271

Appendix B1. Chemical Composition of Dilution Blanks and Vehicle Exhaust Samples from Round1

Species Description	S0-1	S0-2	S0-3	S0-4	S0-5	S0-6	S1-1	S1-2	S2-1	S2-2	S2-3	S2-4	S3-1
Cyclohexene	0.006 ± 0.003	0.048 ± 0.013	0.014 ± 0.001	0.000 ± 0.001	0.001 ± 0.002	0.004 ± 0.002	0.686 ± 0.151	0.043 ± 0.019	0.000 ± 0.138	3.608 ± 2.784	0.778 ± 0.467	4.403 ± 4.724	0.182 ± 0.058
3EtPentane	0.025 ± 0.000	0.119 ± 0.000	0.005 ± 0.000	0.012 ± 0.000	0.018 ± 0.000	0.018 ± 0.000	1.349 ± 0.102	0.172 ± 0.000	2.479 ± 0.000	24.854 ± 0.598	4.170 ± 0.100	42.169 ± 0.926	0.520 ± 0.000
* 1-Heptene	<0.55 ± 0.000	<2.42 ± 0.000	<0.09 ± 0.000	0.000 ± 0.019	0.000 ± 0.018	0.000 ± 0.011	2.063 ± 5.758	0.000 ± 0.128	0.992 ± 0.000	12.078 ± 13.097	2.008 ± 2.225	18.704 ± 21.043	<13.61 ± 0.000
* 224TrMePentane	<0.55 ± 0.000	<2.42 ± 0.001	<0.09 ± 0.000	0.159 ± 0.000	0.147 ± 0.000	0.092 ± 0.000	47.160 ± 0.021	1.051 ± 0.000	20.096 ± 0.013	107.273 ± 0.065	18.229 ± 0.000	172.357 ± 0.102	<13.61 ± 0.002
t-3-Heptene	0.002 ± 0.007	0.016 ± 0.032	0.000 ± 0.001	0.000 ± 0.001	0.001 ± 0.001	0.001 ± 0.002	0.572 ± 0.369	0.010 ± 0.017	0.261 ± 0.405	1.793 ± 2.477	0.000 ± 0.459	2.802 ± 4.827	0.066 ± 0.149
n-Heptane	0.207 ± 0.001	0.965 ± 0.002	0.032 ± 0.000	0.043 ± 0.000	0.046 ± 0.000	0.051 ± 0.000	11.026 ± 0.087	0.524 ± 0.002	7.417 ± 0.047	74.006 ± 0.015	13.701 ± 0.004	144.189 ± 0.044	4.439 ± 0.012
244TMe-1-Pentene	0.008 ± 0.005	0.019 ± 0.022	0.000 ± 0.001	0.002 ± 0.001	0.001 ± 0.001	0.003 ± 0.002	0.897 ± 0.341	0.019 ± 0.013	0.069 ± 0.363	0.155 ± 1.975	0.043 ± 0.452	0.453 ± 3.209	0.124 ± 0.126
MeCyHexane	0.074 ± 0.009	0.308 ± 0.048	0.010 ± 0.002	0.013 ± 0.003	0.019 ± 0.002	0.026 ± 0.001	4.929 ± 0.695	0.191 ± 0.017	2.940 ± 0.574	28.566 ± 2.402	6.533 ± 0.421	46.408 ± 4.343	1.822 ± 0.228
25DiMeHexane	0.082 ± 0.004	0.411 ± 0.022	0.017 ± 0.001	0.024 ± 0.001	0.017 ± 0.001	0.012 ± 0.001	5.955 ± 0.353	0.150 ± 0.011	2.905 ± 0.272	20.575 ± 1.328	3.603 ± 0.208	37.207 ± 2.322	1.956 ± 0.108
24DiMeHexane	0.103 ± 0.005	0.505 ± 0.023	0.019 ± 0.001	0.032 ± 0.002	0.030 ± 0.001	0.025 ± 0.001	8.304 ± 0.436	0.270 ± 0.011	4.862 ± 0.328	31.226 ± 1.175	4.888 ± 0.173	54.608 ± 2.085	2.543 ± 0.132
234TrMePentane	0.141 ± 0.097	0.629 ± 0.575	0.026 ± 0.018	0.047 ± 0.016	0.041 ± 0.031	0.023 ± 0.019	11.761 ± 7.075	0.288 ± 0.132	5.257 ± 4.308	31.719 ± 41.290	4.672 ± 5.650	56.275 ± 48.614	3.567 ± 1.427
Toluene	2.296 ± 0.005	13.581 ± 0.020	0.438 ± 0.001	0.372 ± 0.001	0.740 ± 0.001	0.439 ± 0.000	261.901 ± 0.364	3.106 ± 0.003	69.370 ± 0.317	<975.01 ± 94.350	<133.42 ± 12.911	<1147.97 ± 111.087	33.703 ± 0.126
23DiMeHexane	0.053 ± 0.008	0.223 ± 0.033	0.011 ± 0.001	0.005 ± 0.001	0.006 ± 0.001	0.004 ± 0.001	4.079 ± 0.000	0.037 ± 0.014	2.729 ± 0.304	<975.01 ± 2.223	<133.42 ± 0.384	<1147.97 ± 4.117	1.414 ± 0.112
2MeHeptane	0.155 ± 0.007	0.671 ± 0.031	0.024 ± 0.001	0.013 ± 0.001	0.029 ± 0.001	0.025 ± 0.001	0.000 ± 0.458	0.281 ± 0.011	4.108 ± 0.347	44.739 ± 1.630	7.720 ± 0.245	82.846 ± 3.050	2.247 ± 0.103
4MeHeptane	0.071 ± 0.005	0.327 ± 0.026	0.013 ± 0.001	0.009 ± 0.000	0.011 ± 0.001	0.011 ± 0.001	4.814 ± 0.415	0.117 ± 0.010	1.549 ± 0.255	17.121 ± 1.650	2.574 ± 0.241	32.037 ± 3.090	1.078 ± 0.095
3MeHeptane	0.161 ± 0.003	0.785 ± 0.011	0.022 ± 0.001	0.006 ± 0.001	0.028 ± 0.001	0.026 ± 0.001	12.495 ± 0.215	0.302 ± 0.005	4.592 ± 0.128	49.670 ± 0.253	7.245 ± 0.058	93.031 ± 0.431	2.876 ± 0.043
Hexanal	0.000 ± 0.012	0.020 ± 0.006	0.000 ± 0.013	0.040 ± 0.013	0.020 ± 0.014	0.070 ± 0.013	0.360 ± 0.016	0.020 ± 0.017	0.100 ± 0.018	0.760 ± 0.017	0.000 ± 0.017	0.050 ± 0.017	0.020 ± 0.006
225TMHexane	0.114 ± 0.001	0.677 ± 0.013	0.022 ± 0.001	0.038 ± 0.000	0.019 ± 0.000	0.009 ± 0.000	5.309 ± 0.019	0.130 ± 0.000	3.009 ± 0.116	17.882 ± 0.193	3.709 ± 0.082	37.107 ± 0.278	2.419 ± 0.012
Octene-1	0.009 ± 0.001	0.104 ± 0.002	0.004 ± 0.000	0.003 ± 0.000	0.001 ± 0.000	0.001 ± 0.000	0.154 ± 0.005	0.001 ± 0.000	0.257 ± 0.026	1.591 ± 0.126	0.672 ± 0.029	2.289 ± 0.252	0.099 ± 0.010
11DMeCyHexane	0.022 ± 0.006	0.094 ± 0.029	0.002 ± 0.001	0.003 ± 0.001	0.002 ± 0.001	0.003 ± 0.001	0.206 ± 0.350	0.002 ± 0.010	0.043 ± 0.241	5.290 ± 1.270	1.222 ± 0.277	10.568 ± 2.925	0.439 ± 0.083
n-Octane	0.156 ± 0.002	0.748 ± 0.009	0.032 ± 0.001	0.037 ± 0.000	0.027 ± 0.000	0.024 ± 0.000	9.138 ± 0.105	0.252 ± 0.003	3.685 ± 0.068	33.162 ± 0.455	7.227 ± 0.078	76.384 ± 0.743	2.175 ± 0.028
24DiMeHeptane	0.022 ± 0.001	0.101 ± 0.005	0.007 ± 0.000	0.001 ± 0.000	0.001 ± 0.000	0.002 ± 0.000	1.183 ± 0.059	0.034 ± 0.000	0.670 ± 0.040	5.139 ± 0.178	0.876 ± 0.032	8.396 ± 0.342	0.316 ± 0.017
25DiMeHeptane	0.061 ± 0.003	0.306 ± 0.013	0.012 ± 0.001	0.005 ± 0.000	0.003 ± 0.000	0.003 ± 0.000	3.493 ± 0.152	0.023 ± 0.002	1.444 ± 0.142	10.661 ± 0.212	1.900 ± 0.030	20.431 ± 0.289	1.025 ± 0.070
33DiMeHeptane	0.021 ± 0.051	0.099 ± 0.364	0.005 ± 0.013	0.001 ± 0.011	0.001 ± 0.026	0.002 ± 0.008	1.148 ± 2.686	0.014 ± 0.053	0.059 ± 0.000	1.601 ± 13.773	0.230 ± 1.747	2.182 ± 20.516	0.527 ± 0.497
EtBenzene	0.757 ± 0.124	5.380 ± 0.955	0.197 ± 0.038	0.160 ± 0.033	0.377 ± 0.070	0.115 ± 0.022	39.651 ± 5.222	0.782 ± 0.136	17.898 ± 4.143	203.296 ± 33.224	25.783 ± 4.962	302.827 ± 49.354	7.344 ± 1.162
m/p-xylene	1.995 ± 0.004	15.383 ± 0.020	0.613 ± 0.002	0.526 ± 0.000	1.130 ± 0.001	0.351 ± 0.000	84.096 ± 0.158	2.183 ± 0.001	48.899 ± 0.969	535.036 ± 0.987	79.916 ± 0.173	794.786 ± 1.220	18.717 ± 0.042
2MeOctane	0.174 ± 0.015	0.881 ± 0.080	0.079 ± 0.004	0.014 ± 0.000	0.029 ± 0.000	0.005 ± 0.000	6.970 ± 0.575	0.024 ± 0.001	0.160 ± 0.447	43.594 ± 2.352	7.643 ± 0.439	53.885 ± 5.101	1.841 ± 0.152
3MeOctane	0.143 ± 0.003	0.760 ± 0.017	0.038 ± 0.001	0.003 ± 0.002	0.004 ± 0.011	0.001 ± 0.002	5.447 ± 0.132	0.008 ± 0.006	2.143 ± 0.032	22.290 ± 0.309	4.159 ± 0.077	48.352 ± 0.842	1.437 ± 0.034
Styrene+heptanal	0.037 ± 0.049	0.210 ± 0.331	0.018 ± 0.015	0.024 ± 0.012	0.137 ± 0.023	0.025 ± 0.007	1.684 ± 1.538	0.073 ± 0.042	1.803 ± 1.358	3.940 ± 9.764	0.985 ± 1.465	10.748 ± 15.671	0.429 ± 0.382
o-xylene	1.013 ± 0.007	6.763 ± 0.057	0.301 ± 0.003	0.254 ± 0.000	0.470 ± 0.000	0.139 ± 0.000	31.464 ± 0.186	0.849 ± 0.002	19.293 ± 0.071	199.740 ± 0.037	29.979 ± 0.012	320.588 ± 0.073	7.820 ± 0.038
Nonene-1	0.144 ± 0.004	1.261 ± 0.019	0.068 ± 0.001	0.004 ± 0.001	0.004 ± 0.001	0.004 ± 0.001	4.087 ± 0.098	0.035 ± 0.004	0.191 ± 0.092	0.820 ± 0.392	0.271 ± 0.128	1.599 ± 1.064	0.836 ± 0.033
n-Nonane	0.147 ± 0.005	0.684 ± 0.023	0.045 ± 0.002	0.018 ± 0.001	0.029 ± 0.001	0.018 ± 0.000	3.590 ± 0.119	0.137 ± 0.004	2.117 ± 0.014	14.445 ± 0.446	4.721 ± 0.060	39.156 ± 1.035	1.195 ± 0.028
iPropBenzene	0.101 ± 0.000	0.468 ± 0.002	0.033 ± 0.000	0.025 ± 0.002	0.031 ± 0.001	0.005 ± 0.000	2.426 ± 0.018	0.077 ± 0.004	1.513 ± 0.118	9.095 ± 0.156	1.223 ± 0.041	21.124 ± 0.449	0.575 ± 0.004
iPropCyHexane	0.002 ± 0.007	0.015 ± 0.027	0.003 ± 0.002	0.017 ± 0.004	0.008 ± 0.002	0.001 ± 0.000	0.153 ± 0.138	0.029 ± 0.005	0.602 ± 0.072	1.294 ± 0.361	0.341 ± 0.110	3.734 ± 0.865	0.033 ± 0.050
26DiMeOctane	0.062 ± 0.005	0.249 ± 0.019	0.020 ± 0.001	0.035 ± 0.004	0.017 ± 0.003	0.002 ± 0.002	1.271 ± 0.110	0.046 ± 0.004	0.122 ± 2.010	3.326 ± 0.195	1.015 ± 0.093	7.975 ± 0.730	0.457 ± 0.031
alpha-pinene	0.015 ± 0.021	0.056 ± 0.108	0.004 ± 0.014	0.011 ± 0.013	0.009 ± 0.016	0.006 ± 0.005	0.330 ± 0.476	0.012 ± 0.016	1.117 ± 0.711	0.588 ± 2.237	0.280 ± 0.361	2.198 ± 4.844	0.093 ± 0.107
nPropBenzene	0.312 ± 0.031	1.613 ± 0.179	0.205 ± 0.012	0.200 ± 0.010	0.236 ± 0.021	0.068 ± 0.005	7.101 ± 0.643	0.242 ± 0.017	3.832 ± 0.007	33.404 ± 3.684	5.396 ± 0.615	72.336 ± 6.794	1.599 ± 0.155
mEtToluene	1.074 ± 0.019	6.104 ± 0.109	0.416 ± 0.009	0.324 ± 0.006	0.715 ± 0.013	0.172 ± 0.003	21.894 ± 0.400	0.573 ± 0.011	15.283 ± 0.319	125.518 ± 2.295	20.959 ± 0.388	231.434 ± 4.339	5.272 ± 0.106
pEtToluene	0.472 ± 0.021	2.721 ± 0.111	0.228 ± 0.008	0.150 ± 0.011	0.323 ± 0.018	0.079 ± 0.005	9.975 ± 0.354	0.263 ± 0.014	6.429 ± 0.016	57.249 ± 2.070	9.682 ± 0.399	108.232 ± 3.969	2.652 ± 0.088
135TriMeBenzene	0.492 ± 0.024	2.587 ± 0.103	0.197 ± 0.007	0.256 ± 0.008	0.426 ± 0.012	0.105 ± 0.003	8.264 ± 0.337	0.316 ± 0.010	6.610 ± 0.009	48.325 ± 1.967	9.321 ± 0.324	92.631 ± 3.781	2.058 ± 0.089
oEtToluene	0.558 ± 0.009	2.360 ± 0.034	0.174 ± 0.001	0.179 ± 0.004	0.273 ± 0.007	0.066 ± 0.003	7.764 ± 0.213	0.228 ± 0.006	5.718 ± 0.380	45.275 ± 0.165	7.449 ± 0.277	87.019 ± 0.298	2.058 ± 0.047
Octanal	0.021 ± 0.001	0.083 ± 0.001	0.003 ± 0.000	0.009 ± 0.004	0.017 ± 0.006	0.007 ± 0.008	0.524 ± 0.011	0.016 ± 0.001	0.508 ± 0.011	0.405 ± 0.000	0.680 ± 0.017	0.731 ± 0.037	0.116 ± 0.003
beta-pinene	0.013 ± 0.070	0.018 ± 0.394	0.000 ± 0.029	0.059 ± 0.024	0.088 ± 0.060	0.122 ± 0.016	0.161 ± 1.082	0.017 ± 0.039	0.593 ± 0.910	0.000 ± 7.334	0.256 ± 1.235	0.564 ± 14.414	0.040 ± 0.272
* 124TriMeBenzene	<1.54 ± 0.159	<8.72 ± 0.897	<0.64 ± 0.066	0.525 ± 0.010	1.317 ± 0.006	0.345 ± 0.002	<23.94 ± 2.463	0.864 ± 0.007	20.123 ± 0.142	162.181 ± 0.805	27.315 ± 0.315	318.745 ± 2.204	<6.00 ± 0.618
* n-Decane	<1.54 ± 0.002	<8.72 ± 0.007	<0.64 ± 0.001	0.102 ± 0.001	0.060 ± 0.000	0.023 ± 0.000	<23.94 ± 0.046	0.071 ± 0.000	1.468 ± 0.125	8.336 ± 0.131	3.260 ± 0.022	22.830 ± 0.287	<6.00 ± 0.006
iButBenzene	0.044 ± 0.003	0.144 ± 0.007	0.014 ± 0.001	0.011 ± 0.002	0.005 ± 0.001	0.003 ± 0.000	0.937 ± 0.040	0.007 ± 0.001	0.529 ± 0.288	2.668 ± 0.181	0.453 ± 0.034	5.852 ± 0.385	0.124 ± 0.009
sButBenzene	0.058 ± 0.013	0.135 ± 0.079	0.022 ± 0.006	0.029 ± 0.002	0.023 ± 0.003	0.006 ± 0.001	0.714 ± 0.316	0.019 ± 0.002	0.402 ± 0.033	3.262 ± 3.889	0.602 ± 0.651	6.930 ± 7.848	0.159 ± 0.075
Limonene	0.124 ± 0.007	0.760 ± 0.031	0.057 ± 0.002	0.023 ± 0.003	0.029 ± 0.005	0.010 ± 0.001	3.047 ± 0.077	0.020 ± 0.003	<4.94 ± 0.000	37.516 ± 0.000	6.278 ± 0.000	75.700 ± 0.000	0.725 ± 0.021
Indan	0.129 ± 0.050	0.628 ± 0.259	0.043 ± 0.024	0.050 ± 0.010	0.091 ± 0.021	0.038 ± 0.010	1.988 ± 0.696	0.105 ± 0.010	<2.45 ± 0.194	17.031 ± 1.039	3.267 ± 0.149	33.795 ± 1.694	0.420 ± 0.147
13diethylbenzene	0.505 ± 0.018	2.585 ± 0.091	0.238 ± 0.008	0.051 ± 0.002	0.213 ± 0.007	0.062 ± 0.002	6.957 ± 0.245	0.015 ± 0.001	1.937 ± 0.034	10.390 ± 0.366	1.489 ± 0.053	16.943 ± 0.598	1.471 ± 0.052
14diethylbenzene	0.064 ± 0.006	0.142 ± 0.013	0.023 ± 0.002	0.103 ± 0.010	0.075 ± 0.007	0.018 ± 0.002	0.613 ± 0.056	0.030 ± 0.003	1.019 ± 0.000	5.991 ± 0.545	1.355 ± 0.123	10.494 ± 0.955	0.165 ± 0.015
12diethylbenzene	0.051 ± 0.005	0.188 ± 0.019	0.023 ± 0.002	0.201 ± 0.021	0.027 ± 0.003	0.023 ± 0.002	0.337 ± 0.035	0.015 ± 0.002	0.577 ± 0.011	5.194 ± 0.538	0.647 ± 0.067	7.795 ± 0.808	0.286 ± 0.029
2-propylToluene	0.088 ± 0.003	0.369 ± 0.012	0.034 ± 0.001	0.125 ± 0.004	0.028 ± 0.001	0.042 ± 0.001	1.114 ± 0.037	0.012 ± 0.000	1.118 ± 0.030	8.778 ± 0.289	1.236 ± 0.041	17.779 ± 0.585	0.246 ± 0.008
3-ipropyltoluene	0.089 ± 0.004	0.277 ± 0.014	0.029 ± 0.001	0.014 ± 0.001	0.006 ± 0.000	0.001 ± 0.000	1.086 ± 0.054	0.004 ± 0.000	0.734 ± 0.072	4.422 ± 0.218	0.591 ± 0.029	8.651 ± 0.427	0.278 ± 0.014
4-ipropyltoluene	0.018 ± 0.005	0.005 ± 0.001	0.003 ± 0.001	0.024 ± 0.007	0.018 ± 0.005	0.015 ± 0.005	0.254 ± 0.077	0.012 ± 0.004	0.088 ± 0.623	1.560 ± 0.475	0.390 ± 0.119	2.725 ± 0.829	0.057 ± 0.017
2-ipropyltoluene	0.017 ± 0.003	0.057 ± 0.011	0.006 ± 0.001	0.013 ± 0.003	0.015 ± 0.003	0.007 ± 0.001	0.225 ± 0.045	0.027 ± 0.005	<2.45 ± 0.068	1.530 ± 0.305	0.354 ± 0.071	1.737 ± 0.346	0.081 ± 0.016
Nonanal	0.296 ± 0.048	0.160 ± 0.026	0.184 ± 0.030	0.158 ± 0.026	0.532 ± 0.086	0.145 ± 0.024	3.780 ± 0.615	0.072 ± 0.012	3.546 ± 0.036	26.850 ± 4.368	3.837 ± 0.624	53.531 ± 8.709	0.770 ± 0.125
n-Undecane	0.164 ± 0.019	0.760 ± 0.090	0.089 ± 0.011	0.143 ± 0.017	0.113 ± 0.013	0.037 ± 0.004	1.738 ± 0.204	0.040 ± 0.005	0.463 ± 0.339	4.397 ± 0.517	1.066 ± 0.125	10.493 ± 1.234	0.491 ± 0.058
1245tetraMeBenzene	0.143 ± 0.010	0.944 ± 0.065	0.115 ± 0.008	0.042 ± 0.003	0.009 ± 0.001	0.006 ± 0.000	1.428 ± 0.099	0.010 ± 0.001	0.794 ± 0.000	8.981 ± 0.619	1.314 ± 0.091	21.270 ± 1.467	0.317 ± 0.022
1235tetraMeBenzene	0.184 ± 0.003	1.333 ± 0.025	0.151 ± 0.003	0.086 ± 0.002	0.013 ± 0.000	0.009 ± 0.000	1.673 ± 0.031	0.012 ± 0.000	0.992 ± 0.000	11.485 ± 0.211	1.806 ± 0.033	28.959 ± 0.533	0.354 ± 0.006
1234tetraMeBenzene	0.178 ± 0.032	1.193 ± 0.213	0.150 ± 0.027	0.034 ± 0.006	0.023 ± 0.004	0.034 ± 0.006	2.420 ± 0.432	0.007 ± 0.001	0.257 ± 0.000	11.429 ± 2.039	1.814 ± 0.324	24.847 ± 4.432	0.405 ± 0.072
n-Dodecane	1.098 ± 0.131	2.909 ± 0.349	0.556 ± 0.067	0.059 ± 0.007	1.922 ± 0.230	0.026 ± 0.003	8.064 ± 0.967	0.016 ± 0.002	0.147 ± 0.000	37.208 ± 4.460	5.725 ± 0.686	48.522 ± 5.817	1.926 ± 0.231

Appendix B1. Chemical Composition of Dilution Blanks and Vehicle Exhaust Samples from Round1

Species Description	S3-2	S4-1	S4-2	S5-1	S5-2	S5-3	S5-4	S5-5	S6-1	S6-2	S6-3	S6-4	S7-1
Gravimetric mass (mg/mi)	22.36 ± 3.54	3.31 ± 0.54	2.12 ± 0.35	18.14 ± 2.88	60.91 ± 9.63	9.46 ± 1.51	207.43 ± 32.80	99.63 ± 15.76	41.62 ± 6.58	49.04 ± 7.76	10.10 ± 1.61	22.84 ± 3.62	7.66 ± 1.22
Carbon fractions by TOR (mg/mi)													
Organic Carbon Fraction 1	1.821 ± 0.388	0.217 ± 0.080	0.236 ± 0.053	1.809 ± 0.672	21.743 ± 5.729	1.684 ± 0.448	37.197 ± 10.985	3.375 ± 0.927	21.352 ± 8.475	2.715 ± 1.104	1.584 ± 0.453	2.197 ± 0.655	1.722 ± 0.410
Organic Carbon Fraction 2	2.756 ± 0.514	0.437 ± 0.089	0.348 ± 0.071	3.469 ± 0.698	18.232 ± 3.741	2.691 ± 0.568	50.194 ± 11.291	7.628 ± 1.663	11.518 ± 2.219	2.726 ± 0.538	0.762 ± 0.182	5.693 ± 1.276	1.493 ± 0.301
Organic Carbon Fraction 3	1.957 ± 0.414	0.519 ± 0.181	0.459 ± 0.127	2.502 ± 0.719	5.157 ± 1.061	2.231 ± 0.517	7.264 ± 1.457	5.521 ± 1.151	1.948 ± 0.564	1.780 ± 0.536	0.605 ± 0.260	3.604 ± 0.811	0.371 ± 0.171
Organic Carbon Fraction 4	1.658 ± 0.445	0.275 ± 0.072	0.777 ± 0.196	1.153 ± 0.341	1.385 ± 0.415	0.569 ± 0.179	3.461 ± 1.016	3.446 ± 1.042	0.788 ± 0.214	1.708 ± 0.464	0.804 ± 0.273	2.500 ± 0.867	0.286 ± 0.085
Pyrolyzed Organic Carbon	0.004 ± 0.022	0.021 ± 0.043	0.001 ± 0.016	0.095 ± 0.130	0.003 ± 0.034	0.003 ± 0.037	3.534 ± 1.268	13.964 ± 5.012	0.003 ± 0.037	0.148 ± 0.281	0.002 ± 0.037	0.004 ± 0.036	0.001 ± 0.025
Total Organic Carbon	8.186 ± 1.453	1.438 ± 0.289	1.801 ± 0.333	9.029 ± 1.616	46.521 ± 8.669	7.177 ± 1.388	101.649 ± 19.936	33.934 ± 6.652	35.609 ± 6.209	9.079 ± 1.615	3.738 ± 0.781	13.998 ± 2.783	3.856 ± 0.732
Elemental Carbon Fraction 1	2.228 ± 0.620	0.291 ± 0.075	0.305 ± 0.072	2.641 ± 0.743	2.734 ± 0.967	0.431 ± 0.147	10.210 ± 3.761	9.260 ± 3.243	0.344 ± 0.101	7.289 ± 1.912	2.249 ± 0.950	1.383 ± 0.550	0.585 ± 0.187
Elemental Carbon Fraction 2	3.337 ± 0.584	0.302 ± 0.097	0.602 ± 0.103	7.343 ± 3.049	6.628 ± 1.335	2.112 ± 0.452	70.871 ± 14.926	55.568 ± 11.296	0.298 ± 0.131	29.406 ± 14.514	2.494 ± 0.536	1.256 ± 0.245	1.736 ± 0.315
Elemental Carbon Fraction 3	0.082 ± 0.029	0.011 ± 0.007	0.275 ± 0.121	0.041 ± 0.014	0.055 ± 0.033	0.010 ± 0.013	0.020 ± 0.016	0.006 ± 0.012	0.000 ± 0.011	0.057 ± 0.016	0.000 ± 0.012	0.047 ± 0.022	0.000 ± 0.008
Total Elemental Carbon	5.641 ± 1.085	0.582 ± 0.096	1.178 ± 0.218	9.929 ± 1.571	9.412 ± 2.161	2.549 ± 0.626	77.566 ± 19.006	50.871 ± 11.478	0.639 ± 0.110	36.603 ± 5.789	4.739 ± 1.078	2.682 ± 0.616	2.316 ± 0.459
Total Carbon	13.827 ± 2.390	2.021 ± 0.381	2.975 ± 0.516	18.959 ± 3.343	55.933 ± 10.308	9.731 ± 1.851	179.221 ± 34.287	84.805 ± 15.708	36.249 ± 6.390	45.681 ± 8.138	8.480 ± 1.606	16.681 ± 3.237	6.173 ± 1.111
Elements by XRF (mg/mi)													
Sodium (qualitative only)	0.2292 ± 0.1567	0.1341 ± 0.1326	0.1160 ± 0.0855	0.3977 ± 0.1872	0.3757 ± 0.2197	0.2698 ± 0.1947	0.2127 ± 0.5178	0.0000 ± 0.2171	0.2440 ± 0.2110	0.3421 ± 0.2269	0.2317 ± 0.2595	0.1582 ± 0.2746	0.3097 ± 0.1666
Magnesium (qualitative only)	0.0368 ± 0.0223	0.0354 ± 0.0204	0.0106 ± 0.0160	0.0455 ± 0.0322	0.0402 ± 0.0352	0.0043 ± 0.0370	0.1268 ± 0.0686	0.0058 ± 0.0468	0.0155 ± 0.0382	0.0890 ± 0.0314	0.0000 ± 0.0474	0.0000 ± 0.0461	0.0141 ± 0.0294
Aluminum	0.0663 ± 0.0139	0.0348 ± 0.0112	0.0078 ± 0.0071	0.0002 ± 0.0193	0.0072 ± 0.0193	0.0301 ± 0.0159	0.0685 ± 0.0320	0.0060 ± 0.0201	0.0243 ± 0.0156	0.0054 ± 0.0206	0.0357 ± 0.0150	0.0511 ± 0.0188	0.0096 ± 0.0117
Silicon	2.2776 ± 0.3602	0.1437 ± 0.0231	0.1010 ± 0.0163	0.1254 ± 0.0212	0.2638 ± 0.0425	0.0786 ± 0.0144	0.4661 ± 0.0753	0.8366 ± 0.1326	0.0471 ± 0.0102	0.4305 ± 0.0686	0.1182 ± 0.0202	0.3206 ± 0.0514	0.0279 ± 0.0069
Phosphorous	0.0356 ± 0.0064	0.0039 ± 0.0027	0.0042 ± 0.0020	0.0153 ± 0.0051	0.0349 ± 0.0074	0.0233 ± 0.0061	0.1735 ± 0.0292	0.0317 ± 0.0069	0.0431 ± 0.0082	0.0177 ± 0.0057	0.0635 ± 0.0111	0.0316 ± 0.0073	0.0518 ± 0.0088
Sulfur	0.4772 ± 0.0755	0.0626 ± 0.0101	0.0424 ± 0.0068	0.1930 ± 0.0309	0.7571 ± 0.1198	0.0568 ± 0.0096	0.9955 ± 0.1577	0.2865 ± 0.0455	0.0953 ± 0.0154	0.4036 ± 0.0640	0.1275 ± 0.0205	0.3861 ± 0.0612	0.1514 ± 0.0241
Chlorine	0.0174 ± 0.0053	0.0031 ± 0.0031	0.0005 ± 0.0033	0.0071 ± 0.0055	0.0030 ± 0.0120	0.0021 ± 0.0061	0.0254 ± 0.0164	0.0290 ± 0.0086	0.0009 ± 0.0055	0.0129 ± 0.0088	0.0150 ± 0.0055	0.0112 ± 0.0059	0.0019 ± 0.0043
Potassium	0.0212 ± 0.0037	0.0105 ± 0.0022	0.0020 ± 0.0021	0.0019 ± 0.0031	0.0058 ± 0.0029	0.0049 ± 0.0029	0.0187 ± 0.0065	0.0057 ± 0.0054	0.0455 ± 0.0076	0.0055 ± 0.0029	0.0110 ± 0.0033	0.0311 ± 0.0058	0.0072 ± 0.0024
Calcium	0.3150 ± 0.0499	0.0825 ± 0.0132	0.0674 ± 0.0108	0.0335 ± 0.0064	0.1298 ± 0.0208	0.1155 ± 0.0186	0.5319 ± 0.0844	0.2858 ± 0.0455	0.1049 ± 0.0169	0.1292 ± 0.0208	0.2079 ± 0.0331	0.3050 ± 0.0484	0.1388 ± 0.0221
Titanium	0.0100 ± 0.0104	0.0103 ± 0.0107	0.0055 ± 0.0116	0.0026 ± 0.0192	0.0063 ± 0.0187	0.0095 ± 0.0179	0.0147 ± 0.0352	0.0086 ± 0.0324	0.0024 ± 0.0188	0.0064 ± 0.0196	0.0109 ± 0.0188	0.0074 ± 0.0182	0.0055 ± 0.0136
Vanadium	0.0036 ± 0.0049	0.0080 ± 0.0046	0.0021 ± 0.0054	0.0008 ± 0.0089	0.0019 ± 0.0080	0.0036 ± 0.0077	0.0052 ± 0.0151	0.0034 ± 0.0156	0.0018 ± 0.0080	0.0030 ± 0.0084	0.0047 ± 0.0081	0.0013 ± 0.0090	0.0023 ± 0.0061
Chromium	0.0092 ± 0.0017	0.0046 ± 0.0011	0.0010 ± 0.0011	0.0002 ± 0.0019	0.0009 ± 0.0016	0.0023 ± 0.0014	0.0083 ± 0.0026	0.0062 ± 0.0031	0.0035 ± 0.0014	0.0021 ± 0.0015	0.0173 ± 0.0031	0.0130 ± 0.0028	0.0009 ± 0.0013
Manganese	0.0047 ± 0.0009	0.0013 ± 0.0005	0.0017 ± 0.0006	0.0014 ± 0.0009	0.0021 ± 0.0009	0.0011 ± 0.0010	0.0037 ± 0.0020	0.0033 ± 0.0014	0.0007 ± 0.0009	0.0007 ± 0.0010	0.0022 ± 0.0011	0.0062 ± 0.0015	0.0003 ± 0.0008
Iron	0.5034 ± 0.0796	0.0614 ± 0.0098	0.0575 ± 0.0091	0.0256 ± 0.0045	0.0396 ± 0.0066	0.0778 ± 0.0125	0.4600 ± 0.0729	0.3544 ± 0.0561	0.0511 ± 0.0083	0.0406 ± 0.0067	0.2292 ± 0.0363	1.1917 ± 0.1885	0.0297 ± 0.0049
Cobalt	0.0026 ± 0.0049	0.0004 ± 0.0007	0.0003 ± 0.0005	0.0001 ± 0.0008	0.0005 ± 0.0010	0.0005 ± 0.0012	0.0007 ± 0.0047	0.0023 ± 0.0040	0.0000 ± 0.0010	0.0005 ± 0.0010	0.0012 ± 0.0034	0.0048 ± 0.0176	0.0004 ± 0.0007
Nickel	0.0047 ± 0.0008	0.0063 ± 0.0010	0.0007 ± 0.0003	0.0004 ± 0.0006	0.0003 ± 0.0006	0.0006 ± 0.0006	0.0029 ± 0.0010	0.0050 ± 0.0010	0.0007 ± 0.0006	0.0010 ± 0.0006	0.0026 ± 0.0008	0.0057 ± 0.0011	0.0006 ± 0.0005
Copper	0.0197 ± 0.0031	0.0075 ± 0.0012	0.0045 ± 0.0008	0.0033 ± 0.0008	0.0013 ± 0.0006	0.0042 ± 0.0009	0.0277 ± 0.0045	0.0184 ± 0.0030	0.0031 ± 0.0007	0.0232 ± 0.0037	0.0145 ± 0.0024	0.0301 ± 0.0048	0.0042 ± 0.0008
Zinc	0.1403 ± 0.0223	0.0160 ± 0.0036	0.0249 ± 0.0044	0.0274 ± 0.0063	0.0383 ± 0.0076	0.0408 ± 0.0079	0.3134 ± 0.0503	0.1194 ± 0.0194	0.0472 ± 0.0087	0.0599 ± 0.0106	0.0972 ± 0.0160	0.1853 ± 0.0296	0.0567 ± 0.0095
Gallium	0.0013 ± 0.0011	0.0005 ± 0.0012	0.0010 ± 0.0008	0.0004 ± 0.0021	0.0012 ± 0.0019	0.0003 ± 0.0018	0.0013 ± 0.0037	0.0001 ± 0.0019	0.0000 ± 0.0021	0.0000 ± 0.0022	0.0023 ± 0.0019	0.0019 ± 0.0017	0.0000 ± 0.0014
Arsenic	0.0004 ± 0.0020	0.0001 ± 0.0010	0.0001 ± 0.0007	0.0008 ± 0.0080	0.0005 ± 0.0019	0.0003 ± 0.0016	0.0012 ± 0.0056	0.0000 ± 0.0020	0.0001 ± 0.0019	0.0012 ± 0.0027	0.0000 ± 0.0022	0.0009 ± 0.0030	0.0005 ± 0.0013
Selenium	0.0003 ± 0.0004	0.0000 ± 0.0005	0.0005 ± 0.0003	0.0000 ± 0.0008	0.0003 ± 0.0008	0.0002 ± 0.0007	0.0002 ± 0.0015	0.0005 ± 0.0008	0.0000 ± 0.0008	0.0000 ± 0.0009	0.0001 ± 0.0008	0.0003 ± 0.0007	0.0001 ± 0.0006
Bromine	0.0031 ± 0.0006	0.0011 ± 0.0004	0.0008 ± 0.0003	0.0072 ± 0.0013	0.0060 ± 0.0012	0.0003 ± 0.0006	0.0060 ± 0.0014	0.0063 ± 0.0011	0.0003 ± 0.0007	0.0060 ± 0.0012	0.0003 ± 0.0007	0.0006 ± 0.0007	0.0003 ± 0.0005
Rubidium	0.0003 ± 0.0005	0.0004 ± 0.0005	0.0006 ± 0.0004	0.0004 ± 0.0009	0.0001 ± 0.0009	0.0004 ± 0.0008	0.0002 ± 0.0017	0.0009 ± 0.0008	0.0002 ± 0.0009	0.0001 ± 0.0009	0.0005 ± 0.0009	0.0005 ± 0.0008	0.0002 ± 0.0006
Strontium	0.0006 ± 0.0005	0.0001 ± 0.0006	0.0008 ± 0.0004	0.0000 ± 0.0010	0.0001 ± 0.0010	0.0000 ± 0.0009	0.0001 ± 0.0019	0.0015 ± 0.0008	0.0000 ± 0.0010	0.0000 ± 0.0011	0.0005 ± 0.0010	0.0007 ± 0.0008	0.0005 ± 0.0007
Yttrium	0.0002 ± 0.0007	0.0000 ± 0.0007	0.0010 ± 0.0005	0.0000 ± 0.0013	0.0000 ± 0.0012	0.0000 ± 0.0012	0.0000 ± 0.0024	0.0010 ± 0.0011	0.0000 ± 0.0013	0.0000 ± 0.0014	0.0005 ± 0.0013	0.0000 ± 0.0012	0.0001 ± 0.0009
Zirconium	0.0011 ± 0.0008	0.0069 ± 0.0013	0.0014 ± 0.0006	0.0005 ± 0.0014	0.0002 ± 0.0014	0.0003 ± 0.0013	0.0011 ± 0.0027	0.0025 ± 0.0012	0.0000 ± 0.0015	0.0014 ± 0.0014	0.0012 ± 0.0013	0.0013 ± 0.0012	0.0006 ± 0.0011
Molybdenum	0.0027 ± 0.0011	0.0001 ± 0.0012	0.0010 ± 0.0008	0.0000 ± 0.0021	0.0003 ± 0.0020	0.0007 ± 0.0019	0.0016 ± 0.0039	0.0039 ± 0.0018	0.0000 ± 0.0021	0.0001 ± 0.0022	0.0027 ± 0.0019	0.0025 ± 0.0018	0.0020 ± 0.0014
Palladium	0.0002 ± 0.0015	0.0001 ± 0.0015	0.0045 ± 0.0012	0.0001 ± 0.0027	0.0003 ± 0.0027	0.0002 ± 0.0025	0.0000 ± 0.0050	0.0003 ± 0.0027	0.0001 ± 0.0026	0.0001 ± 0.0028	0.0000 ± 0.0027	0.0009 ± 0.0024	0.0004 ± 0.0019
Silver	0.0010 ± 0.0020	0.0007 ± 0.0020	0.0006 ± 0.0014	0.0007 ± 0.0035	0.0005 ± 0.0035	0.0004 ± 0.0034	0.0001 ± 0.0065	0.0013 ± 0.0033	0.0004 ± 0.0035	0.0009 ± 0.0037	0.0021 ± 0.0036	0.0013 ± 0.0031	0.0011 ± 0.0025
Cadmium	0.0011 ± 0.0019	0.0007 ± 0.0019	0.0003 ± 0.0014	0.0014 ± 0.0034	0.0013 ± 0.0034	0.0027 ± 0.0034	0.0000 ± 0.0065	0.0002 ± 0.0032	0.0017 ± 0.0034	0.0003 ± 0.0035	0.0005 ± 0.0034	0.0008 ± 0.0032	0.0003 ± 0.0025
Indium	0.0004 ± 0.0023	0.0004 ± 0.0024	0.0005 ± 0.0016	0.0006 ± 0.0042	0.0009 ± 0.0040	0.0000 ± 0.0039	0.0044 ± 0.0078	0.0000 ± 0.0039	0.0006 ± 0.0043	0.0003 ± 0.0044	0.0000 ± 0.0041	0.0018 ± 0.0037	0.0006 ± 0.0030
Tin	0.0040 ± 0.0035	0.0008 ± 0.0036	0.0005 ± 0.0025	0.0017 ± 0.0064	0.0025 ± 0.0063	0.0009 ± 0.0060	0.0079 ± 0.0120	0.0001 ± 0.0060	0.0003 ± 0.0064	0.0000 ± 0.0066	0.0027 ± 0.0066	0.0029 ± 0.0057	0.0015 ± 0.0046
Antimony	0.0014 ± 0.0039	0.0021 ± 0.0039	0.0005 ± 0.0028	0.0061 ± 0.0071	0.0000 ± 0.0069	0.0002 ± 0.0066	0.0025 ± 0.0133	0.0013 ± 0.0063	0.0023 ± 0.0071	0.0021 ± 0.0075	0.0014 ± 0.0071	0.0024 ± 0.0066	0.0032 ± 0.0050
Barium	0.0061 ± 0.0185	0.0025 ± 0.0187	0.0021 ± 0.0130	0.0224 ± 0.0309	0.0202 ± 0.0302	0.0011 ± 0.0315	0.0064 ± 0.0625	0.0000 ± 0.0308	0.0187 ± 0.0335	0.0009 ± 0.0350	0.0029 ± 0.0333	0.0076 ± 0.0312	0.0031 ± 0.0240
Lanthanum	0.0184 ± 0.0243	0.0087 ± 0.0246	0.0199 ± 0.0176	0.0229 ± 0.0438	0.0183 ± 0.0424	0.0091 ± 0.0411	0.0088 ± 0.0815	0.0249 ± 0.0416	0.0090 ± 0.0437	0.0142 ± 0.0460	0.0101 ± 0.0434	0.0375 ± 0.0411	0.0192 ± 0.0315
Gold	0.0024 ± 0.0024	0.0010 ± 0.0013	0.0018 ± 0.0011	0.0004 ± 0.0024	0.0009 ± 0.0024	0.0022 ± 0.0023	0.0000 ± 0.0076	0.0007 ± 0.0054	0.0005 ± 0.0026	0.0000 ± 0.0030	0.0009 ± 0.0034	0.0015 ± 0.0058	0.0004 ± 0.0020
Mercury	0.0002 ± 0.0008	0.0000 ± 0.0008	0.0008 ± 0.0006	0.0000 ± 0.0014	0.0002 ± 0.0014	0.0002 ± 0.0013	0.0002 ± 0.0027	0.0003 ± 0.0017	0.0000 ± 0.0015	0.0000 ± 0.0015	0.0000 ± 0.0014	0.0001 ± 0.0013	0.0001 ± 0.0010
Thallium	0.0001 ± 0.0008	0.0004 ± 0.0008	0.0009 ± 0.0006	0.0005 ± 0.0018	0.0001 ± 0.0013	0.0000 ± 0.0012	0.0010 ± 0.0026	0.0017 ± 0.0015	0.0003 ± 0.0014	0.0003 ± 0.0015	0.0002 ± 0.0013	0.0000 ± 0.0013	0.0006 ± 0.0010
Lead	0.0202 ± 0.0034	0.0014 ± 0.0014	0.0050 ± 0.0011	0.0501 ± 0.0082	0.0064 ± 0.0021	0.0029 ± 0.0020	0.0406 ± 0.0073	0.0109 ± 0.0025	0.0000 ± 0.0027	0.0098 ± 0.0030	0.0088 ± 0.0027	0.0158 ± 0.0032	0.0006 ± 0.0018
Uranium	0.0006 ± 0.0012	0.0002 ± 0.0012	0.0011 ± 0.0009	0.0000 ± 0.0021	0.0000 ± 0.0021	0.0001 ± 0.0019	0.0002 ± 0.0040	0.0022 ± 0.0022	0.0001 ± 0.0022	0.0001 ± 0.0023	0.0003 ± 0.0021	0.0000 ± 0.0019	0.0005 ± 0.0016
Anions by IC (mg/mi)													
Nitrate Ion	0.03 ± 0.01	0.02 ± 0.01	0.02 ± 0.01	0.02 ± 0.03	0.02 ± 0.03	0.03 ± 0.03	0.03 ± 0.04	0.02 ± 0.03	0.01 ± 0.03	0.01 ± 0.03	0.00 ± 0.03	0.04 ± 0.03	0.02 ± 0.02
Sulfate Ion	0.92 ± 0.06	0.18 ± 0.02	0.14 ± 0.01	0.56 ± 0.06	1.84 ± 0.12	0.15 ± 0.05	1.55 ± 0.11	0.37 ± 0.06	0.14 ± 0.05	0.89 ± 0.07	0.24 ± 0.05	0.70 ± 0.07	0.37 ± 0.03
Polycyclic aromatic hydrocarbons (ug/mile)													
Naphthalene	1172.12 ± 102.06	1194.42 ± 103.73	1517.09 ± 122.35	2687.12 ± 244.64	8640.93 ± 692.01	1556.41 ± 173.10	7193.84 ± 586.10	7994.70 ± 646.42	10408.33 ± 828.80	3262.24 ± 293.92	2663.67 ± 245.44	1830.59 ± 187.65	1858.31 ± 160.27
2-methylnaphthalene	2707.31 ± 215.27	3708.86 ± 294.71	6857.91 ± 544.16	1634.67 ± 131.34	20962.81 ± 1663.84	3720.12 ± 296.66	33390.50 ± 2649.57	13763.35 ± 1093.13	39587.51 ± 3140.83	7442.66 ± 591.96	8829.54 ± 701.75	7293.35 ± 579.91	3035.79 ± 241.63
1-methylnaphthalene	1327.77 ± 92.35	1876.14 ± 130.38	3476.60 ± 241.23	772.73 ± 54.39	11874.69 ± 824.11	1743.02 ± 121.64	21651.69 ± 1502.17	8364.75 ± 580.81	21354.44 ± 1481.49	3688.04 ± 256.55	4356.98 ± 302.85	3449.06 ± 239.88	1466.67 ± 102.13
Biphenyl	98.36 ± 6.55	53.44 ± 3.84	53.71 ± 3.60	37.78 ± 5.05	702.55 ± 44.98	110.32 ± 8.61	1928.04 ± 122.37	1471.56 ± 93.54	410.25 ± 26.70	317.90 ± 21.11	168.44 ± 11.89	199.22 ± 13.68	104.72 ± 7.21
1+2ethylnaphthalene	153.44 ± 17.31	254.67 ± 24.51	520.08 ± 44.08	106.34 ± 32.65	1825.00 ± 156.98	227.54 ± 38.89	3281.37 ± 277.07	911.66 ± 86.07	3339.84 ± 281.15	566.26 ± 61.37	728.85 ± 70.87	481.78 ± 52.88	271.93 ± 28.74
2,6+2,7-dimethylnaphthalene	213.27 ± 17.54	329.90 ± 26.99	744.66 ± 60.45	174.99 ± 14.58	4025.59 ± 326.24	394.94 ± 32.34	9239.97 ± 748.51	2177.22 ± 176.62	4186.77 ± 339.31	1104.69 ± 89.80	998.16 ± 81.14	500.95 ± 40.90	433.18 ± 35.49
1,3+1,6+1,7dimethylnaphth	299.66 ± 24.89	564.12 ± 46.50	1205.16 ± 98.69	270.78 ± 22.75	6255.85 ± 511.64	639.93 ± 52.89	14506.88 ± 1185.83	3842.07 ± 314.51	6565.46 ± 536.96	1959.21 ± 160.70	1603.69 ± 131.59	681.59 ± 56.26	674.63 ± 55.73
1,4+1,5+2,3-dimethylnaphth	4.63 ± 1.08	6.68 ± 1.29	276.46 ± 32.53	64.40 ± 7.80	1309.61 ± 153.18	161.38 ± 19.08	3722.39 ± 435.09	965.16 ± 112.96	341.40 ± 40.08	167.95 ± 19.87	371.76 ± 43.62	141.83 ± 16.79	1.84 ± 1.22
1,2-dimethylnaphthalene	49.81 ± 5.66	46.93 ± 5.35	152.19 ± 16.67	35.91 ± 4.07	3573.22 ± 388.18	171.39 ± 18.72	12960.25 ± 1407.77	4538.41 ± 493.03	1180.55 ± 128.32	1759.87 ± 191.25	471.76 ± 51.33	90.07 ± 9.91	101.18 ± 11.36
2-Methylbiphenyl	0.00 ± 133.34	2.25 ± 133.85	106.15 ± 80.47	0.00 ± 384.12	0.00 ± 389.16	0.00 ± 405.12	0.00 ± 446.53	0.00 ± 438.73	0.00 ± 404.12	0.00 ± 445.34	0.00 ± 400.91	0.00 ± 391.10	96.62 ± 199.97
3-Methylbiphenyl	40.79 ± 38.28	49.19 ± 38.46	115.17 ± 24.26	0.00 ± 109.56	378.81 ± 115.35	0.00 ± 115.69	1176.22 ± 152.40	807.14 ± 138.65	319.52 ± 118.29	144.65 ± 128.02	10.40 ± 114.58	0.00 ± 111.61	123.54 ± 57.82
4-Methylbiphenyl	15.70 ± 11.78	16.63 ± 11.81	42.89 ± 7.24	0.00 ± 33.85	157.66 ± 35.08	6.96 ± 35.73	552.46 ± 45.41	363.46 ± 41.60	123.41 ± 36.04	67.31 ± 39.41	15.13 ± 35.38	0.00 ± 34.47	26.30 ± 17.59
Dibenzofuran	18.02 ± 1.35	12.73 ± 0.97	10.32 ± 0.77	13.64 ± 1.08	144.12 ± 10.45	32.56 ± 2.42	299.01 ± 21.61	352.15 ± 25.44	71.78 ± 5.23	97.24 ± 7.08	48.79 ± 3.59	34.07 ± 2.52	43.54 ± 3.21
A-trimethylnaphthalene	28.15 ± 1.60	32.61 ± 1.84	56.67 ± 3.08	48.80 ± 2.87	881.55 ± 47.45	91.32 ± 5.09	3174.95 ± 170.62	790.84 ± 42.60	389.81 ± 21.06	305.88 ± 16.58	161.29 ± 8.82	68.70 ± 3.90	61.29 ± 3.41
1-ethyl-2-methylnaphthalene	8.72 ± 0.58	20.43 ± 1.10	13.86 ± 0.73	12.32 ± 1.19	272.82 ± 13.24	27.31 ± 1.74	668.91 ± 32.29	252.37 ± 12.27	225.57 ± 10.98	83.17 ± 4.24	61.07 ± 3.18	19.15 ± 1.41	17.71 ± 1.07
B-trimethylnaphthalene	16.03 ± 1.60	22.25 ± 2.18	33.93 ± 3.20	33.28 ± 3.39	557.20 ± 51.79	65.64 ± 6.34	2182.80 ± 202.36	599.53 ± 55.72	223.31 ± 20.88	210.69 ± 19.74	98.02 ± 9.31	32.85 ± 3.37	40.57 ± 3.91
C-trimethylnaphthalene	12.58 ± 1.15	15.68 ± 1.40	27.61 ± 2.32	24.30 ± 2.31	556.55 ± 45.98	55.72 ± 4.81	1738.35 ± 143.34	531.72 ± 43.95	159.85 ± 13.33	163.67 ± 13.67	75.98 ± 6.45	24.99 ± 2.37	30.49 ± 2.65
2-ethyl-1-methylnaphthalene	0.67 ± 0.22	0.59 ± 0.21	2.51 ± 0.35	0.19 ± 0.48	19.88 ± 2.52	3.10 ± 0.69	115.92 ± 13.95	36.14 ± 4.46	10.33 ± 1.43	8.76 ± 1.29	3.34 ± 0.70	1.92 ± 0.58	1.49 ± 0.36
E-trimethylnaphthalene	5.56 ± 0.59	8.22 ± 0.79	13.75 ± 1.16	13.77 ± 1.48	235.11 ± 19.02	29.14 ± 2.61	1002.41 ± 80.72	267.78 ± 21.67	86.01 ± 7.08	95.81 ± 7.88	37.86 ± 3.27	11.30 ± 1.34	17.03 ± 1.53
F-trimethylnaphthalene	5.92 ± 0.54	4.64 ± 0.45	12.69 ± 1.03	13.88 ± 1.25	235.41 ± 18.46	31.30 ± 2.57	925.46 ± 72.36	280.14 ± 21.96	71.59 ± 5.68	66.00 ± 5.26	32.63 ± 2.67	11.70 ± 1.10	13.76 ± 1.18
2,3,5+I-trimethylnaphthalene	7.02 ± 1.18	9.36 ± 1.51	14.06 ± 2.13	12.66 ± 2.29	239.01 ± 35.24	29.12 ± 4.62	1060.52 ± 155.56	272.78 ± 40.21	83.63 ± 12.52	91.79 ± 13.74	34.78 ± 5.41	10.95 ± 2.08	25.02 ± 3.84

Appendix B1. Chemical Composition of Dilution Blanks and Vehicle Exhaust Samples from Round1

Species Description	S3-2	S4-1	S4-2	S5-1	S5-2	S5-3	S5-4	S5-5	S6-1	S6-2	S6-3	S6-4	S7-1
2,4,5-trimethylnaphthalene	1.87 ± 0.27	2.51 ± 0.32	3.37 ± 0.34	4.19 ± 0.65	58.17 ± 5.12	5.29 ± 0.74	339.91 ± 29.47	102.34 ± 8.93	22.35 ± 2.07	25.29 ± 2.33	7.50 ± 0.88	0.00 ± 0.51	4.78 ± 0.55
J-trimethylnaphthalene	2.08 ± 0.41	1.59 ± 0.35	5.03 ± 0.74	4.19 ± 0.90	73.11 ± 10.21	9.34 ± 1.53	328.82 ± 45.50	75.25 ± 10.52	26.64 ± 3.83	34.36 ± 4.91	10.56 ± 1.68	3.91 ± 0.88	0.78 ± 0.36
1,4,5-trimethylnaphthalene	1.58 ± 0.15	1.94 ± 0.17	2.89 ± 0.19	3.04 ± 0.30	45.97 ± 2.66	4.86 ± 0.38	230.69 ± 13.22	80.95 ± 4.65	21.09 ± 1.24	20.45 ± 1.22	6.60 ± 0.46	2.09 ± 0.27	4.37 ± 0.33
Acenaphthylene	52.21 ± 4.02	13.71 ± 1.27	20.07 ± 1.60	126.68 ± 9.29	1060.10 ± 76.94	265.87 ± 19.38	7731.23 ± 560.60	4006.39 ± 290.55	212.53 ± 15.51	1156.85 ± 83.97	342.24 ± 24.91	130.67 ± 9.59	59.25 ± 4.66
Acenaphthene	7.14 ± 0.83	8.24 ± 0.90	9.41 ± 0.83	22.31 ± 2.28	229.50 ± 16.87	31.93 ± 2.91	876.84 ± 63.74	256.22 ± 18.84	104.18 ± 7.88	229.38 ± 16.91	28.41 ± 2.68	14.56 ± 1.89	7.37 ± 1.06
Fluorene	24.87 ± 3.00	10.48 ± 1.43	20.53 ± 2.43	44.47 ± 5.56	629.80 ± 71.99	63.10 ± 7.64	2750.00 ± 313.51	767.92 ± 87.76	126.81 ± 14.79	258.17 ± 29.75	69.20 ± 8.31	31.61 ± 4.19	10.67 ± 1.61
Dibenzothiophene	2.89 ± 0.35	0.92 ± 0.17	0.97 ± 0.14	1.16 ± 0.34	28.38 ± 2.87	2.28 ± 0.42	63.03 ± 6.30	26.47 ± 2.69	7.43 ± 0.84	14.85 ± 1.57	4.05 ± 0.54	1.92 ± 0.38	3.46 ± 0.44
Phenanthrene	105.70 ± 3.81	27.03 ± 1.18	46.71 ± 1.71	45.28 ± 2.42	921.46 ± 32.54	136.41 ± 5.26	3562.04 ± 125.19	2272.22 ± 79.93	166.86 ± 6.28	769.91 ± 27.27	215.86 ± 7.94	105.52 ± 4.23	136.63 ± 4.97
Anthracene	8.53 ± 0.89	2.42 ± 0.29	5.25 ± 0.55	12.63 ± 1.34	125.72 ± 12.72	21.56 ± 2.23	938.61 ± 94.70	556.70 ± 56.18	15.92 ± 1.67	98.64 ± 10.00	40.95 ± 4.17	22.59 ± 2.33	0.99 ± 0.21
A-methylfluorene	9.83 ± 0.83	7.88 ± 0.69	5.21 ± 0.44	12.43 ± 1.19	300.61 ± 22.65	40.13 ± 3.16	541.31 ± 40.73	253.10 ± 19.11	103.08 ± 7.85	81.65 ± 6.27	34.01 ± 2.72	6.96 ± 0.87	11.42 ± 1.00
1-methylfluorene	9.22 ± 1.25	6.43 ± 0.90	7.95 ± 1.06	8.65 ± 1.30	157.88 ± 20.25	31.80 ± 4.21	252.16 ± 32.27	275.63 ± 35.26	64.38 ± 8.34	60.84 ± 7.91	25.84 ± 3.45	14.63 ± 2.04	12.01 ± 1.65
B-methylfluorene	2.19 ± 0.44	1.68 ± 0.35	1.93 ± 0.37	3.75 ± 0.74	77.56 ± 13.47	10.08 ± 1.82	128.34 ± 22.26	55.14 ± 9.61	23.68 ± 4.16	20.43 ± 3.61	9.96 ± 1.80	3.80 ± 0.75	2.11 ± 0.46
9-fluorenone	2.36 ± 0.28	4.02 ± 0.46	0.42 ± 0.09	2.69 ± 0.44	49.12 ± 4.91	0.61 ± 0.34	27.74 ± 2.82	38.26 ± 3.85	20.20 ± 2.07	32.04 ± 3.25	12.90 ± 1.36	1.13 ± 0.34	1.40 ± 0.26
Xanthone	0.30 ± 0.26	0.19 ± 0.24	0.31 ± 0.18	0.00 ± 0.51	2.07 ± 1.05	0.00 ± 0.50	15.78 ± 5.46	4.84 ± 1.94	0.00 ± 0.55	0.00 ± 0.55	2.09 ± 1.06	0.00 ± 0.49	0.00 ± 0.27
Acenaphthenequinone	0.86 ± 0.29	0.51 ± 0.21	0.87 ± 0.26	1.45 ± 0.55	18.05 ± 4.79	1.03 ± 0.46	24.36 ± 6.44	7.86 ± 2.18	0.46 ± 0.36	7.42 ± 2.07	1.85 ± 0.65	0.32 ± 0.33	0.81 ± 0.34
Perinaphthenone	4.84 ± 1.17	0.00 ± 0.26	2.24 ± 0.56	0.10 ± 0.76	3.48 ± 1.21	1.73 ± 0.97	3.35 ± 1.28	8.59 ± 2.26	4.87 ± 1.49	4.26 ± 1.43	1.36 ± 0.91	0.74 ± 0.83	0.00 ± 0.39
2-methylanthracene	7.14 ± 1.36	4.49 ± 0.88	3.48 ± 0.67	4.96 ± 0.98	183.33 ± 33.78	4.12 ± 0.84	149.98 ± 27.65	85.92 ± 15.87	82.11 ± 15.16	40.92 ± 7.59	13.24 ± 2.50	6.85 ± 1.33	26.44 ± 4.93
3-methylphenanthrene	11.52 ± 0.73	6.20 ± 0.43	8.86 ± 0.56	12.08 ± 0.81	205.03 ± 12.27	25.38 ± 1.59	326.29 ± 19.50	178.13 ± 10.67	64.16 ± 3.89	96.05 ± 5.79	38.06 ± 2.33	14.46 ± 0.95	12.48 ± 0.83
2-methylphenanthrene	13.36 ± 1.14	6.83 ± 0.63	10.01 ± 0.85	13.76 ± 1.28	225.14 ± 18.32	28.06 ± 2.41	324.23 ± 26.35	182.06 ± 14.84	65.67 ± 5.43	105.49 ± 8.66	41.62 ± 3.50	17.68 ± 1.59	14.41 ± 1.28
9-methylphenanthrene	7.32 ± 1.26	2.75 ± 0.51	4.55 ± 0.78	6.07 ± 1.12	152.22 ± 25.08	9.98 ± 1.75	391.43 ± 64.37	134.44 ± 22.17	39.49 ± 6.59	59.93 ± 9.95	19.92 ± 3.37	8.33 ± 1.48	7.16 ± 1.28
1-methylphenanthrene	5.80 ± 0.95	3.29 ± 0.58	3.81 ± 0.62	6.46 ± 1.14	97.90 ± 15.19	10.35 ± 1.74	155.40 ± 24.07	80.69 ± 12.56	25.88 ± 4.11	44.06 ± 6.92	17.48 ± 2.82	6.54 ± 1.16	6.70 ± 1.14
Anthrone	0.04 ± 0.09	0.31 ± 0.16	0.02 ± 0.05	0.28 ± 0.23	5.15 ± 1.62	0.07 ± 0.21	4.10 ± 1.31	2.84 ± 0.94	2.89 ± 0.94	6.73 ± 2.10	0.32 ± 0.24	0.00 ± 0.19	0.84 ± 0.34
Anthraquinone	1.96 ± 0.50	0.09 ± 0.12	0.57 ± 0.17	0.00 ± 0.27	0.00 ± 0.28	0.00 ± 0.29	0.07 ± 0.34	0.90 ± 0.43	0.00 ± 0.29	0.00 ± 0.32	0.00 ± 0.29	0.00 ± 0.28	0.00 ± 0.17
3,6-dimethylphenanthrene	2.13 ± 0.92	0.73 ± 0.87	2.36 ± 0.60	0.75 ± 2.48	36.18 ± 4.85	1.95 ± 2.63	60.71 ± 7.41	21.11 ± 3.82	7.71 ± 2.81	21.00 ± 3.85	3.75 ± 2.65	1.05 ± 2.53	2.11 ± 1.33
A-dimethylphenanthrene	3.01 ± 0.66	1.21 ± 0.30	1.90 ± 0.42	3.22 ± 0.72	49.21 ± 10.17	5.01 ± 1.09	69.53 ± 14.35	26.90 ± 5.58	13.03 ± 2.73	28.16 ± 5.85	7.25 ± 1.55	2.83 ± 0.64	0.11 ± 0.12
B-dimethylphenanthrene	1.38 ± 0.13	0.56 ± 0.09	1.02 ± 0.09	1.94 ± 0.18	22.74 ± 1.48	2.37 ± 0.21	32.90 ± 2.13	11.89 ± 0.79	6.73 ± 0.47	14.09 ± 0.93	3.47 ± 0.27	1.53 ± 0.17	1.25 ± 0.16
C-dimethylphenanthrene	4.49 ± 0.41	1.87 ± 0.21	2.68 ± 0.25	4.94 ± 0.47	78.06 ± 6.49	5.97 ± 0.55	135.49 ± 11.25	51.12 ± 4.27	19.18 ± 1.63	45.46 ± 3.80	10.74 ± 0.94	3.89 ± 0.39	4.05 ± 0.41
D-dimethylphenanthrene	1.09 ± 0.20	0.45 ± 0.11	0.72 ± 0.13	1.63 ± 0.27	20.09 ± 2.87	1.88 ± 0.31	27.48 ± 3.92	9.08 ± 1.31	4.87 ± 0.72	10.62 ± 1.53	3.12 ± 0.47	1.21 ± 0.22	1.06 ± 0.22
1,7-dimethylphenanthrene	3.06 ± 0.33	1.04 ± 0.15	1.57 ± 0.18	3.60 ± 0.39	49.50 ± 4.83	1.92 ± 0.24	92.96 ± 9.06	34.12 ± 3.34	13.76 ± 1.36	26.01 ± 2.55	6.49 ± 0.67	2.75 ± 0.31	2.21 ± 0.28
E-dimethylphenanthrene	1.72 ± 0.36	0.60 ± 0.16	0.97 ± 0.21	1.62 ± 0.36	27.00 ± 5.24	2.16 ± 0.46	43.14 ± 8.36	17.28 ± 3.37	6.46 ± 1.28	16.11 ± 3.14	3.63 ± 0.74	1.33 ± 0.31	1.57 ± 0.37
9-methylanthracene	0.92 ± 0.30	0.72 ± 0.27	0.20 ± 0.12	0.00 ± 0.43	22.11 ± 5.20	0.08 ± 0.46	15.75 ± 3.75	4.91 ± 1.30	8.71 ± 2.13	3.69 ± 1.04	1.49 ± 0.60	0.59 ± 0.48	8.66 ± 2.10
Fluoranthene	55.41 ± 3.01	3.11 ± 0.53	7.97 ± 0.54	11.06 ± 1.48	230.25 ± 12.30	25.12 ± 1.98	906.61 ± 47.93	568.16 ± 30.10	18.02 ± 1.73	307.62 ± 16.40	51.42 ± 3.12	25.90 ± 1.98	27.82 ± 1.74
Pyrene	84.49 ± 8.91	2.98 ± 0.78	7.07 ± 0.88	16.40 ± 2.71	330.19 ± 34.70	28.13 ± 3.75	1483.75 ± 154.90	891.70 ± 93.22	20.99 ± 3.13	490.20 ± 51.40	49.79 ± 5.78	21.13 ± 3.11	22.90 ± 2.74
9-Anthraaldehyde	0.33 ± 0.12	0.07 ± 0.09	0.39 ± 0.11	0.00 ± 0.13	5.87 ± 1.28	0.35 ± 0.20	6.85 ± 1.49	2.63 ± 0.63	0.84 ± 0.28	3.28 ± 0.76	1.27 ± 0.36	0.13 ± 0.16	7.63 ± 1.66
Retene	0.00 ± 0.10	0.01 ± 0.10	0.01 ± 0.06	0.03 ± 0.18	0.11 ± 0.19	0.00 ± 0.19	0.04 ± 0.20	0.04 ± 0.20	0.02 ± 0.18	0.00 ± 0.20	0.00 ± 0.18	0.04 ± 0.18	0.00 ± 0.15
Benzonaphthothiophene	0.18 ± 0.15	0.06 ± 0.15	0.06 ± 0.09	0.00 ± 0.25	2.81 ± 0.60	0.06 ± 0.26	3.64 ± 0.77	1.09 ± 0.36	0.20 ± 0.27	0.41 ± 0.31	0.00 ± 0.26	0.36 ± 0.27	0.09 ± 0.22
1+3-methylfluoranthene	2.43 ± 0.74	0.14 ± 0.10	0.71 ± 0.23	0.98 ± 0.35	40.52 ± 12.12	1.34 ± 0.46	63.82 ± 19.07	18.07 ± 5.43	5.30 ± 1.62	4.24 ± 1.31	3.95 ± 1.22	1.71 ± 0.56	1.62 ± 0.54
1-MeFl+C-MeFl/Py	2.15 ± 0.25	0.54 ± 0.11	0.88 ± 0.12	0.62 ± 0.15	24.54 ± 2.65	1.68 ± 0.23	27.06 ± 2.92	14.35 ± 1.56	4.43 ± 0.51	9.67 ± 1.06	3.10 ± 0.37	1.63 ± 0.23	0.84 ± 0.17
B-MePy/MeFl	2.93 ± 0.55	0.39 ± 0.15	0.70 ± 0.15	2.17 ± 0.51	40.41 ± 7.21	1.23 ± 0.39	63.69 ± 11.33	17.71 ± 3.20	5.19 ± 1.01	12.83 ± 2.34	3.86 ± 0.78	1.42 ± 0.41	1.03 ± 0.29
C-MePy/MeFl	2.72 ± 0.29	0.37 ± 0.10	0.54 ± 0.08	1.60 ± 0.23	33.80 ± 3.38	0.81 ± 0.18	57.26 ± 5.72	13.33 ± 1.36	4.27 ± 0.46	11.58 ± 1.18	2.81 ± 0.33	1.15 ± 0.20	0.59 ± 0.14
D-MePy/MeFl	1.96 ± 0.13	0.30 ± 0.08	0.62 ± 0.06	0.89 ± 0.17	21.42 ± 0.94	1.30 ± 0.19	33.01 ± 1.42	12.53 ± 0.58	2.82 ± 0.22	9.15 ± 0.44	2.73 ± 0.21	1.16 ± 0.18	0.77 ± 0.13
4-methylpyrene	2.35 ± 0.44	0.24 ± 0.11	0.50 ± 0.12	0.87 ± 0.25	23.42 ± 4.20	0.66 ± 0.24	48.65 ± 8.68	11.65 ± 2.12	1.80 ± 0.40	9.47 ± 1.73	1.98 ± 0.43	0.98 ± 0.28	0.90 ± 0.25
1-methylpyrene	2.04 ± 0.94	0.79 ± 0.44	0.16 ± 0.14	0.00 ± 0.38	13.76 ± 6.02	0.43 ± 0.53	46.28 ± 19.88	3.80 ± 1.84	1.43 ± 0.86	8.11 ± 3.65	1.51 ± 0.90	0.02 ± 0.41	10.40 ± 4.55
Benzo(c)phenanthrene	1.50 ± 0.22	0.15 ± 0.08	0.25 ± 0.06	0.39 ± 0.15	9.17 ± 1.28	0.53 ± 0.17	44.22 ± 6.04	12.85 ± 1.78	0.67 ± 0.17	5.26 ± 0.76	1.28 ± 0.24	1.18 ± 0.23	0.76 ± 0.18
Benzo(ghi)fluoranthene	34.59 ± 5.20	0.67 ± 1.00	2.02 ± 0.67	4.77 ± 2.99	97.72 ± 14.80	6.30 ± 3.22	437.11 ± 64.01	255.60 ± 37.65	0.82 ± 2.99	120.82 ± 18.21	11.78 ± 3.57	7.31 ± 3.18	7.61 ± 1.93
Cyclopenta(c,d)pyrene	4.57 ± 0.98	0.00 ± 0.11	0.26 ± 0.10	6.44 ± 1.46	120.66 ± 24.81	1.13 ± 0.46	710.41 ± 145.56	154.78 ± 31.82	1.37 ± 0.50	105.29 ± 21.69	4.02 ± 0.98	0.46 ± 0.35	0.00 ± 0.17
Benz(a)anthracene	2.86 ± 0.54	0.23 ± 0.23	0.95 ± 0.22	2.77 ± 0.67	36.65 ± 6.11	2.03 ± 0.60	89.57 ± 14.83	36.00 ± 6.03	1.84 ± 0.57	16.89 ± 2.90	3.99 ± 0.85	4.62 ± 0.94	1.31 ± 0.44
Triphenylene	1.73 ± 0.29	0.26 ± 0.10	0.44 ± 0.09	0.62 ± 0.19	20.57 ± 3.21	0.58 ± 0.19	42.91 ± 6.66	16.73 ± 2.62	0.48 ± 0.18	7.10 ± 1.14	1.18 ± 0.26	2.76 ± 0.48	1.97 ± 0.35
Chrysene	2.79 ± 0.37	0.18 ± 0.13	0.70 ± 0.12	1.21 ± 0.30	19.36 ± 2.38	1.16 ± 0.31	48.56 ± 5.87	17.60 ± 2.18	0.44 ± 0.26	7.39 ± 0.98	1.92 ± 0.37	2.60 ± 0.43	1.68 ± 0.30
Benzanthrone	5.10 ± 0.53	0.55 ± 0.11	1.02 ± 0.12	0.00 ± 0.13	0.02 ± 0.13	0.00 ± 0.13	0.00 ± 0.15	0.00 ± 0.14	0.00 ± 0.13	0.00 ± 0.15	0.00 ± 0.13	0.08 ± 0.13	1.67 ± 0.23
7-methylbenz(a)anthracene	0.00 ± 0.08	0.03 ± 0.08	0.00 ± 0.05	0.23 ± 0.19	1.34 ± 0.49	0.00 ± 0.16	0.74 ± 0.32	0.00 ± 0.18	0.00 ± 0.16	0.00 ± 0.18	0.00 ± 0.16	0.31 ± 0.21	0.00 ± 0.12
3-methylchrysene	0.36 ± 0.10	0.05 ± 0.07	0.21 ± 0.05	1.67 ± 0.27	12.61 ± 1.78	0.25 ± 0.14	12.48 ± 1.77	4.92 ± 0.72	0.49 ± 0.15	2.55 ± 0.39	0.68 ± 0.16	0.86 ± 0.18	0.18 ± 0.11
Benz(a)anthracene-7,12-dione	3.18 ± 0.21	0.34 ± 0.08	0.45 ± 0.05	0.03 ± 0.13	3.29 ± 0.22	0.05 ± 0.13	0.13 ± 0.15	1.87 ± 0.18	0.00 ± 0.13	1.09 ± 0.15	0.06 ± 0.13	0.49 ± 0.13	1.07 ± 0.13
5+6-methylchrysene	0.08 ± 0.10	0.04 ± 0.09	0.03 ± 0.05	0.76 ± 0.43	4.24 ± 1.96	0.00 ± 0.14	2.46 ± 1.19	0.61 ± 0.38	0.00 ± 0.14	0.17 ± 0.22	0.00 ± 0.13	0.49 ± 0.32	0.01 ± 0.11
Benzo(b+j+k)fluoranthene	7.51 ± 1.45	0.00 ± 1.01	1.99 ± 0.68	16.37 ± 3.74	93.05 ± 11.56	0.00 ± 3.06	223.89 ± 26.45	81.76 ± 10.48	0.20 ± 3.06	52.03 ± 7.36	8.88 ± 3.38	17.69 ± 3.88	23.41 ± 3.31
Benzo(a)fluoranthene	0.69 ± 0.23	0.02 ± 0.07	0.05 ± 0.05	1.79 ± 0.53	2.76 ± 0.78	0.09 ± 0.15	16.29 ± 4.39	4.81 ± 1.33	0.12 ± 0.15	2.44 ± 0.70	1.28 ± 0.41	0.76 ± 0.27	0.20 ± 0.13
BeP	5.77 ± 0.69	0.21 ± 0.11	0.92 ± 0.13	10.08 ± 1.23	47.22 ± 5.37	1.57 ± 0.35	129.98 ± 14.63	66.62 ± 7.56	0.60 ± 0.28	34.83 ± 4.00	6.04 ± 0.80	8.91 ± 1.11	2.97 ± 0.41
BaP	4.91 ± 1.03	0.10 ± 0.24	0.49 ± 0.18	13.19 ± 2.56	41.38 ± 7.76	0.32 ± 0.45	194.86 ± 36.17	48.98 ± 9.18	1.19 ± 0.52	42.15 ± 7.91	3.75 ± 0.89	3.85 ± 0.90	1.77 ± 0.57
Perylene	0.80 ± 0.37	0.00 ± 0.08	0.12 ± 0.08	2.69 ± 1.14	13.05 ± 5.18	0.07 ± 0.18	36.11 ± 14.20	10.84 ± 4.33	0.07 ± 0.18	8.12 ± 3.27	0.86 ± 0.44	1.41 ± 0.65	0.82 ± 0.38
7-methylbenzo(a)pyrene	4.61 ± 1.42	0.46 ± 0.93	6.42 ± 1.47	1.00 ± 2.67	3.33 ± 2.84	0.00 ± 2.77	4.62 ± 3.31	10.43 ± 3.88	12.45 ± 3.96	4.35 ± 3.29	0.65 ± 2.77	2.58 ± 2.80	33.12 ± 6.86
9,10-dihydrobenzo(a)pyrene-7(8H)-one	0.00 ± 0.07	0.01 ± 0.08	0.00 ± 0.04	0.03 ± 0.13	0.00 ± 0.13	0.00 ± 0.13	0.00 ± 0.15	0.00 ± 0.14	0.00 ± 0.13	0.00 ± 0.15	0.00 ± 0.13	0.17 ± 0.17	0.07 ± 0.12
Dibenzo(a,j)anthracene	1.48 ± 0.16	0.09 ± 0.07	0.09 ± 0.05	0.23 ± 0.13	1.79 ± 0.20	0.00 ± 0.13	3.08 ± 0.30	0.98 ± 0.17	0.00 ± 0.13	0.86 ± 0.16	0.24 ± 0.13	0.15 ± 0.13	0.11 ± 0.11
Indeno[123-cd]pyrene	6.21 ± 1.20	0.27 ± 0.11	0.42 ± 0.11	4.08 ± 0.87	40.93 ± 7.72	0.00 ± 0.13	164.00 ± 30.62	44.98 ± 8.48	0.00 ± 0.13	42.34 ± 8.00	1.80 ± 0.46	5.30 ± 1.10	1.94 ± 0.43
Dibenzo(ah+ac)anthracene	0.32 ± 0.13	0.00 ± 0.08	0.07 ± 0.05	0.00 ± 0.14	4.29 ± 1.16	0.00 ± 0.13	4.20 ± 1.14	1.70 ± 0.53	0.00 ± 0.13	0.63 ± 0.29	0.66 ± 0.28	0.96 ± 0.35	0.10 ± 0.12
Benzo(b)chrysene	0.02 ± 0.07	0.03 ± 0.07	0.04 ± 0.04	0.30 ± 0.13	2.03 ± 0.13	0.00 ± 0.13	1.94 ± 0.15	0.73 ± 0.14	0.00 ± 0.13	0.48 ± 0.15	0.63 ± 0.13	0.46 ± 0.13	0.20 ± 0.11
Picene	0.52 ± 0.24	0.00 ± 0.07	0.06 ± 0.06	0.84 ± 0.42	2.77 ± 1.10	0.00 ± 0.14	3.82 ± 1.49	1.27 ± 0.57	0.00 ± 0.14	1.13 ± 0.54	0.34 ± 0.26	0.29 ± 0.23	0.13 ± 0.14
Benzo(ghi)perylene	24.47 ± 3.10	0.65 ± 0.41	1.47 ± 0.31	75.52 ± 9.32	156.99 ± 19.11	3.73 ± 1.16	637.18 ± 76.97	299.35 ± 36.28	2.85 ± 1.11	202.46 ± 24.62	13.01 ± 2.00	15.41 ± 2.25	4.98 ± 0.95
Anthanthrene	0.45 ± 0.13	0.00 ± 0.07	0.05 ± 0.05	6.27 ± 1.22	20.02 ± 3.81	0.00 ± 0.13	133.99 ± 25.38	29.94 ± 5.69	0.10 ± 0.14	20.54 ± 3.92	1.27 ± 0.30	0.48 ± 0.17	0.21 ± 0.13
Dibenzo(b,k)fluoranthene	0.07 ± 0.18	0.00 ± 0.12	0.30 ± 0.19	1.14 ± 0.79	6.16 ± 2.57	0.00 ± 0.27	3.10 ± 1.54	1.68 ± 1.03	0.00 ± 0.42	2.60 ± 1.36	0.32 ± 0.54	0.00 ± 0.27	0.22 ± 0.32
Dibenzo(a,e)pyrene	0.28 ± 0.10	0.00 ± 0.07	0.05 ± 0.05	1.47 ± 0.34	4.96 ± 1.07	0.01 ± 0.13	15.49 ± 3.27	7.46 ± 1.59	0.00 ± 0.13	8.33 ± 1.77	0.27 ± 0.15	0.35 ± 0.15	0.10 ± 0.11
Coronene	8.34 ± 1.43	0.23 ± 0.11	0.39 ± 0.09	49.24 ± 8.21	65.15 ± 10.86	0.89 ± 0.27	230.26 ± 38.31	136.11 ± 22.66	1.15 ± 0.30	100.28 ± 16.70	4.23 ± 0.75	3.54 ± 0.65	1.12 ± 0.27
Dibenzo(a,h)pyrene	0.01 ± 0.07	0.00 ± 0.07	0.00 ± 0.04	0.00 ± 0.13	0.61 ± 0.19	0.00 ± 0.13	2.75 ± 0.66	0.07 ± 0.14	0.00 ± 0.13	1.35 ± 0.35	0.03 ± 0.13	0.04 ± 0.13	0.07 ± 0.11
nitro-PAH (ug/mile)													
1-nitronaphthalene	0.0013 ± 0.0043	0.0067 ± 0.0043	0.0000 ± 0.0025	0.0000 ± 0.0165	0.2266 ± 0.0217	0.1265 ± 0.0194	0.1784 ± 0.0223	0.0678 ± 0.0196	0.7249 ± 0.0440	0.0510 ± 0.0196	0.0622 ± 0.0179	0.0846 ± 0.0179	0.0113 ± 0.0065
2-nitronaphthalene	0.0038 ± 0.0074	0.0153 ± 0.0076	0.0201 ± 0.0048	0.0012 ± 0.0212	0.3247 ± 0.0382	0.0000 ± 0.0222	0.8483 ± 0.0829	0.0000 ± 0.0241	1.1171 ± 0.1051	0.0586 ± 0.0257	0.2024 ± 0.0302	0.1905 ± 0.0291	0.0416 ± 0.0118
2-nitrobiphenyl	0.0005 ± 0.0020	0.0008 ± 0.0020	0.0000 ± 0.0012	0.0000 ± 0.0075	0.0511 ± 0.0086	0.0000 ± 0.0079	0.2676 ± 0.0200	0.0559 ± 0.0096	0.2221 ± 0.0168	0.0993 ± 0.0113	0.0390 ± 0.0084	0.0000 ± 0.0076	0.0018 ± 0.0030
3-nitrobiphenyl	0.0000 ± 0.0020	0.0000 ± 0.0020	0.0000 ± 0.0012	0.0000 ± 0.0072	0.0146 ± 0.0110	0.0431 ± 0.0201	0.0600 ± 0.0264	0.0082 ± 0.0103	0.0000 ± 0.0076	0.0000 ± 0.0084	0.0000 ± 0.0076	0.0313 ± 0.0161	0.0191 ± 0.0078
4-nitrobiphenyl	0.0000 ± 0.0056	0.0000 ± 0.0056	0.0000 ± 0.0033	0.0000 ± 0.0244	0.0327 ± 0.0249	0.0149 ± 0.0258	0.0000 ± 0.0283	0.0000 ± 0.0278	0.0000 ± 0.0256	0.0000 ± 0.0283	0.0000 ± 0.0255	0.3256 ± 0.0309	0.0007 ± 0.0084
2-nitrofluorene	0.0000 ± 0.0028	0.0000 ± 0.0028	0.0000 ± 0.0017	0.0033 ± 0.0143	0.0000 ± 0.0145	0.0204 ± 0.0151	0.0000 ± 0.0166	0.0000 ± 0.0163	0.6613 ± 0.0380	0.0000 ± 0.0165	0.0000 ± 0.0149	0.1661 ± 0.0172	0.0155 ± 0.0043
1,3-dinitronaphthalene	0.0000 ± 0.1327	0.0000 ± 0.1331	0.0000 ± 0.0789	0.0000 ± 0.3717	0.0000 ± 0.3763	0.0000 ± 0.3918	0.0000 ± 0.4309	0.0000 ± 0.4254	0.0000 ± 0.3897	0.0000 ± 0.4302	0.0000 ± 0.3877	0.0000 ± 0.3788	0.0000 ± 0.1984

Appendix B1. Chemical Composition of Dilution Blanks and Vehicle Exhaust Samples from Round1

Species Description	S3-2	S4-1	S4-2	S5-1	S5-2	S5-3	S5-4	S5-5	S6-1	S6-2	S6-3	S6-4	S7-1
1,5-dinitronaphthalene	0.0000 ± 0.0053	0.0000 ± 0.0053	0.0000 ± 0.0032	0.0000 ± 0.0274	0.0000 ± 0.0278	0.0068 ± 0.0296	0.0000 ± 0.0318	0.0138 ± 0.0324	0.0000 ± 0.0288	0.0015 ± 0.0322	0.0000 ± 0.0289	0.0000 ± 0.0279	0.0007 ± 0.0081
5-nitroacenaphthene	0.0000 ± 0.0020	0.0000 ± 0.0020	0.0000 ± 0.0012	0.0000 ± 0.0085	0.0000 ± 0.0086	0.0000 ± 0.0091	0.0000 ± 0.0099	0.0000 ± 0.0097	0.0001 ± 0.0093	0.0000 ± 0.0099	0.0000 ± 0.0089	0.0664 ± 0.0254	0.0143 ± 0.0056
9-nitroanthracene	0.0032 ± 0.0030	0.0000 ± 0.0030	0.0004 ± 0.0018	0.0000 ± 0.0165	0.0000 ± 0.0167	0.0349 ± 0.0176	0.0000 ± 0.0192	0.0000 ± 0.0189	0.0000 ± 0.0173	0.2464 ± 0.0236	0.1847 ± 0.0201	0.0298 ± 0.0170	0.0000 ± 0.0044
4-nitrophenanthrene	0.0000 ± 0.0038	0.0000 ± 0.0038	0.0000 ± 0.0022	0.0000 ± 0.0204	0.0000 ± 0.0206	0.0000 ± 0.0215	0.0000 ± 0.0236	0.0000 ± 0.0232	0.0000 ± 0.0214	0.0000 ± 0.0236	0.0000 ± 0.0213	0.0000 ± 0.0207	0.0052 ± 0.0056
9-nitrophenanthrene	0.0061 ± 0.0115	0.0000 ± 0.0115	0.0000 ± 0.0068	0.0000 ± 0.0572	0.0000 ± 0.0579	0.0000 ± 0.0604	0.0000 ± 0.0664	0.0000 ± 0.0652	0.0000 ± 0.0600	0.0777 ± 0.0665	0.0000 ± 0.0597	0.0000 ± 0.0583	0.0000 ± 0.0171
1,8-dinitronaphthalene	0.0000 ± 0.0034	0.0003 ± 0.0035	0.0000 ± 0.0020	0.0000 ± 0.0141	0.0000 ± 0.0142	0.0000 ± 0.0148	0.0487 ± 0.0228	0.0000 ± 0.0160	0.0000 ± 0.0148	0.0000 ± 0.0163	0.0000 ± 0.0147	0.0000 ± 0.0144	0.0247 ± 0.0088
2-nitrofluoranthene	0.0000 ± 0.0206	0.0275 ± 0.0228	0.0000 ± 0.0123	0.0000 ± 0.0645	0.0000 ± 0.0653	0.0000 ± 0.0680	0.0000 ± 0.0748	0.0000 ± 0.0735	0.0541 ± 0.0733	0.4372 ± 0.1513	0.0133 ± 0.0695	0.0794 ± 0.0741	0.0000 ± 0.0308
3-nitrofluoranthene	0.0002 ± 0.0089	0.0004 ± 0.0090	0.0007 ± 0.0054	0.0138 ± 0.0319	0.0000 ± 0.0315	0.0000 ± 0.0328	0.0458 ± 0.0384	0.0000 ± 0.0354	0.1932 ± 0.0491	0.1567 ± 0.0477	0.0000 ± 0.0326	0.0236 ± 0.0328	0.0452 ± 0.0161
1-nitropyrene	0.0131 ± 0.0064	0.0092 ± 0.0060	0.0003 ± 0.0033	0.3376 ± 0.0863	0.0000 ± 0.0202	0.0290 ± 0.0246	0.1260 ± 0.0427	0.0000 ± 0.0227	0.0541 ± 0.0280	0.5033 ± 0.1254	0.0656 ± 0.0297	0.2609 ± 0.0694	0.1183 ± 0.0244
7-nitrobenzo(a)anthracene	0.0032 ± 0.0009	0.0004 ± 0.0009	0.0000 ± 0.0005	0.0455 ± 0.0038	0.0000 ± 0.0029	0.0000 ± 0.0030	0.0005 ± 0.0034	0.0000 ± 0.0033	0.0000 ± 0.0030	0.1100 ± 0.0068	0.0000 ± 0.0030	0.0238 ± 0.0032	0.0067 ± 0.0014
6-nitrochrysene	0.0006 ± 0.0015	0.0003 ± 0.0015	0.0000 ± 0.0009	0.0167 ± 0.0057	0.0000 ± 0.0057	0.0000 ± 0.0059	0.0000 ± 0.0065	0.0000 ± 0.0064	0.0000 ± 0.0059	0.0000 ± 0.0065	0.0000 ± 0.0058	0.0066 ± 0.0057	0.0035 ± 0.0023
6-nitrobenz[a]pyrene	0.0000 ± 0.0072	0.0000 ± 0.0072	0.0000 ± 0.0043	0.0000 ± 0.0225	0.0000 ± 0.0228	0.0000 ± 0.0237	0.1036 ± 0.0269	0.0000 ± 0.0256	0.0000 ± 0.0236	0.0000 ± 0.0260	0.0000 ± 0.0234	0.0000 ± 0.0229	0.0000 ± 0.0107
Hopanes (ug/mile)													
18a(H),21ß(H)-22,29,30-Trisnorhopane &	3.79 ± 0.31	0.75 ± 0.14	0.75 ± 0.10	0.00 ± 0.27	32.54 ± 2.42	3.47 ± 0.46	38.21 ± 2.95	18.98 ± 1.44	7.41 ± 0.65	2.47 ± 0.39	0.65 ± 0.31	2.80 ± 0.40	1.46 ± 0.23
17a(H),21ß(H)-22,29,30-Trisnorhopane	0.26 ± 0.10	0.03 ± 0.07	0.02 ± 0.04	0.00 ± 0.13	1.73 ± 0.38	0.12 ± 0.14	2.14 ± 0.46	0.80 ± 0.22	0.00 ± 0.13	0.14 ± 0.15	0.00 ± 0.13	0.31 ± 0.15	0.20 ± 0.12
17a(H),21ß(H)-30-Norhopane	5.08 ± 0.75	0.31 ± 0.12	0.60 ± 0.12	24.22 ± 3.49	76.78 ± 10.88	8.38 ± 1.28	100.13 ± 14.15	51.03 ± 7.28	16.94 ± 2.48	4.71 ± 0.82	1.73 ± 0.41	7.09 ± 1.11	3.02 ± 0.49
17a(H),21ß(H)-Hopane	4.07 ± 0.51	0.08 ± 0.11	0.46 ± 0.09	21.59 ± 2.54	65.54 ± 7.57	5.14 ± 0.71	76.25 ± 8.79	35.17 ± 4.12	10.13 ± 1.26	2.65 ± 0.49	0.57 ± 0.30	4.85 ± 0.68	2.01 ± 0.32
17ß(H),21a(H)-hopane	0.32 ± 0.08	0.00 ± 0.07	0.03 ± 0.04	0.00 ± 0.13	1.76 ± 0.19	0.83 ± 0.15	13.42 ± 1.07	5.14 ± 0.43	1.67 ± 0.19	0.34 ± 0.15	0.10 ± 0.13	0.70 ± 0.14	0.18 ± 0.11
22S-17a(H),21ß(H)-30-Homohopane	2.54 ± 0.20	0.04 ± 0.08	0.19 ± 0.05	19.37 ± 1.28	29.44 ± 1.97	2.56 ± 0.26	44.92 ± 2.99	18.06 ± 1.23	4.77 ± 0.37	1.24 ± 0.22	0.23 ± 0.18	2.41 ± 0.25	0.81 ± 0.14
22R-17a(H),21ß(H)-30-Homohopane	2.05 ± 0.18	0.03 ± 0.08	0.15 ± 0.05	11.55 ± 0.85	25.28 ± 1.85	1.87 ± 0.22	38.94 ± 2.83	15.10 ± 1.12	3.63 ± 0.32	1.02 ± 0.20	0.20 ± 0.15	2.40 ± 0.24	0.70 ± 0.13
17ß(H),21ß(H)-Hopane	0.12 ± 0.08	0.00 ± 0.07	0.00 ± 0.04	0.00 ± 0.13	8.45 ± 1.11	1.30 ± 0.21	12.82 ± 1.66	1.61 ± 0.25	0.00 ± 0.13	0.57 ± 0.17	1.07 ± 0.20	0.01 ± 0.13	0.46 ± 0.13
22S-17a(H),21ß(H)-30,31-Bishomohopan	1.67 ± 0.24	0.01 ± 0.07	0.09 ± 0.05	25.90 ± 3.32	16.21 ± 2.10	3.20 ± 0.46	27.28 ± 3.50	10.85 ± 1.42	2.52 ± 0.38	0.65 ± 0.19	0.00 ± 0.13	1.46 ± 0.25	0.51 ± 0.14
22R-17a(H),21ß(H)-30,31-Bishomohopan	1.20 ± 0.18	0.00 ± 0.07	0.08 ± 0.05	8.21 ± 1.01	12.26 ± 1.50	0.78 ± 0.18	20.51 ± 2.49	6.71 ± 0.85	1.70 ± 0.26	0.40 ± 0.16	0.18 ± 0.15	0.99 ± 0.19	0.33 ± 0.12
22S-17a(H),21ß(H)-30,31,32-Trisomohop	1.12 ± 0.18	0.00 ± 0.08	0.11 ± 0.05	9.75 ± 1.31	9.85 ± 1.34	0.66 ± 0.19	18.00 ± 2.43	5.34 ± 0.75	1.30 ± 0.25	0.33 ± 0.18	0.14 ± 0.16	0.80 ± 0.19	0.17 ± 0.12
22R-17a(H),21ß(H)-30,31,32-Trishomoho	0.81 ± 0.14	0.00 ± 0.07	0.08 ± 0.05	7.61 ± 1.02	6.46 ± 0.87	0.53 ± 0.15	11.43 ± 1.52	3.62 ± 0.50	0.96 ± 0.19	0.23 ± 0.15	0.32 ± 0.14	0.56 ± 0.15	0.12 ± 0.11
Steranes (ug/mile)													
C27-20S5a(H),14a(H)-cholestane	0.14 ± 0.08	0.02 ± 0.07	0.11 ± 0.05	0.00 ± 0.13	2.69 ± 0.45	0.00 ± 0.14	2.50 ± 0.44	1.93 ± 0.36	0.29 ± 0.16	0.16 ± 0.16	0.00 ± 0.13	0.09 ± 0.14	0.24 ± 0.12
C27-20R5a(H),14ß(H)-cholestane	0.51 ± 0.11	0.09 ± 0.07	0.17 ± 0.05	0.00 ± 0.13	6.03 ± 0.90	0.77 ± 0.18	6.07 ± 0.91	5.04 ± 0.76	1.45 ± 0.26	1.21 ± 0.24	0.06 ± 0.13	1.28 ± 0.23	1.00 ± 0.20
C27-20S5a(H),14ß(H),17ß(H)-cholestane	0.39 ± 0.08	0.05 ± 0.07	0.11 ± 0.04	0.00 ± 0.13	3.22 ± 0.24	0.39 ± 0.13	3.85 ± 0.28	2.46 ± 0.21	0.76 ± 0.14	0.50 ± 0.15	0.03 ± 0.13	0.56 ± 0.13	0.47 ± 0.11
ster45+40(cholestane)	1.47 ± 0.21	0.01 ± 0.09	0.26 ± 0.07	0.00 ± 0.20	7.02 ± 0.88	0.63 ± 0.24	6.47 ± 0.83	5.22 ± 0.68	1.80 ± 0.32	0.52 ± 0.25	0.05 ± 0.21	1.27 ± 0.27	1.06 ± 0.20
C28-20S5a(H),14a(H),17a(H)-ergostane	0.07 ± 0.07	0.00 ± 0.07	0.01 ± 0.04	0.00 ± 0.13	0.78 ± 0.15	0.09 ± 0.13	1.13 ± 0.19	0.73 ± 0.17	0.21 ± 0.13	0.01 ± 0.15	0.04 ± 0.13	0.17 ± 0.13	0.10 ± 0.11
C28-20R5a(H),14ß(H),17ß(H)-ergostane	0.14 ± 0.07	0.00 ± 0.07	0.06 ± 0.04	0.00 ± 0.13	1.53 ± 0.16	0.00 ± 0.13	1.71 ± 0.18	1.05 ± 0.16	0.00 ± 0.13	0.00 ± 0.15	0.00 ± 0.13	0.00 ± 0.13	0.23 ± 0.11
C28-20S5a(H),14ß(H),17ß(H)-ergostane	0.28 ± 0.09	0.00 ± 0.07	0.07 ± 0.05	0.00 ± 0.13	2.70 ± 0.37	0.00 ± 0.13	2.95 ± 0.41	1.68 ± 0.28	0.37 ± 0.16	0.00 ± 0.15	0.00 ± 0.13	0.16 ± 0.14	0.24 ± 0.12
C28-20R5a(H),14a(H),17a(H)-ergostane	0.19 ± 0.08	0.01 ± 0.07	0.08 ± 0.04	0.00 ± 0.13	2.22 ± 0.23	0.17 ± 0.13	2.50 ± 0.25	1.77 ± 0.20	0.47 ± 0.14	0.13 ± 0.15	0.00 ± 0.13	0.33 ± 0.13	0.25 ± 0.11
C29-20S5a(H),14a(H),17a(H)-stigmastane	0.35 ± 0.09	0.02 ± 0.07	0.05 ± 0.04	0.00 ± 0.13	3.57 ± 0.40	0.45 ± 0.14	4.90 ± 0.53	2.54 ± 0.30	0.81 ± 0.16	0.44 ± 0.16	0.05 ± 0.13	0.58 ± 0.14	0.27 ± 0.12
C29-20R5a(H),14ß(H),17ß(H)-stigmastan	0.71 ± 0.21	0.02 ± 0.08	0.10 ± 0.05	0.00 ± 0.13	6.02 ± 1.56	0.58 ± 0.20	7.57 ± 1.95	4.45 ± 1.16	1.16 ± 0.34	0.59 ± 0.22	0.13 ± 0.14	0.90 ± 0.27	0.52 ± 0.20
C29-20S5a(H),14ß(H),17ß(H)-stigmastan	0.46 ± 0.10	0.01 ± 0.07	0.06 ± 0.05	0.00 ± 0.13	3.90 ± 0.57	0.37 ± 0.14	5.12 ± 0.74	2.74 ± 0.41	0.78 ± 0.18	0.44 ± 0.16	0.08 ± 0.13	0.53 ± 0.15	0.35 ± 0.12
C29-20R5a(H),14a(H),17a(H)-stigmastane	0.41 ± 0.09	0.00 ± 0.07	0.10 ± 0.05	0.00 ± 0.13	4.89 ± 0.47	0.35 ± 0.13	5.72 ± 0.55	2.94 ± 0.31	0.84 ± 0.15	0.38 ± 0.16	0.05 ± 0.13	0.55 ± 0.14	0.34 ± 0.12
Alkanes (ug/mile)													
Dodecane	0.00 ± 3.10	1.14 ± 3.35	0.00 ± 1.71	129.55 ± 49.48	0.00 ± 8.31	0.00 ± 8.57	0.00 ± 10.41	2.44 ± 10.76	7.02 ± 10.84	0.00 ± 9.43	0.00 ± 8.55	0.00 ± 8.27	0.00 ± 4.27
Tridecane	0.19 ± 1.23	4.33 ± 1.76	0.35 ± 0.75	81.06 ± 19.89	0.00 ± 3.48	0.00 ± 3.62	1.16 ± 4.16	0.13 ± 4.03	0.00 ± 3.65	0.00 ± 3.97	0.00 ± 3.58	0.00 ± 3.50	0.00 ± 1.79
Norfarnesane	0.41 ± 0.43	2.89 ± 0.81	0.00 ± 0.24	26.13 ± 5.75	1.82 ± 1.32	0.00 ± 1.14	7.94 ± 2.39	3.36 ± 1.65	53.48 ± 11.24	6.62 ± 2.17	0.00 ± 1.16	3.43 ± 1.54	6.36 ± 1.58
Heptylcyclohexane	1.52 ± 0.70	0.72 ± 0.50	0.18 ± 0.26	5.87 ± 2.34	5.52 ± 2.26	0.00 ± 1.11	0.24 ± 1.32	1.23 ± 1.44	29.01 ± 8.91	0.00 ± 1.23	8.64 ± 3.12	0.00 ± 1.09	0.38 ± 0.63
Farnesane	21.09 ± 8.88	10.32 ± 4.64	0.25 ± 0.71	8.93 ± 5.61	16.93 ± 8.50	7.36 ± 5.24	0.00 ± 3.69	32.29 ± 14.62	0.50 ± 3.48	0.00 ± 3.61	0.00 ± 3.17	17.49 ± 8.72	0.00 ± 1.60
Tetradecane	0.00 ± 5.76	2.13 ± 5.99	6.53 ± 3.99	39.67 ± 20.27	0.00 ± 16.78	26.03 ± 19.67	2.97 ± 19.78	0.00 ± 18.99	0.00 ± 17.64	0.00 ± 19.19	17.05 ± 18.72	25.09 ± 19.00	0.00 ± 8.73
Octylcyclohexane	0.15 ± 1.73	0.00 ± 1.71	0.00 ± 1.01	0.00 ± 4.90	0.00 ± 5.00	0.00 ± 5.15	0.00 ± 5.67	2.40 ± 5.75	56.87 ± 11.20	2.37 ± 5.83	5.33 ± 5.40	0.00 ± 4.99	6.59 ± 2.95
Pentadecane	0.00 ± 2.92	18.16 ± 3.60	6.41 ± 1.92	22.45 ± 8.99	2.57 ± 8.61	18.36 ± 9.30	4.22 ± 9.88	0.00 ± 9.59	779.69 ± 76.36	171.65 ± 20.27	50.04 ± 10.59	3.32 ± 8.66	75.01 ± 8.90
Nonylcyclohexane	0.02 ± 2.50	0.56 ± 2.53	0.00 ± 1.46	0.00 ± 7.12	0.00 ± 7.24	0.00 ± 7.44	2.40 ± 8.50	1.37 ± 8.28	3.29 ± 7.77	0.71 ± 8.37	1.52 ± 7.60	0.00 ± 7.18	0.19 ± 3.73
Hexadecane	17.84 ± 4.15	10.35 ± 3.98	9.44 ± 2.44	10.43 ± 11.15	37.90 ± 11.79	5.71 ± 11.70	0.00 ± 12.74	0.00 ± 12.58	2.32 ± 11.61	0.00 ± 12.72	42.66 ± 12.23	0.00 ± 11.21	0.00 ± 5.71
Norpristane	11.09 ± 2.85	1.86 ± 1.03	3.85 ± 1.12	6.41 ± 3.12	18.62 ± 5.44	3.78 ± 2.85	8.94 ± 3.88	0.83 ± 2.71	18.18 ± 5.39	16.97 ± 5.35	10.43 ± 3.90	0.22 ± 2.37	1.05 ± 1.32
Heptadecane	35.88 ± 4.94	80.69 ± 9.22	13.03 ± 2.24	114.30 ± 15.20	7.49 ± 7.57	10.48 ± 7.96	0.00 ± 8.16	33.56 ± 9.73	108.43 ± 14.91	0.00 ± 8.24	52.69 ± 10.36	0.00 ± 7.33	0.65 ± 3.76
Decylcyclohexane	0.00 ± 1.04	4.46 ± 1.70	0.82 ± 0.70	0.00 ± 3.02	3.28 ± 3.34	0.00 ± 3.15	0.00 ± 3.47	0.00 ± 3.45	10.55 ± 4.54	0.00 ± 3.48	0.06 ± 3.17	0.00 ± 3.04	1.31 ± 1.67
Heptadecane_Pristane	29.98 ± 4.03	68.41 ± 6.25	12.50 ± 2.17	105.77 ± 12.53	76.40 ± 11.29	15.24 ± 9.74	0.00 ± 10.48	39.95 ± 11.05	155.03 ± 15.57	48.39 ± 11.43	54.10 ± 10.65	3.64 ± 9.27	0.14 ± 4.70
Undecylcyclohexane	0.10 ± 0.47	3.89 ± 1.28	0.00 ± 0.25	0.00 ± 1.16	0.00 ± 1.21	0.00 ± 1.28	4.06 ± 2.26	1.67 ± 1.76	0.00 ± 1.10	0.00 ± 1.18	0.14 ± 1.37	0.00 ± 1.29	0.00 ± 0.65
Octadecane	9.58 ± 1.51	69.02 ± 5.26	12.02 ± 1.22	6.80 ± 3.66	103.47 ± 8.78	10.17 ± 3.93	0.00 ± 4.07	0.00 ± 4.03	2.64 ± 3.76	82.96 ± 7.75	20.52 ± 4.21	0.68 ± 3.63	3.01 ± 1.89
Phytane	6.91 ± 0.88	49.01 ± 4.35	6.16 ± 0.67	0.00 ± 1.54	33.79 ± 3.58	6.32 ± 1.82	109.74 ± 9.97	30.28 ± 3.44	27.36 ± 3.10	32.63 ± 3.62	8.86 ± 1.92	2.46 ± 1.63	2.63 ± 0.89
Dodecylcyclohexane	0.67 ± 0.31	3.39 ± 1.03	0.68 ± 0.25	0.92 ± 0.60	1.37 ± 0.71	0.93 ± 0.63	0.23 ± 0.55	0.18 ± 0.54	7.76 ± 2.40	0.81 ± 0.65	1.04 ± 0.65	0.00 ± 0.43	12.36 ± 3.56
Nonadecane	8.39 ± 1.15	47.16 ± 5.13	6.53 ± 0.83	4.83 ± 1.66	71.32 ± 8.10	9.29 ± 2.04	90.92 ± 10.22	18.79 ± 2.94	12.83 ± 2.31	77.58 ± 8.82	15.19 ± 2.51	1.97 ± 1.54	40.27 ± 4.54
Tridecylcyclohexane	2.84 ± 0.89	1.01 ± 0.53	0.00 ± 0.24	1.61 ± 1.31	1.49 ± 1.32	0.00 ± 1.19	5.43 ± 2.10	2.70 ± 1.62	2.22 ± 1.45	1.45 ± 1.48	0.00 ± 1.19	0.00 ± 1.15	1.28 ± 0.75
Eicosane	5.60 ± 0.86	26.59 ± 1.76	5.42 ± 0.58	2.98 ± 2.21	61.45 ± 4.37	6.99 ± 2.38	52.50 ± 4.14	14.66 ± 2.73	24.98 ± 2.82	58.76 ± 4.41	7.06 ± 2.37	0.87 ± 2.23	11.96 ± 1.39
Tetradecylcyclohexane	0.54 ± 0.17	0.53 ± 0.15	0.52 ± 0.15	0.36 ± 0.18	5.35 ± 1.25	1.21 ± 0.35	1.57 ± 0.43	3.89 ± 0.93	9.06 ± 2.07	0.93 ± 0.29	0.51 ± 0.20	0.07 ± 0.15	11.28 ± 2.59
Heneicosane	4.53 ± 0.89	30.85 ± 2.08	2.96 ± 0.54	0.76 ± 2.35	43.53 ± 3.73	4.82 ± 2.52	31.00 ± 3.46	6.81 ± 2.75	15.57 ± 2.72	30.89 ± 3.45	2.12 ± 2.46	0.00 ± 2.38	30.89 ± 2.34
Pentadecylcyclohexane	0.00 ± 2.30	0.27 ± 2.31	0.00 ± 1.37	0.00 ± 6.62	1.76 ± 6.75	0.00 ± 6.99	0.00 ± 7.68	0.00 ± 7.55	0.00 ± 6.95	0.00 ± 7.67	0.00 ± 6.91	0.00 ± 6.74	0.00 ± 3.43
Docosane	3.77 ± 3.57	25.31 ± 4.51	3.02 ± 2.14	0.00 ± 10.11	32.43 ± 11.06	0.00 ± 10.69	0.00 ± 11.72	4.12 ± 11.61	6.26 ± 10.72	17.65 ± 12.05	0.00 ± 10.54	0.00 ± 10.29	16.88 ± 5.66
Hexadecylcyclohexane	1.55 ± 0.30	5.43 ± 0.88	0.43 ± 0.11	0.24 ± 0.31	10.20 ± 1.67	1.35 ± 0.42	4.41 ± 0.84	4.36 ± 0.83	2.64 ± 0.58	0.00 ± 0.34	0.61 ± 0.35	0.00 ± 0.29	0.66 ± 0.23
Tricosane	0.92 ± 4.64	24.73 ± 4.99	2.98 ± 2.77	0.00 ± 13.37	30.59 ± 13.82	0.00 ± 14.08	8.86 ± 15.57	10.44 ± 15.31	0.00 ± 14.03	0.00 ± 15.48	0.00 ± 13.93	0.00 ± 13.59	14.03 ± 7.03
Heptadecylcyclohexane	0.00 ± 1.99	12.55 ± 3.93	0.00 ± 1.17	0.00 ± 5.68	15.09 ± 7.51	0.00 ± 5.95	5.73 ± 7.13	0.00 ± 6.56	8.28 ± 6.78	0.00 ± 6.60	0.00 ± 5.90	0.00 ± 5.77	1.43 ± 3.08
Octadecylcyclohexane	0.00 ± 1.76	0.18 ± 1.80	0.00 ± 1.04	0.00 ± 5.06	0.00 ± 5.15	0.00 ± 5.32	0.00 ± 5.87	0.00 ± 5.75	0.00 ± 5.30	0.00 ± 5.85	0.00 ± 5.26	0.00 ± 5.14	7.41 ± 3.48
Tetracosane	0.00 ± 7.94	24.83 ± 9.32	4.88 ± 4.89	0.00 ± 22.87	0.00 ± 23.16	0.00 ± 24.07	0.00 ± 26.45	0.00 ± 26.15	0.00 ± 23.92	0.00 ± 26.46	0.00 ± 23.82	0.00 ± 23.23	2.33 ± 11.94
Pentacosane	0.00 ± 8.59	23.07 ± 10.55	3.99 ± 5.35	0.00 ± 24.78	5.62 ± 25.57	0.00 ± 26.02	0.00 ± 28.71	0.00 ± 28.22	0.00 ± 26.07	0.00 ± 28.63	0.00 ± 25.75	0.00 ± 25.12	29.34 ± 15.14
Nonadecylcyclohexane	0.00 ± 2.11	3.88 ± 2.50	0.61 ± 1.32	0.00 ± 6.17	0.00 ± 6.19	0.00 ± 6.41	0.00 ± 7.08	0.52 ± 7.10	0.00 ± 6.38	0.00 ± 7.08	0.00 ± 6.36	0.00 ± 6.19	2.87 ± 3.41
Hexacosane	0.00 ± 9.74	17.21 ± 10.81	3.86 ± 5.99	0.00 ± 28.19	2.61 ± 28.81	0.00 ± 29.58	0.00 ± 32.53	0.00 ± 32.07	0.00 ± 29.43	0.00 ± 32.53	0.00 ± 29.28	0.00 ± 28.56	22.67 ± 15.86
Eicosylcyclohexane	0.56 ± 0.18	0.53 ± 0.16	0.02 ± 0.04	0.01 ± 0.13	3.81 ± 0.99	0.00 ± 0.13	4.51 ± 1.18	0.26 ± 0.17	0.44 ± 0.19	0.10 ± 0.16	0.21 ± 0.16	0.36 ± 0.17	1.53 ± 0.42
Heptacosane	0.00 ± 9.76	13.14 ± 10.55	4.09 ± 6.02	0.00 ± 28.25	0.00 ± 28.48	0.00 ± 29.67	0.00 ± 32.64	0.00 ± 32.09	0.00 ± 29.50	0.00 ± 32.60	0.00 ± 29.38	0.00 ± 28.63	30.35 ± 16.59
Heneicosylcyclohexane	0.68 ± 0.28	0.54 ± 0.23	0.04 ± 0.06	1.68 ± 0.68	0.47 ± 0.29	0.00 ± 0.20	1.48 ± 0.63	2.91 ± 1.13	0.40 ± 0.28	0.53 ± 0.33	0.30 ± 0.26	0.03 ± 0.21	5.05 ± 1.85
Octacosane	0.00 ± 9.51	17.81 ± 10.11	3.17 ± 5.73	5.32 ± 27.62	0.00 ± 27.74	0.00 ± 28.88	0.00 ± 31.76	0.00 ± 31.22	0.00 ± 28.82	0.00 ± 31.73	0.00 ± 28.59	0.00 ± 27.89	27.60 ± 15.10
Nonacosane	0.00 ± 6.53	8.83 ± 7.20	1.98 ± 4.01	9.41 ± 19.49	0.00 ± 18.95	0.00 ± 19.72	0.00 ± 21.70	0.00 ± 21.33	0.00 ± 19.62	0.00 ± 21.68	0.00 ± 19.52	0.00 ± 19.04	27.43 ± 12.37
Triacontane	0.00 ± 5.54	8.77 ± 6.05	1.71 ± 3.36	23.53 ± 17.30	0.00 ± 16.19	0.00 ± 16.69	0.00 ± 18.37	0.00 ± 18.06	0.00 ± 16.69	0.00 ± 18.34	0.00 ± 16.53	0.00 ± 16.14	28.29 ± 10.51
Hentriacontane	0.07 ± 3.26	26.57 ± 7.77	0.95 ± 2.00	20.18 ± 11.65	0.00 ± 9.41	0.00 ± 9.59	0.00 ± 10.53	0.00 ± 10.40	0.00 ± 9.54	1.97 ± 11.07	0.00 ± 9.50	0.00 ± 9.26	23.20 ± 8.23
Dotriacontane	0.00 ± 2.48	8.87 ± 2.93	0.90 ± 1.50	29.19 ± 8.72	0.00 ± 7.22	0.00 ± 7.50	0.00 ± 8.25	0.00 ± 8.11	0.00 ± 7.46	0.00 ± 8.25	0.00 ± 7.43	0.00 ± 7.24	18.46 ± 4.82

Appendix B1. Chemical Composition of Dilution Blanks and Vehicle Exhaust Samples from Round1

Species Description	S3-2	S4-1	S4-2	S5-1	S5-2	S5-3	S5-4	S5-5	S6-1	S6-2	S6-3	S6-4	S7-1
Tritriacontane	0.00 ± 0.96	7.16 ± 3.09	0.25 ± 0.61	15.98 ± 7.36	0.00 ± 2.69	0.00 ± 2.79	0.00 ± 3.08	0.00 ± 3.01	0.00 ± 2.79	0.00 ± 3.27	0.00 ± 2.80	0.00 ± 2.69	11.66 ± 4.95
Tetratriacontane	0.16 ± 1.13	4.34 ± 1.98	0.64 ± 0.72	22.09 ± 8.12	0.00 ± 3.08	0.00 ± 3.20	0.00 ± 3.51	0.00 ± 3.46	0.00 ± 3.20	0.00 ± 3.54	0.00 ± 3.20	0.00 ± 3.08	13.82 ± 4.84
Pentatriacontane	0.56 ± 0.53	2.20 ± 0.99	0.26 ± 0.29	12.10 ± 4.60	0.00 ± 1.11	0.00 ± 1.16	0.00 ± 1.27	0.00 ± 1.25	0.18 ± 1.34	0.00 ± 1.30	0.00 ± 1.18	0.00 ± 1.11	6.88 ± 2.59
Hexatriacontane	0.04 ± 0.46	3.92 ± 0.66	0.33 ± 0.28	21.07 ± 2.67	0.00 ± 1.33	0.00 ± 1.38	0.00 ± 1.52	0.00 ± 1.50	0.00 ± 1.38	0.00 ± 1.52	0.00 ± 1.37	0.00 ± 1.34	12.71 ± 1.54
Heptatriacontane	0.30 ± 0.28	1.77 ± 0.77	0.19 ± 0.17	9.80 ± 3.71	0.00 ± 0.49	0.00 ± 0.51	0.00 ± 0.57	0.00 ± 0.56	0.32 ± 0.75	0.24 ± 0.80	0.00 ± 0.52	0.00 ± 0.50	5.01 ± 1.93
Octatriacontane	0.12 ± 0.42	1.84 ± 1.30	0.16 ± 0.23	22.33 ± 12.51	0.00 ± 0.71	0.00 ± 0.74	0.00 ± 0.81	0.00 ± 0.80	3.22 ± 2.79	0.00 ± 0.87	0.00 ± 0.75	0.00 ± 0.71	7.17 ± 4.22
Nonatriacontane	0.00 ± 0.13	0.01 ± 0.13	0.04 ± 0.08	4.62 ± 1.57	0.00 ± 0.27	0.00 ± 0.28	0.00 ± 0.31	0.00 ± 0.30	0.00 ± 0.28	0.00 ± 0.31	0.00 ± 0.28	0.00 ± 0.27	1.68 ± 0.63
Polar compounds (ug/mile)													
heptanoic acid (c7)	17.86 ± 4.67	19.74 ± 4.74	4.20 ± 4.35	0.00 ± 8.38	0.00 ± 8.52	0.00 ± 8.83	0.00 ± 9.71	0.00 ± 9.54	75.28 ± 10.73	0.00 ± 9.69	0.00 ± 8.77	0.00 ± 8.57	17.84 ± 4.65
me-malonic (d-c3)	0.00 ± 1.26	28.63 ± 7.37	0.00 ± 1.24	0.00 ± 1.48	0.00 ± 1.50	0.00 ± 1.56	0.00 ± 1.71	0.00 ± 1.68	17.60 ± 5.71	0.00 ± 1.71	0.00 ± 1.54	5.34 ± 2.28	1.02 ± 1.32
guaiacol	0.00 ± 0.14	0.76 ± 0.22	0.00 ± 0.11	0.13 ± 0.16	0.00 ± 0.15	2.28 ± 0.48	0.00 ± 0.18	0.00 ± 0.17	5.51 ± 1.52	0.00 ± 0.18	0.00 ± 0.16	0.46 ± 0.19	0.89 ± 0.25
benzoic acid	2344.72 ± 1295.09	1343.50 ± 1270.31	1107.09 ± 1240.91	0.00 ± 2329.30	0.00 ± 2356.49	0.00 ± 2465.53	0.00 ± 2710.54	5456.32 ± 2852.34	6265.03 ± 2659.13	1410.00 ± 2790.59	0.00 ± 2436.94	0.00 ± 2376.85	140.70 ± 1241.59
octanoic acid (c8)	25.55 ± 10.72	32.43 ± 11.03	4.76 ± 9.97	0.00 ± 15.26	0.00 ± 15.74	0.00 ± 16.03	0.00 ± 17.63	390.36 ± 44.97	132.08 ± 22.93	0.00 ± 17.76	0.00 ± 16.01	0.00 ± 15.64	25.64 ± 10.73
phenylacetic acid	41.03 ± 36.61	0.17 ± 24.38	0.00 ± 26.62	0.00 ± 32.28	83.63 ± 61.99	175.80 ± 87.56	0.00 ± 37.43	0.00 ± 37.37	0.00 ± 33.91	0.00 ± 37.37	0.00 ± 33.69	0.00 ± 38.56	0.15 ± 29.78
maleic acid	0.00 ± 1.64	8.86 ± 2.20	0.00 ± 1.60	48.07 ± 8.20	0.00 ± 1.64	0.00 ± 1.71	0.00 ± 1.88	0.00 ± 1.85	0.00 ± 1.70	0.00 ± 1.87	0.00 ± 1.69	89.17 ± 13.86	19.22 ± 3.05
succinic acid (d-c4)	0.59 ± 10.71	6.39 ± 10.79	0.00 ± 10.61	79.89 ± 23.19	0.00 ± 19.46	0.00 ± 20.35	0.00 ± 22.21	276.63 ± 46.19	0.00 ± 20.09	0.00 ± 22.18	0.00 ± 19.99	0.00 ± 19.53	12.66 ± 10.84
4-me-guaiacol	0.00 ± 0.06	0.00 ± 0.08	0.00 ± 0.05	0.00 ± 0.66	0.00 ± 0.11	0.00 ± 0.11	0.00 ± 0.12	0.00 ± 0.12	1.37 ± 0.15	0.00 ± 0.12	0.00 ± 0.11	0.00 ± 1.30	0.23 ± 0.16
o-toluic	46.60 ± 8.29	63.86 ± 10.68	26.68 ± 5.75	16.26 ± 6.16	284.89 ± 43.62	21.17 ± 6.72	0.00 ± 5.99	303.21 ± 46.77	417.86 ± 63.15	123.64 ± 20.21	61.59 ± 11.35	32.92 ± 7.74	26.94 ± 5.80
me-succinic acid (d-c4)	0.10 ± 1.61	1.62 ± 1.63	0.00 ± 1.59	11.46 ± 3.46	0.00 ± 2.88	0.00 ± 3.03	0.00 ± 3.30	15.67 ± 4.12	0.00 ± 2.99	21.75 ± 4.60	0.00 ± 2.97	0.00 ± 2.90	3.51 ± 1.66
m-toluic	70.87 ± 5.05	128.81 ± 8.42	48.79 ± 3.88	26.25 ± 4.81	388.63 ± 24.93	0.65 ± 4.66	856.76 ± 53.74	499.80 ± 32.03	242.51 ± 15.76	257.43 ± 17.05	83.46 ± 7.19	52.72 ± 5.76	44.09 ± 3.71
nonanoic acid (c9)	16.90 ± 11.49	50.96 ± 18.02	5.40 ± 9.81	0.00 ± 17.36	0.00 ± 18.56	0.00 ± 17.01	0.00 ± 18.71	270.23 ± 76.69	139.58 ± 45.71	19.39 ± 23.88	0.00 ± 18.15	0.00 ± 17.55	38.40 ± 15.54
p-toluic	53.36 ± 8.34	99.02 ± 14.37	36.43 ± 6.14	15.85 ± 5.55	320.88 ± 45.53	0.00 ± 4.68	941.54 ± 130.52	460.76 ± 64.97	138.84 ± 20.88	235.07 ± 33.99	60.20 ± 10.56	37.06 ± 7.74	31.86 ± 5.75
2,6-dimethylbenzoic acid	4.91 ± 2.00	0.62 ± 1.95	3.62 ± 1.92	0.00 ± 2.55	35.50 ± 6.49	0.00 ± 2.68	0.00 ± 15.56	30.33 ± 8.85	50.42 ± 5.94	9.80 ± 5.03	0.00 ± 2.82	0.00 ± 2.69	5.16 ± 2.03
4-ethyl-guaiacol	0.00 ± 0.06	0.26 ± 0.33	0.00 ± 0.05	0.02 ± 0.18	2.18 ± 2.06	4.40 ± 0.33	0.00 ± 0.12	0.00 ± 0.12	2.61 ± 2.15	0.00 ± 2.03	0.15 ± 0.75	0.15 ± 0.12	0.16 ± 0.12
syringol	0.00 ± 0.07	0.00 ± 0.06	0.00 ± 0.05	0.10 ± 0.11	1.32 ± 0.54	0.00 ± 0.11	0.00 ± 0.12	0.00 ± 0.52	2.44 ± 0.75	0.00 ± 0.20	0.00 ± 0.11	0.08 ± 0.11	0.00 ± 0.09
glutaric acid (d-c5)	0.00 ± 0.10	1.25 ± 0.14	0.00 ± 0.09	33.52 ± 2.00	60.12 ± 3.64	0.00 ± 0.15	0.00 ± 0.15	0.00 ± 0.14	0.00 ± 0.14	0.00 ± 0.15	81.41 ± 4.91	13.82 ± 0.86	4.95 ± 0.27
2-methylglutaric (d-c5)	0.03 ± 0.07	1.48 ± 0.43	0.00 ± 0.05	0.88 ± 0.32	0.00 ± 0.11	0.00 ± 0.11	0.00 ± 0.12	14.56 ± 4.06	19.82 ± 5.50	0.00 ± 0.12	0.00 ± 0.11	0.00 ± 0.11	1.53 ± 0.45
2,5-dimethylbenzoic acid	7.22 ± 4.08	15.49 ± 6.20	2.94 ± 2.78	0.00 ± 3.67	34.89 ± 13.94	0.00 ± 3.73	0.00 ± 4.10	12.63 ± 8.68	0.00 ± 4.37	48.82 ± 18.34	0.00 ± 4.75	0.00 ± 4.23	5.11 ± 4.00
3-methylglutaric acid (d-c5)	0.01 ± 3.22	23.79 ± 5.07	8.21 ± 3.55	5.95 ± 5.86	50.51 ± 10.01	0.00 ± 6.01	0.00 ± 6.61	0.00 ± 6.51	0.00 ± 5.99	0.00 ± 6.60	0.00 ± 5.95	18.22 ± 6.64	4.51 ± 3.31
2,4-dimethylbenzoic acid	258.91 ± 213.59	352.96 ± 220.12	607.47 ± 232.39	0.00 ± 352.53	0.00 ± 358.63	0.00 ± 371.25	888.00 ± 476.33	274.83 ± 430.73	1710.78 ± 509.00	106.21 ± 429.18	0.00 ± 368.21	0.00 ± 359.21	423.97 ± 228.70
2,3- and 3,5- dimethylbenzoic acid	3.77 ± 1.02	5.14 ± 1.21	4.48 ± 0.91	0.00 ± 0.58	31.96 ± 5.86	0.00 ± 0.25	27.42 ± 5.40	62.22 ± 10.18	17.42 ± 3.85	8.09 ± 2.75	0.64 ± 1.59	0.00 ± 1.23	1.40 ± 0.94
decanoic acid (c10)	2.20 ± 3.20	0.00 ± 3.41	10.43 ± 3.51	0.00 ± 4.41	0.00 ± 4.46	0.00 ± 4.64	0.00 ± 15.29	18.92 ± 7.05	0.00 ± 25.01	0.00 ± 5.38	0.00 ± 4.60	0.00 ± 4.49	0.00 ± 4.22
4-allyl-guaiacol (eugenol)	22.52 ± 2.47	42.62 ± 4.48	7.09 ± 0.78	33.85 ± 3.71	52.26 ± 5.79	0.00 ± 0.16	0.00 ± 0.48	13.22 ± 1.80	0.00 ± 0.29	482.76 ± 53.06	325.41 ± 35.84	14.55 ± 1.61	10.79 ± 0.95
4-methyl-syringol	0.00 ± 0.06	0.00 ± 0.06	0.21 ± 0.09	0.00 ± 0.10	0.00 ± 0.11	22.94 ± 7.41	0.00 ± 0.12	1.11 ± 0.49	0.23 ± 0.13	0.00 ± 0.12	0.00 ± 0.11	1.57 ± 0.52	0.23 ± 0.11
3,4-dimethylbenzoic acid	7.79 ± 2.34	18.09 ± 2.97	9.06 ± 2.38	1.23 ± 3.15	63.79 ± 7.88	18.83 ± 4.02	98.46 ± 11.53	118.96 ± 13.64	28.27 ± 4.67	35.99 ± 9.52	12.18 ± 5.95	8.82 ± 3.40	5.85 ± 2.26
hexanedioic (adipic) acid (d-c6)	0.47 ± 0.95	0.00 ± 0.93	0.00 ± 0.91	28.53 ± 6.06	0.00 ± 1.67	0.00 ± 1.80	0.00 ± 1.92	26.43 ± 5.84	38.79 ± 7.98	0.00 ± 1.91	0.00 ± 1.72	0.00 ± 1.70	0.28 ± 0.95
salcylic acid	2.16 ± 2.81	2.13 ± 2.80	18.96 ± 4.40	17.32 ± 5.83	2.31 ± 4.90	66.12 ± 12.38	20.66 ± 7.01	12.28 ± 6.31	80.95 ± 14.57	0.00 ± 5.38	0.00 ± 4.79	0.23 ± 4.76	1.06 ± 2.77
trans-2-decenoic acid	0.00 ± 0.46	0.00 ± 0.46	2.93 ± 0.54	0.00 ± 0.65	0.00 ± 0.53	0.00 ± 0.55	0.00 ± 0.61	2.48 ± 0.84	1.15 ± 0.81	0.00 ± 0.61	0.00 ± 0.55	0.00 ± 0.53	1.02 ± 0.48
cis-pinonic acid	0.00 ± 3.47	0.00 ± 3.47	0.00 ± 3.43	0.00 ± 4.63	0.00 ± 4.49	0.00 ± 4.77	0.00 ± 5.16	0.00 ± 5.06	0.00 ± 5.01	0.00 ± 5.18	0.00 ± 4.63	0.00 ± 4.52	0.00 ± 3.44
3-methyladipic acid (d-c6)	11.23 ± 2.01	1.17 ± 0.35	172.20 ± 29.98	38.20 ± 6.75	0.00 ± 0.37	1928.71 ± 334.81	0.00 ± 0.42	680.29 ± 118.74	389.67 ± 67.80	8.98 ± 1.73	19.98 ± 3.61	27.29 ± 4.86	2.70 ± 0.56
4-formyl-guaiacol (vanillin)	0.00 ± 0.72	0.68 ± 0.75	5.59 ± 1.55	6.25 ± 1.96	0.00 ± 0.75	0.00 ± 0.77	0.00 ± 0.84	11.32 ± 3.21	57.43 ± 14.25	0.12 ± 0.92	0.04 ± 0.83	0.49 ± 0.85	0.50 ± 0.74
undecanoic acid (c11)	0.00 ± 1.38	0.03 ± 1.40	0.65 ± 1.48	4.04 ± 2.59	0.83 ± 2.37	0.00 ± 27.03	0.00 ± 2.63	0.00 ± 11.62	8.67 ± 6.39	0.00 ± 2.63	0.00 ± 2.38	0.00 ± 2.36	5.51 ± 1.75
isoeugenol	1.46 ± 0.64	0.00 ± 0.28	0.00 ± 0.28	0.00 ± 0.33	1.00 ± 0.58	0.00 ± 0.33	0.00 ± 0.36	0.00 ± 0.40	0.24 ± 0.91	0.94 ± 0.60	0.00 ± 0.33	0.00 ± 0.32	0.29 ± 0.34
heptanedioic (pimelic) acid (d-c7)	0.00 ± 1.01	0.48 ± 1.02	0.00 ± 1.00	11.86 ± 2.37	3.32 ± 1.35	0.00 ± 1.17	0.00 ± 1.29	0.00 ± 1.27	76.30 ± 12.34	0.00 ± 1.31	1.79 ± 1.27	2.74 ± 1.30	0.64 ± 1.01
2,3-dimethoxybenzoic acid	0.01 ± 0.07	0.00 ± 0.06	0.00 ± 0.05	0.00 ± 0.10	0.00 ± 0.11	0.00 ± 0.11	0.00 ± 0.12	66.55 ± 24.45	494.86 ± 181.60	19.18 ± 7.05	0.00 ± 0.11	0.00 ± 0.11	0.11 ± 0.09
acetovanillone	28.00 ± 4.49	2.68 ± 3.94	0.00 ± 3.89	0.00 ± 3.89	0.00 ± 3.94	0.00 ± 4.10	0.00 ± 4.51	0.00 ± 4.43	0.00 ± 4.22	0.00 ± 4.50	0.00 ± 4.06	0.00 ± 3.96	0.00 ± 3.91
2,6-dimethoxybenzoic acid	0.13 ± 0.08	0.00 ± 0.06	8.06 ± 2.84	0.00 ± 0.10	0.00 ± 0.11	0.00 ± 0.11	0.00 ± 0.12	37.62 ± 13.46	0.00 ± 7.11	0.00 ± 0.33	2.14 ± 0.77	0.00 ± 0.11	0.59 ± 0.19
dodecanoic (lauric) acid (c12)	30.60 ± 35.00	21.97 ± 35.02	37.20 ± 34.69	0.00 ± 51.24	0.00 ± 51.84	0.00 ± 53.98	0.00 ± 59.36	214.04 ± 61.49	36.73 ± 54.18	0.00 ± 59.40	0.00 ± 53.43	0.00 ± 52.13	0.00 ± 34.55
2,5-dimethoxybenzoic acid	0.00 ± 0.73	13.82 ± 3.47	0.00 ± 0.72	0.00 ± 1.28	0.00 ± 1.29	0.00 ± 1.35	0.00 ± 1.48	0.00 ± 1.58	8.36 ± 2.55	22.10 ± 5.63	6.10 ± 2.10	0.00 ± 1.31	6.51 ± 1.82
phthalic acid	158.58 ± 40.76	144.73 ± 38.71	0.00 ± 25.36	77.15 ± 45.36	52.29 ± 43.79	7154.14 ± 1394.11	6990.63 ± 1367.29	0.00 ± 45.68	178.16 ± 58.91	92.98 ± 52.87	267.31 ± 72.06	307.47 ± 77.88	169.99 ± 43.73
suberic acid (d-c8)	0.00 ± 18.94	0.00 ± 19.04	10.76 ± 19.33	0.00 ± 25.23	0.00 ± 25.86	165.18 ± 66.94	0.00 ± 28.81	59.90 ± 40.01	15.87 ± 30.53	0.00 ± 29.41	0.00 ± 26.26	0.00 ± 25.34	0.00 ± 18.86
levoglucosan	1.18 ± 1.90	0.90 ± 1.78	0.00 ± 1.52	5.84 ± 3.56	0.00 ± 1.55	0.00 ± 99.86	0.00 ± 113.45	0.00 ± 1.72	0.00 ± 3.12	0.00 ± 2.36	1.97 ± 4.64	0.00 ± 4.67	3.55 ± 2.38
3,5-dimethoxybenzoic acid	0.16 ± 0.41	1.18 ± 0.43	2.37 ± 0.46	0.51 ± 0.77	0.00 ± 0.77	0.00 ± 2.44	0.00 ± 0.89	0.00 ± 1.32	5.19 ± 0.96	7.24 ± 1.10	0.56 ± 0.80	1.11 ± 0.79	0.08 ± 0.41
syringaldehyde	0.00 ± 0.06	1.87 ± 0.44	1.54 ± 0.37	1.22 ± 0.33	0.00 ± 0.11	0.00 ± 0.11	0.00 ± 0.12	3.73 ± 0.91	0.00 ± 0.11	0.00 ± 0.12	0.00 ± 0.12	0.00 ± 0.11	0.24 ± 0.11
3,4-dimethoxybenzoic acid	0.00 ± 0.39	6.33 ± 2.34	0.00 ± 0.38	1.97 ± 1.23	51.63 ± 18.70	0.00 ± 0.49	0.00 ± 0.54	0.00 ± 0.53	41.10 ± 14.99	0.00 ± 0.55	7.64 ± 3.20	3.28 ± 1.74	6.15 ± 2.27
2,4-dimethoxybenzoic acid	0.00 ± 0.06	3.74 ± 0.27	0.00 ± 0.05	2.07 ± 0.18	31.70 ± 2.27	0.00 ± 0.11	0.00 ± 0.12	0.00 ± 0.13	24.61 ± 1.73	20.78 ± 1.49	5.66 ± 0.42	1.87 ± 0.17	4.25 ± 0.31
tridecanoic acid (c13)	0.00 ± 0.54	1.99 ± 0.67	0.49 ± 0.59	0.00 ± 0.54	1.15 ± 1.00	0.00 ± 0.54	0.00 ± 0.60	0.00 ± 0.59	1.50 ± 0.93	3.48 ± 1.05	0.11 ± 0.59	0.00 ± 0.56	0.59 ± 0.56
isophthalic acid	58.34 ± 80.72	70.50 ± 79.73	0.00 ± 77.02	147.90 ± 97.70	106.08 ± 94.66	0.00 ± 89.95	0.00 ± 98.92	0.00 ± 97.24	84.96 ± 95.94	44.52 ± 102.51	1998.91 ± 461.91	1199.92 ± 291.01	12.12 ± 77.42
vanillic acid	0.00 ± 5.39	30.86 ± 6.78	0.00 ± 5.35	7.42 ± 6.12	24.87 ± 7.67	0.00 ± 6.10	0.00 ± 6.71	0.00 ± 6.59	24.08 ± 7.76	0.00 ± 6.70	0.00 ± 6.04	6.40 ± 6.17	0.00 ± 5.37
homovanillic acid	7.68 ± 3.71	14.89 ± 5.57	1.92 ± 2.60	28.17 ± 9.76	0.00 ± 2.97	0.00 ± 2.64	0.00 ± 2.91	0.00 ± 2.86	0.00 ± 2.90	0.00 ± 2.99	0.00 ± 29.16	15.13 ± 18.39	0.00 ± 2.38
azelaic acid (d-c9)	0.00 ± 4.88	10.70 ± 5.03	0.00 ± 4.84	30.01 ± 6.55	20.52 ± 6.19	0.00 ± 5.82	0.00 ± 6.40	0.00 ± 6.29	2.37 ± 5.87	0.00 ± 6.42	3.98 ± 5.85	0.00 ± 5.64	0.00 ± 4.86
myristoleic acid	1.68 ± 0.39	28.97 ± 3.54	0.42 ± 0.26	7.19 ± 1.21	37.30 ± 4.82	0.00 ± 0.25	0.00 ± 0.27	0.00 ± 0.27	59.69 ± 7.53	11.27 ± 1.68	1.77 ± 0.53	13.43 ± 1.99	0.00 ± 0.23
myristic acid (c14)	27.36 ± 12.79	62.53 ± 20.76	7.69 ± 8.51	23.28 ± 17.81	0.00 ± 9.50	0.00 ± 6.49	137.09 ± 47.97	25.86 ± 20.15	37.22 ± 21.72	79.24 ± 33.24	0.00 ± 8.75	0.00 ± 12.43	7.23 ± 9.35
sebacic acid (d-c10)	0.00 ± 1.03	0.00 ± 1.04	0.00 ± 1.02	1.84 ± 1.17	0.00 ± 1.26	0.00 ± 1.18	0.00 ± 1.30	0.00 ± 1.28	0.00 ± 1.45	0.00 ± 1.31	0.00 ± 1.17	0.00 ± 1.16	0.00 ± 1.03
syringic acid	1.56 ± 0.56	2.72 ± 0.67	0.00 ± 0.50	3.04 ± 0.77	23.88 ± 2.87	0.00 ± 0.61	0.00 ± 2.32	0.00 ± 0.79	29.79 ± 3.56	13.39 ± 2.15	8.52 ± 1.20	2.18 ± 0.66	30.13 ± 3.50
pentadecanoic acid (c15)	0.00 ± 2.85	1.87 ± 2.89	3.05 ± 2.94	0.16 ± 3.59	0.00 ± 3.55	0.00 ± 3.58	0.00 ± 3.94	0.00 ± 3.87	0.96 ± 3.80	0.00 ± 4.13	0.00 ± 3.57	0.00 ± 3.49	0.00 ± 2.87
undecanedioic acid (d-c11)	0.01 ± 0.14	1.00 ± 0.63	0.00 ± 0.10	0.45 ± 0.51	0.52 ± 0.66	0.00 ± 0.12	0.00 ± 0.13	0.00 ± 0.13	1.57 ± 1.28	0.29 ± 0.50	0.11 ± 0.34	0.23 ± 0.37	0.32 ± 0.37
palmitoleic acid	0.00 ± 0.78	0.00 ± 0.75	0.10 ± 0.95	2.26 ± 2.17	0.00 ± 0.92	0.00 ± 0.96	83.23 ± 35.77	0.00 ± 1.04	3.23 ± 2.60	2.96 ± 2.64	0.00 ± 1.00	0.00 ± 1.36	2.97 ± 1.92
palmitic acid (c16)	0.00 ± 17.51	9.11 ± 20.12	1.08 ± 15.79	427.22 ± 186.59	0.00 ± 25.81	0.00 ± 9.44	88.06 ± 69.16	0.00 ± 25.05	82.86 ± 60.65	0.00 ± 18.50	0.00 ± 20.27	0.00 ± 22.34	7.69 ± 19.44
isostearic acid	0.00 ± 0.34	0.00 ± 0.34	0.00 ± 0.33	0.00 ± 0.52	0.00 ± 0.53	0.00 ± 0.55	0.00 ± 1.48	0.00 ± 0.59	0.00 ± 0.55	0.00 ± 0.60	0.00 ± 0.54	0.00 ± 0.53	0.00 ± 0.34
dodecanedioic acid (d-c12)	0.00 ± 0.33	0.00 ± 0.33	0.00 ± 0.32	0.00 ± 5.85	0.00 ± 0.37	0.00 ± 0.38	0.00 ± 1.49	0.00 ± 0.41	0.19 ± 1.26	0.00 ± 0.42	0.00 ± 0.39	0.00 ± 0.37	0.46 ± 0.35
traumatic acid	0.00 ± 0.06	0.00 ± 0.06	0.00 ± 0.05	0.00 ± 0.10	0.00 ± 0.11	0.00 ± 0.11	0.00 ± 0.12	0.00 ± 0.12	0.00 ± 0.11	0.00 ± 0.12	0.00 ± 0.11	0.00 ± 0.11	0.00 ± 0.08
heptadecanoic acid (c17)	0.00 ± 3.30	1.00 ± 3.54	0.00 ± 3.30	12.68 ± 9.17	0.00 ± 6.15	0.00 ± 6.25	0.00 ± 6.87	27.21 ± 14.57	1.49 ± 6.82	3.09 ± 7.77	0.00 ± 6.22	0.00 ± 6.11	0.27 ± 3.33
1,11-undecanedicarboxylic acid (d-c13)	0.05 ± 0.10	0.00 ± 0.07	0.00 ± 0.06	0.00 ± 0.11	0.00 ± 0.11	0.00 ± 0.12	0.00 ± 0.13	0.00 ± 0.12	0.89 ± 0.42	0.00 ± 0.13	0.31 ± 0.28	0.00 ± 0.11	0.21 ± 0.17
oleic acid	0.00 ± 5.08	0.00 ± 5.55	0.00 ± 5.34	167.53 ± 96.70	0.00 ± 18.95	0.00 ± 5.89	0.00 ± 6.48	0.00 ± 6.38	0.00 ± 26.73	0.00 ± 18.50	0.00 ± 8.70	0.00 ± 11.98	4.15 ± 7.66
elaidic acid	0.00 ± 0.81	2.39 ± 0.84	0.00 ± 0.80	11.50 ± 1.26	0.00 ± 0.73	0.00 ± 0.73	0.00 ± 0.80	0.00 ± 0.79	0.00 ± 0.77	1.37 ± 0.90	0.00 ± 0.74	0.00 ± 0.71	2.49 ± 0.84
stearic acid (c18)	19.44 ± 25.95	0.00 ± 20.20	0.00 ± 17.99	259.00 ± 131.69	0.00 ± 34.41	0.00 ± 32.18	0.00 ± 35.39	0.00 ± 34.79	0.00 ± 46.40	0.00 ± 38.04	0.00 ± 32.97	0.00 ± 33.31	0.00 ± 19.41
1,12-dodecanedicarboxylic acid (d-c14)	0.02 ± 0.22	2.09 ± 0.68	0.85 ± 0.34	0.02 ± 0.32	3.70 ± 1.30	0.00 ± 0.26	0.00 ± 0.29	0.00 ± 0.28	3.93 ± 1.37	1.85 ± 0.77	5.35 ± 1.80	0.23 ± 0.30	1.62 ± 0.46
8,15-pimaradien-18-oic acd	0.00 ± 0.40	0.00 ± 0.39	0.00 ± 0.40	3.81 ± 3.76	0.00 ± 0.16	0.00 ± 0.16	0.00 ± 0.18	0.00 ± 0.18	0.00 ± 0.16	0.00 ± 0.18	0.00 ± 0.18	0.00 ± 0.18	0.26 ± 0.43
pimaric acid	2.74 ± 0.64	0.00 ± 0.50	0.06 ± 0.49	6.75 ± 1.28	0.00 ± 0.87	0.00 ± 0.90	0.00 ± 0.99	0.00 ± 0.97	37.80 ± 5.09	0.00 ± 0.99	0.00 ± 0.89	0.00 ± 0.87	0.44 ± 0.51

Appendix B1. Chemical Composition of Dilution Blanks and Vehicle Exhaust Samples from Round1

Species Description	S3-2	S4-1	S4-2	S5-1	S5-2	S5-3	S5-4	S5-5	S6-1	S6-2	S6-3	S6-4	S7-1
sandaracopimaric acid	0.06 ± 0.17	0.02 ± 0.17	0.00 ± 0.16	7.56 ± 0.62	0.00 ± 0.27	0.00 ± 0.29	0.00 ± 0.31	0.00 ± 0.31	0.00 ± 0.28	0.00 ± 0.31	0.00 ± 0.28	0.00 ± 0.28	0.32 ± 0.18
nonadecanoic acid (c19)	0.00 ± 5.61	0.02 ± 5.63	3.44 ± 5.57	0.00 ± 9.95	0.00 ± 10.07	0.00 ± 10.48	0.00 ± 11.53	0.00 ± 11.33	0.00 ± 10.44	0.00 ± 11.51	0.00 ± 10.38	0.00 ± 10.12	0.27 ± 5.59
isopimaric acid	0.00 ± 0.58	0.00 ± 0.59	0.42 ± 0.72	0.88 ± 1.20	0.00 ± 0.97	0.00 ± 1.01	0.00 ± 1.11	0.00 ± 1.09	0.00 ± 1.00	0.00 ± 1.11	0.00 ± 1.00	0.00 ± 0.98	0.00 ± 0.62
palustric acid	0.00 ± 0.53	0.00 ± 0.54	0.00 ± 0.53	1.02 ± 0.60	0.00 ± 0.60	0.00 ± 0.62	0.00 ± 0.68	0.00 ± 0.67	0.00 ± 0.62	1.24 ± 0.69	0.00 ± 0.61	0.00 ± 0.60	0.00 ± 0.53
dihydroisopimaric acid	0.00 ± 0.23	0.12 ± 0.23	0.00 ± 0.22	2.16 ± 0.32	0.00 ± 0.26	0.00 ± 0.27	0.00 ± 0.30	0.00 ± 0.30	0.00 ± 0.27	1.15 ± 0.32	0.00 ± 0.27	0.00 ± 0.26	0.37 ± 0.24
8-abietic acid	0.00 ± 0.34	0.00 ± 0.37	0.00 ± 0.34	2.06 ± 1.20	0.00 ± 0.44	0.00 ± 0.27	0.00 ± 0.30	0.00 ± 0.29	0.81 ± 0.83	0.00 ± 0.40	0.00 ± 0.27	0.00 ± 0.29	0.00 ± 0.42
dehydroabietic acid	0.00 ± 7.76	5.54 ± 9.01	0.00 ± 7.87	14.68 ± 14.89	0.00 ± 9.62	0.00 ± 9.32	0.00 ± 10.24	0.00 ± 10.07	1.86 ± 11.87	0.00 ± 11.55	0.00 ± 9.29	0.00 ± 9.06	2.31 ± 8.15
8,14-abietenic acid	0.00 ± 0.06	0.00 ± 0.06	0.00 ± 0.05	0.00 ± 0.11	0.00 ± 0.11	0.00 ± 0.11	0.00 ± 0.12	0.00 ± 0.12	0.00 ± 0.11	0.00 ± 0.12	0.00 ± 0.11	0.00 ± 0.11	0.00 ± 0.08
abietic acid	0.00 ± 0.10	0.00 ± 0.11	0.00 ± 0.09	2.12 ± 0.31	0.00 ± 0.14	0.00 ± 0.14	0.00 ± 0.16	0.00 ± 0.16	0.00 ± 0.15	0.00 ± 0.16	0.00 ± 0.14	0.00 ± 0.14	0.12 ± 0.12
eicosanoic acid (c20)	0.00 ± 1.77	0.00 ± 1.78	0.42 ± 1.76	7.23 ± 1.87	0.00 ± 1.77	0.00 ± 1.84	0.00 ± 2.03	0.00 ± 1.99	0.00 ± 1.83	0.00 ± 2.02	0.00 ± 1.82	0.00 ± 1.78	0.19 ± 1.76
levopimaric acid	0.00 ± 0.06	0.00 ± 0.06	0.00 ± 0.05	0.00 ± 0.11	0.00 ± 0.11	0.00 ± 0.11	0.00 ± 0.12	0.00 ± 0.12	0.00 ± 0.11	0.00 ± 0.12	0.00 ± 0.11	0.00 ± 0.11	0.00 ± 0.08
heneicosanoic acid (c21)	0.00 ± 2.00	0.00 ± 2.00	0.00 ± 1.99	0.00 ± 2.66	0.00 ± 2.65	0.00 ± 2.76	0.00 ± 3.03	0.00 ± 2.98	4.72 ± 3.34	0.00 ± 3.03	0.00 ± 2.73	0.00 ± 2.66	0.00 ± 1.99
7-oxodehydroabietic acid	0.00 ± 0.14	0.96 ± 0.18	0.10 ± 0.14	0.00 ± 0.25	0.00 ± 0.26	0.00 ± 0.27	0.00 ± 0.29	0.00 ± 0.29	5.49 ± 0.86	5.68 ± 0.91	0.00 ± 0.27	0.00 ± 0.26	2.56 ± 0.30
docosanoic acid (c22)	0.00 ± 5.63	0.00 ± 5.60	0.00 ± 5.53	7.38 ± 9.53	0.00 ± 8.79	0.00 ± 9.15	0.00 ± 10.06	0.00 ± 9.89	2.94 ± 9.52	0.00 ± 10.13	0.00 ± 9.06	0.00 ± 8.87	0.00 ± 5.61
tricosanoic acid (c23)	0.16 ± 0.96	0.00 ± 0.94	0.17 ± 0.95	0.98 ± 0.93	0.00 ± 0.74	0.00 ± 0.77	0.00 ± 0.84	0.00 ± 0.83	1.89 ± 1.11	1.78 ± 1.18	0.00 ± 0.76	0.00 ± 0.74	0.85 ± 1.01
tetracosanoic acid (c24)	0.09 ± 0.57	0.00 ± 0.41	0.33 ± 0.61	0.00 ± 0.89	0.00 ± 0.90	0.00 ± 0.93	0.00 ± 1.03	0.00 ± 1.01	0.00 ± 0.93	0.00 ± 1.03	0.00 ± 1.11	0.00 ± 1.88	0.00 ± 0.41
cholesterol	0.00 ± 0.98	0.00 ± 1.04	0.00 ± 0.99	0.00 ± 0.24	0.00 ± 0.24	0.00 ± 0.25	0.00 ± 0.27	0.00 ± 0.27	0.00 ± 0.25	0.00 ± 0.28	0.00 ± 0.25	0.00 ± 0.24	0.00 ± 1.09
cholestanol	4.24 ± 7.01	0.10 ± 7.01	0.00 ± 6.92	0.00 ± 7.95	0.00 ± 8.05	0.00 ± 8.38	0.00 ± 9.22	0.00 ± 9.06	0.00 ± 8.34	1.81 ± 9.23	0.00 ± 8.30	0.00 ± 8.09	0.00 ± 6.95
ergosterol	0.00 ± 0.06	0.07 ± 0.06	0.00 ± 0.05	0.00 ± 0.10	0.00 ± 0.11	0.00 ± 0.11	0.00 ± 0.12	0.00 ± 0.12	0.00 ± 0.11	0.00 ± 0.12	0.00 ± 0.11	0.00 ± 0.11	0.00 ± 0.08
stigmasterol	0.00 ± 2.17	0.00 ± 2.17	0.00 ± 2.15	28.84 ± 3.25	0.00 ± 2.50	0.00 ± 2.60	0.00 ± 2.86	0.00 ± 2.81	0.00 ± 2.59	0.00 ± 2.86	0.00 ± 2.58	0.00 ± 2.51	0.00 ± 2.16
sitosterol	0.00 ± 0.06	0.00 ± 0.06	0.00 ± 0.05	0.00 ± 0.10	0.00 ± 0.11	0.00 ± 0.11	0.00 ± 0.12	0.00 ± 0.12	0.00 ± 0.11	0.00 ± 0.12	0.00 ± 0.11	0.00 ± 0.11	0.00 ± 0.08
Carbonyls (mg/mile)													
formaldehyde	5.34 ± 0.02	7.35 ± 0.02	1.78 ± 0.01	42.00 ± 0.06	49.80 ± 0.06	22.25 ± 0.06	31.71 ± 0.06	18.86 ± 0.06	38.71 ± 0.06	7.07 ± 0.06	15.61 ± 0.06	9.71 ± 0.06	5.27 ± 0.03
acetaldehyde	1.57 ± 0.33	1.32 ± 0.32	0.60 ± 0.19	13.13 ± 0.99	11.35 ± 0.96	5.83 ± 0.99	11.29 ± 0.98	10.68 ± 0.96	8.95 ± 0.98	0.32 ± 0.99	4.13 ± 0.99	2.82 ± 0.96	3.16 ± 0.49
acetone	0.23 ± 0.47	0.44 ± 0.46	0.15 ± 0.28	1.68 ± 1.41	1.23 ± 1.37	3.57 ± 1.41	0.81 ± 1.40	0.29 ± 1.37	0.83 ± 1.39	0.00 ± 1.42	0.00 ± 1.42	0.00 ± 1.37	0.00 ± 0.69
* acrolein	1.32 ± 0.33	1.42 ± 0.35	0.20 ± 0.05	12.28 ± 3.07	12.18 ± 3.05	3.74 ± 0.93	0.53 ± 0.13	0.80 ± 0.20	7.05 ± 1.76	2.24 ± 0.56	5.54 ± 1.39	2.74 ± 0.69	1.82 ± 0.45
propionaldehyde	0.22 ± 0.01	0.23 ± 0.01	0.08 ± 0.01	1.47 ± 0.04	1.95 ± 0.04	1.32 ± 0.04	1.99 ± 0.04	0.34 ± 0.04	1.20 ± 0.04	0.20 ± 0.04	0.67 ± 0.04	0.55 ± 0.04	0.18 ± 0.02
crotonaldehyde	0.08 ± 0.01	0.08 ± 0.01	0.00 ± 0.01	0.10 ± 0.01	0.73 ± 0.01	0.27 ± 0.01	1.43 ± 0.01	0.25 ± 0.01	0.83 ± 0.01	0.13 ± 0.01	0.39 ± 0.01	0.06 ± 0.01	0.14 ± 0.02
methyl ethyl ketone	0.20 ± 0.04	0.23 ± 0.04	0.06 ± 0.02	0.93 ± 0.11	0.99 ± 0.11	0.75 ± 0.11	1.09 ± 0.11	0.12 ± 0.11	0.63 ± 0.11	0.13 ± 0.11	0.41 ± 0.11	0.36 ± 0.11	0.16 ± 0.06
Methacrolein	0.17 ± 0.01	0.20 ± 0.01	0.05 ± 0.01	2.02 ± 0.01	2.19 ± 0.01	0.89 ± 0.01	1.82 ± 0.01	1.07 ± 0.01	1.39 ± 0.01	0.23 ± 0.01	0.97 ± 0.01	0.42 ± 0.01	0.20 ± 0.01
* n-butyraldehyde	0.06 ± 0.02	0.17 ± 0.04	0.04 ± 0.02	2.81 ± 0.70	1.14 ± 0.29	1.36 ± 0.34	4.29 ± 1.07	3.32 ± 0.83	0.76 ± 0.19	0.08 ± 0.02	0.61 ± 0.15	0.23 ± 0.06	0.10 ± 0.03
benzaldehyde	1.23 ± 0.01	1.82 ± 0.01	0.46 ± 0.01	12.82 ± 0.02	14.83 ± 0.02	5.24 ± 0.02	13.64 ± 0.02	6.90 ± 0.02	6.85 ± 0.02	2.02 ± 0.02	4.79 ± 0.02	3.22 ± 0.02	2.08 ± 0.01
glyoxal	0.00 ± 0.01	0.00 ± 0.01	0.00 ± 0.01	0.14 ± 0.01	0.19 ± 0.01	0.05 ± 0.01	0.17 ± 0.01	0.01 ± 0.01	0.15 ± 0.01	0.00 ± 0.01	0.08 ± 0.01	0.05 ± 0.01	0.00 ± 0.01
valeraldehyde	0.03 ± 0.01	0.03 ± 0.01	0.03 ± 0.01	0.27 ± 0.02	0.24 ± 0.02	0.08 ± 0.02	0.30 ± 0.02	0.02 ± 0.02	0.23 ± 0.02	0.01 ± 0.02	0.08 ± 0.02	0.14 ± 0.02	0.02 ± 0.01
tolualdehyde	0.03 ± 0.01	0.05 ± 0.01	0.08 ± 0.01	1.43 ± 0.03	0.52 ± 0.03	0.38 ± 0.03	1.10 ± 0.03	1.08 ± 0.03	0.76 ± 0.03	0.20 ± 0.03	0.20 ± 0.03	0.05 ± 0.03	0.05 ± 0.01
hexanal	0.03 ± 0.01	0.05 ± 0.01	0.08 ± 0.01	1.43 ± 0.02	0.52 ± 0.02	0.38 ± 0.02	1.10 ± 0.02	1.08 ± 0.02	0.76 ± 0.02	0.20 ± 0.02	0.20 ± 0.02	0.05 ± 0.02	0.05 ± 0.01
*** acrolein converts to an unknown rear**													
VOC (mg/mi)													
1,3 butadiene (estimated)	3.103 ± 4.593	2.224 ± 3.292	0.617 ± 0.914	28.865 ± 42.720	29.506 ± 43.669	11.245 ± 16.642	1.489 ± 2.203	0.091 ± 0.134	24.624 ± 36.444	10.183 ± 15.070	11.914 ± 17.633	4.173 ± 6.176	3.652 ± 5.405
C2 compounds	35.193 ± 8.665	30.738 ± 7.568	12.634 ± 3.111	378.917 ± 93.293	1374.654 ± 40.482	130.464 ± 32.121	103.973 ± 25.599	2.981 ± 0.734	417.284 ± 102.739	786.758 ± 34.589	165.363 ± 40.714	33.652 ± 8.285	78.880 ± 19.421
propene	22.963 ± 4.854	16.460 ± 3.480	4.568 ± 0.966	213.598 ± 45.153	218.347 ± 38.387	83.212 ± 17.590	11.017 ± 2.329	0.671 ± 0.142	182.218 ± 38.519	75.352 ± 15.929	88.164 ± 18.637	30.880 ± 6.528	27.025 ± 5.713
propane	1.002 ± 0.057	0.707 ± 0.040	0.522 ± 0.029	5.184 ± 0.294	4.733 ± 0.268	2.517 ± 0.142	0.133 ± 0.007	0.086 ± 0.005	3.960 ± 0.224	2.749 ± 0.156	3.090 ± 0.175	1.276 ± 0.072	1.098 ± 0.062
isoButane	1.835 ± 0.118	0.933 ± 0.060	0.321 ± 0.021	7.941 ± 0.511	5.448 ± 0.351	8.889 ± 0.572	0.995 ± 0.064	0.199 ± 0.013	5.710 ± 0.368	5.453 ± 0.351	2.878 ± 0.185	3.029 ± 0.195	1.466 ± 0.094
1Butene+iButylene	13.928 ± 1.641	8.445 ± 0.995	2.461 ± 0.290	99.645 ± 11.737	95.722 ± 11.275	42.974 ± 5.062	4.836 ± 0.570	0.433 ± 0.051	95.344 ± 11.230	39.072 ± 4.602	54.053 ± 6.367	19.498 ± 2.297	13.150 ± 1.549
n-Butane	3.190 ± 0.307	1.240 ± 0.119	0.431 ± 0.041	13.130 ± 1.262	11.399 ± 1.095	6.319 ± 0.607	1.686 ± 0.162	0.069 ± 0.007	11.738 ± 1.128	6.141 ± 0.590	6.625 ± 0.637	3.659 ± 0.352	1.973 ± 0.190
t-2-Butene	2.644 ± 0.417	1.055 ± 0.166	0.902 ± 0.142	10.659 ± 1.682	9.612 ± 1.517	4.201 ± 0.663	0.892 ± 0.141	0.038 ± 0.006	9.353 ± 1.476	7.590 ± 1.198	5.142 ± 0.811	2.372 ± 0.374	1.575 ± 0.249
c-2-Butene	0.911 ± 0.059	0.501 ± 0.032	0.153 ± 0.010	4.928 ± 0.319	4.292 ± 0.277	2.443 ± 0.158	0.441 ± 0.028	0.017 ± 0.001	4.987 ± 0.322	2.099 ± 0.136	2.474 ± 0.160	1.334 ± 0.086	0.617 ± 0.040
3-Me-1-Butene	51.808 ± 5.728	20.025 ± 2.214	7.433 ± 0.822	159.605 ± 17.645	118.924 ± 13.148	72.934 ± 8.063	26.188 ± 2.895	1.170 ± 0.129	109.041 ± 12.055	106.762 ± 11.803	56.022 ± 6.194	57.642 ± 6.373	25.060 ± 2.770
isopentane	1.505 ± 0.157	0.989 ± 0.103	0.284 ± 0.030	7.082 ± 0.739	4.435 ± 0.463	2.156 ± 0.225	0.743 ± 0.078	0.016 ± 0.002	8.187 ± 0.855	6.851 ± 0.715	2.845 ± 0.297	2.120 ± 0.221	1.405 ± 0.147
1-Pentene	2.510 ± 0.316	1.404 ± 0.176	0.482 ± 0.061	14.981 ± 1.885	13.281 ± 1.671	2.795 ± 0.352	1.663 ± 0.209	0.040 ± 0.005	12.915 ± 1.625	7.526 ± 0.947	6.466 ± 0.813	3.340 ± 0.420	1.531 ± 0.193
2-Me-1-Butene	9.431 ± 0.956	3.994 ± 0.405	2.190 ± 0.222	59.544 ± 6.036	46.922 ± 4.756	21.775 ± 2.207	8.325 ± 0.844	0.220 ± 0.022	21.808 ± 2.210	34.612 ± 3.508	21.166 ± 2.146	10.995 ± 1.114	7.063 ± 0.716
n-Pentane	0.082 ± 0.024	0.145 ± 0.043	0.016 ± 0.005	0.000 ± 0.000	0.000 ± 0.000	0.225 ± 0.067	0.000 ± 0.000	0.033 ± 0.010	0.000 ± 0.000	0.009 ± 0.002	3.174 ± 0.941	0.059 ± 0.017	0.000 ± 0.000
t-2-Pentene	2.956 ± 0.168	1.121 ± 0.064	0.509 ± 0.029	15.037 ± 0.854	11.496 ± 0.652	2.609 ± 0.148	1.950 ± 0.111	0.025 ± 0.001	8.972 ± 0.509	7.540 ± 0.428	4.473 ± 0.254	3.681 ± 0.209	1.310 ± 0.074
c-2-Pentene	1.630 ± 0.243	0.632 ± 0.094	0.267 ± 0.040	7.855 ± 1.169	6.327 ± 0.942	1.107 ± 0.165	1.079 ± 0.160	0.014 ± 0.002	5.264 ± 0.783	4.074 ± 0.606	2.435 ± 0.362	2.158 ± 0.321	0.767 ± 0.114
2-Me-2-Butene	3.287 ± 0.307	1.724 ± 0.161	0.583 ± 0.054	15.343 ± 1.432	12.909 ± 1.205	0.518 ± 0.048	2.402 ± 0.224	0.058 ± 0.006	10.959 ± 1.023	10.800 ± 1.008	8.164 ± 0.762	2.512 ± 0.235	1.528 ± 0.143
22DiMeButane	3.354 ± 0.368	1.184 ± 0.130	0.578 ± 0.063	15.629 ± 1.714	9.430 ± 1.034	6.249 ± 0.685	3.065 ± 0.336	0.056 ± 0.006	8.384 ± 0.920	12.510 ± 1.372	6.287 ± 0.690	3.465 ± 0.380	3.120 ± 0.342
CycloPentene	0.895 ± 0.099	0.375 ± 0.041	0.178 ± 0.020	4.457 ± 0.490	3.857 ± 0.424	0.712 ± 0.078	0.717 ± 0.079	0.007 ± 0.001	3.512 ± 0.386	2.103 ± 0.231	1.327 ± 0.146	1.036 ± 0.114	0.466 ± 0.051
CycloPentane	1.538 ± 0.077	0.666 ± 0.033	0.243 ± 0.012	5.711 ± 0.286	4.180 ± 0.209	2.107 ± 0.105	1.406 ± 0.070	0.021 ± 0.001	5.029 ± 0.252	3.936 ± 0.197	2.231 ± 0.111	2.297 ± 0.115	0.748 ± 0.038
23DiMeButane	6.330 ± 0.640	2.367 ± 0.239	0.969 ± 0.098	27.045 ± 2.734	21.600 ± 2.183	18.445 ± 1.865	4.568 ± 0.462	0.144 ± 0.014	16.717 ± 1.690	18.954 ± 1.916	11.125 ± 1.125	10.178 ± 1.029	3.846 ± 0.389
MTBE	0.032 ± 0.003	0.020 ± 0.002	<3.41 ± 0.353	0.392 ± 0.033	0.352 ± 0.030	1.249 ± 0.106	1.025 ± 0.086	0.000 ± 0.000	0.379 ± 0.032	0.168 ± 0.014	0.170 ± 0.014	0.706 ± 0.060	0.045 ± 0.004
2-MePentane	22.209 ± 2.161	7.411 ± 0.721	<3.41 ± 0.200	86.138 ± 8.381	69.802 ± 6.791	28.433 ± 2.766	14.947 ± 1.454	0.243 ± 0.024	57.891 ± 5.632	59.864 ± 5.824	31.995 ± 3.113	35.353 ± 3.440	11.928 ± 1.161
3-MePentane	13.517 ± 0.708	4.489 ± 0.235	2.053 ± 0.107	59.050 ± 3.093	48.969 ± 2.565	21.640 ± 1.133	10.812 ± 0.566	0.162 ± 0.009	33.912 ± 1.776	41.147 ± 2.155	22.371 ± 1.172	21.660 ± 1.135	8.041 ± 0.421
2-Me-1-Pentene	0.640 ± 0.023	0.427 ± 0.016	0.108 ± 0.004	6.043 ± 0.221	6.673 ± 0.244	0.592 ± 0.021	1.520 ± 0.056	0.006 ± 0.000	2.524 ± 0.092	3.052 ± 0.111	0.955 ± 0.035	0.794 ± 0.029	0.400 ± 0.015
1-Hexene	0.871 ± 0.081	0.424 ± 0.039	0.182 ± 0.017	5.510 ± 0.512	4.122 ± 0.383	1.828 ± 0.170	0.641 ± 0.060	0.008 ± 0.001	6.681 ± 0.621	1.749 ± 0.163	2.671 ± 0.248	1.517 ± 0.141	0.899 ± 0.084
n-Hexane	10.112 ± 0.863	3.570 ± 0.304	1.504 ± 0.128	64.515 ± 5.503	52.163 ± 4.449	19.294 ± 1.646	9.387 ± 0.801	0.140 ± 0.012	25.123 ± 2.143	39.867 ± 3.400	24.180 ± 2.062	16.252 ± 1.386	6.817 ± 0.581
t-2-Hexene	1.137 ± 0.058	0.363 ± 0.019	0.174 ± 0.009	5.255 ± 0.267	4.174 ± 0.212	1.165 ± 0.059	0.714 ± 0.036	0.007 ± 0.000	2.987 ± 0.152	3.070 ± 0.156	1.437 ± 0.073	1.630 ± 0.083	0.500 ± 0.025
2-Me-2-Pentene	0.688 ± 0.063	0.364 ± 0.033	0.124 ± 0.012	3.223 ± 0.295	2.794 ± 0.255	0.335 ± 0.031	0.351 ± 0.032	0.007 ± 0.001	2.273 ± 0.208	2.808 ± 0.257	1.410 ± 0.129	0.704 ± 0.064	0.310 ± 0.028
c-3-Me-2-Pentene	0.509 ± 0.022	0.430 ± 0.019	0.102 ± 0.005	4.735 ± 0.206	4.086 ± 0.178	0.408 ± 0.018	0.238 ± 0.010	0.007 ± 0.000	3.411 ± 0.148	3.051 ± 0.133	1.637 ± 0.071	0.522 ± 0.023	0.454 ± 0.020
c-3-Hexene	0.151 ± 0.008	0.049 ± 0.003	0.026 ± 0.001	0.607 ± 0.033	0.500 ± 0.027	0.205 ± 0.011	0.203 ± 0.011	0.001 ± 0.000	0.455 ± 0.025	0.376 ± 0.020	0.174 ± 0.009	0.155 ± 0.008	0.065 ± 0.004
c-2-Hexene	0.601 ± 0.045	0.231 ± 0.017	0.093 ± 0.007	3.135 ± 0.234	2.659 ± 0.198	0.543 ± 0.040	0.543 ± 0.040	0.004 ± 0.000	1.943 ± 0.145	1.960 ± 0.146	0.936 ± 0.070	0.991 ± 0.074	0.313 ± 0.023
t-3-Me-2-Pentene	0.820 ± 0.050	0.347 ± 0.021	0.142 ± 0.009	3.631 ± 0.222	3.078 ± 0.189	0.411 ± 0.025	0.563 ± 0.034	0.007 ± 0.001	2.310 ± 0.141	2.983 ± 0.183	1.310 ± 0.080	0.271 ± 0.017	0.334 ± 0.020
MeCyPentane	8.411 ± 0.836	2.225 ± 0.221	1.187 ± 0.118	35.903 ± 3.567	29.788 ± 2.959	7.898 ± 0.785	6.948 ± 0.690	0.067 ± 0.007	18.275 ± 1.816	23.207 ± 2.306	12.157 ± 1.208	10.006 ± 0.994	4.486 ± 0.446
2,4-DiMePentane	6.193 ± 0.318	2.902 ± 0.149	0.821 ± 0.042	24.946 ± 1.280	21.329 ± 1.094	26.163 ± 1.342	3.884 ± 0.199	0.160 ± 0.008	20.258 ± 1.039	17.622 ± 0.904	14.119 ± 0.724	13.602 ± 0.698	3.141 ± 0.161
223TriMeButane	0.219 ± 0.020	0.074 ± 0.007	0.037 ± 0.004	1.023 ± 0.092	0.734 ± 0.066	0.565 ± 0.051	0.000 ± 0.000	0.005 ± 0.001	0.748 ± 0.067	0.787 ± 0.071	0.391 ± 0.035	0.477 ± 0.043	0.160 ± 0.014
Benzene	42.626 ± 4.949	17.575 ± 2.040	5.523 ± 0.641	278.974 ± 32.390	249.491 ± 18.015	83.359 ± 9.678	26.165 ± 3.038	0.676 ± 0.078	108.019 ± 12.541	150.037 ± 15.096	65.892 ± 7.650	46.570 ± 5.407	36.842 ± 4.278
CycloHexane	<19.02 ± 0.703	1.371 ± 0.138	0.957 ± 0.096	10.971 ± 1.101	7.993 ± 0.802	<26.11 ± 0.122	<14.34 ± 0.202	0.021 ± 0.002	7.179 ± 0.720	6.402 ± 0.642	3.475 ± 0.348	<24.50 ± 0.769	1.283 ± 0.129
4MeHexene	0.161 ± 0.026	0.091 ± 0.015	0.032 ± 0.005	0.922 ± 0.150	0.875 ± 0.143	0.187 ± 0.030	0.346 ± 0.056	0.003 ± 0.001	0.961 ± 0.157	0.478 ± 0.078	0.400 ± 0.065	0.458 ± 0.075	0.135 ± 0.022
2MeHexane	9.493 ± 0.392	3.078 ± 0.127	1.357 ± 0.056	50.204 ± 2.071	43.268 ± 1.785	18.695 ± 0.771	8.994 ± 0.371	0.123 ± 0.005	21.013 ± 0.867	35.067 ± 1.447	18.083 ± 0.746	13.036 ± 0.538	6.808 ± 0.281
23DiMePentane	8.163 ± 0.288	3.771 ± 0.133	1.180 ± 0.042	39.657 ± 1.398	37.114 ± 1.308	30.245 ± 1.066	5.506 ± 0.194	0.226 ± 0.008	25.755 ± 0.908	29.552 ± 1.041	24.893 ± 0.877	17.972 ± 0.633	4.733 ± 0.167
3MeHexane	<12.01 ± 0.447	3.347 ± 0.142	1.488 ± 0.063	56.429 ± 2.400	49.001 ± 2.084	<24.89 ± 0.926	<12.33 ± 0.459	0.146 ± 0.006	22.361 ± 0.951	39.716 ± 1.689	20.857 ± 0.887	<16.84 ± 0.626	7.695 ± 0.327

Appendix B1. Chemical Composition of Dilution Blanks and Vehicle Exhaust Samples from Round1

Species Description	S3-2	S4-1	S4-2	S5-1	S5-2	S5-3	S5-4	S5-5	S6-1	S6-2	S6-3	S6-4	S7-1
Cyclohexene	0.000 ± 0.298	0.212 ± 0.037	0.070 ± 0.042	1.807 ± 0.541	0.441 ± 0.694	0.000 ± 0.395	0.000 ± 0.339	0.004 ± 0.003	1.802 ± 0.200	0.881 ± 0.401	0.690 ± 0.128	0.000 ± 0.431	0.242 ± 0.074
3EtPentane	2.665 ± 0.030	0.335 ± 0.000	0.378 ± 0.015	4.830 ± 0.000	6.189 ± 0.000	3.525 ± 0.011	3.027 ± 0.016	0.024 ± 0.000	1.782 ± 0.000	3.581 ± 0.000	1.145 ± 0.000	3.847 ± 0.050	0.663 ± 0.000
* 1-Heptene	0.599 ± 2.015	<8.59 ± 0.000	0.301 ± 0.232	<82.54 ± 0.000	<68.19 ± 0.000	0.231 ± 27.565	0.314 ± 1.504	0.003 ± 0.165	<59.44 ± 0.000	<51.27 ± 0.000	<64.92 ± 0.000	1.013 ± 4.998	<10.98 ± 0.000
* 224TrMePentane	16.501 ± 0.015	<8.59 ± 0.003	1.901 ± 0.002	<82.54 ± 0.039	<68.19 ± 0.027	225.782 ± 0.018	12.319 ± 0.026	1.348 ± 0.000	<59.44 ± 0.026	<51.27 ± 0.020	<64.92 ± 0.010	40.939 ± 0.022	<10.98 ± 0.004
t-3-Heptene	0.403 ± 0.229	0.073 ± 0.077	0.045 ± 0.037	1.073 ± 1.285	0.746 ± 1.168	0.498 ± 0.528	0.705 ± 0.282	0.001 ± 0.003	0.708 ± 0.484	0.555 ± 0.928	0.263 ± 0.482	0.591 ± 0.348	0.091 ± 0.180
n-Heptane	6.846 ± 0.012	2.287 ± 0.003	1.100 ± 0.000	38.403 ± 0.124	34.881 ± 0.123	15.775 ± 0.051	8.426 ± 0.059	0.107 ± 0.001	14.473 ± 0.088	27.717 ± 0.103	14.385 ± 0.040	10.396 ± 0.045	5.377 ± 0.015
244TMe-1-Pentene	0.127 ± 0.222	0.036 ± 0.066	0.003 ± 0.030	1.277 ± 0.860	1.270 ± 0.973	0.530 ± 0.135	0.611 ± 0.222	0.006 ± 0.002	0.910 ± 0.471	1.067 ± 0.616	0.416 ± 0.296	0.461 ± 0.281	0.152 ± 0.121
MeCyHexane	3.213 ± 0.305	0.951 ± 0.123	0.438 ± 0.044	12.440 ± 1.479	14.070 ± 1.208	1.948 ± 2.894	3.208 ± 0.153	0.023 ± 0.013	6.816 ± 0.874	8.916 ± 0.979	4.272 ± 0.768	4.067 ± 0.570	1.751 ± 0.199
25DiMeHexane	2.609 ± 0.194	1.052 ± 0.058	0.379 ± 0.023	12.671 ± 0.713	10.348 ± 0.585	24.791 ± 1.390	1.312 ± 0.125	0.116 ± 0.008	7.491 ± 0.411	8.387 ± 0.483	6.579 ± 0.389	4.887 ± 0.359	1.704 ± 0.098
24DiMeHexane	4.548 ± 0.153	1.365 ± 0.070	0.546 ± 0.026	16.764 ± 0.797	13.753 ± 0.692	32.686 ± 2.301	2.943 ± 0.120	0.182 ± 0.015	9.659 ± 0.490	11.354 ± 0.526	9.155 ± 0.601	8.447 ± 0.361	2.294 ± 0.105
234TrMePentane	4.123 ± 3.029	1.881 ± 1.240	0.687 ± 0.518	21.516 ± 17.977	18.691 ± 8.676	62.115 ± 11.568	3.236 ± 2.817	0.417 ± 0.062	13.219 ± 9.623	14.197 ± 6.499	16.227 ± 4.607	9.743 ± 4.820	2.822 ± 2.264
Toluene	71.522 ± 0.201	29.282 ± 0.051	<12.23 ± 1.184	461.040 ± 0.820	421.067 ± 0.827	273.156 ± 1.892	66.514 ± 0.182	1.458 ± 0.015	227.233 ± 0.404	191.892 ± 0.628	110.906 ± 0.558	113.815 ± 0.393	53.460 ± 0.104
23DiMeHexane	2.250 ± 0.239	0.576 ± 0.063	<12.23 ± 0.037	9.197 ± 0.698	9.271 ± 0.054	21.203 ± 0.376	2.047 ± 0.233	0.164 ± 0.002	4.534 ± 0.443	7.042 ± 0.406	6.253 ± 0.299	4.408 ± 0.357	1.166 ± 0.118
2MeHeptane	4.804 ± 0.171	1.274 ± 0.069	0.749 ± 0.031	14.058 ± 1.102	1.080 ± 0.773	7.566 ± 0.382	4.686 ± 0.211	0.046 ± 0.002	8.919 ± 0.541	8.169 ± 0.710	6.027 ± 0.418	7.192 ± 0.259	2.377 ± 0.131
4MeHeptane	1.793 ± 0.173	0.725 ± 0.052	0.322 ± 0.028	11.575 ± 0.772	8.114 ± 0.699	4.008 ± 0.295	2.213 ± 0.161	0.021 ± 0.002	5.678 ± 0.382	7.460 ± 0.560	4.389 ± 0.303	2.723 ± 0.262	1.372 ± 0.115
3MeHeptane	5.215 ± 0.018	1.580 ± 0.025	0.848 ± 0.006	23.241 ± 0.386	21.048 ± 0.322	8.868 ± 0.024	4.841 ± 0.110	0.054 ± 0.001	11.493 ± 0.184	16.851 ± 0.272	9.107 ± 0.153	7.895 ± 0.032	3.451 ± 0.056
Hexanal	0.030 ± 0.006	0.050 ± 0.006	0.080 ± 0.013	1.430 ± 0.017	0.520 ± 0.016	0.380 ± 0.017	1.100 ± 0.017	1.080 ± 0.016	0.760 ± 0.017	0.200 ± 0.017	0.200 ± 0.017	0.050 ± 0.017	0.050 ± 0.008
225TMHexane	2.091 ± 0.020	1.104 ± 0.012	0.366 ± 0.005	13.291 ± 0.104	12.254 ± 0.134	23.794 ± 0.044	1.298 ± 0.034	0.013 ± 0.023	7.705 ± 0.218	11.939 ± 0.049	7.007 ± 0.059	4.034 ± 0.046	2.166 ± 0.025
Octene-1	0.166 ± 0.003	0.100 ± 0.005	0.037 ± 0.004	0.859 ± 0.080	1.108 ± 0.068	0.367 ± 0.011	0.276 ± 0.021	0.189 ± 0.000	1.791 ± 0.044	0.405 ± 0.046	0.489 ± 0.025	0.376 ± 0.006	0.209 ± 0.009
11DMeCyHexane	0.120 ± 0.151	0.221 ± 0.048	0.140 ± 0.026	3.349 ± 0.644	2.855 ± 0.576	0.444 ± 0.222	0.868 ± 0.160	0.003 ± 0.002	1.837 ± 0.312	1.919 ± 0.503	1.055 ± 0.229	0.237 ± 0.211	0.391 ± 0.101
n-Octane	3.955 ± 0.064	1.239 ± 0.015	0.686 ± 0.008	16.806 ± 0.197	15.040 ± 0.158	5.783 ± 0.118	4.181 ± 0.051	0.040 ± 0.005	8.159 ± 0.107	13.135 ± 0.132	5.984 ± 0.080	5.497 ± 0.109	2.653 ± 0.028
24DiMeHeptane	0.718 ± 0.032	0.169 ± 0.008	0.089 ± 0.004	2.225 ± 0.113	1.789 ± 0.102	1.330 ± 0.041	0.579 ± 0.020	0.060 ± 0.000	1.209 ± 0.063	1.497 ± 0.080	0.904 ± 0.041	1.228 ± 0.042	0.320 ± 0.015
25DiMeHeptane	1.922 ± 0.015	0.498 ± 0.030	0.205 ± 0.002	6.729 ± 0.301	6.083 ± 0.044	2.446 ± 0.000	1.195 ± 0.000	0.018 ± 0.001	3.744 ± 0.193	4.761 ± 0.036	2.441 ± 0.119	2.515 ± 0.006	0.892 ± 0.054
33DiMeHeptane	0.111 ± 1.481	0.224 ± 0.383	0.019 ± 0.220	2.270 ± 6.254	0.332 ± 5.442	0.000 ± 2.600	0.000 ± 1.237	0.003 ± 0.011	1.459 ± 3.646	0.275 ± 3.289	0.899 ± 1.587	0.043 ± 1.401	0.405 ± 0.790
EtBenzene	21.864 ± 4.155	5.657 ± 0.768	3.240 ± 0.563	92.306 ± 16.192	80.326 ± 11.610	38.373 ± 7.825	18.262 ± 3.300	0.168 ± 0.028	53.817 ± 6.715	48.545 ± 8.091	23.428 ± 3.059	20.678 ± 2.860	11.664 ± 1.851
m/p-xylene	66.910 ± 0.021	12.374 ± 0.023	9.060 ± 0.012	260.755 ± 0.319	208.559 ± 0.267	126.018 ± 0.030	53.136 ± 0.010	0.457 ± 0.000	108.137 ± 0.166	130.299 ± 0.224	49.263 ± 0.100	46.058 ± 0.026	29.814 ± 0.045
2MeOctane	0.935 ± 0.320	1.022 ± 0.108	0.546 ± 0.053	14.063 ± 1.755	11.800 ± 1.155	1.314 ± 0.248	0.450 ± 0.242	0.011 ± 0.002	7.321 ± 0.809	9.902 ± 0.841	4.399 ± 0.450	1.155 ± 0.343	2.003 ± 0.172
3MeOctane	3.032 ± 0.026	1.022 ± 0.018	0.503 ± 0.016	16.633 ± 0.217	10.950 ± 0.242	2.352 ± 0.243	2.292 ± 0.027	0.018 ± 0.003	7.670 ± 0.189	7.976 ± 0.146	4.261 ± 0.078	3.250 ± 0.021	1.627 ± 0.034
Styrene+heptanal	0.339 ± 1.328	0.227 ± 0.236	0.209 ± 0.170	2.773 ± 4.624	3.092 ± 3.881	3.098 ± 2.207	0.345 ± 0.967	0.038 ± 0.010	2.413 ± 2.039	1.867 ± 2.424	0.996 ± 1.027	0.270 ± 0.815	0.429 ± 0.573
o-xylene	27.158 ± 0.006	4.833 ± 0.050	3.482 ± 0.001	94.593 ± 0.190	79.388 ± 0.196	45.153 ± 0.049	19.781 ± 0.007	0.197 ± 0.000	41.724 ± 0.181	49.596 ± 0.139	21.012 ± 0.107	16.672 ± 0.002	11.725 ± 0.010
Nonene-1	0.136 ± 0.079	1.091 ± 0.018	0.030 ± 0.011	4.172 ± 0.222	4.315 ± 0.189	1.085 ± 0.049	0.155 ± 0.058	0.004 ± 0.001	3.980 ± 0.106	3.061 ± 0.162	2.348 ± 0.066	0.050 ± 0.063	0.213 ± 0.035
n-Nonane	2.925 ± 0.125	0.665 ± 0.019	0.407 ± 0.009	8.167 ± 0.234	6.980 ± 0.230	1.806 ± 0.137	2.140 ± 0.073	0.016 ± 0.001	3.919 ± 0.136	5.950 ± 0.157	2.445 ± 0.070	2.335 ± 0.080	1.280 ± 0.037
iPropBenzene	2.543 ± 0.044	0.377 ± 0.003	0.181 ± 0.005	4.783 ± 0.031	4.692 ± 0.056	2.805 ± 0.025	1.489 ± 0.027	0.017 ± 0.001	2.771 ± 0.019	3.205 ± 0.017	1.436 ± 0.013	1.632 ± 0.051	0.747 ± 0.005
iPropCyHexane	0.371 ± 0.032	0.029 ± 0.025	0.040 ± 0.014	0.259 ± 0.281	0.464 ± 0.300	0.209 ± 0.018	0.221 ± 0.010	0.004 ± 0.001	0.157 ± 0.148	0.140 ± 0.186	0.109 ± 0.111	0.423 ± 0.025	0.045 ± 0.033
26DiMeOctane	0.296 ± 0.494	0.233 ± 0.026	0.129 ± 0.018	2.589 ± 0.211	2.768 ± 0.290	0.165 ± 0.482	0.094 ± 0.220	0.009 ± 0.004	1.365 ± 0.118	1.721 ± 0.139	1.021 ± 0.044	0.230 ± 0.580	0.301 ± 0.027
alpha-pinene	1.487 ± 0.500	0.077 ± 0.068	0.053 ± 0.051	0.634 ± 1.117	0.875 ± 1.463	1.452 ± 0.563	0.662 ± 0.383	0.012 ± 0.002	0.354 ± 0.584	0.417 ± 0.684	0.132 ± 0.254	1.747 ± 0.231	0.082 ± 0.156
nPropBenzene	7.473 ± 0.745	1.017 ± 0.100	0.766 ± 0.094	16.673 ± 1.974	21.846 ± 1.986	8.408 ± 0.878	5.724 ± 0.536	0.032 ± 0.003	8.718 ± 0.902	10.221 ± 0.965	3.802 ± 0.366	3.452 ± 0.352	2.333 ± 0.233
mEtToluene	25.371 ± 0.427	3.397 ± 0.063	3.213 ± 0.061	67.264 ± 1.314	67.641 ± 1.300	29.914 ± 0.517	18.247 ± 0.326	0.095 ± 0.001	30.721 ± 0.593	32.874 ± 0.674	12.453 ± 0.268	12.006 ± 0.200	7.950 ± 0.135
pEtToluene	10.635 ± 0.549	1.566 ± 0.053	1.512 ± 0.061	32.764 ± 1.335	32.424 ± 1.322	12.885 ± 0.640	8.119 ± 0.338	0.035 ± 0.002	14.779 ± 0.455	16.806 ± 0.628	6.676 ± 0.196	4.981 ± 0.221	3.365 ± 0.147
135TriMeBenzene	12.805 ± 0.404	1.244 ± 0.056	1.413 ± 0.051	31.163 ± 0.969	30.857 ± 0.978	14.953 ± 0.441	7.893 ± 0.282	0.045 ± 0.002	10.628 ± 0.476	14.657 ± 0.490	4.578 ± 0.229	5.157 ± 0.174	3.439 ± 0.128
oEtToluene	9.288 ± 0.151	1.275 ± 0.028	1.172 ± 0.004	22.312 ± 0.354	22.504 ± 0.466	10.144 ± 0.304	6.487 ± 0.036	0.038 ± 0.004	10.961 ± 0.207	11.273 ± 0.221	5.262 ± 0.079	4.006 ± 0.052	2.947 ± 0.044
Octanal	0.372 ± 0.018	0.069 ± 0.002	0.010 ± 0.004	0.870 ± 0.011	1.146 ± 0.018	0.748 ± 0.080	0.088 ± 0.011	0.009 ± 0.000	0.509 ± 0.008	0.544 ± 0.009	0.195 ± 0.004	0.127 ± 0.016	0.108 ± 0.001
beta-pinene	0.265 ± 1.858	0.026 ± 0.177	0.055 ± 0.203	0.169 ± 3.906	0.276 ± 3.993	1.212 ± 1.846	0.174 ± 1.304	0.002 ± 0.006	0.120 ± 1.455	0.141 ± 2.019	0.055 ± 0.458	0.244 ± 0.580	0.023 ± 0.447
* 124TriMeBenzene	41.098 ± 0.266	<3.92 ± 0.404	4.501 ± 0.032	<86.37 ± 8.887	<88.30 ± 9.085	40.824 ± 0.239	28.830 ± 0.151	0.133 ± 0.002	<32.17 ± 3.309	<44.65 ± 4.594	<10.13 ± 1.042	12.821 ± 0.118	<9.89 ± 1.017
* n-Decane	2.749 ± 0.057	<3.92 ± 0.004	0.330 ± 0.004	<86.37 ± 0.069	<88.30 ± 0.085	2.472 ± 0.055	1.565 ± 0.026	0.020 ± 0.000	<32.17 ± 0.028	<44.65 ± 0.036	<10.13 ± 0.015	1.221 ± 0.021	<9.89 ± 0.007
iButBenzene	1.164 ± 0.046	0.077 ± 0.005	0.086 ± 0.006	1.406 ± 0.096	1.736 ± 0.110	1.128 ± 0.041	0.521 ± 0.027	0.007 ± 0.000	0.568 ± 0.034	0.728 ± 0.038	0.298 ± 0.020	0.420 ± 0.018	0.151 ± 0.008
sButBenzene	0.823 ± 1.218	0.087 ± 0.053	0.109 ± 0.112	1.726 ± 1.017	1.970 ± 1.089	0.743 ± 0.818	0.486 ± 0.666	0.005 ± 0.000	0.613 ± 0.434	0.682 ± 0.525	0.351 ± 0.116	0.332 ± 0.299	0.142 ± 0.103
Limonene	<11.74 ± 0.185	0.516 ± 0.002	1.083 ± 0.000	9.805 ± 0.267	10.510 ± 0.277	<7.89 ± 0.000	<6.42 ± 0.000	0.003 ± 0.001	4.187 ± 0.102	5.066 ± 0.137	1.122 ± 0.043	<2.89 ± 0.000	0.993 ± 0.035
Indan	<4.15 ± 0.443	0.264 ± 0.089	0.499 ± 0.037	5.559 ± 2.116	5.873 ± 2.143	<3.27 ± 0.437	<3.75 ± 0.149	0.008 ± 0.010	2.488 ± 0.819	2.171 ± 0.847	0.818 ± 0.230	<1.76 ± 0.101	0.546 ± 0.217
13diethylbenzene	4.430 ± 0.156	0.893 ± 0.031	0.368 ± 0.013	21.159 ± 0.747	21.428 ± 0.756	4.374 ± 0.154	1.491 ± 0.053	0.019 ± 0.001	8.185 ± 0.289	8.465 ± 0.299	2.299 ± 0.081	1.009 ± 0.036	2.171 ± 0.077
14diethylbenzene	2.218 ± 0.202	0.081 ± 0.007	0.275 ± 0.025	1.294 ± 0.118	1.091 ± 0.099	0.743 ± 0.068	1.109 ± 0.101	0.025 ± 0.002	0.389 ± 0.035	0.629 ± 0.057	0.274 ± 0.025	0.460 ± 0.042	0.108 ± 0.010
12diethylbenzene	1.597 ± 0.166	0.118 ± 0.012	0.233 ± 0.024	1.510 ± 0.156	0.563 ± 0.058	1.094 ± 0.113	0.481 ± 0.050	0.005 ± 0.001	1.150 ± 0.119	0.497 ± 0.052	0.627 ± 0.065	0.340 ± 0.035	0.194 ± 0.020
2-propylToluene	3.921 ± 0.129	0.139 ± 0.005	0.321 ± 0.011	3.102 ± 0.102	3.384 ± 0.111	3.103 ± 0.102	0.892 ± 0.029	0.020 ± 0.001	1.304 ± 0.043	1.342 ± 0.044	0.466 ± 0.015	0.531 ± 0.017	0.326 ± 0.011
3-ipropyltoluene	1.687 ± 0.083	0.157 ± 0.008	0.172 ± 0.008	2.296 ± 0.113	2.682 ± 0.132	1.107 ± 0.055	0.848 ± 0.042	0.005 ± 0.000	1.074 ± 0.053	1.309 ± 0.065	0.521 ± 0.026	0.617 ± 0.030	0.300 ± 0.015
4-ipropyltoluene	0.025 ± 0.007	0.017 ± 0.005	0.084 ± 0.026	0.589 ± 0.179	0.673 ± 0.205	0.041 ± 0.013	0.000 ± 0.000	0.004 ± 0.001	0.308 ± 0.094	0.236 ± 0.072	0.094 ± 0.029	0.000 ± 0.000	0.015 ± 0.005
2-ipropyltoluene	<4.15 ± 0.846	0.039 ± 0.008	0.049 ± 0.010	0.489 ± 0.097	0.789 ± 0.157	<3.27 ± 0.667	<3.75 ± 0.765	0.005 ± 0.001	0.172 ± 0.034	0.255 ± 0.051	0.166 ± 0.033	<1.76 ± 0.358	0.068 ± 0.014
Nonanal	14.313 ± 2.329	0.129 ± 0.021	1.054 ± 0.172	13.114 ± 2.134	13.170 ± 2.143	5.167 ± 0.841	3.354 ± 0.546	0.019 ± 0.003	4.866 ± 0.792	4.690 ± 0.763	0.849 ± 0.138	1.614 ± 0.262	0.188 ± 0.031
n-Undecane	2.529 ± 0.298	0.303 ± 0.036	0.227 ± 0.027	4.926 ± 0.579	5.186 ± 0.610	0.758 ± 0.089	0.466 ± 0.055	0.013 ± 0.002	2.145 ± 0.252	2.259 ± 0.266	0.523 ± 0.061	0.358 ± 0.042	0.432 ± 0.051
1245tetraMeBenzene	5.795 ± 0.400	0.193 ± 0.013	0.423 ± 0.029	5.220 ± 0.360	4.597 ± 0.317	1.273 ± 0.088	0.750 ± 0.052	0.006 ± 0.001	1.542 ± 0.106	1.474 ± 0.102	0.321 ± 0.022	0.442 ± 0.030	0.555 ± 0.038
1235tetraMeBenzene	7.465 ± 0.137	0.235 ± 0.004	0.582 ± 0.011	6.437 ± 0.118	5.508 ± 0.101	1.399 ± 0.026	1.031 ± 0.019	0.008 ± 0.000	1.780 ± 0.033	1.837 ± 0.034	0.292 ± 0.005	0.555 ± 0.010	0.740 ± 0.014
1234tetraMeBenzene	2.056 ± 0.367	0.288 ± 0.051	0.599 ± 0.107	7.411 ± 1.322	6.784 ± 1.210	0.314 ± 0.056	0.377 ± 0.067	0.004 ± 0.001	2.683 ± 0.478	2.278 ± 0.406	0.309 ± 0.055	0.153 ± 0.027	0.713 ± 0.127
n-Dodecane	1.535 ± 0.184	1.190 ± 0.143	1.765 ± 0.211	19.107 ± 2.290	16.793 ± 2.013	0.134 ± 0.016	0.228 ± 0.027	0.008 ± 0.001	7.137 ± 0.855	4.166 ± 0.499	3.658 ± 0.438	0.252 ± 0.030	2.338 ± 0.280

Appendix B1. Chemical Composition of Dilution Blanks and Vehicle Exhaust Samples from Round1

Species Description	S7-2	S7-3	S7-4	S8-1	S8-2	S8-3
Gravimetric mass (mg/mi)	8.81 ± 1.40	4.12 ± 0.69	4.78 ± 0.79	1.81 ± 0.30	2.08 ± 0.34	3.48 ± 0.56
Carbon fractions by TOR (mg/mi)						
Organic Carbon Fraction 1	0.947 ± 0.255	0.170 ± 0.075	0.038 ± 0.055	0.125 ± 0.049	0.267 ± 0.061	0.333 ± 0.069
Organic Carbon Fraction 2	1.775 ± 0.356	0.312 ± 0.107	0.331 ± 0.111	0.392 ± 0.074	0.579 ± 0.109	0.432 ± 0.083
Organic Carbon Fraction 3	1.729 ± 0.371	0.484 ± 0.251	0.556 ± 0.254	0.337 ± 0.125	0.489 ± 0.132	0.849 ± 0.186
Organic Carbon Fraction 4	0.824 ± 0.241	0.711 ± 0.244	0.263 ± 0.113	0.139 ± 0.039	0.158 ± 0.044	0.755 ± 0.173
Pyrolyzed Organic Carbon	0.002 ± 0.021	0.004 ± 0.037	0.001 ± 0.036	0.011 ± 0.020	0.001 ± 0.016	0.026 ± 0.019
Total Organic Carbon	5.258 ± 0.989	1.666 ± 0.447	1.155 ± 0.374	0.983 ± 0.201	1.488 ± 0.284	2.346 ± 0.416
Elemental Carbon Fraction 1	0.725 ± 0.242	0.618 ± 0.239	0.266 ± 0.100	0.205 ± 0.047	0.183 ± 0.047	0.589 ± 0.141
Elemental Carbon Fraction 2	1.060 ± 0.185	0.358 ± 0.079	1.248 ± 0.258	0.353 ± 0.097	0.716 ± 0.129	0.697 ± 0.123
Elemental Carbon Fraction 3	0.027 ± 0.013	0.028 ± 0.019	0.028 ± 0.020	0.000 ± 0.005	0.010 ± 0.007	0.080 ± 0.024
Total Elemental Carbon	1.808 ± 0.351	0.994 ± 0.243	1.537 ± 0.360	0.544 ± 0.088	0.906 ± 0.174	1.339 ± 0.248
Total Carbon	7.068 ± 1.280	2.661 ± 0.608	2.680 ± 0.598	1.527 ± 0.283	2.372 ± 0.423	3.685 ± 0.628
Elements by XRF (mg/mi)						
Sodium (qualitative only)	0.1742 ± 0.1410	0.0481 ± 0.2109	0.1952 ± 0.2134	0.1727 ± 0.0971	0.1412 ± 0.1034	0.1484 ± 0.1059
Magnesium (qualitative only)	0.0211 ± 0.0221	0.0040 ± 0.0451	0.0062 ± 0.0377	0.0279 ± 0.0140	0.0102 ± 0.0168	0.0161 ± 0.0159
Aluminum	0.0140 ± 0.0092	0.0165 ± 0.0155	0.0115 ± 0.0152	0.0150 ± 0.0071	0.0098 ± 0.0075	0.0107 ± 0.0076
Silicon	0.0405 ± 0.0078	0.0753 ± 0.0138	0.0768 ± 0.0141	0.0454 ± 0.0078	0.0470 ± 0.0081	0.2111 ± 0.0336
Phosphorous	0.0483 ± 0.0081	0.0346 ± 0.0070	0.0022 ± 0.0069	0.0036 ± 0.0023	0.0058 ± 0.0023	0.0131 ± 0.0028
Sulfur	0.3445 ± 0.0545	0.0978 ± 0.0158	0.5370 ± 0.0850	0.0620 ± 0.0099	0.0721 ± 0.0115	0.0863 ± 0.0137
Chlorine	0.0013 ± 0.0049	0.0015 ± 0.0081	0.0013 ± 0.0107	0.0014 ± 0.0023	0.0025 ± 0.0026	0.0014 ± 0.0026
Potassium	0.0119 ± 0.0026	0.0453 ± 0.0079	0.0054 ± 0.0032	0.0031 ± 0.0014	0.0034 ± 0.0015	0.0069 ± 0.0017
Calcium	0.1255 ± 0.0200	0.1167 ± 0.0189	0.0489 ± 0.0084	0.0494 ± 0.0080	0.0639 ± 0.0102	0.0738 ± 0.0118
Titanium	0.0044 ± 0.0107	0.0115 ± 0.0272	0.0028 ± 0.0180	0.0058 ± 0.0082	0.0051 ± 0.0082	0.0048 ± 0.0081
Vanadium	0.0017 ± 0.0048	0.0037 ± 0.0117	0.0009 ± 0.0078	0.0024 ± 0.0038	0.0022 ± 0.0035	0.0020 ± 0.0036
Chromium	0.0007 ± 0.0010	0.0035 ± 0.0017	0.0017 ± 0.0014	0.0012 ± 0.0008	0.0013 ± 0.0007	0.0028 ± 0.0008
Manganese	0.0006 ± 0.0006	0.0016 ± 0.0010	0.0004 ± 0.0010	0.0008 ± 0.0004	0.0008 ± 0.0004	0.0015 ± 0.0005
Iron	0.0331 ± 0.0054	0.1972 ± 0.0313	0.0424 ± 0.0070	0.0535 ± 0.0085	0.0311 ± 0.0050	0.0985 ± 0.0156
Cobalt	0.0001 ± 0.0005	0.0016 ± 0.0029	0.0004 ± 0.0010	0.0002 ± 0.0006	0.0002 ± 0.0004	0.0006 ± 0.0008
Nickel	0.0007 ± 0.0004	0.0021 ± 0.0007	0.0010 ± 0.0006	0.0003 ± 0.0002	0.0007 ± 0.0003	0.0014 ± 0.0004
Copper	0.0041 ± 0.0007	0.0079 ± 0.0014	0.0040 ± 0.0008	0.0023 ± 0.0005	0.0023 ± 0.0005	0.0063 ± 0.0010
Zinc	0.0640 ± 0.0105	0.0343 ± 0.0071	0.0223 ± 0.0057	0.0135 ± 0.0029	0.0273 ± 0.0048	0.0392 ± 0.0065
Gallium	0.0007 ± 0.0011	0.0001 ± 0.0019	0.0002 ± 0.0018	0.0004 ± 0.0009	0.0009 ± 0.0008	0.0005 ± 0.0008
Arsenic	0.0002 ± 0.0010	0.0000 ± 0.0018	0.0001 ± 0.0016	0.0005 ± 0.0008	0.0002 ± 0.0007	0.0001 ± 0.0008
Selenium	0.0001 ± 0.0004	0.0006 ± 0.0007	0.0002 ± 0.0007	0.0000 ± 0.0003	0.0000 ± 0.0003	0.0003 ± 0.0003
Bromine	0.0005 ± 0.0004	0.0008 ± 0.0007	0.0016 ± 0.0006	0.0003 ± 0.0003	0.0003 ± 0.0003	0.0004 ± 0.0003
Rubidium	0.0002 ± 0.0005	0.0006 ± 0.0009	0.0003 ± 0.0008	0.0003 ± 0.0004	0.0001 ± 0.0004	0.0002 ± 0.0004
Strontium	0.0003 ± 0.0005	0.0010 ± 0.0009	0.0000 ± 0.0009	0.0000 ± 0.0004	0.0002 ± 0.0004	0.0002 ± 0.0004
Yttrium	0.0001 ± 0.0007	0.0010 ± 0.0011	0.0001 ± 0.0012	0.0000 ± 0.0005	0.0001 ± 0.0005	0.0004 ± 0.0005
Zirconium	0.0003 ± 0.0008	0.0014 ± 0.0013	0.0003 ± 0.0013	0.0003 ± 0.0006	0.0004 ± 0.0006	0.0005 ± 0.0006
Molybdenum	0.0022 ± 0.0011	0.0024 ± 0.0019	0.0007 ± 0.0019	0.0003 ± 0.0009	0.0013 ± 0.0009	0.0009 ± 0.0008
Palladium	0.0004 ± 0.0015	0.0000 ± 0.0026	0.0004 ± 0.0026	0.0002 ± 0.0012	0.0003 ± 0.0012	0.0003 ± 0.0012
Silver	0.0012 ± 0.0020	0.0006 ± 0.0034	0.0002 ± 0.0034	0.0005 ± 0.0015	0.0009 ± 0.0016	0.0009 ± 0.0015
Cadmium	0.0014 ± 0.0019	0.0000 ± 0.0032	0.0004 ± 0.0032	0.0010 ± 0.0015	0.0014 ± 0.0015	0.0008 ± 0.0015
Indium	0.0014 ± 0.0023	0.0005 ± 0.0039	0.0000 ± 0.0039	0.0007 ± 0.0018	0.0013 ± 0.0018	0.0004 ± 0.0018
Tin	0.0034 ± 0.0036	0.0000 ± 0.0060	0.0027 ± 0.0062	0.0011 ± 0.0027	0.0020 ± 0.0028	0.0011 ± 0.0027
Antimony	0.0021 ± 0.0039	0.0020 ± 0.0068	0.0015 ± 0.0067	0.0028 ± 0.0030	0.0012 ± 0.0030	0.0015 ± 0.0030
Barium	0.0160 ± 0.0178	0.0000 ± 0.0311	0.0187 ± 0.0319	0.0032 ± 0.0143	0.0068 ± 0.0145	0.0092 ± 0.0140
Lanthanum	0.0178 ± 0.0244	0.0102 ± 0.0416	0.0167 ± 0.0411	0.0168 ± 0.0189	0.0099 ± 0.0189	0.0190 ± 0.0184
Gold	0.0008 ± 0.0017	0.0003 ± 0.0029	0.0011 ± 0.0022	0.0014 ± 0.0010	0.0013 ± 0.0011	0.0014 ± 0.0011
Mercury	0.0004 ± 0.0008	0.0008 ± 0.0015	0.0002 ± 0.0013	0.0000 ± 0.0006	0.0001 ± 0.0006	0.0004 ± 0.0006
Thallium	0.0002 ± 0.0007	0.0014 ± 0.0013	0.0002 ± 0.0012	0.0001 ± 0.0006	0.0005 ± 0.0006	0.0000 ± 0.0005
Lead	0.0019 ± 0.0014	0.0056 ± 0.0023	0.0016 ± 0.0021	0.0005 ± 0.0011	0.0017 ± 0.0010	0.0050 ± 0.0012
Uranium	0.0002 ± 0.0012	0.0015 ± 0.0023	0.0000 ± 0.0020	0.0002 ± 0.0009	0.0004 ± 0.0009	0.0003 ± 0.0009
Anions by IC (mg/mi)						
Nitrate Ion	0.02 ± 0.01	0.01 ± 0.03	0.02 ± 0.03	0.02 ± 0.01	0.01 ± 0.01	0.03 ± 0.01
Sulfate Ion	0.89 ± 0.06	0.32 ± 0.05	1.43 ± 0.10	0.15 ± 0.01	0.15 ± 0.01	0.21 ± 0.02
Polycyclic aromatic hydrocarbons (ug/mile)						
Naphthalene	1723.13 ± 142.99	1159.06 ± 148.11	2596.81 ± 240.85	590.90 ± 52.89	703.59 ± 61.29	119.55 ± 24.43
2-methylnaphthalene	8275.21 ± 656.79	799.94 ± 65.47	1970.31 ± 157.99	1639.57 ± 130.37	2456.06 ± 195.10	690.36 ± 55.11
1-methylnaphthalene	4998.45 ± 346.88	361.27 ± 26.05	842.37 ± 59.25	807.45 ± 56.16	1243.07 ± 86.36	346.03 ± 24.17
Biphenyl	211.58 ± 13.62	19.59 ± 4.64	47.21 ± 5.56	27.45 ± 2.03	60.45 ± 4.02	15.19 ± 1.37
1+2ethylnaphthalene	813.98 ± 69.18	41.06 ± 31.98	169.23 ± 36.11	149.54 ± 14.37	179.99 ± 16.75	52.75 ± 8.03
2,6+2,7-dimethylnaphthalene	1987.70 ± 161.21	93.56 ± 8.12	105.94 ± 9.11	175.73 ± 14.39	273.93 ± 22.33	73.23 ± 6.10
1,3+1,6+1,7dimethylnaphth	3307.09 ± 270.58	139.03 ± 12.12	148.68 ± 12.90	286.93 ± 23.69	429.62 ± 35.33	114.09 ± 9.57
1,4+1,5+2,3-dimethylnaphth	32.96 ± 4.27	39.33 ± 4.96	12.68 ± 2.16	2.31 ± 0.60	3.38 ± 0.70	9.14 ± 1.34
1,2-dimethylnaphthalene	709.87 ± 77.35	19.56 ± 2.36	18.28 ± 2.24	26.63 ± 3.04	60.39 ± 6.71	11.37 ± 1.39
2-Methylbiphenyl	0.00 ± 133.97	0.00 ± 395.06	0.00 ± 401.62	71.41 ± 78.87	30.85 ± 80.62	79.58 ± 80.42
3-Methylbiphenyl	146.55 ± 39.98	0.00 ± 112.66	0.00 ± 114.56	47.64 ± 22.69	51.33 ± 23.35	50.95 ± 23.14
4-Methylbiphenyl	51.47 ± 12.05	0.00 ± 34.81	0.00 ± 35.38	12.99 ± 6.92	16.34 ± 7.12	18.97 ± 7.07
Dibenzofuran	48.21 ± 3.52	9.81 ± 0.83	15.52 ± 1.22	8.22 ± 0.62	15.24 ± 1.13	3.60 ± 0.29
A-trimethylnaphthalene	386.79 ± 20.83	24.43 ± 1.69	20.10 ± 1.51	22.78 ± 1.27	50.94 ± 2.77	12.49 ± 0.73
1-ethyl-2-methylnaphthalene	73.67 ± 3.62	4.76 ± 1.06	5.02 ± 1.08	6.36 ± 0.40	11.68 ± 0.63	2.89 ± 0.27
B-trimethylnaphthalene	246.40 ± 22.90	15.98 ± 1.94	8.58 ± 1.41	15.15 ± 1.47	31.09 ± 2.93	7.70 ± 0.79
C-trimethylnaphthalene	184.71 ± 15.29	12.75 ± 1.50	8.34 ± 1.25	10.24 ± 0.90	30.67 ± 2.57	5.87 ± 0.56
2-ethyl-1-methylnaphthalene	10.10 ± 1.28	0.26 ± 0.50	0.00 ± 0.50	0.60 ± 0.14	1.84 ± 0.28	0.45 ± 0.14
E-trimethylnaphthalene	100.38 ± 8.14	6.49 ± 1.09	3.65 ± 0.99	6.44 ± 0.58	12.70 ± 1.07	2.99 ± 0.33
F-trimethylnaphthalene	68.86 ± 5.44	7.34 ± 0.81	4.09 ± 0.63	3.26 ± 0.30	9.56 ± 0.78	2.91 ± 0.28
2,3,5+I-trimethylnaphthalene	59.01 ± 8.74	6.60 ± 1.55	5.12 ± 1.41	6.37 ± 1.01	13.90 ± 2.10	2.87 ± 0.52

Appendix B1. Chemical Composition of Dilution Blanks and Vehicle Exhaust Samples from Round1

Species Description	S7-2	S7-3	S7-4	S8-1	S8-2	S8-3
2,4,5-trimethylnaphthalene	33.03 ± 2.91	2.21 ± 0.57	0.46 ± 0.53	1.58 ± 0.19	3.52 ± 0.35	0.72 ± 0.14
J-trimethylnaphthalene	3.61 ± 0.60	1.70 ± 0.69	1.95 ± 0.72	0.17 ± 0.14	0.45 ± 0.16	1.19 ± 0.24
1,4,5-trimethylnaphthalene	21.68 ± 1.28	1.74 ± 0.26	1.16 ± 0.25	1.41 ± 0.11	3.28 ± 0.22	0.08 ± 0.06
Acenaphthylene	88.99 ± 6.69	58.84 ± 4.42	54.59 ± 4.12	11.26 ± 0.97	40.54 ± 3.08	9.09 ± 0.81
Acenaphthene	77.90 ± 5.82	6.49 ± 1.58	3.59 ± 1.52	7.02 ± 0.67	11.96 ± 1.01	2.30 ± 0.39
Fluorene	93.04 ± 10.72	25.14 ± 3.54	4.18 ± 1.87	3.29 ± 0.56	9.02 ± 1.14	3.41 ± 0.57
Dibenzothiophene	5.03 ± 0.55	0.82 ± 0.33	1.18 ± 0.35	1.44 ± 0.18	2.27 ± 0.26	0.44 ± 0.09
Phenanthrene	160.88 ± 5.75	69.16 ± 3.11	57.44 ± 2.80	22.06 ± 0.88	63.86 ± 2.31	13.90 ± 0.63
Anthracene	5.46 ± 0.59	17.63 ± 1.83	3.21 ± 0.46	0.21 ± 0.07	1.28 ± 0.15	1.80 ± 0.20
A-methylfluorene	77.27 ± 5.86	6.21 ± 0.84	5.31 ± 0.81	3.44 ± 0.32	11.37 ± 0.90	2.58 ± 0.26
1-methylfluorene	39.79 ± 5.14	6.02 ± 1.00	6.47 ± 1.06	3.44 ± 0.49	9.43 ± 1.25	2.08 ± 0.32
B-methylfluorene	3.77 ± 0.71	1.42 ± 0.39	1.39 ± 0.38	0.65 ± 0.15	2.26 ± 0.42	0.61 ± 0.14
9-fluorenone	5.94 ± 0.63	0.00 ± 0.31	0.48 ± 0.33	1.96 ± 0.23	0.89 ± 0.13	0.48 ± 0.09
Xanthone	0.71 ± 0.37	0.00 ± 0.49	0.57 ± 0.67	0.08 ± 0.13	0.25 ± 0.17	0.19 ± 0.15
Acenaphthenequinone	2.94 ± 0.81	0.87 ± 0.43	0.26 ± 0.32	0.96 ± 0.28	0.81 ± 0.25	0.25 ± 0.12
Perinaphthenone	0.29 ± 0.29	0.50 ± 0.81	0.77 ± 0.85	0.18 ± 0.17	0.56 ± 0.23	1.70 ± 0.44
2-methylanthracene	96.58 ± 17.81	3.06 ± 0.64	3.23 ± 0.67	1.96 ± 0.39	13.97 ± 2.60	1.18 ± 0.25
3-methylphenanthrene	43.79 ± 2.65	7.39 ± 0.57	5.89 ± 0.50	2.70 ± 0.20	11.03 ± 0.69	3.02 ± 0.21
2-methylphenanthrene	46.72 ± 3.84	9.29 ± 0.95	7.75 ± 0.84	3.11 ± 0.30	12.58 ± 1.05	3.49 ± 0.33
9-methylphenanthrene	26.56 ± 4.42	4.41 ± 0.86	2.60 ± 0.59	1.42 ± 0.27	5.09 ± 0.87	1.50 ± 0.28
1-methylphenanthrene	20.18 ± 3.17	3.98 ± 0.79	2.86 ± 0.63	1.43 ± 0.26	5.45 ± 0.88	1.58 ± 0.28
Anthrone	1.18 ± 0.41	0.00 ± 0.20	0.47 ± 0.27	0.23 ± 0.11	0.10 ± 0.07	0.08 ± 0.06
Anthraquinone	0.17 ± 0.14	0.00 ± 0.29	0.00 ± 0.29	0.16 ± 0.09	0.15 ± 0.09	0.60 ± 0.18
3,6-dimethylphenanthrene	7.07 ± 1.23	0.00 ± 2.52	6.60 ± 2.75	0.90 ± 0.53	2.22 ± 0.60	0.30 ± 0.52
A-dimethylphenanthrene	9.90 ± 2.07	1.69 ± 0.42	1.07 ± 0.30	0.36 ± 0.11	2.40 ± 0.52	0.98 ± 0.22
B-dimethylphenanthrene	4.56 ± 0.33	0.94 ± 0.15	0.71 ± 0.14	0.28 ± 0.05	1.22 ± 0.10	0.51 ± 0.06
C-dimethylphenanthrene	16.39 ± 1.40	2.70 ± 0.31	1.56 ± 0.24	0.94 ± 0.11	3.35 ± 0.30	1.56 ± 0.15
D-dimethylphenanthrene	3.66 ± 0.56	0.75 ± 0.18	0.50 ± 0.16	0.24 ± 0.06	0.93 ± 0.16	0.46 ± 0.09
1,7-dimethylphenanthrene	10.14 ± 1.02	1.99 ± 0.24	1.08 ± 0.18	0.48 ± 0.07	1.99 ± 0.22	0.90 ± 0.11
E-dimethylphenanthrene	5.22 ± 1.05	1.13 ± 0.27	0.62 ± 0.19	0.30 ± 0.08	1.28 ± 0.27	0.56 ± 0.13
9-methylanthracene	10.09 ± 2.40	0.00 ± 0.44	0.02 ± 0.45	0.76 ± 0.22	1.09 ± 0.30	0.10 ± 0.11
Fluoranthene	24.94 ± 1.48	30.32 ± 2.17	15.56 ± 1.65	2.16 ± 0.32	10.95 ± 0.69	6.37 ± 0.47
Pyrene	29.58 ± 3.25	43.68 ± 5.17	13.04 ± 2.54	1.73 ± 0.46	12.18 ± 1.39	10.68 ± 1.23
9-Anthraaldehyde	0.96 ± 0.25	0.00 ± 0.13	13.59 ± 2.88	0.00 ± 0.04	0.13 ± 0.07	0.16 ± 0.07
Retene	0.01 ± 0.10	0.01 ± 0.18	0.02 ± 0.18	0.00 ± 0.06	0.00 ± 0.06	0.01 ± 0.06
Benzonaphthothiophene	0.18 ± 0.15	0.09 ± 0.26	0.19 ± 0.27	0.01 ± 0.09	0.09 ± 0.09	0.09 ± 0.09
1+3-methylfluoranthene	2.51 ± 0.79	0.38 ± 0.20	0.72 ± 0.28	0.05 ± 0.05	0.49 ± 0.17	0.91 ± 0.28
1-MeFl+C-MeFl/Py	3.30 ± 0.39	0.89 ± 0.17	0.76 ± 0.16	0.03 ± 0.04	0.95 ± 0.12	1.02 ± 0.13
B-MePy/MeFl	3.92 ± 0.73	1.62 ± 0.43	0.62 ± 0.33	0.12 ± 0.08	0.98 ± 0.21	1.61 ± 0.30
C-MePy/MeFl	3.23 ± 0.35	0.96 ± 0.18	0.48 ± 0.16	0.10 ± 0.05	0.82 ± 0.11	1.51 ± 0.17
D-MePy/MeFl	2.44 ± 0.15	0.91 ± 0.18	0.19 ± 0.17	0.13 ± 0.05	0.87 ± 0.07	0.94 ± 0.07
4-methylpyrene	2.17 ± 0.42	0.69 ± 0.24	0.52 ± 0.22	0.08 ± 0.06	0.66 ± 0.14	0.93 ± 0.19
1-methylpyrene	1.18 ± 0.58	0.20 ± 0.46	0.86 ± 0.66	0.00 ± 0.08	0.81 ± 0.40	0.83 ± 0.40
Benzo(c)phenanthrene	0.97 ± 0.16	0.26 ± 0.15	0.56 ± 0.16	0.08 ± 0.05	0.42 ± 0.08	0.55 ± 0.10
Benzo(ghi)fluoranthene	9.61 ± 1.80	22.65 ± 4.62	5.48 ± 3.15	0.55 ± 0.59	4.25 ± 0.90	9.27 ± 1.51
Cyclopenta(c,d)pyrene	4.12 ± 0.89	11.62 ± 2.51	0.89 ± 0.42	0.00 ± 0.07	0.62 ± 0.17	0.32 ± 0.11
Benz(a)anthracene	3.89 ± 0.70	2.52 ± 0.64	1.82 ± 0.56	0.11 ± 0.14	1.17 ± 0.27	1.32 ± 0.27
Triphenylene	3.59 ± 0.57	0.80 ± 0.21	0.82 ± 0.21	0.10 ± 0.05	1.08 ± 0.19	0.74 ± 0.13
Chrysene	3.20 ± 0.42	1.97 ± 0.38	1.27 ± 0.31	0.11 ± 0.07	1.09 ± 0.16	1.08 ± 0.16
Benzanthrone	5.57 ± 0.57	0.00 ± 0.13	0.00 ± 0.13	0.21 ± 0.05	1.10 ± 0.13	1.70 ± 0.19
7-methylbenz(a)anthracene	0.14 ± 0.10	0.00 ± 0.16	0.01 ± 0.17	0.00 ± 0.05	0.34 ± 0.14	0.01 ± 0.05
3-methylchrysene	1.17 ± 0.19	0.44 ± 0.15	0.30 ± 0.14	0.02 ± 0.04	0.21 ± 0.05	0.18 ± 0.05
Benz(a)anthracene-7,12-dione	3.53 ± 0.23	0.00 ± 0.13	0.00 ± 0.13	0.11 ± 0.04	0.50 ± 0.06	0.53 ± 0.06
5+6-methylchrysene	0.35 ± 0.21	0.00 ± 0.14	0.12 ± 0.19	0.00 ± 0.04	0.02 ± 0.05	0.01 ± 0.05
Benzo(b+j+k)fluoranthene	7.43 ± 1.44	3.82 ± 3.11	7.96 ± 3.33	0.16 ± 0.60	2.07 ± 0.69	0.77 ± 0.63
Benzo(a)fluoranthene	0.53 ± 0.19	0.52 ± 0.22	0.10 ± 0.15	0.01 ± 0.04	0.07 ± 0.05	0.12 ± 0.06
BeP	3.25 ± 0.42	4.18 ± 0.60	1.86 ± 0.38	0.08 ± 0.06	0.70 ± 0.12	0.78 ± 0.12
BaP	4.18 ± 0.89	3.18 ± 0.80	2.03 ± 0.63	0.01 ± 0.14	0.37 ± 0.17	0.28 ± 0.16
Perylene	0.93 ± 0.42	0.45 ± 0.28	0.35 ± 0.26	0.03 ± 0.05	0.07 ± 0.07	0.03 ± 0.05
7-methylbenzo(a)pyrene	0.00 ± 0.91	0.00 ± 2.68	10.81 ± 3.72	0.49 ± 0.56	0.00 ± 0.54	1.10 ± 0.63
9,10-dihydrobenzo(a)pyrene-7(8H)-one	0.04 ± 0.08	0.00 ± 0.13	0.00 ± 0.13	0.04 ± 0.05	0.02 ± 0.05	0.01 ± 0.05
Dibenzo(a,j)anthracene	0.71 ± 0.11	0.00 ± 0.13	0.00 ± 0.13	0.00 ± 0.04	0.14 ± 0.05	0.10 ± 0.05
Indeno[123-cd]pyrene	3.15 ± 0.63	0.00 ± 0.13	0.00 ± 0.14	0.22 ± 0.08	0.44 ± 0.11	0.37 ± 0.10
Dibenzo(ah+ac)anthracene	0.51 ± 0.18	0.48 ± 0.24	0.00 ± 0.13	0.04 ± 0.05	0.01 ± 0.04	0.00 ± 0.05
Benzo(b)chrysene	0.29 ± 0.07	0.00 ± 0.13	0.00 ± 0.13	0.08 ± 0.04	0.00 ± 0.04	0.00 ± 0.04
Picene	0.27 ± 0.16	0.00 ± 0.13	0.00 ± 0.14	0.01 ± 0.05	0.00 ± 0.05	0.00 ± 0.05
Benzo(ghi)perylene	7.33 ± 1.08	9.79 ± 1.66	5.65 ± 1.30	0.07 ± 0.23	1.54 ± 0.33	1.43 ± 0.32
Anthanthrene	1.00 ± 0.24	0.80 ± 0.22	0.28 ± 0.16	0.00 ± 0.04	0.08 ± 0.05	0.05 ± 0.05
Dibenzo(b,k)fluoranthene	0.53 ± 0.35	0.00 ± 0.37	0.00 ± 0.26	0.00 ± 0.08	0.40 ± 0.23	0.00 ± 0.06
Dibenzo(a,e)pyrene	0.43 ± 0.13	0.00 ± 0.13	0.00 ± 0.13	0.00 ± 0.04	0.01 ± 0.04	0.03 ± 0.04
Coronene	2.60 ± 0.47	2.18 ± 0.44	1.89 ± 0.40	0.05 ± 0.05	0.24 ± 0.07	0.47 ± 0.11
Dibenzo(a,h)pyrene	0.02 ± 0.07	0.02 ± 0.13	0.00 ± 0.13	0.01 ± 0.04	0.03 ± 0.04	0.00 ± 0.04
nitro-PAH (ug/mile)						
1-nitronaphthalene	0.0000 ± 0.0043	0.0033 ± 0.0170	0.1199 ± 0.0190	0.0000 ± 0.0025	0.0000 ± 0.0026	0.0000 ± 0.0025
2-nitronaphthalene	0.0095 ± 0.0075	0.0189 ± 0.0220	0.0718 ± 0.0238	0.0028 ± 0.0044	0.0065 ± 0.0045	0.0001 ± 0.0044
2-nitrobiphenyl	0.0009 ± 0.0020	0.0000 ± 0.0077	0.0000 ± 0.0078	0.0000 ± 0.0012	0.0000 ± 0.0012	0.0000 ± 0.0012
3-nitrobiphenyl	0.0000 ± 0.0020	0.0125 ± 0.0105	0.0000 ± 0.0075	0.0000 ± 0.0012	0.0000 ± 0.0012	0.0000 ± 0.0012
4-nitrobiphenyl	0.0000 ± 0.0057	0.0912 ± 0.0258	0.0000 ± 0.0255	0.0000 ± 0.0033	0.0000 ± 0.0034	0.0000 ± 0.0034
2-nitrofluorene	0.0285 ± 0.0032	0.0000 ± 0.0147	0.0000 ± 0.0149	0.0003 ± 0.0016	0.0000 ± 0.0017	0.0000 ± 0.0017
1,3-dinitronaphthalene	0.0000 ± 0.1334	0.0000 ± 0.3821	0.0000 ± 0.3882	0.0000 ± 0.0777	0.0000 ± 0.0799	0.0000 ± 0.0792

Appendix B1. Chemical Composition of Dilution Blanks and Vehicle Exhaust Samples from Round1

Species Description	S7-2	S7-3	S7-4	S8-1	S8-2	S8-3
1,5-dinitronaphthalene	0.0000 ± 0.0054	0.0000 ± 0.0282	0.0324 ± 0.0312	0.0000 ± 0.0031	0.0000 ± 0.0032	0.0000 ± 0.0032
5-nitroacenaphthene	0.0003 ± 0.0021	0.0000 ± 0.0088	0.0005 ± 0.0093	0.0000 ± 0.0012	0.0000 ± 0.0012	0.0000 ± 0.0012
9-nitroanthracene	0.0044 ± 0.0030	0.0000 ± 0.0170	0.0000 ± 0.0173	0.0000 ± 0.0017	0.0000 ± 0.0018	0.0000 ± 0.0018
4-nitrophenanthrene	0.0000 ± 0.0038	1.0440 ± 0.0594	0.0000 ± 0.0213	0.0000 ± 0.0022	0.0000 ± 0.0023	0.0000 ± 0.0022
9-nitrophenanthrene	0.0000 ± 0.0115	0.0000 ± 0.0588	0.0000 ± 0.0598	0.0000 ± 0.0067	0.0000 ± 0.0069	0.0000 ± 0.0069
1,8-dinitronaphthalene	0.0026 ± 0.0036	0.0000 ± 0.0144	0.0217 ± 0.0171	0.0000 ± 0.0020	0.0000 ± 0.0021	0.0000 ± 0.0021
2-nitrofluoranthene	0.0274 ± 0.0228	0.0000 ± 0.0663	0.0809 ± 0.0760	0.0000 ± 0.0121	0.0000 ± 0.0124	0.0000 ± 0.0123
3-nitrofluoranthene	0.0029 ± 0.0090	0.0000 ± 0.0320	0.1531 ± 0.0443	0.0000 ± 0.0052	0.0000 ± 0.0054	0.0000 ± 0.0053
1-nitropyrene	0.0253 ± 0.0083	0.0000 ± 0.0205	0.5372 ± 0.1321	0.0000 ± 0.0032	0.0007 ± 0.0033	0.0007 ± 0.0033
7-nitrobenzo(a)anthracene	0.0056 ± 0.0009	0.0000 ± 0.0030	0.0000 ± 0.0030	0.0000 ± 0.0005	0.0002 ± 0.0005	0.0000 ± 0.0005
6-nitrochrysene	0.0045 ± 0.0015	0.0000 ± 0.0057	0.0000 ± 0.0058	0.0000 ± 0.0009	0.0001 ± 0.0009	0.0000 ± 0.0009
6-nitrobenz[a]pyrene	0.0000 ± 0.0072	0.0000 ± 0.0231	0.0000 ± 0.0235	0.0000 ± 0.0042	0.0000 ± 0.0043	0.0000 ± 0.0043
Hopanes (ug/mile)						
18a(H),21ß(H)-22,29,30-Trisnorhopane &	2.66 ± 0.25	2.12 ± 0.40	1.21 ± 0.33	0.23 ± 0.08	0.65 ± 0.09	1.05 ± 0.11
17a(H),21ß(H)-22,29,30-Trisnorhopane	0.43 ± 0.13	0.00 ± 0.13	0.07 ± 0.13	0.02 ± 0.04	0.04 ± 0.05	0.03 ± 0.04
17a(H),21ß(H)-30-Norhopane	6.20 ± 0.92	1.19 ± 0.34	1.58 ± 0.38	0.26 ± 0.08	0.98 ± 0.17	0.84 ± 0.15
17a(H),21ß(H)-Hopane	4.89 ± 0.61	1.07 ± 0.32	0.31 ± 0.28	0.11 ± 0.07	0.59 ± 0.10	0.50 ± 0.10
17ß(H),21a(H)-hopane	0.33 ± 0.08	0.19 ± 0.13	0.00 ± 0.13	0.00 ± 0.04	0.01 ± 0.04	0.02 ± 0.04
22S-17a(H),21ß(H)-30-Homohopane	2.82 ± 0.22	0.57 ± 0.18	0.19 ± 0.18	0.06 ± 0.05	0.33 ± 0.06	0.30 ± 0.06
22R-17a(H),21ß(H)-30-Homohopane	2.40 ± 0.21	0.00 ± 0.15	0.26 ± 0.15	0.04 ± 0.05	0.21 ± 0.05	0.22 ± 0.05
17ß(H),21ß(H)-Hopane	0.62 ± 0.13	4.36 ± 0.58	3.61 ± 0.49	0.00 ± 0.04	0.01 ± 0.04	0.00 ± 0.04
22S-17a(H),21ß(H)-30,31-Bishomohopan	1.60 ± 0.24	0.00 ± 0.13	0.00 ± 0.13	0.02 ± 0.04	0.17 ± 0.05	0.16 ± 0.05
22R-17a(H),21ß(H)-30,31-Bishomohopan	1.25 ± 0.19	0.00 ± 0.14	0.00 ± 0.14	0.03 ± 0.04	0.13 ± 0.05	0.11 ± 0.05
22S-17a(H),21ß(H)-30,31,32-Trisomohop	1.15 ± 0.19	0.28 ± 0.16	0.19 ± 0.16	0.04 ± 0.05	0.14 ± 0.05	0.11 ± 0.05
22R-17a(H),21ß(H)-30,31,32-Trishomoho	0.72 ± 0.13	0.00 ± 0.13	0.00 ± 0.13	0.04 ± 0.04	0.10 ± 0.05	0.13 ± 0.05
Steranes (ug/mile)						
C27-20S5a(H),14a(H)-cholestane	0.42 ± 0.11	0.00 ± 0.13	0.00 ± 0.13	0.02 ± 0.04	0.03 ± 0.04	0.06 ± 0.05
C27-20R5a(H),14ß(H)-cholestane	0.88 ± 0.17	0.08 ± 0.13	0.07 ± 0.13	0.06 ± 0.04	0.16 ± 0.05	0.15 ± 0.05
C27-20S5a(H),14ß(H),17ß(H)-cholestane	0.52 ± 0.08	0.01 ± 0.13	0.02 ± 0.13	0.04 ± 0.04	0.08 ± 0.04	0.09 ± 0.04
ster45+40(cholestane)	1.20 ± 0.19	0.03 ± 0.21	0.00 ± 0.21	0.07 ± 0.06	0.19 ± 0.06	0.18 ± 0.06
C28-20S5a(H),14a(H),17a(H)-ergostane	0.12 ± 0.07	0.09 ± 0.13	0.00 ± 0.13	0.01 ± 0.04	0.02 ± 0.04	0.01 ± 0.04
C28-20R5a(H),14ß(H),17ß(H)-ergostane	0.21 ± 0.08	0.00 ± 0.13	0.00 ± 0.13	0.00 ± 0.04	0.03 ± 0.04	0.05 ± 0.04
C28-20S5a(H),14ß(H),17ß(H)-ergostane	0.40 ± 0.10	0.00 ± 0.13	0.00 ± 0.13	0.01 ± 0.04	0.03 ± 0.04	0.05 ± 0.04
C28-20R5a(H),14a(H),17a(H)-ergostane	0.30 ± 0.08	0.00 ± 0.13	0.00 ± 0.13	0.01 ± 0.04	0.02 ± 0.04	0.03 ± 0.04
C29-20S5a(H),14a(H),17a(H)-stigmastane	0.50 ± 0.10	0.01 ± 0.13	0.05 ± 0.13	0.03 ± 0.04	0.06 ± 0.04	0.08 ± 0.04
C29-20R5a(H),14ß(H),17ß(H)-stigmastan	0.96 ± 0.28	0.02 ± 0.13	0.07 ± 0.13	0.05 ± 0.05	0.13 ± 0.06	0.09 ± 0.05
C29-20S5a(H),14ß(H),17ß(H)-stigmastan	0.69 ± 0.14	0.04 ± 0.13	0.04 ± 0.13	0.02 ± 0.04	0.08 ± 0.05	0.08 ± 0.04
C29-20R5a(H),14a(H),17a(H)-stigmastane	0.58 ± 0.10	0.02 ± 0.13	0.01 ± 0.13	0.03 ± 0.04	0.08 ± 0.04	0.07 ± 0.04
Alkanes (ug/mile)						
Dodecane	0.00 ± 2.92	3.69 ± 9.98	0.00 ± 8.54	0.00 ± 1.70	0.00 ± 1.81	0.00 ± 1.68
Tridecane	0.44 ± 1.26	23.24 ± 7.16	0.00 ± 3.58	0.00 ± 0.71	0.00 ± 0.73	0.00 ± 0.72
Norfarnesane	5.36 ± 1.27	0.57 ± 1.22	0.00 ± 1.17	0.02 ± 0.23	0.70 ± 0.32	0.21 ± 0.26
Heptylcyclohexane	0.73 ± 0.51	0.00 ± 1.13	6.82 ± 2.62	0.01 ± 0.23	0.00 ± 0.23	0.33 ± 0.29
Farnesane	9.54 ± 4.35	0.00 ± 3.26	8.18 ± 5.47	1.62 ± 1.08	0.00 ± 0.66	1.60 ± 1.09
Tetradecane	0.00 ± 5.86	3.76 ± 17.59	53.66 ± 22.71	0.00 ± 3.39	0.00 ± 3.49	0.00 ± 3.43
Octylcyclohexane	0.00 ± 1.73	0.00 ± 5.03	14.40 ± 6.04	5.57 ± 1.46	1.67 ± 1.12	0.00 ± 1.01
Pentadecane	0.00 ± 2.94	1.02 ± 8.72	0.00 ± 8.78	21.30 ± 2.83	43.58 ± 4.74	0.00 ± 1.74
Nonylcyclohexane	2.93 ± 2.76	0.00 ± 7.30	12.03 ± 8.69	0.04 ± 1.47	0.00 ± 1.49	0.00 ± 1.46
Hexadecane	0.02 ± 3.85	0.00 ± 11.34	45.33 ± 12.27	1.23 ± 2.25	0.91 ± 2.31	6.84 ± 2.39
Norpristane	0.85 ± 0.90	0.00 ± 2.35	2.20 ± 2.63	0.90 ± 0.58	0.33 ± 0.52	4.38 ± 1.24
Heptadecane	0.11 ± 2.52	0.00 ± 7.43	21.95 ± 8.40	12.91 ± 2.21	0.00 ± 1.50	4.52 ± 1.68
Decylcyclohexane	0.90 ± 1.13	0.00 ± 3.07	9.97 ± 4.43	1.47 ± 0.79	0.16 ± 0.64	0.00 ± 0.63
Heptadecane_Pristane	0.00 ± 3.16	4.90 ± 9.37	24.68 ± 9.82	9.00 ± 2.02	4.84 ± 1.96	13.81 ± 2.23
Undecylcyclohexane	0.43 ± 0.53	3.13 ± 1.90	2.76 ± 1.85	0.17 ± 0.29	0.00 ± 0.22	0.00 ± 0.25
Octadecane	38.39 ± 3.17	0.00 ± 3.64	23.24 ± 4.29	11.55 ± 1.18	16.29 ± 1.47	6.05 ± 0.91
Phytane	21.42 ± 2.02	0.00 ± 1.60	6.37 ± 1.81	11.02 ± 1.06	8.96 ± 0.89	3.22 ± 0.47
Dodecylcyclohexane	1.06 ± 0.39	1.01 ± 0.63	0.30 ± 0.51	0.66 ± 0.24	0.16 ± 0.13	0.46 ± 0.20
Nonadecane	24.13 ± 2.73	0.00 ± 1.44	3.67 ± 1.66	6.39 ± 0.82	8.44 ± 1.02	4.79 ± 0.66
Tridecylcyclohexane	0.75 ± 0.49	1.51 ± 1.34	0.00 ± 1.17	0.09 ± 0.25	0.00 ± 0.24	1.96 ± 0.59
Eicosane	15.16 ± 1.21	0.00 ± 2.24	3.69 ± 2.32	0.04 ± 0.45	6.27 ± 0.61	4.20 ± 0.54
Tetradecylcyclohexane	1.82 ± 0.43	0.78 ± 0.25	0.46 ± 0.19	1.67 ± 0.38	0.18 ± 0.07	0.31 ± 0.10
Heneicosane	14.46 ± 1.25	0.00 ± 2.39	0.00 ± 2.44	4.06 ± 0.56	4.43 ± 0.58	4.38 ± 0.58
Pentadecylcyclohexane	0.38 ± 2.32	0.00 ± 6.81	0.00 ± 6.92	0.00 ± 1.34	0.00 ± 1.38	0.00 ± 1.37
Docosane	8.76 ± 3.72	0.00 ± 10.39	0.00 ± 10.56	2.47 ± 2.10	3.18 ± 2.17	3.51 ± 2.16
Hexadecylcyclohexane	3.70 ± 0.61	1.24 ± 0.40	0.00 ± 0.31	0.04 ± 0.07	0.69 ± 0.15	0.00 ± 0.07
Tricosane	6.75 ± 4.71	0.00 ± 13.72	0.00 ± 13.94	0.69 ± 2.72	1.85 ± 2.80	2.33 ± 2.78
Heptadecylcyclohexane	2.42 ± 2.21	0.00 ± 5.79	0.00 ± 5.90	0.00 ± 1.16	0.91 ± 1.27	0.00 ± 1.19
Octadecylcyclohexane	1.14 ± 1.87	0.00 ± 5.19	0.00 ± 5.29	0.00 ± 1.03	0.00 ± 1.06	0.00 ± 1.04
Tetracosane	4.34 ± 8.13	0.00 ± 23.45	0.00 ± 23.84	0.65 ± 4.68	1.12 ± 4.82	0.00 ± 4.75
Pentacosane	3.51 ± 8.87	0.00 ± 25.39	0.00 ± 25.81	0.92 ± 5.12	1.11 ± 5.27	0.00 ± 5.13
Nonadecylcyclohexane	0.42 ± 2.18	0.00 ± 6.26	0.00 ± 6.37	0.01 ± 1.26	0.20 ± 1.30	0.00 ± 1.27
Hexacosane	3.21 ± 9.99	0.00 ± 28.86	0.00 ± 29.32	0.16 ± 5.76	1.14 ± 5.96	0.00 ± 5.81
Eicosylcyclohexane	0.28 ± 0.11	1.05 ± 0.32	0.00 ± 0.13	0.00 ± 0.04	0.09 ± 0.05	0.02 ± 0.04
Heptacosane	2.88 ± 10.00	0.00 ± 28.93	0.00 ± 29.40	0.00 ± 5.76	0.40 ± 5.95	0.00 ± 5.83
Heneicosylcyclohexane	0.74 ± 0.30	5.32 ± 1.97	0.00 ± 0.20	0.07 ± 0.06	0.01 ± 0.05	0.03 ± 0.06
Octacosane	5.12 ± 9.69	0.00 ± 28.17	0.00 ± 28.62	0.00 ± 5.58	2.11 ± 5.78	0.00 ± 5.68
Nonacosane	4.53 ± 6.87	0.00 ± 19.25	0.00 ± 19.56	0.00 ± 3.84	1.90 ± 4.06	0.00 ± 3.88
Triacontane	6.58 ± 5.91	0.00 ± 16.31	0.00 ± 16.54	0.00 ± 3.24	2.59 ± 3.46	0.00 ± 3.28
Hentriacontane	4.64 ± 3.73	0.00 ± 9.39	0.00 ± 9.50	0.10 ± 1.92	2.31 ± 2.18	0.00 ± 1.90
Dotriacontane	5.97 ± 2.74	0.00 ± 7.36	0.00 ± 7.44	0.05 ± 1.46	3.75 ± 1.65	0.00 ± 1.48

Appendix B1. Chemical Composition of Dilution Blanks and Vehicle Exhaust Samples from Round1

Species Description	S7-2	S7-3	S7-4	S8-1	S8-2	S8-3
Tritriacontane	2.79 ± 1.69	0.05 ± 3.02	0.00 ± 2.77	0.09 ± 0.60	1.70 ± 1.02	0.00 ± 0.56
Tetratriacontane	4.08 ± 1.92	0.00 ± 3.23	0.00 ± 3.17	0.00 ± 0.64	2.52 ± 1.17	0.00 ± 0.64
Pentatriacontane	2.67 ± 1.14	0.83 ± 1.44	0.00 ± 1.15	0.00 ± 0.25	1.18 ± 0.56	0.00 ± 0.24
Hexatriacontane	1.42 ± 0.52	0.00 ± 1.35	0.00 ± 1.37	0.00 ± 0.27	2.23 ± 0.40	0.00 ± 0.27
Heptatriacontane	2.76 ± 1.08	0.00 ± 0.59	0.00 ± 0.52	0.02 ± 0.14	0.94 ± 0.42	0.00 ± 0.12
Octatriacontane	7.62 ± 4.28	4.98 ± 3.64	0.00 ± 0.75	0.01 ± 0.25	1.62 ± 1.05	0.00 ± 0.16
Nonatriacontane	0.77 ± 0.31	0.00 ± 0.27	0.00 ± 0.28	0.00 ± 0.06	0.55 ± 0.22	0.00 ± 0.07
Polar compounds (ug/mile)						
heptanoic acid (c7)	0.00 ± 4.34	0.00 ± 8.61	8.87 ± 8.93	8.19 ± 4.35	2.82 ± 4.38	6.65 ± 4.40
me-malonic (d-c3)	0.00 ± 1.26	0.00 ± 1.52	1.51 ± 1.73	3.28 ± 1.45	0.00 ± 1.25	0.00 ± 1.24
guaiacol	0.00 ± 0.11	0.26 ± 0.17	0.00 ± 0.20	0.42 ± 0.14	0.33 ± 0.13	0.60 ± 0.17
benzoic acid	0.00 ± 1211.41	0.00 ± 2400.94	0.00 ± 2466.03	0.00 ± 1180.86	0.00 ± 1211.95	6333.88 ± 1431.36
octanoic acid (c8)	6.07 ± 10.19	0.00 ± 15.63	8.72 ± 16.64	19.96 ± 10.23	8.78 ± 10.19	11.50 ± 10.16
phenylacetic acid	0.00 ± 25.26	0.00 ± 35.19	0.00 ± 33.72	0.00 ± 25.88	0.32 ± 25.95	41.42 ± 35.35
maleic acid	0.11 ± 1.64	0.00 ± 1.66	0.00 ± 1.69	6.30 ± 1.91	24.82 ± 3.47	93.23 ± 10.35
succinic acid (d-c4)	5.35 ± 10.80	0.00 ± 19.70	0.00 ± 20.01	4.30 ± 10.48	6.26 ± 10.79	13.45 ± 10.86
4-me-guaiacol	0.00 ± 0.06	0.00 ± 0.11	0.00 ± 0.11	0.55 ± 0.06	0.00 ± 0.09	0.00 ± 0.27
o-toluic	101.57 ± 16.06	0.00 ± 5.31	25.88 ± 7.11	6.21 ± 3.83	19.14 ± 4.97	33.63 ± 6.61
me-succinic acid (d-c4)	2.70 ± 1.69	0.00 ± 2.93	0.00 ± 2.98	1.85 ± 1.59	1.17 ± 1.62	3.28 ± 1.65
m-toluic	130.44 ± 8.46	0.00 ± 4.53	44.87 ± 5.52	11.06 ± 2.42	37.69 ± 3.37	55.99 ± 4.28
nonanoic acid (c9)	10.86 ± 10.66	0.00 ± 16.59	0.00 ± 18.42	34.27 ± 14.25	15.59 ± 11.26	14.18 ± 10.88
p-toluic	98.11 ± 14.22	0.00 ± 4.56	36.74 ± 7.76	9.42 ± 3.29	26.17 ± 4.94	49.55 ± 7.80
2,6-dimethylbenzoic acid	8.91 ± 2.19	0.00 ± 2.61	0.00 ± 2.71	1.61 ± 1.85	4.03 ± 1.95	16.49 ± 2.48
4-ethyl-guaiacol	1.33 ± 0.35	0.00 ± 0.35	0.00 ± 0.11	0.00 ± 0.05	0.00 ± 0.07	0.00 ± 0.09
syringol	0.00 ± 0.08	0.00 ± 0.11	0.00 ± 0.11	0.00 ± 0.05	0.81 ± 0.08	1.04 ± 0.10
glutaric acid (d-c5)	4.98 ± 0.25	0.00 ± 0.13	0.00 ± 0.13	1.21 ± 0.12	2.29 ± 0.18	2.57 ± 0.19
2-methylglutaric (d-c5)	0.50 ± 0.17	0.00 ± 0.11	0.00 ± 0.11	0.82 ± 0.24	0.00 ± 0.05	0.51 ± 0.16
2,5-dimethylbenzoic acid	10.52 ± 4.91	0.00 ± 3.64	0.00 ± 3.83	0.00 ± 2.00	0.05 ± 2.06	12.63 ± 5.07
3-methylglutaric acid (d-c5)	3.97 ± 3.35	0.00 ± 5.86	0.00 ± 5.96	0.00 ± 3.14	0.00 ± 3.23	6.09 ± 3.43
2,4-dimethylbenzoic acid	0.00 ± 196.08	0.00 ± 361.97	0.00 ± 369.25	0.00 ± 193.90	0.00 ± 194.75	1330.77 ± 303.33
2,3- and 3,5- dimethylbenzoic acid	9.96 ± 1.85	0.00 ± 0.69	0.00 ± 0.59	0.29 ± 0.39	4.17 ± 0.88	5.48 ± 1.06
decanoic acid (c10)	0.00 ± 2.95	0.00 ± 4.53	0.00 ± 4.60	0.00 ± 2.87	0.00 ± 2.95	0.88 ± 4.81
4-allyl-guaiacol (eugenol)	5.48 ± 0.52	1.03 ± 0.20	20.50 ± 2.25	61.72 ± 6.64	17.55 ± 1.42	11.90 ± 1.31
4-methyl-syringol	0.69 ± 0.23	0.00 ± 0.11	0.87 ± 0.30	0.00 ± 0.05	0.43 ± 0.15	0.00 ± 0.05
3,4-dimethylbenzoic acid	20.65 ± 3.16	3.39 ± 3.25	3.25 ± 3.31	1.19 ± 2.11	6.14 ± 2.28	8.65 ± 2.37
hexanedioic (adipic) acid (d-c6)	0.29 ± 0.95	0.00 ± 1.70	0.00 ± 1.77	0.00 ± 0.90	1.49 ± 1.01	0.72 ± 0.95
salcylic acid	1.50 ± 2.79	0.00 ± 4.73	6.62 ± 5.17	0.30 ± 2.69	6.11 ± 2.98	2.71 ± 2.79
trans-2-decenoic acid	0.00 ± 0.46	0.00 ± 0.54	0.00 ± 0.55	0.00 ± 0.45	0.00 ± 0.46	0.22 ± 0.46
cis-pinonic acid	0.00 ± 3.48	0.00 ± 4.56	0.00 ± 4.64	0.00 ± 3.38	0.00 ± 3.47	0.00 ± 3.44
3-methyladipic acid (d-c6)	7.27 ± 1.32	179.64 ± 31.39	14.69 ± 2.67	0.38 ± 0.27	42.63 ± 7.38	2.37 ± 0.52
4-formyl-guaiacol (vanillin)	0.13 ± 0.73	8.85 ± 2.56	4.51 ± 1.59	0.12 ± 0.70	6.71 ± 1.49	1.37 ± 0.85
undecanoic acid (c11)	0.79 ± 1.41	0.00 ± 3.49	0.00 ± 2.38	0.00 ± 1.35	0.00 ± 1.39	0.91 ± 1.40
isoeugenol	1.96 ± 0.83	0.00 ± 0.35	0.00 ± 0.33	0.44 ± 0.32	0.00 ± 0.28	0.00 ± 0.28
heptanedioic (pimelic) acid (d-c7)	1.36 ± 1.04	4.30 ± 1.44	0.00 ± 1.16	0.17 ± 0.98	0.18 ± 1.02	0.47 ± 1.01
2,3-dimethoxybenzoic acid	6.66 ± 2.45	0.00 ± 0.11	0.00 ± 0.11	0.00 ± 0.05	0.00 ± 0.05	0.00 ± 0.05
acetovanillone	0.00 ± 3.94	0.00 ± 4.00	0.00 ± 4.06	0.00 ± 3.83	6.72 ± 3.99	7.30 ± 3.95
2,6-dimethoxybenzoic acid	0.31 ± 0.13	0.00 ± 0.11	0.00 ± 0.11	0.27 ± 0.11	0.00 ± 0.05	0.20 ± 0.09
dodecanoic (lauric) acid (c12)	0.00 ± 34.89	0.00 ± 52.63	0.00 ± 53.61	0.59 ± 33.96	0.00 ± 34.82	5.77 ± 34.64
2,5-dimethoxybenzoic acid	3.14 ± 1.14	0.00 ± 1.31	1.90 ± 1.49	7.76 ± 2.09	2.23 ± 0.98	3.17 ± 1.14
phthalic acid	63.02 ± 29.67	94.91 ± 48.17	0.00 ± 41.74	181.55 ± 44.35	83.25 ± 31.39	127.93 ± 34.49
suberic acid (d-c8)	0.00 ± 19.03	0.00 ± 26.17	0.00 ± 26.52	0.00 ± 18.49	0.00 ± 19.01	0.00 ± 18.83
levoglucosan	0.00 ± 1.60	0.84 ± 2.65	0.00 ± 1.70	0.52 ± 1.63	0.00 ± 1.54	0.72 ± 1.71
3,5-dimethoxybenzoic acid	1.37 ± 0.43	1.34 ± 0.80	0.00 ± 0.80	0.42 ± 0.40	0.02 ± 0.41	1.86 ± 0.44
syringaldehyde	0.03 ± 0.07	0.00 ± 0.11	0.00 ± 0.11	0.09 ± 0.06	0.16 ± 0.07	0.88 ± 0.17
3,4-dimethoxybenzoic acid	13.00 ± 4.68	5.00 ± 2.34	0.00 ± 0.49	1.67 ± 0.76	4.17 ± 1.59	6.71 ± 2.47
2,4-dimethoxybenzoic acid	8.13 ± 0.58	3.19 ± 0.25	0.00 ± 0.11	2.75 ± 0.20	2.87 ± 0.21	4.72 ± 0.34
tridecanoic acid (c13)	0.63 ± 0.56	0.00 ± 0.54	0.00 ± 0.54	0.86 ± 0.56	0.36 ± 0.55	0.57 ± 0.55
isophthalic acid	68.16 ± 80.57	0.00 ± 87.71	0.00 ± 89.11	1.76 ± 75.93	223.29 ± 91.80	416.19 ± 112.32
vanillic acid	0.00 ± 5.42	0.00 ± 5.95	0.00 ± 6.04	0.00 ± 5.27	0.00 ± 5.41	14.32 ± 5.98
homovanillic acid	0.00 ± 2.42	0.00 ± 2.58	0.00 ± 2.62	0.00 ± 2.33	0.00 ± 2.48	8.84 ± 3.48
azelaic acid (d-c9)	0.00 ± 4.91	0.00 ± 5.67	0.00 ± 5.76	0.00 ± 4.77	0.00 ± 4.90	1.91 ± 4.87
myristoleic acid	0.00 ± 0.23	0.00 ± 0.24	24.87 ± 3.35	0.00 ± 0.21	0.00 ± 0.21	13.13 ± 1.57
myristic acid (c14)	0.00 ± 7.74	0.00 ± 6.33	0.00 ± 6.51	20.93 ± 10.71	0.00 ± 7.41	38.29 ± 14.43
sebacic acid (d-c10)	0.00 ± 1.04	0.00 ± 1.15	0.00 ± 1.22	0.00 ± 1.00	0.00 ± 1.03	0.00 ± 1.03
syringic acid	5.80 ± 0.84	0.00 ± 0.59	0.00 ± 0.60	9.29 ± 1.18	0.38 ± 0.51	0.61 ± 0.52
pentadecanoic acid (c15)	0.00 ± 2.86	0.00 ± 3.49	0.00 ± 3.55	0.00 ± 2.78	0.00 ± 2.85	0.53 ± 2.85
undecanedioic acid (d-c11)	0.02 ± 0.15	0.00 ± 0.12	0.00 ± 0.12	0.00 ± 0.12	0.00 ± 0.12	0.24 ± 0.21
palmitoleic acid	0.00 ± 0.82	0.00 ± 0.94	0.00 ± 0.95	0.00 ± 0.72	0.00 ± 0.81	2.23 ± 1.32
palmitic acid (c16)	0.00 ± 16.48	0.00 ± 9.21	0.00 ± 9.37	0.00 ± 16.03	0.00 ± 16.14	0.70 ± 15.60
isostearic acid	0.00 ± 0.34	0.00 ± 0.54	0.00 ± 0.54	0.00 ± 0.33	0.00 ± 0.34	0.00 ± 0.33
dodecanedioic acid (d-c12)	0.13 ± 0.33	0.00 ± 0.37	0.00 ± 0.38	0.00 ± 0.32	0.00 ± 0.33	0.13 ± 0.32
traumatic acid	0.00 ± 0.06	0.00 ± 0.11	0.00 ± 0.11	0.00 ± 0.05	0.00 ± 0.05	0.00 ± 0.05
heptadecanoic acid (c17)	0.00 ± 3.32	0.00 ± 6.09	0.00 ± 6.19	0.00 ± 3.22	0.00 ± 3.31	0.00 ± 3.36
1,11-undecanedicarboxylic acid (d-c13)	0.00 ± 0.09	0.00 ± 0.11	0.00 ± 0.11	0.00 ± 0.06	0.00 ± 0.06	0.20 ± 0.08
oleic acid	13.82 ± 14.14	0.00 ± 5.74	3.19 ± 34.78	12.97 ± 11.17	5.79 ± 9.26	0.00 ± 6.69
elaidic acid	0.15 ± 0.82	0.00 ± 0.71	0.00 ± 0.72	0.91 ± 0.79	0.00 ± 0.81	0.32 ± 0.81
stearic acid (c18)	0.00 ± 18.87	0.00 ± 39.32	0.00 ± 31.88	0.00 ± 18.35	0.00 ± 18.64	0.00 ± 19.09
1,12-dodecanedicarboxylic acid (d-c14)	0.76 ± 0.31	0.00 ± 0.25	0.00 ± 0.26	0.00 ± 0.21	1.06 ± 0.39	1.09 ± 0.40
8,15-pimaradien-18-oic acd	0.00 ± 0.39	0.00 ± 0.16	0.00 ± 0.16	0.00 ± 0.37	0.00 ± 0.39	0.00 ± 0.38
pimaric acid	7.98 ± 1.16	0.00 ± 0.88	0.00 ± 0.89	0.00 ± 0.48	8.73 ± 1.25	3.33 ± 0.66

Appendix B1. Chemical Composition of Dilution Blanks and Vehicle Exhaust Samples from Round1

Species Description	S7-2	S7-3	S7-4	S8-1	S8-2	S8-3
sandaracopimaric acid	0.00 ± 0.17	0.00 ± 0.28	0.00 ± 0.28	1.40 ± 0.19	0.00 ± 0.16	0.25 ± 0.16
nonadecanoic acid (c19)	0.00 ± 5.64	0.00 ± 10.22	0.00 ± 10.39	0.29 ± 5.49	0.00 ± 5.63	0.00 ± 5.58
isopimaric acid	0.00 ± 0.59	0.00 ± 0.98	0.00 ± 1.00	0.00 ± 0.57	0.00 ± 0.59	0.22 ± 0.59
palustric acid	0.39 ± 0.54	0.00 ± 0.60	0.00 ± 0.61	0.97 ± 0.52	0.38 ± 0.54	0.43 ± 0.53
dihydroisopimaric acid	0.00 ± 0.23	0.00 ± 0.27	0.00 ± 0.27	0.00 ± 0.22	0.00 ± 0.23	0.00 ± 0.22
8-abietic acid	0.00 ± 0.35	0.00 ± 0.26	0.00 ± 0.27	0.23 ± 0.36	0.09 ± 0.35	0.00 ± 0.34
dehydroabietic acid	0.00 ± 7.81	0.00 ± 9.08	0.00 ± 9.23	0.00 ± 7.64	0.00 ± 7.80	0.00 ± 7.73
8,14-abietenic acid	0.00 ± 0.06	0.00 ± 0.11	0.00 ± 0.11	0.00 ± 0.05	0.00 ± 0.05	0.00 ± 0.05
abietic acid	0.00 ± 0.10	0.00 ± 0.14	0.00 ± 0.14	0.00 ± 0.09	0.00 ± 0.10	0.00 ± 0.09
eicosanoic acid (c20)	0.00 ± 1.78	0.00 ± 1.80	0.00 ± 1.82	0.00 ± 1.73	0.00 ± 1.78	0.00 ± 1.76
levopimaric acid	0.00 ± 0.06	0.00 ± 0.11	0.00 ± 0.11	0.00 ± 0.05	0.00 ± 0.05	0.00 ± 0.05
heneicosanoic acid (c21)	0.00 ± 2.00	0.00 ± 2.69	0.00 ± 2.73	0.00 ± 1.94	0.00 ± 2.00	0.00 ± 1.98
7-oxodehydroabietic acid	0.00 ± 0.15	0.00 ± 0.26	0.00 ± 0.27	0.45 ± 0.15	0.00 ± 0.14	0.59 ± 0.17
docosanoic acid (c22)	0.00 ± 5.61	0.00 ± 8.92	0.00 ± 9.07	0.88 ± 5.47	0.00 ± 5.59	0.00 ± 5.55
tricosanoic acid (c23)	0.00 ± 0.93	0.00 ± 0.75	0.00 ± 0.76	0.00 ± 0.90	0.00 ± 0.93	0.18 ± 0.92
tetracosanoic acid (c24)	0.29 ± 0.64	0.00 ± 0.91	0.00 ± 0.93	1.36 ± 0.80	0.00 ± 0.54	0.00 ± 1.03
cholesterol	0.00 ± 1.04	0.00 ± 0.24	0.00 ± 0.25	0.00 ± 0.99	0.00 ± 1.00	1.25 ± 1.03
cholestanol	0.00 ± 7.03	0.00 ± 8.17	0.00 ± 8.31	0.02 ± 6.82	0.00 ± 7.01	3.79 ± 6.99
ergosterol	0.00 ± 0.06	0.00 ± 0.11	0.00 ± 0.11	0.00 ± 0.05	0.00 ± 0.05	0.00 ± 0.05
stigmasterol	0.00 ± 2.18	0.00 ± 2.54	0.00 ± 2.58	0.00 ± 2.12	0.00 ± 2.18	0.00 ± 2.16
sitosterol	0.00 ± 0.06	0.00 ± 0.11	0.00 ± 0.11	0.00 ± 0.05	0.00 ± 0.05	0.00 ± 0.05
Carbonyls (mg/mile)						
formaldehyde	3.08 ± 0.02	1.85 ± 0.06	5.40 ± 0.06	1.85 ± 0.01	2.59 ± 0.01	4.25 ± 0.01
acetaldehyde	0.85 ± 0.33	0.00 ± 0.98	0.77 ± 0.99	0.52 ± 0.19	1.01 ± 0.20	1.81 ± 0.20
acetone	0.50 ± 0.47	0.00 ± 1.41	0.00 ± 1.41	0.70 ± 0.27	0.56 ± 0.28	0.58 ± 0.28
* acrolein	0.99 ± 0.25	0.28 ± 0.07	2.30 ± 0.58	0.37 ± 0.09	0.78 ± 0.19	1.29 ± 0.32
propionaldehyde	0.21 ± 0.01	0.11 ± 0.04	0.30 ± 0.04	0.10 ± 0.01	0.16 ± 0.01	0.25 ± 0.01
crotonaldehyde	0.03 ± 0.01	0.00 ± 0.01	0.12 ± 0.01	0.03 ± 0.01	0.03 ± 0.01	0.01 ± 0.01
methyl ethyl ketone	0.21 ± 0.04	0.00 ± 0.11	0.13 ± 0.11	0.19 ± 0.02	0.20 ± 0.02	0.17 ± 0.02
Methacrolein	0.18 ± 0.01	0.03 ± 0.01	0.31 ± 0.01	0.04 ± 0.01	0.09 ± 0.01	0.18 ± 0.01
* n-butyraldehyde	0.15 ± 0.04	0.01 ± 0.02	0.37 ± 0.09	0.12 ± 0.03	0.11 ± 0.03	0.03 ± 0.02
benzaldehyde	1.15 ± 0.01	0.67 ± 0.02	1.92 ± 0.02	0.55 ± 0.01	0.88 ± 0.01	1.39 ± 0.01
glyoxal	0.00 ± 0.01	0.01 ± 0.02	0.01 ± 0.01	0.00 ± 0.01	0.02 ± 0.01	0.01 ± 0.01
valeraldehyde	0.03 ± 0.01	0.00 ± 0.02	0.05 ± 0.02	0.04 ± 0.01	0.03 ± 0.01	0.03 ± 0.01
tolualdehyde	0.10 ± 0.01	0.00 ± 0.03	0.05 ± 0.03	0.03 ± 0.01	0.00 ± 0.01	0.00 ± 0.01
hexanal	0.10 ± 0.01	0.00 ± 0.02	0.05 ± 0.02	0.03 ± 0.01	0.00 ± 0.01	0.00 ± 0.01
*** acrolein converts to an unknown rear**						
VOC (mg/mi)						
1,3 butadiene (estimated)	5.608 ± 8.300	1.046 ± 1.548	2.471 ± 3.657	0.813 ± 1.204	0.988 ± 1.462	0.552 ± 0.817
C2 compounds	65.798 ± 16.200	14.473 ± 3.564	23.293 ± 5.735	6.697 ± 1.649	17.916 ± 4.411	12.896 ± 3.175
propene	41.502 ± 8.773	7.739 ± 1.636	18.285 ± 3.865	6.018 ± 1.272	7.308 ± 1.545	4.083 ± 0.863
propane	1.215 ± 0.069	0.487 ± 0.028	0.763 ± 0.043	0.609 ± 0.035	0.944 ± 0.053	0.880 ± 0.050
isoButane	3.258 ± 0.210	1.133 ± 0.073	1.170 ± 0.075	0.444 ± 0.029	0.439 ± 0.028	0.535 ± 0.035
1Butene+iButylene	22.886 ± 2.696	4.304 ± 0.507	8.023 ± 0.945	3.523 ± 0.415	4.353 ± 0.513	3.685 ± 0.434
n-Butane	6.036 ± 0.580	0.964 ± 0.093	1.757 ± 0.169	0.620 ± 0.060	0.647 ± 0.062	0.692 ± 0.067
t-2-Butene	2.860 ± 0.451	0.595 ± 0.094	1.407 ± 0.222	0.544 ± 0.086	0.550 ± 0.087	0.529 ± 0.083
c-2-Butene	1.499 ± 0.097	0.281 ± 0.018	0.796 ± 0.051	0.214 ± 0.014	0.246 ± 0.016	0.157 ± 0.010
3-Me-1-Butene	49.584 ± 5.482	19.187 ± 2.121	37.141 ± 4.106	12.593 ± 1.392	9.903 ± 1.095	13.064 ± 1.444
isopentane	2.660 ± 0.278	0.423 ± 0.044	1.231 ± 0.128	0.571 ± 0.060	0.457 ± 0.048	0.413 ± 0.043
1-Pentene	4.655 ± 0.586	0.789 ± 0.099	1.406 ± 0.177	0.654 ± 0.082	0.690 ± 0.087	0.737 ± 0.093
2-Me-1-Butene	16.277 ± 1.650	4.168 ± 0.422	6.295 ± 0.638	2.437 ± 0.247	3.137 ± 0.318	3.628 ± 0.368
n-Pentane	0.022 ± 0.007	0.045 ± 0.013	0.053 ± 0.016	0.487 ± 0.144	0.144 ± 0.043	0.035 ± 0.010
t-2-Pentene	4.522 ± 0.257	0.764 ± 0.043	2.317 ± 0.132	0.567 ± 0.032	0.656 ± 0.037	0.802 ± 0.046
c-2-Pentene	2.530 ± 0.377	0.403 ± 0.060	1.140 ± 0.170	0.317 ± 0.047	0.364 ± 0.054	0.411 ± 0.061
2-Me-2-Butene	4.312 ± 0.403	0.382 ± 0.036	0.348 ± 0.033	1.106 ± 0.103	1.030 ± 0.096	1.013 ± 0.095
22DiMeButane	5.490 ± 0.602	2.131 ± 0.234	1.440 ± 0.158	0.618 ± 0.068	0.723 ± 0.079	1.130 ± 0.124
CycloPentene	1.537 ± 0.169	0.245 ± 0.026	0.559 ± 0.062	0.230 ± 0.025	0.290 ± 0.032	0.315 ± 0.035
CycloPentane	2.398 ± 0.120	0.651 ± 0.032	0.879 ± 0.044	0.298 ± 0.015	0.413 ± 0.021	0.469 ± 0.023
23DiMeButane	9.557 ± 0.966	2.336 ± 0.236	3.720 ± 0.376	1.273 ± 0.129	1.302 ± 0.132	1.682 ± 0.170
MTBE	0.786 ± 0.066	0.108 ± 0.009	0.359 ± 0.030	0.014 ± 0.001	<4.31 ± 0.447	<5.44 ± 0.564
2-MePentane	32.171 ± 3.130	7.762 ± 0.755	12.618 ± 1.228	3.804 ± 0.370	<4.31 ± 0.419	<5.44 ± 0.530
3-MePentane	23.141 ± 1.212	5.137 ± 0.269	8.349 ± 0.437	2.632 ± 0.138	2.711 ± 0.142	3.407 ± 0.179
2-Me-1-Pentene	1.249 ± 0.046	0.158 ± 0.006	0.265 ± 0.010	0.152 ± 0.006	0.152 ± 0.006	0.152 ± 0.006
1-Hexene	1.886 ± 0.175	0.245 ± 0.023	0.602 ± 0.056	0.266 ± 0.025	0.304 ± 0.028	0.248 ± 0.023
n-Hexane	19.996 ± 1.706	3.732 ± 0.318	5.734 ± 0.489	8.708 ± 0.743	2.367 ± 0.202	2.679 ± 0.229
t-2-Hexene	1.942 ± 0.099	0.234 ± 0.012	0.767 ± 0.039	0.209 ± 0.011	0.237 ± 0.012	0.291 ± 0.015
2-Me-2-Pentene	1.042 ± 0.095	0.044 ± 0.004	0.041 ± 0.004	0.270 ± 0.025	0.214 ± 0.019	0.219 ± 0.020
c-3-Me-2-Pentene	0.794 ± 0.035	0.050 ± 0.002	0.079 ± 0.004	0.263 ± 0.011	0.146 ± 0.006	0.156 ± 0.007
c-3-Hexene	0.229 ± 0.012	0.029 ± 0.002	0.082 ± 0.005	0.032 ± 0.002	0.115 ± 0.006	0.046 ± 0.002
c-2-Hexene	1.023 ± 0.076	0.122 ± 0.009	0.356 ± 0.027	0.128 ± 0.010	0.121 ± 0.009	0.137 ± 0.010
t-3-Me-2-Pentene	0.318 ± 0.019	0.104 ± 0.006	0.106 ± 0.006	0.235 ± 0.014	0.216 ± 0.013	0.232 ± 0.014
MeCyPentane	13.809 ± 1.372	2.899 ± 0.288	5.103 ± 0.507	2.124 ± 0.211	1.680 ± 0.167	1.964 ± 0.195
2,4-DiMePentane	10.405 ± 0.534	1.680 ± 0.086	3.993 ± 0.205	1.265 ± 0.065	1.186 ± 0.061	1.349 ± 0.069
223TriMeButane	0.430 ± 0.039	0.086 ± 0.008	0.169 ± 0.015	0.046 ± 0.004	0.050 ± 0.005	0.067 ± 0.006
Benzene	63.746 ± 7.401	13.399 ± 1.556	16.533 ± 1.919	9.254 ± 1.074	9.177 ± 1.066	7.616 ± 0.884
CycloHexane	<28.39 ± 0.437	<5.23 ± 0.099	<10.39 ± 0.396	0.585 ± 0.059	0.705 ± 0.071	1.018 ± 0.102
4MeHexene	0.363 ± 0.059	0.043 ± 0.007	0.111 ± 0.018	0.054 ± 0.009	0.049 ± 0.008	0.042 ± 0.007
2MeHexane	18.111 ± 0.747	3.251 ± 0.134	5.126 ± 0.211	2.139 ± 0.088	2.009 ± 0.083	2.242 ± 0.092
23DiMePentane	18.054 ± 0.636	2.232 ± 0.079	5.109 ± 0.180	2.018 ± 0.071	1.817 ± 0.064	2.025 ± 0.071
3MeHexane	<24.03 ± 0.894	<4.24 ± 0.158	<6.44 ± 0.240	2.412 ± 0.102	2.231 ± 0.095	2.452 ± 0.104

Appendix B1. Chemical Composition of Dilution Blanks and Vehicle Exhaust Samples from Round1

Species Description	S7-2	S7-3	S7-4	S8-1	S8-2	S8-3
Cyclohexene	0.000 ± 0.573	0.000 ± 0.100	0.000 ± 0.161	0.092 ± 0.026	0.047 ± 0.072	0.074 ± 0.072
3EtPentane	5.116 ± 0.060	0.894 ± 0.010	1.438 ± 0.022	0.236 ± 0.000	0.639 ± 0.000	0.638 ± 0.000
* 1-Heptene	1.210 ± 4.152	0.206 ± 0.657	0.448 ± 1.258	<3.80 ± 0.000	0.000 ± 0.543	0.000 ± 0.542
* 224TrMePentane	34.007 ± 0.023	5.379 ± 0.002	10.308 ± 0.008	<3.80 ± 0.001	4.443 ± 0.001	4.441 ± 0.001
t-3-Heptene	0.629 ± 0.490	0.064 ± 0.090	0.225 ± 0.104	0.042 ± 0.061	0.032 ± 0.057	0.020 ± 0.058
n-Heptane	14.632 ± 0.009	2.691 ± 0.005	3.118 ± 0.012	1.818 ± 0.002	1.695 ± 0.006	1.728 ± 0.005
244TMe-1-Pentene	0.091 ± 0.357	0.053 ± 0.071	0.126 ± 0.098	0.019 ± 0.061	0.064 ± 0.059	0.053 ± 0.054
MeCyHexane	5.165 ± 0.552	1.027 ± 0.117	1.423 ± 0.162	0.877 ± 0.072	0.861 ± 0.071	0.786 ± 0.072
25DiMeHexane	4.726 ± 0.360	1.004 ± 0.061	1.389 ± 0.106	0.620 ± 0.035	0.606 ± 0.047	0.618 ± 0.046
24DiMeHexane	8.474 ± 0.365	1.433 ± 0.045	2.487 ± 0.088	0.813 ± 0.040	1.107 ± 0.046	1.082 ± 0.045
234TrMePentane	9.859 ± 5.793	1.218 ± 0.909	2.372 ± 1.324	1.078 ± 0.680	1.253 ± 0.717	1.217 ± 0.665
Toluene	122.604 ± 0.437	21.454 ± 0.067	31.255 ± 0.103	16.064 ± 0.036	16.925 ± 0.010	15.710 ± 0.009
23DiMeHexane	4.899 ± 0.409	0.754 ± 0.071	1.151 ± 0.106	0.399 ± 0.047	0.110 ± 0.052	0.102 ± 0.054
2MeHeptane	8.222 ± 0.353	1.429 ± 0.055	2.131 ± 0.083	0.958 ± 0.049	1.057 ± 0.034	1.084 ± 0.041
4MeHeptane	3.705 ± 0.313	0.574 ± 0.052	0.874 ± 0.078	0.518 ± 0.040	0.354 ± 0.037	0.426 ± 0.039
3MeHeptane	9.434 ± 0.044	1.567 ± 0.005	2.340 ± 0.012	1.215 ± 0.020	1.124 ± 0.001	1.170 ± 0.025
Hexanal	0.100 ± 0.006	0.000 ± 0.017	0.050 ± 0.017	0.030 ± 0.010	0.000 ± 0.013	0.000 ± 0.013
225TMHexane	4.570 ± 0.061	0.704 ± 0.004	0.887 ± 0.011	0.822 ± 0.008	0.524 ± 0.002	0.517 ± 0.002
Octene-1	0.501 ± 0.007	0.033 ± 0.001	0.089 ± 0.001	0.065 ± 0.005	0.018 ± 0.001	0.020 ± 0.001
11DMeCyHexane	0.310 ± 0.266	0.035 ± 0.048	0.053 ± 0.052	0.197 ± 0.041	0.047 ± 0.031	0.038 ± 0.034
n-Octane	6.951 ± 0.132	1.261 ± 0.015	1.367 ± 0.026	1.059 ± 0.011	0.814 ± 0.001	0.871 ± 0.001
24DiMeHeptane	1.489 ± 0.048	0.169 ± 0.008	0.295 ± 0.012	0.122 ± 0.006	0.006 ± 0.001	0.012 ± 0.001
25DiMeHeptane	2.848 ± 0.038	0.458 ± 0.003	0.737 ± 0.004	0.383 ± 0.027	0.071 ± 0.007	0.086 ± 0.009
33DiMeHeptane	0.289 ± 2.215	0.023 ± 0.308	0.031 ± 0.478	0.207 ± 0.249	0.054 ± 0.234	0.067 ± 0.288
EtBenzene	32.691 ± 5.476	4.545 ± 0.793	7.053 ± 1.040	3.674 ± 0.532	3.450 ± 0.580	4.256 ± 0.797
m/p-xylene	88.176 ± 0.033	12.778 ± 0.006	16.755 ± 0.005	8.574 ± 0.018	9.336 ± 0.002	12.837 ± 0.003
2MeOctane	1.471 ± 0.416	0.276 ± 0.068	0.204 ± 0.101	0.796 ± 0.074	0.102 ± 0.003	0.127 ± 0.003
3MeOctane	3.945 ± 0.050	0.644 ± 0.016	0.958 ± 0.008	0.701 ± 0.011	0.030 ± 0.032	0.027 ± 0.019
Styrene+heptanal	0.639 ± 1.631	0.203 ± 0.229	0.098 ± 0.288	0.138 ± 0.173	0.406 ± 0.182	0.245 ± 0.231
o-xylene	33.355 ± 0.010	4.690 ± 0.002	5.896 ± 0.002	3.539 ± 0.030	3.734 ± 0.005	4.737 ± 0.005
Nonene-1	0.210 ± 0.082	0.039 ± 0.017	0.045 ± 0.017	0.664 ± 0.016	0.101 ± 0.012	0.098 ± 0.014
n-Nonane	3.002 ± 0.118	0.642 ± 0.017	0.608 ± 0.023	0.587 ± 0.014	0.441 ± 0.006	0.500 ± 0.013
iPropBenzene	2.404 ± 0.052	0.347 ± 0.010	0.465 ± 0.013	0.284 ± 0.002	0.122 ± 0.013	0.272 ± 0.002
iPropCyHexane	0.428 ± 0.024	0.081 ± 0.004	0.108 ± 0.008	0.020 ± 0.019	0.110 ± 0.008	0.017 ± 0.006
26DiMeOctane	0.226 ± 0.375	0.036 ± 0.279	0.079 ± 0.113	0.178 ± 0.020	0.076 ± 0.012	0.058 ± 0.011
alpha-pinene	1.128 ± 0.405	0.840 ± 0.057	0.341 ± 0.073	0.060 ± 0.051	0.035 ± 0.072	0.033 ± 0.085
nPropBenzene	6.048 ± 0.655	0.853 ± 0.101	1.090 ± 0.112	0.765 ± 0.071	1.072 ± 0.110	1.276 ± 0.147
mEtToluene	22.303 ± 0.374	3.445 ± 0.064	3.826 ± 0.064	2.429 ± 0.043	3.742 ± 0.069	5.011 ± 0.090
pEtToluene	9.337 ± 0.418	1.589 ± 0.071	1.599 ± 0.071	1.067 ± 0.039	1.714 ± 0.086	2.254 ± 0.115
135TriMeBenzene	9.766 ± 0.344	1.662 ± 0.053	1.652 ± 0.054	0.899 ± 0.042	2.013 ± 0.067	2.679 ± 0.078
oEtToluene	7.920 ± 0.091	1.224 ± 0.006	1.252 ± 0.021	0.962 ± 0.026	1.539 ± 0.032	1.786 ± 0.014
Octanal	0.224 ± 0.014	0.015 ± 0.003	0.052 ± 0.006	0.064 ± 0.001	0.079 ± 0.002	0.036 ± 0.008
beta-pinene	0.207 ± 1.290	0.042 ± 0.228	0.095 ± 0.182	0.014 ± 0.119	0.036 ± 0.233	0.128 ± 0.361
* 124TriMeBenzene	28.536 ± 0.142	5.037 ± 0.031	4.037 ± 0.039	<2.64 ± 0.271	5.160 ± 0.051	7.970 ± 0.039
* n-Decane	1.469 ± 0.031	0.327 ± 0.006	0.403 ± 0.007	<2.64 ± 0.003	0.526 ± 0.002	0.406 ± 0.007
iButBenzene	0.644 ± 0.028	0.115 ± 0.005	0.149 ± 0.006	0.054 ± 0.003	0.052 ± 0.007	0.138 ± 0.006
sButBenzene	0.498 ± 0.671	0.088 ± 0.129	0.106 ± 0.097	0.053 ± 0.035	0.135 ± 0.127	0.112 ± 0.184
Limonene	<6.48 ± 0.102	<1.25 ± 0.020	<0.94 ± 0.000	0.342 ± 0.009	1.231 ± 0.002	1.775 ± 0.001
Indan	<3.05 ± 0.191	<0.52 ± 0.040	<0.61 ± 0.034	0.155 ± 0.056	0.644 ± 0.049	0.809 ± 0.078
13diethylbenzene	1.906 ± 0.067	0.402 ± 0.014	0.341 ± 0.012	0.557 ± 0.020	0.487 ± 0.017	0.784 ± 0.028
14diethylbenzene	0.712 ± 0.065	0.176 ± 0.016	0.197 ± 0.018	0.051 ± 0.005	0.303 ± 0.028	0.461 ± 0.042
12diethylbenzene	0.549 ± 0.057	0.113 ± 0.012	0.154 ± 0.016	0.031 ± 0.003	0.198 ± 0.021	0.147 ± 0.015
2-propylToluene	1.283 ± 0.042	0.278 ± 0.009	0.217 ± 0.007	0.089 ± 0.003	0.315 ± 0.010	0.570 ± 0.019
3-ipropyltoluene	0.897 ± 0.044	0.173 ± 0.008	0.143 ± 0.007	0.115 ± 0.006	0.084 ± 0.004	0.060 ± 0.003
4-ipropyltoluene	0.121 ± 0.037	0.032 ± 0.010	0.012 ± 0.004	0.025 ± 0.007	0.126 ± 0.038	0.128 ± 0.039
2-ipropyltoluene	<3.05 ± 0.621	<0.52 ± 0.107	<0.61 ± 0.125	0.034 ± 0.007	0.107 ± 0.021	0.094 ± 0.019
Nonanal	4.236 ± 0.689	1.188 ± 0.193	0.570 ± 0.093	0.072 ± 0.012	0.594 ± 0.097	1.410 ± 0.229
n-Undecane	0.522 ± 0.062	0.140 ± 0.017	0.211 ± 0.025	0.158 ± 0.019	0.384 ± 0.045	0.336 ± 0.040
1245tetraMeBenzene	1.317 ± 0.091	0.526 ± 0.036	0.156 ± 0.011	0.129 ± 0.009	0.374 ± 0.026	1.015 ± 0.070
1235tetraMeBenzene	1.674 ± 0.031	0.710 ± 0.013	0.194 ± 0.004	0.171 ± 0.003	0.522 ± 0.010	1.480 ± 0.027
1234tetraMeBenzene	0.390 ± 0.070	0.248 ± 0.044	0.070 ± 0.012	0.176 ± 0.031	0.147 ± 0.026	0.182 ± 0.032
n-Dodecane	0.533 ± 0.064	0.320 ± 0.038	0.220 ± 0.027	0.862 ± 0.103	0.178 ± 0.021	0.277 ± 0.033

Appendix B2. Chemical Composition of Dilution Blanks and Vehicle Exhaust Samples from Round2

Species Description	W0-1	W0-2	W0-3	W0-4	W0-5	W0-6	W1-1	W1-2	W1-3	W2-1	W2-2	W2-3
Gravimetric mass (mg/mi)	0.85 ± 0.06	0.27 ± 0.08	0.50 ± 0.06	0.39 ± 0.06	0.90 ± 0.07	0.45 ± 0.06	113.12 ± 5.66	43.21 ± 2.17	59.60 ± 2.99	52.30 ± 2.63	15.30 ± 0.80	5.98 ± 0.32
Carbon fractions by TOR (mg/mi)												
Organic Carbon Fraction 1	0.297 ± 0.035	0.330 ± 0.054	0.380 ± 0.044	0.333 ± 0.040	0.432 ± 0.047	0.370 ± 0.043	30.315 ± 3.862	19.243 ± 2.447	13.521 ± 1.848	11.534 ± 1.330	1.673 ± 0.220	0.739 ± 0.073
Organic Carbon Fraction 2	0.152 ± 0.019	0.139 ± 0.028	0.126 ± 0.019	0.178 ± 0.024	0.158 ± 0.022	0.151 ± 0.021	32.806 ± 4.713	6.533 ± 0.973	12.019 ± 2.088	9.862 ± 1.459	1.198 ± 0.190	0.516 ± 0.048
Organic Carbon Fraction 3	0.177 ± 0.039	0.161 ± 0.058	0.110 ± 0.037	0.161 ± 0.043	0.138 ± 0.042	0.131 ± 0.038	6.667 ± 1.498	2.070 ± 0.492	5.339 ± 1.370	2.920 ± 0.708	0.987 ± 0.289	0.599 ± 0.094
Organic Carbon Fraction 4	0.059 ± 0.032	0.026 ± 0.048	0.037 ± 0.035	0.034 ± 0.034	0.101 ± 0.040	0.041 ± 0.034	4.799 ± 1.228	0.886 ± 0.247	3.168 ± 0.810	1.375 ± 0.359	0.812 ± 0.273	0.601 ± 0.119
Pyrolyzed Organic Carbon	0.000 ± 0.005	0.000 ± 0.009	0.000 ± 0.006	0.004 ± 0.006	0.070 ± 0.025	0.009 ± 0.007	0.370 ± 0.130	2.526 ± 0.888	0.040 ± 0.030	0.004 ± 0.027	0.133 ± 0.054	0.071 ± 0.022
Total Organic Carbon	0.684 ± 0.062	0.655 ± 0.088	0.645 ± 0.066	0.710 ± 0.068	0.900 ± 0.078	0.702 ± 0.068	74.958 ± 5.708	31.258 ± 2.533	34.087 ± 2.917	25.693 ± 1.956	4.795 ± 0.439	2.503 ± 0.176
Elemental Carbon Fraction 1	0.059 ± 0.018	0.014 ± 0.024	0.078 ± 0.026	0.045 ± 0.021	0.156 ± 0.036	0.068 ± 0.023	7.742 ± 1.999	1.609 ± 0.397	4.826 ± 1.026	5.015 ± 1.247	0.811 ± 0.225	1.257 ± 0.200
Elemental Carbon Fraction 2	0.084 ± 0.022	0.028 ± 0.032	0.059 ± 0.024	0.040 ± 0.023	0.085 ± 0.025	0.043 ± 0.023	6.666 ± 1.123	10.889 ± 2.025	6.633 ± 0.941	17.759 ± 3.283	2.840 ± 0.435	1.436 ± 0.146
Elemental Carbon Fraction 3	0.000 ± 0.002	0.000 ± 0.003	0.024 ± 0.020	0.000 ± 0.002	0.000 ± 0.002	0.000 ± 0.002	0.059 ± 0.049	0.035 ± 0.026	0.170 ± 0.103	0.075 ± 0.047	0.063 ± 0.036	0.039 ± 0.016
Total Elemental Carbon	0.143 ± 0.039	0.035 ± 0.053	0.160 ± 0.047	0.080 ± 0.040	0.171 ± 0.046	0.102 ± 0.041	14.094 ± 2.406	10.008 ± 2.132	11.589 ± 1.939	22.844 ± 4.953	3.580 ± 0.654	2.660 ± 0.285
Total Carbon	0.827 ± 0.080	0.687 ± 0.112	0.802 ± 0.087	0.788 ± 0.085	1.070 ± 0.096	0.804 ± 0.086	89.053 ± 6.078	41.266 ± 3.021	45.677 ± 3.317	48.538 ± 3.443	8.381 ± 0.660	5.158 ± 0.320
Elements by XRF (mg/mi)												
Sodium (qualitative only)	0.0014 ± 0.0064	0.0048 ± 0.0103	0.0057 ± 0.0075	0.0072 ± 0.0073	0.0012 ± 0.0070	0.0000 ± 0.0073	0.1497 ± 0.0394	0.0044 ± 0.0330	0.0067 ± 0.0341	0.0000 ± 0.0324	0.0798 ± 0.0343	0.0093 ± 0.0149
Magnesium (qualitative only)	0.0005 ± 0.0064	0.0008 ± 0.0102	0.0002 ± 0.0074	0.0012 ± 0.0072	0.0041 ± 0.0070	0.0022 ± 0.0073	0.0323 ± 0.0366	0.0000 ± 0.0324	0.0112 ± 0.0337	0.0000 ± 0.0323	0.0026 ± 0.0328	0.0059 ± 0.0147
Aluminum	0.0006 ± 0.0043	0.0000 ± 0.0069	0.0015 ± 0.0050	0.0020 ± 0.0049	0.0034 ± 0.0047	0.0013 ± 0.0049	0.0884 ± 0.0253	0.0520 ± 0.0223	0.3477 ± 0.0296	0.0151 ± 0.0220	0.0878 ± 0.0229	0.0180 ± 0.0100
Silicon	0.0091 ± 0.0022	0.0042 ± 0.0033	0.0093 ± 0.0025	0.0045 ± 0.0024	0.0256 ± 0.0027	0.0076 ± 0.0024	0.3956 ± 0.0252	0.4679 ± 0.0276	4.1770 ± 0.2194	0.1465 ± 0.0136	0.9915 ± 0.0538	0.0717 ± 0.0061
Phosphorous	0.0019 ± 0.0004	0.0010 ± 0.0006	0.0019 ± 0.0005	0.0016 ± 0.0005	0.0052 ± 0.0005	0.0016 ± 0.0005	0.2364 ± 0.0122	0.0641 ± 0.0039	0.0572 ± 0.0036	0.0211 ± 0.0023	0.0811 ± 0.0046	0.0250 ± 0.0016
Sulfur	0.0121 ± 0.0010	0.0090 ± 0.0013	0.0119 ± 0.0010	0.0119 ± 0.0010	0.0298 ± 0.0017	0.0103 ± 0.0010	2.8849 ± 0.1469	0.4669 ± 0.0240	0.6226 ± 0.0318	0.1011 ± 0.0063	1.3880 ± 0.0702	0.1161 ± 0.0061
Chlorine	0.0010 ± 0.0004	0.0000 ± 0.0006	0.0006 ± 0.0004	0.0002 ± 0.0004	0.0021 ± 0.0004	0.0001 ± 0.0004	0.0304 ± 0.0026	0.0118 ± 0.0019	0.0558 ± 0.0034	0.0111 ± 0.0019	0.0151 ± 0.0020	0.0153 ± 0.0011
Potassium	0.0006 ± 0.0006	0.0000 ± 0.0009	0.0006 ± 0.0007	0.0007 ± 0.0007	0.0010 ± 0.0006	0.0009 ± 0.0007	0.0076 ± 0.0034	0.0002 ± 0.0030	0.0027 ± 0.0031	0.0022 ± 0.0030	0.0000 ± 0.0031	0.0033 ± 0.0014
Calcium	0.0103 ± 0.0006	0.0081 ± 0.0007	0.0122 ± 0.0008	0.0081 ± 0.0006	0.0236 ± 0.0013	0.0092 ± 0.0006	0.1876 ± 0.0097	0.1276 ± 0.0067	0.1277 ± 0.0068	0.0650 ± 0.0038	0.0686 ± 0.0040	0.0721 ± 0.0037
Titanium	0.0000 ± 0.0002	0.0000 ± 0.0003	0.0001 ± 0.0002	0.0002 ± 0.0002	0.0003 ± 0.0002	0.0002 ± 0.0002	0.0019 ± 0.0012	0.0004 ± 0.0010	0.0014 ± 0.0011	0.0019 ± 0.0010	0.0003 ± 0.0011	0.0008 ± 0.0005
Vanadium	0.0000 ± 0.0001	0.0001 ± 0.0001	0.0000 ± 0.0001	0.0000 ± 0.0001	0.0000 ± 0.0001	0.0001 ± 0.0001	0.0001 ± 0.0005	0.0000 ± 0.0004	0.0004 ± 0.0004	0.0002 ± 0.0004	0.0002 ± 0.0004	0.0002 ± 0.0002
Chromium	0.0010 ± 0.0003	0.0004 ± 0.0005	0.0007 ± 0.0004	0.0006 ± 0.0004	0.0020 ± 0.0004	0.0007 ± 0.0004	0.0170 ± 0.0020	0.0023 ± 0.0016	0.0088 ± 0.0018	0.0032 ± 0.0016	0.0025 ± 0.0017	0.0069 ± 0.0008
Manganese	0.0001 ± 0.0009	0.0000 ± 0.0014	0.0003 ± 0.0011	0.0003 ± 0.0010	0.0003 ± 0.0010	0.0001 ± 0.0010	0.0057 ± 0.0052	0.0004 ± 0.0046	0.0062 ± 0.0048	0.0006 ± 0.0046	0.0000 ± 0.0047	0.0010 ± 0.0021
Iron	0.0132 ± 0.0015	0.0064 ± 0.0022	0.0217 ± 0.0019	0.0103 ± 0.0016	0.0626 ± 0.0035	0.0274 ± 0.0021	0.6778 ± 0.0352	0.1231 ± 0.0094	0.4376 ± 0.0233	0.0430 ± 0.0073	0.0356 ± 0.0073	0.0922 ± 0.0056
Cobalt	0.0000 ± 0.0002	0.0001 ± 0.0002	0.0000 ± 0.0002	0.0001 ± 0.0002	0.0000 ± 0.0002	0.0000 ± 0.0002	0.0001 ± 0.0009	0.0001 ± 0.0008	0.0004 ± 0.0008	0.0000 ± 0.0008	0.0000 ± 0.0008	0.0002 ± 0.0004
Nickel	0.0001 ± 0.0002	0.0004 ± 0.0004	0.0004 ± 0.0003	0.0002 ± 0.0003	0.0004 ± 0.0003	0.0003 ± 0.0003	0.0037 ± 0.0014	0.0011 ± 0.0012	0.0032 ± 0.0013	0.0005 ± 0.0012	0.0007 ± 0.0012	0.0022 ± 0.0006
Copper	0.0008 ± 0.0002	0.0003 ± 0.0003	0.0009 ± 0.0003	0.0013 ± 0.0003	0.0013 ± 0.0002	0.0003 ± 0.0002	0.0118 ± 0.0014	0.0013 ± 0.0011	0.0129 ± 0.0013	0.0026 ± 0.0011	0.0015 ± 0.0011	0.0056 ± 0.0006
Zinc	0.0051 ± 0.0007	0.0015 ± 0.0010	0.0045 ± 0.0007	0.0044 ± 0.0007	0.0081 ± 0.0008	0.0025 ± 0.0007	0.1230 ± 0.0071	0.0295 ± 0.0034	0.0594 ± 0.0044	0.0240 ± 0.0033	0.0281 ± 0.0034	0.0345 ± 0.0022
Gallium	0.0005 ± 0.0008	0.0000 ± 0.0013	0.0001 ± 0.0009	0.0001 ± 0.0009	0.0008 ± 0.0009	0.0007 ± 0.0009	0.0000 ± 0.0045	0.0016 ± 0.0040	0.0012 ± 0.0042	0.0000 ± 0.0040	0.0002 ± 0.0041	0.0006 ± 0.0018
Arsenic	0.0000 ± 0.0002	0.0000 ± 0.0003	0.0000 ± 0.0002	0.0000 ± 0.0002	0.0000 ± 0.0002	0.0000 ± 0.0002	0.0051 ± 0.0013	0.0000 ± 0.0011	0.0005 ± 0.0011	0.0000 ± 0.0011	0.0000 ± 0.0011	0.0002 ± 0.0005
Selenium	0.0000 ± 0.0002	0.0000 ± 0.0003	0.0000 ± 0.0002	0.0000 ± 0.0002	0.0000 ± 0.0002	0.0000 ± 0.0002	0.0000 ± 0.0010	0.0000 ± 0.0009	0.0000 ± 0.0009	0.0000 ± 0.0009	0.0000 ± 0.0009	0.0000 ± 0.0004
Bromine	0.0001 ± 0.0002	0.0003 ± 0.0004	0.0000 ± 0.0003	0.0002 ± 0.0003	0.0002 ± 0.0003	0.0002 ± 0.0003	0.0509 ± 0.0029	0.0154 ± 0.0014	0.0164 ± 0.0015	0.0021 ± 0.0012	0.0004 ± 0.0012	0.0005 ± 0.0005
Rubidium	0.0000 ± 0.0002	0.0000 ± 0.0003	0.0002 ± 0.0003	0.0000 ± 0.0002	0.0000 ± 0.0002	0.0000 ± 0.0002	0.0001 ± 0.0013	0.0004 ± 0.0011	0.0001 ± 0.0012	0.0000 ± 0.0011	0.0006 ± 0.0011	0.0002 ± 0.0005
Strontium	0.0001 ± 0.0005	0.0003 ± 0.0007	0.0006 ± 0.0005	0.0003 ± 0.0005	0.0001 ± 0.0005	0.0004 ± 0.0005	0.0002 ± 0.0026	0.0007 ± 0.0023	0.0009 ± 0.0024	0.0004 ± 0.0023	0.0002 ± 0.0023	0.0004 ± 0.0010
Yttrium	0.0001 ± 0.0003	0.0000 ± 0.0005	0.0000 ± 0.0003	0.0001 ± 0.0003	0.0000 ± 0.0003	0.0000 ± 0.0003	0.0000 ± 0.0017	0.0004 ± 0.0015	0.0000 ± 0.0015	0.0000 ± 0.0015	0.0002 ± 0.0015	0.0004 ± 0.0007
Zirconium	0.0004 ± 0.0006	0.0000 ± 0.0010	0.0000 ± 0.0007	0.0000 ± 0.0007	0.0006 ± 0.0007	0.0012 ± 0.0007	0.0000 ± 0.0035	0.0014 ± 0.0031	0.0000 ± 0.0032	0.0007 ± 0.0031	0.0000 ± 0.0032	0.0019 ± 0.0014
Molybdenum	0.0001 ± 0.0007	0.0000 ± 0.0011	0.0002 ± 0.0008	0.0000 ± 0.0008	0.0003 ± 0.0008	0.0002 ± 0.0008	0.0027 ± 0.0040	0.0002 ± 0.0036	0.0005 ± 0.0037	0.0002 ± 0.0036	0.0022 ± 0.0037	0.0015 ± 0.0016
Palladium	0.0001 ± 0.0009	0.0012 ± 0.0014	0.0002 ± 0.0010	0.0010 ± 0.0010	0.0011 ± 0.0010	0.0012 ± 0.0010	0.0025 ± 0.0050	0.0008 ± 0.0045	0.0044 ± 0.0047	0.0029 ± 0.0045	0.0009 ± 0.0045	0.0033 ± 0.0020
Silver	0.0006 ± 0.0007	0.0000 ± 0.0011	0.0005 ± 0.0008	0.0005 ± 0.0008	0.0007 ± 0.0007	0.0011 ± 0.0008	0.0022 ± 0.0039	0.0000 ± 0.0035	0.0017 ± 0.0036	0.0014 ± 0.0034	0.0009 ± 0.0035	0.0003 ± 0.0016
Cadmium	0.0000 ± 0.0009	0.0000 ± 0.0015	0.0006 ± 0.0011	0.0000 ± 0.0010	0.0001 ± 0.0010	0.0000 ± 0.0011	0.0000 ± 0.0053	0.0000 ± 0.0048	0.0000 ± 0.0049	0.0000 ± 0.0047	0.0028 ± 0.0048	0.0004 ± 0.0022
Indium	0.0000 ± 0.0007	0.0000 ± 0.0012	0.0000 ± 0.0008	0.0001 ± 0.0008	0.0001 ± 0.0008	0.0005 ± 0.0008	0.0000 ± 0.0042	0.0008 ± 0.0037	0.0000 ± 0.0039	0.0023 ± 0.0037	0.0017 ± 0.0038	0.0007 ± 0.0017
Tin	0.0010 ± 0.0009	0.0009 ± 0.0014	0.0001 ± 0.0010	0.0003 ± 0.0010	0.0000 ± 0.0010	0.0004 ± 0.0010	0.0011 ± 0.0051	0.0002 ± 0.0045	0.0000 ± 0.0047	0.0075 ± 0.0045	0.0000 ± 0.0046	0.0032 ± 0.0021
Antimony	0.0000 ± 0.0009	0.0005 ± 0.0014	0.0004 ± 0.0010	0.0005 ± 0.0010	0.0002 ± 0.0010	0.0008 ± 0.0010	0.0028 ± 0.0051	0.0024 ± 0.0046	0.0026 ± 0.0048	0.0008 ± 0.0046	0.0000 ± 0.0046	0.0023 ± 0.0021
Barium	0.0026 ± 0.0021	0.0005 ± 0.0033	0.0004 ± 0.0024	0.0005 ± 0.0024	0.0000 ± 0.0023	0.0014 ± 0.0024	0.0054 ± 0.0120	0.0000 ± 0.0107	0.0068 ± 0.0111	0.0102 ± 0.0107	0.0043 ± 0.0108	0.0070 ± 0.0049
Lanthanum	0.0012 ± 0.0050	0.0000 ± 0.0080	0.0020 ± 0.0058	0.0000 ± 0.0056	0.0005 ± 0.0055	0.0000 ± 0.0057	0.0055 ± 0.0286	0.0089 ± 0.0256	0.0059 ± 0.0264	0.0110 ± 0.0255	0.0000 ± 0.0258	0.0057 ± 0.0116
Gold	0.0000 ± 0.0010	0.0014 ± 0.0015	0.0003 ± 0.0011	0.0004 ± 0.0011	0.0005 ± 0.0011	0.0005 ± 0.0011	0.0002 ± 0.0055	0.0000 ± 0.0049	0.0000 ± 0.0051	0.0029 ± 0.0049	0.0000 ± 0.0050	0.0008 ± 0.0022
Mercury	0.0000 ± 0.0004	0.0000 ± 0.0006	0.0002 ± 0.0004	0.0003 ± 0.0004	0.0002 ± 0.0004	0.0004 ± 0.0004	0.0004 ± 0.0021	0.0000 ± 0.0019	0.0000 ± 0.0019	0.0000 ± 0.0019	0.0000 ± 0.0019	0.0003 ± 0.0009
Thallium	0.0002 ± 0.0007	0.0000 ± 0.0011	0.0001 ± 0.0008	0.0000 ± 0.0008	0.0000 ± 0.0007	0.0001 ± 0.0008	0.0001 ± 0.0039	0.0000 ± 0.0035	0.0000 ± 0.0036	0.0018 ± 0.0035	0.0003 ± 0.0035	0.0001 ± 0.0016
Lead	0.0004 ± 0.0007	0.0002 ± 0.0010	0.0007 ± 0.0008	0.0003 ± 0.0007	0.0014 ± 0.0007	0.0004 ± 0.0007	0.0684 ± 0.0051	0.0048 ± 0.0033	0.0457 ± 0.0042	0.0082 ± 0.0033	0.0003 ± 0.0034	0.0024 ± 0.0015
Uranium	0.0000 ± 0.0009	0.0005 ± 0.0014	0.0000 ± 0.0010	0.0004 ± 0.0010	0.0000 ± 0.0010	0.0000 ± 0.0010	0.0026 ± 0.0052	0.0006 ± 0.0046	0.0000 ± 0.0048	0.0033 ± 0.0046	0.0013 ± 0.0047	0.0002 ± 0.0021
Anions by IC (mg/mi)												
Nitrate Ion	0.01 ± 0.00	0.01 ± 0.00	0.01 ± 0.00	0.01 ± 0.00	0.01 ± 0.00	0.00 ± 0.00	0.07 ± 0.01	0.02 ± 0.01	0.03 ± 0.01	0.01 ± 0.01	0.02 ± 0.01	0.02 ± 0.00
Sulfate Ion	0.03 ± 0.00	0.03 ± 0.00	0.03 ± 0.00	0.03 ± 0.00	0.05 ± 0.00	0.02 ± 0.00	8.40 ± 0.45	0.98 ± 0.05	1.11 ± 0.06	0.12 ± 0.01	2.13 ± 0.11	0.25 ± 0.01
Polycyclic aromatic hydrocarbons (ug/mile)												
Naphthalene	51.40 ± 10.19	80.89 ± 14.99	49.75 ± 10.12	123.92 ± 21.34	64.48 ± 12.34	37.62 ± 8.28	4081.51 ± 627.38	5910.91 ± 910.03	4700.21 ± 721.41	5290.14 ± 813.27	2007.10 ± 311.76	5865.27 ± 902.14
2-methylnaphthalene	55.38 ± 5.78	109.34 ± 11.39	71.23 ± 7.43	136.98 ± 14.09	87.69 ± 9.09	59.95 ± 6.26	9410.47 ± 956.87	12495.84 ± 1280.70	16274.70 ± 1652.13	18396.17 ± 1875.71	1686.84 ± 173.50	11540.78 ± 1179.57
1-methylnaphthalene	24.78 ± 2.80	47.01 ± 5.25	29.01 ± 3.27	57.50 ± 6.33	37.04 ± 4.13	25.62 ± 2.89	5346.25 ± 577.52	6622.75 ± 720.47	9824.14 ± 1059.65	10660.97 ± 1154.41	764.52 ± 83.51	5654.05 ± 613.61
Biphenyl	2.87 ± 0.41	4.76 ± 0.67	2.97 ± 0.43	4.68 ± 0.64	3.80 ± 0.54	2.74 ± 0.40	589.43 ± 75.66	467.30 ± 60.30	750.63 ± 96.24	980.79 ± 126.09	48.83 ± 6.38	414.04 ± 53.35
1+2ethylnaphthalene	20.89 ± 3.03	24.16 ± 3.50	10.24 ± 1.59	15.01 ± 2.24	16.23 ± 2.41	15.31 ± 2.28	1217.18 ± 166.27	1439.55 ± 197.47	1964.00 ± 267.90	2213.12 ± 302.60	185.05 ± 25.65	997.31 ± 136.70
2,6+2,7-dimethylnaphthalene	8.22 ± 1.04	11.69 ± 1.50	7.88 ± 1.01	13.20 ± 1.64	9.86 ± 1.24	6.59 ± 0.86	1396.61 ± 167.69	1156.44 ± 139.68	2283.57 ± 273.84	2525.65 ± 303.83	177.23 ± 21.52	992.13 ± 119.61
1,3+1,6+1,7dimethylnaphth	13.28 ± 1.70	18.71 ± 2.42	12.10 ± 1.58	20.74 ± 2.61	15.23 ± 1.95	9.92 ± 1.31	2129.17 ± 257.46	1682.82 ± 204.69	3303.98 ± 399.00	3731.02 ± 451.96	281.50 ± 34.43	1379.09 ± 167.45
1,4+1,5+2,3-dimethylnaphth	0.89 ± 0.34	3.66 ± 0.83	1.87 ± 0.46	1.88 ± 0.46	0.58 ± 0.40	1.03 ± 0.42	585.96 ± 68.46	362.92 ± 42.70	778.60 ± 90.85	586.16 ± 68.65	28.08 ± 3.63	264.79 ± 31.12
1,2-dimethylnaphthalene	1.32 ± 0.27	1.88 ± 0.50	1.44 ± 0.31	2.17 ± 0.38	1.63 ± 0.33	1.00 ± 0.28	1090.95 ± 145.82	551.67 ± 74.09	1260.23 ± 168.31	1568.63 ± 210.03	32.43 ± 4.46	955.66 ± 128.14
2-Methylbiphenyl	0.00 ± 16.31	55.40 ± 25.35	0.00 ± 11.29	0.00 ± 10.87	0.00 ± 13.34	0.00 ± 11.03	0.00 ± 25.99	0.00 ± 23.19	0.00 ± 26.09	45.40 ± 35.31	0.00 ± 26.09	0.00 ± 25.43
3-Methylbiphenyl	0.00 ± 3.85	25.51 ± 7.26	0.00 ± 3.11	0.00 ± 2.98	0.00 ± 3.84	0.00 ± 2.91	247.43 ± 30.39	94.05 ± 15.59	288.56 ± 34.37	460.76 ± 52.02	0.00 ± 7.58	114.80 ± 17.92
4-Methylbiphenyl	0.00 ± 1.37	7.31 ± 2.45	0.00 ± 1.17	0.00 ± 1.11	0.00 ± 1.32	0.00 ± 1.10	132.75 ± 14.09	46.04 ± 6.42	139.50 ± 14.66	218.78 ± 22.08	2.48 ± 3.06	46.04 ± 6.55
Dibenzofuran	1.29 ± 0.15	1.16 ± 0.15	0.90 ± 0.11	1.52 ± 0.18	0.00 ± 0.04	0.00 ± 0.04	51.04 ± 5.65	52.10 ± 5.81	53.73 ± 5.94	50.78 ± 5.64	11.30 ± 1.28	45.47 ± 5.06
A-trimethylnaphthalene	1.65 ± 0.15	2.04 ± 0.20	1.33 ± 0.13	2.30 ± 0.21	1.58 ± 0.15	1.06 ± 0.11	240.31 ± 21.07	156.27 ± 13.85	338.39 ± 29.61	326.42 ± 28.73	27.34 ± 2.45	118.98 ± 10.51
1-ethyl-2-methylnaphthalene	0.31 ± 0.04	0.38 ± 0.07	0.27 ± 0.04	0.46 ± 0.05	0.33 ± 0.04	0.20 ± 0.04	47.68 ± 3.65	29.19 ± 2.27	61.26 ± 4.68	54.17 ± 4.17	5.20 ± 0.43	21.61 ± 1.67
B-trimethylnaphthalene	2.22 ± 0.34	1.97 ± 0.32	1.36 ± 0.23	2.44 ± 0.38	1.91 ± 0.30	1.19 ± 0.20	174.90 ± 25.29	79.22 ± 11.52	255.01 ± 36.82	410.19 ± 59.34	25.38 ± 3.73	133.32 ± 19.34
C-trimethylnaphthalene	1.71 ± 0.15	1.80 ± 0.17	1.19 ± 0.11	1.84 ± 0.16	1.52 ± 0.13	0.86 ± 0.08	184.48 ± 14.76	86.46 ± 7.02	235.86 ± 18.83	222.65 ± 17.90	20.23 ± 1.66	81.80 ± 6.61
2-ethyl-1-methylnaphthalene	0.02 ± 0.03	0.03 ± 0.07	0.01 ± 0.04	0.03 ± 0.04	0.04 ± 0.04	0.02 ± 0.04	5.57 ± 0.73	3.37 ± 0.46	7.73 ± 1.00	6.47 ± 0.85	0.49 ± 0.14	2.66 ± 0.37
E-trimethylnaphthalene	0.92 ± 0.09	1.00 ± 0.12	0.67 ± 0.08	1.17 ± 0.12	0.89 ± 0.09	0.53 ± 0.07	137.40 ± 12.35	54.31 ± 4.94	162.67 ± 14.59	148.98 ± 13.44	11.44 ± 1.06	53.35 ± 4.84
F-trimethylnaphthalene	1.01 ± 0.12	1.10 ± 0.15	0.72 ± 0.09	1.19 ± 0.14	0.96 ± 0.12	0.56 ± 0.08	112.28 ± 12.31	52.58 ± 5.81	144.41 ± 15.80	135.59 ± 14.90	13.29 ± 1.49	51.64 ± 5.69
2,3,5+I-trimethylnaphthalene	1.32 ± 0.16	1.36 ± 0.18	0.94 ± 0.12	1.54 ± 0.18	1.19 ± 0.15	0.64 ± 0.09	141.28 ± 15.64	62.35 ± 6.96	171.02 ± 18.91	160.59 ± 17.82	13.93 ± 1.58	61.74 ± 6.88
2,4,5-trimethylnaphthalene	0.26 ± 0.05	0.25 ± 0.08	0.10 ± 0.04	0.22 ± 0.05	0.20 ± 0.05	0.15 ± 0.04	29.15 ± 4.31	12.75 ± 1.91	30.19 ± 4.47	24.81 ± 3.68	1.84 ± 0.31	9.46 ± 1.42
J-trimethylnaphthalene	0.31 ± 0.05	0.16 ± 0.07	0.21 ± 0.04	0.35 ± 0.06	0.09 ± 0.04	0.06 ± 0.04	68.65 ± 7.90	26.42 ± 3.07	74.02 ± 8.51	87.29 ± 10.08	3.19 ± 0.40	24.31 ± 2.82
1,4,5-trimethylnaphthalene	0.03 ± 0.03	0.11 ± 0.07	0.03 ± 0.04	0.08 ± 0.04	0.10 ± 0.05	0.03 ± 0.04	26.37 ± 4.30	11.35 ± 1.87	28.71 ± 4.68	26.74 ± 4.37	1.46 ± 0.29	8.50 ± 1.41
Acenaphthylene	2.16 ± 0.31	5.40 ± 0.73	5.61 ± 0.66	4.96 ± 0.59	3.82 ± 0.48	1.41 ± 0.29	477.44 ± 51.17	260.61 ± 28.15	462.42 ± 49.50	653.11 ± 70.17	66.40 ± 7.25	1426.55 ± 153.56
Acenaphthene	1.27 ± 0.53	0.00 ± 0.38	0.00 ± 0.41	0.00 ± 0.39	0.00 ± 0.26	0.00 ± 0.27	57.97 ± 5.31	358.67 ± 30.49	77.35 ± 6.88	82.10 ± 7.35	16.64 ± 2.03	57.19 ± 5.31
Fluorene	3.65 ± 0.38	3.16 ± 0.35	1.92 ± 0.21	3.42 ± 0.36	3.53 ± 0.38	2.31 ± 0.25	256.67 ± 26.32	189.69 ± 19.62	290.88 ± 29.78	458.55 ± 47.11	55.02 ± 5.74	336.73 ± 34.69

Appendix B2. Chemical Composition of Dilution Blanks and Vehicle Exhaust Samples from Round2

Species Description	W0-1	W0-2	W0-3	W0-4	W0-5	W0-6	W1-1	W1-2	W1-3	W2-1	W2-2	W2-3
Dibenzothiophene	0.17 ± 0.04	0.17 ± 0.07	0.15 ± 0.04	0.21 ± 0.05	0.17 ± 0.04	0.07 ± 0.04	7.88 ± 0.95	5.43 ± 0.66	6.80 ± 0.82	6.41 ± 0.78	1.31 ± 0.21	5.14 ± 0.63
Phenanthrene	14.66 ± 1.64	11.84 ± 1.36	8.16 ± 0.96	14.76 ± 1.66	11.59 ± 1.33	8.15 ± 0.96	877.20 ± 93.45	536.59 ± 57.64	741.64 ± 78.93	1466.54 ± 156.57	111.00 ± 12.05	908.52 ± 97.25
Anthracene	0.01 ± 0.02	1.79 ± 0.26	0.97 ± 0.14	0.71 ± 0.11	0.96 ± 0.14	1.48 ± 0.21	217.94 ± 29.59	124.71 ± 17.01	197.89 ± 26.84	454.31 ± 61.75	13.84 ± 1.90	196.90 ± 26.81
A-methylfluorene	1.40 ± 0.17	1.36 ± 0.18	0.71 ± 0.10	1.59 ± 0.19	1.46 ± 0.18	0.58 ± 0.09	132.39 ± 14.36	55.35 ± 6.07	141.57 ± 15.34	119.47 ± 13.01	16.16 ± 1.80	55.84 ± 6.11
1-methylfluorene	0.98 ± 0.13	1.05 ± 0.15	0.67 ± 0.09	1.28 ± 0.16	1.01 ± 0.13	0.44 ± 0.07	68.03 ± 7.81	36.27 ± 4.20	74.95 ± 8.60	72.59 ± 8.36	12.07 ± 1.42	35.91 ± 4.16
B-methylfluorene	0.30 ± 0.07	0.31 ± 0.09	0.20 ± 0.06	0.42 ± 0.08	0.22 ± 0.06	0.18 ± 0.05	25.52 ± 4.76	12.09 ± 2.27	36.01 ± 6.71	20.98 ± 3.93	4.71 ± 0.91	12.31 ± 2.31
9-fluorenone	0.00 ± 0.07	0.00 ± 0.08	2.58 ± 0.33	0.64 ± 0.14	0.00 ± 0.06	0.08 ± 0.05	152.32 ± 17.50	153.41 ± 17.74	68.22 ± 7.87	131.37 ± 15.14	33.52 ± 3.94	132.15 ± 15.26
Xanthone	1.06 ± 0.15	1.17 ± 0.18	1.65 ± 0.22	2.50 ± 0.35	0.16 ± 0.05	0.86 ± 0.13	96.35 ± 13.49	31.15 ± 4.39	59.78 ± 8.37	50.96 ± 7.16	4.89 ± 0.72	23.65 ± 3.34
Acenaphthenequinone	2.58 ± 0.33	0.18 ± 0.08	0.21 ± 0.06	1.31 ± 0.17	0.76 ± 0.11	0.77 ± 0.11	20.66 ± 2.61	0.00 ± 0.14	30.06 ± 3.76	31.93 ± 4.00	0.86 ± 0.21	0.00 ± 0.15
Perinaphthenone	2.29 ± 0.35	5.68 ± 0.77	11.24 ± 1.50	6.23 ± 0.81	3.08 ± 0.41	2.10 ± 0.29	186.86 ± 33.67	58.23 ± 10.54	180.46 ± 32.50	88.60 ± 16.00	11.53 ± 2.12	71.66 ± 12.95
2-methylanthracene	1.30 ± 0.14	1.61 ± 0.18	0.51 ± 0.07	1.09 ± 0.12	0.91 ± 0.10	0.68 ± 0.08	79.93 ± 8.06	31.07 ± 3.17	72.17 ± 7.27	86.59 ± 8.76	2.29 ± 0.27	23.06 ± 2.35
3-methylphenanthrene	3.69 ± 0.28	3.94 ± 0.31	2.09 ± 0.17	3.37 ± 0.26	3.20 ± 0.25	1.71 ± 0.14	190.22 ± 14.04	72.26 ± 5.43	146.84 ± 10.81	171.85 ± 12.76	15.81 ± 1.21	55.87 ± 4.18
2-methylphenanthrene	4.60 ± 0.45	4.81 ± 0.48	2.74 ± 0.28	4.26 ± 0.42	4.28 ± 0.42	2.05 ± 0.22	198.55 ± 18.67	80.02 ± 7.62	155.75 ± 14.63	184.04 ± 17.37	18.83 ± 1.82	62.69 ± 5.96
9-methylphenanthrene	2.13 ± 0.21	1.68 ± 0.18	0.98 ± 0.10	1.92 ± 0.19	1.62 ± 0.17	0.90 ± 0.10	86.12 ± 8.61	37.61 ± 3.80	79.54 ± 7.94	108.07 ± 10.83	5.32 ± 0.56	35.90 ± 3.62
1-methylphenanthrene	3.73 ± 0.63	6.48 ± 1.09	2.85 ± 0.48	5.40 ± 0.91	3.85 ± 0.65	2.09 ± 0.36	104.70 ± 17.65	45.80 ± 7.75	78.98 ± 13.31	103.60 ± 17.48	9.63 ± 1.64	36.64 ± 6.20
Anthrone	0.04 ± 0.03	0.56 ± 0.14	0.14 ± 0.05	0.05 ± 0.04	0.88 ± 0.19	0.14 ± 0.05	6.83 ± 1.46	1.53 ± 0.37	3.85 ± 0.84	4.22 ± 0.92	0.00 ± 0.13	1.23 ± 0.31
Anthraquinone	3.52 ± 0.45	3.41 ± 0.49	8.15 ± 0.94	6.68 ± 0.86	3.12 ± 0.45	1.04 ± 0.19	129.24 ± 17.83	44.19 ± 6.20	82.23 ± 11.38	95.57 ± 13.24	34.16 ± 4.83	88.24 ± 12.25
3,6-dimethylphenanthrene	1.73 ± 0.18	1.76 ± 0.20	0.68 ± 0.08	1.66 ± 0.18	1.59 ± 0.17	0.50 ± 0.07	30.94 ± 3.19	11.85 ± 1.25	20.85 ± 2.16	23.83 ± 2.47	2.18 ± 0.27	6.99 ± 0.75
A-dimethylphenanthrene	1.69 ± 0.18	2.56 ± 0.28	1.61 ± 0.18	2.00 ± 0.22	1.93 ± 0.21	0.99 ± 0.11	44.59 ± 4.80	15.79 ± 1.72	28.98 ± 3.12	32.97 ± 3.56	3.02 ± 0.36	9.89 ± 1.08
B-dimethylphenanthrene	1.40 ± 0.16	1.71 ± 0.20	0.68 ± 0.09	1.12 ± 0.13	0.60 ± 0.08	0.61 ± 0.08	25.40 ± 2.88	11.07 ± 1.27	17.26 ± 1.96	19.22 ± 2.18	2.74 ± 0.34	6.49 ± 0.75
C-dimethylphenanthrene	3.93 ± 0.33	3.49 ± 0.30	1.53 ± 0.14	3.70 ± 0.31	3.27 ± 0.28	1.15 ± 0.10	71.89 ± 5.96	23.22 ± 1.96	48.04 ± 3.98	50.43 ± 4.21	3.35 ± 0.32	15.78 ± 1.33
D-dimethylphenanthrene	1.27 ± 0.14	0.96 ± 0.13	0.60 ± 0.08	1.19 ± 0.14	1.07 ± 0.12	0.41 ± 0.06	19.76 ± 2.17	6.38 ± 0.72	10.61 ± 1.17	13.67 ± 1.51	1.24 ± 0.20	4.69 ± 0.54
1,7-dimethylphenanthrene	2.39 ± 0.20	2.18 ± 0.19	0.93 ± 0.09	2.16 ± 0.18	1.87 ± 0.16	0.78 ± 0.07	41.12 ± 3.37	14.65 ± 1.22	32.83 ± 2.68	23.02 ± 1.90	2.00 ± 0.21	9.54 ± 0.80
E-dimethylphenanthrene	1.69 ± 0.16	1.52 ± 0.15	0.82 ± 0.08	1.97 ± 0.18	1.41 ± 0.13	0.50 ± 0.06	26.83 ± 2.46	9.61 ± 0.90	18.41 ± 1.69	17.86 ± 1.65	1.71 ± 0.21	6.52 ± 0.62
9-methylanthracene	0.21 ± 0.05	0.00 ± 0.07	0.00 ± 0.04	0.00 ± 0.04	0.09 ± 0.04	0.00 ± 0.04	3.74 ± 0.63	2.03 ± 0.36	5.38 ± 0.89	6.41 ± 1.05	0.00 ± 0.13	1.42 ± 0.29
Fluoranthene	21.16 ± 1.60	18.53 ± 1.43	17.69 ± 1.34	32.12 ± 2.42	19.22 ± 1.45	12.45 ± 0.94	188.61 ± 14.28	146.04 ± 11.22	183.33 ± 13.85	442.87 ± 33.68	43.82 ± 3.40	258.94 ± 19.78
Pyrene	27.40 ± 2.44	23.32 ± 2.12	27.09 ± 2.42	50.66 ± 4.51	26.64 ± 2.38	16.01 ± 1.43	280.79 ± 25.15	222.44 ± 20.14	268.57 ± 24.02	516.74 ± 46.42	39.06 ± 3.59	271.61 ± 24.50
9-Anthraaldehyde	1.17 ± 0.31	0.72 ± 0.20	1.68 ± 0.45	3.45 ± 0.90	0.32 ± 0.10	0.34 ± 0.10	4.01 ± 1.09	1.14 ± 0.35	1.15 ± 0.35	1.70 ± 0.49	0.08 ± 0.14	0.69 ± 0.25
Retene	0.23 ± 0.06	0.00 ± 0.09	0.15 ± 0.06	0.27 ± 0.07	0.00 ± 0.05	0.05 ± 0.05	1.35 ± 0.31	0.71 ± 0.22	0.97 ± 0.26	0.59 ± 0.23	0.24 ± 0.19	0.39 ± 0.20
Benzonaphthothiophene	0.04 ± 0.06	0.01 ± 0.13	0.02 ± 0.07	0.02 ± 0.07	0.02 ± 0.07	0.00 ± 0.07	0.00 ± 0.26	0.00 ± 0.26	0.18 ± 0.26	0.00 ± 0.28	0.00 ± 0.26	0.00 ± 0.28
1+3-methylfluoranthene	1.90 ± 0.24	1.95 ± 0.26	1.56 ± 0.20	2.29 ± 0.29	1.61 ± 0.21	0.95 ± 0.13	18.57 ± 2.45	8.15 ± 1.09	13.69 ± 1.80	15.86 ± 2.10	2.24 ± 0.33	8.91 ± 1.19
1-MeFl+C-MeFl/Py	2.84 ± 0.28	2.28 ± 0.24	1.62 ± 0.16	2.68 ± 0.26	1.90 ± 0.19	1.16 ± 0.12	18.45 ± 1.87	9.24 ± 0.95	15.80 ± 1.60	17.40 ± 1.77	2.55 ± 0.29	8.91 ± 0.91
B-MePy/MeFl	3.86 ± 0.32	3.80 ± 0.32	1.81 ± 0.15	3.32 ± 0.27	2.62 ± 0.21	1.74 ± 0.14	36.33 ± 3.09	11.14 ± 0.97	28.15 ± 2.39	42.90 ± 3.66	2.75 ± 0.27	17.93 ± 1.54
C-MePy/MeFl	2.73 ± 0.21	2.92 ± 0.24	1.24 ± 0.10	2.14 ± 0.17	1.84 ± 0.15	1.36 ± 0.11	29.54 ± 2.41	9.16 ± 0.77	21.75 ± 1.77	36.37 ± 2.98	2.18 ± 0.22	14.91 ± 1.24
D-MePy/MeFl	2.01 ± 0.24	1.36 ± 0.18	1.33 ± 0.16	1.94 ± 0.24	1.53 ± 0.19	0.85 ± 0.11	19.70 ± 2.48	8.05 ± 1.02	13.02 ± 1.64	13.65 ± 1.73	1.94 ± 0.28	7.64 ± 0.98
4-methylpyrene	1.96 ± 0.21	1.31 ± 0.16	1.11 ± 0.13	1.93 ± 0.21	1.34 ± 0.15	0.77 ± 0.09	16.99 ± 1.90	7.26 ± 0.83	12.34 ± 1.38	14.55 ± 1.63	1.38 ± 0.20	7.14 ± 0.81
1-methylpyrene	3.27 ± 0.31	1.62 ± 0.17	0.89 ± 0.09	5.86 ± 0.56	5.97 ± 0.57	0.77 ± 0.08	16.12 ± 1.56	5.92 ± 0.59	12.21 ± 1.18	14.70 ± 1.43	0.79 ± 0.15	5.78 ± 0.58
Benzo(c)phenanthrene	1.89 ± 0.25	1.36 ± 0.19	0.68 ± 0.09	0.81 ± 0.11	1.14 ± 0.15	1.12 ± 0.15	11.92 ± 1.67	5.50 ± 0.79	8.42 ± 1.18	17.71 ± 2.47	2.70 ± 0.41	7.55 ± 1.06
Benzo(ghi)fluoranthene	8.83 ± 0.69	18.96 ± 1.62	5.49 ± 0.43	3.94 ± 0.29	11.65 ± 0.96	12.32 ± 1.03	143.34 ± 12.49	90.54 ± 7.98	136.15 ± 11.84	208.93 ± 18.28	33.71 ± 2.98	107.82 ± 9.47
Cyclopenta(c,d)pyrene	2.27 ± 0.26	1.62 ± 0.22	1.47 ± 0.19	1.28 ± 0.17	0.16 ± 0.04	0.71 ± 0.10	142.88 ± 22.62	15.34 ± 2.45	59.97 ± 9.50	77.12 ± 12.24	3.22 ± 0.54	40.99 ± 6.51
Benz(a)anthracene	4.19 ± 0.48	3.63 ± 0.49	1.59 ± 0.24	2.69 ± 0.35	2.75 ± 0.36	1.86 ± 0.23	59.16 ± 8.44	17.55 ± 2.55	38.02 ± 5.44	74.79 ± 10.68	5.23 ± 0.85	31.01 ± 4.45
Triphenylene	0.66 ± 0.06	0.30 ± 0.07	0.09 ± 0.04	0.53 ± 0.05	0.48 ± 0.05	0.89 ± 0.08	0.00 ± 0.13	0.00 ± 0.13	0.00 ± 0.13	0.00 ± 0.14	0.00 ± 0.13	0.00 ± 0.14
Chrysene	5.72 ± 0.39	3.80 ± 0.28	2.70 ± 0.18	3.63 ± 0.25	3.90 ± 0.26	3.32 ± 0.23	66.75 ± 5.48	18.70 ± 1.57	39.89 ± 3.28	86.44 ± 7.13	8.84 ± 0.76	36.14 ± 3.00
Benzanthrone	2.38 ± 0.38	1.52 ± 0.26	2.48 ± 0.40	2.29 ± 0.37	1.99 ± 0.32	2.25 ± 0.37	0.00 ± 0.13	0.00 ± 0.13	0.00 ± 0.13	0.00 ± 0.14	0.00 ± 0.13	0.00 ± 0.14
7-methylbenz(a)anthracene	0.00 ± 0.03	0.00 ± 0.07	0.00 ± 0.04	0.00 ± 0.04	0.02 ± 0.04	0.00 ± 0.04	1.80 ± 1.03	0.00 ± 0.13	0.54 ± 0.34	1.00 ± 0.59	0.00 ± 0.13	0.00 ± 0.14
3-methylchrysene	0.27 ± 0.04	0.16 ± 0.07	0.15 ± 0.04	0.20 ± 0.04	0.16 ± 0.04	0.13 ± 0.04	8.88 ± 0.93	1.99 ± 0.25	4.37 ± 0.48	6.67 ± 0.71	0.45 ± 0.14	2.07 ± 0.26
Benz(a)anthracene-7,12-dione	0.52 ± 0.10	0.38 ± 0.10	0.50 ± 0.11	0.57 ± 0.12	0.45 ± 0.10	0.48 ± 0.10	9.07 ± 1.82	2.50 ± 0.53	6.95 ± 1.40	3.58 ± 0.74	1.53 ± 0.34	2.47 ± 0.52
5+6-methylchrysene	0.09 ± 0.03	0.00 ± 0.07	0.01 ± 0.04	0.03 ± 0.04	0.02 ± 0.04	0.02 ± 0.04	7.73 ± 1.31	0.00 ± 0.13	1.23 ± 0.25	1.81 ± 0.34	0.06 ± 0.13	0.70 ± 0.18
Benzo(b+j+k)fluoranthene	1.40 ± 0.26	0.47 ± 0.17	3.60 ± 0.70	0.49 ± 0.13	1.01 ± 0.18	0.51 ± 0.14	28.07 ± 6.09	8.17 ± 1.85	13.35 ± 2.95	89.15 ± 19.13	10.61 ± 2.37	28.79 ± 6.26
Benzo(a)fluoranthene	0.14 ± 0.04	0.03 ± 0.07	0.15 ± 0.05	0.00 ± 0.04	0.08 ± 0.04	0.04 ± 0.04	3.19 ± 0.67	0.59 ± 0.18	1.73 ± 0.39	10.60 ± 2.17	2.97 ± 0.63	5.37 ± 1.11
BeP	0.60 ± 0.07	0.33 ± 0.08	1.16 ± 0.14	0.48 ± 0.06	0.53 ± 0.06	0.36 ± 0.05	38.79 ± 4.33	12.25 ± 1.38	31.08 ± 3.46	38.59 ± 4.32	2.69 ± 0.33	20.26 ± 2.28
BaP	0.44 ± 0.10	0.02 ± 0.21	0.98 ± 0.15	0.07 ± 0.12	0.04 ± 0.12	0.02 ± 0.12	48.41 ± 4.60	11.66 ± 1.19	49.88 ± 4.73	66.81 ± 6.36	1.42 ± 0.44	37.82 ± 3.63
Perylene	0.01 ± 0.03	0.02 ± 0.07	0.22 ± 0.05	0.00 ± 0.04	0.05 ± 0.04	0.00 ± 0.04	8.81 ± 1.66	2.55 ± 0.50	6.87 ± 1.29	12.75 ± 2.39	1.65 ± 0.34	7.12 ± 1.35
7-methylbenzo(a)pyrene	0.00 ± 0.03	0.00 ± 0.07	0.00 ± 0.04	0.00 ± 0.04	0.19 ± 0.09	0.00 ± 0.04	0.00 ± 0.13	0.00 ± 0.13	0.00 ± 0.13	5.69 ± 1.61	0.00 ± 0.13	0.00 ± 0.14
9,10-dihydrobenzo(a)pyrene-7(8H)-one	0.00 ± 0.03	0.00 ± 0.07	0.00 ± 0.04	0.00 ± 0.04	0.00 ± 0.04	0.00 ± 0.04	0.00 ± 0.13	0.00 ± 0.13	0.00 ± 0.13	0.24 ± 0.14	0.00 ± 0.13	0.00 ± 0.14
Dibenzo(a,j)anthracene	0.00 ± 0.03	0.00 ± 0.07	0.00 ± 0.04	0.00 ± 0.04	0.00 ± 0.04	0.00 ± 0.04	6.95 ± 1.37	0.83 ± 0.21	3.06 ± 0.61	2.88 ± 0.59	0.00 ± 0.13	1.54 ± 0.34
Indeno[123-cd]pyrene	0.00 ± 0.03	0.00 ± 0.07	0.00 ± 0.04	0.00 ± 0.04	0.00 ± 0.04	0.00 ± 0.04	77.90 ± 15.05	14.23 ± 2.78	44.22 ± 8.55	83.67 ± 16.18	2.55 ± 0.53	36.33 ± 7.04
Dibenzo(ah+ac)anthracene	0.00 ± 0.03	0.00 ± 0.07	0.00 ± 0.04	0.00 ± 0.04	0.00 ± 0.04	0.00 ± 0.04	3.88 ± 0.52	0.38 ± 0.14	1.02 ± 0.19	3.57 ± 0.48	0.00 ± 0.13	1.38 ± 0.24
Benzo(b)chrysene	0.00 ± 0.03	0.00 ± 0.07	0.00 ± 0.04	0.00 ± 0.04	0.00 ± 0.04	0.00 ± 0.04	2.36 ± 0.52	0.27 ± 0.15	1.31 ± 0.32	2.67 ± 0.59	0.00 ± 0.13	0.86 ± 0.24
Picene	0.00 ± 0.03	0.00 ± 0.07	0.00 ± 0.04	0.00 ± 0.04	0.00 ± 0.04	0.00 ± 0.04	6.71 ± 1.23	0.47 ± 0.16	1.35 ± 0.28	3.78 ± 0.70	0.00 ± 0.13	1.53 ± 0.32
Benzo(ghi)perylene	0.13 ± 0.10	0.00 ± 0.23	0.00 ± 0.13	0.07 ± 0.13	0.00 ± 0.13	0.00 ± 0.13	203.06 ± 26.82	50.43 ± 6.71	127.86 ± 16.88	165.40 ± 21.88	1.25 ± 0.49	63.34 ± 8.41
Anthanthrene	0.01 ± 0.03	0.00 ± 0.07	0.00 ± 0.04	0.00 ± 0.04	0.00 ± 0.04	0.00 ± 0.04	14.83 ± 2.16	4.43 ± 0.67	14.52 ± 2.11	31.01 ± 4.51	0.00 ± 0.13	12.94 ± 1.90
Dibenzo(b,k)fluoranthene	0.00 ± 0.03	0.00 ± 0.07	0.00 ± 0.04	0.00 ± 0.04	0.00 ± 0.04	0.00 ± 0.04	4.00 ± 0.56	0.56 ± 0.15	3.20 ± 0.45	5.34 ± 0.73	0.28 ± 0.14	3.62 ± 0.51
Dibenzo(a,e)pyrene	0.00 ± 0.03	0.00 ± 0.07	0.00 ± 0.04	0.00 ± 0.04	0.00 ± 0.04	0.00 ± 0.04	12.16 ± 2.22	2.58 ± 0.49	10.31 ± 1.89	11.50 ± 2.10	0.00 ± 0.13	6.37 ± 1.17
Coronene	0.17 ± 0.04	0.00 ± 0.07	0.09 ± 0.04	0.06 ± 0.04	0.07 ± 0.04	0.09 ± 0.04	83.48 ± 11.02	23.06 ± 3.06	79.19 ± 10.44	70.27 ± 9.29	3.34 ± 0.46	28.51 ± 3.78
Dibenzo(a,h)pyrene	0.00 ± 0.03	0.00 ± 0.07	0.00 ± 0.04	0.00 ± 0.04	0.01 ± 0.04	0.00 ± 0.04	0.00 ± 0.13	0.99 ± 0.16	0.00 ± 0.13	0.00 ± 0.14	0.00 ± 0.13	0.00 ± 0.14
nitro-PAH (ug/mile)												
1-nitronaphthalene	0.0000 ± 0.0023	0.0157 ± 0.0039	0.0043 ± 0.0029	0.0002 ± 0.0023	0.0000 ± 0.0021	0.0000 ± 0.0025	0.9942 ± 0.0903	0.2246 ± 0.0228	0.5651 ± 0.0524	0.2109 ± 0.0216	0.2146 ± 0.0220	0.1401 ± 0.0155
2-nitronaphthalene	0.0050 ± 0.0028	0.0036 ± 0.0030	0.0017 ± 0.0027	0.0076 ± 0.0032	0.0000 ± 0.0016	0.0000 ± 0.0019	2.1823 ± 0.2711	0.5336 ± 0.0687	1.1204 ± 0.1403	0.4881 ± 0.0630	0.4300 ± 0.0560	0.2443 ± 0.0331
2-nitrobiphenyl	0.0046 ± 0.0010	0.0000 ± 0.0003	0.0002 ± 0.0003	0.0003 ± 0.0004	0.0000 ± 0.0002	0.0000 ± 0.0002	0.0971 ± 0.0167	0.0181 ± 0.0034	0.0757 ± 0.0131	0.0204 ± 0.0038	0.0121 ± 0.0024	0.0085 ± 0.0019
3-nitrobiphenyl	0.0000 ± 0.0001	0.0035 ± 0.0007	0.0013 ± 0.0004	0.0001 ± 0.0002	0.0016 ± 0.0004	0.0000 ± 0.0001	0.0803 ± 0.0136	0.0166 ± 0.0030	0.0308 ± 0.0053	0.0191 ± 0.0034	0.0177 ± 0.0031	0.0128 ± 0.0023
4-nitrobiphenyl	0.0000 ± 0.0015	0.0000 ± 0.0013	0.0016 ± 0.0023	0.0000 ± 0.0014	0.0000 ± 0.0009	0.0000 ± 0.0018	0.1715 ± 0.0320	0.0432 ± 0.0100	0.1037 ± 0.0203	0.0959 ± 0.0191	0.0609 ± 0.0130	0.0079 ± 0.0045
2-nitrofluorene	0.0013 ± 0.0002	0.0000 ± 0.0001	0.0029 ± 0.0003	0.0002 ± 0.0001	0.0000 ± 0.0001	0.0001 ± 0.0001	0.0414 ± 0.0037	0.0261 ± 0.0024	0.0167 ± 0.0016	0.0081 ± 0.0009	0.0038 ± 0.0005	0.0085 ± 0.0009
1,3-dinitronaphthalene	0.0000 ± 0.0003	0.0000 ± 0.0003	0.0000 ± 0.0002	0.0000 ± 0.0003	0.0000 ± 0.0002	0.0000 ± 0.0002	0.0129 ± 0.0021	0.0000 ± 0.0009	0.0000 ± 0.0009	0.0000 ± 0.0008	0.0065 ± 0.0016	0.0013 ± 0.0012
1,5-dinitronaphthalene	0.0001 ± 0.0001	0.0000 ± 0.0001	0.0000 ± 0.0000	0.0009 ± 0.0001	0.0000 ± 0.0000	0.0000 ± 0.0000	0.0042 ± 0.0006	0.0007 ± 0.0002	0.0026 ± 0.0004	0.0124 ± 0.0018	0.0013 ± 0.0003	0.0047 ± 0.0007
5-nitroacenaphthene	0.0000 ± 0.0004	0.0045 ± 0.0011	0.0000 ± 0.0004	0.0020 ± 0.0006	0.0000 ± 0.0003	0.0000 ± 0.0003	0.0000 ± 0.0010	0.0182 ± 0.0030	0.0336 ± 0.0045	0.0153 ± 0.0028	0.0049 ± 0.0018	0.0004 ± 0.0016
9-nitroanthracene	0.0334 ± 0.0052	0.0000 ± 0.0001	0.0072 ± 0.0012	0.0068 ± 0.0012	0.0000 ± 0.0001	0.0079 ± 0.0013	0.0000 ± 0.0002	0.0395 ± 0.0066	0.0265 ± 0.0045	0.0204 ± 0.0035	0.3047 ± 0.0500	0.0440 ± 0.0074
4-nitrophenanthrene	0.0000 ± 0.0000	0.0000 ± 0.0001	0.0000 ± 0.0000	0.0009 ± 0.0001	0.0000 ± 0.0000	0.0000 ± 0.0000	0.0000 ± 0.0001	0.0024 ± 0.0003	0.0034 ± 0.0004	0.0014 ± 0.0002	0.0015 ± 0.0002	0.0277 ± 0.0024
9-nitrophenanthrene	0.0031 ± 0.0004	0.0000 ± 0.0001	0.0026 ± 0.0003	0.0009 ± 0.0001	0.0013 ± 0.0002	0.0004 ± 0.0001	0.0000 ± 0.0001	0.0036 ± 0.0006	0.0000 ± 0.0001	0.0043 ± 0.0007	0.0091 ± 0.0014	0.0244 ± 0.0037
1,8-dinitronaphthalene	0.0000 ± 0.0001	0.0000 ± 0.0001	0.0000 ± 0.0001	0.0000 ± 0.0001	0.0000 ± 0.0001	0.0000 ± 0.0001	0.0067 ± 0.0011	0.0352 ± 0.0044	0.0000 ± 0.0003	0.0000 ± 0.0003	0.0047 ± 0.0008	0.0027 ± 0.0006
2-nitrofluoranthene	0.0075 ± 0.0008	0.0000 ± 0.0002	0.0116 ± 0.0013	0.0101 ± 0.0011	0.0000 ± 0.0001	0.0120 ± 0.0012	0.0000 ± 0.0003	0.0513 ± 0.0057	0.0851 ± 0.0093	0.0394 ± 0.0045	0.0359 ± 0.0041	0.0412 ± 0.0047
3-nitrofluoranthene	0.0000 ± 0.0000	0.0000 ± 0.0001	0.0000 ± 0.0001	0.0002 ± 0.0001	0.0024 ± 0.0002	0.0000 ± 0.0001	0.1195 ± 0.0085	0.0199 ± 0.0015	0.0000 ± 0.0002	0.0000 ± 0.0002	0.0102 ± 0.0008	0.0787 ± 0.0057
1-nitropyrene	0.0214 ± 0.0026	0.0000 ± 0.0003	0.0154 ± 0.0019	0.0110 ± 0.0012	0.0154 ± 0.0019	0.0034 ± 0.0005	0.4422 ± 0.0536	0.1245 ± 0.0154	0.2797 ± 0.0340	0.1133 ± 0.0140	0.4616 ± 0.0563	0.0362 ± 0.0047
7-nitrobenzo(a)anthracene	0.0020 ± 0.0004	0.0000 ± 0.0001	0.0011 ± 0.0003	0.0185 ± 0.0025	0.0016 ± 0.0004	0.0002 ± 0.0001	0.1138 ± 0.0152	0.0675 ± 0.0092	0.0686 ± 0.0093	0.0500 ± 0.0069	0.1032 ± 0.0139	0.0478 ± 0.0066
6-nitrochrysene	0.0007 ± 0.0001	0.0000 ± 0.0001	0.0003 ± 0.0001	0.0165 ± 0.0026	0.0000 ± 0.0000	0.0000 ± 0.0000	0.0404 ± 0.0064	0.0088 ± 0.0014	0.0349 ± 0.0055	0.0250 ± 0.0040	0.0122 ± 0.0020	0.0078 ± 0.0013

Appendix B2. Chemical Composition of Dilution Blanks and Vehicle Exhaust Samples from Round2

Species Description	W0-1	W0-2	W0-3	W0-4	W0-5	W0-6	W1-1	W1-2	W1-3	W2-1	W2-2	W2-3
6-nitrobenz[a]pyrene	0.0000 ± 0.0000	0.0000 ± 0.0001	0.0000 ± 0.0000	0.0000 ± 0.0000	0.0000 ± 0.0000	0.0000 ± 0.0000	0.0336 ± 0.0029	0.0000 ± 0.0001	0.0000 ± 0.0001	0.0000 ± 0.0001	0.0082 ± 0.0007	0.0178 ± 0.0015
Hopanes (ug/mile)												
18a(H),21ß(H)-22,29,30-Trisnorhopane &	0.22 ± 0.03	0.07 ± 0.07	0.00 ± 0.04	0.10 ± 0.04	0.16 ± 0.04	0.10 ± 0.04	19.74 ± 2.09	8.90 ± 0.96	5.21 ± 0.57	14.71 ± 1.57	1.83 ± 0.24	2.75 ± 0.32
17a(H),21ß(H)-22,29,30-Trisnorhopane	0.06 ± 0.05	0.04 ± 0.08	0.04 ± 0.05	0.01 ± 0.04	0.02 ± 0.05	0.00 ± 0.05	18.07 ± 3.69	1.53 ± 0.39	2.06 ± 0.49	7.63 ± 1.60	0.00 ± 0.16	0.39 ± 0.21
17a(H),21ß(H)-30-Norhopane	0.25 ± 0.06	0.11 ± 0.08	0.15 ± 0.06	0.19 ± 0.06	0.23 ± 0.07	0.16 ± 0.06	83.25 ± 16.92	30.10 ± 6.20	19.49 ± 4.05	43.59 ± 8.92	7.02 ± 1.54	6.56 ± 1.46
17a(H),21ß(H)-Hopane	0.24 ± 0.05	0.02 ± 0.07	0.18 ± 0.06	0.15 ± 0.05	0.11 ± 0.05	0.21 ± 0.05	55.34 ± 10.74	14.74 ± 2.89	8.97 ± 1.77	27.42 ± 5.35	3.10 ± 0.64	4.44 ± 0.90
17ß(H),21a(H)-hopane	0.00 ± 0.03	0.01 ± 0.07	0.01 ± 0.04	0.00 ± 0.04	0.04 ± 0.04	0.00 ± 0.04	3.28 ± 0.88	0.00 ± 0.13	0.00 ± 0.13	0.00 ± 0.14	0.00 ± 0.13	0.20 ± 0.15
22S-17a(H),21ß(H)-30-Homohopane	0.12 ± 0.03	0.04 ± 0.07	0.05 ± 0.04	0.03 ± 0.04	0.05 ± 0.04	0.00 ± 0.04	34.84 ± 4.40	14.80 ± 1.89	9.76 ± 1.25	23.57 ± 2.99	1.11 ± 0.20	3.98 ± 0.53
22R-17a(H),21ß(H)-30-Homohopane	0.08 ± 0.04	0.00 ± 0.07	0.00 ± 0.04	0.00 ± 0.04	0.04 ± 0.04	0.00 ± 0.04	25.08 ± 5.55	10.95 ± 2.44	10.71 ± 2.38	18.86 ± 4.18	0.00 ± 0.13	3.00 ± 0.69
17ß(H),21ß(H)-Hopane	0.00 ± 0.03	0.00 ± 0.07	0.00 ± 0.04	0.00 ± 0.04	0.00 ± 0.04	0.00 ± 0.04	4.99 ± 0.94	0.00 ± 0.13	1.61 ± 0.32	5.88 ± 1.10	0.00 ± 0.13	0.75 ± 0.19
22S-17a(H),21ß(H)-30,31-Bishomohopan	0.00 ± 0.03	0.00 ± 0.07	0.00 ± 0.04	0.00 ± 0.04	0.00 ± 0.04	0.02 ± 0.04	17.76 ± 4.98	7.27 ± 2.06	3.78 ± 1.09	12.94 ± 3.64	1.35 ± 0.42	0.00 ± 0.14
22R-17a(H),21ß(H)-30,31-Bishomohopan	0.00 ± 0.03	0.00 ± 0.07	0.00 ± 0.04	0.00 ± 0.04	0.00 ± 0.04	0.00 ± 0.04	11.63 ± 1.48	5.59 ± 0.73	3.07 ± 0.42	7.71 ± 1.00	0.60 ± 0.15	1.46 ± 0.24
22S-17a(H),21ß(H)-30,31,32-Trisomohop	0.00 ± 0.03	0.00 ± 0.07	0.00 ± 0.04	0.00 ± 0.04	0.00 ± 0.04	0.00 ± 0.04	11.25 ± 2.48	0.00 ± 0.13	1.98 ± 0.46	6.79 ± 1.51	0.00 ± 0.13	0.43 ± 0.18
22R-17a(H),21ß(H)-30,31,32-Trishomoho	0.00 ± 0.03	0.00 ± 0.07	0.00 ± 0.04	0.00 ± 0.04	0.00 ± 0.04	0.00 ± 0.04	5.21 ± 0.95	0.00 ± 0.13	0.00 ± 0.13	4.18 ± 0.77	0.00 ± 0.13	0.00 ± 0.14
Steranes (ug/mile)												
C27-20S5a(H),14a(H)-cholestane	0.00 ± 0.03	0.01 ± 0.07	0.00 ± 0.04	0.00 ± 0.04	0.00 ± 0.04	0.00 ± 0.04	0.00 ± 0.13	0.00 ± 0.13	0.00 ± 0.13	0.00 ± 0.14	0.00 ± 0.13	0.00 ± 0.14
C27-20R5a(H),14ß(H)-cholestane	0.01 ± 0.03	0.00 ± 0.07	0.00 ± 0.04	0.00 ± 0.04	0.00 ± 0.04	0.02 ± 0.04	9.87 ± 2.57	0.00 ± 0.13	1.35 ± 0.40	1.83 ± 0.51	0.35 ± 0.18	0.53 ± 0.22
C27-20S5a(H),14ß(H),17ß(H)-cholestane	0.07 ± 0.03	0.04 ± 0.07	0.02 ± 0.04	0.02 ± 0.04	0.04 ± 0.04	0.05 ± 0.04	11.14 ± 2.22	1.42 ± 0.32	1.31 ± 0.30	2.52 ± 0.53	0.48 ± 0.17	0.00 ± 0.14
ster45+40(cholestane)	0.05 ± 0.03	0.02 ± 0.07	0.01 ± 0.04	0.01 ± 0.04	0.01 ± 0.04	0.03 ± 0.04	11.67 ± 1.79	1.25 ± 0.24	1.39 ± 0.26	2.37 ± 0.40	0.43 ± 0.15	0.34 ± 0.15
C28-20S5a(H),14a(H),17a(H)-ergostane	0.01 ± 0.03	0.00 ± 0.07	0.01 ± 0.04	0.03 ± 0.04	0.00 ± 0.04	0.03 ± 0.04	4.54 ± 1.08	1.44 ± 0.37	0.00 ± 0.13	0.92 ± 0.26	0.49 ± 0.18	0.47 ± 0.18
C28-20R5a(H),14ß(H),17ß(H)-ergostane	0.00 ± 0.03	0.00 ± 0.07	0.00 ± 0.04	0.00 ± 0.04	0.00 ± 0.04	0.00 ± 0.04	6.11 ± 1.67	0.50 ± 0.21	0.64 ± 0.24	0.86 ± 0.30	0.00 ± 0.14	0.00 ± 0.14
C28-20S5a(H),14ß(H),17ß(H)-ergostane	0.00 ± 0.03	0.00 ± 0.07	0.00 ± 0.04	0.00 ± 0.04	0.01 ± 0.04	0.00 ± 0.04	9.46 ± 2.25	0.00 ± 0.13	0.00 ± 0.13	1.18 ± 0.32	0.00 ± 0.13	0.00 ± 0.14
C28-20R5a(H),14a(H),17a(H)-ergostane	0.01 ± 0.03	0.00 ± 0.07	0.00 ± 0.04	0.03 ± 0.04	0.02 ± 0.04	0.01 ± 0.04	6.68 ± 0.94	0.00 ± 0.13	2.22 ± 0.34	0.62 ± 0.17	0.00 ± 0.13	0.00 ± 0.14
C29-20S5a(H),14a(H),17a(H)-stigmastan	0.06 ± 0.03	0.02 ± 0.07	0.01 ± 0.04	0.02 ± 0.04	0.02 ± 0.04	0.03 ± 0.04	3.53 ± 0.68	0.00 ± 0.13	0.00 ± 0.13	1.12 ± 0.25	0.41 ± 0.15	0.00 ± 0.14
C29-20R5a(H),14ß(H),17ß(H)-stigmastan	0.02 ± 0.03	0.03 ± 0.07	0.04 ± 0.04	0.02 ± 0.04	0.02 ± 0.04	0.04 ± 0.04	6.75 ± 0.90	0.00 ± 0.13	0.00 ± 0.13	1.71 ± 0.27	0.32 ± 0.14	0.00 ± 0.14
C29-20S5a(H),14ß(H),17ß(H)-stigmastan	0.05 ± 0.03	0.03 ± 0.07	0.01 ± 0.04	0.04 ± 0.04	0.02 ± 0.04	0.04 ± 0.04	10.74 ± 2.19	0.00 ± 0.13	0.00 ± 0.13	1.28 ± 0.29	0.28 ± 0.14	0.29 ± 0.15
C29-20R5a(H),14a(H),17a(H)-stigmastan	0.04 ± 0.03	0.05 ± 0.07	0.02 ± 0.04	0.00 ± 0.04	0.01 ± 0.04	0.00 ± 0.04	0.00 ± 0.13	1.00 ± 0.25	1.58 ± 0.36	1.37 ± 0.33	0.00 ± 0.13	0.00 ± 0.14
Alkanes (ug/mile)												
Dodecane	15.89 ± 6.29	7.88 ± 4.79	7.22 ± 4.48	14.38 ± 6.06	9.90 ± 5.07	1.50 ± 3.18	139.28 ± 35.92	178.00 ± 44.77	753.76 ± 176.78	254.17 ± 62.45	176.32 ± 44.44	368.74 ± 88.76
Tridecane	5.91 ± 1.90	5.57 ± 2.02	4.18 ± 1.80	8.16 ± 2.21	12.52 ± 2.72	0.81 ± 1.45	133.98 ± 17.56	175.47 ± 22.56	244.21 ± 30.53	165.33 ± 21.38	141.27 ± 18.53	660.39 ± 80.25
Norfarnesane	3.50 ± 1.06	0.00 ± 0.38	0.00 ± 0.46	0.80 ± 0.63	0.00 ± 0.49	0.00 ± 0.30	161.83 ± 29.52	185.47 ± 33.79	53.54 ± 10.32	13.63 ± 3.37	25.20 ± 5.34	306.66 ± 55.35
Heptylcyclohexane	0.39 ± 0.19	0.63 ± 0.26	0.31 ± 0.19	0.85 ± 0.28	0.71 ± 0.25	0.03 ± 0.15	15.85 ± 3.00	46.26 ± 8.33	20.91 ± 3.87	14.38 ± 2.75	6.25 ± 1.32	3.86 ± 0.93
Farnesane	2.47 ± 0.68	2.66 ± 0.74	1.84 ± 0.58	2.27 ± 0.66	1.97 ± 0.61	1.45 ± 0.52	100.23 ± 18.44	79.57 ± 14.76	145.62 ± 26.55	73.15 ± 13.62	19.50 ± 3.99	89.68 ± 16.59
Tetradecane	14.26 ± 1.80	7.25 ± 1.41	0.16 ± 0.86	5.08 ± 1.16	4.98 ± 1.17	0.00 ± 0.69	330.51 ± 28.42	184.59 ± 16.61	469.86 ± 39.81	624.56 ± 52.96	31.55 ± 4.11	253.13 ± 22.29
Octylcyclohexane	0.00 ± 0.10	0.20 ± 0.30	0.17 ± 0.21	0.00 ± 0.15	0.31 ± 0.23	0.00 ± 0.15	10.48 ± 2.61	0.00 ± 0.54	7.39 ± 1.99	18.35 ± 4.20	0.00 ± 0.42	0.00 ± 0.31
Pentadecane	4.85 ± 0.82	2.49 ± 0.61	1.19 ± 0.44	2.35 ± 0.55	1.93 ± 0.51	0.35 ± 0.35	203.19 ± 24.43	58.72 ± 7.56	234.87 ± 28.11	341.92 ± 40.81	11.04 ± 2.03	113.60 ± 14.03
Nonylcyclohexane	0.00 ± 0.09	0.50 ± 0.28	0.00 ± 0.09	0.18 ± 0.18	0.00 ± 0.10	0.00 ± 0.15	2.90 ± 0.88	7.12 ± 1.64	0.00 ± 0.27	9.91 ± 2.17	0.15 ± 0.43	8.37 ± 1.88
Hexadecane	6.88 ± 0.93	22.77 ± 1.70	6.14 ± 0.84	8.73 ± 0.97	11.67 ± 1.10	7.38 ± 0.90	127.60 ± 10.27	66.67 ± 5.86	172.41 ± 13.56	186.04 ± 14.74	28.79 ± 3.10	111.48 ± 9.21
Norpristane	0.00 ± 0.04	1.61 ± 0.19	1.28 ± 0.15	1.96 ± 0.20	0.51 ± 0.09	0.70 ± 0.10	62.99 ± 5.36	22.62 ± 2.00	78.83 ± 6.67	109.07 ± 9.26	4.89 ± 0.52	33.09 ± 2.88
Heptadecane	2.24 ± 0.29	3.31 ± 0.40	1.37 ± 0.25	2.04 ± 0.29	0.60 ± 0.21	0.52 ± 0.20	164.07 ± 12.83	34.32 ± 2.93	183.05 ± 14.25	171.50 ± 13.49	7.17 ± 0.89	68.21 ± 5.55
Decylcyclohexane	0.78 ± 0.15	0.00 ± 0.08	0.08 ± 0.06	0.12 ± 0.06	0.39 ± 0.10	0.00 ± 0.04	4.50 ± 0.87	3.55 ± 0.72	0.30 ± 0.25	4.60 ± 0.90	0.00 ± 0.17	2.57 ± 0.58
Heptadecane_Pristane	2.82 ± 0.35	1.52 ± 0.24	1.34 ± 0.21	1.64 ± 0.24	1.52 ± 0.23	0.50 ± 0.14	45.19 ± 4.61	19.30 ± 2.08	65.69 ± 6.62	84.08 ± 8.48	4.14 ± 0.60	30.26 ± 3.16
Undecylcyclohexane	0.54 ± 0.16	0.08 ± 0.13	0.25 ± 0.11	0.43 ± 0.14	0.31 ± 0.12	0.06 ± 0.08	13.78 ± 3.16	0.16 ± 0.32	9.31 ± 2.22	13.38 ± 3.09	0.38 ± 0.36	5.07 ± 1.34
Octadecane	1.16 ± 1.00	12.27 ± 1.84	0.00 ± 0.99	0.00 ± 0.99	0.00 ± 1.13	1.38 ± 1.04	103.40 ± 9.54	31.89 ± 4.59	106.94 ± 9.76	126.08 ± 11.36	13.72 ± 3.51	56.53 ± 6.38
Phytane	2.61 ± 0.52	1.21 ± 0.41	1.45 ± 0.39	1.75 ± 0.42	1.92 ± 0.45	0.54 ± 0.27	66.37 ± 10.03	18.98 ± 3.24	66.33 ± 10.01	78.56 ± 11.81	2.98 ± 1.01	25.98 ± 4.27
Dodecylcyclohexane	0.19 ± 0.06	0.02 ± 0.07	0.17 ± 0.06	0.40 ± 0.09	0.00 ± 0.04	0.06 ± 0.05	3.56 ± 0.57	2.16 ± 0.38	9.04 ± 1.31	3.04 ± 0.50	0.47 ± 0.19	2.49 ± 0.43
Nonadecane	3.07 ± 0.31	1.66 ± 0.23	2.19 ± 0.25	2.66 ± 0.28	2.17 ± 0.24	0.74 ± 0.14	102.07 ± 8.56	29.30 ± 2.60	71.05 ± 5.99	97.42 ± 8.22	7.13 ± 0.78	35.47 ± 3.11
Tridecylcyclohexane	0.00 ± 0.04	0.00 ± 0.08	0.14 ± 0.07	0.00 ± 0.04	0.44 ± 0.12	0.03 ± 0.06	4.85 ± 0.88	1.80 ± 0.40	2.23 ± 0.47	4.96 ± 0.90	0.34 ± 0.21	2.40 ± 0.49
Eicosane	0.00 ± 1.36	0.00 ± 1.92	0.00 ± 1.18	0.00 ± 1.19	0.00 ± 1.26	0.00 ± 1.20	82.46 ± 9.76	13.24 ± 4.94	40.81 ± 6.68	59.15 ± 8.25	0.00 ± 4.01	18.31 ± 5.48
Tetradecylcyclohexane	0.53 ± 0.12	0.56 ± 0.14	0.11 ± 0.06	0.43 ± 0.11	0.64 ± 0.15	0.17 ± 0.07	1.79 ± 0.41	4.51 ± 0.92	4.43 ± 0.90	6.88 ± 1.38	0.86 ± 0.26	0.86 ± 0.26
Heneicosane	2.85 ± 0.31	2.72 ± 0.32	2.59 ± 0.30	3.69 ± 0.38	3.34 ± 0.36	2.52 ± 0.29	50.53 ± 4.65	18.64 ± 1.87	20.11 ± 1.97	38.25 ± 3.59	5.39 ± 0.73	18.42 ± 1.85
Pentadecylcyclohexane	0.99 ± 0.26	0.53 ± 0.26	0.26 ± 0.17	0.91 ± 0.27	0.75 ± 0.27	0.38 ± 0.29	19.83 ± 4.63	2.65 ± 1.09	0.00 ± 0.42	5.12 ± 1.63	0.00 ± 0.45	0.62 ± 0.74
Docosane	0.00 ± 1.32	2.19 ± 1.82	0.00 ± 1.19	0.00 ± 1.01	0.00 ± 1.15	0.72 ± 1.57	46.27 ± 8.57	10.43 ± 4.98	10.55 ± 5.01	21.35 ± 6.24	0.00 ± 4.09	21.42 ± 6.24
Hexadecylcyclohexane	0.17 ± 0.05	1.27 ± 0.26	0.12 ± 0.05	0.05 ± 0.04	0.92 ± 0.18	0.52 ± 0.11	1.52 ± 0.36	7.33 ± 1.58	2.48 ± 0.56	7.57 ± 1.63	1.93 ± 0.45	2.80 ± 0.63
Tricosane	1.89 ± 0.32	1.89 ± 0.42	1.37 ± 0.34	1.60 ± 0.33	3.44 ± 0.48	4.53 ± 0.64	44.18 ± 4.54	13.43 ± 1.94	12.37 ± 1.84	23.07 ± 2.78	0.00 ± 0.83	16.22 ± 2.22
Heptadecylcyclohexane	2.32 ± 0.59	3.65 ± 0.88	3.04 ± 0.74	0.00 ± 0.08	1.00 ± 0.33	1.06 ± 0.34	0.00 ± 0.33	0.60 ± 0.47	2.89 ± 0.90	7.89 ± 1.93	0.30 ± 0.41	0.01 ± 0.39
Octadecylcyclohexane	0.20 ± 0.05	0.37 ± 0.10	0.11 ± 0.04	0.12 ± 0.04	0.10 ± 0.04	0.12 ± 0.04	15.58 ± 3.39	3.15 ± 0.73	2.61 ± 0.61	4.30 ± 0.97	1.43 ± 0.37	1.81 ± 0.45
Tetracosane	0.00 ± 1.19	0.00 ± 1.54	0.00 ± 1.08	0.00 ± 1.02	0.00 ± 1.17	0.00 ± 1.38	0.00 ± 3.98	0.00 ± 3.22	0.00 ± 3.26	0.00 ± 3.53	0.00 ± 3.42	0.00 ± 3.83
Pentacosane	0.04 ± 0.44	0.17 ± 0.64	0.00 ± 0.49	0.33 ± 0.49	0.30 ± 0.55	0.00 ± 0.72	21.94 ± 4.62	1.39 ± 1.92	9.88 ± 2.97	12.35 ± 3.40	0.00 ± 1.64	5.94 ± 2.56
Nonadecylcyclohexane	0.00 ± 0.08	0.85 ± 0.27	0.23 ± 0.16	0.19 ± 0.14	0.42 ± 0.17	0.53 ± 0.20	5.05 ± 1.30	0.19 ± 0.40	0.59 ± 0.46	6.20 ± 1.55	2.49 ± 0.81	2.72 ± 0.86
Hexacosane	0.00 ± 0.39	0.00 ± 0.53	0.00 ± 0.35	0.00 ± 0.31	0.00 ± 0.34	0.00 ± 0.39	3.38 ± 1.58	0.00 ± 1.04	3.01 ± 1.55	0.00 ± 1.07	0.00 ± 1.35	0.64 ± 1.48
Eicosylcyclohexane	0.01 ± 0.03	0.01 ± 0.07	0.02 ± 0.04	0.02 ± 0.04	0.19 ± 0.05	0.00 ± 0.04	4.15 ± 0.65	6.83 ± 1.06	0.85 ± 0.19	7.50 ± 1.15	0.04 ± 0.13	0.22 ± 0.14
Heptacosane	0.00 ± 0.18	0.33 ± 0.31	0.00 ± 0.19	0.00 ± 0.19	0.00 ± 0.20	0.00 ± 0.19	5.70 ± 1.55	9.72 ± 2.22	8.51 ± 2.02	13.50 ± 2.90	5.75 ± 1.56	0.39 ± 0.75
Heneicosylcyclohexane	0.02 ± 0.03	0.02 ± 0.07	0.02 ± 0.04	0.00 ± 0.04	0.02 ± 0.04	0.02 ± 0.04	1.77 ± 0.44	0.53 ± 0.19	0.55 ± 0.19	1.65 ± 0.41	0.02 ± 0.13	0.11 ± 0.15
Octacosane	0.47 ± 0.51	0.00 ± 0.73	0.00 ± 0.40	0.00 ± 0.40	0.00 ± 0.45	0.00 ± 0.43	0.00 ± 1.13	0.00 ± 1.25	5.59 ± 2.28	0.00 ± 1.43	2.07 ± 1.89	0.18 ± 1.78
Nonacosane	0.28 ± 0.13	0.64 ± 0.26	0.31 ± 0.13	0.21 ± 0.13	0.14 ± 0.13	0.27 ± 0.13	6.71 ± 1.70	0.47 ± 0.63	11.89 ± 2.62	11.86 ± 2.64	3.88 ± 1.21	3.87 ± 1.24
Triacontane	0.39 ± 0.35	0.00 ± 0.56	0.00 ± 0.30	0.00 ± 0.30	0.00 ± 0.36	0.00 ± 0.33	0.00 ± 1.23	1.21 ± 1.56	6.31 ± 2.39	0.00 ± 0.91	0.00 ± 1.33	0.12 ± 1.48
Hentriacontane	0.00 ± 0.06	0.00 ± 0.14	0.00 ± 0.09	0.00 ± 0.08	0.00 ± 0.08	0.00 ± 0.09	0.00 ± 0.43	0.00 ± 0.32	0.22 ± 0.76	0.00 ± 0.50	0.00 ± 0.56	0.00 ± 0.38
Dotriacontane	0.08 ± 0.15	0.35 ± 0.27	0.00 ± 0.13	0.00 ± 0.13	0.00 ± 0.16	0.00 ± 0.16	0.00 ± 0.51	0.00 ± 0.39	2.91 ± 0.85	0.00 ± 0.39	0.99 ± 0.64	1.08 ± 0.67
Tritriacontane	0.00 ± 0.04	0.00 ± 0.09	0.00 ± 0.04	0.00 ± 0.04	0.00 ± 0.05	0.00 ± 0.04	0.87 ± 0.52	0.00 ± 0.15	0.00 ± 0.30	0.00 ± 0.15	0.00 ± 0.18	0.00 ± 0.19
Tetratriacontane	0.25 ± 0.13	0.44 ± 0.26	0.00 ± 0.12	0.04 ± 0.12	0.27 ± 0.16	0.20 ± 0.14	0.00 ± 0.34	0.00 ± 0.47	1.79 ± 0.80	0.00 ± 0.36	0.00 ± 0.47	0.00 ± 0.56
Pentatriacontane	0.00 ± 0.04	0.00 ± 0.09	0.00 ± 0.05	0.00 ± 0.05	0.00 ± 0.05	0.00 ± 0.05	0.00 ± 0.17	0.00 ± 0.18	0.11 ± 0.41	0.00 ± 0.15	0.00 ± 0.17	0.00 ± 0.16
Hexatriacontane	0.16 ± 0.12	0.48 ± 0.24	0.00 ± 0.10	0.00 ± 0.10	0.07 ± 0.12	0.13 ± 0.13	0.00 ± 0.35	0.00 ± 0.29	0.00 ± 0.38	0.00 ± 0.30	0.00 ± 0.29	0.00 ± 0.51
Heptatriacontane	0.00 ± 0.03	0.00 ± 0.07	0.00 ± 0.04	0.00 ± 0.04	0.00 ± 0.04	0.00 ± 0.04	0.00 ± 0.14	0.00 ± 0.16	0.00 ± 0.13	0.00 ± 0.14	0.00 ± 0.14	0.00 ± 0.28
Octatriacontane	0.17 ± 0.09	0.23 ± 0.16	0.00 ± 0.08	0.00 ± 0.07	0.15 ± 0.10	0.23 ± 0.11	0.00 ± 0.24	0.00 ± 0.26	0.00 ± 0.26	0.00 ± 0.29	0.00 ± 0.21	0.00 ± 0.33
Nonatriacontane	0.00 ± 0.03	0.00 ± 0.07	0.00 ± 0.04	0.00 ± 0.04	0.00 ± 0.04	0.00 ± 0.04	0.00 ± 0.13	0.00 ± 0.13	0.00 ± 0.13	0.00 ± 0.14	0.00 ± 0.13	0.00 ± 0.14
Polar compounds (ug/mile)												
heptanoic acid (c7)	1.47 ± 1.37	0.00 ± 1.11	0.00 ± 1.07	0.00 ± 0.93	0.00 ± 1.30	0.00 ± 1.21	0.00 ± 5.21	0.00 ± 2.24	0.00 ± 1.84	0.00 ± 1.95	22.26 ± 9.80	0.00 ± 1.96
me-malonic (d-c3)	0.39 ± 0.11	0.00 ± 0.18	0.11 ± 0.08	0.00 ± 0.06	0.00 ± 0.08	0.00 ± 0.06	0.00 ± 0.21	0.06 ± 0.69	0.05 ± 0.70	7.24 ± 2.10	0.00 ± 0.37	0.00 ± 0.21
guaiacol	-99.00 ± 0.03	-99.00 ± 0.07	-99.00 ± 0.04	-99.00 ± 0.04	-99.00 ± 0.04	-99.00 ± 0.04	-99.00 ± 0.13	-99.00 ± 0.13	-99.00 ± 0.13	-99.00 ± 0.16	-99.00 ± 0.13	-99.00 ± 0.14
benzoic acid	0.00 ± 69.10	0.00 ± 127.28	0.00 ± 47.11	0.00 ± 53.04	0.00 ± 82.67	0.00 ± 55.47	0.00 ± 303.75	0.00 ± 146.02	0.00 ± 97.57	0.00 ± 358.22	0.00 ± 370.53	0.00 ± 116.36
octanoic acid (c8)	0.00 ± 1.33	0.00 ± 1.57	0.00 ± 1.34	0.00 ± 1.49	0.00 ± 1.52	0.41 ± 1.65	27.43 ± 8.43	0.00 ± 2.74	0.00 ± 2.92	0.00 ± 3.24	23.68 ± 7.85	0.00 ± 3.08
phenylacetic acid	0.33 ± 0.23	1.47 ± 0.63	0.22 ± 0.28	1.16 ± 0.39	1.57 ± 0.45	0.05 ± 0.26	177.79 ± 26.08	34.33 ± 5.82	0.00 ± 0.37	68.67 ± 10.72	27.51 ± 4.87	11.48 ± 2.68
maleic acid	0.00 ± 0.12	0.00 ± 0.21	0.00 ± 0.16	0.00 ± 0.11	0.00 ± 0.12	0.00 ± 0.17	0.00 ± 1.71	0.00 ± 0.40	0.00 ± 0.33	0.00 ± 0.98	0.00 ± 0.86	0.00 ± 0.34
succinic acid (d-c4)	0.00 ± 0.23	0.00 ± 0.41	0.00 ± 0.23	0.00 ± 0.24	0.00 ± 0.23	0.00 ± 0.24	0.00 ± 1.57	0.00 ± 1.01	0.00 ± 1.81	0.00 ± 0.51	0.00 ± 2.17	0.00 ± 0.49

Appendix B2. Chemical Composition of Dilution Blanks and Vehicle Exhaust Samples from Round2

Species Description	W0-1	W0-2	W0-3	W0-4	W0-5	W0-6	W1-1	W1-2	W1-3	W2-1	W2-2	W2-3
4-me-guaiacol	-99.00 ± 0.03	-99.00 ± 0.07	-99.00 ± 0.04	-99.00 ± 0.04	-99.00 ± 0.04	-99.00 ± 0.04	-99.00 ± 0.22	-99.00 ± 0.13	-99.00 ± 0.14	-99.00 ± 0.16	-99.00 ± 0.14	-99.00 ± 0.14
o-toluic	0.58 ± 0.50	2.16 ± 1.26	0.39 ± 0.57	1.57 ± 0.79	1.99 ± 0.89	0.44 ± 0.57	209.73 ± 46.75	28.39 ± 7.90	0.00 ± 0.70	80.33 ± 19.12	33.32 ± 8.97	15.47 ± 5.26
me-succinic acid (d-c4)	0.00 ± 0.04	0.00 ± 0.08	0.00 ± 0.05	0.00 ± 0.05	0.00 ± 0.05	0.00 ± 0.05	0.00 ± 0.15	0.00 ± 0.14	0.00 ± 0.15	0.00 ± 0.67	0.00 ± 0.78	0.00 ± 0.15
m-toluic	0.88 ± 0.45	0.10 ± 0.80	0.04 ± 0.43	0.96 ± 0.56	2.57 ± 0.73	0.09 ± 0.39	444.71 ± 53.01	53.60 ± 8.06	229.09 ± 28.15	108.58 ± 14.45	61.77 ± 9.01	14.49 ± 3.81
nonanoic acid (c9)	0.00 ± 1.73	0.00 ± 2.07	0.00 ± 1.84	0.00 ± 2.02	0.00 ± 2.02	0.00 ± 2.08	0.00 ± 5.66	0.00 ± 3.71	0.00 ± 3.32	0.00 ± 4.95	16.67 ± 7.52	0.00 ± 4.14
p-toluic	0.39 ± 0.45	0.08 ± 0.77	0.04 ± 0.43	0.82 ± 0.61	1.08 ± 0.65	0.08 ± 0.37	327.74 ± 45.97	36.78 ± 7.19	56.51 ± 9.81	93.27 ± 14.83	42.04 ± 7.91	8.53 ± 3.72
2,6-dimethylbenzoic acid	0.00 ± 0.10	0.00 ± 0.27	0.00 ± 0.07	0.00 ± 0.10	0.00 ± 0.15	0.00 ± 0.12	24.85 ± 5.71	0.00 ± 0.64	14.28 ± 3.57	7.43 ± 2.22	25.12 ± 5.78	0.53 ± 0.85
4-ethyl-guaiacol	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00
syringol	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00
glutaric acid (d-c5)	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00
2-methylglutaric (d-c5)	0.01 ± 0.06	0.04 ± 0.08	0.01 ± 0.04	0.01 ± 0.04	0.03 ± 0.05	0.15 ± 0.06	0.00 ± 0.15	0.00 ± 0.15	0.00 ± 0.15	0.00 ± 0.31	0.00 ± 0.42	0.00 ± 0.16
2,5-dimethylbenzoic acid	0.00 ± 0.14	0.67 ± 0.57	0.00 ± 0.25	0.01 ± 0.30	0.54 ± 0.43	0.03 ± 0.29	0.00 ± 0.46	6.62 ± 1.93	30.16 ± 5.75	1.47 ± 1.22	13.29 ± 3.02	2.26 ± 1.32
3-methylglutaric acid (d-c5)	0.01 ± 0.17	0.00 ± 0.13	0.00 ± 0.06	0.00 ± 0.10	0.00 ± 0.09	0.00 ± 0.06	0.00 ± 0.19	0.00 ± 0.20	0.00 ± 0.19	0.00 ± 0.24	0.00 ± 0.43	0.00 ± 0.20
2,4-dimethylbenzoic acid	0.00 ± 39.58	0.56 ± 67.61	0.00 ± 25.82	0.00 ± 26.33	0.00 ± 36.71	0.00 ± 24.98	0.00 ± 62.82	0.00 ± 72.72	0.00 ± 51.18	0.00 ± 150.54	0.00 ± 191.81	0.00 ± 53.36
2,3- and 3,5- dimethylbenzoic acid	0.00 ± 0.13	0.00 ± 0.24	0.00 ± 0.16	0.00 ± 0.16	0.00 ± 0.19	0.00 ± 0.13	50.91 ± 9.81	0.00 ± 1.62	34.50 ± 7.29	1.64 ± 2.52	7.64 ± 3.26	0.00 ± 0.93
decanoic acid (c10)	0.35 ± 0.16	0.00 ± 0.16	0.00 ± 0.13	0.00 ± 0.14	0.00 ± 0.15	0.00 ± 0.15	0.00 ± 0.41	0.00 ± 0.30	0.00 ± 0.33	0.00 ± 0.38	0.00 ± 0.51	0.00 ± 0.33
4-allyl-guaiacol (eugenol)	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00
4-methyl-syringol	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00
3,4-dimethylbenzoic acid	0.56 ± 0.27	0.00 ± 0.37	0.30 ± 0.28	0.87 ± 0.36	1.00 ± 0.39	0.00 ± 0.19	78.26 ± 14.43	9.74 ± 2.99	56.84 ± 10.84	17.28 ± 4.33	15.83 ± 4.02	0.00 ± 1.37
hexanedioic (adipic) acid (d-c6)	0.00 ± 0.04	0.09 ± 0.10	0.17 ± 0.07	0.00 ± 0.10	0.00 ± 0.06	0.04 ± 0.05	0.00 ± 0.15	0.00 ± 0.15	0.00 ± 0.15	0.00 ± 0.16	0.00 ± 0.28	0.00 ± 0.16
salcylic acid	0.25 ± 0.51	0.32 ± 0.79	0.47 ± 0.45	0.36 ± 0.80	1.37 ± 1.09	0.07 ± 0.30	122.36 ± 21.72	0.00 ± 4.44	14.33 ± 6.53	0.00 ± 4.80	26.11 ± 8.12	0.00 ± 1.16
trans-2-decenoic acid	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00
cis-pinonic acid	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00
3-methyladipic acid (d-c6)	0.02 ± 0.03	0.00 ± 0.07	0.01 ± 0.04	0.00 ± 0.04	0.00 ± 0.04	0.00 ± 0.04	0.00 ± 0.13	0.00 ± 0.13	0.00 ± 0.16	0.00 ± 0.18	0.00 ± 0.13	0.00 ± 0.14
4-formyl-guaiacol (vanillin)	0.00 ± 0.04	0.00 ± 0.09	0.00 ± 0.05	0.00 ± 0.06	0.00 ± 0.06	0.00 ± 0.05	0.00 ± 0.31	0.00 ± 0.15	0.00 ± 0.15	0.82 ± 0.52	0.00 ± 0.22	0.00 ± 0.16
undecanoic acid (c11)	0.00 ± 0.12	0.00 ± 0.15	0.00 ± 0.12	0.00 ± 0.13	0.00 ± 0.13	0.00 ± 0.13	1.84 ± 0.75	0.00 ± 0.30	0.00 ± 0.34	0.00 ± 0.41	1.85 ± 0.75	0.00 ± 0.29
isoeugenol	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00
heptanedioic (pimelic) acid (d-c7)	0.00 ± 0.07	0.00 ± 0.12	0.01 ± 0.09	0.00 ± 0.08	0.00 ± 0.08	0.01 ± 0.09	0.00 ± 0.26	0.00 ± 0.25	0.00 ± 0.25	0.00 ± 0.27	0.00 ± 0.28	0.00 ± 0.27
2,3-dimethoxybenzoic acid	0.00 ± 0.04	0.00 ± 0.08	0.00 ± 0.05	0.00 ± 0.15	0.00 ± 0.05	0.00 ± 0.05	0.00 ± 11.18	0.00 ± 0.17	0.00 ± 0.17	0.00 ± 20.57	0.00 ± 0.20	0.00 ± 0.18
acetovanillone	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00
2,6-dimethoxybenzoic acid	0.14 ± 0.21	0.00 ± 0.16	0.00 ± 0.11	1.15 ± 0.40	0.00 ± 0.11	0.00 ± 0.11	6.46 ± 1.71	0.00 ± 0.31	0.00 ± 0.32	4.72 ± 1.45	0.00 ± 0.43	0.00 ± 0.33
dodecanoic (lauric) acid (c12)	0.72 ± 0.46	0.00 ± 0.44	0.00 ± 0.29	1.78 ± 0.55	0.00 ± 0.45	0.00 ± 0.38	0.00 ± 0.90	0.00 ± 0.72	0.00 ± 0.88	10.33 ± 1.72	7.09 ± 1.46	0.00 ± 0.78
2,5-dimethoxybenzoic acid	0.01 ± 0.03	0.00 ± 0.07	0.00 ± 0.04	0.00 ± 0.04	0.00 ± 0.04	0.00 ± 0.04	2.41 ± 0.39	0.00 ± 0.13	0.00 ± 0.13	0.00 ± 0.14	0.56 ± 0.21	0.00 ± 0.14
phthalic acid	0.27 ± 0.78	0.00 ± 1.41	0.00 ± 1.29	0.00 ± 1.15	0.00 ± 1.14	0.00 ± 1.24	18.48 ± 32.57	0.00 ± 7.03	0.00 ± 13.41	0.00 ± 12.19	72.00 ± 43.10	0.00 ± 3.04
suberic acid (d-c8)	0.00 ± 0.03	0.00 ± 0.07	0.00 ± 0.04	0.00 ± 0.04	0.00 ± 0.04	0.00 ± 0.04	0.00 ± 0.13	0.00 ± 0.13	0.00 ± 0.13	0.00 ± 0.14	0.00 ± 0.13	0.00 ± 0.14
levoglucosan	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00
3,5-dimethoxybenzoic acid	0.00 ± 0.04	0.00 ± 0.08	0.10 ± 0.07	0.07 ± 0.06	0.01 ± 0.06	0.49 ± 0.14	14.70 ± 3.34	5.89 ± 1.45	0.00 ± 0.16	24.69 ± 5.49	0.83 ± 0.39	0.00 ± 0.16
syringaldehyde	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00
3,4-dimethoxybenzoic acid	0.00 ± 0.03	0.00 ± 0.12	0.00 ± 0.05	0.00 ± 0.05	0.00 ± 0.06	0.00 ± 0.05	0.00 ± 0.15	0.00 ± 0.14	0.00 ± 0.14	0.00 ± 0.15	0.00 ± 0.28	0.00 ± 0.15
2,4-dimethoxybenzoic acid	0.32 ± 0.07	0.25 ± 0.10	0.23 ± 0.07	0.41 ± 0.09	0.41 ± 0.10	1.23 ± 0.23	36.09 ± 6.28	0.66 ± 0.26	26.63 ± 4.66	35.81 ± 6.24	0.00 ± 0.15	0.00 ± 0.15
tridecanoic acid (c13)	0.04 ± 0.09	0.00 ± 0.11	0.00 ± 0.08	0.00 ± 0.09	0.00 ± 0.10	0.09 ± 0.10	1.59 ± 0.67	0.00 ± 0.29	0.00 ± 0.35	0.00 ± 0.26	1.15 ± 0.61	0.00 ± 0.29
isophthalic acid	0.00 ± 1.62	0.00 ± 2.15	0.00 ± 1.27	0.00 ± 1.42	0.00 ± 1.16	0.00 ± 0.92	0.00 ± 6.84	0.00 ± 6.57	0.00 ± 5.76	0.00 ± 12.22	0.00 ± 7.69	0.00 ± 2.56
vanillic acid	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00
homovanillic acid	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00
azelaic acid (d-c9)	0.00 ± 0.05	0.00 ± 0.14	0.05 ± 0.12	0.00 ± 0.08	0.00 ± 0.09	0.38 ± 0.13	0.00 ± 0.30	0.00 ± 0.19	0.00 ± 0.17	0.00 ± 0.21	0.00 ± 0.17	0.00 ± 0.21
myristoleic acid	0.00 ± 0.03	0.00 ± 0.08	0.00 ± 0.04	0.00 ± 0.04	0.00 ± 0.04	0.00 ± 0.04	0.00 ± 0.32	0.00 ± 0.15	0.00 ± 0.14	0.00 ± 0.26	0.00 ± 0.24	0.00 ± 0.15
myristic acid (c14)	0.00 ± 0.28	0.04 ± 0.40	0.00 ± 0.21	0.00 ± 0.38	0.00 ± 0.31	1.53 ± 0.27	26.68 ± 2.56	0.00 ± 0.63	0.00 ± 0.68	0.00 ± 0.79	3.33 ± 1.04	0.00 ± 0.65
sebacic acid (d-c10)	0.00 ± 0.04	0.00 ± 0.10	0.00 ± 0.05	0.00 ± 0.05	0.00 ± 0.04	0.00 ± 0.04	0.00 ± 0.23	0.00 ± 0.13	0.00 ± 0.14	0.00 ± 0.14	0.00 ± 0.14	0.00 ± 0.14
syringic acid	0.77 ± 0.20	12.03 ± 1.98	0.48 ± 0.17	6.16 ± 1.03	4.62 ± 0.79	0.00 ± 0.09	1.50 ± 0.59	0.00 ± 0.20	0.00 ± 0.29	3.10 ± 0.84	2.00 ± 0.66	0.00 ± 0.21
pentadecanoic acid (c15)	0.22 ± 0.14	0.05 ± 0.19	0.00 ± 0.13	0.12 ± 0.16	0.00 ± 0.13	1.64 ± 0.31	10.58 ± 2.17	0.00 ± 0.59	0.00 ± 0.48	0.00 ± 0.41	1.28 ± 0.88	0.00 ± 0.61
undecanedioic acid (c11)	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
palmitoleic acid	0.04 ± 0.08	0.03 ± 0.17	0.02 ± 0.10	0.01 ± 0.17	0.00 ± 0.11	0.05 ± 0.10	1.99 ± 1.76	0.00 ± 0.28	0.00 ± 0.31	0.00 ± 0.31	0.00 ± 0.43	0.00 ± 0.32
palmitic acid (c16)	1.27 ± 0.57	0.00 ± 0.93	0.00 ± 0.52	0.30 ± 0.71	0.00 ± 0.60	13.23 ± 1.16	258.42 ± 20.92	0.00 ± 1.57	0.00 ± 1.72	0.00 ± 1.45	8.29 ± 2.21	0.00 ± 1.57
isostearic acid	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00
dodecanedioic acid (d-c12)	0.01 ± 0.03	0.00 ± 0.07	0.01 ± 0.04	0.00 ± 0.04	0.00 ± 0.04	0.00 ± 0.04	0.00 ± 0.13	0.00 ± 0.13	0.00 ± 0.13	0.00 ± 0.14	0.00 ± 0.14	0.00 ± 0.14
traumatic acid	0.00 ± 0.03	0.00 ± 0.08	0.00 ± 0.04	0.00 ± 0.04	0.00 ± 0.04	0.01 ± 0.04	0.00 ± 0.13	0.00 ± 0.17	0.00 ± 0.15	0.00 ± 0.17	0.00 ± 0.16	0.00 ± 0.14
heptadecanoic acid (c17)	0.10 ± 0.10	0.00 ± 0.17	0.00 ± 0.11	0.00 ± 0.10	0.00 ± 0.10	1.04 ± 0.27	29.67 ± 6.94	0.00 ± 0.34	0.00 ± 0.36	0.00 ± 0.38	0.00 ± 0.62	0.00 ± 0.62
1,11-undecanedicarboxylic acid (d-c13)	0.01 ± 0.04	0.00 ± 0.07	0.00 ± 0.04	0.00 ± 0.04	0.00 ± 0.04	0.00 ± 0.04	0.00 ± 0.14	0.00 ± 0.14	0.00 ± 0.15	0.00 ± 0.16	0.00 ± 0.17	0.00 ± 0.15
oleic acid	0.27 ± 0.42	3.38 ± 1.27	0.00 ± 0.43	0.30 ± 0.63	0.00 ± 0.43	6.54 ± 1.43	133.09 ± 24.58	3.15 ± 2.79	0.00 ± 1.60	0.00 ± 1.38	2.08 ± 2.65	0.00 ± 1.62
elaidic acid	0.00 ± 0.05	0.00 ± 0.12	0.00 ± 0.06	0.00 ± 0.05	0.00 ± 0.06	0.00 ± 0.14	126.63 ± 30.07	0.00 ± 0.40	0.00 ± 0.79	0.00 ± 0.27	0.00 ± 0.47	0.00 ± 0.23
stearic acid (c18)	0.00 ± 2.53	0.00 ± 2.97	0.00 ± 1.96	0.00 ± 2.21	0.00 ± 2.07	6.07 ± 2.88	352.50 ± 77.39	0.00 ± 6.48	11.53 ± 9.61	0.00 ± 6.72	4.03 ± 8.41	0.00 ± 6.96
1,12-dodecanedicarboxylic acid (d-c14)	0.04 ± 0.04	0.00 ± 0.09	0.03 ± 0.05	0.00 ± 0.05	0.00 ± 0.05	0.00 ± 0.05	0.00 ± 0.24	0.00 ± 0.17	0.00 ± 0.16	0.00 ± 0.17	0.00 ± 0.16	0.00 ± 0.17
8,15-pimaradien-18-oic acid	0.00 ± 0.04	0.38 ± 0.17	0.00 ± 0.04	0.00 ± 0.04	0.00 ± 0.04	0.03 ± 0.05	0.00 ± 0.20	0.00 ± 0.15	0.00 ± 0.15	0.00 ± 0.17	0.00 ± 0.16	0.00 ± 0.16
pimaric acid	1.37 ± 0.33	0.52 ± 0.21	0.00 ± 0.06	0.02 ± 0.11	0.00 ± 0.09	0.00 ± 0.07	1.36 ± 0.47	0.00 ± 0.24	0.00 ± 0.21	0.03 ± 0.30	0.06 ± 0.28	0.00 ± 0.22
sandaracopimaric acid	0.18 ± 0.24	0.21 ± 0.24	0.00 ± 0.10	0.33 ± 0.31	2.51 ± 1.23	0.02 ± 0.11	0.77 ± 0.71	0.00 ± 0.30	0.00 ± 0.30	11.37 ± 5.16	0.16 ± 0.49	0.00 ± 0.32
nonadecanoic acid (c19)	0.40 ± 0.19	0.00 ± 0.12	0.00 ± 0.08	2.72 ± 0.55	0.91 ± 0.28	0.00 ± 0.08	1.36 ± 0.49	0.06 ± 0.32	2.02 ± 0.57	0.00 ± 0.27	0.94 ± 0.42	0.00 ± 0.25
isopimaric acid	0.04 ± 0.04	0.26 ± 0.11	0.00 ± 0.04	0.00 ± 0.04	0.20 ± 0.08	0.00 ± 0.05	0.00 ± 0.15	0.00 ± 0.14	0.00 ± 0.15	0.04 ± 0.18	0.00 ± 0.15	0.00 ± 0.15
palustric acid	0.03 ± 0.03	0.03 ± 0.07	0.00 ± 0.04	0.00 ± 0.04	0.00 ± 0.04	0.00 ± 0.04	0.97 ± 0.23	0.00 ± 0.13	0.00 ± 0.13	0.00 ± 0.14	0.03 ± 0.13	0.00 ± 0.14
dihydroisopimaric acid	0.00 ± 0.03	0.00 ± 0.07	0.00 ± 0.04	0.00 ± 0.04	0.00 ± 0.04	0.00 ± 0.04	0.00 ± 0.13	0.00 ± 0.13	0.00 ± 0.13	0.00 ± 0.14	0.00 ± 0.13	0.00 ± 0.14
8-abietic acid	0.00 ± 0.03	0.00 ± 0.08	0.00 ± 0.04	0.00 ± 0.04	0.00 ± 0.04	0.01 ± 0.05	0.00 ± 0.14	0.00 ± 0.14	0.00 ± 0.15	0.00 ± 0.17	0.00 ± 0.15	0.00 ± 0.14
dehydroabietic acid	0.00 ± 0.09	0.00 ± 0.15	0.00 ± 0.08	0.00 ± 0.09	0.00 ± 0.10	0.48 ± 0.15	0.00 ± 0.51	0.00 ± 0.32	0.00 ± 0.31	0.00 ± 0.33	0.00 ± 0.32	0.00 ± 0.33
8,14-abietenic acid	0.07 ± 0.07	0.00 ± 0.08	0.00 ± 0.05	0.00 ± 0.06	0.00 ± 0.05	0.00 ± 0.05	1.48 ± 0.45	0.71 ± 0.32	0.00 ± 0.20	0.27 ± 0.26	0.00 ± 0.20	0.00 ± 0.22
abietic acid	0.06 ± 0.03	0.00 ± 0.07	0.00 ± 0.04	0.00 ± 0.04	0.00 ± 0.04	0.00 ± 0.04	0.20 ± 0.16	0.00 ± 0.14	0.00 ± 0.13	0.00 ± 0.14	0.00 ± 0.13	0.00 ± 0.14
eicosanoic acid (c20)	0.00 ± 0.05	0.00 ± 0.09	0.00 ± 0.06	0.00 ± 0.05	0.00 ± 0.05	0.00 ± 0.07	0.83 ± 0.61	0.00 ± 0.18	0.00 ± 0.25	0.00 ± 0.21	0.00 ± 0.20	0.00 ± 0.21
levopimaric acid	0.00 ± 0.04	1.42 ± 0.40	0.00 ± 0.04	0.00 ± 0.05	0.00 ± 0.05	0.00 ± 0.04	0.86 ± 0.30	0.00 ± 0.14	0.00 ± 0.14	0.37 ± 0.21	0.08 ± 0.16	0.00 ± 0.15
heneicosanoic acid (c21)	0.00 ± 0.05	0.00 ± 0.10	0.00 ± 0.05	0.47 ± 0.13	0.00 ± 0.05	0.00 ± 0.05	1.69 ± 0.53	0.00 ± 0.20	0.00 ± 0.23	0.10 ± 0.30	0.21 ± 0.30	0.00 ± 0.21
7-oxodehydroabietic acid	0.00 ± 0.11	0.00 ± 0.20	0.00 ± 0.14	2.43 ± 0.79	4.40 ± 1.23	0.00 ± 0.14	0.00 ± 0.49	0.00 ± 0.39	0.00 ± 0.40	0.00 ± 0.49	0.00 ± 0.53	0.00 ± 0.42
docosanoic acid (c22)	0.00 ± 0.09	0.00 ± 0.17	0.00 ± 0.11	0.00 ± 0.10	0.00 ± 0.12	0.00 ± 0.12	0.00 ± 0.82	0.00 ± 0.35	0.27 ± 0.91	0.00 ± 0.62	0.00 ± 0.45	0.00 ± 0.44
tricosanoic acid (c23)	0.04 ± 0.05	0.38 ± 0.17	0.00 ± 0.04	0.00 ± 0.04	0.00 ± 0.04	0.04 ± 0.05	0.00 ± 0.15	0.00 ± 0.15	0.00 ± 0.15	0.00 ± 0.18	0.00 ± 0.17	0.00 ± 0.16
tetracosanoic acid (c24)	0.08 ± 0.14	0.14 ± 0.17	0.00 ± 0.10	0.00 ± 0.10	0.00 ± 0.14	0.00 ± 0.10	0.00 ± 0.49	0.00 ± 0.39	0.00 ± 0.53	0.00 ± 0.36	4.95 ± 1.60	0.00 ± 0.44
cholesterol	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00
cholestanol	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00
ergosterol	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00
stigmasterol	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00
sitosterol	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00

Appendix B2. Chemical Composition of Dilution Blanks and Vehicle Exhaust Samples from Round2

Species Description	W0-1	W0-2	W0-3	W0-4	W0-5	W0-6	W1-1	W1-2	W1-3	W2-1	W2-2	W2-3
Carbonyls (mg/mile)												
formaldehyde	10.32 ± 0.60							2.04 ± 0.98		292.42 ± 16.34	6.00 ± 1.10	
acetaldehyde	3.02 ± 0.46							0.00 ± 1.71		266.47 ± 25.51	2.07 ± 1.90	
acetone	14.01 ± 1.13							27.14 ± 4.31		88.47 ± 7.28	0.00 ± 3.65	
* acrolein	<0.042 ± <0.007							<0.020		4.57 ± 1.14	<0.065 ± <0.043	
propionaldehyde	0.00 ± 0.15							0.00 ± 1.00		27.73 ± 3.28	0.00 ± 1.01	
crotonaldehyde	0.00 ± 0.22							0.00 ± 1.44		15.15 ± 2.18	0.00 ± 1.44	
methyl ethyl ketone	0.72 ± 0.32							0.00 ± 1.80		11.47 ± 2.98	0.00 ± 1.81	
Methacrolein	0.00 ± 0.22							0.00 ± 1.44		28.74 ± 3.58	0.00 ± 1.44	
* n-butyraldehyde	-0.04 ± -0.01							<0.020		0.00 ± 0.00	-0.07 ± -0.03	
benzaldehyde	2.28 ± 0.37							0.00 ± 1.91		158.01 ± 16.09	0.62 ± 1.92	
glyoxal	0.00 ± 0.11							0.00 ± 0.71		0.57 ± 0.71	0.00 ± 0.71	
valeraldehyde	0.00 ± 0.25							0.00 ± 1.66		9.41 ± 2.05	0.00 ± 1.67	
tolualdehyde	1.26 ± 0.38							0.00 ± 2.06		72.42 ± 11.81	0.00 ± 2.07	
hexanal	0.00 ± 0.28							0.00 ± 1.84		5.98 ± 2.05	0.00 ± 1.85	
*** acrolein converts to an unknown rearrangement product that co-elutes with butyraldehyde. Where indicated, the sum of acrolein and butyraldehyde is given as an estimate of the upper limit of the true value for either compound.**												
VOC (mg/mi)												
1,3 butadiene (estimated)	0.021 ± 0.100									16.987 ± 9.388	2.069 ± 1.143	
C2 compounds	0.873 ± 0.123									583.030 ± 82.328	53.674 ± 7.579	
propene	0.121 ± 0.015									97.989 ± 11.883	11.934 ± 1.447	
propane	0.529 ± 0.026									5.191 ± 0.260	1.348 ± 0.067	
isoButane	0.434 ± 0.022									11.388 ± 0.569	10.534 ± 0.527	
1Butene+iButylene	0.097 ± 0.007									51.360 ± 3.482	7.972 ± 0.540	
n-Butane	1.397 ± 0.070									141.736 ± 7.087	67.430 ± 3.371	
t-2-Butene	0.039 ± 0.002									12.866 ± 0.709	2.426 ± 0.134	
c-2-Butene	0.036 ± 0.003									9.830 ± 0.909	1.420 ± 0.131	
3-Me-1-Butene	0.009 ± 0.001									3.180 ± 0.159	0.711 ± 0.036	
isopentane	0.955 ± 0.062									166.535 ± 10.872	43.804 ± 2.860	
1-Pentene	0.017 ± 0.001									6.471 ± 0.388	0.672 ± 0.040	
2-Me-1-Butene	0.031 ± 0.002									10.382 ± 0.760	1.321 ± 0.097	
n-Pentane	0.299 ± 0.018									37.995 ± 2.265	14.511 ± 0.865	
t-2-Pentene	0.031 ± 0.002									12.742 ± 0.637	1.176 ± 0.059	
c-2-Pentene	0.018 ± 0.002									6.767 ± 0.588	0.615 ± 0.053	
2-Me-2-Butene	0.550 ± 0.029									12.314 ± 0.660	1.371 ± 0.073	
22DiMeButane	0.027 ± 0.002									7.264 ± 0.470	3.625 ± 0.235	
CycloPentene	0.008 ± 0.001									3.488 ± 0.214	0.854 ± 0.052	
CycloPentane	0.037 ± 0.002									5.382 ± 0.269	1.279 ± 0.064	
23DiMeButane	0.048 ± 0.003									18.455 ± 1.095	4.857 ± 0.288	
MTBE	0.041 ± 0.002									1.419 ± 0.086	0.107 ± 0.006	
2-MePentane	0.139 ± 0.008									63.020 ± 3.605	12.314 ± 0.704	
3-MePentane	0.118 ± 0.006									41.405 ± 2.070	8.381 ± 0.419	
2-Me-1-Pentene	0.006 ± 0.001									2.767 ± 0.138	0.272 ± 0.014	
1-Hexene	0.007 ± 0.001									4.045 ± 0.202	0.377 ± 0.019	
n-Hexane	0.367 ± 0.018									41.519 ± 2.079	6.244 ± 0.313	
t-2-Hexene	0.058 ± 0.003									5.030 ± 0.252	0.462 ± 0.023	
2-Me-2-Pentene	0.010 ± 0.001									2.700 ± 0.142	0.236 ± 0.012	
c-3-Me-2-Pentene	0.005 ± 0.001									2.132 ± 0.107	0.176 ± 0.009	
c-3-Hexene	0.003 ± 0.001									0.617 ± 0.031	0.056 ± 0.003	
c-2-Hexene	0.004 ± 0.001									2.669 ± 0.133	0.212 ± 0.011	
t-3-Me-2-Pentene	0.014 ± 0.001									3.943 ± 0.197	0.368 ± 0.018	
MeCyPentane	0.090 ± 0.005									32.376 ± 1.865	4.240 ± 0.244	
2,4-DiMePentane	0.058 ± 0.003									28.249 ± 1.412	4.031 ± 0.202	
223TriMeButane	0.003 ± 0.001									0.510 ± 0.025	0.127 ± 0.006	
Benzene	0.191 ± 0.012									160.599 ± 9.929	8.903 ± 0.550	
CycloHexane	0.030 ± 0.002									17.403 ± 1.005	1.298 ± 0.075	
4MeHexene	0.003 ± 0.001									0.922 ± 0.085	0.150 ± 0.014	
2MeHexane	0.051 ± 0.003									35.993 ± 1.800	3.597 ± 0.180	
23DiMePentane	0.082 ± 0.004									50.348 ± 2.517	6.500 ± 0.325	
3MeHexane	0.063 ± 0.003									40.649 ± 2.032	4.260 ± 0.213	
Cyclohexene	0.006 ± 0.001									0.181 ± 0.038	0.015 ± 0.003	
3EtPentane	0.020 ± 0.001									11.583 ± 0.741	1.133 ± 0.072	
1-Heptene	0.012 ± 0.001									4.578 ± 0.229	0.564 ± 0.028	
224TrMePentane	0.202 ± 0.014									109.638 ± 7.820	10.272 ± 0.733	
t-3-Heptene	0.004 ± 0.001									2.150 ± 0.108	0.114 ± 0.006	
n-Heptane	0.060 ± 0.003									32.692 ± 1.635	3.182 ± 0.159	
244TMe-1-Pentene	0.005 ± 0.001									0.616 ± 0.032	0.039 ± 0.002	
MeCyHexane	0.046 ± 0.002									14.754 ± 0.738	1.588 ± 0.079	
25DiMeHexane	0.026 ± 0.002									11.913 ± 0.812	1.161 ± 0.079	
24DiMeHexane	0.041 ± 0.002									22.907 ± 1.145	1.966 ± 0.098	
234TrMePentane	0.071 ± 0.004									33.279 ± 1.664	2.543 ± 0.127	
Toluene	1.073 ± 0.054									282.351 ± 14.118	18.258 ± 0.913	
23DiMeHexane	0.034 ± 0.002									12.972 ± 0.698	1.219 ± 0.066	
2MeHeptane	0.037 ± 0.002									21.231 ± 1.062	1.491 ± 0.075	
4MeHeptane	0.017 ± 0.001									8.674 ± 0.667	0.626 ± 0.048	
3MeHeptane	0.036 ± 0.002									23.037 ± 1.152	1.460 ± 0.073	
Hexanal	0.000 ± 0.279									5.980 ± 2.046	0.000 ± 1.854	
225TMHexane	0.014 ± 0.001									4.950 ± 0.248	0.450 ± 0.022	
Octene-1	0.030 ± 0.001									8.278 ± 0.414	1.490 ± 0.075	
11DMeCyHexane	0.003 ± 0.001									1.076 ± 0.054	0.103 ± 0.005	
n-Octane	0.044 ± 0.002									20.698 ± 1.035	1.385 ± 0.069	
24DiMeHeptane	0.029 ± 0.001									2.121 ± 0.106	0.318 ± 0.016	
25DiMeHeptane	0.020 ± 0.001									8.939 ± 0.447	0.550 ± 0.027	
33DiMeHeptane	0.002 ± 0.001									0.301 ± 0.015	0.021 ± 0.001	
EtBenzene	0.293 ± 0.015									67.992 ± 3.400	3.167 ± 0.158	
m/p-xylene	0.887 ± 0.044									193.225 ± 9.661	11.796 ± 0.590	

Appendix B2. Chemical Composition of Dilution Blanks and Vehicle Exhaust Samples from Round2

Species Description	W0-1	W0-2	W0-3	W0-4	W0-5	W0-6	W1-1	W1-2	W1-3	W2-1	W2-2	W2-3
2MeOctane	0.023 ± 0.001									6.570 ± 0.329	0.000 ± 0.001	
3MeOctane	0.032 ± 0.002									13.391 ± 0.824	0.600 ± 0.037	
Styrene+heptanal	0.134 ± 0.007									4.536 ± 0.227	0.224 ± 0.011	
o-xylene	0.378 ± 0.019									70.561 ± 3.528	3.824 ± 0.191	
Nonene-1	0.016 ± 0.001									3.885 ± 0.194	0.200 ± 0.010	
n-Nonane	0.057 ± 0.003									10.513 ± 0.526	0.614 ± 0.031	
iPropBenzene	0.044 ± 0.002									6.662 ± 0.333	0.302 ± 0.015	
iPropCyHexane	0.005 ± 0.001									1.297 ± 0.086	0.076 ± 0.005	
26DiMeOctane	0.035 ± 0.002									4.280 ± 0.269	0.296 ± 0.019	
alpha-pinene	0.028 ± 0.005									0.567 ± 0.104	0.043 ± 0.008	
nPropBenzene	0.139 ± 0.007									15.555 ± 0.778	0.614 ± 0.031	
mEtToluene	0.576 ± 0.029									53.167 ± 2.658	2.711 ± 0.136	
pEtToluene	0.261 ± 0.013									20.666 ± 1.033	1.088 ± 0.054	
135TriMeBenzene	0.313 ± 0.016									25.833 ± 1.292	1.396 ± 0.070	
oEtToluene	0.224 ± 0.011									16.783 ± 0.839	0.884 ± 0.044	
Octanal	0.033 ± 0.009									1.375 ± 0.393	0.110 ± 0.031	
beta-pinene	0.006 ± 0.001									0.563 ± 0.028	0.039 ± 0.002	
124TriMeBenzene	1.074 ± 0.054									64.800 ± 3.240	3.721 ± 0.186	
n-Decane	0.089 ± 0.005									5.982 ± 0.334	0.576 ± 0.032	
iButBenzene	0.036 ± 0.002									1.812 ± 0.091	0.111 ± 0.006	
sButBenzene	0.023 ± 0.001									1.392 ± 0.070	0.069 ± 0.003	
Limonene	0.293 ± 0.015									12.781 ± 0.639	0.897 ± 0.045	
Indan	0.076 ± 0.008									8.506 ± 0.913	0.425 ± 0.046	
13diethylbenzene	0.164 ± 0.016									3.873 ± 0.388	0.294 ± 0.029	
14diethylbenzene	0.465 ± 0.026									11.343 ± 0.630	0.653 ± 0.036	
12diethylbenzene	0.044 ± 0.002									1.720 ± 0.086	0.118 ± 0.006	
2-propylToluene	0.134 ± 0.007									2.349 ± 0.117	0.274 ± 0.014	
3-ipropyltoluene	0.037 ± 0.002									1.871 ± 0.094	0.099 ± 0.005	
4-ipropyltoluene	0.038 ± 0.002									0.082 ± 0.005	0.021 ± 0.001	
2-ipropyltoluene	0.028 ± 0.005									0.416 ± 0.076	0.048 ± 0.009	
Nonanal	0.337 ± 0.017									7.059 ± 0.353	0.567 ± 0.028	
n-Undecane	0.079 ± 0.016									1.487 ± 0.297	0.108 ± 0.022	
1245tetraMeBenzene	0.161 ± 0.026									1.778 ± 0.286	0.203 ± 0.033	
1235tetraMeBenzene	0.228 ± 0.011									2.036 ± 0.102	0.263 ± 0.013	
1234tetraMeBenzene	0.098 ± 0.005									0.480 ± 0.024	0.089 ± 0.004	
n-Dodecane	0.092 ± 0.005									0.193 ± 0.010	0.048 ± 0.002	

Appendix B2. Chemical Composition of Dilution Blanks and Vehicle Exhaust Samples from Round2

Species Description	W3-1	W3-2	W3-3	W4-1	W4-2	W4-3	W5-1	W5-2	W5-3	W6-1	W6-2	W6-3
Gravimetric mass (mg/mi)	29.38 ± 1.49	23.57 ± 1.19	15.21 ± 0.77	6.89 ± 0.42	6.02 ± 0.33	11.65 ± 0.60	16.82 ± 0.86	47.47 ± 2.39	45.26 ± 2.28	56.31 ± 2.83	17.14 ± 0.90	9.97 ± 0.53
Carbon fractions by TOR (mg/mi)												
Organic Carbon Fraction 1	4.040 ± 0.488	2.341 ± 0.210	1.499 ± 0.140	0.831 ± 0.151	0.935 ± 0.106	1.763 ± 0.162	4.747 ± 0.457	7.529 ± 0.874	3.870 ± 0.448	19.798 ± 2.738	3.142 ± 0.379	1.484 ± 0.165
Organic Carbon Fraction 2	2.800 ± 0.406	2.387 ± 0.253	1.558 ± 0.159	0.552 ± 0.097	0.564 ± 0.063	1.418 ± 0.188	2.218 ± 0.254	2.971 ± 0.407	5.775 ± 0.918	7.444 ± 1.182	2.527 ± 0.345	1.948 ± 0.227
Organic Carbon Fraction 3	1.350 ± 0.323	1.643 ± 0.285	0.840 ± 0.148	0.417 ± 0.158	0.709 ± 0.146	1.213 ± 0.253	0.873 ± 0.166	2.442 ± 0.610	3.732 ± 0.967	2.636 ± 0.678	1.157 ± 0.281	0.983 ± 0.198
Organic Carbon Fraction 4	1.935 ± 0.539	1.376 ± 0.250	1.194 ± 0.247	0.289 ± 0.168	0.370 ± 0.108	0.877 ± 0.175	0.716 ± 0.169	3.503 ± 0.896	2.193 ± 0.580	2.170 ± 0.617	0.505 ± 0.201	0.601 ± 0.172
Pyrolyzed Organic Carbon	0.083 ± 0.039	0.200 ± 0.070	0.030 ± 0.018	0.036 ± 0.030	0.002 ± 0.016	0.042 ± 0.020	0.010 ± 0.020	0.009 ± 0.027	0.004 ± 0.028	0.075 ± 0.037	0.003 ± 0.028	0.003 ± 0.020
Total Organic Carbon	10.207 ± 0.792	7.938 ± 0.521	5.109 ± 0.341	2.090 ± 0.270	2.563 ± 0.208	5.301 ± 0.376	8.544 ± 0.582	16.452 ± 1.260	15.572 ± 1.241	32.125 ± 2.732	7.333 ± 0.590	4.996 ± 0.362
Elemental Carbon Fraction 1	6.625 ± 1.529	2.653 ± 0.393	2.479 ± 0.448	1.848 ± 0.513	1.101 ± 0.189	2.445 ± 0.418	2.623 ± 0.476	10.626 ± 2.388	6.031 ± 1.451	7.804 ± 2.158	2.791 ± 0.724	1.681 ± 0.346
Elemental Carbon Fraction 2	9.589 ± 1.503	6.486 ± 0.820	1.726 ± 0.183	1.536 ± 0.278	1.962 ± 0.225	2.794 ± 0.375	4.761 ± 0.648	17.472 ± 2.513	9.459 ± 1.570	12.598 ± 1.972	6.798 ± 0.938	1.527 ± 0.200
Elemental Carbon Fraction 3	0.118 ± 0.098	0.062 ± 0.030	0.057 ± 0.028	0.000 ± 0.009	0.014 ± 0.009	0.045 ± 0.025	0.031 ± 0.017	0.042 ± 0.032	0.177 ± 0.123	0.063 ± 0.053	0.000 ± 0.009	0.022 ± 0.015
Total Elemental Carbon	16.248 ± 2.884	9.001 ± 1.220	4.232 ± 0.564	3.349 ± 0.650	3.073 ± 0.409	5.237 ± 0.770	7.389 ± 1.099	28.129 ± 4.914	15.662 ± 3.042	20.387 ± 4.074	9.585 ± 1.674	3.216 ± 0.484
Total Carbon	26.457 ± 1.812	16.938 ± 0.999	9.341 ± 0.577	5.415 ± 0.492	5.637 ± 0.378	10.535 ± 0.676	15.932 ± 1.004	44.582 ± 3.029	31.238 ± 2.129	52.513 ± 3.899	16.921 ± 1.175	8.203 ± 0.543
Elements by XRF (mg/mi)												
Sodium (qualitative only)	0.0998 ± 0.0352	0.0459 ± 0.0195	0.0433 ± 0.0195	0.0398 ± 0.0331	0.0037 ± 0.0191	0.0182 ± 0.0187	0.0052 ± 0.0232	0.0787 ± 0.0371	0.1537 ± 0.0406	0.0664 ± 0.0353	0.0000 ± 0.0343	0.0180 ± 0.0236
Magnesium (qualitative only)	0.0073 ± 0.0331	0.0030 ± 0.0189	0.0016 ± 0.0189	0.0150 ± 0.0322	0.0000 ± 0.0189	0.0125 ± 0.0185	0.0009 ± 0.0229	0.0000 ± 0.0354	0.0550 ± 0.0377	0.0081 ± 0.0341	0.0000 ± 0.0341	0.0105 ± 0.0233
Aluminum	0.0222 ± 0.0224	0.0837 ± 0.0136	0.0598 ± 0.0133	0.0234 ± 0.0218	0.0051 ± 0.0128	0.0256 ± 0.0126	0.0109 ± 0.0155	0.0362 ± 0.0242	0.3248 ± 0.0310	0.0032 ± 0.0231	0.0079 ± 0.0232	0.0144 ± 0.0157
Silicon	0.1455 ± 0.0137	0.8640 ± 0.0448	0.3649 ± 0.0199	0.1494 ± 0.0135	0.0571 ± 0.0069	0.1216 ± 0.0088	0.0350 ± 0.0077	0.3011 ± 0.0205	3.7576 ± 0.1997	0.1327 ± 0.0136	0.0781 ± 0.0122	0.1605 ± 0.0116
Phosphorous	0.0950 ± 0.0053	0.0780 ± 0.0041	0.1059 ± 0.0055	0.0480 ± 0.0032	0.0159 ± 0.0014	0.0286 ± 0.0019	0.0353 ± 0.0023	0.2070 ± 0.0107	0.0902 ± 0.0052	0.1367 ± 0.0072	0.0558 ± 0.0036	0.0363 ± 0.0023
Sulfur	0.2153 ± 0.0115	1.0009 ± 0.0504	0.6767 ± 0.0341	0.0952 ± 0.0061	0.1660 ± 0.0086	0.1344 ± 0.0071	0.1312 ± 0.0071	0.4076 ± 0.0211	1.8294 ± 0.0931	0.2325 ± 0.0124	0.0934 ± 0.0062	0.3340 ± 0.0171
Chlorine	0.0187 ± 0.0021	0.0305 ± 0.0019	0.8524 ± 0.0428	0.0080 ± 0.0018	0.0030 ± 0.0011	0.0035 ± 0.0010	0.0109 ± 0.0014	0.0328 ± 0.0026	0.0398 ± 0.0029	0.0481 ± 0.0031	0.0074 ± 0.0019	0.0043 ± 0.0013
Potassium	0.0022 ± 0.0031	0.0033 ± 0.0018	0.0036 ± 0.0018	0.0060 ± 0.0030	0.0012 ± 0.0018	0.0048 ± 0.0017	0.0018 ± 0.0021	0.0223 ± 0.0035	0.0000 ± 0.0035	0.0025 ± 0.0032	0.0000 ± 0.0032	0.0019 ± 0.0022
Calcium	0.2356 ± 0.0120	0.0975 ± 0.0050	0.1874 ± 0.0095	0.1038 ± 0.0056	0.0401 ± 0.0023	0.0885 ± 0.0046	0.0898 ± 0.0047	0.3298 ± 0.0167	0.0681 ± 0.0041	0.3576 ± 0.0181	0.1648 ± 0.0085	0.0817 ± 0.0043
Titanium	0.0013 ± 0.0011	0.0010 ± 0.0006	0.0013 ± 0.0006	0.0010 ± 0.0010	0.0005 ± 0.0006	0.0019 ± 0.0006	0.0009 ± 0.0007	0.0005 ± 0.0011	0.0005 ± 0.0012	0.0007 ± 0.0011	0.0008 ± 0.0011	0.0011 ± 0.0007
Vanadium	0.0003 ± 0.0004	0.0001 ± 0.0002	0.0001 ± 0.0002	0.0000 ± 0.0004	0.0002 ± 0.0002	0.0001 ± 0.0002	0.0000 ± 0.0003	0.0005 ± 0.0005	0.0000 ± 0.0005	0.0004 ± 0.0004	0.0003 ± 0.0004	0.0000 ± 0.0003
Chromium	0.0115 ± 0.0018	0.0094 ± 0.0011	0.0095 ± 0.0011	0.0042 ± 0.0016	0.0028 ± 0.0010	0.0088 ± 0.0010	0.0061 ± 0.0012	0.0134 ± 0.0019	0.0047 ± 0.0019	0.0089 ± 0.0018	0.0032 ± 0.0017	0.0055 ± 0.0012
Manganese	0.0022 ± 0.0047	0.0015 ± 0.0027	0.0011 ± 0.0027	0.0001 ± 0.0046	0.0005 ± 0.0027	0.0007 ± 0.0026	0.0016 ± 0.0033	0.0032 ± 0.0051	0.0018 ± 0.0053	0.0017 ± 0.0049	0.0000 ± 0.0049	0.0008 ± 0.0033
Iron	0.3880 ± 0.0209	0.1566 ± 0.0089	0.1676 ± 0.0094	0.1286 ± 0.0096	0.0452 ± 0.0047	0.1343 ± 0.0079	0.0878 ± 0.0066	0.2512 ± 0.0150	0.0542 ± 0.0085	0.1646 ± 0.0112	0.0705 ± 0.0082	0.0741 ± 0.0063
Cobalt	0.0001 ± 0.0008	0.0000 ± 0.0005	0.0003 ± 0.0005	0.0000 ± 0.0008	0.0001 ± 0.0005	0.0000 ± 0.0004	0.0004 ± 0.0006	0.0000 ± 0.0009	0.0001 ± 0.0009	0.0000 ± 0.0008	0.0000 ± 0.0008	0.0000 ± 0.0006
Nickel	0.0032 ± 0.0013	0.0031 ± 0.0007	0.0022 ± 0.0007	0.0012 ± 0.0012	0.0013 ± 0.0007	0.0015 ± 0.0007	0.0026 ± 0.0009	0.0046 ± 0.0014	0.0005 ± 0.0014	0.0022 ± 0.0013	0.0007 ± 0.0013	0.0010 ± 0.0009
Copper	0.0085 ± 0.0012	0.0047 ± 0.0007	0.0073 ± 0.0007	0.0149 ± 0.0013	0.0097 ± 0.0008	0.0054 ± 0.0007	0.0036 ± 0.0008	0.0122 ± 0.0013	0.0017 ± 0.0013	0.0040 ± 0.0012	0.0060 ± 0.0012	0.0031 ± 0.0008
Zinc	0.1143 ± 0.0066	0.0405 ± 0.0027	0.0957 ± 0.0051	0.0806 ± 0.0051	0.0177 ± 0.0020	0.0271 ± 0.0022	0.0461 ± 0.0032	0.2213 ± 0.0116	0.0234 ± 0.0037	0.1834 ± 0.0098	0.0583 ± 0.0044	0.0255 ± 0.0025
Gallium	0.0000 ± 0.0041	0.0025 ± 0.0023	0.0001 ± 0.0023	0.0017 ± 0.0040	0.0017 ± 0.0023	0.0036 ± 0.0023	0.0018 ± 0.0028	0.0002 ± 0.0044	0.0000 ± 0.0046	0.0000 ± 0.0042	0.0048 ± 0.0043	0.0027 ± 0.0029
Arsenic	0.0000 ± 0.0011	0.0001 ± 0.0006	0.0001 ± 0.0006	0.0000 ± 0.0011	0.0005 ± 0.0006	0.0000 ± 0.0006	0.0000 ± 0.0008	0.0000 ± 0.0012	0.0000 ± 0.0013	0.0000 ± 0.0012	0.0006 ± 0.0012	0.0000 ± 0.0008
Selenium	0.0000 ± 0.0009	0.0000 ± 0.0005	0.0000 ± 0.0005	0.0000 ± 0.0009	0.0000 ± 0.0005	0.0000 ± 0.0005	0.0000 ± 0.0006	0.0000 ± 0.0010	0.0000 ± 0.0010	0.0000 ± 0.0010	0.0000 ± 0.0010	0.0000 ± 0.0007
Bromine	0.0023 ± 0.0012	0.0036 ± 0.0007	0.0084 ± 0.0008	0.0002 ± 0.0012	0.0010 ± 0.0007	0.0013 ± 0.0007	0.0001 ± 0.0008	0.0021 ± 0.0013	0.0199 ± 0.0017	0.0004 ± 0.0012	0.0000 ± 0.0012	0.0033 ± 0.0009
Rubidium	0.0004 ± 0.0011	0.0001 ± 0.0007	0.0002 ± 0.0007	0.0001 ± 0.0011	0.0005 ± 0.0007	0.0003 ± 0.0006	0.0003 ± 0.0008	0.0000 ± 0.0012	0.0004 ± 0.0013	0.0005 ± 0.0012	0.0000 ± 0.0012	0.0001 ± 0.0008
Strontium	0.0016 ± 0.0024	0.0012 ± 0.0013	0.0011 ± 0.0013	0.0007 ± 0.0023	0.0006 ± 0.0013	0.0005 ± 0.0013	0.0000 ± 0.0016	0.0002 ± 0.0025	0.0002 ± 0.0026	0.0009 ± 0.0024	0.0007 ± 0.0024	0.0005 ± 0.0016
Yttrium	0.0000 ± 0.0015	0.0002 ± 0.0009	0.0000 ± 0.0009	0.0000 ± 0.0015	0.0002 ± 0.0009	0.0000 ± 0.0008	0.0000 ± 0.0011	0.0002 ± 0.0016	0.0000 ± 0.0017	0.0004 ± 0.0016	0.0004 ± 0.0016	0.0008 ± 0.0011
Zirconium	0.0009 ± 0.0032	0.0004 ± 0.0018	0.0040 ± 0.0018	0.0019 ± 0.0031	0.0009 ± 0.0018	0.0034 ± 0.0018	0.0012 ± 0.0022	0.0034 ± 0.0034	0.0019 ± 0.0036	0.0019 ± 0.0033	0.0012 ± 0.0033	0.0008 ± 0.0022
Molybdenum	0.0022 ± 0.0037	0.0014 ± 0.0021	0.0051 ± 0.0021	0.0007 ± 0.0036	0.0003 ± 0.0021	0.0002 ± 0.0021	0.0021 ± 0.0025	0.0141 ± 0.0040	0.0039 ± 0.0042	0.0017 ± 0.0038	0.0096 ± 0.0039	0.0000 ± 0.0026
Palladium	0.0039 ± 0.0046	0.0008 ± 0.0026	0.0020 ± 0.0026	0.0004 ± 0.0044	0.0018 ± 0.0026	0.0043 ± 0.0026	0.0004 ± 0.0032	0.0001 ± 0.0049	0.0038 ± 0.0052	0.0049 ± 0.0047	0.0004 ± 0.0047	0.0032 ± 0.0032
Silver	0.0000 ± 0.0035	0.0006 ± 0.0020	0.0014 ± 0.0020	0.0002 ± 0.0034	0.0007 ± 0.0020	0.0022 ± 0.0020	0.0006 ± 0.0024	0.0011 ± 0.0038	0.0024 ± 0.0040	0.0048 ± 0.0036	0.0000 ± 0.0036	0.0011 ± 0.0025
Cadmium	0.0000 ± 0.0048	0.0003 ± 0.0028	0.0000 ± 0.0028	0.0000 ± 0.0047	0.0004 ± 0.0028	0.0000 ± 0.0027	0.0001 ± 0.0033	0.0000 ± 0.0052	0.0000 ± 0.0054	0.0000 ± 0.0050	0.0000 ± 0.0050	0.0000 ± 0.0034
Indium	0.0014 ± 0.0038	0.0004 ± 0.0022	0.0008 ± 0.0022	0.0000 ± 0.0037	0.0005 ± 0.0022	0.0000 ± 0.0021	0.0003 ± 0.0026	0.0021 ± 0.0041	0.0000 ± 0.0043	0.0006 ± 0.0039	0.0016 ± 0.0039	0.0000 ± 0.0027
Tin	0.0009 ± 0.0046	0.0002 ± 0.0026	0.0020 ± 0.0026	0.0009 ± 0.0045	0.0030 ± 0.0026	0.0017 ± 0.0026	0.0012 ± 0.0032	0.0000 ± 0.0049	0.0000 ± 0.0052	0.0004 ± 0.0047	0.0020 ± 0.0048	0.0028 ± 0.0032
Antimony	0.0003 ± 0.0047	0.0018 ± 0.0027	0.0023 ± 0.0027	0.0000 ± 0.0045	0.0020 ± 0.0027	0.0005 ± 0.0026	0.0000 ± 0.0032	0.0027 ± 0.0050	0.0008 ± 0.0053	0.0000 ± 0.0048	0.0016 ± 0.0048	0.0022 ± 0.0033
Barium	0.0071 ± 0.0109	0.0030 ± 0.0062	0.0042 ± 0.0063	0.0028 ± 0.0106	0.0052 ± 0.0062	0.0091 ± 0.0061	0.0035 ± 0.0075	0.0077 ± 0.0117	0.0000 ± 0.0122	0.0051 ± 0.0113	0.0004 ± 0.0113	0.0130 ± 0.0077
Lanthanum	0.0000 ± 0.0260	0.0058 ± 0.0149	0.0094 ± 0.0149	0.0000 ± 0.0252	0.0008 ± 0.0149	0.0031 ± 0.0145	0.0028 ± 0.0180	0.0012 ± 0.0280	0.0106 ± 0.0293	0.0082 ± 0.0268	0.0146 ± 0.0269	0.0087 ± 0.0183
Gold	0.0000 ± 0.0050	0.0017 ± 0.0029	0.0025 ± 0.0029	0.0000 ± 0.0049	0.0019 ± 0.0029	0.0002 ± 0.0028	0.0003 ± 0.0035	0.0000 ± 0.0054	0.0002 ± 0.0057	0.0004 ± 0.0052	0.0037 ± 0.0052	0.0034 ± 0.0035
Mercury	0.0017 ± 0.0019	0.0009 ± 0.0011	0.0006 ± 0.0011	0.0000 ± 0.0019	0.0007 ± 0.0011	0.0000 ± 0.0011	0.0004 ± 0.0013	0.0000 ± 0.0021	0.0000 ± 0.0022	0.0000 ± 0.0020	0.0007 ± 0.0020	0.0000 ± 0.0013
Thallium	0.0000 ± 0.0035	0.0006 ± 0.0020	0.0003 ± 0.0020	0.0000 ± 0.0034	0.0000 ± 0.0020	0.0000 ± 0.0020	0.0004 ± 0.0024	0.0020 ± 0.0038	0.0000 ± 0.0040	0.0000 ± 0.0036	0.0000 ± 0.0036	0.0012 ± 0.0025
Lead	0.0358 ± 0.0039	0.0035 ± 0.0019	0.0047 ± 0.0020	0.0043 ± 0.0033	0.0015 ± 0.0019	0.0030 ± 0.0019	0.0030 ± 0.0023	0.0142 ± 0.0037	0.0020 ± 0.0038	0.0018 ± 0.0035	0.0067 ± 0.0035	0.0051 ± 0.0024
Uranium	0.0000 ± 0.0047	0.0015 ± 0.0027	0.0012 ± 0.0027	0.0002 ± 0.0046	0.0011 ± 0.0027	0.0002 ± 0.0026	0.0013 ± 0.0033	0.0000 ± 0.0051	0.0000 ± 0.0053	0.0009 ± 0.0048	0.0007 ± 0.0049	0.0023 ± 0.0033
Anions by IC (mg/mi)												
Nitrate Ion	0.02 ± 0.01	0.03 ± 0.01	0.04 ± 0.01	0.01 ± 0.01	0.03 ± 0.01	0.02 ± 0.01	0.03 ± 0.01	0.02 ± 0.01	0.06 ± 0.01	0.01 ± 0.01	0.01 ± 0.01	0.05 ± 0.01
Sulfate Ion	0.24 ± 0.02	1.99 ± 0.11	1.65 ± 0.09	0.17 ± 0.01	0.40 ± 0.02	0.24 ± 0.01	0.23 ± 0.02	0.59 ± 0.03	4.19 ± 0.22	0.20 ± 0.02	0.11 ± 0.01	0.81 ± 0.04
Polycyclic aromatic hydrocarbons (ug/mile)												
Naphthalene	1924.91 ± 296.78	835.97 ± 130.70	1862.48 ± 287.77	479.49 ± 76.38	523.21 ± 83.25	1111.88 ± 173.51	2213.96 ± 342.90	1511.38 ± 235.25	7313.75 ± 1120.23	4786.73 ± 738.00	6271.44 ± 963.02	983.66 ± 153.93
2-methylnaphthalene	3566.82 ± 362.07	1557.06 ± 158.54	2639.91 ± 268.01	1010.27 ± 103.23	753.20 ± 77.28	2508.56 ± 257.39	5147.60 ± 528.11	13825.62 ± 1409.79	18124.51 ± 1838.57	5840.62 ± 599.28	10287.39 ± 1048.32	2770.00 ± 282.68
1-methylnaphthalene	1923.09 ± 207.49	720.62 ± 78.01	1195.15 ± 128.99	511.28 ± 55.54	346.41 ± 37.79	1404.54 ± 153.00	2677.12 ± 291.53	7100.06 ± 768.91	9217.26 ± 993.59	2700.41 ± 294.13	4962.15 ± 537.11	1350.73 ± 146.44
Biphenyl	241.78 ± 31.01	65.07 ± 8.39	99.64 ± 12.81	46.09 ± 5.97	37.00 ± 4.81	115.90 ± 14.99	176.17 ± 22.78	640.29 ± 82.34	648.08 ± 83.07	235.45 ± 30.43	371.17 ± 47.74	122.78 ± 15.84
1+2ethylnaphthalene	499.03 ± 68.21	169.62 ± 23.37	357.48 ± 48.92	176.39 ± 24.34	115.33 ± 16.03	377.59 ± 51.98	602.90 ± 82.88	1536.80 ± 210.22	1993.46 ± 271.81	461.93 ± 63.59	865.71 ± 118.49	422.23 ± 57.94
2,6+2,7-dimethylnaphthalene	476.49 ± 57.14	172.11 ± 20.70	243.70 ± 29.25	116.16 ± 14.01	65.10 ± 7.90	387.07 ± 46.78	497.13 ± 60.10	1843.72 ± 221.82	1442.15 ± 172.89	494.64 ± 59.83	924.93 ± 111.27	310.68 ± 37.43
1,3+1,6+1,7dimethylnaphth	715.20 ± 86.42	256.39 ± 31.11	384.67 ± 46.53	190.42 ± 23.17	105.88 ± 12.97	636.87 ± 77.54	758.63 ± 92.38	2721.45 ± 329.72	1919.17 ± 231.73	832.91 ± 101.45	1378.59 ± 167.03	503.06 ± 61.06
1,4+1,5+2,3-dimethylnaphth	57.40 ± 6.75	32.08 ± 3.83	13.64 ± 2.36	13.42 ± 1.65	3.71 ± 0.78	58.44 ± 6.93	62.75 ± 7.46	654.49 ± 76.65	325.24 ± 37.99	208.06 ± 24.55	321.11 ± 37.63	26.45 ± 3.25
1,2-dimethylnaphthalene	280.72 ± 37.50	62.71 ± 8.40	45.67 ± 6.19	51.12 ± 6.86	17.20 ± 2.35	295.20 ± 39.67	332.10 ± 44.63	1886.01 ± 252.52	722.21 ± 96.43	440.76 ± 59.23	360.57 ± 48.27	71.38 ± 9.59
2-Methylbiphenyl	0.00 ± 13.84	0.00 ± 12.67	108.74 ± 39.81	0.00 ± 11.37	0.00 ± 13.54	0.00 ± 13.83	0.00 ± 17.54	0.00 ± 23.43	117.60 ± 41.36	0.00 ± 22.88	0.00 ± 23.10	78.90 ± 33.95
3-Methylbiphenyl	65.93 ± 11.97	0.00 ± 5.44	105.06 ± 16.59	0.00 ± 5.12	0.00 ± 4.36	42.48 ± 9.95	66.44 ± 12.42	197.57 ± 25.88	259.64 ± 31.72	59.05 ± 12.57	93.63 ± 15.84	163.25 ± 21.89
4-Methylbiphenyl	29.78 ± 4.67	0.00 ± 1.99	40.36 ± 5.91	0.00 ± 1.77	0.00 ± 1.62	19.51 ± 3.87	28.08 ± 4.68	97.91 ± 11.10	91.97 ± 10.47	23.29 ± 4.58	41.90 ± 6.15	76.33 ± 8.96
Dibenzofuran	24.91 ± 2.75	12.09 ± 1.34	26.29 ± 2.91	8.29 ± 0.93	6.95 ± 0.78	9.60 ± 1.08	18.99 ± 2.13	68.79 ± 7.64	48.01 ± 5.31	52.11 ± 5.82	71.15 ± 7.88	17.49 ± 1.95
A-trimethylnaphthalene	70.40 ± 6.16	29.89 ± 2.63	32.34 ± 2.84	20.65 ± 1.83	10.56 ± 0.94	69.67 ± 6.19	68.25 ± 6.06	269.45 ± 23.72	117.99 ± 10.33	91.24 ± 8.10	130.87 ± 11.52	48.84 ± 4.31
1-ethyl-2-methylnaphthalene	14.38 ± 1.10	5.52 ± 0.43	6.44 ± 0.52	4.00 ± 0.31	2.16 ± 0.18	12.41 ± 0.97	12.84 ± 1.00	49.79 ± 3.83	20.88 ± 1.60	21.86 ± 1.70	24.62 ± 1.90	9.40 ± 0.73
B-trimethylnaphthalene	92.54 ± 13.38	32.06 ± 4.66	39.49 ± 5.73	25.74 ± 3.75	10.31 ± 1.52	79.33 ± 11.53	80.06 ± 11.65	184.73 ± 26.75	99.83 ± 14.44	100.80 ± 14.66	151.49 ± 21.94	60.49 ± 8.78
C-trimethylnaphthalene	48.02 ± 3.84	21.10 ± 1.70	26.10 ± 2.10	14.95 ± 1.21	6.73 ± 0.56	52.23 ± 4.25	47.07 ± 3.83	190.42 ± 15.31	59.10 ± 4.72	74.83 ± 6.08	94.53 ± 7.60	38.12 ± 3.07
2-ethyl-1-methylnaphthalene	1.53 ± 0.21	0.47 ± 0.09	0.60 ± 0.18	0.46 ± 0.07	0.19 ± 0.07	1.29 ± 0.18	1.48 ± 0.21	6.83 ± 0.89	2.16 ± 0.31	3.05 ± 0.42	2.64 ± 0.37	0.92 ± 0.15
E-trimethylnaphthalene	30.97 ± 2.78	12.15 ± 1.10	13.29 ± 1.21	8.60 ± 0.78	3.72 ± 0.35	31.18 ± 2.84	29.78 ± 2.72	128.77 ± 11.62	38.82 ± 3.49	45.88 ± 4.18	54.54 ± 4.92	23.32 ± 2.12
F-trimethylnaphthalene	29.38 ± 3.22	12.33 ± 1.36	15.88 ± 1.75	9.27 ± 1.03	4.02 ± 0.46	31.67 ± 3.50	29.26 ± 3.24	116.22 ± 12.77	35.91 ± 3.95	43.25 ± 4.79	52.79 ± 5.81	23.12 ± 2.55
2,3,5+I-trimethylnaphthalene	32.77 ± 3.63	14.97 ± 1.67	19.26 ± 2.15	11.74 ± 1.32	4.42 ± 0.51	37.39 ± 4.18	34.05 ± 3.81	139.37 ± 15.47	40.23 ± 4.46	59.16 ± 6.61	65.83 ± 7.32	27.38 ± 3.05
2,4,5-trimethylnaphthalene	5.60 ± 0.84	4.56 ± 0.68	2.82 ± 0.45	2.44 ± 0.37	0.63 ± 0.12	5.58 ± 0.84	5.48 ± 0.82	24.40 ± 3.62	6.52 ± 0.98	11.63 ± 1.74	15.66 ± 2.33	7.45 ± 1.11
J-trimethylnaphthalene	17.27 ± 1.99	2.40 ± 0.29	5.04 ± 0.61	4.31 ± 0.50	1.26 ± 0.16	15.81 ± 1.84	14.65 ± 1.70	60.36 ± 6.97	14.64 ± 1.69	16.76 ± 1.95	10.73 ± 1.25	3.63 ± 0.43
1,4,5-trimethylnaphthalene	5.76 ± 0.95	2.34 ± 0.40	0.83 ± 0.23	0.80 ± 0.15	0.55 ± 0.12	5.83 ± 0.96	4.88 ± 0.82	22.39 ± 3.66	5.70 ± 0.96	8.19 ± 1.36	4.22 ± 0.72	2.07 ± 0.36
Acenaphthylene	128.24 ± 13.71	93.06 ± 9.98	61.06 ± 6.57	42.54 ± 4.59	31.32 ± 3.41	139.51 ± 15.07	228.95 ± 24.74	994.70 ± 106.86	993.69 ± 106.26	1125.66 ± 121.56	393.69 ± 42.29	43.63 ± 4.73
Acenaphthene	88.89 ± 7.79	58.79 ± 5.33	15.86 ± 1.94	8.34 ± 1.23	24.35 ± 2.54	11.59 ± 1.51	62.87 ± 5.75	60.15 ± 5.54	139.78 ± 12.01	15.41 ± 1.95	29.91 ± 3.08	3.81 ± 1.00
Fluorene	112.50 ± 11.51	62.64 ± 6.43	57.79 ± 5.95	33.16 ± 3.42	18.64 ± 1.94	74.15 ± 7.67	123.29 ± 12.76	300.25 ± 30.87	311.17 ± 31.83	157.06 ± 16.27	162.52 ± 16.73	56.83 ± 5.87

Appendix B2. Chemical Composition of Dilution Blanks and Vehicle Exhaust Samples from Round2

Species Description	W3-1	W3-2	W3-3	W4-1	W4-2	W4-3	W5-1	W5-2	W5-3	W6-1	W6-2	W6-3
Dibenzothiophene	1.90 ± 0.23	2.31 ± 0.28	3.35 ± 0.43	1.06 ± 0.13	0.99 ± 0.13	1.71 ± 0.21	1.73 ± 0.22	9.18 ± 1.11	7.38 ± 0.89	46.86 ± 5.62	4.62 ± 0.57	10.23 ± 1.23
Phenanthrene	376.44 ± 40.02	180.77 ± 19.26	200.52 ± 21.36	92.77 ± 9.99	69.73 ± 7.55	231.09 ± 24.83	297.02 ± 31.98	1044.58 ± 111.56	695.50 ± 73.98	608.41 ± 65.38	471.95 ± 50.45	216.38 ± 23.22
Anthracene	94.40 ± 12.76	27.82 ± 3.75	8.65 ± 1.17	6.38 ± 0.86	9.04 ± 1.23	28.35 ± 3.85	70.59 ± 9.64	232.54 ± 31.62	174.01 ± 23.59	108.81 ± 14.86	108.68 ± 14.78	16.63 ± 2.28
A-methylfluorene	30.39 ± 3.31	13.13 ± 1.44	16.03 ± 1.76	9.38 ± 1.04	4.33 ± 0.50	20.61 ± 2.27	33.07 ± 3.64	109.08 ± 11.87	55.81 ± 6.07	38.67 ± 4.25	45.03 ± 4.91	22.39 ± 2.46
1-methylfluorene	20.15 ± 2.31	10.56 ± 1.22	14.42 ± 1.67	6.98 ± 0.81	5.07 ± 0.60	14.07 ± 1.64	24.97 ± 2.90	59.83 ± 6.89	36.92 ± 4.25	31.66 ± 3.68	37.23 ± 4.29	17.16 ± 1.99
B-methylfluorene	6.39 ± 1.19	3.61 ± 0.68	3.64 ± 0.70	1.87 ± 0.35	1.15 ± 0.23	3.97 ± 0.75	8.40 ± 1.58	21.20 ± 3.96	15.50 ± 2.90	11.20 ± 2.11	11.03 ± 2.07	3.90 ± 0.74
9-fluorenone	37.54 ± 4.30	26.40 ± 3.02	62.25 ± 7.11	18.94 ± 2.20	22.93 ± 2.67	15.21 ± 1.78	20.98 ± 2.49	179.42 ± 20.65	98.34 ± 11.31	137.97 ± 15.97	138.37 ± 15.93	37.78 ± 4.41
Xanthone	14.10 ± 1.96	0.31 ± 0.08	10.75 ± 1.49	4.32 ± 0.60	10.52 ± 1.47	6.98 ± 0.97	6.45 ± 0.92	46.52 ± 6.53	28.17 ± 3.95	8.63 ± 1.23	12.70 ± 1.80	8.92 ± 1.27
Acenaphthenequinone	8.39 ± 1.05	0.00 ± 0.06	0.00 ± 0.17	0.45 ± 0.08	5.03 ± 0.63	4.00 ± 0.51	0.00 ± 0.08	11.34 ± 1.47	12.13 ± 1.55	0.00 ± 0.14	0.00 ± 0.15	0.00 ± 0.09
Perinaphthenone	39.51 ± 6.73	10.97 ± 1.65	3.74 ± 0.52	6.79 ± 0.96	29.71 ± 4.95	24.51 ± 3.92	36.76 ± 6.66	133.25 ± 24.04	131.46 ± 23.68	58.36 ± 10.57	13.88 ± 2.54	7.11 ± 1.31
2-methylanthracene	18.71 ± 1.88	4.22 ± 0.43	2.52 ± 0.30	3.34 ± 0.34	6.35 ± 0.65	8.50 ± 0.87	13.44 ± 1.37	47.62 ± 4.82	30.25 ± 3.05	17.93 ± 1.83	16.44 ± 1.67	5.94 ± 0.61
3-methylphenanthrene	40.85 ± 3.01	18.02 ± 1.34	20.13 ± 1.50	11.06 ± 0.83	16.05 ± 1.21	37.14 ± 2.79	33.66 ± 2.54	121.18 ± 9.00	51.04 ± 3.77	56.92 ± 4.28	44.91 ± 3.34	29.30 ± 2.19
2-methylphenanthrene	44.54 ± 4.18	21.55 ± 2.03	23.00 ± 2.18	12.03 ± 1.16	19.12 ± 1.83	41.66 ± 3.95	35.76 ± 3.42	134.63 ± 12.71	58.44 ± 5.51	70.75 ± 6.75	51.34 ± 4.87	33.75 ± 3.21
9-methylphenanthrene	19.19 ± 1.91	8.29 ± 0.83	6.61 ± 0.68	6.25 ± 0.63	6.72 ± 0.68	15.05 ± 1.51	16.12 ± 1.63	64.41 ± 6.46	41.22 ± 4.11	33.77 ± 3.41	20.66 ± 2.08	11.13 ± 1.12
1-methylphenanthrene	28.70 ± 4.81	12.09 ± 2.02	12.01 ± 2.02	7.95 ± 1.33	13.87 ± 2.34	23.57 ± 3.97	24.48 ± 4.14	73.95 ± 12.48	42.30 ± 7.14	55.76 ± 9.44	28.17 ± 4.77	25.72 ± 4.35
Anthrone	0.00 ± 0.06	0.43 ± 0.12	0.00 ± 0.16	0.00 ± 0.04	0.74 ± 0.17	1.02 ± 0.23	0.00 ± 0.08	3.09 ± 0.68	0.00 ± 0.14	1.18 ± 0.30	0.00 ± 0.14	0.00 ± 0.08
Anthraquinone	40.72 ± 5.48	11.20 ± 1.46	0.13 ± 0.21	4.42 ± 0.60	31.01 ± 4.22	23.71 ± 3.20	2.60 ± 0.49	8.38 ± 1.30	90.53 ± 12.51	31.21 ± 4.42	17.62 ± 2.54	11.99 ± 1.77
3,6-dimethylphenanthrene	5.86 ± 0.61	2.52 ± 0.27	3.09 ± 0.36	2.63 ± 0.28	5.13 ± 0.54	7.67 ± 0.80	6.28 ± 0.66	20.60 ± 2.14	6.59 ± 0.70	9.73 ± 1.03	6.05 ± 0.65	4.67 ± 0.50
A-dimethylphenanthrene	7.96 ± 0.85	4.23 ± 0.46	4.88 ± 0.54	0.89 ± 0.10	7.77 ± 0.84	9.46 ± 1.02	7.63 ± 0.83	26.59 ± 2.87	7.88 ± 0.86	19.79 ± 2.16	10.57 ± 1.16	7.25 ± 0.79
B-dimethylphenanthrene	4.31 ± 0.46	2.24 ± 0.26	1.72 ± 0.25	0.48 ± 0.07	0.98 ± 0.13	3.85 ± 0.42	1.00 ± 0.14	7.89 ± 0.91	8.75 ± 1.00	7.74 ± 0.90	4.03 ± 0.48	2.84 ± 0.33
C-dimethylphenanthrene	11.90 ± 0.98	4.64 ± 0.39	3.86 ± 0.36	4.56 ± 0.38	10.92 ± 0.92	12.66 ± 1.06	9.73 ± 0.83	36.27 ± 3.03	14.24 ± 1.19	23.77 ± 2.01	12.68 ± 1.07	6.38 ± 0.54
D-dimethylphenanthrene	3.32 ± 0.36	1.53 ± 0.18	1.31 ± 0.22	1.27 ± 0.15	3.21 ± 0.36	4.27 ± 0.47	2.37 ± 0.28	9.57 ± 1.07	4.29 ± 0.49	7.10 ± 0.80	3.17 ± 0.38	2.11 ± 0.25
1,7-dimethylphenanthrene	8.21 ± 0.66	2.78 ± 0.23	2.17 ± 0.24	2.73 ± 0.23	6.80 ± 0.56	7.80 ± 0.64	5.81 ± 0.49	21.41 ± 1.77	7.99 ± 0.67	14.60 ± 1.22	7.51 ± 0.64	3.57 ± 0.31
E-dimethylphenanthrene	5.55 ± 0.50	2.24 ± 0.21	1.81 ± 0.23	2.08 ± 0.19	5.02 ± 0.46	5.80 ± 0.53	3.66 ± 0.35	14.64 ± 1.35	5.90 ± 0.55	10.39 ± 0.97	5.22 ± 0.50	2.66 ± 0.26
9-methylanthracene	1.37 ± 0.23	0.00 ± 0.06	0.00 ± 0.16	0.53 ± 0.10	0.75 ± 0.14	0.80 ± 0.15	1.00 ± 0.19	3.14 ± 0.54	2.09 ± 0.38	1.52 ± 0.29	0.00 ± 0.14	0.00 ± 0.08
Fluoranthene	96.38 ± 7.12	43.20 ± 3.20	36.69 ± 2.75	32.09 ± 2.42	30.44 ± 2.32	46.24 ± 3.51	76.41 ± 5.89	265.40 ± 20.19	203.23 ± 15.33	199.98 ± 15.38	73.82 ± 5.63	48.42 ± 3.71
Pyrene	96.81 ± 8.41	44.24 ± 3.87	31.42 ± 2.79	37.51 ± 3.34	37.04 ± 3.32	47.37 ± 4.21	76.98 ± 7.01	321.20 ± 28.88	227.09 ± 20.30	241.66 ± 21.90	69.63 ± 6.30	37.27 ± 3.39
9-Anthraaldehyde	0.33 ± 0.10	0.01 ± 0.06	0.00 ± 0.16	3.18 ± 0.84	0.36 ± 0.11	0.60 ± 0.18	0.00 ± 0.08	0.83 ± 0.28	12.77 ± 3.39	22.38 ± 5.93	12.30 ± 3.28	8.23 ± 2.18
Retene	0.23 ± 0.09	0.20 ± 0.09	0.00 ± 0.23	0.58 ± 0.12	0.22 ± 0.09	0.19 ± 0.09	0.31 ± 0.12	0.66 ± 0.23	1.14 ± 0.28	5.20 ± 0.96	0.00 ± 0.19	0.07 ± 0.11
Benzonaphthothiophene	0.10 ± 0.12	0.06 ± 0.12	0.03 ± 0.32	0.04 ± 0.08	0.04 ± 0.12	0.03 ± 0.12	0.00 ± 0.15	0.00 ± 0.28	0.00 ± 0.27	0.00 ± 0.27	0.33 ± 0.28	0.27 ± 0.17
1+3-methylfluoranthene	4.79 ± 0.58	1.91 ± 0.24	1.39 ± 0.24	2.02 ± 0.26	3.51 ± 0.45	4.38 ± 0.56	4.44 ± 0.60	10.78 ± 1.43	8.74 ± 1.16	14.04 ± 1.86	5.94 ± 0.79	2.51 ± 0.34
1-MeFl+C-MeFl/Py	4.81 ± 0.45	2.23 ± 0.22	1.89 ± 0.24	2.10 ± 0.21	4.07 ± 0.40	5.30 ± 0.52	4.68 ± 0.48	12.02 ± 1.22	9.17 ± 0.94	13.55 ± 1.39	7.13 ± 0.73	3.21 ± 0.34
B-MePy/MeFl	8.36 ± 0.66	2.68 ± 0.22	1.87 ± 0.22	3.41 ± 0.28	5.17 ± 0.43	7.79 ± 0.65	7.99 ± 0.69	19.79 ± 1.70	20.91 ± 1.78	19.78 ± 1.70	7.96 ± 0.69	3.41 ± 0.30
C-MePy/MeFl	6.24 ± 0.47	1.86 ± 0.15	1.14 ± 0.18	2.11 ± 0.16	3.29 ± 0.26	6.22 ± 0.49	5.62 ± 0.47	13.79 ± 1.14	16.88 ± 1.38	13.55 ± 1.12	5.36 ± 0.46	2.07 ± 0.19
D-MePy/MeFl	4.08 ± 0.46	1.66 ± 0.20	1.53 ± 0.24	1.73 ± 0.21	2.73 ± 0.33	3.71 ± 0.45	3.49 ± 0.45	9.77 ± 1.23	7.52 ± 0.95	11.79 ± 1.50	4.10 ± 0.53	2.13 ± 0.28
4-methylpyrene	3.19 ± 0.32	1.45 ± 0.16	1.40 ± 0.22	1.76 ± 0.19	1.92 ± 0.21	2.95 ± 0.32	3.31 ± 0.38	8.72 ± 0.99	8.26 ± 0.93	11.17 ± 1.27	3.92 ± 0.46	1.82 ± 0.22
1-methylpyrene	3.00 ± 0.26	1.25 ± 0.12	0.86 ± 0.18	1.91 ± 0.18	1.88 ± 0.18	2.52 ± 0.24	2.70 ± 0.27	7.09 ± 0.70	6.69 ± 0.66	11.99 ± 1.17	3.87 ± 0.40	1.96 ± 0.20
Benzo(c)phenanthrene	3.69 ± 0.43	1.68 ± 0.22	0.15 ± 0.16	0.22 ± 0.05	1.74 ± 0.23	2.09 ± 0.27	0.00 ± 0.08	7.30 ± 1.04	8.31 ± 1.16	12.35 ± 1.73	2.44 ± 0.38	1.69 ± 0.25
Benzo(ghi)fluoranthene	40.60 ± 3.18	18.30 ± 1.49	18.38 ± 1.48	19.88 ± 1.62	18.72 ± 1.54	26.46 ± 2.22	46.58 ± 4.11	120.31 ± 10.53	141.95 ± 12.33	80.84 ± 7.14	15.44 ± 1.36	11.91 ± 1.05
Cyclopenta(c,d)pyrene	12.02 ± 1.37	2.69 ± 0.34	1.32 ± 0.23	3.31 ± 0.38	2.20 ± 0.27	5.25 ± 0.68	11.21 ± 1.79	56.52 ± 8.97	42.22 ± 6.69	99.99 ± 15.89	6.07 ± 0.99	2.20 ± 0.37
Benz(a)anthracene	14.89 ± 1.60	4.82 ± 0.61	3.09 ± 0.58	7.24 ± 0.86	4.64 ± 0.57	10.50 ± 1.28	13.02 ± 1.88	27.81 ± 3.99	36.60 ± 5.23	40.96 ± 5.88	9.29 ± 1.39	6.75 ± 1.00
Triphenylene	0.00 ± 0.06	0.35 ± 0.07	0.00 ± 0.16	0.00 ± 0.04	0.00 ± 0.06	0.00 ± 0.06	0.00 ± 0.08	0.00 ± 0.14	0.00 ± 0.14	0.00 ± 0.13	0.00 ± 0.14	0.00 ± 0.08
Chrysene	18.63 ± 1.10	7.67 ± 0.51	5.76 ± 0.43	6.81 ± 0.45	6.51 ± 0.44	10.34 ± 0.72	13.92 ± 1.17	33.75 ± 2.79	46.16 ± 3.79	43.07 ± 3.59	9.75 ± 0.83	7.41 ± 0.63
Benzanthrone	35.34 ± 5.66	19.17 ± 3.07	1.66 ± 0.33	7.15 ± 1.15	11.41 ± 1.84	6.96 ± 1.13	0.00 ± 0.08	0.00 ± 0.14	0.00 ± 0.14	0.00 ± 0.13	0.00 ± 0.14	0.00 ± 0.08
7-methylbenz(a)anthracene	0.11 ± 0.09	0.00 ± 0.06	0.00 ± 0.16	0.11 ± 0.07	0.04 ± 0.06	0.30 ± 0.18	0.00 ± 0.08	0.30 ± 0.23	0.77 ± 0.46	0.00 ± 0.13	0.00 ± 0.14	0.00 ± 0.08
3-methylchrysene	1.71 ± 0.15	0.56 ± 0.07	0.26 ± 0.16	0.46 ± 0.05	0.42 ± 0.07	1.27 ± 0.12	0.89 ± 0.12	3.73 ± 0.42	3.52 ± 0.39	3.38 ± 0.38	0.31 ± 0.14	0.18 ± 0.08
Benz(a)anthracene-7,12-dione	7.02 ± 1.37	4.99 ± 1.00	0.52 ± 0.20	1.23 ± 0.25	2.84 ± 0.55	1.41 ± 0.29	0.93 ± 0.21	5.25 ± 1.07	17.42 ± 3.48	5.26 ± 1.07	1.06 ± 0.27	1.89 ± 0.39
5+6-methylchrysene	0.44 ± 0.08	0.13 ± 0.06	0.05 ± 0.16	0.17 ± 0.04	0.13 ± 0.06	0.29 ± 0.07	0.34 ± 0.10	1.03 ± 0.23	1.21 ± 0.25	0.00 ± 0.13	0.00 ± 0.14	0.05 ± 0.08
Benzo(b+j+k)fluoranthene	19.34 ± 4.04	16.76 ± 3.61	4.54 ± 0.94	7.36 ± 1.48	10.05 ± 2.06	27.29 ± 5.75	2.13 ± 0.52	15.93 ± 3.51	28.65 ± 6.21	60.55 ± 13.04	16.81 ± 3.70	19.54 ± 4.22
Benzo(a)fluoranthene	2.40 ± 0.49	1.47 ± 0.29	0.74 ± 0.21	0.84 ± 0.17	0.89 ± 0.18	5.83 ± 1.18	0.22 ± 0.09	2.76 ± 0.58	3.66 ± 0.77	7.07 ± 1.45	1.69 ± 0.38	0.55 ± 0.14
BeP	16.80 ± 1.63	7.16 ± 0.76	3.65 ± 0.34	3.33 ± 0.28	4.96 ± 0.49	8.69 ± 0.73	4.82 ± 0.55	29.13 ± 3.26	39.44 ± 4.39	24.90 ± 2.80	5.32 ± 0.62	7.04 ± 0.79
BaP	16.78 ± 1.47	4.95 ± 0.50	1.75 ± 0.55	3.20 ± 0.27	4.09 ± 0.38	9.10 ± 0.77	4.36 ± 0.48	35.56 ± 3.41	50.61 ± 4.80	32.84 ± 3.17	8.09 ± 0.89	4.27 ± 0.48
Perylene	3.36 ± 0.47	0.89 ± 0.18	0.41 ± 0.18	0.81 ± 0.12	0.92 ± 0.15	2.01 ± 0.33	1.16 ± 0.24	6.13 ± 1.16	8.32 ± 1.57	8.66 ± 1.63	2.72 ± 0.54	1.05 ± 0.22
7-methylbenzo(a)pyrene	0.00 ± 0.06	0.00 ± 0.06	0.00 ± 0.16	0.00 ± 0.04	0.79 ± 0.26	0.52 ± 0.19	6.51 ± 1.73	0.00 ± 0.14	0.00 ± 0.14	0.00 ± 0.13	0.00 ± 0.14	0.00 ± 0.08
9,10-dihydrobenzo(a)pyrene-7(8H)-one	0.00 ± 0.06	0.00 ± 0.06	0.00 ± 0.16	0.00 ± 0.04	0.00 ± 0.06	0.00 ± 0.06	0.00 ± 0.08	0.00 ± 0.14	0.00 ± 0.14	0.00 ± 0.13	0.00 ± 0.14	0.00 ± 0.08
Dibenzo(a,j)anthracene	1.26 ± 0.25	0.61 ± 0.13	0.14 ± 0.16	0.08 ± 0.04	0.40 ± 0.10	0.34 ± 0.09	0.00 ± 0.08	2.66 ± 0.54	5.05 ± 1.00	1.90 ± 0.40	0.00 ± 0.14	0.00 ± 0.08
Indeno[123-cd]pyrene	19.27 ± 3.69	8.97 ± 1.74	6.23 ± 1.24	2.62 ± 0.51	5.51 ± 1.08	9.42 ± 1.83	3.16 ± 0.63	40.30 ± 7.81	59.27 ± 11.46	87.92 ± 17.03	0.00 ± 0.14	2.79 ± 0.56
Dibenzo(ah+ac)anthracene	1.16 ± 0.16	0.60 ± 0.10	0.03 ± 0.16	0.00 ± 0.04	0.37 ± 0.08	0.42 ± 0.08	0.00 ± 0.08	2.04 ± 0.30	2.93 ± 0.40	1.83 ± 0.28	0.00 ± 0.14	0.04 ± 0.08
Benzo(b)chrysene	1.03 ± 0.22	0.00 ± 0.06	0.20 ± 0.17	0.00 ± 0.04	0.00 ± 0.06	0.13 ± 0.07	0.00 ± 0.08	0.35 ± 0.17	1.87 ± 0.42	1.16 ± 0.29	0.00 ± 0.14	0.13 ± 0.09
Picene	2.14 ± 0.39	0.00 ± 0.06	0.14 ± 0.16	0.09 ± 0.04	0.00 ± 0.06	0.43 ± 0.10	0.00 ± 0.08	1.30 ± 0.27	1.33 ± 0.28	1.57 ± 0.32	0.00 ± 0.14	0.24 ± 0.09
Benzo(ghi)perylene	37.46 ± 4.95	5.49 ± 0.75	6.31 ± 1.01	5.09 ± 0.69	8.87 ± 1.19	10.20 ± 1.37	6.08 ± 0.85	84.08 ± 11.13	118.47 ± 15.63	94.43 ± 12.55	17.63 ± 2.38	9.83 ± 1.33
Anthanthrene	3.02 ± 0.45	0.27 ± 0.07	0.49 ± 0.18	0.17 ± 0.05	0.17 ± 0.06	0.99 ± 0.16	0.00 ± 0.08	0.00 ± 0.14	12.44 ± 1.81	11.43 ± 1.68	2.47 ± 0.39	0.10 ± 0.08
Dibenzo(b,k)fluoranthene	1.55 ± 0.22	0.54 ± 0.09	0.00 ± 0.16	0.25 ± 0.05	0.56 ± 0.09	1.35 ± 0.19	0.41 ± 0.10	2.59 ± 0.38	6.08 ± 0.83	2.61 ± 0.38	0.00 ± 0.14	0.82 ± 0.13
Dibenzo(a,e)pyrene	0.44 ± 0.10	1.11 ± 0.21	0.60 ± 0.20	0.49 ± 0.10	0.78 ± 0.16	1.95 ± 0.36	0.00 ± 0.08	7.07 ± 1.30	12.70 ± 2.32	3.02 ± 0.57	0.88 ± 0.21	0.89 ± 0.18
Coronene	15.11 ± 1.98	6.89 ± 0.91	3.69 ± 0.51	2.08 ± 0.27	4.70 ± 0.62	6.56 ± 0.85	5.55 ± 0.74	46.42 ± 6.14	74.44 ± 9.81	24.30 ± 3.23	7.16 ± 0.96	5.46 ± 0.73
Dibenzo(a,h)pyrene	0.00 ± 0.06	0.00 ± 0.06	0.00 ± 0.16	0.00 ± 0.04	0.00 ± 0.06	0.07 ± 0.06	0.00 ± 0.08	0.00 ± 0.14	4.57 ± 0.41	0.00 ± 0.13	0.00 ± 0.14	0.00 ± 0.08
nitro-PAH (ug/mile)												
1-nitronaphthalene	0.1798 ± 0.0184	0.0000 ± 0.0028	0.1501 ± 0.0160	0.0027 ± 0.0034	0.0168 ± 0.0046	0.0177 ± 0.0047	0.5800 ± 0.0544	0.2849 ± 0.0281	0.3013 ± 0.0293	0.0175 ± 0.0054	0.0670 ± 0.0092	0.1121 ± 0.0128
2-nitronaphthalene	0.4275 ± 0.0550	0.0777 ± 0.0120	0.2597 ± 0.0326	0.0436 ± 0.0079	0.0781 ± 0.0124	0.2786 ± 0.0370	0.8353 ± 0.1060	0.6360 ± 0.0812	0.5122 ± 0.0657	0.0369 ± 0.0079	0.1231 ± 0.0182	0.3106 ± 0.0411
2-nitrobiphenyl	0.0117 ± 0.0023	0.0030 ± 0.0008	0.0086 ± 0.0018	0.0038 ± 0.0010	0.0057 ± 0.0013	0.0000 ± 0.0004	0.0095 ± 0.0020	0.0185 ± 0.0035	0.0039 ± 0.0011	0.0081 ± 0.0018	0.0136 ± 0.0027	0.0102 ± 0.0021
3-nitrobiphenyl	0.0300 ± 0.0052	0.0023 ± 0.0006	0.0130 ± 0.0021	0.0002 ± 0.0002	0.0058 ± 0.0011	0.0086 ± 0.0016	0.0285 ± 0.0049	0.0243 ± 0.0042	0.0390 ± 0.0067	0.0059 ± 0.0012	0.0050 ± 0.0010	0.0084 ± 0.0016
4-nitrobiphenyl	0.0000 ± 0.0013	0.0000 ± 0.0013	0.0272 ± 0.0061	0.0000 ± 0.0011	0.0000 ± 0.0019	0.0000 ± 0.0013	0.0734 ± 0.0150	0.0000 ± 0.0025	0.1192 ± 0.0230	0.0244 ± 0.0069	0.0000 ± 0.0033	0.1153 ± 0.0223
2-nitrofluorene	0.0015 ± 0.0002	0.0000 ± 0.0001	0.0130 ± 0.0010	0.0000 ± 0.0001	0.0012 ± 0.0002	0.0004 ± 0.0001	0.0046 ± 0.0006	0.0000 ± 0.0002	0.0131 ± 0.0013	0.0050 ± 0.0006	0.0116 ± 0.0012	0.0014 ± 0.0003
1,3-dinitronaphthalene	0.0000 ± 0.0003	0.0000 ± 0.0003	0.0115 ± 0.0015	0.0000 ± 0.0003	0.0000 ± 0.0003	0.0000 ± 0.0003	0.0000 ± 0.0006	0.0039 ± 0.0014	0.0158 ± 0.0024	0.0098 ± 0.0019	0.0000 ± 0.0008	0.0000 ± 0.0010
1,5-dinitronaphthalene	0.0000 ± 0.0001	0.0000 ± 0.0001	0.0022 ± 0.0003	0.0000 ± 0.0000	0.0000 ± 0.0001	0.0000 ± 0.0001	0.0012 ± 0.0002	0.0000 ± 0.0002	0.0044 ± 0.0007	0.0005 ± 0.0002	0.0012 ± 0.0003	0.0032 ± 0.0005
5-nitroacenaphthene	0.0043 ± 0.0013	0.0000 ± 0.0005	0.0071 ± 0.0015	0.0000 ± 0.0004	0.0000 ± 0.0005	0.0000 ± 0.0005	0.0147 ± 0.0026	0.0000 ± 0.0014	0.0272 ± 0.0039	0.0000 ± 0.0011	0.0000 ± 0.0012	0.0317 ± 0.0042
9-nitroanthracene	0.0639 ± 0.0099	0.0000 ± 0.0001	0.0091 ± 0.0016	0.0000 ± 0.0001	0.0000 ± 0.0001	0.0143 ± 0.0024	0.2022 ± 0.0332	0.0158 ± 0.0028	0.0538 ± 0.0090	0.0008 ± 0.0004	0.0181 ± 0.0031	0.0196 ± 0.0034
4-nitrophenanthrene	0.0012 ± 0.0001	0.0000 ± 0.0001	0.0024 ± 0.0003	0.0000 ± 0.0000	0.0000 ± 0.0001	0.0000 ± 0.0001	0.0027 ± 0.0003	0.0015 ± 0.0002	0.0068 ± 0.0006	0.0001 ± 0.0001	0.0009 ± 0.0002	0.0000 ± 0.0001
9-nitrophenanthrene	0.0042 ± 0.0006	0.0000 ± 0.0001	0.0234 ± 0.0035	0.0000 ± 0.0000	0.0000 ± 0.0001	0.0065 ± 0.0010	0.0048 ± 0.0008	0.0084 ± 0.0013	0.0000 ± 0.0002	0.0046 ± 0.0007	0.0053 ± 0.0009	0.0000 ± 0.0001
1,8-dinitronaphthalene	0.0000 ± 0.0001	0.0000 ± 0.0001	0.0000 ± 0.0002	0.0000 ± 0.0001	0.0000 ± 0.0001	0.0048 ± 0.0007	0.0027 ± 0.0006	0.0000 ± 0.0003	0.0000 ± 0.0003	0.0057 ± 0.0009	0.0041 ± 0.0008	0.0000 ± 0.0002
2-nitrofluoranthene	0.0305 ± 0.0035	0.0018 ± 0.0005	0.0140 ± 0.0016	0.0135 ± 0.0015	0.0000 ± 0.0003	0.0152 ± 0.0017	0.0273 ± 0.0032	0.0000 ± 0.0004	0.0229 ± 0.0027	0.0623 ± 0.0069	0.0221 ± 0.0026	0.0000 ± 0.0002
3-nitrofluoranthene	0.0051 ± 0.0004	0.0000 ± 0.0001	0.0635 ± 0.0045	0.0043 ± 0.0003	0.0000 ± 0.0001	0.0041 ± 0.0003	0.0022 ± 0.0003	0.0256 ± 0.0019	0.1186 ± 0.0084	0.0073 ± 0.0006	0.0024 ± 0.0003	0.0080 ± 0.0006
1-nitropyrene	0.3259 ± 0.0380	0.0049 ± 0.0009	0.0542 ± 0.0052	0.0499 ± 0.0061	0.0674 ± 0.0077	0.0301 ± 0.0037	0.2510 ± 0.0307	0.1122 ± 0.0139	0.6285 ± 0.0759	0.0903 ± 0.0112	0.0507 ± 0.0064	0.1771 ± 0.0217
7-nitrobenzo(a)anthracene	0.0000 ± 0.0001	0.0000 ± 0.0001	0.0084 ± 0.0012	0.0009 ± 0.0003	0.0049 ± 0.0008	0.0023 ± 0.0005	0.0603 ± 0.0082	0.0350 ± 0.0049	0.0000 ± 0.0003	0.0807 ± 0.0109	0.0233 ± 0.0033	0.2039 ± 0.0272
6-nitrochrysene	0.0049 ± 0.0008	0.0000 ± 0.0001	0.0199 ± 0.0023	0.0000 ± 0.0000	0.0020 ± 0.0003	0.0000 ± 0.0001	0.0301 ± 0.0048	0.0125 ± 0.0020	0.0341 ± 0.0054	0.0904 ± 0.0143	0.0137 ± 0.0022	0.0574 ± 0.0091

Appendix B2. Chemical Composition of Dilution Blanks and Vehicle Exhaust Samples from Round2

Species Description	W3-1	W3-2	W3-3	W4-1	W4-2	W4-3	W5-1	W5-2	W5-3	W6-1	W6-2	W6-3
6-nitrobenz[a]pyrene	0.0000 ± 0.0001	0.0000 ± 0.0001	0.0000 ± 0.0002	0.0030 ± 0.0003	0.0000 ± 0.0001	0.0000 ± 0.0001	0.0000 ± 0.0001	0.0000 ± 0.0001	0.0067 ± 0.0006	0.0000 ± 0.0001	0.0000 ± 0.0001	0.0000 ± 0.0001
Hopanes (ug/mile)												
18a(H),21ß(H)-22,29,30-Trisnorhopane &	1.15 ± 0.14	0.83 ± 0.10	0.00 ± 0.16	0.21 ± 0.05	0.15 ± 0.06	0.63 ± 0.09	1.49 ± 0.18	0.00 ± 0.14	2.01 ± 0.26	12.58 ± 1.36	0.88 ± 0.17	0.73 ± 0.11
17a(H),21ß(H)-22,29,30-Trisnorhopane	0.47 ± 0.16	0.28 ± 0.13	0.00 ± 0.18	0.00 ± 0.05	0.00 ± 0.07	0.44 ± 0.15	0.00 ± 0.10	0.00 ± 0.17	0.43 ± 0.22	9.75 ± 2.02	0.00 ± 0.16	0.09 ± 0.13
17a(H),21ß(H)-30-Norhopane	4.19 ± 0.81	3.06 ± 0.63	1.44 ± 0.37	0.70 ± 0.16	0.51 ± 0.13	2.43 ± 0.46	2.25 ± 0.52	7.34 ± 1.62	7.73 ± 1.69	47.16 ± 9.66	1.69 ± 0.48	1.95 ± 0.46
17a(H),21ß(H)-Hopane	2.68 ± 0.53	2.11 ± 0.41	1.23 ± 0.32	0.47 ± 0.10	0.33 ± 0.10	1.16 ± 0.23	1.49 ± 0.32	5.58 ± 1.13	5.01 ± 1.01	29.18 ± 5.69	1.14 ± 0.29	1.42 ± 0.30
17ß(H),21a(H)-hopane	0.00 ± 0.06	0.00 ± 0.06	0.00 ± 0.16	0.00 ± 0.04	0.00 ± 0.06	0.03 ± 0.06	0.00 ± 0.08	0.00 ± 0.14	0.00 ± 0.14	1.70 ± 0.47	0.00 ± 0.14	0.16 ± 0.09
22S-17a(H),21ß(H)-30-Homohopane	1.55 ± 0.18	1.86 ± 0.24	0.00 ± 0.16	0.27 ± 0.05	0.36 ± 0.08	1.37 ± 0.17	0.95 ± 0.15	0.00 ± 0.14	2.51 ± 0.35	21.04 ± 2.68	0.87 ± 0.18	1.02 ± 0.15
22R-17a(H),21ß(H)-30-Homohopane	0.85 ± 0.20	1.78 ± 0.40	0.00 ± 0.16	0.00 ± 0.04	0.25 ± 0.08	1.21 ± 0.27	0.67 ± 0.17	0.00 ± 0.14	0.00 ± 0.14	17.26 ± 3.84	0.71 ± 0.22	0.91 ± 0.23
17ß(H),21ß(H)-Hopane	0.28 ± 0.08	0.00 ± 0.06	0.00 ± 0.16	0.00 ± 0.04	0.00 ± 0.06	0.00 ± 0.06	0.00 ± 0.08	0.00 ± 0.14	0.00 ± 0.14	2.19 ± 0.43	0.00 ± 0.14	0.13 ± 0.08
22S-17a(H),21ß(H)-30,31-Bishomohopan	0.72 ± 0.22	1.01 ± 0.30	0.34 ± 0.20	0.11 ± 0.05	0.06 ± 0.06	0.28 ± 0.10	0.00 ± 0.08	0.00 ± 0.14	0.81 ± 0.28	12.50 ± 3.53	0.43 ± 0.20	0.63 ± 0.20
22R-17a(H),21ß(H)-30,31-Bishomohopan	0.52 ± 0.09	0.37 ± 0.08	0.00 ± 0.16	0.13 ± 0.04	0.14 ± 0.06	0.00 ± 0.06	0.00 ± 0.08	0.00 ± 0.14	0.45 ± 0.15	8.03 ± 1.04	0.00 ± 0.14	0.38 ± 0.09
22S-17a(H),21ß(H)-30,31,32-Trisomohop	0.24 ± 0.08	0.50 ± 0.13	0.00 ± 0.16	0.06 ± 0.04	0.11 ± 0.07	0.41 ± 0.11	0.00 ± 0.08	0.00 ± 0.14	0.00 ± 0.14	6.66 ± 1.48	0.00 ± 0.14	0.22 ± 0.10
22R-17a(H),21ß(H)-30,31,32-Trishomoho	0.16 ± 0.07	0.22 ± 0.07	0.00 ± 0.16	0.02 ± 0.04	0.00 ± 0.06	0.00 ± 0.06	0.00 ± 0.08	0.00 ± 0.14	0.00 ± 0.14	2.77 ± 0.52	0.00 ± 0.14	0.06 ± 0.08
Steranes (ug/mile)												
C27-20S5a(H),14a(H)-cholestane	0.08 ± 0.06	0.00 ± 0.06	0.00 ± 0.16	0.00 ± 0.04	0.00 ± 0.06	0.00 ± 0.06	0.00 ± 0.08	0.00 ± 0.14	1.25 ± 0.26	0.25 ± 0.14	0.00 ± 0.14	0.42 ± 0.11
C27-20R5a(H),14ß(H)-cholestane	0.03 ± 0.06	0.09 ± 0.07	0.00 ± 0.16	0.03 ± 0.05	0.03 ± 0.07	0.10 ± 0.08	0.00 ± 0.08	0.73 ± 0.26	1.65 ± 0.47	4.64 ± 1.23	0.50 ± 0.21	1.50 ± 0.42
C27-20S5a(H),14ß(H),17ß(H)-cholestane	0.48 ± 0.12	0.17 ± 0.07	0.00 ± 0.16	0.05 ± 0.04	0.09 ± 0.06	0.35 ± 0.09	0.00 ± 0.08	0.46 ± 0.17	0.74 ± 0.21	6.32 ± 1.27	0.39 ± 0.16	0.95 ± 0.21
ster45+40(cholestane)	0.42 ± 0.10	0.18 ± 0.07	0.11 ± 0.16	0.09 ± 0.05	0.06 ± 0.06	0.14 ± 0.06	0.33 ± 0.10	0.65 ± 0.18	0.65 ± 0.18	5.54 ± 0.87	0.37 ± 0.16	0.21 ± 0.09
C28-20S5a(H),14a(H),17a(H)-ergostane	0.24 ± 0.09	0.16 ± 0.07	0.00 ± 0.16	0.09 ± 0.05	0.03 ± 0.06	0.00 ± 0.06	0.00 ± 0.08	0.00 ± 0.14	0.40 ± 0.17	2.96 ± 0.71	0.28 ± 0.16	0.13 ± 0.09
C28-20R5a(H),14ß(H),17ß(H)-ergostane	0.08 ± 0.07	0.01 ± 0.06	0.02 ± 0.16	0.00 ± 0.04	0.00 ± 0.06	0.00 ± 0.06	0.00 ± 0.08	0.00 ± 0.14	0.39 ± 0.20	3.37 ± 0.95	0.17 ± 0.16	0.04 ± 0.09
C28-20S5a(H),14ß(H),17ß(H)-ergostane	0.15 ± 0.07	0.16 ± 0.07	0.00 ± 0.16	0.00 ± 0.04	0.07 ± 0.06	0.00 ± 0.06	0.00 ± 0.08	0.00 ± 0.14	1.53 ± 0.40	2.15 ± 0.54	0.00 ± 0.14	0.04 ± 0.08
C28-20R5a(H),14a(H),17a(H)-ergostane	0.21 ± 0.07	0.12 ± 0.06	0.00 ± 0.16	0.02 ± 0.04	0.06 ± 0.06	0.00 ± 0.06	0.00 ± 0.08	0.00 ± 0.14	0.30 ± 0.15	3.32 ± 0.49	0.46 ± 0.16	0.09 ± 0.08
C29-20S5a(H),14a(H),17a(H)-stigmastan	0.23 ± 0.07	0.06 ± 0.06	0.00 ± 0.16	0.06 ± 0.04	0.09 ± 0.06	0.00 ± 0.06	0.00 ± 0.08	0.00 ± 0.14	0.96 ± 0.22	4.41 ± 0.84	0.20 ± 0.15	0.16 ± 0.08
C29-20R5a(H),14ß(H),17ß(H)-stigmastan	0.00 ± 1.12	0.16 ± 0.06	0.00 ± 0.16	0.20 ± 0.05	0.25 ± 0.07	0.09 ± 0.06	0.00 ± 0.08	0.00 ± 0.14	2.30 ± 0.34	7.79 ± 1.04	0.45 ± 0.15	0.21 ± 0.08
C29-20S5a(H),14ß(H),17ß(H)-stigmastan	0.39 ± 0.10	0.10 ± 0.06	0.00 ± 0.16	0.10 ± 0.04	0.08 ± 0.06	0.15 ± 0.07	0.24 ± 0.09	0.00 ± 0.14	0.87 ± 0.22	6.02 ± 1.24	0.27 ± 0.15	0.17 ± 0.09
C29-20R5a(H),14a(H),17a(H)-stigmastan	0.23 ± 0.08	0.09 ± 0.06	0.00 ± 0.16	0.07 ± 0.04	0.16 ± 0.07	0.06 ± 0.06	0.00 ± 0.08	0.00 ± 0.14	0.74 ± 0.21	3.27 ± 0.70	0.25 ± 0.15	0.10 ± 0.08
Alkanes (ug/mile)												
Dodecane	75.95 ± 20.82	72.14 ± 19.83	217.07 ± 52.72	57.00 ± 16.49	57.48 ± 16.55	53.80 ± 15.76	86.48 ± 23.56	421.68 ± 100.88	163.35 ± 41.54	1.92 ± 5.63	212.13 ± 52.76	0.00 ± 3.06
Tridecane	46.82 ± 7.02	80.68 ± 11.01	218.04 ± 27.17	124.83 ± 16.28	69.76 ± 9.78	57.47 ± 8.34	85.39 ± 11.82	0.00 ± 2.02	514.91 ± 62.59	367.10 ± 45.43	22.83 ± 4.76	420.00 ± 51.51
Norfarnesane	10.86 ± 2.50	3.24 ± 1.20	87.74 ± 16.20	32.40 ± 6.31	9.99 ± 2.36	28.25 ± 4.86	20.37 ± 4.41	327.16 ± 58.96	343.54 ± 61.75	138.13 ± 25.40	203.62 ± 37.00	120.10 ± 22.11
Heptylcyclohexane	9.22 ± 1.77	0.45 ± 0.26	1.22 ± 0.48	0.00 ± 0.15	3.15 ± 0.71	4.22 ± 0.90	19.72 ± 3.64	9.84 ± 1.96	3.42 ± 0.85	0.40 ± 0.37	1.16 ± 0.50	2.23 ± 0.60
Farnesane	43.89 ± 8.17	9.43 ± 2.00	28.04 ± 5.18	9.33 ± 1.98	4.48 ± 1.12	26.97 ± 5.16	44.15 ± 8.35	223.92 ± 40.66	103.23 ± 18.98	29.59 ± 5.80	79.96 ± 14.83	59.48 ± 11.09
Tetradecane	105.11 ± 9.40	26.16 ± 3.00	115.93 ± 9.71	47.78 ± 4.76	15.25 ± 2.19	104.54 ± 9.52	144.72 ± 13.28	464.74 ± 39.72	234.56 ± 20.50	120.91 ± 11.37	209.27 ± 18.56	221.99 ± 19.57
Octylcyclohexane	2.07 ± 0.65	1.00 ± 0.44	4.31 ± 1.38	1.84 ± 0.55	0.00 ± 0.26	0.00 ± 0.19	4.67 ± 1.25	9.90 ± 2.52	7.74 ± 2.08	4.99 ± 1.53	0.00 ± 0.47	6.03 ± 1.52
Pentadecane	4.83 ± 0.92	13.34 ± 1.90	29.56 ± 3.87	15.83 ± 2.18	4.39 ± 0.88	47.94 ± 5.98	64.18 ± 8.13	196.76 ± 23.77	38.86 ± 5.23	50.02 ± 6.56	78.00 ± 9.82	75.51 ± 9.44
Nonylcyclohexane	1.13 ± 0.40	0.00 ± 0.20	1.81 ± 0.64	0.00 ± 0.13	0.00 ± 0.21	0.00 ± 0.16	4.11 ± 1.01	4.16 ± 1.12	3.07 ± 0.92	3.05 ± 0.91	2.50 ± 0.83	5.28 ± 1.22
Hexadecane	27.10 ± 2.30	18.05 ± 1.58	93.08 ± 5.52	15.79 ± 1.60	20.55 ± 1.73	44.20 ± 3.60	51.06 ± 4.66	109.74 ± 9.05	66.92 ± 5.79	93.23 ± 7.87	59.64 ± 5.32	57.35 ± 5.09
Norpristane	17.49 ± 1.50	4.86 ± 0.45	3.03 ± 0.36	1.44 ± 0.17	3.04 ± 0.31	22.54 ± 1.95	23.53 ± 2.07	43.95 ± 3.79	6.65 ± 0.66	14.18 ± 1.30	15.80 ± 1.42	19.34 ± 1.70
Heptadecane	26.65 ± 2.18	7.80 ± 0.75	16.46 ± 1.45	6.77 ± 0.67	3.64 ± 0.45	32.60 ± 2.42	28.26 ± 2.44	95.89 ± 7.66	14.51 ± 1.41	34.23 ± 2.94	31.68 ± 2.72	30.40 ± 2.59
Decylcyclohexane	1.69 ± 0.31	0.62 ± 0.15	0.84 ± 0.30	0.14 ± 0.07	0.04 ± 0.08	1.74 ± 0.32	3.00 ± 0.56	6.17 ± 1.13	0.26 ± 0.26	5.05 ± 0.96	1.54 ± 0.43	0.85 ± 0.23
Heptadecane_Pristane	11.74 ± 1.24	3.79 ± 0.47	8.50 ± 0.96	6.00 ± 0.68	2.81 ± 0.38	22.83 ± 2.35	16.71 ± 1.81	25.95 ± 2.74	6.33 ± 0.81	12.77 ± 1.44	14.51 ± 1.60	17.24 ± 1.85
Undecylcyclohexane	1.99 ± 0.50	1.56 ± 0.41	3.08 ± 0.79	2.55 ± 0.59	0.49 ± 0.19	4.65 ± 1.04	1.78 ± 0.53	1.37 ± 0.57	0.37 ± 0.38	1.38 ± 0.56	3.72 ± 1.05	4.86 ± 1.18
Octadecane	12.45 ± 2.17	0.00 ± 1.59	72.05 ± 5.17	0.10 ± 1.43	3.64 ± 1.78	21.14 ± 2.82	13.67 ± 3.19	60.59 ± 6.64	46.16 ± 5.55	139.88 ± 12.45	60.04 ± 6.57	24.03 ± 3.87
Phytane	13.59 ± 2.17	4.08 ± 0.82	10.01 ± 1.84	6.94 ± 1.19	2.91 ± 0.67	20.65 ± 3.20	15.89 ± 2.68	28.71 ± 4.67	5.24 ± 1.34	16.19 ± 2.86	10.75 ± 2.10	15.98 ± 2.70
Dodecylcyclohexane	0.96 ± 0.17	0.65 ± 0.13	2.09 ± 0.35	0.33 ± 0.08	0.44 ± 0.08	2.27 ± 0.35	1.39 ± 0.25	3.60 ± 0.57	0.12 ± 0.17	3.25 ± 0.53	0.52 ± 0.20	2.40 ± 0.39
Nonadecane	16.43 ± 1.43	6.78 ± 0.64	9.76 ± 0.89	6.99 ± 0.65	4.70 ± 0.48	31.25 ± 2.67	20.34 ± 1.84	41.29 ± 3.58	8.65 ± 0.89	37.51 ± 3.29	15.21 ± 1.43	22.19 ± 1.98
Tridecylcyclohexane	0.85 ± 0.20	0.20 ± 0.10	0.18 ± 0.19	0.00 ± 0.05	0.26 ± 0.11	1.33 ± 0.26	1.40 ± 0.31	2.00 ± 0.43	0.37 ± 0.21	2.91 ± 0.58	0.90 ± 0.28	0.00 ± 0.11
Eicosane	0.00 ± 2.10	0.00 ± 1.76	33.57 ± 4.43	0.00 ± 1.43	0.00 ± 2.06	10.11 ± 2.81	0.00 ± 3.24	15.66 ± 5.32	22.08 ± 5.60	156.32 ± 15.77	40.83 ± 6.89	11.34 ± 4.43
Tetradecylcyclohexane	1.74 ± 0.36	0.53 ± 0.14	0.18 ± 0.17	0.38 ± 0.11	1.27 ± 0.28	2.09 ± 0.38	2.13 ± 0.46	2.30 ± 0.51	1.05 ± 0.29	9.19 ± 1.82	0.87 ± 0.26	1.22 ± 0.29
Heneicosane	6.05 ± 0.61	3.90 ± 0.43	4.18 ± 0.50	2.96 ± 0.34	3.58 ± 0.40	10.82 ± 1.03	7.93 ± 0.92	14.19 ± 1.49	7.60 ± 0.91	40.72 ± 3.83	6.25 ± 0.81	7.30 ± 0.86
Pentadecylcyclohexane	1.26 ± 0.38	0.47 ± 0.24	0.00 ± 0.37	0.21 ± 0.15	1.13 ± 0.35	1.40 ± 0.41	2.48 ± 0.91	0.00 ± 0.62	0.00 ± 0.58	14.19 ± 3.47	0.77 ± 0.76	1.14 ± 0.66
Docosane	0.34 ± 1.79	2.28 ± 1.99	2.46 ± 3.18	0.00 ± 1.13	0.00 ± 1.64	2.73 ± 2.08	0.00 ± 2.39	0.00 ± 4.09	14.58 ± 5.53	109.39 ± 15.60	26.79 ± 6.72	2.87 ± 3.92
Hexadecylcyclohexane	1.24 ± 0.27	0.73 ± 0.16	1.01 ± 0.28	1.39 ± 0.28	1.21 ± 0.24	2.51 ± 0.43	4.16 ± 0.90	3.87 ± 0.86	2.52 ± 0.57	4.45 ± 0.97	0.39 ± 0.18	0.17 ± 0.10
Tricosane	3.68 ± 0.56	6.91 ± 0.79	3.21 ± 0.74	2.50 ± 0.42	1.66 ± 0.43	6.56 ± 0.82	0.00 ± 0.83	6.30 ± 1.44	0.00 ± 0.93	16.75 ± 2.23	0.33 ± 1.04	0.00 ± 0.76
Heptadecylcyclohexane	3.99 ± 0.97	2.63 ± 0.69	0.50 ± 0.31	0.00 ± 0.10	2.30 ± 0.61	4.53 ± 1.04	1.94 ± 0.65	6.72 ± 1.69	12.61 ± 2.90	23.49 ± 5.15	0.29 ± 0.43	0.00 ± 0.19
Octadecylcyclohexane	1.32 ± 0.23	0.53 ± 0.12	0.00 ± 0.16	0.46 ± 0.11	0.86 ± 0.15	2.01 ± 0.33	0.31 ± 0.12	3.48 ± 0.80	4.63 ± 1.04	3.97 ± 0.90	1.02 ± 0.30	0.17 ± 0.10
Tetracosane	0.00 ± 1.60	0.00 ± 1.79	0.00 ± 3.02	0.00 ± 1.20	0.00 ± 1.54	0.00 ± 1.71	0.00 ± 2.32	0.00 ± 3.44	0.00 ± 3.89	15.56 ± 6.11	7.92 ± 5.50	0.00 ± 2.46
Pentacosane	1.91 ± 1.37	5.46 ± 1.20	1.92 ± 1.20	0.71 ± 0.64	0.00 ± 0.66	0.99 ± 0.94	0.00 ± 1.45	5.10 ± 2.46	0.00 ± 1.68	3.31 ± 2.18	0.00 ± 1.33	0.00 ± 1.07
Nonadecylcyclohexane	1.61 ± 0.44	1.86 ± 0.43	0.56 ± 0.34	0.61 ± 0.23	0.73 ± 0.27	1.26 ± 0.38	0.00 ± 0.28	2.14 ± 0.75	4.02 ± 1.11	3.85 ± 1.07	1.85 ± 0.70	2.28 ± 0.72
Hexacosane	0.00 ± 0.68	1.75 ± 0.76	0.43 ± 0.97	0.00 ± 0.38	0.00 ± 0.49	0.00 ± 0.61	0.00 ± 0.75	0.00 ± 1.33	7.12 ± 1.89	32.03 ± 3.99	14.21 ± 2.46	0.00 ± 1.06
Eicosylcyclohexane	0.46 ± 0.09	0.13 ± 0.06	0.21 ± 0.16	0.04 ± 0.04	0.03 ± 0.06	0.22 ± 0.07	0.73 ± 0.14	0.74 ± 0.18	0.30 ± 0.15	5.79 ± 0.90	0.47 ± 0.16	0.78 ± 0.15
Heptacosane	5.28 ± 1.13	3.17 ± 0.67	2.11 ± 0.71	0.26 ± 0.31	0.00 ± 0.24	1.56 ± 0.51	1.65 ± 0.75	3.32 ± 1.19	7.00 ± 1.78	0.10 ± 0.68	2.64 ± 1.07	0.86 ± 0.64
Heneicosylcyclohexane	0.42 ± 0.11	0.01 ± 0.06	0.09 ± 0.16	0.08 ± 0.04	0.03 ± 0.06	0.18 ± 0.07	0.76 ± 0.20	0.18 ± 0.15	0.96 ± 0.27	0.31 ± 0.16	0.39 ± 0.18	0.05 ± 0.08
Octacosane	1.26 ± 0.83	0.48 ± 0.82	4.60 ± 1.56	0.00 ± 0.56	0.00 ± 0.72	0.00 ± 0.71	0.00 ± 1.26	2.31 ± 2.00	6.94 ± 2.51	35.28 ± 6.21	7.58 ± 2.59	0.00 ± 1.30
Nonacosane	5.25 ± 1.03	2.36 ± 0.46	0.82 ± 0.53	0.63 ± 0.20	0.76 ± 0.26	0.81 ± 0.27	0.00 ± 0.27	9.58 ± 2.24	6.35 ± 1.65	10.72 ± 2.42	3.48 ± 1.16	0.00 ± 0.25
Triacontane	2.11 ± 0.78	0.72 ± 0.61	1.45 ± 1.17	0.00 ± 0.39	0.00 ± 0.53	0.38 ± 0.54	0.00 ± 0.82	0.04 ± 1.47	3.51 ± 1.99	14.39 ± 3.82	2.88 ± 1.89	0.00 ± 0.88
Hentriacontane	1.70 ± 0.53	0.64 ± 0.29	0.00 ± 0.33	0.05 ± 0.10	0.00 ± 0.14	0.00 ± 0.13	0.00 ± 0.12	0.00 ± 0.28	0.00 ± 0.60	0.00 ± 0.59	0.00 ± 0.31	0.00 ± 0.18
Dotriacontane	1.18 ± 0.33	0.45 ± 0.27	1.97 ± 0.55	0.00 ± 0.16	0.00 ± 0.24	0.00 ± 0.23	0.00 ± 0.28	0.00 ± 0.53	2.83 ± 0.86	8.54 ± 1.56	1.59 ± 0.72	0.00 ± 0.34
Tritriacontane	0.73 ± 0.20	0.00 ± 0.10	0.00 ± 0.18	0.00 ± 0.06	0.00 ± 0.07	0.00 ± 0.07	0.00 ± 0.10	0.00 ± 0.17	0.00 ± 0.28	0.00 ± 0.19	0.00 ± 0.20	0.00 ± 0.09
Tetratriacontane	0.82 ± 0.27	0.39 ± 0.23	0.69 ± 0.49	0.17 ± 0.15	0.13 ± 0.21	2.34 ± 0.47	0.00 ± 0.29	0.00 ± 0.48	1.96 ± 0.84	5.15 ± 1.26	0.00 ± 0.58	0.00 ± 0.32
Pentatriacontane	0.04 ± 0.10	0.00 ± 0.07	0.00 ± 0.18	0.00 ± 0.05	0.00 ± 0.07	0.00 ± 0.07	0.00 ± 0.08	0.00 ± 0.15	0.00 ± 0.24	0.00 ± 0.21	0.00 ± 0.15	0.00 ± 0.09
Hexatriacontane	0.40 ± 0.22	0.13 ± 0.20	0.29 ± 0.40	0.00 ± 0.13	0.00 ± 0.19	0.00 ± 0.16	0.00 ± 0.22	0.00 ± 0.39	1.62 ± 0.74	4.16 ± 1.06	0.00 ± 0.43	0.00 ± 0.23
Heptatriacontane	0.16 ± 0.12	0.00 ± 0.06	0.00 ± 0.18	0.00 ± 0.04	0.00 ± 0.06	0.46 ± 0.21	0.00 ± 0.08	0.00 ± 0.14	0.00 ± 0.16	0.00 ± 0.13	0.00 ± 0.14	0.00 ± 0.08
Octatriacontane	0.04 ± 0.13	0.13 ± 0.14	0.40 ± 0.33	0.00 ± 0.08	0.12 ± 0.13	0.00 ± 0.12	0.00 ± 0.16	0.00 ± 0.28	0.52 ± 0.46	1.68 ± 0.61	0.00 ± 0.35	0.00 ± 0.16
Nonatriacontane	0.93 ± 0.32	0.00 ± 0.06	0.00 ± 0.17	0.33 ± 0.13	0.00 ± 0.06	0.00 ± 0.06	0.00 ± 0.08	0.00 ± 0.14	0.00 ± 0.14	0.00 ± 0.13	0.00 ± 0.14	0.00 ± 0.08
Polar compounds (ug/mile)												
heptanoic acid (c7)	0.00 ± 1.90	0.00 ± 1.17	0.00 ± 3.00	0.30 ± 1.56	0.00 ± 1.86	0.00 ± 1.13	0.00 ± 1.60	0.00 ± 1.84	0.00 ± 3.16	0.00 ± 1.86	0.00 ± 2.25	1.29 ± 3.62
me-malonic (d-c3)	7.51 ± 1.66	0.00 ± 0.11	0.00 ± 0.54	0.40 ± 0.21	1.20 ± 0.41	4.29 ± 1.03	0.00 ± 0.34	0.00 ± 0.22	0.00 ± 0.37	0.00 ± 0.25	0.00 ± 0.54	1.07 ± 0.56
guaiacol	-99.00 ± 0.06	-99.00 ± 0.06	-99.00 ± 0.16	-99.00 ± 0.04	-99.00 ± 0.06	-99.00 ± 0.06	-99.00 ± 0.08	-99.00 ± 0.16	-99.00 ± 0.15	-99.00 ± 0.13	-99.00 ± 0.14	-99.00 ± 0.09
benzoic acid	0.00 ± 144.25	0.00 ± 64.19	0.00 ± 255.72	0.00 ± 105.49	0.00 ± 88.17	0.00 ± 105.54	0.00 ± 112.60	0.00 ± 120.43	0.00 ± 227.01	0.00 ± 95.96	0.00 ± 104.66	0.00 ± 65.57
octanoic acid (c8)	8.21 ± 3.36	0.00 ± 2.15	4.97 ± 4.59	0.00 ± 1.66	0.84 ± 2.34	1.31 ± 2.40	0.00 ± 2.64	0.00 ± 3.17	0.00 ± 4.17	0.00 ± 2.50	0.00 ± 2.87	15.79 ± 5.49
phenylacetic acid	47.76 ± 7.07	7.96 ± 1.46	15.74 ± 3.20	7.58 ± 1.29	6.28 ± 1.23	6.42 ± 1.26	31.20 ± 4.92	61.85 ± 9.75	3.91 ± 1.64	1.69 ± 1.33	6.40 ± 1.98	30.12 ± 4.77
maleic acid	0.00 ± 0.15	0.00 ± 0.30	0.00 ± 0.38	0.00 ± 0.17	0.00 ± 0.22	0.00 ± 0.16	0.00 ± 0.22	0.00 ± 1.42	0.00 ± 1.17	0.00 ± 0.57	0.00 ± 0.81	0.00 ± 0.26
succinic acid (d-c4)	0.00 ± 1.14	0.00 ± 0.45	0.00 ± 0.84	0.20 ± 0.40	0.00 ± 0.49	0.00 ± 0.67	0.00 ± 0.85	0.00 ± 1.78	0.00 ± 2.63	0.00 ± 0.59	0.00 ± 0.97	0.00 ± 0.91

Appendix B2. Chemical Composition of Dilution Blanks and Vehicle Exhaust Samples from Round2

Species Description	W3-1	W3-2	W3-3	W4-1	W4-2	W4-3	W5-1	W5-2	W5-3	W6-1	W6-2	W6-3
4-me-guaiacol	-99.00 ± 0.06	-99.00 ± 0.06	-99.00 ± 0.16	-99.00 ± 0.04	-99.00 ± 0.06	-99.00 ± 0.06	-99.00 ± 0.09	-99.00 ± 0.15	-99.00 ± 0.14	-99.00 ± 0.14	-99.00 ± 0.14	-99.00 ± 0.11
o-toluic	62.03 ± 13.95	9.53 ± 2.71	21.83 ± 6.50	9.42 ± 2.48	7.99 ± 2.39	8.74 ± 2.56	26.21 ± 6.59	79.36 ± 18.92	0.00 ± 1.69	0.00 ± 1.51	4.27 ± 2.91	40.96 ± 9.77
me-succinic acid (d-c4)	0.00 ± 0.16	0.00 ± 0.06	0.00 ± 0.17	0.00 ± 0.05	0.00 ± 0.08	0.00 ± 0.06	0.00 ± 0.13	0.00 ± 0.15	0.00 ± 0.36	0.00 ± 0.15	0.00 ± 0.71	0.00 ± 0.27
m-toluic	114.73 ± 13.77	21.04 ± 3.02	35.15 ± 5.90	12.95 ± 1.87	16.36 ± 2.49	20.01 ± 2.91	41.01 ± 5.68	133.23 ± 17.29	62.83 ± 9.16	0.00 ± 1.60	13.21 ± 3.66	89.09 ± 11.22
nonanoic acid (c9)	6.60 ± 3.60	1.44 ± 3.01	0.41 ± 4.88	0.00 ± 2.41	0.00 ± 2.82	2.34 ± 3.16	0.43 ± 4.08	0.00 ± 4.02	0.00 ± 4.72	0.00 ± 3.20	0.00 ± 3.78	16.01 ± 5.97
p-toluic	98.01 ± 13.76	15.15 ± 2.75	21.06 ± 5.12	8.57 ± 1.60	13.94 ± 2.59	13.06 ± 2.49	29.66 ± 5.10	92.51 ± 14.73	39.97 ± 7.71	0.00 ± 1.58	4.80 ± 3.25	61.22 ± 9.32
2,6-dimethylbenzoic acid	7.03 ± 1.65	0.00 ± 0.12	0.05 ± 0.47	0.00 ± 0.12	0.01 ± 0.14	0.17 ± 0.28	1.06 ± 0.57	11.14 ± 2.97	0.00 ± 0.43	0.00 ± 0.26	0.00 ± 0.39	0.84 ± 0.54
4-ethyl-guaiacol	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00
syringol	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00
glutaric acid (d-c5)	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00
2-methylglutaric (d-c5)	0.00 ± 0.12	0.00 ± 0.08	0.50 ± 0.69	0.02 ± 0.05	0.04 ± 0.12	0.06 ± 0.29	0.00 ± 0.15	0.00 ± 0.16	0.00 ± 0.48	0.00 ± 0.16	0.00 ± 0.15	0.00 ± 0.10
2,5-dimethylbenzoic acid	7.77 ± 1.70	1.38 ± 0.69	3.54 ± 1.47	2.30 ± 0.75	1.44 ± 0.70	3.75 ± 1.07	4.58 ± 1.31	15.08 ± 3.34	5.54 ± 1.81	0.00 ± 0.64	1.15 ± 1.16	17.46 ± 3.41
3-methylglutaric acid (d-c5)	0.00 ± 0.13	0.00 ± 0.22	0.00 ± 0.23	0.00 ± 0.06	0.02 ± 0.11	0.00 ± 0.36	0.00 ± 0.12	0.00 ± 0.20	0.00 ± 0.36	0.00 ± 0.21	0.00 ± 0.20	0.00 ± 0.36
2,4-dimethylbenzoic acid	0.00 ± 40.32	0.00 ± 29.61	0.08 ± 101.65	0.00 ± 48.40	0.00 ± 41.14	0.00 ± 51.87	0.00 ± 47.45	0.00 ± 49.42	0.00 ± 97.25	0.00 ± 47.37	0.00 ± 49.28	336.46 ± 206.70
2,3- and 3,5- dimethylbenzoic acid	6.03 ± 1.59	0.00 ± 0.66	0.13 ± 1.19	0.57 ± 0.52	0.08 ± 0.64	0.04 ± 0.70	0.02 ± 1.09	5.52 ± 3.07	0.00 ± 1.78	0.00 ± 0.43	0.00 ± 0.78	10.15 ± 2.61
decanoic acid (c10)	0.45 ± 0.26	0.00 ± 0.18	0.05 ± 0.47	0.31 ± 0.21	0.00 ± 0.20	0.77 ± 0.29	0.00 ± 0.28	0.00 ± 0.31	0.00 ± 0.37	0.00 ± 0.30	0.00 ± 0.34	11.95 ± 1.33
4-allyl-guaiacol (eugenol)	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00
4-methyl-syringol	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00
3,4-dimethylbenzoic acid	16.19 ± 3.04	4.47 ± 1.09	3.32 ± 1.65	4.04 ± 0.89	4.83 ± 1.16	5.57 ± 1.28	5.81 ± 1.66	19.90 ± 4.76	8.24 ± 2.82	0.00 ± 0.67	0.00 ± 1.18	17.84 ± 3.68
hexanedioic (adipic) acid (d-c6)	0.00 ± 0.07	0.00 ± 0.10	0.00 ± 0.22	0.12 ± 0.09	0.00 ± 0.08	0.00 ± 0.11	0.00 ± 0.09	0.00 ± 0.16	0.00 ± 0.17	0.00 ± 0.15	0.00 ± 0.17	0.00 ± 0.14
salcylic acid	26.05 ± 4.99	1.51 ± 1.18	0.95 ± 3.12	6.96 ± 1.82	2.20 ± 1.61	3.90 ± 1.82	0.00 ± 2.14	0.00 ± 2.70	20.53 ± 7.55	0.00 ± 0.87	0.00 ± 1.05	17.87 ± 4.79
trans-2-decenoic acid	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00
cis-pinonic acid	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00
3-methyladipic acid (d-c6)	0.00 ± 0.06	0.00 ± 0.06	0.00 ± 0.16	0.00 ± 0.04	0.00 ± 0.06	0.00 ± 0.06	0.00 ± 0.08	0.00 ± 0.14	0.00 ± 0.14	0.00 ± 0.13	0.00 ± 0.15	0.00 ± 0.08
4-formyl-guaiacol (vanillin)	0.00 ± 0.08	0.00 ± 0.09	0.00 ± 0.21	0.00 ± 0.07	0.00 ± 0.08	0.00 ± 0.09	0.00 ± 0.09	0.00 ± 0.16	0.00 ± 0.17	0.00 ± 0.17	0.00 ± 0.19	0.03 ± 0.22
undecanoic acid (c11)	1.11 ± 0.33	0.00 ± 0.19	0.00 ± 0.47	0.00 ± 0.17	0.00 ± 0.18	0.03 ± 0.23	0.00 ± 0.30	0.00 ± 0.32	0.00 ± 0.38	0.00 ± 0.29	0.00 ± 0.34	8.67 ± 1.27
isoeugenol	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00
heptanedioic (pimelic) acid (d-c7)	0.00 ± 0.12	0.00 ± 0.12	0.00 ± 0.27	0.00 ± 0.09	0.00 ± 0.12	0.00 ± 0.18	0.00 ± 0.17	0.00 ± 0.27	0.00 ± 0.27	0.00 ± 0.26	0.00 ± 0.27	0.08 ± 0.46
2,3-dimethoxybenzoic acid	0.00 ± 3.81	0.00 ± 0.08	0.00 ± 0.77	0.00 ± 0.05	0.00 ± 0.09	0.00 ± 0.11	0.00 ± 0.11	0.00 ± 0.18	0.00 ± 2.71	0.00 ± 0.25	0.00 ± 2.54	0.00 ± 1.50
acetovanillone	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00
2,6-dimethoxybenzoic acid	2.90 ± 0.79	0.63 ± 0.41	0.00 ± 0.55	0.00 ± 0.12	0.03 ± 0.20	1.99 ± 0.64	5.45 ± 1.32	0.00 ± 0.44	5.65 ± 1.59	0.00 ± 0.36	18.59 ± 3.83	27.81 ± 5.22
dodecanoic (lauric) acid (c12)	5.18 ± 0.93	0.18 ± 0.61	32.64 ± 3.19	4.09 ± 0.82	0.71 ± 0.66	6.83 ± 1.07	1.14 ± 0.86	0.00 ± 0.79	0.00 ± 0.83	0.00 ± 0.75	0.00 ± 0.80	62.81 ± 5.57
2,5-dimethoxybenzoic acid	0.00 ± 0.07	0.00 ± 0.06	0.00 ± 0.16	0.00 ± 0.04	0.00 ± 0.06	0.00 ± 0.06	1.75 ± 0.26	0.00 ± 0.14	0.99 ± 0.25	0.00 ± 0.13	0.00 ± 0.16	0.00 ± 0.09
phthalic acid	14.98 ± 12.31	0.45 ± 4.33	2.82 ± 3.87	0.00 ± 2.74	1.32 ± 4.11	0.71 ± 2.60	0.00 ± 5.04	0.00 ± 29.98	14.74 ± 32.80	0.00 ± 1.80	0.00 ± 2.25	0.00 ± 2.09
suberic acid (d-c8)	0.00 ± 0.06	0.00 ± 0.06	0.00 ± 0.16	0.00 ± 0.04	0.00 ± 0.06	0.00 ± 0.06	0.00 ± 0.08	0.00 ± 0.14	0.00 ± 0.14	0.00 ± 0.13	0.00 ± 0.14	0.00 ± 0.08
levoglucosan	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00
3,5-dimethoxybenzoic acid	3.97 ± 0.91	1.23 ± 0.32	2.02 ± 0.60	1.78 ± 0.42	0.26 ± 0.13	2.97 ± 0.69	1.98 ± 0.54	0.00 ± 0.16	6.31 ± 1.55	0.00 ± 0.22	0.00 ± 0.16	23.45 ± 5.15
syringaldehyde	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00
3,4-dimethoxybenzoic acid	0.00 ± 0.06	0.00 ± 0.06	0.00 ± 0.17	0.00 ± 0.04	0.00 ± 0.06	0.00 ± 0.06	0.00 ± 0.09	0.00 ± 0.21	0.00 ± 0.24	0.00 ± 0.14	0.00 ± 0.16	0.00 ± 0.17
2,4-dimethoxybenzoic acid	8.11 ± 1.41	3.37 ± 0.61	0.00 ± 0.18	3.08 ± 0.55	1.04 ± 0.22	0.29 ± 0.10	7.54 ± 1.35	2.52 ± 0.56	6.33 ± 1.19	3.61 ± 0.73	29.39 ± 5.14	44.04 ± 7.60
tridecanoic acid (c13)	0.55 ± 0.23	0.12 ± 0.18	0.00 ± 0.26	0.49 ± 0.17	0.00 ± 0.13	0.00 ± 0.16	0.00 ± 0.19	0.00 ± 0.25	0.00 ± 0.24	0.00 ± 0.22	0.00 ± 0.27	1.92 ± 0.51
isophthalic acid	2.53 ± 6.76	0.00 ± 2.04	0.00 ± 7.16	0.00 ± 3.31	0.00 ± 3.51	0.00 ± 4.29	0.00 ± 3.87	0.00 ± 4.64	0.00 ± 10.94	0.00 ± 2.43	0.00 ± 2.78	0.00 ± 4.48
vanillic acid	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00
homovanillic acid	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00
azelaic acid (d-c9)	0.00 ± 0.18	0.24 ± 0.27	0.00 ± 0.23	0.00 ± 0.10	0.00 ± 0.12	0.00 ± 0.13	0.00 ± 0.17	0.00 ± 0.28	0.00 ± 0.34	0.00 ± 0.17	0.00 ± 0.21	0.00 ± 0.11
myristoleic acid	0.08 ± 0.09	0.00 ± 0.07	0.00 ± 0.17	0.40 ± 0.13	0.00 ± 0.07	0.00 ± 0.07	0.00 ± 0.15	0.00 ± 0.17	0.00 ± 0.16	0.00 ± 0.16	0.00 ± 0.20	0.00 ± 0.14
myristic acid (c14)	1.58 ± 0.60	0.00 ± 0.39	16.66 ± 1.75	3.16 ± 0.67	0.06 ± 0.43	1.37 ± 0.60	0.00 ± 0.61	0.00 ± 0.67	0.00 ± 0.65	0.00 ± 0.65	0.00 ± 0.67	12.97 ± 1.51
sebacic acid (d-c10)	0.00 ± 0.07	0.00 ± 0.06	0.00 ± 0.18	0.00 ± 0.07	0.00 ± 0.07	0.00 ± 0.06	0.00 ± 0.08	0.00 ± 0.14	0.00 ± 0.18	0.00 ± 0.15	0.00 ± 0.14	0.00 ± 0.08
syringic acid	2.05 ± 0.45	0.08 ± 0.17	21.02 ± 3.51	8.65 ± 1.42	0.85 ± 0.28	4.06 ± 0.75	11.36 ± 1.92	6.95 ± 1.41	2.99 ± 0.82	0.00 ± 0.23	0.00 ± 0.33	12.83 ± 2.15
pentadecanoic acid (c15)	1.07 ± 0.35	0.18 ± 0.25	0.00 ± 0.41	1.51 ± 0.31	0.35 ± 0.22	0.85 ± 0.31	0.00 ± 0.35	0.00 ± 0.46	0.00 ± 0.42	0.00 ± 0.36	0.00 ± 0.50	0.43 ± 0.48
undecanedioic acid (c11)	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
palmitoleic acid	0.00 ± 0.24	0.00 ± 0.14	0.00 ± 0.50	0.27 ± 0.34	0.00 ± 0.18	0.10 ± 0.18	0.00 ± 0.19	0.00 ± 0.37	0.00 ± 0.31	0.00 ± 0.30	0.00 ± 0.32	0.00 ± 0.41
palmitic acid (c16)	1.48 ± 1.15	0.00 ± 0.98	12.96 ± 2.11	3.68 ± 1.04	1.09 ± 0.88	1.77 ± 1.17	0.00 ± 1.19	0.00 ± 1.41	0.00 ± 1.36	0.00 ± 1.25	0.00 ± 1.41	0.00 ± 1.41
isostearic acid	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00
dodecanedioic acid (d-c12)	0.00 ± 0.06	0.00 ± 0.06	0.00 ± 0.16	0.00 ± 0.04	0.00 ± 0.06	0.00 ± 0.06	0.00 ± 0.08	0.00 ± 0.14	0.00 ± 0.15	0.00 ± 0.20	0.00 ± 0.14	0.00 ± 0.08
traumatic acid	0.01 ± 0.06	0.01 ± 0.06	0.09 ± 0.19	0.00 ± 0.05	0.00 ± 0.06	0.03 ± 0.06	0.00 ± 0.08	0.00 ± 0.16	0.00 ± 0.15	0.00 ± 0.14	0.00 ± 0.14	0.00 ± 0.12
heptadecanoic acid (c17)	0.10 ± 0.21	0.04 ± 0.24	0.00 ± 0.33	0.23 ± 0.17	0.00 ± 0.15	0.00 ± 0.14	0.00 ± 0.27	0.00 ± 0.35	0.00 ± 0.39	0.00 ± 0.32	0.00 ± 0.30	0.00 ± 0.21
1,11-undecanedicarboxylic acid (d-c13)	0.00 ± 0.07	0.00 ± 0.06	0.00 ± 0.17	0.00 ± 0.04	0.00 ± 0.07	0.00 ± 0.07	0.00 ± 0.09	0.00 ± 0.16	0.00 ± 0.16	0.00 ± 0.20	0.00 ± 0.15	0.00 ± 0.12
oleic acid	1.23 ± 0.97	0.00 ± 0.57	0.88 ± 1.25	0.00 ± 0.68	1.77 ± 1.00	1.49 ± 0.91	0.00 ± 0.62	0.00 ± 1.39	0.00 ± 1.04	0.00 ± 1.25	0.00 ± 1.63	0.00 ± 0.84
elaidic acid	0.00 ± 0.14	0.00 ± 0.10	0.00 ± 0.29	0.00 ± 0.12	0.00 ± 0.09	0.00 ± 0.10	0.00 ± 0.11	0.00 ± 0.25	0.00 ± 0.21	0.00 ± 0.24	0.00 ± 0.21	0.00 ± 0.24
stearic acid (c18)	0.00 ± 3.21	0.00 ± 3.30	1.91 ± 6.79	0.00 ± 2.70	0.00 ± 2.95	0.00 ± 3.19	0.00 ± 4.47	0.00 ± 7.04	0.00 ± 6.60	0.00 ± 6.59	0.00 ± 7.89	0.00 ± 6.63
1,12-dodecanedicarboxylic acid (d-c14)	0.00 ± 0.07	0.00 ± 0.08	0.00 ± 0.18	0.00 ± 0.05	0.00 ± 0.08	0.00 ± 0.07	0.00 ± 0.12	0.00 ± 0.17	0.00 ± 0.17	0.00 ± 0.16	0.00 ± 0.17	0.00 ± 0.14
8,15-pimaradien-18-oic acid	0.00 ± 0.07	0.00 ± 0.07	0.00 ± 0.17	0.00 ± 0.06	0.00 ± 0.08	0.00 ± 0.07	0.00 ± 0.10	0.00 ± 0.16	0.00 ± 0.16	0.00 ± 0.18	0.00 ± 0.25	0.00 ± 0.15
pimaric acid	0.11 ± 0.12	0.00 ± 0.11	0.31 ± 0.29	1.01 ± 0.30	0.00 ± 0.11	0.00 ± 0.09	0.00 ± 0.17	0.00 ± 0.22	0.23 ± 0.32	0.00 ± 0.23	0.62 ± 0.37	3.28 ± 0.75
sandaracopimaric acid	0.00 ± 0.18	0.09 ± 0.19	0.37 ± 0.52	0.00 ± 0.15	0.12 ± 0.30	0.04 ± 0.25	0.00 ± 0.20	0.00 ± 0.32	0.00 ± 0.42	0.00 ± 0.37	1.16 ± 0.88	0.11 ± 0.39
nonadecanoic acid (c19)	0.01 ± 0.17	0.02 ± 0.12	13.04 ± 2.22	1.29 ± 0.35	0.00 ± 0.18	0.94 ± 0.33	1.69 ± 0.47	0.59 ± 0.40	0.10 ± 0.34	0.00 ± 0.28	1.99 ± 0.58	0.38 ± 0.30
isopimaric acid	0.11 ± 0.08	0.17 ± 0.09	0.00 ± 0.17	0.00 ± 0.04	0.00 ± 0.07	0.24 ± 0.10	0.00 ± 0.09	0.00 ± 0.15	0.00 ± 0.15	0.24 ± 0.19	0.35 ± 0.22	0.00 ± 0.11
palustric acid	0.29 ± 0.08	0.00 ± 0.06	0.02 ± 0.16	0.07 ± 0.05	0.01 ± 0.06	0.19 ± 0.07	0.00 ± 0.08	0.16 ± 0.15	0.16 ± 0.15	0.08 ± 0.14	0.09 ± 0.15	0.04 ± 0.08
dihydroisopimaric acid	0.06 ± 0.06	0.05 ± 0.06	0.00 ± 0.16	0.00 ± 0.04	0.00 ± 0.06	0.02 ± 0.06	0.01 ± 0.08	0.16 ± 0.15	0.00 ± 0.14	0.49 ± 0.17	0.46 ± 0.17	0.48 ± 0.12
8-abietic acid	0.07 ± 0.07	0.16 ± 0.08	0.00 ± 0.17	0.00 ± 0.05	0.00 ± 0.07	0.08 ± 0.07	0.00 ± 0.10	0.00 ± 0.15	0.00 ± 0.15	0.00 ± 0.16	0.00 ± 0.14	0.08 ± 0.14
dehydroabietic acid	0.00 ± 0.12	0.00 ± 0.12	0.00 ± 0.25	0.00 ± 0.10	0.00 ± 0.15	0.00 ± 0.13	0.00 ± 0.22	0.00 ± 0.29	0.00 ± 0.28	0.00 ± 0.47	0.00 ± 0.31	0.00 ± 0.19
8,14-abietenic acid	0.00 ± 0.09	0.08 ± 0.11	0.00 ± 0.19	0.00 ± 0.07	0.00 ± 0.08	0.00 ± 0.07	0.00 ± 0.14	0.00 ± 0.18	0.00 ± 0.19	0.55 ± 0.30	0.76 ± 0.34	0.44 ± 0.23
abietic acid	0.04 ± 0.06	0.03 ± 0.06	0.00 ± 0.16	0.00 ± 0.04	0.00 ± 0.06	0.03 ± 0.06	0.00 ± 0.08	0.00 ± 0.14	0.00 ± 0.14	0.76 ± 0.25	0.00 ± 0.14	0.01 ± 0.08
eicosanoic acid (c20)	0.00 ± 0.09	0.00 ± 0.08	0.00 ± 0.19	0.00 ± 0.06	0.00 ± 0.09	0.00 ± 0.09	0.00 ± 0.16	0.00 ± 0.22	0.00 ± 0.20	0.00 ± 0.22	2.65 ± 1.03	0.00 ± 0.22
levopimaric acid	0.00 ± 0.07	0.02 ± 0.07	0.01 ± 0.17	0.00 ± 0.04	0.00 ± 0.07	0.00 ± 0.07	0.00 ± 0.09	0.00 ± 0.15	0.00 ± 0.15	0.14 ± 0.16	0.83 ± 0.30	0.39 ± 0.17
heneicosanoic acid (c21)	0.00 ± 0.08	0.60 ± 0.18	0.00 ± 0.21	0.00 ± 0.06	0.00 ± 0.08	0.00 ± 0.09	0.00 ± 0.14	0.66 ± 0.38	0.00 ± 0.23	0.00 ± 0.28	1.40 ± 0.49	0.04 ± 0.19
7-oxodehydroabietic acid	0.00 ± 0.20	0.00 ± 0.20	0.03 ± 0.41	0.00 ± 0.17	0.00 ± 0.20	0.00 ± 0.20	0.00 ± 0.33	0.00 ± 0.42	0.00 ± 0.42	0.00 ± 0.42	0.00 ± 0.53	0.00 ± 0.30
docosanoic acid (c22)	0.00 ± 0.19	0.00 ± 0.21	0.00 ± 0.35	0.00 ± 0.12	0.00 ± 0.16	0.03 ± 0.24	0.00 ± 0.27	3.22 ± 1.73	0.00 ± 0.40	0.00 ± 0.80	0.00 ± 0.48	0.13 ± 0.54
tricosanoic acid (c23)	0.18 ± 0.11	0.12 ± 0.11	0.00 ± 0.20	0.00 ± 0.05	0.00 ± 0.07	0.04 ± 0.09	0.00 ± 0.09	0.00 ± 0.16	0.00 ± 0.17	0.00 ± 0.22	0.00 ± 0.18	0.00 ± 0.11
tetracosanoic acid (c24)	0.00 ± 0.17	0.00 ± 0.16	0.00 ± 0.30	0.00 ± 0.14	0.00 ± 0.18	0.00 ± 0.18	0.00 ± 0.21	0.00 ± 0.33	0.00 ± 0.52	0.00 ± 0.32	0.00 ± 0.34	0.00 ± 0.23
cholesterol	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00
cholestanol	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00
ergosterol	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00
stigmasterol	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00
sitosterol	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00

Appendix B2. Chemical Composition of Dilution Blanks and Vehicle Exhaust Samples from Round2

Species Description	W3-1	W3-2	W3-3	W4-1	W4-2	W4-3	W5-1	W5-2	W5-3	W6-1	W6-2	W6-3
Carbonyls (mg/mile)												
formaldehyde	221.82 ± 12.36			25.48 ± 1.44			304.19 ± 16.94			58.66 ± 3.46		
acetaldehyde	130.33 ± 12.39			29.00 ± 2.86			193.16 ± 18.35			130.75 ± 13.02		
acetone	200.18 ± 12.97			29.15 ± 2.10			117.89 ± 8.00			136.52 ± 10.00		
* acrolein	4.55 ± 1.14			0.41 ± 0.10			3.07 ± 0.77			1.94 ± 0.49		
propionaldehyde	24.33 ± 2.72			5.42 ± 0.62			39.19 ± 4.44			11.55 ± 1.65		
crotonaldehyde	14.36 ± 1.69			0.00 ± 0.29			8.92 ± 1.19			5.46 ± 1.61		
methyl ethyl ketone	11.20 ± 2.11			4.12 ± 0.87			20.94 ± 3.78			3.18 ± 1.96		
Methacrolein	34.15 ± 3.85			3.89 ± 0.52			25.22 ± 2.87			9.36 ± 1.80		
* n-butyraldehyde	0.08 ± 0.02			0.05 ± 0.01			0.30 ± 0.07			0.10 ± 0.03		
benzaldehyde	126.70 ± 12.71			17.48 ± 1.80			93.10 ± 9.39			47.26 ± 5.21		
glyoxal	1.15 ± 0.27			0.77 ± 0.16			0.57 ± 0.36			1.15 ± 0.72		
valeraldehyde	6.72 ± 0.91			3.14 ± 0.50			8.95 ± 1.26			4.05 ± 1.68		
tolualdehyde	64.57 ± 10.45			8.37 ± 1.44			18.36 ± 3.16			20.70 ± 3.83		
hexanal	9.96 ± 1.27			4.49 ± 0.61			1.99 ± 0.93			2.50 ± 1.86		
*** acrolein converts to an unknown rear**												
VOC (mg/mi)												
1,3 butadiene (estimated)	11.059 ± 6.112			1.827 ± 1.010			5.123 ± 2.831			9.722 ± 5.373		
C2 compounds	256.860 ± 36.271			34.717 ± 4.902			140.835 ± 19.887			209.616 ± 29.599		
propene	63.793 ± 7.736			10.538 ± 1.278			29.552 ± 3.584			56.077 ± 6.801		
propane	1.677 ± 0.084			0.784 ± 0.039			1.655 ± 0.083			2.060 ± 0.103		
isoButane	8.893 ± 0.445			2.123 ± 0.106			7.723 ± 0.386			6.091 ± 0.305		
1Butene+iButylene	32.603 ± 2.210			7.212 ± 0.489			15.790 ± 1.070			26.866 ± 1.821		
n-Butane	59.466 ± 2.973			15.892 ± 0.795			62.473 ± 3.124			34.995 ± 1.750		
t-2-Butene	7.487 ± 0.412			1.675 ± 0.092			5.134 ± 0.283			5.484 ± 0.302		
c-2-Butene	4.889 ± 0.452			1.130 ± 0.104			3.123 ± 0.289			3.261 ± 0.301		
3-Me-1-Butene	1.795 ± 0.090			0.315 ± 0.016			0.922 ± 0.046			1.018 ± 0.051		
isopentane	59.476 ± 3.883			18.151 ± 1.185			60.547 ± 3.953			43.875 ± 2.864		
1-Pentene	2.932 ± 0.176			0.441 ± 0.026			1.833 ± 0.110			2.460 ± 0.147		
2-Me-1-Butene	5.222 ± 0.382			0.935 ± 0.068			2.788 ± 0.204			3.381 ± 0.247		
n-Pentane	18.771 ± 1.119			4.608 ± 0.275			17.860 ± 1.064			22.367 ± 1.333		
t-2-Pentene	4.845 ± 0.242			0.823 ± 0.041			3.983 ± 0.199			3.271 ± 0.164		
c-2-Pentene	2.631 ± 0.229			0.463 ± 0.040			2.045 ± 0.178			1.856 ± 0.161		
2-Me-2-Butene	47.566 ± 2.548			1.650 ± 0.088			4.600 ± 0.246			4.805 ± 0.257		
22DiMeButane	4.056 ± 0.263			0.805 ± 0.052			3.573 ± 0.231			4.191 ± 0.271		
CycloPentene	1.822 ± 0.112			0.311 ± 0.019			1.158 ± 0.071			1.212 ± 0.074		
CycloPentane	2.632 ± 0.132			0.554 ± 0.028			2.143 ± 0.107			2.328 ± 0.116		
23DiMeButane	7.154 ± 0.424			2.091 ± 0.124			7.684 ± 0.456			6.116 ± 0.363		
MTBE	0.615 ± 0.037			0.128 ± 0.008			0.285 ± 0.017			0.289 ± 0.017		
2-MePentane	24.113 ± 1.379			5.572 ± 0.319			23.420 ± 1.340			21.916 ± 1.254		
3-MePentane	15.662 ± 0.783			3.777 ± 0.189			15.653 ± 0.783			13.951 ± 0.698		
2-Me-1-Pentene	1.041 ± 0.052			0.215 ± 0.011			0.893 ± 0.045			0.586 ± 0.029		
1-Hexene	1.615 ± 0.081			0.281 ± 0.014			1.329 ± 0.066			2.193 ± 0.110		
n-Hexane	16.483 ± 0.826			3.734 ± 0.187			13.922 ± 0.697			11.363 ± 0.569		
t-2-Hexene	1.815 ± 0.091			0.511 ± 0.026			1.921 ± 0.096			1.288 ± 0.064		
2-Me-2-Pentene	1.226 ± 0.065			0.365 ± 0.019			1.183 ± 0.062			0.954 ± 0.050		
c-3-Me-2-Pentene	0.910 ± 0.045			0.254 ± 0.013			0.830 ± 0.042			0.628 ± 0.031		
c-3-Hexene	0.260 ± 0.013			0.050 ± 0.003			0.267 ± 0.013			0.182 ± 0.009		
c-2-Hexene	0.875 ± 0.044			0.185 ± 0.009			0.971 ± 0.049			0.686 ± 0.034		
t-3-Me-2-Pentene	1.546 ± 0.077			0.405 ± 0.020			1.455 ± 0.073			1.060 ± 0.053		
MeCyPentane	11.508 ± 0.663			2.621 ± 0.151			10.773 ± 0.621			7.152 ± 0.412		
2,4-DiMePentane	7.735 ± 0.387			3.052 ± 0.153			10.214 ± 0.511			3.933 ± 0.197		
223TriMeButane	0.198 ± 0.010			0.062 ± 0.003			0.219 ± 0.011			0.196 ± 0.010		
Benzene	75.769 ± 4.685			12.591 ± 0.778			36.063 ± 2.230			53.602 ± 3.314		
CycloHexane	4.050 ± 0.234			0.929 ± 0.054			4.339 ± 0.251			2.146 ± 0.124		
4MeHexene	0.349 ± 0.032			0.068 ± 0.006			0.316 ± 0.029			0.284 ± 0.026		
2MeHexane	10.872 ± 0.544			2.749 ± 0.137			10.365 ± 0.518			8.328 ± 0.416		
23DiMePentane	12.370 ± 0.618			5.119 ± 0.256			17.567 ± 0.878			6.377 ± 0.319		
3MeHexane	12.592 ± 0.630			3.175 ± 0.159			11.841 ± 0.592			9.745 ± 0.487		
Cyclohexene	0.066 ± 0.014			0.020 ± 0.004			0.050 ± 0.010			0.041 ± 0.009		
3EtPentane	3.638 ± 0.233			0.897 ± 0.057			3.458 ± 0.221			2.759 ± 0.176		
1-Heptene	1.080 ± 0.054			0.275 ± 0.014			1.942 ± 0.097			1.506 ± 0.075		
224TrMePentane	24.413 ± 1.741			12.316 ± 0.878			30.049 ± 2.143			15.820 ± 1.128		
t-3-Heptene	0.595 ± 0.030			0.125 ± 0.006			0.667 ± 0.033			0.416 ± 0.021		
n-Heptane	9.679 ± 0.484			2.673 ± 0.134			9.421 ± 0.471			7.250 ± 0.362		
244TMe-1-Pentene	0.259 ± 0.014			0.100 ± 0.005			0.145 ± 0.008			0.148 ± 0.008		
MeCyHexane	4.956 ± 0.248			1.263 ± 0.063			4.709 ± 0.235			3.731 ± 0.187		
25DiMeHexane	3.148 ± 0.215			1.374 ± 0.094			3.389 ± 0.231			2.517 ± 0.172		
24DiMeHexane	5.798 ± 0.290			2.312 ± 0.116			6.276 ± 0.314			4.412 ± 0.221		
234TrMePentane	6.911 ± 0.346			3.795 ± 0.190			8.451 ± 0.423			6.519 ± 0.326		
Toluene	107.730 ± 5.387			27.999 ± 1.400			73.510 ± 3.676			92.506 ± 4.625		
23DiMeHexane	3.323 ± 0.179			1.617 ± 0.087			3.704 ± 0.199			2.687 ± 0.145		
2MeHeptane	5.498 ± 0.275			1.641 ± 0.082			5.145 ± 0.257			4.749 ± 0.237		
4MeHeptane	2.348 ± 0.181			0.693 ± 0.053			2.162 ± 0.166			1.970 ± 0.152		
3MeHeptane	5.610 ± 0.280			1.710 ± 0.085			5.248 ± 0.262			5.223 ± 0.261		
Hexanal	9.958 ± 1.272			4.490 ± 0.612			1.991 ± 0.928			2.503 ± 1.860		
225TMHexane	1.533 ± 0.077			0.450 ± 0.023			1.463 ± 0.073			1.554 ± 0.078		
Octene-1	2.768 ± 0.138			1.544 ± 0.077			3.547 ± 0.177			2.626 ± 0.131		
11DMeCyHexane	0.311 ± 0.016			0.075 ± 0.004			0.383 ± 0.019			0.560 ± 0.028		
n-Octane	5.335 ± 0.267			1.665 ± 0.083			5.079 ± 0.254			4.707 ± 0.235		
24DiMeHeptane	0.610 ± 0.030			0.345 ± 0.017			0.754 ± 0.038			0.607 ± 0.030		
25DiMeHeptane	2.265 ± 0.113			0.734 ± 0.037			2.211 ± 0.111			2.029 ± 0.101		
33DiMeHeptane	0.080 ± 0.004			0.031 ± 0.002			0.089 ± 0.004			0.089 ± 0.004		
EtBenzene	22.971 ± 1.149			5.641 ± 0.282			16.668 ± 0.833			15.540 ± 0.777		
m/p-xylene	71.190 ± 3.560			17.419 ± 0.871			49.642 ± 2.482			46.692 ± 2.335		

Appendix B2. Chemical Composition of Dilution Blanks and Vehicle Exhaust Samples from Round2

Species Description	W3-1	W3-2	W3-3	W4-1	W4-2	W4-3	W5-1	W5-2	W5-3	W6-1	W6-2	W6-3
2MeOctane	1.846 ± 0.092			0.554 ± 0.028			2.315 ± 0.116			2.193 ± 0.110		
3MeOctane	2.980 ± 0.183			0.950 ± 0.058			2.903 ± 0.179			3.018 ± 0.186		
Styrene+heptanal	1.796 ± 0.090			0.963 ± 0.048			1.233 ± 0.062			1.080 ± 0.054		
o-xylene	24.974 ± 1.249			6.558 ± 0.328			18.002 ± 0.900			17.700 ± 0.885		
Nonene-1	0.567 ± 0.028			0.304 ± 0.015			1.010 ± 0.050			0.585 ± 0.029		
n-Nonane	2.845 ± 0.142			0.950 ± 0.048			2.798 ± 0.140			3.113 ± 0.156		
iPropBenzene	1.773 ± 0.089			0.618 ± 0.031			1.725 ± 0.086			1.276 ± 0.064		
iPropCyHexane	0.385 ± 0.026			0.125 ± 0.008			0.392 ± 0.026			0.422 ± 0.028		
26DiMeOctane	1.287 ± 0.081			0.459 ± 0.029			1.349 ± 0.085			1.292 ± 0.081		
alpha-pinene	0.227 ± 0.042			0.080 ± 0.015			0.265 ± 0.049			0.211 ± 0.039		
nPropBenzene	4.560 ± 0.228			1.312 ± 0.066			4.042 ± 0.202			3.691 ± 0.185		
mEtToluene	19.537 ± 0.977			5.165 ± 0.258			14.890 ± 0.745			15.517 ± 0.776		
pEtToluene	7.789 ± 0.389			2.089 ± 0.104			5.726 ± 0.286			6.025 ± 0.301		
135TriMeBenzene	9.307 ± 0.465			2.527 ± 0.126			7.351 ± 0.368			7.546 ± 0.377		
oEtToluene	6.449 ± 0.322			1.813 ± 0.091			4.967 ± 0.248			5.478 ± 0.274		
Octanal	0.434 ± 0.124			0.208 ± 0.060			0.474 ± 0.135			0.351 ± 0.100		
beta-pinene	0.156 ± 0.008			0.069 ± 0.003			0.189 ± 0.009			0.116 ± 0.006		
124TriMeBenzene	25.918 ± 1.296			7.002 ± 0.350			20.028 ± 1.001			19.996 ± 1.000		
n-Decane	1.863 ± 0.104			0.675 ± 0.038			1.978 ± 0.110			2.422 ± 0.135		
iButBenzene	0.533 ± 0.027			0.184 ± 0.009			0.568 ± 0.028			0.468 ± 0.023		
sButBenzene	0.394 ± 0.020			0.125 ± 0.006			0.417 ± 0.021			0.388 ± 0.019		
Limonene	5.959 ± 0.298			1.685 ± 0.084			4.842 ± 0.242			5.008 ± 0.250		
Indan	3.186 ± 0.342			0.704 ± 0.076			2.530 ± 0.272			2.733 ± 0.293		
13diethylbenzene	2.060 ± 0.206			0.604 ± 0.061			1.699 ± 0.170			1.846 ± 0.185		
14diethylbenzene	6.191 ± 0.344			1.426 ± 0.079			5.164 ± 0.287			4.815 ± 0.267		
12diethylbenzene	0.637 ± 0.032			0.199 ± 0.010			0.612 ± 0.031			0.790 ± 0.039		
2-propylToluene	1.349 ± 0.067			0.477 ± 0.024			1.180 ± 0.059			1.132 ± 0.057		
3-ipropyltoluene	0.720 ± 0.036			0.219 ± 0.011			0.700 ± 0.035			0.643 ± 0.032		
4-ipropyltoluene	0.126 ± 0.007			0.039 ± 0.002			0.042 ± 0.002			0.054 ± 0.003		
2-ipropyltoluene	0.277 ± 0.050			0.109 ± 0.020			0.221 ± 0.040			0.256 ± 0.047		
Nonanal	4.843 ± 0.242			1.116 ± 0.056			3.853 ± 0.193			3.892 ± 0.195		
n-Undecane	0.888 ± 0.178			0.254 ± 0.051			0.799 ± 0.160			1.307 ± 0.261		
1245tetraMeBenzene	1.636 ± 0.263			0.400 ± 0.064			1.421 ± 0.228			1.358 ± 0.218		
1235tetraMeBenzene	2.048 ± 0.102			0.516 ± 0.026			1.794 ± 0.090			1.642 ± 0.082		
1234tetraMeBenzene	0.762 ± 0.038			0.185 ± 0.009			0.721 ± 0.036			0.569 ± 0.028		
n-Dodecane	0.679 ± 0.034			0.183 ± 0.009			0.593 ± 0.030			0.715 ± 0.036		

Appendix B2. Chemical Composition of Dilution Blanks and Vehicle Exhaust Samples from Round2

Species Description	W6-4	W7-1	W7-2	W7-3	W7-4	W8-1	W8-2	W8-3
Gravimetric mass (mg/mi)	73.13 ± 3.66	5.08 ± 0.31	12.44 ± 0.64	3.45 ± 0.26	4.65 ± 0.29	4.21 ± 0.24	8.46 ± 0.46	27.78 ± 1.40
Carbon fractions by TOR (mg/mi)								
Organic Carbon Fraction 1	27.138 ± 2.784	0.693 ± 0.099	2.520 ± 0.241	0.594 ± 0.103	0.910 ± 0.113	0.692 ± 0.076	0.715 ± 0.108	0.900 ± 0.098
Organic Carbon Fraction 2	17.357 ± 2.672	0.691 ± 0.084	1.796 ± 0.196	0.856 ± 0.113	0.498 ± 0.066	0.661 ± 0.064	0.539 ± 0.078	0.672 ± 0.077
Organic Carbon Fraction 3	2.799 ± 0.614	0.795 ± 0.157	1.133 ± 0.181	0.903 ± 0.181	0.652 ± 0.144	0.506 ± 0.094	0.628 ± 0.140	0.581 ± 0.120
Organic Carbon Fraction 4	1.806 ± 0.473	0.515 ± 0.143	1.101 ± 0.225	0.370 ± 0.141	0.459 ± 0.148	0.730 ± 0.138	1.053 ± 0.247	0.369 ± 0.113
Pyrolyzed Organic Carbon	0.103 ± 0.044	0.009 ± 0.019	0.147 ± 0.037	0.002 ± 0.021	0.081 ± 0.030	0.032 ± 0.018	0.036 ± 0.022	0.002 ± 0.016
Total Organic Carbon	49.201 ± 3.545	2.700 ± 0.230	6.682 ± 0.446	2.692 ± 0.249	2.576 ± 0.231	2.602 ± 0.187	2.950 ± 0.254	2.517 ± 0.204
Elemental Carbon Fraction 1	2.344 ± 0.599	1.073 ± 0.229	2.524 ± 0.523	1.000 ± 0.246	0.611 ± 0.149	0.578 ± 0.095	3.180 ± 0.758	1.487 ± 0.302
Elemental Carbon Fraction 2	1.981 ± 0.287	1.734 ± 0.255	1.422 ± 0.168	0.295 ± 0.087	0.944 ± 0.141	0.947 ± 0.107	1.306 ± 0.232	1.860 ± 0.218
Elemental Carbon Fraction 3	0.047 ± 0.039	0.036 ± 0.020	0.040 ± 0.018	0.003 ± 0.007	0.028 ± 0.017	0.009 ± 0.007	0.094 ± 0.072	0.005 ± 0.006
Total Elemental Carbon	4.270 ± 0.787	2.824 ± 0.464	3.836 ± 0.556	1.285 ± 0.265	1.488 ± 0.263	1.499 ± 0.186	4.534 ± 0.884	3.343 ± 0.470
Total Carbon	53.470 ± 3.536	5.525 ± 0.401	10.518 ± 0.658	3.978 ± 0.352	4.063 ± 0.339	4.098 ± 0.278	7.483 ± 0.547	5.857 ± 0.396
Elements by XRF (mg/mi)								
Sodium (qualitative only)	0.0607 ± 0.0320	0.0007 ± 0.0229	0.0225 ± 0.0192	0.0436 ± 0.0255	0.0112 ± 0.0235	0.0056 ± 0.0164	0.0330 ± 0.0233	0.0071 ± 0.0191
Magnesium (qualitative only)	0.0050 ± 0.0308	0.0000 ± 0.0227	0.0065 ± 0.0189	0.0121 ± 0.0250	0.0091 ± 0.0232	0.0031 ± 0.0162	0.0013 ± 0.0226	0.0060 ± 0.0189
Aluminum	0.0160 ± 0.0209	0.0167 ± 0.0154	0.0112 ± 0.0128	0.0105 ± 0.0169	0.0056 ± 0.0157	0.0042 ± 0.0110	0.0159 ± 0.0154	0.0047 ± 0.0128
Silicon	0.0772 ± 0.0111	0.1340 ± 0.0105	0.0998 ± 0.0082	0.0580 ± 0.0088	0.1021 ± 0.0095	0.0278 ± 0.0055	0.0565 ± 0.0081	0.0399 ± 0.0065
Phosphorous	0.1608 ± 0.0084	0.0106 ± 0.0015	0.0481 ± 0.0027	0.0191 ± 0.0018	0.0411 ± 0.0025	0.0210 ± 0.0015	0.0344 ± 0.0023	0.0150 ± 0.0014
Sulfur	0.2488 ± 0.0131	0.0716 ± 0.0045	0.1855 ± 0.0096	0.0743 ± 0.0047	0.1116 ± 0.0062	0.0837 ± 0.0046	0.1662 ± 0.0088	0.0868 ± 0.0049
Chlorine	0.0178 ± 0.0019	0.0054 ± 0.0013	0.0121 ± 0.0012	0.0015 ± 0.0014	0.0041 ± 0.0013	0.0052 ± 0.0009	0.0050 ± 0.0013	0.0088 ± 0.0011
Potassium	0.0090 ± 0.0029	0.0032 ± 0.0021	0.0008 ± 0.0018	0.0203 ± 0.0025	0.0017 ± 0.0022	0.0014 ± 0.0015	0.0041 ± 0.0021	0.0003 ± 0.0018
Calcium	0.3285 ± 0.0166	0.0488 ± 0.0028	0.1025 ± 0.0053	0.0684 ± 0.0038	0.1425 ± 0.0073	0.0578 ± 0.0031	0.0762 ± 0.0041	0.0538 ± 0.0029
Titanium	0.0021 ± 0.0010	0.0007 ± 0.0007	0.0010 ± 0.0006	0.0013 ± 0.0008	0.0005 ± 0.0007	0.0007 ± 0.0005	0.0007 ± 0.0007	0.0006 ± 0.0006
Vanadium	0.0000 ± 0.0004	0.0000 ± 0.0003	0.0001 ± 0.0002	0.0001 ± 0.0003	0.0002 ± 0.0003	0.0002 ± 0.0002	0.0002 ± 0.0003	0.0001 ± 0.0002
Chromium	0.0141 ± 0.0017	0.0035 ± 0.0012	0.0076 ± 0.0010	0.0017 ± 0.0013	0.0040 ± 0.0012	0.0035 ± 0.0008	0.0075 ± 0.0012	0.0042 ± 0.0010
Manganese	0.0020 ± 0.0044	0.0003 ± 0.0032	0.0012 ± 0.0027	0.0006 ± 0.0036	0.0005 ± 0.0033	0.0003 ± 0.0023	0.0003 ± 0.0032	0.0006 ± 0.0027
Iron	0.4563 ± 0.0240	0.0575 ± 0.0057	0.0994 ± 0.0065	0.0527 ± 0.0060	0.1222 ± 0.0080	0.0480 ± 0.0042	0.1075 ± 0.0073	0.0855 ± 0.0059
Cobalt	0.0000 ± 0.0007	0.0001 ± 0.0006	0.0000 ± 0.0005	0.0001 ± 0.0006	0.0004 ± 0.0006	0.0000 ± 0.0004	0.0002 ± 0.0006	0.0000 ± 0.0005
Nickel	0.0036 ± 0.0012	0.0009 ± 0.0009	0.0022 ± 0.0007	0.0000 ± 0.0009	0.0015 ± 0.0009	0.0011 ± 0.0006	0.0026 ± 0.0009	0.0011 ± 0.0007
Copper	0.0146 ± 0.0013	0.0046 ± 0.0008	0.0056 ± 0.0007	0.0032 ± 0.0009	0.0042 ± 0.0008	0.0038 ± 0.0006	0.0063 ± 0.0008	0.0039 ± 0.0007
Zinc	0.1670 ± 0.0089	0.0122 ± 0.0022	0.0508 ± 0.0031	0.0149 ± 0.0025	0.0461 ± 0.0032	0.0265 ± 0.0020	0.0288 ± 0.0026	0.0257 ± 0.0022
Gallium	0.0069 ± 0.0038	0.0002 ± 0.0028	0.0013 ± 0.0023	0.0012 ± 0.0031	0.0018 ± 0.0029	0.0009 ± 0.0020	0.0018 ± 0.0028	0.0001 ± 0.0023
Arsenic	0.0000 ± 0.0010	0.0000 ± 0.0008	0.0000 ± 0.0006	0.0003 ± 0.0008	0.0000 ± 0.0008	0.0006 ± 0.0005	0.0000 ± 0.0008	0.0000 ± 0.0006
Selenium	0.0000 ± 0.0009	0.0000 ± 0.0006	0.0000 ± 0.0005	0.0000 ± 0.0007	0.0000 ± 0.0007	0.0000 ± 0.0005	0.0000 ± 0.0006	0.0000 ± 0.0005
Bromine	0.0012 ± 0.0011	0.0003 ± 0.0008	0.0007 ± 0.0007	0.0009 ± 0.0009	0.0012 ± 0.0008	0.0003 ± 0.0006	0.0011 ± 0.0008	0.0003 ± 0.0007
Rubidium	0.0008 ± 0.0011	0.0001 ± 0.0008	0.0002 ± 0.0007	0.0000 ± 0.0009	0.0000 ± 0.0008	0.0004 ± 0.0006	0.0002 ± 0.0008	0.0003 ± 0.0007
Strontium	0.0029 ± 0.0022	0.0001 ± 0.0016	0.0009 ± 0.0013	0.0006 ± 0.0018	0.0000 ± 0.0016	0.0001 ± 0.0011	0.0002 ± 0.0016	0.0007 ± 0.0013
Yttrium	0.0002 ± 0.0014	0.0001 ± 0.0010	0.0000 ± 0.0009	0.0010 ± 0.0011	0.0005 ± 0.0011	0.0005 ± 0.0007	0.0000 ± 0.0010	0.0001 ± 0.0009
Zirconium	0.0020 ± 0.0030	0.0007 ± 0.0022	0.0019 ± 0.0018	0.0026 ± 0.0024	0.0018 ± 0.0022	0.0021 ± 0.0016	0.0022 ± 0.0022	0.0004 ± 0.0018
Molybdenum	0.0090 ± 0.0035	0.0000 ± 0.0025	0.0049 ± 0.0021	0.0003 ± 0.0028	0.0038 ± 0.0026	0.0008 ± 0.0018	0.0004 ± 0.0025	0.0012 ± 0.0021
Palladium	0.0003 ± 0.0042	0.0019 ± 0.0031	0.0018 ± 0.0026	0.0027 ± 0.0035	0.0020 ± 0.0032	0.0019 ± 0.0022	0.0027 ± 0.0031	0.0014 ± 0.0026
Silver	0.0000 ± 0.0033	0.0012 ± 0.0024	0.0019 ± 0.0020	0.0033 ± 0.0027	0.0026 ± 0.0025	0.0000 ± 0.0017	0.0010 ± 0.0024	0.0005 ± 0.0020
Cadmium	0.0000 ± 0.0045	0.0004 ± 0.0033	0.0003 ± 0.0028	0.0006 ± 0.0036	0.0021 ± 0.0034	0.0000 ± 0.0024	0.0000 ± 0.0033	0.0006 ± 0.0028
Indium	0.0000 ± 0.0035	0.0007 ± 0.0026	0.0003 ± 0.0022	0.0012 ± 0.0029	0.0002 ± 0.0027	0.0011 ± 0.0019	0.0015 ± 0.0026	0.0010 ± 0.0022
Tin	0.0009 ± 0.0043	0.0019 ± 0.0032	0.0002 ± 0.0026	0.0025 ± 0.0035	0.0018 ± 0.0032	0.0018 ± 0.0023	0.0001 ± 0.0032	0.0019 ± 0.0026
Antimony	0.0042 ± 0.0044	0.0032 ± 0.0032	0.0010 ± 0.0027	0.0000 ± 0.0035	0.0007 ± 0.0033	0.0012 ± 0.0023	0.0047 ± 0.0032	0.0024 ± 0.0027
Barium	0.0022 ± 0.0101	0.0068 ± 0.0075	0.0083 ± 0.0063	0.0112 ± 0.0083	0.0065 ± 0.0077	0.0115 ± 0.0054	0.0063 ± 0.0075	0.0023 ± 0.0062
Lanthanum	0.0113 ± 0.0242	0.0073 ± 0.0179	0.0000 ± 0.0149	0.0018 ± 0.0196	0.0071 ± 0.0183	0.0026 ± 0.0128	0.0074 ± 0.0179	0.0000 ± 0.0148
Gold	0.0031 ± 0.0047	0.0000 ± 0.0035	0.0003 ± 0.0029	0.0031 ± 0.0038	0.0012 ± 0.0035	0.0008 ± 0.0025	0.0007 ± 0.0035	0.0004 ± 0.0029
Mercury	0.0025 ± 0.0018	0.0000 ± 0.0013	0.0002 ± 0.0011	0.0013 ± 0.0014	0.0001 ± 0.0013	0.0007 ± 0.0009	0.0004 ± 0.0013	0.0000 ± 0.0011
Thallium	0.0000 ± 0.0033	0.0000 ± 0.0024	0.0000 ± 0.0020	0.0007 ± 0.0026	0.0000 ± 0.0025	0.0005 ± 0.0017	0.0013 ± 0.0024	0.0008 ± 0.0020
Lead	0.0137 ± 0.0032	0.0009 ± 0.0023	0.0028 ± 0.0019	0.0015 ± 0.0025	0.0040 ± 0.0024	0.0017 ± 0.0017	0.0021 ± 0.0023	0.0009 ± 0.0019
Uranium	0.0000 ± 0.0044	0.0009 ± 0.0032	0.0017 ± 0.0027	0.0002 ± 0.0036	0.0000 ± 0.0033	0.0010 ± 0.0023	0.0015 ± 0.0032	0.0014 ± 0.0027
Anions by IC (mg/mi)								
Nitrate Ion	0.01 ± 0.01	0.01 ± 0.01	0.02 ± 0.01	0.02 ± 0.01	0.01 ± 0.01	0.02 ± 0.01	0.03 ± 0.01	0.02 ± 0.01
Sulfate Ion	0.22 ± 0.02	0.15 ± 0.01	0.43 ± 0.02	0.13 ± 0.01	0.18 ± 0.01	0.18 ± 0.01	0.31 ± 0.02	0.19 ± 0.01
Polycyclic aromatic hydrocarbons (ug/mile)								
Naphthalene	4284.80 ± 657.84	753.59 ± 117.48	1131.41 ± 176.12	928.52 ± 145.26	1228.44 ± 191.68	616.23 ± 97.27	1524.80 ± 236.26	781.55 ± 122.75
2-methylnaphthalene	9798.31 ± 994.83	1700.61 ± 172.46	2539.05 ± 259.83	2080.22 ± 213.19	3419.88 ± 350.92	1644.33 ± 168.34	3288.80 ± 335.22	1903.50 ± 195.50
1-methylnaphthalene	4261.56 ± 459.80	805.89 ± 86.85	1258.91 ± 136.82	971.29 ± 105.67	1567.22 ± 170.73	836.86 ± 91.00	1661.23 ± 179.90	914.91 ± 99.76
Biphenyl	230.05 ± 29.54	63.47 ± 8.16	130.05 ± 16.78	67.08 ± 8.69	101.32 ± 13.12	55.91 ± 7.24	157.10 ± 20.21	74.74 ± 9.69
1+2ethylnaphthalene	734.77 ± 100.39	214.52 ± 29.44	354.67 ± 48.77	163.24 ± 22.58	275.25 ± 37.98	220.87 ± 30.46	370.80 ± 50.86	215.75 ± 29.82
2,6+2,7-dimethylnaphthalene	756.20 ± 90.74	158.38 ± 18.99	303.70 ± 36.65	195.65 ± 23.65	299.26 ± 36.20	194.48 ± 23.48	351.61 ± 42.31	188.89 ± 22.86
1,3+1,6+1,7dimethylnaphth	1092.67 ± 132.07	249.53 ± 30.15	493.89 ± 60.03	308.54 ± 37.56	451.29 ± 55.00	325.20 ± 39.57	553.22 ± 67.08	309.84 ± 37.78
1,4+1,5+2,3-dimethylnaphth	251.20 ± 29.37	16.06 ± 2.07	33.36 ± 3.99	67.81 ± 8.03	105.43 ± 12.46	22.73 ± 2.74	120.27 ± 14.13	70.30 ± 8.32
1,2-dimethylnaphthalene	271.98 ± 36.35	63.38 ± 8.48	141.70 ± 19.02	64.93 ± 8.72	56.97 ± 7.68	84.25 ± 11.32	232.75 ± 31.16	73.19 ± 9.85
2-Methylbiphenyl	0.00 ± 23.53	0.00 ± 22.01	0.00 ± 18.62	0.00 ± 15.06	0.00 ± 15.93	0.00 ± 13.54	0.02 ± 17.85	0.00 ± 16.44
3-Methylbiphenyl	66.11 ± 12.72	34.12 ± 9.21	78.95 ± 13.32	0.00 ± 5.40	2.31 ± 7.05	8.32 ± 6.62	43.75 ± 10.15	7.30 ± 7.12
4-Methylbiphenyl	29.35 ± 4.88	17.16 ± 3.65	38.90 ± 5.52	0.00 ± 2.07	3.50 ± 2.80	5.98 ± 2.66	20.62 ± 3.97	5.42 ± 2.83
Dibenzofuran	42.46 ± 4.70	11.64 ± 1.28	19.45 ± 2.17	15.95 ± 1.78	19.33 ± 2.16	9.08 ± 1.02	15.41 ± 1.71	9.92 ± 1.11
A-trimethylnaphthalene	101.71 ± 8.91	25.36 ± 2.22	53.36 ± 4.72	30.65 ± 2.72	46.54 ± 4.14	32.75 ± 2.90	52.16 ± 4.59	30.40 ± 2.71
1-ethyl-2-methylnaphthalene	20.69 ± 1.59	4.82 ± 0.38	10.53 ± 0.82	6.04 ± 0.48	8.72 ± 0.68	6.33 ± 0.49	10.10 ± 0.78	5.97 ± 0.47
B-trimethylnaphthalene	109.16 ± 15.78	25.36 ± 3.67	68.28 ± 9.91	32.66 ± 4.75	46.33 ± 6.75	35.81 ± 5.21	52.53 ± 7.62	30.90 ± 4.51
C-trimethylnaphthalene	73.11 ± 5.84	17.87 ± 1.42	42.40 ± 3.43	23.14 ± 1.88	31.84 ± 2.59	23.80 ± 1.93	34.92 ± 2.81	20.88 ± 1.70
2-ethyl-1-methylnaphthalene	2.30 ± 0.33	0.41 ± 0.10	1.18 ± 0.17	0.61 ± 0.12	0.68 ± 0.13	0.58 ± 0.09	0.95 ± 0.15	0.45 ± 0.09
E-trimethylnaphthalene	45.18 ± 4.06	10.17 ± 0.92	26.04 ± 2.37	13.99 ± 1.28	17.83 ± 1.63	14.32 ± 1.30	22.24 ± 2.01	12.76 ± 1.17
F-trimethylnaphthalene	44.44 ± 4.88	10.44 ± 1.14	26.96 ± 2.97	13.65 ± 1.51	19.13 ± 2.12	13.68 ± 1.51	20.45 ± 2.25	12.06 ± 1.34
2,3,5+I-trimethylnaphthalene	56.57 ± 6.27	12.36 ± 1.37	35.59 ± 3.97	16.44 ± 1.84	21.33 ± 2.39	17.50 ± 1.96	25.07 ± 2.79	14.79 ± 1.66
2,4,5-trimethylnaphthalene	8.95 ± 1.33	2.95 ± 0.45	10.43 ± 1.55	4.15 ± 0.63	4.91 ± 0.74	4.25 ± 0.64	7.10 ± 1.06	3.25 ± 0.49
J-trimethylnaphthalene	16.82 ± 1.95	1.50 ± 0.19	8.04 ± 0.94	1.81 ± 0.23	2.08 ± 0.26	2.63 ± 0.31	3.24 ± 0.39	2.04 ± 0.25
1,4,5-trimethylnaphthalene	8.14 ± 1.34	1.15 ± 0.22	2.37 ± 0.40	0.91 ± 0.18	1.19 ± 0.23	1.15 ± 0.21	1.26 ± 0.24	1.22 ± 0.22
Acenaphthylene	440.69 ± 47.17	104.76 ± 11.14	79.06 ± 8.51	99.39 ± 10.70	66.48 ± 7.20	71.17 ± 7.68	280.80 ± 30.13	97.98 ± 10.54
Acenaphthene	14.88 ± 1.84	0.67 ± 0.71	71.56 ± 6.41	5.22 ± 1.02	24.30 ± 2.56	1.55 ± 0.72	89.69 ± 7.87	22.86 ± 2.42
Fluorene	157.99 ± 16.20	48.23 ± 4.92	67.15 ± 6.92	47.98 ± 4.97	64.52 ± 6.68	34.23 ± 3.54	110.31 ± 11.32	46.86 ± 4.84

Appendix B2. Chemical Composition of Dilution Blanks and Vehicle Exhaust Samples from Round2

Species Description	W6-4	W7-1	W7-2	W7-3	W7-4	W8-1	W8-2	W8-3
Dibenzothiophene	4.13 ± 0.51	1.60 ± 0.20	2.44 ± 0.30	2.88 ± 0.36	0.72 ± 0.13	0.84 ± 0.11	1.09 ± 0.16	1.45 ± 0.19
Phenanthrene	292.67 ± 31.22	137.33 ± 14.46	253.37 ± 27.12	96.62 ± 10.39	124.18 ± 13.36	86.86 ± 9.37	221.26 ± 23.54	136.64 ± 14.67
Anthracene	69.30 ± 9.41	10.92 ± 1.41	42.71 ± 5.78	17.17 ± 2.32	14.77 ± 2.00	8.75 ± 1.18	39.81 ± 5.34	24.75 ± 3.34
A-methylfluorene	51.88 ± 5.64	11.06 ± 1.20	27.64 ± 3.03	13.56 ± 1.50	22.11 ± 2.41	12.28 ± 1.36	18.29 ± 1.97	10.75 ± 1.19
1-methylfluorene	36.85 ± 4.24	8.69 ± 1.00	16.88 ± 1.96	10.54 ± 1.23	17.18 ± 2.00	8.59 ± 1.00	13.00 ± 1.51	8.96 ± 1.05
B-methylfluorene	10.81 ± 2.03	2.49 ± 0.47	4.27 ± 0.80	3.15 ± 0.60	3.95 ± 0.75	2.69 ± 0.51	4.18 ± 0.79	2.20 ± 0.42
9-fluorenone	50.20 ± 5.81	10.84 ± 1.13	31.90 ± 3.66	18.16 ± 2.12	22.33 ± 2.60	2.31 ± 0.31	12.97 ± 1.50	31.14 ± 3.58
Xanthone	8.85 ± 1.26	3.75 ± 0.51	10.90 ± 1.52	4.88 ± 0.69	3.03 ± 0.44	1.84 ± 0.26	1.48 ± 0.23	6.04 ± 0.82
Acenaphthenequinone	0.00 ± 0.14	1.68 ± 0.24	3.66 ± 0.47	3.63 ± 0.48	0.00 ± 0.09	0.00 ± 0.05	0.70 ± 0.14	2.38 ± 0.32
Perinaphthenone	19.94 ± 3.62	5.59 ± 1.03	10.74 ± 1.58	9.99 ± 1.53	6.04 ± 1.12	5.61 ± 0.79	6.01 ± 0.79	12.52 ± 1.85
2-methylanthracene	18.22 ± 1.84	4.94 ± 0.49	21.08 ± 2.13	3.71 ± 0.39	2.54 ± 0.27	4.48 ± 0.46	3.27 ± 0.34	4.55 ± 0.47
3-methylphenanthrene	49.11 ± 3.63	12.03 ± 0.89	37.91 ± 2.83	10.40 ± 0.79	17.08 ± 1.29	10.39 ± 0.79	12.42 ± 0.93	14.32 ± 1.08
2-methylphenanthrene	56.13 ± 5.29	14.64 ± 1.36	41.51 ± 3.93	12.40 ± 1.19	20.34 ± 1.94	11.47 ± 1.11	13.93 ± 1.32	16.54 ± 1.58
9-methylphenanthrene	22.59 ± 2.26	6.29 ± 0.61	16.04 ± 1.61	5.23 ± 0.53	4.97 ± 0.50	4.95 ± 0.50	6.56 ± 0.65	6.65 ± 0.66
1-methylphenanthrene	28.16 ± 4.75	19.62 ± 3.27	40.38 ± 6.80	10.86 ± 1.82	9.36 ± 1.57	11.11 ± 1.87	9.41 ± 1.56	10.56 ± 1.77
Anthrone	1.72 ± 0.40	0.27 ± 0.11	1.69 ± 0.37	0.21 ± 0.10	0.00 ± 0.09	0.04 ± 0.05	0.00 ± 0.08	0.02 ± 0.06
Anthraquinone	21.70 ± 3.09	10.56 ± 1.40	13.05 ± 1.75	7.86 ± 1.13	5.43 ± 0.82	5.90 ± 0.83	3.78 ± 0.53	14.24 ± 1.77
3,6-dimethylphenanthrene	8.73 ± 0.92	1.54 ± 0.18	7.25 ± 0.76	1.80 ± 0.21	2.53 ± 0.28	1.95 ± 0.21	1.48 ± 0.18	2.40 ± 0.26
A-dimethylphenanthrene	14.11 ± 1.53	2.69 ± 0.30	6.81 ± 0.74	2.26 ± 0.26	4.31 ± 0.48	2.26 ± 0.25	2.72 ± 0.30	4.87 ± 0.51
B-dimethylphenanthrene	7.28 ± 0.84	1.16 ± 0.15	4.98 ± 0.56	3.66 ± 0.42	1.15 ± 0.15	1.77 ± 0.21	0.76 ± 0.12	2.25 ± 0.26
C-dimethylphenanthrene	18.63 ± 1.55	4.10 ± 0.34	14.65 ± 1.22	4.30 ± 0.37	3.45 ± 0.30	3.60 ± 0.31	2.29 ± 0.21	5.66 ± 0.47
D-dimethylphenanthrene	5.57 ± 0.63	1.23 ± 0.16	3.63 ± 0.40	1.32 ± 0.17	1.30 ± 0.17	0.98 ± 0.12	0.67 ± 0.11	1.87 ± 0.21
1,7-dimethylphenanthrene	12.43 ± 1.03	2.24 ± 0.20	8.89 ± 0.73	2.54 ± 0.23	2.04 ± 0.19	2.15 ± 0.18	1.19 ± 0.13	3.32 ± 0.28
E-dimethylphenanthrene	7.24 ± 0.67	1.58 ± 0.16	6.04 ± 0.55	1.94 ± 0.20	1.66 ± 0.18	1.37 ± 0.13	0.93 ± 0.12	2.66 ± 0.25
9-methylanthracene	1.60 ± 0.30	0.00 ± 0.08	1.51 ± 0.26	0.22 ± 0.10	0.00 ± 0.09	0.00 ± 0.05	0.00 ± 0.08	0.00 ± 0.06
Fluoranthene	104.71 ± 7.92	48.55 ± 3.59	75.30 ± 5.67	24.15 ± 1.84	36.54 ± 2.77	25.20 ± 1.91	29.55 ± 2.19	67.47 ± 5.10
Pyrene	133.50 ± 11.97	37.67 ± 3.30	76.32 ± 6.72	21.93 ± 1.98	47.19 ± 4.22	23.96 ± 2.15	26.04 ± 2.29	74.60 ± 6.61
9-Anthraaldehyde	5.61 ± 1.51	0.69 ± 0.20	0.08 ± 0.06	0.00 ± 0.08	0.00 ± 0.09	0.04 ± 0.05	0.00 ± 0.08	5.54 ± 1.46
Retene	1.02 ± 0.26	0.00 ± 0.11	0.00 ± 0.08	0.00 ± 0.12	0.00 ± 0.12	0.00 ± 0.06	0.01 ± 0.12	0.00 ± 0.09
Benzonaphthothiophene	0.00 ± 0.25	0.13 ± 0.16	0.00 ± 0.12	0.13 ± 0.17	0.00 ± 0.17	0.02 ± 0.09	0.11 ± 0.17	0.11 ± 0.12
1+3-methylfluoranthene	8.31 ± 1.10	2.67 ± 0.35	3.47 ± 0.43	2.54 ± 0.33	2.27 ± 0.30	1.52 ± 0.20	0.97 ± 0.15	2.85 ± 0.36
1-MeFl+C-MeFl/Py	10.14 ± 1.03	2.91 ± 0.29	4.71 ± 0.45	3.03 ± 0.31	2.72 ± 0.28	1.97 ± 0.20	1.22 ± 0.14	3.39 ± 0.33
B-MePy/MeFl	14.56 ± 1.24	4.47 ± 0.37	4.83 ± 0.39	3.38 ± 0.29	3.07 ± 0.27	3.06 ± 0.25	2.29 ± 0.20	3.77 ± 0.31
C-MePy/MeFl	10.81 ± 0.89	3.36 ± 0.27	3.52 ± 0.28	2.22 ± 0.19	2.37 ± 0.21	1.98 ± 0.16	1.48 ± 0.14	2.56 ± 0.21
D-MePy/MeFl	8.49 ± 1.07	1.88 ± 0.24	3.11 ± 0.36	1.60 ± 0.21	2.23 ± 0.28	1.22 ± 0.15	0.92 ± 0.14	2.27 ± 0.27
4-methylpyrene	7.99 ± 0.90	1.74 ± 0.20	2.66 ± 0.28	1.33 ± 0.17	2.13 ± 0.25	1.29 ± 0.15	1.03 ± 0.14	1.79 ± 0.20
1-methylpyrene	6.62 ± 0.65	2.14 ± 0.21	2.93 ± 0.27	2.73 ± 0.27	1.92 ± 0.20	0.07 ± 0.05	1.02 ± 0.13	1.62 ± 0.16
Benzo(c)phenanthrene	5.16 ± 0.74	2.39 ± 0.33	2.56 ± 0.32	0.98 ± 0.15	1.87 ± 0.26	1.66 ± 0.22	1.80 ± 0.24	1.63 ± 0.21
Benzo(ghi)fluoranthene	25.61 ± 2.23	11.38 ± 0.87	16.95 ± 1.22	9.39 ± 0.75	2.02 ± 0.20	7.30 ± 0.51	10.83 ± 0.83	12.72 ± 0.95
Cyclopenta(c,d)pyrene	17.57 ± 2.79	3.58 ± 0.46	7.49 ± 0.85	2.37 ± 0.35	2.27 ± 0.35	4.15 ± 0.49	4.01 ± 0.53	5.28 ± 0.67
Benz(a)anthracene	20.19 ± 2.90	6.87 ± 0.83	9.41 ± 1.02	3.79 ± 0.53	5.62 ± 0.68	4.88 ± 0.54	5.54 ± 0.66	6.31 ± 0.72
Triphenylene	0.00 ± 0.13	0.00 ± 0.08	0.00 ± 0.06	0.21 ± 0.08	0.00 ± 0.09	0.00 ± 0.05	0.00 ± 0.08	0.00 ± 0.06
Chrysene	20.81 ± 1.72	7.31 ± 0.50	9.74 ± 0.60	4.53 ± 0.32	6.05 ± 0.41	5.51 ± 0.35	6.36 ± 0.41	6.31 ± 0.41
Benzanthrone	0.00 ± 0.13	1.86 ± 0.32	5.18 ± 0.84	1.61 ± 0.28	1.79 ± 0.31	1.79 ± 0.30	2.05 ± 0.35	2.09 ± 0.35
7-methylbenz(a)anthracene	0.00 ± 0.13	0.00 ± 0.08	0.00 ± 0.06	0.00 ± 0.08	0.00 ± 0.09	0.12 ± 0.08	0.06 ± 0.09	0.00 ± 0.06
3-methylchrysene	2.83 ± 0.32	0.46 ± 0.09	0.93 ± 0.10	0.24 ± 0.08	0.26 ± 0.09	0.44 ± 0.06	0.47 ± 0.09	0.34 ± 0.07
Benz(a)anthracene-7,12-dione	1.02 ± 0.25	0.82 ± 0.19	2.02 ± 0.41	0.73 ± 0.17	0.68 ± 0.16	0.79 ± 0.16	0.77 ± 0.18	0.91 ± 0.19
5+6-methylchrysene	0.00 ± 0.13	0.33 ± 0.09	0.54 ± 0.11	0.20 ± 0.09	0.17 ± 0.09	0.22 ± 0.06	0.21 ± 0.09	0.23 ± 0.07
Benzo(b+j+k)fluoranthene	19.29 ± 4.22	9.61 ± 1.59	15.95 ± 2.87	4.02 ± 0.91	3.57 ± 0.82	5.99 ± 1.21	10.63 ± 2.00	8.26 ± 1.80
Benzo(a)fluoranthene	1.67 ± 0.37	1.25 ± 0.22	2.20 ± 0.39	0.38 ± 0.11	0.16 ± 0.09	0.56 ± 0.11	1.38 ± 0.26	1.02 ± 0.19
BeP	8.57 ± 0.97	2.71 ± 0.28	7.77 ± 0.82	1.78 ± 0.20	1.78 ± 0.20	2.22 ± 0.22	3.81 ± 0.40	3.59 ± 0.38
BaP	8.14 ± 0.87	4.07 ± 0.42	9.08 ± 0.83	2.13 ± 0.32	1.40 ± 0.30	2.55 ± 0.26	5.67 ± 0.53	4.83 ± 0.46
Perylene	1.60 ± 0.33	2.30 ± 0.32	2.82 ± 0.38	0.33 ± 0.10	0.50 ± 0.12	1.02 ± 0.15	0.84 ± 0.18	0.91 ± 0.18
7-methylbenzo(a)pyrene	0.00 ± 0.13	0.00 ± 0.08	0.00 ± 0.06	0.00 ± 0.08	0.00 ± 0.09	0.00 ± 0.05	0.00 ± 0.08	0.00 ± 0.06
9,10-dihydrobenzo(a)pyrene-7(8H)-one	0.00 ± 0.13	0.04 ± 0.08	0.00 ± 0.06	0.00 ± 0.08	0.00 ± 0.09	0.00 ± 0.05	0.00 ± 0.08	0.00 ± 0.06
Dibenzo(a,j)anthracene	0.00 ± 0.13	0.21 ± 0.09	0.44 ± 0.10	0.12 ± 0.09	0.06 ± 0.09	0.14 ± 0.05	0.20 ± 0.09	0.20 ± 0.07
Indeno[123-cd]pyrene	21.41 ± 4.15	0.54 ± 0.14	2.09 ± 0.35	0.57 ± 0.14	1.94 ± 0.40	0.76 ± 0.13	0.00 ± 0.08	4.12 ± 0.81
Dibenzo(ah+ac)anthracene	0.29 ± 0.14	0.33 ± 0.09	0.27 ± 0.07	0.20 ± 0.09	0.05 ± 0.09	0.00 ± 0.05	0.00 ± 0.08	0.00 ± 0.06
Benzo(b)chrysene	0.00 ± 0.13	0.23 ± 0.10	0.38 ± 0.10	0.00 ± 0.08	0.40 ± 0.12	0.21 ± 0.06	0.42 ± 0.12	0.35 ± 0.10
Picene	0.43 ± 0.15	0.00 ± 0.08	0.23 ± 0.07	0.04 ± 0.08	0.08 ± 0.09	0.23 ± 0.06	0.38 ± 0.11	0.35 ± 0.09
Benzo(ghi)perylene	26.06 ± 3.47	6.89 ± 0.96	22.32 ± 2.85	5.31 ± 0.75	6.32 ± 0.88	6.21 ± 0.84	10.17 ± 1.33	9.79 ± 1.32
Anthanthrene	1.43 ± 0.26	1.33 ± 0.21	1.93 ± 0.29	0.71 ± 0.14	0.64 ± 0.13	0.55 ± 0.09	1.26 ± 0.20	2.22 ± 0.33
Dibenzo(b,k)fluoranthene	0.00 ± 0.13	0.00 ± 0.08	0.44 ± 0.08	0.00 ± 0.08	0.00 ± 0.09	0.00 ± 0.05	0.73 ± 0.13	0.51 ± 0.09
Dibenzo(a,e)pyrene	0.82 ± 0.20	0.46 ± 0.12	1.64 ± 0.31	0.00 ± 0.08	0.26 ± 0.10	0.48 ± 0.10	0.82 ± 0.17	0.72 ± 0.15
Coronene	4.09 ± 0.56	2.99 ± 0.40	9.96 ± 1.32	2.64 ± 0.36	3.05 ± 0.41	2.43 ± 0.32	4.22 ± 0.56	4.20 ± 0.56
Dibenzo(a,h)pyrene	0.00 ± 0.13	0.00 ± 0.08	0.00 ± 0.06	0.00 ± 0.08	0.00 ± 0.09	0.00 ± 0.05	0.00 ± 0.08	0.00 ± 0.06
nitro-PAH (ug/mile)								
1-nitronaphthalene	0.1068 ± 0.0122	0.0465 ± 0.0069	0.0785 ± 0.0097	0.0000 ± 0.0034	0.0002 ± 0.0034	0.0092 ± 0.0039	0.0256 ± 0.0053	0.0171 ± 0.0048
2-nitronaphthalene	0.1829 ± 0.0252	0.2575 ± 0.0340	0.2761 ± 0.0365	0.0292 ± 0.0065	0.0453 ± 0.0085	0.0451 ± 0.0082	0.1831 ± 0.0247	0.8450 ± 0.1069
2-nitrobiphenyl	0.0117 ± 0.0023	0.0077 ± 0.0016	0.0207 ± 0.0038	0.0036 ± 0.0010	0.0004 ± 0.0005	0.0008 ± 0.0005	0.0008 ± 0.0005	0.0040 ± 0.0010
3-nitrobiphenyl	0.0084 ± 0.0016	0.0024 ± 0.0006	0.0058 ± 0.0011	0.0015 ± 0.0004	0.0010 ± 0.0004	0.0028 ± 0.0006	0.0053 ± 0.0011	0.0038 ± 0.0008
4-nitrobiphenyl	0.0199 ± 0.0061	0.0000 ± 0.0024	0.0000 ± 0.0013	0.0000 ± 0.0025	0.0010 ± 0.0031	0.0000 ± 0.0012	0.0000 ± 0.0022	0.0000 ± 0.0015
2-nitrofluorene	0.0027 ± 0.0004	0.0138 ± 0.0011	0.0072 ± 0.0006	0.0023 ± 0.0003	0.0005 ± 0.0002	0.0031 ± 0.0003	0.0031 ± 0.0003	0.0040 ± 0.0004
1,3-dinitronaphthalene	0.0063 ± 0.0015	0.0038 ± 0.0009	0.0026 ± 0.0006	0.0000 ± 0.0004	0.0000 ± 0.0005	0.0000 ± 0.0004	0.0068 ± 0.0010	0.0000 ± 0.0004
1,5-dinitronaphthalene	0.0007 ± 0.0002	0.0005 ± 0.0001	0.0024 ± 0.0003	0.0000 ± 0.0001	0.0013 ± 0.0002	0.0009 ± 0.0001	0.0000 ± 0.0001	0.0000 ± 0.0001
5-nitroacenaphthene	0.0000 ± 0.0011	0.0002 ± 0.0010	0.0038 ± 0.0012	0.0000 ± 0.0007	0.0000 ± 0.0007	0.0001 ± 0.0006	0.0055 ± 0.0010	0.0000 ± 0.0009
9-nitroanthracene	0.0156 ± 0.0027	0.0277 ± 0.0043	0.0870 ± 0.0132	0.0099 ± 0.0017	0.0130 ± 0.0020	0.0443 ± 0.0070	0.0087 ± 0.0014	0.0180 ± 0.0028
4-nitrophenanthrene	0.0015 ± 0.0002	0.0291 ± 0.0025	0.0000 ± 0.0001	0.0007 ± 0.0001	0.0006 ± 0.0001	0.0000 ± 0.0000	0.0091 ± 0.0007	0.0006 ± 0.0001
9-nitrophenanthrene	0.0038 ± 0.0006	0.0031 ± 0.0004	0.0041 ± 0.0006	0.0012 ± 0.0002	0.0000 ± 0.0001	0.0000 ± 0.0001	0.0019 ± 0.0003	0.0023 ± 0.0003
1,8-dinitronaphthalene	0.0000 ± 0.0003	0.0069 ± 0.0009	0.0059 ± 0.0008	0.0000 ± 0.0001	0.0060 ± 0.0007	0.0000 ± 0.0001	0.0002 ± 0.0002	0.0046 ± 0.0007
2-nitrofluoranthene	0.0319 ± 0.0036	0.0609 ± 0.0056	0.0259 ± 0.0030	0.0102 ± 0.0010	0.0022 ± 0.0005	0.0105 ± 0.0012	0.0103 ± 0.0012	0.0119 ± 0.0013
3-nitrofluoranthene	0.0002 ± 0.0002	0.0376 ± 0.0021	0.0051 ± 0.0003	0.0000 ± 0.0001	0.0000 ± 0.0001	0.0014 ± 0.0002	0.0001 ± 0.0001	0.0007 ± 0.0001
1-nitropyrene	0.0561 ± 0.0070	0.0276 ± 0.0030	0.1192 ± 0.0132	0.0223 ± 0.0027	0.0221 ± 0.0027	0.0529 ± 0.0060	0.0250 ± 0.0031	0.0231 ± 0.0029
7-nitrobenzo(a)anthracene	0.0231 ± 0.0033	0.2920 ± 0.0375	0.0402 ± 0.0039	0.0016 ± 0.0004	0.0011 ± 0.0004	0.0337 ± 0.0036	0.0044 ± 0.0007	0.0028 ± 0.0006
6-nitrochrysene	0.0096 ± 0.0016	0.0036 ± 0.0006	0.0159 ± 0.0018	0.0004 ± 0.0001	0.0016 ± 0.0003	0.0076 ± 0.0010	0.0016 ± 0.0003	0.0004 ± 0.0001

Appendix B2. Chemical Composition of Dilution Blanks and Vehicle Exhaust Samples from Round2

Species Description	W6-4	W7-1	W7-2	W7-3	W7-4	W8-1	W8-2	W8-3
6-nitrobenz[a]pyrene	0.0000 ± 0.0001	0.0000 ± 0.0001	0.0171 ± 0.0015	0.0000 ± 0.0001	0.0000 ± 0.0001	0.0020 ± 0.0002	0.0000 ± 0.0001	0.0004 ± 0.0001
Hopanes (ug/mile)								
18a(H),21ß(H)-22,29,30-Trisnorhopane &	14.75 ± 1.57	0.21 ± 0.08	0.60 ± 0.08	0.34 ± 0.09	0.06 ± 0.09	0.25 ± 0.05	0.26 ± 0.08	0.23 ± 0.06
17a(H),21ß(H)-22,29,30-Trisnorhopane	13.99 ± 2.87	0.03 ± 0.09	0.85 ± 0.22	0.18 ± 0.10	0.00 ± 0.10	0.00 ± 0.06	0.14 ± 0.10	0.03 ± 0.07
17a(H),21ß(H)-30-Norhopane	61.83 ± 12.58	0.31 ± 0.12	1.88 ± 0.40	0.63 ± 0.17	0.23 ± 0.11	0.64 ± 0.14	0.71 ± 0.18	0.64 ± 0.16
17a(H),21ß(H)-Hopane	39.59 ± 7.68	0.33 ± 0.11	0.92 ± 0.20	0.83 ± 0.16	0.21 ± 0.10	0.46 ± 0.11	0.51 ± 0.13	0.47 ± 0.11
17ß(H),21a(H)-hopane	3.63 ± 0.98	0.06 ± 0.08	0.11 ± 0.07	0.00 ± 0.08	0.00 ± 0.09	0.05 ± 0.05	0.00 ± 0.08	0.05 ± 0.06
22S-17a(H),21ß(H)-30-Homohopane	25.66 ± 3.24	0.13 ± 0.09	0.71 ± 0.11	0.44 ± 0.10	0.22 ± 0.09	0.29 ± 0.06	0.28 ± 0.09	0.23 ± 0.07
22R-17a(H),21ß(H)-30-Homohopane	20.73 ± 4.59	0.10 ± 0.09	0.65 ± 0.16	0.43 ± 0.12	0.03 ± 0.09	0.15 ± 0.06	0.15 ± 0.09	0.28 ± 0.09
17ß(H),21ß(H)-Hopane	4.11 ± 0.78	0.00 ± 0.08	0.00 ± 0.06	0.00 ± 0.08	0.00 ± 0.09	0.02 ± 0.05	0.00 ± 0.08	0.00 ± 0.06
22S-17a(H),21ß(H)-30,31-Bishomohopan	13.90 ± 3.90	0.00 ± 0.08	0.32 ± 0.11	0.09 ± 0.09	0.00 ± 0.09	0.11 ± 0.06	0.08 ± 0.09	0.04 ± 0.06
22R-17a(H),21ß(H)-30,31-Bishomohopan	8.81 ± 1.13	0.00 ± 0.08	0.13 ± 0.06	0.11 ± 0.09	0.00 ± 0.09	0.02 ± 0.05	0.00 ± 0.08	0.07 ± 0.06
22S-17a(H),21ß(H)-30,31,32-Trisomohop	7.26 ± 1.60	0.00 ± 0.08	0.24 ± 0.08	0.00 ± 0.08	0.00 ± 0.09	0.09 ± 0.05	0.00 ± 0.08	0.02 ± 0.06
22R-17a(H),21ß(H)-30,31,32-Trishomoho	2.29 ± 0.44	0.00 ± 0.08	0.00 ± 0.06	0.00 ± 0.08	0.00 ± 0.09	0.00 ± 0.05	0.00 ± 0.08	0.00 ± 0.06
Steranes (ug/mile)								
C27-20S5a(H),14a(H)-cholestane	0.00 ± 0.13	0.00 ± 0.08	0.00 ± 0.06	0.04 ± 0.08	0.00 ± 0.09	0.00 ± 0.05	0.00 ± 0.08	0.01 ± 0.06
C27-20R5a(H),14ß(H)-cholestane	10.95 ± 2.85	0.01 ± 0.09	0.22 ± 0.10	0.18 ± 0.10	0.08 ± 0.10	0.10 ± 0.06	0.02 ± 0.09	0.06 ± 0.07
C27-20S5a(H),14ß(H),17ß(H)-cholestane	11.85 ± 2.36	0.00 ± 0.08	0.29 ± 0.09	0.32 ± 0.10	0.09 ± 0.09	0.10 ± 0.05	0.10 ± 0.09	0.09 ± 0.06
ster45+40(cholestane)	11.47 ± 1.75	0.05 ± 0.08	0.28 ± 0.08	0.34 ± 0.10	0.08 ± 0.09	0.12 ± 0.05	0.11 ± 0.09	0.10 ± 0.07
C28-20S5a(H),14a(H),17a(H)-ergostane	6.04 ± 1.42	0.05 ± 0.08	0.11 ± 0.07	0.08 ± 0.08	0.02 ± 0.09	0.03 ± 0.05	0.07 ± 0.08	0.03 ± 0.06
C28-20R5a(H),14ß(H),17ß(H)-ergostane	7.49 ± 2.03	0.01 ± 0.08	0.04 ± 0.07	0.10 ± 0.10	0.00 ± 0.09	0.00 ± 0.05	0.11 ± 0.09	0.02 ± 0.07
C28-20S5a(H),14ß(H),17ß(H)-ergostane	5.26 ± 1.26	0.00 ± 0.08	0.08 ± 0.07	0.14 ± 0.09	0.00 ± 0.09	0.02 ± 0.05	0.01 ± 0.08	0.00 ± 0.06
C28-20R5a(H),14a(H),17a(H)-ergostane	5.67 ± 0.80	0.00 ± 0.08	0.36 ± 0.08	0.00 ± 0.08	0.00 ± 0.09	0.30 ± 0.07	0.75 ± 0.14	0.00 ± 0.06
C29-20S5a(H),14a(H),17a(H)-stigmastan	8.21 ± 1.54	0.06 ± 0.08	0.17 ± 0.07	0.06 ± 0.08	0.04 ± 0.09	0.09 ± 0.05	0.06 ± 0.08	0.06 ± 0.06
C29-20R5a(H),14ß(H),17ß(H)-stigmastan	13.83 ± 1.82	0.06 ± 0.08	0.32 ± 0.07	0.22 ± 0.09	0.09 ± 0.09	0.14 ± 0.05	0.14 ± 0.09	0.04 ± 0.06
C29-20S5a(H),14ß(H),17ß(H)-stigmastan	10.02 ± 2.05	0.07 ± 0.08	0.25 ± 0.08	0.16 ± 0.09	0.06 ± 0.09	0.12 ± 0.05	0.10 ± 0.09	0.07 ± 0.06
C29-20R5a(H),14a(H),17a(H)-stigmastan	8.19 ± 1.73	0.03 ± 0.08	0.11 ± 0.07	0.10 ± 0.09	0.00 ± 0.09	0.06 ± 0.05	0.01 ± 0.08	0.04 ± 0.06
Alkanes (ug/mile)								
Dodecane	334.31 ± 80.40	0.19 ± 2.62	45.86 ± 14.03	0.00 ± 2.90	103.41 ± 27.33	90.21 ± 24.08	140.52 ± 35.64	150.76 ± 38.23
Tridecane	500.95 ± 60.84	143.43 ± 18.39	39.56 ± 6.20	0.00 ± 1.82	133.79 ± 17.41	154.25 ± 19.78	185.68 ± 23.46	174.06 ± 22.29
Norfarnesane	202.38 ± 36.67	49.90 ± 9.42	52.78 ± 9.94	9.01 ± 2.15	0.06 ± 0.77	18.21 ± 3.79	85.48 ± 15.75	49.53 ± 9.41
Heptylcyclohexane	2.88 ± 0.74	0.45 ± 0.28	0.00 ± 0.16	1.33 ± 0.42	0.78 ± 0.34	0.11 ± 0.19	0.00 ± 0.18	0.48 ± 0.27
Farnesane	55.64 ± 10.42	22.00 ± 4.26	33.35 ± 6.30	16.00 ± 3.20	13.05 ± 2.69	13.87 ± 2.79	31.67 ± 6.00	15.03 ± 3.03
Tetradecane	156.09 ± 13.99	77.17 ± 7.12	90.74 ± 8.33	36.56 ± 3.89	31.55 ± 3.54	50.44 ± 4.98	83.77 ± 7.71	44.58 ± 4.59
Octylcyclohexane	4.88 ± 1.48	1.63 ± 0.63	0.00 ± 0.14	0.00 ± 0.18	0.98 ± 0.53	0.00 ± 0.13	0.00 ± 0.21	0.00 ± 0.20
Pentadecane	67.46 ± 8.51	41.32 ± 5.17	40.37 ± 5.07	15.71 ± 2.20	16.20 ± 2.28	24.66 ± 3.21	29.12 ± 3.75	20.86 ± 2.82
Nonylcyclohexane	3.34 ± 0.94	0.27 ± 0.29	0.00 ± 0.18	0.25 ± 0.29	1.29 ± 0.48	0.00 ± 0.16	0.00 ± 0.25	0.00 ± 0.13
Hexadecane	62.91 ± 5.44	44.61 ± 3.24	19.21 ± 1.99	11.10 ± 1.46	30.89 ± 2.35	11.47 ± 1.42	29.56 ± 2.29	21.51 ± 1.93
Norpristane	23.47 ± 2.04	12.10 ± 1.06	14.90 ± 1.30	4.96 ± 0.48	5.32 ± 0.51	3.72 ± 0.36	7.06 ± 0.64	5.59 ± 0.52
Heptadecane	46.59 ± 3.81	16.63 ± 1.42	12.99 ± 1.16	8.36 ± 0.82	10.23 ± 0.94	7.33 ± 0.72	9.69 ± 0.91	7.74 ± 0.77
Decylcyclohexane	5.07 ± 0.94	0.60 ± 0.18	1.28 ± 0.25	0.40 ± 0.16	0.72 ± 0.20	0.71 ± 0.15	0.87 ± 0.22	0.69 ± 0.17
Heptadecane_Pristane	22.57 ± 2.37	8.00 ± 0.88	8.50 ± 0.93	5.16 ± 0.62	5.34 ± 0.64	5.01 ± 0.59	5.61 ± 0.66	3.23 ± 0.43
Undecylcyclohexane	3.02 ± 0.89	2.24 ± 0.59	0.06 ± 0.09	0.61 ± 0.25	0.60 ± 0.26	0.00 ± 0.08	0.59 ± 0.23	0.80 ± 0.26
Octadecane	65.27 ± 6.70	46.82 ± 3.74	10.90 ± 2.14	10.11 ± 2.14	48.52 ± 3.99	0.84 ± 1.46	43.56 ± 3.62	14.74 ± 2.34
Phytane	23.89 ± 3.91	8.20 ± 1.44	9.76 ± 1.63	3.20 ± 0.75	4.30 ± 0.92	5.23 ± 0.96	4.29 ± 0.89	2.92 ± 0.67
Dodecylcyclohexane	1.97 ± 0.69	0.99 ± 0.19	0.17 ± 0.08	0.47 ± 0.13	0.54 ± 0.14	0.00 ± 0.06	0.57 ± 0.14	0.27 ± 0.10
Nonadecane	35.70 ± 3.08	8.76 ± 0.80	14.02 ± 1.24	4.41 ± 0.46	5.75 ± 0.58	6.97 ± 0.66	4.95 ± 0.50	4.60 ± 0.47
Tridecylcyclohexane	2.26 ± 0.46	0.71 ± 0.19	0.00 ± 0.07	0.05 ± 0.11	0.52 ± 0.16	0.00 ± 0.06	0.29 ± 0.13	0.25 ± 0.12
Eicosane	61.11 ± 7.99	46.05 ± 4.71	6.38 ± 2.67	9.83 ± 3.00	46.74 ± 5.01	0.00 ± 1.98	38.69 ± 4.35	7.13 ± 2.90
Tetradecylcyclohexane	6.57 ± 1.31	0.84 ± 0.21	1.27 ± 0.27	0.46 ± 0.14	0.41 ± 0.14	0.57 ± 0.14	0.15 ± 0.10	0.63 ± 0.16
Heneicosane	56.74 ± 5.17	3.08 ± 0.37	3.97 ± 0.43	3.07 ± 0.37	3.70 ± 0.44	2.55 ± 0.31	1.75 ± 0.27	3.70 ± 0.42
Pentadecylcyclohexane	16.57 ± 3.93	0.23 ± 0.26	0.91 ± 0.31	1.00 ± 0.38	0.95 ± 0.45	0.91 ± 0.28	0.00 ± 0.22	0.75 ± 0.30
Docosane	87.39 ± 12.86	15.49 ± 3.55	0.00 ± 1.89	4.75 ± 2.86	26.06 ± 4.48	0.00 ± 1.52	19.56 ± 3.84	7.17 ± 2.84
Hexadecylcyclohexane	1.99 ± 0.46	0.07 ± 0.09	0.06 ± 0.06	0.11 ± 0.09	0.28 ± 0.10	0.02 ± 0.05	0.01 ± 0.08	1.13 ± 0.24
Tricosane	26.49 ± 2.98	2.67 ± 0.55	4.25 ± 0.60	1.17 ± 0.47	4.37 ± 0.73	2.04 ± 0.40	1.38 ± 0.49	1.96 ± 0.48
Heptadecylcyclohexane	1.70 ± 0.66	1.35 ± 0.40	4.46 ± 1.04	6.87 ± 1.54	0.56 ± 0.26	2.01 ± 0.56	0.19 ± 0.23	0.86 ± 0.33
Octadecylcyclohexane	3.20 ± 0.74	0.20 ± 0.09	0.31 ± 0.09	0.11 ± 0.09	0.24 ± 0.11	0.22 ± 0.06	0.18 ± 0.09	0.30 ± 0.09
Tetracosane	1.95 ± 4.59	0.34 ± 2.82	0.00 ± 2.08	0.58 ± 2.66	9.99 ± 3.65	0.00 ± 1.64	5.47 ± 3.16	0.00 ± 2.37
Pentacosane	15.29 ± 3.63	0.60 ± 0.87	0.00 ± 0.82	0.00 ± 0.80	0.00 ± 1.01	0.26 ± 0.62	0.00 ± 0.85	0.00 ± 0.72
Nonadecylcyclohexane	2.07 ± 0.71	0.80 ± 0.32	1.06 ± 0.35	0.70 ± 0.31	0.00 ± 0.17	0.00 ± 0.11	1.80 ± 0.48	0.00 ± 0.13
Hexacosane	0.00 ± 1.03	4.63 ± 1.04	0.53 ± 0.77	1.89 ± 0.92	6.30 ± 1.20	0.00 ± 0.53	4.90 ± 1.07	0.53 ± 0.77
Eicosylcyclohexane	3.64 ± 0.99	0.02 ± 0.08	1.35 ± 0.21	0.02 ± 0.08	0.02 ± 0.09	0.25 ± 0.06	0.06 ± 0.08	0.10 ± 0.06
Heptacosane	0.00 ± 0.43	0.57 ± 0.42	0.12 ± 0.32	0.00 ± 0.31	0.87 ± 0.46	0.02 ± 0.30	0.20 ± 0.37	0.27 ± 0.34
Heneicosylcyclohexane	1.86 ± 0.45	0.06 ± 0.08	0.51 ± 0.13	0.08 ± 0.09	0.03 ± 0.09	0.05 ± 0.05	0.05 ± 0.08	0.03 ± 0.06
Octacosane	0.00 ± 1.37	4.46 ± 1.33	2.41 ± 1.04	2.40 ± 1.16	4.33 ± 1.39	0.40 ± 0.74	4.43 ± 1.33	0.85 ± 0.93
Nonacosane	1.52 ± 0.79	0.47 ± 0.28	0.20 ± 0.18	0.00 ± 0.18	0.71 ± 0.29	0.56 ± 0.19	0.38 ± 0.27	0.67 ± 0.24
Triacontane	0.00 ± 1.15	1.26 ± 0.84	2.51 ± 0.89	0.85 ± 0.78	2.21 ± 1.00	0.32 ± 0.51	1.80 ± 0.91	0.65 ± 0.64
Hentriacontane	0.00 ± 0.41	0.00 ± 0.13	0.06 ± 0.16	0.00 ± 0.09	0.10 ± 0.25	0.00 ± 0.06	0.00 ± 0.12	0.00 ± 0.10
Dotriacontane	0.00 ± 0.41	0.73 ± 0.36	0.50 ± 0.28	0.60 ± 0.34	1.67 ± 0.46	0.00 ± 0.20	1.01 ± 0.38	0.26 ± 0.27
Tritriacontane	0.00 ± 0.14	0.00 ± 0.09	0.00 ± 0.07	0.00 ± 0.09	0.00 ± 0.10	0.00 ± 0.05	0.00 ± 0.09	0.00 ± 0.07
Tetratriacontane	0.00 ± 0.54	0.43 ± 0.30	0.52 ± 0.25	0.28 ± 0.29	0.86 ± 0.36	0.37 ± 0.19	0.93 ± 0.36	0.64 ± 0.27
Pentatriacontane	3.15 ± 1.20	0.00 ± 0.10	0.00 ± 0.07	0.00 ± 0.09	0.00 ± 0.09	0.00 ± 0.05	0.00 ± 0.10	0.00 ± 0.07
Hexatriacontane	0.00 ± 0.28	0.00 ± 0.22	0.15 ± 0.19	0.00 ± 0.25	0.54 ± 0.31	0.00 ± 0.12	0.49 ± 0.29	0.11 ± 0.21
Heptatriacontane	0.00 ± 0.18	0.11 ± 0.14	0.00 ± 0.06	0.00 ± 0.08	0.00 ± 0.09	0.00 ± 0.06	0.13 ± 0.17	0.02 ± 0.11
Octatriacontane	0.00 ± 0.32	0.04 ± 0.17	0.00 ± 0.12	0.03 ± 0.17	0.33 ± 0.21	0.00 ± 0.09	0.40 ± 0.21	0.08 ± 0.15
Nonatriacontane	0.00 ± 0.13	0.00 ± 0.08	0.00 ± 0.06	0.00 ± 0.08	0.00 ± 0.09	0.00 ± 0.05	0.00 ± 0.08	0.00 ± 0.06
Polar compounds (ug/mile)								
heptanoic acid (c7)	0.00 ± 2.12	0.00 ± 2.51	9.79 ± 3.85	0.00 ± 1.34	0.00 ± 1.31	4.34 ± 2.45	0.00 ± 2.21	3.08 ± 2.80
me-malonic (d-c3)	0.00 ± 0.29	0.00 ± 0.18	2.06 ± 0.59	0.65 ± 0.26	0.00 ± 0.22	0.10 ± 0.18	0.23 ± 0.33	0.00 ± 0.16
guaiacol	-99.00 ± 0.13	-99.00 ± 0.09	-99.00 ± 0.07	-99.00 ± 0.08	-99.00 ± 0.09	-99.00 ± 0.05	-99.00 ± 0.08	-99.00 ± 0.06
benzoic acid	0.00 ± 120.50	0.00 ± 145.41	0.00 ± 51.42	0.00 ± 68.36	0.00 ± 72.90	0.00 ± 167.55	0.00 ± 84.77	0.00 ± 143.21
octanoic acid (c8)	0.00 ± 3.30	4.62 ± 3.21	5.77 ± 3.00	0.00 ± 1.72	0.00 ± 1.73	1.11 ± 2.11	0.00 ± 2.17	0.49 ± 2.38
phenylacetic acid	13.82 ± 2.91	24.78 ± 3.98	64.13 ± 9.42	2.09 ± 0.83	0.70 ± 0.68	5.24 ± 1.01	0.02 ± 0.55	6.08 ± 1.23
maleic acid	0.00 ± 0.35	0.00 ± 0.57	0.00 ± 0.36	0.01 ± 0.55	0.00 ± 0.29	0.00 ± 0.18	0.13 ± 1.40	0.00 ± 0.18
succinic acid (d-c4)	0.00 ± 0.77	0.00 ± 0.89	0.00 ± 1.13	0.00 ± 0.48	0.00 ± 0.41	0.00 ± 0.74	0.00 ± 2.35	0.00 ± 0.48

Appendix B2. Chemical Composition of Dilution Blanks and Vehicle Exhaust Samples from Round2

Species Description	W6-4	W7-1	W7-2	W7-3	W7-4	W8-1	W8-2	W8-3
4-me-guaiacol	-99.00 ± 0.13	-99.00 ± 0.08	-99.00 ± 0.06	-99.00 ± 0.08	-99.00 ± 0.09	-99.00 ± 0.05	-99.00 ± 0.08	-99.00 ± 0.06
o-toluic	16.65 ± 5.34	32.83 ± 7.96	83.42 ± 18.55	3.79 ± 1.80	2.27 ± 1.54	7.39 ± 2.13	0.96 ± 1.23	8.52 ± 2.55
me-succinic acid (d-c4)	0.00 ± 0.38	0.00 ± 0.09	0.00 ± 0.19	0.00 ± 0.09	0.00 ± 0.09	0.00 ± 0.23	0.00 ± 0.33	0.00 ± 0.22
m-toluic	6.58 ± 2.80	21.22 ± 3.37	116.10 ± 14.01	8.97 ± 2.02	8.12 ± 1.97	11.97 ± 1.85	0.16 ± 1.05	15.41 ± 2.46
nonanoic acid (c9)	0.00 ± 4.00	5.51 ± 3.90	6.61 ± 3.61	0.00 ± 2.32	0.00 ± 2.07	0.00 ± 2.48	0.00 ± 2.65	0.00 ± 2.81
p-toluic	0.00 ± 2.04	13.44 ± 2.92	84.75 ± 12.05	3.21 ± 1.64	1.96 ± 1.54	9.14 ± 1.78	0.13 ± 0.87	9.52 ± 2.09
2,6-dimethylbenzoic acid	0.61 ± 0.81	0.21 ± 0.39	4.67 ± 1.17	0.02 ± 0.25	0.04 ± 0.13	0.34 ± 0.25	0.00 ± 0.18	0.00 ± 0.18
4-ethyl-guaiacol	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00
syringol	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00
glutaric acid (d-c5)	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00
2-methylglutaric (d-c5)	0.00 ± 0.15	0.00 ± 0.10	0.04 ± 0.24	0.01 ± 0.10	0.00 ± 0.09	0.00 ± 0.22	0.00 ± 0.11	0.00 ± 0.07
2,5-dimethylbenzoic acid	1.86 ± 1.18	5.79 ± 1.48	20.96 ± 3.86	0.05 ± 0.54	1.16 ± 0.79	4.56 ± 1.14	0.53 ± 0.67	2.49 ± 0.89
3-methylglutaric acid (d-c5)	0.00 ± 0.18	0.00 ± 0.34	0.00 ± 0.34	0.00 ± 0.12	0.00 ± 0.12	0.00 ± 0.30	0.00 ± 0.18	0.00 ± 0.17
2,4-dimethylbenzoic acid	0.00 ± 53.72	0.00 ± 60.81	642.03 ± 177.89	0.00 ± 32.79	0.00 ± 34.69	0.00 ± 71.18	0.00 ± 40.56	0.00 ± 75.98
2,3- and 3,5- dimethylbenzoic acid	0.00 ± 0.87	0.00 ± 1.04	13.95 ± 2.80	0.00 ± 0.42	0.00 ± 0.74	0.60 ± 0.61	0.00 ± 0.28	0.01 ± 0.75
decanoic acid (c10)	0.00 ± 0.34	1.13 ± 0.36	0.62 ± 0.27	0.00 ± 0.20	0.00 ± 0.19	0.04 ± 0.20	0.00 ± 0.21	0.00 ± 0.23
4-allyl-guaiacol (eugenol)	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00
4-methyl-syringol	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00
3,4-dimethylbenzoic acid	0.00 ± 0.97	6.35 ± 1.57	23.46 ± 4.27	0.67 ± 0.67	1.95 ± 0.89	3.50 ± 0.85	0.00 ± 0.37	3.94 ± 1.03
hexanedioic (adipic) acid (d-c6)	0.00 ± 0.14	0.00 ± 0.13	0.00 ± 0.08	0.28 ± 0.15	0.00 ± 0.12	0.00 ± 0.13	0.00 ± 0.28	0.00 ± 0.15
salcylic acid	0.00 ± 0.89	0.23 ± 1.87	25.90 ± 4.99	0.46 ± 0.87	0.07 ± 0.49	5.96 ± 1.89	0.26 ± 0.63	0.00 ± 1.15
trans-2-decenoic acid	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00
cis-pinonic acid	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00
3-methyladipic acid (d-c6)	0.00 ± 0.13	0.00 ± 0.08	0.00 ± 0.06	0.03 ± 0.08	0.00 ± 0.09	0.05 ± 0.06	0.00 ± 0.09	0.00 ± 0.07
4-formyl-guaiacol (vanillin)	0.00 ± 0.19	0.21 ± 0.19	1.02 ± 0.29	0.00 ± 0.11	0.00 ± 0.12	0.00 ± 0.05	0.00 ± 0.12	0.00 ± 0.08
undecanoic acid (c11)	0.00 ± 0.37	0.36 ± 0.32	0.22 ± 0.25	0.00 ± 0.20	0.00 ± 0.19	0.00 ± 0.18	0.00 ± 0.21	0.00 ± 0.21
isoeugenol	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00
heptanedioic (pimelic) acid (d-c7)	0.00 ± 0.25	0.00 ± 0.30	0.00 ± 0.12	0.00 ± 0.16	0.00 ± 0.16	0.00 ± 0.11	0.00 ± 0.16	0.00 ± 0.28
2,3-dimethoxybenzoic acid	0.00 ± 0.39	0.00 ± 0.14	0.00 ± 0.50	0.00 ± 0.12	0.00 ± 14.89	0.00 ± 0.07	0.00 ± 0.32	0.00 ± 17.31
acetovanillone	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00
2,6-dimethoxybenzoic acid	1.59 ± 0.87	0.35 ± 0.45	3.07 ± 0.80	0.06 ± 0.25	0.87 ± 0.55	0.20 ± 0.29	0.74 ± 0.51	0.33 ± 0.38
dodecanoic (lauric) acid (c12)	0.00 ± 0.72	4.28 ± 0.91	6.88 ± 1.06	0.00 ± 0.52	0.00 ± 0.46	2.40 ± 0.71	0.00 ± 0.50	0.00 ± 0.51
2,5-dimethoxybenzoic acid	0.00 ± 0.13	0.00 ± 0.09	0.00 ± 0.06	0.03 ± 0.08	0.00 ± 0.09	0.00 ± 0.05	0.00 ± 0.08	0.00 ± 0.06
phthalic acid	0.00 ± 9.28	0.42 ± 3.50	1.21 ± 3.50	0.81 ± 2.63	0.42 ± 1.80	0.26 ± 2.90	0.42 ± 5.33	0.00 ± 2.87
suberic acid (d-c8)	0.00 ± 0.13	0.00 ± 0.08	0.00 ± 0.06	0.00 ± 0.09	0.00 ± 0.09	0.00 ± 0.05	0.00 ± 0.08	0.00 ± 0.06
levoglucosan	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00
3,5-dimethoxybenzoic acid	7.51 ± 1.79	0.19 ± 0.15	3.02 ± 0.70	0.78 ± 0.26	1.67 ± 0.45	0.86 ± 0.23	1.02 ± 0.31	1.05 ± 0.29
syringaldehyde	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00
3,4-dimethoxybenzoic acid	0.00 ± 0.14	0.00 ± 0.09	0.00 ± 0.07	0.00 ± 0.09	0.00 ± 0.09	0.00 ± 0.05	0.00 ± 0.09	0.00 ± 0.07
2,4-dimethoxybenzoic acid	10.48 ± 1.90	2.32 ± 0.45	5.78 ± 1.02	1.96 ± 0.39	3.34 ± 0.62	2.08 ± 0.38	2.88 ± 0.54	2.65 ± 0.49
tridecanoic acid (c13)	0.00 ± 0.29	0.00 ± 0.19	0.16 ± 0.18	0.00 ± 0.14	0.00 ± 0.14	0.00 ± 0.12	0.00 ± 0.16	0.00 ± 0.14
isophthalic acid	0.00 ± 2.64	0.00 ± 6.84	2.81 ± 6.22	0.00 ± 1.73	0.00 ± 1.69	0.00 ± 2.97	0.00 ± 9.44	0.00 ± 3.65
vanillic acid	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00
homovanillic acid	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00
azelaic acid (d-c9)	0.00 ± 0.17	0.00 ± 0.11	0.00 ± 0.09	0.00 ± 0.17	0.00 ± 0.15	0.00 ± 0.13	0.00 ± 0.20	0.00 ± 0.12
myristoleic acid	0.00 ± 0.14	0.21 ± 0.15	0.49 ± 0.17	0.00 ± 0.09	0.00 ± 0.09	0.00 ± 0.05	0.19 ± 0.14	0.00 ± 0.07
myristic acid (c14)	0.00 ± 0.59	0.14 ± 0.58	1.39 ± 0.60	0.00 ± 0.38	0.00 ± 0.37	0.00 ± 0.41	0.00 ± 0.36	0.00 ± 0.34
sebacic acid (d-c10)	0.00 ± 0.13	0.00 ± 0.08	0.00 ± 0.07	0.00 ± 0.09	0.00 ± 0.10	0.00 ± 0.07	0.00 ± 0.09	0.00 ± 0.07
syringic acid	0.00 ± 0.20	0.78 ± 0.31	1.69 ± 0.40	0.00 ± 0.21	0.00 ± 0.15	0.96 ± 0.27	0.00 ± 0.13	0.00 ± 0.11
pentadecanoic acid (c15)	0.00 ± 0.38	0.36 ± 0.33	0.40 ± 0.27	0.00 ± 0.20	0.19 ± 0.23	0.29 ± 0.22	0.00 ± 0.22	0.00 ± 0.19
undecanedioic acid (c11)	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
palmitoleic acid	0.00 ± 0.30	0.00 ± 0.18	0.29 ± 0.21	0.00 ± 0.18	0.00 ± 0.17	0.00 ± 0.13	0.07 ± 0.19	0.00 ± 0.15
palmitic acid (c16)	0.00 ± 1.17	1.72 ± 1.23	0.00 ± 0.99	0.00 ± 0.87	0.00 ± 0.81	0.00 ± 0.86	0.00 ± 0.86	0.00 ± 0.78
isostearic acid	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00
dodecanedioic acid (d-c12)	0.00 ± 0.14	0.00 ± 0.08	0.00 ± 0.06	0.03 ± 0.09	0.00 ± 0.09	0.00 ± 0.06	0.00 ± 0.09	0.00 ± 0.06
traumatic acid	0.00 ± 0.13	0.00 ± 0.09	0.00 ± 0.07	0.05 ± 0.08	0.00 ± 0.09	0.00 ± 0.05	0.07 ± 0.09	0.00 ± 0.06
heptadecanoic acid (c17)	0.00 ± 0.28	0.00 ± 0.21	0.01 ± 0.17	0.00 ± 0.17	0.14 ± 0.22	0.00 ± 0.14	0.00 ± 0.20	0.00 ± 0.16
1,11-undecanedicarboxylic acid (d-c13)	0.00 ± 0.14	0.00 ± 0.09	0.00 ± 0.07	0.08 ± 0.11	0.00 ± 0.09	0.00 ± 0.07	0.00 ± 0.11	0.00 ± 0.07
oleic acid	0.00 ± 0.90	2.82 ± 1.10	2.19 ± 1.04	1.30 ± 0.97	0.00 ± 0.94	0.00 ± 0.50	1.03 ± 1.03	0.00 ± 0.66
elaidic acid	0.00 ± 0.18	0.00 ± 0.11	0.00 ± 0.09	0.00 ± 0.13	0.00 ± 0.15	0.00 ± 0.11	0.00 ± 0.12	0.00 ± 0.13
stearic acid (c18)	0.00 ± 6.61	2.39 ± 5.81	0.63 ± 4.28	2.47 ± 4.15	1.89 ± 3.81	0.00 ± 3.06	0.00 ± 3.94	0.00 ± 3.55
1,12-dodecanedicarboxylic acid (d-c14)	0.00 ± 0.16	0.00 ± 0.10	0.00 ± 0.07	0.20 ± 0.12	0.00 ± 0.10	0.00 ± 0.07	0.00 ± 0.11	0.00 ± 0.08
8,15-pimaradien-18-oic acd	0.00 ± 0.19	0.00 ± 0.10	0.04 ± 0.08	0.00 ± 0.11	0.00 ± 0.10	0.00 ± 0.06	0.00 ± 0.09	0.02 ± 0.08
pimaric acid	0.25 ± 0.30	0.76 ± 0.28	2.31 ± 0.53	1.07 ± 0.33	0.00 ± 0.16	0.00 ± 0.08	0.10 ± 0.18	0.11 ± 0.17
sandaracopimaric acid	0.00 ± 0.42	0.00 ± 0.20	0.23 ± 0.31	0.07 ± 0.27	0.00 ± 0.24	0.00 ± 0.21	0.00 ± 0.23	0.00 ± 0.26
nonadecanoic acid (c19)	0.13 ± 0.32	1.33 ± 0.39	1.74 ± 0.44	1.99 ± 0.47	0.10 ± 0.15	0.31 ± 0.22	0.00 ± 0.15	0.00 ± 0.13
isopimaric acid	0.12 ± 0.17	0.10 ± 0.10	0.12 ± 0.08	0.04 ± 0.10	0.09 ± 0.11	0.08 ± 0.07	0.24 ± 0.12	0.00 ± 0.07
palustric acid	0.07 ± 0.14	0.01 ± 0.08	0.30 ± 0.08	0.08 ± 0.09	0.04 ± 0.09	0.01 ± 0.05	0.00 ± 0.08	0.00 ± 0.06
dihydroisopimaric acid	0.22 ± 0.15	0.03 ± 0.08	0.15 ± 0.07	0.02 ± 0.09	0.00 ± 0.09	0.04 ± 0.05	0.04 ± 0.09	0.12 ± 0.07
8-abietic acid	0.00 ± 0.15	0.25 ± 0.12	0.05 ± 0.08	0.20 ± 0.11	0.04 ± 0.10	0.00 ± 0.05	0.72 ± 0.18	0.00 ± 0.07
dehydroabietic acid	0.00 ± 0.38	0.07 ± 0.22	0.12 ± 0.21	0.00 ± 0.21	0.00 ± 0.24	0.00 ± 0.11	0.00 ± 0.20	0.00 ± 0.17
8,14-abietenic acid	1.16 ± 0.39	0.00 ± 0.11	0.11 ± 0.12	0.01 ± 0.13	0.00 ± 0.11	0.24 ± 0.12	0.00 ± 0.12	0.00 ± 0.10
abietic acid	0.34 ± 0.17	0.26 ± 0.11	0.07 ± 0.06	0.11 ± 0.09	0.03 ± 0.09	0.02 ± 0.05	0.23 ± 0.10	0.06 ± 0.06
eicosanoic acid (c20)	0.00 ± 0.33	0.05 ± 0.15	0.00 ± 0.10	0.00 ± 0.15	0.00 ± 0.12	0.00 ± 0.09	0.00 ± 0.12	0.00 ± 0.09
levopimaric acid	0.75 ± 0.28	0.00 ± 0.09	0.02 ± 0.07	0.07 ± 0.09	0.00 ± 0.09	0.00 ± 0.06	0.00 ± 0.09	0.00 ± 0.07
heneicosanoic acid (c21)	3.48 ± 0.82	0.00 ± 0.12	0.00 ± 0.10	0.08 ± 0.14	0.00 ± 0.12	0.00 ± 0.07	0.00 ± 0.12	0.00 ± 0.09
7-oxodehydroabietic acid	0.00 ± 0.59	0.00 ± 0.26	0.00 ± 0.28	0.05 ± 0.25	0.00 ± 0.26	0.00 ± 0.19	0.00 ± 0.24	0.00 ± 0.23
docosanoic acid (c22)	0.00 ± 0.64	0.00 ± 0.21	0.00 ± 0.25	0.00 ± 0.28	0.00 ± 0.19	0.00 ± 0.13	0.00 ± 0.19	0.04 ± 0.25
tricosanoic acid (c23)	0.00 ± 0.18	0.00 ± 0.09	0.08 ± 0.10	0.17 ± 0.13	0.00 ± 0.10	0.01 ± 0.06	0.02 ± 0.11	0.00 ± 0.08
tetracosanoic acid (c24)	0.00 ± 0.33	0.00 ± 0.18	0.00 ± 0.20	0.93 ± 0.33	0.49 ± 0.28	0.00 ± 0.12	0.00 ± 0.23	0.19 ± 0.28
cholesterol	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00
cholestanol	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00
ergosterol	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00
stigmasterol	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00
sitosterol	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00	-99.00 ± -99.00

Appendix B2. Chemical Composition of Dilution Blanks and Vehicle Exhaust Samples from Round2

Species Description	W6-4	W7-1	W7-2	W7-3	W7-4	W8-1	W8-2	W8-3
Carbonyls (mg/mile)								
formaldehyde		29.04 ± 1.72	58.54 ± 3.29			34.30 ± 1.94		
acetaldehyde		30.31 ± 3.28	74.74 ± 7.21			23.88 ± 2.44		
acetone		426.41 ± 27.41	43.46 ± 3.22			22.55 ± 1.83		
* acrolein		<0.730 ± <0.021	1.17 ± 0.29			0.41 ± 0.10		
propionaldehyde		5.38 ± 0.74	9.80 ± 1.15			4.05 ± 0.50		
crotonaldehyde		2.70 ± 0.80	3.10 ± 0.60			1.94 ± 0.41		
methyl ethyl ketone		4.33 ± 1.30	5.66 ± 1.25			3.95 ± 0.89		
Methacrolein		5.02 ± 0.89	9.70 ± 1.20			3.88 ± 0.55		
* n-butyraldehyde		-0.73 ± -0.04	0.00 ± 0.00			0.00 ± 0.00		
benzaldehyde		24.42 ± 2.60	48.85 ± 4.97			17.41 ± 1.81		
glyoxal		0.57 ± 0.35	0.57 ± 0.24			0.76 ± 0.20		
valeraldehyde		2.23 ± 0.83	4.03 ± 0.69			2.68 ± 0.51		
tolualdehyde		13.29 ± 2.43	25.05 ± 4.12			9.45 ± 1.64		
hexanal		8.92 ± 1.38	1.99 ± 0.68			3.48 ± 0.63		
*** acrolein converts to an unknown rear**								
VOC (mg/mi)								
1,3 butadiene (estimated)		2.453 ± 1.356	4.898 ± 2.707			1.796 ± 0.993		
C2 compounds		44.392 ± 6.268	104.984 ± 14.824			33.364 ± 4.711		
propene		14.152 ± 1.716	28.253 ± 3.426			10.361 ± 1.256		
propane		1.707 ± 0.085	1.333 ± 0.067			0.780 ± 0.039		
isoButane		4.377 ± 0.219	4.075 ± 0.204			2.889 ± 0.144		
1Butene+iButylene		8.925 ± 0.605	17.356 ± 1.177			7.174 ± 0.486		
n-Butane		29.527 ± 1.476	36.581 ± 1.829			20.850 ± 1.042		
t-2-Butene		2.304 ± 0.127	3.953 ± 0.218			1.657 ± 0.091		
c-2-Butene		1.193 ± 0.110	3.508 ± 0.324			0.948 ± 0.088		
3-Me-1-Butene		0.521 ± 0.026	0.811 ± 0.041			0.391 ± 0.020		
isopentane		33.010 ± 2.155	49.634 ± 3.240			22.703 ± 1.482		
1-Pentene		0.844 ± 0.051	1.206 ± 0.072			0.611 ± 0.037		
2-Me-1-Butene		1.803 ± 0.132	2.465 ± 0.180			1.175 ± 0.086		
n-Pentane		11.347 ± 0.676	10.426 ± 0.621			7.361 ± 0.439		
t-2-Pentene		1.804 ± 0.090	2.283 ± 0.114			1.038 ± 0.052		
c-2-Pentene		0.987 ± 0.086	1.323 ± 0.115			0.575 ± 0.050		
2-Me-2-Butene		3.372 ± 0.181	3.871 ± 0.207			1.950 ± 0.104		
22DiMeButane		4.766 ± 0.309	1.925 ± 0.125			1.486 ± 0.096		
CycloPentene		0.616 ± 0.038	0.779 ± 0.048			0.333 ± 0.020		
CycloPentane		2.012 ± 0.101	1.284 ± 0.064			0.874 ± 0.044		
23DiMeButane		5.355 ± 0.318	5.217 ± 0.310			3.226 ± 0.191		
MTBE		0.113 ± 0.007	0.231 ± 0.014			0.131 ± 0.008		
2-MePentane		17.222 ± 0.985	13.467 ± 0.770			8.845 ± 0.506		
3-MePentane		11.276 ± 0.564	8.914 ± 0.446			5.899 ± 0.295		
2-Me-1-Pentene		0.473 ± 0.024	0.567 ± 0.028			0.325 ± 0.016		
1-Hexene		0.486 ± 0.024	0.749 ± 0.037			0.428 ± 0.021		
n-Hexane		7.054 ± 0.353	8.513 ± 0.426			5.114 ± 0.256		
t-2-Hexene		0.734 ± 0.037	0.931 ± 0.047			0.470 ± 0.024		
2-Me-2-Pentene		0.663 ± 0.035	0.801 ± 0.042			0.494 ± 0.026		
c-3-Me-2-Pentene		0.445 ± 0.022	0.601 ± 0.030			0.338 ± 0.017		
c-3-Hexene		0.100 ± 0.005	0.138 ± 0.007			0.067 ± 0.003		
c-2-Hexene		0.364 ± 0.018	0.521 ± 0.026			0.254 ± 0.013		
t-3-Me-2-Pentene		0.744 ± 0.037	0.922 ± 0.046			0.552 ± 0.028		
MeCyPentane		6.736 ± 0.388	6.171 ± 0.356			3.929 ± 0.226		
2,4-DiMePentane		3.584 ± 0.179	6.729 ± 0.336			4.076 ± 0.204		
223TriMeButane		0.131 ± 0.007	0.191 ± 0.010			0.094 ± 0.005		
Benzene		19.781 ± 1.223	33.823 ± 2.091			12.332 ± 0.762		
CycloHexane		2.102 ± 0.121	2.244 ± 0.130			1.318 ± 0.076		
4MeHexene		0.123 ± 0.011	0.178 ± 0.016			0.106 ± 0.010		
2MeHexane		4.643 ± 0.232	6.657 ± 0.333			3.890 ± 0.194		
23DiMePentane		5.503 ± 0.275	10.814 ± 0.541			6.890 ± 0.345		
3MeHexane		5.400 ± 0.270	7.651 ± 0.383			4.501 ± 0.225		
Cyclohexene		0.046 ± 0.010	0.038 ± 0.008			0.029 ± 0.006		
3EtPentane		1.595 ± 0.102	2.097 ± 0.134			1.319 ± 0.084		
1-Heptene		0.771 ± 0.039	1.047 ± 0.052			0.460 ± 0.023		
224TrMePentane		14.044 ± 1.002	34.575 ± 2.466			13.809 ± 0.985		
t-3-Heptene		0.256 ± 0.013	0.324 ± 0.016			0.167 ± 0.008		
n-Heptane		4.007 ± 0.200	5.766 ± 0.288			3.849 ± 0.192		
244TMe-1-Pentene		0.151 ± 0.008	0.179 ± 0.009			0.131 ± 0.007		
MeCyHexane		2.218 ± 0.111	2.588 ± 0.129			2.024 ± 0.101		
25DiMeHexane		1.896 ± 0.129	3.626 ± 0.247			1.833 ± 0.125		
24DiMeHexane		2.991 ± 0.150	5.867 ± 0.293			3.045 ± 0.152		
234TrMePentane		5.510 ± 0.275	11.334 ± 0.567			4.509 ± 0.225		
Toluene		42.219 ± 2.111	80.985 ± 4.049			29.397 ± 1.470		
23DiMeHexane		1.934 ± 0.104	4.341 ± 0.234			2.106 ± 0.113		
2MeHeptane		2.498 ± 0.125	3.506 ± 0.175			2.404 ± 0.120		
4MeHeptane		1.083 ± 0.083	1.448 ± 0.111			0.974 ± 0.075		
3MeHeptane		2.651 ± 0.133	3.778 ± 0.189			2.446 ± 0.122		
Hexanal		8.919 ± 1.379	1.992 ± 0.682			3.481 ± 0.627		
225TMHexane		0.847 ± 0.042	0.878 ± 0.044			0.790 ± 0.040		
Octene-1		2.728 ± 0.136	3.435 ± 0.172			2.565 ± 0.128		
11DMeCyHexane		0.124 ± 0.006	0.164 ± 0.008			0.144 ± 0.007		
n-Octane		1.964 ± 0.098	3.220 ± 0.161			2.533 ± 0.127		
24DiMeHeptane		0.556 ± 0.028	0.660 ± 0.033			0.571 ± 0.029		
25DiMeHeptane		1.151 ± 0.058	1.428 ± 0.071			1.196 ± 0.060		
33DiMeHeptane		0.049 ± 0.002	0.061 ± 0.003			0.045 ± 0.002		
EtBenzene		8.147 ± 0.407	14.399 ± 0.720			6.614 ± 0.331		
m/p-xylene		26.786 ± 1.339	45.446 ± 2.272			22.269 ± 1.113		

Appendix B2. Chemical Composition of Dilution Blanks and Vehicle Exhaust Samples from Round2

Species Description	W6-4	W7-1	W7-2	W7-3	W7-4	W8-1	W8-2	W8-3
2MeOctane		0.810 ± 0.041	1.311 ± 0.066			0.807 ± 0.040		
3MeOctane		1.508 ± 0.093	1.896 ± 0.117			1.437 ± 0.088		
Styrene+heptanal		1.376 ± 0.069	1.731 ± 0.087			1.386 ± 0.069		
o-xylene		10.428 ± 0.521	17.591 ± 0.880			8.630 ± 0.431		
Nonene-1		0.404 ± 0.020	0.572 ± 0.029			0.509 ± 0.025		
n-Nonane		1.489 ± 0.074	1.538 ± 0.077			1.606 ± 0.080		
iPropBenzene		1.318 ± 0.066	1.488 ± 0.074			0.898 ± 0.045		
iPropCyHexane		0.209 ± 0.014	0.206 ± 0.014			0.211 ± 0.014		
26DiMeOctane		0.712 ± 0.045	0.760 ± 0.048			0.838 ± 0.053		
alpha-pinene		0.126 ± 0.023	0.167 ± 0.031			0.120 ± 0.022		
nPropBenzene		4.599 ± 0.230	3.598 ± 0.180			1.909 ± 0.095		
mEtToluene		17.864 ± 0.893	13.671 ± 0.684			7.241 ± 0.362		
pEtToluene		7.610 ± 0.381	5.627 ± 0.281			2.788 ± 0.139		
135TriMeBenzene		8.527 ± 0.426	6.499 ± 0.325			3.686 ± 0.184		
oEtToluene		6.211 ± 0.311	4.983 ± 0.249			2.684 ± 0.134		
Octanal		0.304 ± 0.087	0.385 ± 0.110			0.352 ± 0.101		
beta-pinene		0.098 ± 0.005	0.139 ± 0.007			0.122 ± 0.006		
124TriMeBenzene		25.224 ± 1.261	20.092 ± 1.005			10.431 ± 0.522		
n-Decane		1.209 ± 0.068	1.130 ± 0.063			1.214 ± 0.068		
iButBenzene		0.388 ± 0.019	0.387 ± 0.019			0.328 ± 0.016		
sButBenzene		0.335 ± 0.017	0.276 ± 0.014			0.211 ± 0.011		
Limonene		5.681 ± 0.284	4.898 ± 0.245			2.734 ± 0.137		
Indan		2.167 ± 0.233	1.934 ± 0.208			1.067 ± 0.115		
13diethylbenzene		1.660 ± 0.166	1.579 ± 0.158			0.967 ± 0.097		
14diethylbenzene		4.996 ± 0.278	3.958 ± 0.220			2.584 ± 0.144		
12diethylbenzene		0.496 ± 0.025	0.499 ± 0.025			0.365 ± 0.018		
2-propylToluene		1.207 ± 0.060	1.369 ± 0.068			0.846 ± 0.042		
3-ipropyltoluene		0.665 ± 0.033	0.591 ± 0.030			0.427 ± 0.021		
4-ipropyltoluene		0.110 ± 0.006	0.047 ± 0.003			0.031 ± 0.002		
2-ipropyltoluene		0.178 ± 0.032	0.280 ± 0.051			0.182 ± 0.033		
Nonanal		4.113 ± 0.206	3.203 ± 0.160			2.021 ± 0.101		
n-Undecane		0.649 ± 0.130	0.557 ± 0.111			0.529 ± 0.106		
1245tetraMeBenzene		1.556 ± 0.250	1.233 ± 0.198			0.766 ± 0.123		
1235tetraMeBenzene		2.044 ± 0.102	1.630 ± 0.082			0.972 ± 0.049		
1234tetraMeBenzene		0.655 ± 0.033	0.597 ± 0.030			0.345 ± 0.017		
n-Dodecane		0.637 ± 0.032	0.459 ± 0.023			0.362 ± 0.018		

Kansas City PM Characterization Study
Final Report

Appendix C
Round 1 Recruitment

Assessment and Standards Division
Office of Transportation and Air Quality
U.S. Environmental Protection Agency

Sponsors:

National Renewable Energy Laboratory, U.S. Department of Energy
Federal Highway Administration, U.S. Department of Transportation
STAPPA-ALAPCO Emission Inventory Improvement Program
Coordinating Research Council Inc. (Project No. E-69)

Prepared for EPA by
Eastern Research Group, Incorporated
Austin, TX

Bevilacqua-Knight Incorporated
Oakland, CA

NuStats LLC
Austin, TX

Desert Research Institute
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EPA United States Environmental Protection Agency

EPA420-R-08-009
April 2008

Interviewer Training Guide

EPA KANSAS CITY PROJECT:

Characterizing Exhaust Emissions from Light-Duty Gasoline Vehicles in the Kansas City Metropolitan Area

Study Goal: Use random sampling methodology to *recruit* and test vehicles so that emissions data are representative of a metropolitan area so that emissions testing can be conducted on the vehicles. Testing data will be used in revising a major Air Quality Model.

Study Background: Mobile sources (cars, trucks) significantly contribute to ambient concentrations of air pollution (NOx, Ozone, Particulate Matter (PM)). Studies suggest that mobile sources can contribute to over half of the PM measured in urban areas. Recent and past emissions testing studies have tried to estimate the contribution of PM to air pollution, but these studies have obstacles such as recruitment of vehicles using non-random sampling techniques, high non-participation rates, and high costs associated with trying to entice persons to participate. Because of this, none of the studies conducted to date can be used to accurately represent the distribution of vehicle emissions in a large population.

5.2.1 - Recruitment pilot study/ Incentive pretest

Purpose **–** The purpose of this task is to identify the incentives that will be necessary to ensure participation by regional households. The result will be the creation of an effective motorist recruitment incentive package for vehicle testing and instrumentation, as well as providing the best assurance for a high response rate**. The sole purpose of the pretest is to find what will be the minimum incentive ($, car rental, taxi) that will get car owners to participate in the study?**

Household Sample Design – The demographic and fleet characteristics of the households that participated in the Kansas City Regional Household Travel Survey will be reviewed and categorized in order to draw a random sample of households for contact in the incentives test. This will be supplemented by a random general population sample, as both are anticipated for inclusion in the full study. **The goal for the incentives test is to include a geo-demographic representation of Kansas City residents**, not necessarily a sample that is representative of the regional vehicle fleet. The fleet characteristics will be considered for the full study testing. Here, the pilot is concerned with identifying incentives necessary to offer to the vehicle owners for participating in the study.

Develop Incentive Options – As identified in the proposal, specific incentives (or combinations thereof) that will be investigated include cash (different levels), rental cars (different quality), gas tank refill, car wash, and guaranteed rides. A matrix of options with varying levels as well as combinations of options will be developed to ensure a thorough testing during the survey.

Survey Instrument – The survey was designed to test respondent reaction to the incentive options for both, vehicle testing as well as vehicle instrumentation. The survey will begin with a brief explanation of the project and what is being requested of the respondent in terms of vehicle testing and instrumentation. Then the respondent will be presented with varying levels and combinations of incentives to identify the optimal mix for ensuring high participation rates and minimizing non-response. This survey will be conducted in English and Spanish, based on the language preference of the respondent. We anticipate about 5% of the interviewers to be in Spanish, based on language incidences in a current transportation study of the Kansas City region. The questionnaire is designed for administration using computer-aided telephone interviewing (CATI) technology. The power of the CATI software will allow for a thorough and random testing of the incentive options. The survey will be designed for an interview that might last up to 20 minutes.

FREQUENTLY ASKED QUESTIONS

Selection

Q: How are households selected?

A: Since it is not cost effective to survey every single household within the Kansas City area, a representative sample is being taken that focuses on the geographic location, household size, and number of vehicles available to each household.

Q: I just participated in a Travel Study; is this the same thing?

A: {Answer goes here}.

Q: How do you select which vehicle to use or which one I should bring in?

A: Based on information gained from previous studies and available vehicle registration data, a vehicle listing of specific makes, models, and vehicle condition is used to determine which vehicles to test

Testing

Q: Who will conduct the emission test at Lenexa?

A: BKi (Bevilacqua Knight, Inc) specializes in conducting vehicle emission testing for research studies.

Q: What type of emissions data will be collected?

A: {Answer goes here}.

Q: Will I be able to view the videotape of my vehicle?

A: The videotape will be used to document the vehicle's condition before and after testing. Viewing the videotape will only be necessary if upon return, the vehicles condition is in question.

Q: Will I be liable for any fines or penalties if my vehicle fails emission quality test?

A: {Answer goes here}.

Q: Will I need to show proof of insurance?

A: {Answer goes here}.

Q: How long will my vehicle be tested? (How many miles will be placed on my vehicle)

A: {Answer goes here}.

Scheduling

Q: What are the hours I can drop off and pick up my vehicle?

A: {Answer goes here}.

Q: Can my vehicle be picked up at home?

A: At the current time, at home vehicle pick up is not an option.

Demographic Specific

Q: Why do you need my household's income?

A: Since each participating household represents a cross section of households in the study area, we need to make sure that we have the right mix of household income. Previous research has shown that both the mode of travel and vehicle condition vary greatly based on household income. To get an accurate selection of vehicles in the region, we must collect information from households at all income levels.

Q: Why do you need other demographic data?

A: Since each participating household represents a cross section of households in the study area, we need to make sure that we have the right mix of household demographics. To get an accurate selection of vehicles in the region, we must collect information from households of all demographics.

Recruitment Questionnaire

Kansas City Emissions Testing Program
Round 1 Scheduling Questionnaire

Hi, my name is __________ and I'm calling on behalf of the U.S. Environmental Protection Agency and the Mid-America Regional Council. May I speak with [**FNAME** **LNAME**]? [If new person, reintroduce, if same person, continue]. The EPA and MARC have collaborated on a program to measure air pollution from cars and trucks in the Kansas City region. This breakthrough study is the first major study in the U.S., focusing on emissions from cars and trucks under real world driving conditions. It is very important because vehicle emissions include very small particles like what is found in smoke or soot. These particles can be inhaled contributing to heart and respiratory disease. So this study will help to measure those particles coming from vehicles in the Kansas City region.

For this study, vehicles will be tested for a 24 period at our testing facility in Wyandotte.

Given your preference of drop off dates, we ask you to drop off your vehicle before 1 pm on one day, and pick it up after 5 pm the next day, but can work around your schedule. While the testing is being conducted a rental car and a token of appreciation will be given to you. The company performing the test is BKI, an industry leader in atmospheric, emission, and particle testing. They are licensed and insured, and accept full responsibility for the vehicle while in its care. Each vehicle is videotaped when it's dropped off, and again before it's picked up to verify its condition before and after the testing. The specific information about your vehicles admissions will be kept confidential.

To see if you qualify I would like to obtain some information about your vehicles.

1. I show that you live in **COUNTY** county. Is that correct? IF NOT, What county do you live in?

CASS COUNTY, MO	29037	
CLAY COUNTY, MO	29047	
JACKSON COUNTY, MO	29095	
PLATTE COUNTY, MO	29165	
JOHNSON COUNTY, KS	20091	
LEAVENWORTH COUNTY, KS	20103	
WYANDOTTE COUNTY, KS	20209	
OTHER, SPECIFY COUNTY AND STATE	77777	INELIGIBLE-TERMINATE
DK/RF	99999	INELIGIBLE-TERMINATE

2. And is your home zip code **ZIP**? IF NOT, OBTAIN
   Our records indicate your household has **HHVEH** available for testing.

3. We are interested in testing the **YEAR**, **MAKE** **MODEL**, is this vehicle available for testing?

4. Does the vehicle run on another fuel besides gasoline?

5. How many exhaust outlets (Tailpipes) does the vehicle have?

6. Does the vehicle have 4WD? If yes, is the 4WD option able to be turned off?

If you are able to help us with this important study, we will provide you with a rental car and **INCENT** for your time.

7. We have an opening on **ASSN**, would you be able to bring your vehicle in for testing on this day? If not, what day/ date would work best for you? [One drop down selection]

If it is convenient, we ask that you drop off your vehicle before 9 am, so it will be ready for you to pick up the following day between 4 pm and 6 pm. Does this time frame work for you?

8. Does this time work for you? If not we can definitely work around your schedule, but it may require the testing facility to keep your vehicle an extra day.

9. What time do you think you can drop off your vehicle? (Based on time, change drop off date)

10. We are also interested in testing another Household vehicle, are you interested if offered an additional
INCENT. [Loop back using 2nd vehicle]

11. And what is your name? (FIRST AND LAST) [Confirm name if MARC sample]

12. So that I can send you a packet of information about the study, I need to confirm/obtain your home address.
ADDRESS, CITY, STATE, ZIP

13. Your telephone number is ###-###-####, in case there is a change in testing, or the testing facility has some information about vehicle, may I have a number where you can be reached on the testing day?

14. Do you have an email address where I can send a reminder?

We are also planning on calling you 2 days before your scheduled testing date, to remind you and confirm that you received our information packet. If you have any question please feel free to contact us at 1-888-###-####. Thank you so much for your help and participation in this very important study!

Vehicles Scheduled by Date

Scheduled by date

Assignment	Test Date	Total
695	Tuesday, 7/13	4
696	Wednesday, 7/14	2
697	Thursday, 7/15	3
698	Friday, 7/16	3
699	Saturday, 7/17	3
701	Monday, 7/19	6
702	Tuesday, 7/20	6
703	Wednesday, 7/21	6
704	Thursday, 7/22	5
705	Friday, 7/23	4
706	Saturday, 7/24	4
708	Monday, 7/26	4
709	Tuesday, 7/27	6
710	Wednesday, 7/28	5
711	Thursday, 7/29	5
712	Friday, 7/30	6
713	Saturday, 7/31	5
715	Monday, 8/2	5
716	Tuesday, 8/3	5
717	Wednesday, 8/4	5
718	Thursday, 8/5	5
719	Friday, 8/6	5
720	Saturday, 8/7	4
722	Monday, 8/9	5
723	Tuesday, 8/10	6
724	Wednesday, 8/11	6
725	Thursday, 8/12	5
726	Friday, 8/13	4
727	Saturday, 8/14	4
729	Monday, 8/16	4
730	Tuesday, 8/17	5
731	Wednesday, 8/18	6
732	Thursday, 8/19	2
733	Friday, 8/20	3
734	Saturday, 8/21	6
736	Monday, 8/23	6
737	Tuesday, 8/24	6
738	Wednesday, 8/25	6
739	Thursday, 8/26	7
740	Friday, 8/27	4
741	Saturday, 8/28	7
743	Monday, 8/30	7
744	Tuesday, 8/31	5
745	Wednesday, 9/1	6
751	Tuesday, 9/7	1
752	Wednesday, 9/8	7
753	Thursday, 9/9	7

Assignment	Test Date	Total
754	Friday, 9/10	7
755	Saturday, 9/11	5
757	Monday, 9/13	5
758	Tuesday, 9/14	7
759	Wednesday, 9/15	7
760	Thursday, 9/16	7
761	Friday, 9/17	6
762	Saturday, 9/18	7
764	Monday, 9/20	5
765	Tuesday, 9/21	7
766	Wednesday, 9/22	6
767	Thursday, 9/23	7
768	Friday, 9/24	5
769	Saturday, 9/25	5
771	Monday, 9/27	7
772	Tuesday, 9/28	7
773	Wednesday, 9/29	5
774	Thursday, 9/30	6

Study Brochure

What's in it for me?

In addition to the free rental car, every study participant receives an appreciation gift as well as the knowledge that they contributed to a ground-breaking study in how vehicle emission levels are measured.

What if I have additional questions?

If you have any questions or would like additional information, please contact:

Gene Tierney, EPA
Tierney.Gene@epamail.epa.gov

Todd Ashby, MARC
tashby@marc.org

OR

call the toll-free particpant hotline:
800-275-2209

visit the project website:
http://www2.ergweb.com/projects/KansasCity/

Kansas City Emissions Study

Project Leaders:

MARC
Mid-America Regional Council

Help us to better measure vehicle emission levels

Project Leaders:

MARC
Mid-America Regional Council

What is the Kansas City Emissions Study?

This landmark study led by the Environmental Protection Agency (EPA) and the Mid-America Regional Council (MARC), will measure air pollution from cars and trucks in the Kansas City region. Vehicle emissions include tiny particles (like in smoke and soot) that, when inhaled, contribute to heart and respiratory disease. It's the first major study in the United States that will look at vehicle emissions under real world driving conditions. In addition, this effort will be a role model for other regions across the nation.

Why is my participation important?

Your involvement is so important because EPA and MARC will be able to measure emissions from many types of vehicles in a real-life setting. The results will provide the input needed to make air quality modeling more accurate and serve as a role model for other regions.

During this study, it's critical that we test emissions from all types of vehicles: new and old, compact and luxury, cars and SUVs, vehicles that smoke and those that don't. The test results are confidential and there are no consequences to any vehicle owner regardless of the emissions testing outcome.

How does the testing work?

Participants bring their vehicles to a central facility and drop them off for testing. Owners may choose the most convenient drop-off and pick-up times, between the hours of 7am and 6pm, seven days a week. Vehicles will be needed for 24-72 hours; depending on the scheduled drop-off time. Each participant is provided a free rental car for use while their vehicle is being tested. And everyone in the study receives an appreciation gift as a way of saying 'thank you' for your time and cooperation.

Some vehicles may qualify for a second stage of testing that involves putting special emissions detection equipment in your vehicle for 24 hours. If your auto is eligible for this stage, a technician at the testing facility will discuss it with you. Participants in this test will receive an additional appreciation gift.

Why is my vehicle needed for 24 hours?

Unlike emissions testing during a car inspection, which only takes a few minutes, this study requires vehicles to go through a cold-start test following 12 hours of sitting without being used.

Where do I take my vehicle?

The test facility is located west of downtown Kansas City, in Wyandotte, with easy access from I70, I-435, I-635, and I-35.

The standard check-in process includes videotaping each vehicle before and after the testing to verify it's condition. Eastern Research Group, the study lead, will take full responsibility for vehicles while under the care of the test facility. The facility itself is fully licensed and insured, and has been designed with the care and security

Why are emissions a problem?

Personal automobiles are big polluters because of the sheer number of vehicles on our roads today. We may not realize it because we can't always see it, but driving a car pollutes our air. Besides particles, exhaust pollutants include hydrocarbons, nitrogen oxides (NOx), carbon monoxide (CO) and carbon dioxide (CO_2). Hydrocarbons and NOx, when mixed in the presence of sunlight, form ground-level ozone, which irritates the eyes, damages the lungs, and aggravates respiratory problems. NOx also contributes to forming acid rain. Carbon monoxide reduces the flow of oxygen in the bloodstream - a risk for persons with heart disease. Fuel evaporation also contributes to hydrocarbon pollution, such as during refueling.

MARC
Mid-America Regional Council

Kansas City Emissions Study
c/o 3006 Bee Caves Road, Suite A-300
Austin, Texas 78746

Toll-free Participant Hotline:
800-275-2209

Todd Ashby, MARC
tashby@marc.org

Gene Tierney, EPA
Tierney.Gene@epamail.epa.gov

Recruitment Letter

<Name>
<Address>
<city>, <State> <zip>

Dear John,

Thank you for agreeing to participate in the **Kansas City Emissions Study**. The study is being conducted by a team of experts led by Eastern Research Group (ERG), the Mid-America Regional Council (MARC), and the United States Environmental Protection Agency (EPA).

> Your vehicle testing date is: **<<Date>>**
>
> Vehicle: **<<Year>>, <<Make>> <<Model>>**
>
> If you drop off your vehicle by 9am on your testing date, in most cases you may pick up your vehicle anytime after 4pm the following day. If you drop-off after 9am or on a Saturday, your pick-up day and time will vary. A testing facility representative will determine your pick-up time once they check in your vehicle. If these times are not convenient, alternate drop off and pick up times are available. Please call 800-275-2209 for more details.

For your convenience, we have included a detailed map with directions from your home to the testing facility. The map is intended as a guide, it does not take into consideration any construction along the route. **If you have any trouble finding the facility, please call 913-299-9480.**

Please be sure to bring the following to your appointment:

1) Completed Owner's Survey,
2) Driver's License, and
3) Proof of insurance card.

When you arrive at the facility, a representative will check in your vehicle and provide you with a rental car and the appreciation gift of <incentive> that was discussed in the phone interview.

If you have any general questions concerning this important survey, please contact Todd Ashby of MARC at 816-474-4240 or send an email to tashby@marc.org or Gene Tierney of EPA at Tierney.gene@epamail.epa.gov. For scheduling or other information about your appointment, please call 800-275-2209. Thank you for your participation.

Sincerely,

Dr. Charles A. Eddy
Chair of MARC's Board of Directors
and Council member, Kansas City, Missouri

Gene Tierney
Director Center for Air Quality
and Modeling, U.S. EPA

Kansas City Emissions Study
Participant Questionnaire

Thank you for participating in this vehicle emission study. Please take a few minutes to respond to the following questions. Your answers will help us correlate vehicle history to emission patterns.

Owner name: <first> <last>
Vehicle: <make>, <model>, <year>
Testing date: <Date>

1. **Last brand of gasoline purchased was:**

   ☐a. Shell ☐d. BP ☐f. Other: ______________________

   ☐b. Exxon ☐e. Chevron

   ☐c. Texaco ☐g. Don't know

2. **What grade of gasoline was this?**

   ☐a. Regular ☐b. Premium ☐c. Super

3. **How long ago was the last oil change?** ______________________

4. **What brand of motor oil was used?** ______________________

5. **What was the oil viscosity?** (example: 10W30) ______________________

6. **What oil additives are being used?** ______________________

7. **Within the last year, have major repairs been performed (this includes rebuilding or replacing the engine, transmission or catalyst)?**

   ☐a. Yes (briefly describe): ______________________ ☐b. No ☐c. Don't know

8. **Briefly describe any driveability or engine running problems.** ______________________

   ____

If you have any questions or if you need to change your testing appointment, please call 1-800-275-2209.

Please bring this form, your driver's license and your proof of insurance card with you to the testing facility.

Office Use: Date Received: ____________

Vehicle Make, model, yr. ______________________ License Tag # ______________

Kansas City PM Characterization Study

Final Report

Appendix D
Round 2 Recruitment

Assessment and Standards Division
Office of Transportation and Air Quality
U.S. Environmental Protection Agency

Sponsors:

National Renewable Energy Laboratory, U.S. Department of Energy
Federal Highway Administration, U.S. Department of Transportation
STAPPA-ALAPCO Emission Inventory Improvement Program
Coordinating Research Council Inc. (Project No. E-69)

Prepared for EPA by
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EPA United States Environmental Protection Agency

EPA420-R-08-009
April 2008

Interviewer Training Guide

EPA KANSAS CITY PROJECT:
Characterizing Exhaust Emissions from Light-Duty Gasoline Vehicles in the Kansas City Metropolitan Area
Round 2

Study Goal: Recruit and test vehicles for particulate matter (PM) emissions so that emissions data are representative of a metropolitan area. Testing data will be used in revising a major Air Quality Model for PM. Under this study, we will recruit respondents to drive their vehicles to a study facility, where emissions testing will be conducted on their vehicles. The testing will be conducted on a dynamometer (a treadmill-like device for vehicles) and under cold-start conditions; therefore, these tests require the vehicles to be left at the facility over night. The respondents will need to drive their vehicle to the test site before 9am of the test day, and pick up their vehicle after 5pm the next day. Vehicles can be left a day early if they can not drop it off by 9am, but will have to be in at the site for longer than 1 day. A total of 255 separate vehicles will be tested.

Study Background: Mobile sources (cars, trucks) significantly contribute to ambient concentrations of air pollution (NOx, Ozone, Particulate Matter (PM)). Studies suggest that mobile sources can contribute to over half of the PM measured in urban areas. Recent and past emissions testing studies have tried to estimate the contribution of PM to air pollution, but these studies have obstacles such as recruitment of vehicles using non-random sampling techniques, high non-participation rates, and high costs associated with trying to entice persons to participate. Because of this, none of the studies conducted to date can be used to accurately represent the distribution of vehicle emissions in a large population.

Vehicle Recruitment: Along with the vehicle recruitment goals, there are 3 specific limitations surrounding the testing availability of vehicles.

- Vehicles must run on unleaded gas only (no hybrids or diesels)
- Vehicles can not be 4WD (four wheel drive) or AWD (all wheel drive), but are accepted if there is a switch to turn these features off
- Vehicles may only have one tailpipe.

Recruitment Goals: The goals for this survey are broken down between 2 dimensions. First, testing will be made on 33 vehicles that previously participated in this study last fall (Stype 3). All other participants have not participated in the study or received any forward information about the study. The second dimension is the vehicle class. Each recruited vehicle is places in a specific class based on its type of structure and year of production. Cars include, coupes, sedans, and wagons. Trucks include pickups, mini-vans, and sport utility vehicles. (Heavy duty trucks and motor cycles are not accepted).

Truck	Pre-1981	1	13	1	14
Truck	1981-1990	2	47	5	52
Truck	1991-1995	3	40	3	43
Truck	1996+	4	60	7	67
Car	Pre-1981	5	20	3	23
Car	1981-1990	6	47	5	52
Car	1991-1995	7	47	5	52
Car	1996+	8	33	4	37
			307	33	340

FREQUENTLY ASKED QUESTIONS

Selection

Q: How are households selected?

A: Since it is not cost effective to survey every single household within the Kansas City area, a representative sample is being taken that focuses on the geographic location, household size, and number of vehicles available to each household.

Q: I just participated in a Travel Study; is this the same thing?

A: This study is being conducted to confirm that the program developed to obtain accurate vehicle emissions will work and that we understand what is necessary to have the full participation of regional households. That study looked at travel behavior characteristics of regional households, which is a different topic.

Q: How do you select which vehicle to use or which one I should bring in?

A: Based on information gained from previous studies and available vehicle registration data, a vehicle listing of specific makes, models, and vehicle condition is used to determine which vehicles to test

Testing

Q: Who will conduct the emission test at Kansas City?

A: BKI (Bevilacqua Knight, Inc) specializes in conducting vehicle emission testing for research studies.

Q: What type of emissions data will be collected?

A: Levels of pollutants coming from the vehicle.

Q: Will I be able to view the videotape of my vehicle?

A: The videotape will be used to document the vehicle's condition before and after testing. Viewing the videotape will only be necessary if upon return, the vehicles condition is in question.

Q: Will I be liable for any fines or penalties if my vehicle fails emission quality test?

A: No, this is a research study, independent of local or regional emissions registration and regulation.

Q: Will I need to show proof of insurance?

A: Proof of vehicle insurance will not have to be shown at the testing facility, but to use a rental insurance will be needed.

Q: How long will my vehicle be tested? (How many miles will be placed on my vehicle)

A: They need emissions data for both after the vehicle has been running and after the vehicle has been resting for a while. They will be conducting short test through both periods.

Scheduling

Q: What are the hours I can drop off and pick up my vehicle?

A: Vehicle drop off will need to be before 10:00 am on the drop off date and pick up will be available after 5:00 pm the following day. Besides the testing time, vehicle pick up and drop off is at the respondents' convenience.

Q: Can my vehicle be picked up at home?

A: Yes, we can arrange for your vehicle to be picked up and a rental vehicle left for use.

Demographic Specific

Q: Why do you need my household's income?

A: Since each participating household represents a cross section of households in the study area, we need to make sure that we have the right mix of household income. Previous research has shown that both the mode of travel and vehicle condition vary greatly based on household income. To get an accurate selection of vehicles in the region, we must collect information from households at all income levels.

Q: Why do you need other demographic data?

A: Since each participating household represents a cross section of households in the study area, we need to make sure that we have the right mix of household demographics. To get an accurate selection of vehicles in the region, we must collect information from households of all demographics.

Recruitment Questionnaire

Kansas City Emissions Testing Program
Round 2 Scheduling Questionnaire

Hi, my name is __________ and I'm calling on behalf of the U.S. Environmental Protection Agency and the Mid-America Regional Council. May I speak with [**FNAME** **LNAME**]? [If new person, reintroduce, if same person, continue]. The EPA and MARC have collaborated on a program to measure air pollution from cars and trucks in the Kansas City region. This breakthrough study is the first of its kind in the U.S., focusing on emissions from cars and trucks under real time driving conditions. It is very important because vehicle emissions include very small particles like what is found in smoke or soot. These particles can be inhaled, causing health problems like asthma and emphysema. So this study will help to measure those particles coming from vehicles in the Kansas City region.

For this study, vehicles will be tested for a 24 hour period at our testing facility in Wyandotte. Given your preference of drop off dates, we ask you to drop off your vehicle before 1 pm on one day, and pick it up after 5 pm the next day, but can work around your schedule. While the testing is being conducted a rental car and a token of appreciation will be given to you. The company performing the test is BKI, an industry leader in atmospheric, emission, and particle testing. They are licensed and insured, and accept full responsibility for the vehicle while in its care. Each vehicle is videotaped when it's dropped off, and again before it's picked up to verify its condition before and after the testing. The specific information about your vehicles admissions will be kept confidential.

1. If you are able to help us with this important study, you will be eligible for an incentive of $75 for your time and participation. Are you interested in participating in this study?

   If No – what if we offered you an incentive of $100? What about $125?

1=$75 [Go to 2]
2=$100 [Go to 2]
3=$125 [Go to 2]
4=Need more information about the study first. [Go to 13]
NEED MORE INFO – go to mail-out section but disposition should be Advance mail out required.
9=RF – Thank you for your time.

To see if you qualify I would like to obtain some information about your vehicles.

2. I show that you live in **COUNTY** county. Is that correct? IF NOT, What county do you live in?

CASS COUNTY, MO	29037	
CLAY COUNTY, MO	29047	
JACKSON COUNTY, MO	29095	
PLATTE COUNTY, MO	29165	
JOHNSON COUNTY, KS	20091	
LEAVENWORTH COUNTY, KS	20103	
WYANDOTTE COUNTY, KS	20209	
OTHER, SPECIFY COUNTY AND STATE	77777	INELIGIBLE-TERMINATE
DK/RF	99999	INELIGIBLE-TERMINATE

3. And is your home zip code **ZIP**? IF NOT, OBTAIN
   Our records indicate your household has **HHVEH** available for testing.

Recruitment Questionnaire, Page 2

4. We are interested in testing the **YEAR**, **MAKE** **MODEL**, is this vehicle available for testing?

5. Does the vehicle run on another fuel besides unleaded gasoline? Yes – Vehicle DNQ (Does not qualify)

6. How many exhaust outlets (Tailpipes) does the vehicle have? – More than 1 - – Vehicle DNQ

7. Does the vehicle have 4WD or all wheel drive? If yes, is the 4WD or AWD option able to be turned off? If 4WD or AWD can not be turned off - – Vehicle DNQ
   If you are able to help us with this important study, we will provide you with a rental car and **INCENT** for your time.

8. We have an opening on **ASSN**, would you be able to bring your vehicle in for testing on this day? If not, what day/ date would work best for you? [One drop down selection]
   If it is convenient, we ask that you drop off your vehicle before 9 am, so it will be ready for you to pick up the following day between 4 pm and 6 pm. Does this time frame work for you?

9. Does this time work for you? If not we can definitely work around your schedule, but it may require the testing facility to keep your vehicle an extra day.

10. What time do you think you can drop off your vehicle? (Based on time, change drop off date)

11. We are also interested in testing another Household vehicle, are you interested if offered an additional **INCENT**. [Loop back using 2nd vehicle]

12. What name should we schedule your vehicles under? (FIRST AND LAST) [Confirm name if MARC sample]

13. So that I can send you a packet of information about the study, I need to confirm/obtain your home address.
    ADDRESS, CITY, STATE, ZIP

    IF THIS IS AN ADVANCE MAILOUT PACKET INT = ADM
    You should receive more information about the study in a few days, we will call you back at a later date, Thank you for your time.

14. Your telephone number is ###-###-####, in case there is a change in testing, or the testing facility has some information about vehicle testing, is there a better number where you can be reached at? [OBTAINE ALTERNATIVE PHONE NUMBER] This is a second phone number

15. Do you have an email address where I can send a reminder?

    We will also plan to call you 2 days before your scheduled testing date to remind and confirm that you received your information packet. If you have any question please feel free to contact us at 1-877-221-7828. Thank you so much for your help and participation in this very important study! [Enter notes or any special scheduling comments if respondent is dropping off a day early]

Vehicles Scheduled by date

Assignment	Test Date	Total
111	Tuesday, January 11, 2005	4
112	Wednesday, January 12, 2005	4
113	Thursday, January 13, 2005	5
114	Friday, January 14, 2005	6
115	Sunday, January 16, 2005	5
117	Monday, January 17, 2005	5
118	Tuesday, January 18, 2005	5
119	Wednesday, January 19, 2005	6
120	Thursday, January 20, 2005	5
121	Friday, January 21, 2005	6
122	Saturday, January 22, 2005	5
124	Monday, January 24, 2005	3
125	Tuesday, January 25, 2005	5
126	Wednesday, January 26, 2005	5
127	Thursday, January 27, 2005	6
128	Friday, January 28, 2005	6
129	Saturday, January 29, 2005	6
131	Monday, January 31, 2005	6
132	Tuesday, February 01, 2005	7
133	Wednesday, February 02, 2005	7
134	Thursday, February 03, 2005	7
135	Friday, February 04, 2005	4
136	Saturday, February 05, 2005	7
138	Monday, February 07, 2005	6
139	Tuesday, February 08, 2005	5
140	Wednesday, February 09, 2005	5
141	Thursday, February 10, 2005	6
142	Friday, February 11, 2005	6
143	Saturday, February 12, 2005	4
145	Monday, February 14, 2005	4
146	Tuesday, February 15, 2005	6
147	Wednesday, February 16, 2005	6
148	Thursday, February 17, 2005	6
149	Friday, February 18, 2005	4
150	Saturday, February 19, 2005	5
152	Monday, February 21, 2005	2
153	Tuesday, February 22, 2005	3
154	Wednesday, February 23, 2005	3
155	Thursday, February 24, 2005	3
156	Friday, February 25, 2005	6
157	Saturday, February 26, 2005	4
159	Monday, February 28, 2005	5
161	Tuesday, March 01, 2005	4
162	Wednesday, March 02, 2005	5
163	Thursday, March 03, 2005	5

Assignment	Test Date	Total
164	Friday, March 04, 2005	6
165	Saturday, March 05, 2005	7
167	Monday, March 07, 2005	8
168	Tuesday, March 08, 2005	3
169	Wednesday, March 09, 2005	6
170	Thursday, March 10, 2005	6
171	Friday, March 11, 2005	6
172	Saturday, March 12, 2005	6
174	Monday, March 14, 2005	9
175	Tuesday, March 15, 2005	7
176	Wednesday, March 16, 2005	9
177	Thursday, March 17, 2005	7
178	Friday, March 18, 2005	10
179	Saturday, March 19, 2005	10
181	Monday, March 21, 2005	7
182	Tuesday, March 22, 2005	7
183	Wednesday, March 23, 2005	6
184	Thursday, March 24, 2005	8
185	Friday, March 25, 2005	7
186	Saturday, March 26, 2005	7
188	Monday, March 28, 2005	6
189	Tuesday, March 29, 2005	5
190	Wednesday, March 30, 2005	2
191	Thursday, March 31, 2005	1
192	Friday, April 01, 2005	3
193	Saturday, April 02, 2005	7
195	Monday, April 04, 2005	8
196	Tuesday, April 05, 2005	5
197	Wednesday, April 06, 2005	9
198	Thursday, April 07, 2005	7
199	Friday, April 08, 2005	10
		433

Study Brochure

What's in it for me?

In addition to the free rental car, every study participant receives an appreciation gift as well as the knowledge that they contributed to a ground-breaking study in how vehicle emission levels are measured.

What if I have questions?

If you have any questions or would like additional information, please contact:

Gene Tierney, EPA
Tierney.Gene@epa.gov

Todd Ashby, MARC
tashby@marc.org

OR

call the toll-free particpant hotline:
877-221-7828

visit the project website:
www2.ergweb.com/projects/KansasCity/

Project Leader:

In Association With:

MARC
Mid-America Regional Council

Kansas City Emissions Study

Help us to better measure vehicle emission levels

Project Leader:

In Association With: MARC

What is the Kansas City Emissions Study?

This landmark study led by the Environmental Protection Agency (EPA) with support from the Mid-America Regional Council (MARC), will measure air pollution from cars and trucks in the Kansas City region. Vehicle emissions include tiny particles (like in smoke and soot) that, when inhaled, contribute to heart and respiratory disease. It's the first major study in the United States that will look at vehicle emissions under real world driving conditions. In addition, this effort will be a role model for other regions across the nation.

Why should I participate?

Your involvement is so important because EPA will be able to measure emissions from many types of vehicles in a real-life setting. The results will provide the input needed to make air quality modeling more accurate and serve as a role model for other regions.

During this study, it's critical that we test emissions from all types of vehicles: new and old, compact and luxury, cars and SUVs, vehicles that smoke and those that don't. The test results are confidential and there are no consequences to any vehicle owner regardless of the emissions testing outcome.

How does the testing work?

Participants bring their vehicles to a central facility and drop them off for testing. Owners may choose the most convenient drop-off and pick-up times, between the hours of 7am and 6pm, seven days a week. Most vehicles will be needed for 24 hours; in some cases, a little longer, depending on the scheduled drop-off time. Each participant is provided a free rental car for use while their vehicle is being tested. And everyone in the study receives an appreciation gift as a way of saying "thank you" for your time and cooperation.

Some vehicles may qualify for a second stage of testing that involves putting special emission detection equipment in your vehicle for 24-72 hours. If your auto is eligible for this stage, a technician at the testing facility will discuss it with you. Participants in this test will receive an additional appreciation gift.

Why is my vehicle needed for 24 hours?

Unlike emissions testing during a car inspection, which only takes a few minutes, this study requires vehicles to go through a cold-start test following 12 hours of sitting without being used.

Where do I take my vehicle?

The test facility is located west of downtown Kansas City, in Wyandotte, with easy access from I70, I-435, I-635, and I-35.

The standard check-in process includes videotaping each vehicle before and after the testing to verify it's condition. Eastern Research Group, the study lead, will take full responsibility for vehicles while under the care of the test facility. The facility itself is fully licensed and insured, and has been designed with the care and security of your vehicle in mind.

Why are emissions a problem?

Personal automobiles are big polluters because of the sheer number of vehicles on our roads today. We may not realize it because we can't always see it, but driving a car pollutes our air. Besides particles, exhaust pollutants include hydrocarbons, nitrogen oxides (NOx), carbon monoxide (CO) and carbon dioxide (CO_2). Hydrocarbons and NOx, when mixed in the presence of sunlight, form ground-level ozone, which irritates the eyes, damages the lungs, and aggravates respiratory problems. NOx also contributes to forming acid rain. Carbon monoxide reduces the flow of oxygen in the bloodstream - a risk for persons with heart disease. Fuel evaporation also contributes to hydrocarbon pollution, such as during refueling.

Recruitment Letter

«FNAME» «LNAME»
«Address»
«City», «State» «Zip»

Dear «FNAME»,

You have been selected to participate in the **Kansas City Emissions Study**. The study is the first of its kind to be conducted in the US and will serve as a role model for other US cities to more accurately document the levels of vehicle emissions in other regions. The study is being conducted by a team of experts from Eastern Research Group (ERG), and sponsored by the Mid-America Regional Council (MARC) and the United States Environmental Protection Agency (EPA).

The **Kansas City Emissions Study** focuses on the emissions of specific vehicle years, makes, and models. For this study your vehicle will represent all similar makes and models from owners in the area. Your participation is very important so an accurate representation of the Kansas City Area can be made. As a token of appreciation all study participants will receive a monetary incentive.

A study representative will be calling you back in a few days to see if you are available to help us with this important study. Enclosed is a brochure that provides more info about the study. If you have any general questions concerning this study, please call 877-221-7827 or visit us online at ***www2.ergweb.com/projects/kansascity***.

We hope that you can help in this very important study.

Sincerely,

Dr. Charles A. Eddy
Chair of MARC's Board of Directors
and Council member, Kansas City, Missouri

Gene Tierney
Director Center for Air Quality
and Modeling, U.S. EPA

Kansas City Emissions Study
Participant Questionnaire

Thank you for participating in this vehicle emission study. Please take a few minutes to respond to the following questions. Your answers will help us correlate vehicle history to emission patterns.

Owner name: <first> <last>
Vehicle: <make>, <model>, <year>
Testing date: <Date>

1. **Last brand of gasoline purchased was:**

   ☐a. Shell ☐d. BP ☐f. Other: ______________________________
   ☐b. Exxon ☐e. Chevron
   ☐c. Texaco ☐g. Don't know

2. **What grade of gasoline was this?**

   ☐a. Regular ☐b. Premium ☐c. Super

3. **How long ago was the last oil change?** ______________________________

4. **What brand of motor oil was used?** ______________________________

5. **What was the oil viscosity?** (example: 10W30) ______________________________

6. **What oil additives are being used?** ______________________________

7. **Within the last year, have major repairs been performed (this includes rebuilding or replacing the engine, transmission or catalyst)?**

   ☐a. Yes (briefly describe): ☐b. No ☐c. Don't know
   ____

8. **Briefly describe any driveability or engine running problems.** ______________________________

   ____

If you have any questions or if you need to change your testing appointment, please call 1-800-275-2209.

Please bring this form, your driver's license and your proof of insurance card with you to the testing facility.

Office Use: Date Received: ____________
Vehicle Make, model, yr. ______________________ License Tag # ____________

Kansas City PM Characterization Study

Final Report

Appendix E
Dynamometer QA Checks

Assessment and Standards Division
Office of Transportation and Air Quality
U.S. Environmental Protection Agency

Sponsors:

National Renewable Energy Laboratory, U.S. Department of Energy
Federal Highway Administration, U.S. Department of Transportation
STAPPA-ALAPCO Emission Inventory Improvement Program
Coordinating Research Council Inc. (Project No. E-69)

Prepared for EPA by
Eastern Research Group, Incorporated
Austin, TX

Bevilacqua-Knight Incorporated
Oakland, CA

NuStats LLC
Austin, TX

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Reno, NV

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EPA United States Environmental Protection Agency

EPA420-R-08-009
April 2008

Table E-1. CVS Propane Injection for July 2004.

	Bag 1	Bag 2	Bag 3	Modal 1	Modal 2	Modal 3
Date	07/25/04	07/25/04	07/25/04	07/25/04	07/25/04	07/25/04
Start Mass (Gm)	792.8	777.8	752	792.8	777.8	752
Finish Mass (Gm)	777.8	752	743.6	777.8	752	743.6
Time(Min)	5.00	18.92	5.00	5.00	18.92	5.00
Temperature PDP, F	114.8	114.8	114.8	114.8	114.8	114.8
Barometric Pressure,	749.00	749.00	749.00	750.50	750.50	750.5
PDP inlet Pressure, "H20	11.00	11.00	11.00	11.00	11.00	11
HC bkg, ppmC	5.00	4.00	4.00	2.70	2.70	2.7
HC sample, ppmC	374.00	169.00	205.00	358.88	167.65	203.77
PDP counts	8850.00	33482.50	8850.00	8850.00	33482.50	8850.00
Vmix	2385.04	9023.42	2385.04	2389.95	9041.99	2389.95
Propane Mass Recovered,	15.23	25.76	8.29	14.73	25.80	8.31
Propane Mass Injected, Gm	15.00	25.80	8.40	15.00	25.80	8.40
% Difference	1.50	-0.17	-1.27	-1.82	0.01	-1.03

Table E-2. CVS Propane Injection for August 2004.

	Bag 1	Bag 2	Bag 3	Modal 1	Modal 2	Modal 3
Date	08/30/04	08/30/04	08/30/04	08/30/04	08/30/04	08/30/04
Start Mass (Gm)	1005	992.3	937	1005	992.3	937
Finish Mass (Gm)	992.3	937	922.8	992.3	937	922.8
Time(Min)	5.00	18.92	5.00	5.00	18.92	5.00
Temperature PDP, F	114.8	114.8	114.8	114.8	114.8	114.8
Barometric Pressure,	747.00	747.00	747.00	747.00	747.00	747.00
PDP inlet Pressure, "H20	11.00	11.00	11.00	11.00	11.00	11
HC bkg, ppmC	2.00	2.00	2.00	2.05	2.05	2.05
HC sample, ppmC	291.00	332.00	329.00	306.20	353.90	329
PDP counts	8850.00	33488.4	8850.00	8850.00	33488.4	8850.00
Vmix	2378.50	8998.65	2378.50	2378.50	8998.65	2378.50
Propane Mass Recovered,	11.89	51.37	13.46	12.52	54.77	13.45
Propane Mass Injected, Gm	12.70	55.30	14.20	12.70	55.30	14.20
% Difference	-6.36	-7.10	-5.24	-1.46	-0.95	-5.26

Table E-3. CVS Propane Injection for September 2004.

	Bag 1	Bag 2	Bag 3	Modal 1	Modal 2	Modal 3
Date	09/30/04	09/30/04	09/30/04	09/30/04	09/30/04	09/30/04
Start Mass (Gm)	1020.2	1006.6	947.5	1020.2	1006.6	947.5
Finish Mass (Gm)	1006.6	947.5	936.1	1006.6	947.5	936.1
Time(Min)	5.00	18.92	5.00	5.00	18.92	5.00
Temperature PDP, F	113.5	113.5	113.5	113.5	113.5	113.5
Barometric Pressure,	744.10	744.10	744.10	744.10	744.10	744.10
PDP inlet Pressure, "H20	11.00	11.00	11.00	11.00	11.00	11
HC bkq, ppmC	3.00	3.00	3.00	2.33	2.33	2.33
HC sample, ppmC	325.00	375.00	278.00	323.40	373.60	273.2
PDP counts	8850.00	33488.4	8850.00	8850.00	33488.4	8850.00
Vmix	2374.38	8983.05	2374.38	2374.38	8983.05	2374.38
Propane Mass Recovered,	13.23	57.81	11.30	13.19	57.70	11.13
Propane Mass Injected, Gm	13.60	59.10	11.40	13.60	59.10	11.40
% Difference	-2.74	-2.18	-0.91	-3.03	-2.37	-2.40

Table E-4. CVS Propane Injection for January 2005.

	Bag 1	Bag 2	Bag 3	Modal 1	Modal 2	Modal 3
Date	01/10/05	01/10/05	01/10/05	01/10/05	01/10/05	01/10/05
Start Mass (Gm)	828.6	813.9	794.7	828.6	813.9	794.7
Finish Mass (Gm)	813.9	794.7	781.9	813.9	794.7	781.9
Time(Min)	5.00	18.92	5.00	5.00	18.92	5.00
Temperature PDP, F	111.8	111.8	111.8	111.8	111.8	111.8
Barometric Pressure,	745.80	745.80	745.80	745.80	745.80	745.80
PDP inlet Pressure, "H20	11.00	11.00	11.00	11.00	11.00	11
HC bkq, ppmC	4.00	3.00	3.00	2.36	2.39	2.55
HC sample, ppmC	347.00	124.00	304.00	341.00	120.70	296.2
PDP counts	8850.00	33488.4	8850.00	8850.00	33488.4	8850.00
Vmix	2387.03	9032.52	2387.03	2387.03	9032.52	2387.03
Propane Mass Recovered,	14.16	18.91	12.43	13.98	18.49	12.13
Propane Mass Injected, Gm	14.70	19.20	12.80	14.70	19.20	12.80
% Difference	-3.64	-1.52	-2.89	-4.87	-3.71	-5.26

Table E-5. CVS Propane Injection for February, 2005.

	Bag 1	Bag 2	Bag 3	Modal 1	Modal 2	Modal 3
Date	02/24/05	02/24/05	02/24/05	02/24/05	02/24/05	02/24/05
Start Mass (Gm)	760.8	751.9	720.6	760.8	751.9	720.6
Finish Mass (Gm)	751.9	720.6	712.6	751.9	720.6	712.6
Time(Min)	5.00	18.92	5.00	5.00	18.92	5.00
Temperature PDP, F	114.2	114.2	114.2	114.2	114.2	114.2
Barometric Pressure,	749.20	749.20	749.20	749.20	749.20	749.20
PDP inlet Pressure, "H20	11.00	11.00	11.00	11.00	11.00	11
HC bkq, ppmC	3.00	2.00	3.00	2.38	2.38	2.38
HC sample, ppmC	220.00	200.00	189.00	210.90	199.20	188.8
PDP counts	8860.00	33526.24	8860.00	8860.00	33526.24	8860.00
Vmix	2390.89	9047.13	2390.89	2390.89	9047.13	2390.89
Propane Mass Recovered,	8.98	30.99	7.69	8.62	30.81	7.71
Propane Mass Injected, Gm	8.90	31.30	8.00	8.90	31.30	8.00
% Difference	0.85	-0.99	-3.83	-3.09	-1.58	-3.62

Table E-6. CVS Propane Injection for March 2005.

	Bag 1	Bag 2	Bag 3	Modal 1	Modal 2	Modal 3
Date	03/29/05	03/29/05	03/29/05	03/29/05	03/29/05	03/29/05
Start Mass (Gm)	975.8	971.1	948.7	975.8	971.1	948.7
Finish Mass (Gm)	971.1	948.7	940.8	971.1	948.7	940.8
Time(Min)	5.00	18.92	5.00	5.00	18.92	5.00
Temperature PDP, F	116.5	116.5	116.5	116.5	116.5	116.5
Barometric Pressure,	736.10	736.10	736.10	736.10	736.10	736.10
PDP inlet Pressure, "H20	11.00	11.00	11.00	11.00	11.00	11
HC bkq, ppmC	2.00	2.00	2.00	1.02	1.02	1.25
HC sample, ppmC	116.00	148.00	197.00	113.60	144.80	194.4
PDP counts	8860.00	33526.24	8860.00	8860.00	33526.24	8860.00
Vmix	2338.55	8849.08	2338.55	2338.55	8849.08	2338.55
Propane Mass Recovered,	4.61	22.35	7.89	4.55	22.01	7.81
Propane Mass Injected, Gm	4.70	22.40	7.90	4.70	22.40	7.90
% Difference	-1.87	-0.22	-0.14	-3.09	-1.74	-1.09

Table E-7. Multipoint Calibration for Dynamometer FID.

Instrument	HC1	***Date***	Aug 30, 2004
$Conc_{Std}$, ppm	**$Conc_{Meas}$ ppm**	**$Conc_{Reg}$ ppm**	**Difference, %**
891	891	892.9	0.2
801.9	800	801.8	-0.0
712.8	711	712.7	-0.0
623.7	621	622.6	-0.2
534.6	532	533.4	-0.2
445.5	444	445.3	-0.0
356.4	355	356.2	-0.1
267.3	266	267.1	-0.1
178.2	177	178.0	-0.1
89.1	89	89.8	0.8
0	0		
	Slope	1.00	
	Intercept	-0.73	
	R^2	0.9999	

Table E-8. Multipoint Calibration for Dynamometer Chemiluminescence.

Instrument	NOx	***Date***	Aug 30, 2004
$Conc_{Std}$, ppm	**$Conc_{Meas}$ ppm**	**$Conc_{Reg}$ ppm**	**Difference, %**
93.6	93.6	93.8	0.2
84.24	84	84.2	-0.1
74.88	74.7	74.9	-0.0
65.52	65.4	65.6	0.0
56.16	55.8	55.9	-0.4
46.8	46.8	46.9	0.3
37.44	37.2	37.3	-0.3
28.08	27.9	28.0	-0.2
18.72	18.6	18.7	-0.0
9.36	9.3	9.4	0.5
0	0		
	Slope	1.00	
	Intercept	-0.10	
	R^2	0.9999	

Table E-9. Multipoint Calibration for Dynamometer NDIR.

Instrument	CO_2	*Date*	Aug 30, 2004
$Conc_{Std}$, ppm	$Conc_{Meas}$ ppm	$Conc_{Reg}$ ppm	Difference, %
2.864	2.864	2.9	-0.1
2.5776	2.578	2.6	-0.1
2.2912	2.295	2.3	0.0
2.0048	2.011	2.0	0.1
1.7184	1.723	1.7	-0.0
1.432	1.441	1.4	0.3
1.1456	1.152	1.1	0.0
0.8592	0.868	0.9	0.3
0.5728	0.581	0.6	0.2
0.2864	0.292	0.3	-0.7
0	0.005		
	Slope	1.00	
	Intercept	0.01	
	R^2	0.9999	

Table E-10. Multipoint Calibration for Dynamometer NDIR.

Instrument	Low CO	*Date*	Aug 30, 2004
$Conc_{Std}$, ppm	$Conc_{Meas}$ ppm	$Conc_{Reg}$ ppm	Difference, %
888	888	890.9	0.3
799.2	793	795.5	-0.5
710.4	709	711.1	0.1
621.6	619	620.7	-0.1
532.8	532	533.3	0.1
444	444	444.9	0.2
355.2	354	354.5	-0.2
266.4	265	265.1	-0.5
177.6	179	178.7	0.6
88.8	91	90.3	1.7
0	0		
	Slope	1.00	
	Intercept	1.09	
	R^2	0.9999	

Table E-11. Multipoint Calibration for Dynamometer NDIR.

Instrument	**High CO**	***Date***	Aug 30, 2004
$Conc_{Std}$, ppm	**$Conc_{Meas}$ ppm**	**$Conc_{Reg}$ ppm**	**Difference, %**
912	912	926.7	1.6
820.8	803	817.5	-0.4
729.6	715	729.3	-0.0
638.4	620	634.1	-0.7
547.2	527	540.9	-1.2
456	441	454.7	-0.3
364.8	347	360.5	-1.2
273.6	254	267.3	-2.3
182.4	166	179.1	-1.8
91.2	80	92.9	1.9
0	0		
	Slope	1.00	
	Intercept	-12.77	
	R^2	0.9994	

Table E-12. Multipoint Calibration for Dynamometer FID.

Instrument	**HC1**	***Date***	Oct 4, 2004
$Conc_{Std}$, ppm	**$Conc_{Meas}$ ppm**	**$Conc_{Reg}$ ppm**	**Difference, %**
904	904	903.9	-0.0
813.6	813	812.9	-0.1
723.2	725	724.9	0.2
632.8	632	631.9	-0.1
542.4	543	542.9	0.1
452	452	451.9	-0.0
361.6	361	360.9	-0.2
271.2	271	270.9	-0.1
180.8	181	180.9	0.1
90.4	91	90.9	0.6
0	0		
	Slope	1.00	
	Intercept	0.09	
	R^2	0.9999	

Table E-13. Multipoint Calibration for Dynamometer Chemiluminescence.

Instrument	**NOx**	***Date***	Oct 4, 2004
$Conc_{Std}$, ppm	**$Conc_{Meas}$ ppm**	**$Conc_{Reg}$ ppm**	**Difference, %**
93.6	93.6	93.7	0.1
84.24	83.9	84.0	-0.3
74.88	74.8	74.9	0.0
65.52	65.5	65.6	0.1
56.16	56.2	56.2	0.2
46.8	46.8	46.8	0.1
37.44	37.4	37.4	-0.1
28.08	28.1	28.1	0.0
18.72	18.8	18.8	0.3
9.36	9.4	9.4	-0.1
0	0		
	Slope	1.00	
	Intercept	0.06	
	R^2	0.9999	

Table E-14. Multipoint Calibration for Dynamometer NDIR.

Instrument	**CO2**	***Date***	Oct 4, 2004
$Conc_{Std}$, ppm	**$Conc_{Meas}$ ppm**	**$Conc_{Reg}$ ppm**	**Difference, %**
2.9	2.9	2.9	-0.1
2.61	2.608	2.6	-0.2
2.32	2.325	2.3	0.1
2.03	2.031	2.0	-0.1
1.74	1.745	1.7	0.1
1.45	1.46	1.5	0.4
1.16	1.168	1.2	0.3
0.87	0.877	0.9	0.2
0.58	0.587	0.6	0.2
0.29	0.2935	0.3	-0.9
0	0.002		
	Slope	1.00	
	Intercept	0.01	
	R^2	0.9999	

Table E-15. Multipoint Calibration for Dynamometer NDIR.

Instrument	Low CO	*Date*	Oct 4, 2004
$Conc_{Std}$, ppm	$Conc_{Meas}$ ppm	$Conc_{Reg}$ ppm	Difference, %
910	910	915.8	0.6
819	810	815.2	-0.5
728	722	726.6	-0.2
637	630	634.0	-0.5
546	543	546.5	0.1
455	453	455.9	0.2
364	361	363.3	-0.2
273	272	273.8	0.3
182	181	182.2	0.1
91	91	91.6	0.7
0	0		
	Slope	0.99	
	Intercept	-0.05	
	R^2	0.9999	

Table E-16. Multipoint Calibration for Dynamometer NDIR.

Instrument	High CO	*Date*	Oct 4, 2004
$Conc_{Std}$, ppm	$Conc_{Meas}$ ppm	$Conc_{Reg}$ ppm	Difference, %
903	903	915.2	1.3
812.7	803	815.9	0.4
722.4	706	719.5	-0.4
632.1	617	631.1	-0.2
541.8	519	533.8	-1.5
451.5	435	450.4	-0.3
361.2	338	354.0	-2.0
270.9	246	262.6	-3.0
180.6	161	178.2	-1.3
90.3	71	88.8	-1.6
0	0		
	Slope	1.01	
	Intercept	-18.32	
	R^2	0.9992	

Table E-17. Multipoint Calibration for Dynamometer FID.

Instrument	HC1	***Date***	Jan 10, 2005
$Conc_{Std}$, ppm	**$Conc_{Meas}$ ppm**	**$Conc_{Reg}$ ppm**	**Difference, %**
858	858	856.7	-0.2
772.2	767	765.8	-0.8
686.4	692	691.0	0.7
600.6	603	602.1	0.3
514.8	519	518.3	0.7
429	432	431.5	0.6
343.2	345	344.6	0.4
257.4	254	253.8	-1.4
171.6	169	168.9	-1.6
85.8	86	86.1	0.3
0	0		na
	Slope	1.00	
	Intercept	-0.23	
	R^2	0.9999	

Table E-18. Multipoint Calibration for Dynamometer Chemiluminescence.

Instrument	NOx	***Date***	Jan 10, 2005
$Conc_{Std}$, ppm	**$Conc_{Meas}$ ppm**	**$Conc_{Reg}$ ppm**	**Difference, %**
93.57	93.57	93.3	-0.3
84.213	83.4	83.1	-1.3
74.856	75.4	75.1	0.4
65.499	66.9	66.6	1.7
56.142	56.9	56.6	0.8
46.785	46.6	46.3	-1.0
37.428	38.1	37.8	1.0
28.071	28.7	28.4	1.1
18.714	19	18.7	-0.2
9.357	9.4	9.1	-3.2
0	0		
	Slope	1.00	
	Intercept	0.35	
	R^2	0.9996	

Table E-19. Multipoint Calibration for Dynamometer NDIR.

Instrument	**CO2**	***Date***	Jan 10, 2005
$Conc_{Std}$, ppm	**$Conc_{Meas}$ ppm**	**$Conc_{Reg}$ ppm**	**Difference, %**
2.909	2.909	2.9	-0.6
2.6181	2.61	2.6	-0.9
2.3272	2.359	2.3	0.7
2.0363	2.064	2.0	0.7
1.7454	1.77	1.8	0.7
1.4545	1.485	1.5	1.3
1.1636	1.186	1.2	1.0
0.8727	0.875	0.9	-0.9
0.5818	0.5808	0.6	-1.8
0.2909	0.294	0.3	-1.8
0	0		
	Slope	1.00	
	Intercept	0.01	
	R^2	0.9998	

Table E-20. Multipoint Calibration for Dynamometer NDIR.

Instrument	**Low CO**	***Date***	Jan 10, 2005
$Conc_{Std}$, ppm	**$Conc_{Meas}$ ppm**	**$Conc_{Reg}$ ppm**	**Difference, %**
905	905	905.0	-0.0
814.5	805	804.9	-1.2
724	730	729.8	0.8
633.5	636	635.7	0.3
543	546	545.6	0.5
452.5	457	456.5	0.9
362	364	363.4	0.4
271.5	268	267.3	-1.5
181	180	179.2	-1.0
90.5	92	91.1	0.7
0	0		
	Slope	1.00	
	Intercept	0.95	
	R^2	0.9998	

Table E-21. Multipoint Calibration for Dynamometer NDIR.

Instrument	**High CO**	***Date***	Jan 10, 2005
$Conc_{Std}$, ppm	**$Conc_{Meas}$ ppm**	**$Conc_{Reg}$ ppm**	**Difference, %**
908	908	910.0	0.2
817.2	805	806.6	-1.3
726.4	728	729.4	0.4
635.6	639	640.1	0.7
544.8	548	548.8	0.7
454	455	455.6	0.3
363.2	363	363.3	0.0
272.4	269	269.0	-1.3
181.6	180	179.7	-1.0
90.8	93	92.4	1.8
0	0		
	Slope	1.00	
	Intercept	0.86	
	R^2	0.9998	

Table E-22. Multipoint Calibration for Dynamometer FID.

Instrument	**HC1**	***Date***	Feb 24, 2005
$Conc_{Std}$, ppm	**$Conc_{Meas}$ ppm**	**$Conc_{Reg}$ ppm**	**Difference, %**
907	907	909.0	0.2
816.3	814	815.8	-0.1
725.6	723	724.7	-0.1
634.9	632	633.6	-0.2
544.2	542	543.4	-0.1
453.5	453	454.3	0.2
362.8	362	363.2	0.1
272.1	271	272.1	-0.0
181.4	181	181.9	0.3
90.7	89	89.8	-1.0
0	0		
	Slope	1.00	
	Intercept	-0.68	
	R^2	0.9999	

Table E-23. Multipoint Calibration for Dynamometer Chemiluminescence.

Instrument	NOx	*Date*	Feb 24, 2005
$Conc_{Std}$, ppm	$Conc_{Meas}$ ppm	$Conc_{Reg}$ ppm	Difference, %
93.6	93.6	93.4	-0.3
84.24	85.8	85.6	1.6
74.88	75	74.9	-0.0
65.52	64.8	64.7	-1.2
56.16	55.5	55.5	-1.2
46.8	46.8	46.8	0.1
37.44	37.2	37.3	-0.4
28.08	28.2	28.3	0.9
18.72	18.3	18.5	-1.2
9.36	9.3	9.5	2.0
0	0		
	Slope	1.01	
	Intercept	-0.30	
	R^2	0.9997	

Table E-24. Multipoint Calibration for Dynamometer NDIR.

Instrument	CO2	*Date*	Feb 24, 2005
$Conc_{Std}$, ppm	$Conc_{Meas}$ ppm	$Conc_{Reg}$ ppm	Difference, %
2.9025	2.9025	2.9	-0.2
2.61225	2.6214	2.6	0.1
2.322	2.329	2.3	-0.0
2.03175	2.045	2.0	0.3
1.7415	1.7507	1.7	0.1
1.45125	1.4526	1.4	-0.5
1.161	1.175	1.2	0.5
0.87075	0.8835	0.9	0.4
0.5805	0.5939	0.6	0.7
0.29025	0.2966	0.3	-1.1
0	0.0045		
	Slope	1.00	
	Intercept	0.01	
	R^2	.9999	

Table E-25. Multipoint Calibration for Dynamometer NDIR.

Instrument	**Low CO**	***Date***	Feb 24, 2005
$Conc_{Std}$, ppm	**$Conc_{Meas}$ ppm**	**$Conc_{Reg}$ ppm**	**Difference, %**
901	901	904.6	0.4
810.9	807	810.2	-0.1
720.8	717	719.9	-0.1
630.7	626	628.6	-0.3
540.6	537	539.3	-0.2
450.5	449	451.0	0.1
360.4	358	359.6	-0.2
270.3	268	269.3	-0.4
180.2	181	182.0	1.0
90.1	90	90.7	0.6
0	0		
	Slope	1.00	
	Intercept	-0.36	
	R^2	0.9999	

Table E-26. Multipoint Calibration for Dynamometer NDIR.

Instrument	**High CO**	***Date***	Feb 24, 2005
$Conc_{Std}$, ppm	**$Conc_{Meas}$ ppm**	**$Conc_{Reg}$ ppm**	**Difference, %**
905	905	917.7	1.4
814.5	803	815.7	0.1
724	710	722.7	-0.2
633.5	618	630.7	-0.4
543	525	537.7	-1.0
452.5	431	443.7	-1.9
362	341	353.7	-2.3
271.5	264	276.7	1.9
181	162	174.7	-3.5
90.5	76.4	89.1	-1.5
0	2.34		
	Slope	1.00	
	Intercept	-12.74	
	R^2	0.9993	

Table E-27. Multipoint Calibration for Dynamometer FID.

Instrument	**HC1**	***Date***	Mar 28, 2005
$Conc_{Std}$, ppm	**$Conc_{Meas}$ ppm**	**$Conc_{Reg}$ ppm**	**Difference, %**
907	907	915.7	1.0
816.3	809	816.4	0.0
725.6	713	719.1	-0.9
634.9	621	625.9	-1.4
544.2	534	537.7	-1.2
453.5	454	456.7	0.7
362.8	370	371.6	2.4
272.1	277	277.3	1.9
181.4	184	183.1	0.9
90.7	91	88.8	-2.0
0	0		
	Slope	0.99	
	Intercept	3.36	
	R^2	0.9996	

Table E-28. Multipoint Calibration for Dynamometer Chemiluminescence.

Instrument	**NOx**	***Date***	Mar 28, 2005
$Conc_{Std}$, ppm	**$Conc_{Meas}$ ppm**	**$Conc_{Reg}$ ppm**	**Difference, %**
93.6	93.6	93.4	-0.3
84.24	85.8	85.6	1.6
74.88	75	74.9	-0.0
65.52	64.8	64.7	-1.2
56.16	55.5	55.5	-1.2
46.8	46.8	46.8	0.1
37.44	37.2	37.3	-0.4
28.08	28.2	28.3	0.9
18.72	18.3	18.5	-1.2
9.36	9.3	9.5	2.0
0	0		
	Slope	1.01	
	Intercept	-0.30	
	R^2	0.9997	

Table E-29. Multipoint Calibration for Dynamometer NDIR.

Instrument	**CO2**	***Date***	Mar 28, 2005
$Conc_{Std}$, ppm	**$Conc_{Meas}$ ppm**	**$Conc_{Reg}$ ppm**	**Difference, %**
2.9025	2.9025	2.9	0.9
2.61225	2.5907	2.6	-0.0
2.322	2.2869	2.3	-0.8
2.03175	1.9928	2.0	-1.3
1.7415	1.7118	1.7	-1.2
1.45125	1.4582	1.5	0.8
1.161	1.1864	1.2	2.3
0.87075	0.8938	0.9	2.3
0.5805	0.5939	0.6	1.0
0.29025	0.2951	0.3	-2.5
0	0.0045		
	Slope	0.99	
	Intercept	0.02	
	R^2	0.9996	

Table E-30. Multipoint Calibration for Dynamometer NDIR.

Instrument	**Low CO**	***Date***	Mar 28, 2005
$Conc_{Std}$, ppm	**$Conc_{Meas}$ ppm**	**$Conc_{Reg}$ ppm**	**Difference, %**
901	900	915.3	1.6
810.9	795	808.3	-0.3
720.8	703	714.5	-0.9
630.7	611	620.8	-1.6
540.6	525	533.2	-1.4
450.5	445	451.6	0.3
360.4	362	367.1	1.9
270.3	270	273.3	1.1
180.2	181	182.7	1.4
90.1	91	90.9	0.9
0	0		
	Slope	0.98	
	Intercept	1.77	
	R^2	0.9995	

Table E-31. Multipoint Calibration for Dynamometer NDIR.

Instrument	**High CO**	***Date***	Mar 28, 2005
Conc$_{Std}$, ppm	**Conc$_{Meas}$ ppm**	**Conc$_{Reg}$ ppm**	**Difference, %**
905	899.26	925.8	2.3
814.5	793.03	816.9	0.3
724	694.79	716.1	-1.1
633.5	600.29	619.2	-2.3
543	513.25	529.9	-2.4
452.5	433.39	448.0	-1.0
362	353	365.6	1.0
271.5	264.88	275.2	1.4
181	174.93	183.0	1.1
90.5	85.1	90.8	0.4
0	2.34		
	Slope	0.98	
	Intercept	-3.57	
	R^2	0.9989	

Table E-33. Daily PDP and Dynamometer QA Checks.

Date	PDP Speed, rpm	Actual Dyno Speed, rpm	Actual Dyno Speed, mph	Measured Dyno Speed, mph	Coastdown time, seconds
July 15, 2004	1766	1942	50.0	50.1	23.52
July 16, 2004	1769	1952	50.2	50.1	22.78
July 17, 2004	1767	1980	51.0	50.8	23.3
July 18, 2004	1767	1970	50.7	50.5	-
July 19, 2004	1767	1934	49.8	49.5	22.38
July 20, 2004	1767	1948	50.1	50.1	24.38
July 21, 2004	1768	1942	50.0	49.8	23.73
July 22, 2004	1748	1956	50.3	49.7	24.37
July 23, 2004	1765	2004	51.6	51.2	24.62
July 24, 2004	1767	1964	50.5	50.4	23.6
July 26, 2004	1772	1984	51.1	50.9	23.63
July 27, 2004	1767	1980	51.0	50.5	23.69
July 28, 2004	1770	1982	51.0	50.8	23.7
July 29, 2004	1768	1946	50.1	50	23.66
July 30, 2004	1770	1962	50.5	50.6	23.85
July 31, 2004	1768	1946	50.1	49.8	23.24
August 2,2004	1770	1934	49.8	49.7	23.83
August 3,2004	1770	1951	50.2	50	23.78
August 4,2004	1768	1948	50.1	50.1	24.03
August 5,2004	1770	1952	50.2	50.2	23.16
August 6,2004	1768	1946	50.1	50	23.28
August 7,2004	1768	1956	50.3	50.2	23.4
August 9,2004	1770	1959	50.4	50.1	23.8
August 10,2004	1770	1952	50.2	50.1	22.87
August 11,2004	1770	1945	50.1	49.9	23.31
August 12,2004	1770	1960	50.4	50.3	23.47
August 13,2004	1770	1948	50.1	50	23.51
August 14,2004	1768	1947	50.1	50	23.37
August 16,2004	1768	1953	50.3	50.1	23.03
August 17,2004	1770	1946	50.1	50	23.83
August 18,2004	1768	1950	50.2	50.1	23.05
August 19,2004	1770	1952	50.2	50.1	23.02
August 20,2004	1769	1960	50.2	50.2	22.91
August 21,2004	1769	1940	49.9	49.8	23.79
August 23,2004	1772	1952	50.2	50.2	23.76
August 24,2004	1772	1936	49.8	49.6	23.5
August 25,2004	1768	1953	50.3	50.2	23.63
August 26,2004	1768	1943	50.0	49.9	24.26
August 27,2004	1768	1950	50.2	50.1	23.85
August 28,2004	1768	1952	50.2	49.9	23.6
August 30,2004	1768	1954	50.3	50.1	23.05

Date	PDP Speed, rpm	Actual Dyno Speed, rpm	Actual Dyno Speed, mph	Measured Dyno Speed, mph	Coastdown time, seconds
August 31,2004	1768	1959	50.4	50.3	23.17
Sept 1, 2004	1770	1942	50.0	49.9	23.15
Sept 2, 2004	1768	1936	49.8	49.6	23.9
Sept 8, 2004	1768	1954	50.3	50.1	23.04
Sept 9, 2004	1770	1941	50.0	49.8	23
Sept 10, 2004	1769	1958	50.4	50	23.5
Sept 11, 2004	1768	1953	50.3	50	23.33
Sept 13, 2004	1770	1946	50.1	49.9	23.02
Sept 14, 2004	1768	1964	50.5	50.4	23.75
Sept 15, 2004	1772	1933	49.7	49.6	23.73
Sept 16, 2004	1770	1956	50.3	50.2	22.77
Sept 17, 2004	1770	1938	49.9	49.7	23.95
Sept 18, 2004	1770	1942	50.0	49.9	23.74
Sept 20, 2004	1770	1966	50.6	50.5	23.54
Sept 21, 2004	1770	1976	50.9	50.6	23.78
Sept 22, 2004	1769	1953	50.3	50.3	23.72
Sept 23, 2004	1769	1954	50.3	50.2	23.28
Sept 24, 2004	1769	1958	50.4	50.2	23.12
Sept 25, 2004	1769	1944	50.0	49.8	22.92
Sept 27, 2004	1770	1944	50.0	49.9	23.72
Sept 28, 2004	1770	1957	50.4	50	23.72
Sept 29, 2004	1768	1958	50.4	50.3	23.21
Sept 30, 2004	1772	1952	50.2	50.1	23.24
Oct 1, 2004	1770	1966	50.6	50.4	23.79
Jan 11,2005	1770	1962	50.5	50.3	-
Jan 12, 2005	1774	1956	50.3	50.1	22.8
Jan 13, 2005	1772	1956	50.3	49.9	22.82
Jan 14, 2005	1772	1928	49.6	49.4	20.2
Jan 15, 2005	1776	1958	50.4	50.4	20.89
Jan 17, 2005	1768	1974	50.8	50.4	20.5
Jan 18,2005	1768	1940	49.9	50.3	20.89
Jan 19,2005	1772	1962	50.5	50.2	21.59
Jan 20,2005	1770	1954	50.3	50	22.09
Jan 21,2005	1770	1955	50.3	49.9	21.44
Jan 22,2005	1770	1977	50.9	50.3	21.74
Jan 25,2005	1773	1957	50.4	50	21.13
Jan 26,2005	1774	1988	51.2	50.8	21.56
Jan 27,2005	1770	1970	50.7	50.3	21.41
Jan 28,2005	1772	1964	50.5	50.2	21.21
Jan 29,2005	1771	1969	50.7	50.3	21.25
Jan 31,2005	1772	1962	50.5	50.2	22.18
Feb 1,2005	1772	1969	50.7	50.3	22.24

Date	PDP Speed, rpm	Actual Dyno Speed, rpm	Actual Dyno Speed, mph	Measured Dyno Speed, mph	Coastdown time, seconds
Feb 2,2005	1773	1970	50.7	50.4	21.72
Feb 3,2005	1771	1960	50.4	50.1	21.52
Feb 4,2005	1772	1964	50.5	50.2	22.14
Feb 5,2005	1772	1958	50.4	50.1	22.68
Feb 7,2005	1780	1962	50.5	50.2	22.6
Feb 8,2005	1772	1968	50.6	50.3	22.13
Feb 9,2005	1772	1952	50.2	49.9	21.65
Feb 20,2005	1772	1968	50.6	50.3	21.73
Feb 11,2005	1771	1983	50.7	50.7	21.59
Feb 12,2005	1772	1968	50.6	50.2	22.61
Feb 14,2005	1771	1961	50.5	50.1	21.91
Feb 15,2005	1772	1955	50.3	50	22.4
Feb 16,2005	1771	1980	51.0	50.5	21.76
Feb 17,2005	1772	1960	50.4	50.1	22.07
Feb 18,2005	1772	1974	50.8	50.4	21.72
Feb 19,2005	1772	1951	50.2	49.9	21.91
Feb 21,2005	1772	1967	50.6	50.6	22.33
Feb 22,2005	1772	1971	50.7	50.4	22.6
Feb 23,2005	1771	1959	50.4	50.1	22.57
Feb 24, 2005	1772	1952	50.2	49.5	22.57
Feb 25, 2005	1772	1963	50.5	50.5	22.07
Feb 26,2005	1772	1948	50.1	50.2	21.89
Feb 28,2005	1772	1946	50.1	50.1	21.47
March 1,2005	1772	1940	49.9	49.9	21.26
March 2,2005	1772	1957	50.4	50.4	21.31
March 3,2005	1771	1944	50.0	50.1	21.38
March 4,2005	1772	1925	49.5	49.6	21.86
March 5,2005	1772	1946	50.1	50.2	21.6
March 7,2005	1772	1942	50.0	50.1	22.58
March 8,2005	1772	1956	50.3	50.4	21.39
March 9,2005	1772	1952	50.2	50.3	21.57
March 10,2005	1772	1925	49.5	49.6	21.8
March 11,2005	1772	1954	50.3	50.4	21.8
March 12,2005	1772	1952	50.2	50.3	21.91
March 14,2005	1772	1949	50.2	50.2	22.13
March 15,2005	1773	1938	49.9	50	21.59
March 16,2005	1772	1958	50.4	50.5	21.57
March 17,2005	1773	1942	50.0	50.1	22.55
March 18,2005	1773	1938	49.9	49.8	22.13
March 19,2005	1772	1938	49.9	49.8	22.59
March 21,2005	1772	1948	50.1	50.3	22.44
March 22,2005	1771	1948	50.1	50.3	22.4
March 23,2005	1772	1950	50.2	50.3	22.24

Date	PDP Speed, rpm	Actual Dyno Speed, rpm	Actual Dyno Speed, mph	Measured Dyno Speed, mph	Coastdown time, seconds
March 24,2005	1774	1930	49.7	49.8	22.16
March 25,2005	1773	1933	49.7	49.9	22.41
March 26,2005	1772	1924	49.5	49.6	22.16
March 28,2005	1773	1943	50.0	50.1	22.28
March 29,2005	1773	1930	49.7	49.8	22.7
March 30,2005	1772	1946	50.1	50.3	22.4
March 31,2005	1772	1932	49.7	49.9	22.32
April 1,2005	1772	1946	50.1	50.3	22.47
April 2,2005	1772	1940	49.9	50.1	-
April 4,2005	1773	1940	49.9	50.1	22.52
April 5,2005	1772	1924	49.5	49.8	23.09
April 6,2005	1772	1923	49.5	49.8	22.57
April 7,2005	1772	1944	50.0	50.3	22.89
April 8,2005	1772	1932	49.7	49.9	22.26

Kansas City PM Characterization Study

Final Report

Appendix F
Dynamometer Calculations

Assessment and Standards Division
Office of Transportation and Air Quality
U.S. Environmental Protection Agency

Sponsors:

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Calculations for the Dynamometer Determined Regulated Emissions

Individual phase and weighted regulated emissions rates and fuel economy were determined from both the modal and bag THC, CO, NOx, and CO2 analyses. Emission rates were calculated according to procedures found in the Code of Federal Regulations (CFR) Title 40, Part 86, Paragraph 86.144-90. Methanol, formaldehyde, and methane were not measured, so emission rates for these compounds, as well as Non-Methane Hydrocarbon (NMHC) and Total hydrocarbon equivalent (THCE) were not determined.

Calculations were performed within a Lotus123 spreadsheet , *KC_Regdata.wk4*, designed specifically for this study. The spreadsheet contained macros to import and process the modal data files and bag data files containing user input. The spreadsheet also served as a "log" file to distribute regulated emission results to study participants during the course of the study and is included as two separate files (one for Round 1 and one for Round 2) on the ERG study web site. The spreadsheet contains 203 data fields (including 22 blank fields included to improve readability) as listed in Table F-1. Specific calculations used for all calculated fields are described in the comments column of the Table. In reporting weighted emissions, the same phase weighting factors as used for the Federal Test Procedure were applied to this data set. Included within the spreadsheet are intermediary calculations for the NOx correction factor, Vmix, and dilution factor, as follows:

NOx correction factor = 1 / (1 - 0.0047*(H-75)),

where H = absolute humidity (grains H2O per lb dry air)

= {(43.478)Ra * Psat} / {Pb - (Psat * Ra / 100)}

where Ra = relative humidity (percent)

Pb = barometric pressure (in Hg)

Psat = saturated vapor pressure @ dry bulb temp (in Hg)

= 29.92 * 218.167 / Pw,

where Log(Pw) = $[A(x-t) + B(x-t)^2 + C(x-t)^4] / [t(1 + D(x-t))]$ and

A = 3.244

B = 0.005868

C = 0.0000000117

D = .002188

x = 647.27

t = Tdry, Farenheit.

Vmix = Vo * N * {(Pb - Ppdp) * 528 / (760 * Tpdp)},

where Vo = Volume of gas pumped by the PDP per revolution (cu ft / revolution)

N = number of PDP revolutions per test phase.

Ppdp = PDP inlet pressure depression (mm Hg)

Tpdp = average temperature at PDP inlet (degrees Rankine)

Pb = barometric pressure (mm Hg)

The constant, Vo = 0.306 cu ft/rev, has been previously determined by propane injections. N is also considered a constant, determined from PDP rpm and phase duration.

Dilution Factor = 13.4 / $\{CO_2 + (HC + CO) * 10^{-4}\}$

Where CO_2, HC, and CO are the average dilute concentrations.

Emission rates (grams/mile) for each test phase for the regulated emissions were calculated from the following format:

HC (gm/mile) = HC (ppmC) * 10^{-6} * Vmix * 16.33 (gm /cu ft) /Miles

CO (gm/mile) = CO (ppm) * 10^{-6} * Vmix * 32.97 (gm/cu ft) /Miles

CO_2 (gm/mile) = CO_2 (%) * 10^{-4} * Vmix * 51.81 (gm/cu ft) /Miles

NOx (gm/mile) = NOx (ppm) * 10^{-6} * Vmix * 54.16 (gm/cu ft) /Miles

Since the fuel properties of the tested consumer vehicles were unknown, fuel properties for a "generic" fuel were used for fuel economy calculations. The control vehicle, however, was fueled with Indolene, so fuel properties for Indolene were used when performing fuel economy calculations for the control vehicle. Fuel economy was calculated as follows:

Fuel Economy (mpg) = CGAL / {(.429 * CO) + (.273 * CO_2) + (0.8646 *HC},
where CGAL = grams C / gallon fuel = 2350.00 and CO, CO_2, and HC are grams/mile emitted per test phase.

Table F-1. Data Fields for the Regulated Emission Calculation Spreadsheet.

Data Field #	Label	Units	Source	Example Value	Comment
1	Run#		Keyboard Input	84101	Test number
2	Veh.Tag #		Keyboard Input	763TTY	Vehicle License Plate number
3	Veh Yr, Make, Model		Keyboard Input	2004 Toyota Camry	Vehicle Make,model, and model year
4	Odometer	*Miles*	Keyboard Input	169043	Vehicle odometer reading, may not be actual miles
5	Inertia	*Lbs*	Keyboard Input	3500	Dynamometer test inertia used
6	Hp@50mph	*Hp*	Keyboard Input	7.2	Dynamometer load used
7	Time		Keyboard Input	1:22 p.m.	Test start time
8	Date		Keyboard Input	07/30/2004	Test date
9	Comments		Keyboard Input		
10	(Blank Field)				
11	Vo	*ACF/Rev*	Keyboard Input	0.306	Positive displacement pump (PDP) volume per revolution
12	PDP_Speed	*Rpm*	Keyboard Input	1770	PDP speed
13	Ph_Length_1	*Seconds*	Constant	300	Phase 1 duration
14	Ph_Length_2	*Seconds*	Constant	1136	Phase 2 duration
15	Ph_Length_3	*Seconds*	Constant	300	Phase 3 duration
16	Pi_pdp	*mmHg*	Keyboard Input	20.46	PDP inlet pressure depression
17	Pbaro.	*mmHg*	Realtime	742.87	Barometric pressure
18	Tpdp_1	*degreesC*	Realtime	46.36	PDP inlet air average temperature for Phase 1
19	Tpdp_2	*degreesC*	Realtime	46.91	PDP inlet air average temperature for Phase 2
20	Tpdp_3	*degreesC*	Realtime	46.23	PDP inlet air average temperature for Phase 3
21	Vmix_1	*Cu. Ft*	Calculated	2361.87	Vo * (PDP_Speed / Ph_Length_1 /60) * {(Pbaro - Pi_pdp)/760} * {528 / ((Tpdp_1 * 9 / 5) + 32 + 460)}
22	Vmix_2	*Cu. Ft*	Calculated	8928.29	Vo * (PDP_Speed / Ph_Length_2 /60) * {(Pbaro - Pi_pdp)/760} * {528 / ((Tpdp_2 * 9 / 5) + 32 + 460)}
23	Vmix_3	*Cu. Ft*	Calculated	2362.83	Vo * (PDP_Speed / Ph_Length_3 /60) * {(Pbaro - Pi_pdp)/760} * {528 / ((Tpdp_3 * 9 / 5) + 32 + 460)}
24	(Blank Field)				

Data Field #	Label	Units	Source	Example Value	Comment
25	Tamb	*F*	Realtime	77.4	Average ambient temperature during all test Phases and hot soak.
26	Rel_Hum	*%*	Realtime	49.9	Average relative humidity during all test Phases and hot soak.
27	DryBulbT	*degrees K*	Calculated	298.4	(Tamb -32)*(5/9)+273.15
28	PsatDry	*inHg*	Calculated	0.94648	29.92 * 218.167 / (@EXP(@LN(10) * (647.27 - DryBulbT) / DryBulbT * (3.2437814 + 0.00586826 * (647.27 - DryBulbT) + 1.1702379E-008 * (647.27 - DryBulbT)^3) / (1 + (0.0021878462 * (647.27-DryBulbT)))))
29	Spec_Humidity	*Grains/lb*	Calculated	71.31191	4347.8 * (Rel_Hum / 100) * PsatDry / {(Pbaro / 25.4) - PsatDry * (Rel_Hum / 100)}
30	NOx_Corr_Fac		Calculated	0.98296	1 / {1 - 0.0047 *(Spec_Humidity - 75)}
31	(Blank Field)				
32	RR_Spd_1	*MPH*	Realtime	14.3732	Average speed for Phase 1 (t=1 to 301seconds)
33	RR_Spd_2	*MPH*	Realtime	27.5901	Average speed for Phase 2 (t=302 to 1437 seconds)
34	RR_Spd_3	*MPH*	Realtime	14.2443	Average speed for Phase 3 (t=2037 to 2337 seconds)
35	RR_Dist_1	*Miles*	Calculated	1.198	Test distance for phase 1= RR_Spd_1 * Ph_Length_1 / 3600
36	RR_Dist_2	*Miles*	Calculated	8.706	Test distance for phase 2= RR_Spd_2 * Ph_Length_2 / 3600
37	RR_Dist_3	*Miles*	Calculated	1.187	Test distance for phase 3= RR_Spd_3 * Ph_Length_3 / 3600
38	(Blank Field)				
39	HC_1_Exh_m	*ppmC*	Realtime	102.562	Avg HC concentration Phase 1 (t = 1 to 301 seconds)
40	HC_1_Bkg_m	*ppmC*	Realtime	2.733	Avg HC concentration Hot Soak Background (t = 1494 to 1994 seconds)
41	HC_2_Exh_m	*ppmC*	Realtime	27.095	Avg HC concentration Phase 2 (t = 317 to 1437 seconds)
42	HC_2_Bkg_m	*ppmC*	Realtime	2.733	Avg HC concentration Hot Soak Background (t = 1494 to 1994 seconds)
43	HC_3_Exh_m	*ppmC*	Realtime	15.615	Avg HC concentration Phase 3 (t = 2037 to 2337 seconds)
44	HC_3_Bkg_m	*ppmC*	Realtime	2.733	Avg HC concentration Hot Soak Background (t = 1494 to 1994 seconds)

Data Field #	Label	Units	Source	Example Value	Comment
45	(Blank Field)				
46	NOx_1_Exh_m	*Ppm*	Realtime	42.574	Avg NOx concentration Phase 1 (t = 1 to 301 seconds)
47	NOx_1_Bkg_m	*Ppm*	Realtime	0.008	Avg NOx concentration Hot Soak Background (t = 1494 to 1994 seconds)
48	NOx_2_Exh_m	*Ppm*	Realtime	36.455	Avg NOx concentration Phase 2 (t = 317 to 1437 seconds)
49	NOx_2_Bkg_m	*Ppm*	Realtime	0.008	Avg NOx concentration Hot Soak Background (t = 1494 to 1994 seconds)
50	NOx_3_Exh_m	*Ppm*	Realtime	24.800	Avg NOx concentration Phase 3 (t = 2037 to 2337 seconds)
51	NOx_3_Bkg_m	*Ppm*	Realtime	0.008	Avg NOx concentration Hot Soak Background (t = 1494 to 1994 seconds)
52	(Blank Field)				
53	CO_1_Exh_m	*Ppm*	Realtime	613.094	Avg CO concentration Phase 1 (t = 1 to 301 seconds)
54	CO_1_Bkg_m	*Ppm*	Realtime	0.379	Avg CO concentration Hot Soak Background (t = 1494 to 1994 seconds)
55	CO_2_Exh_m	*Ppm*	Realtime	675.482	Avg CO concentration Phase 2 (t = 317 to 1437 seconds)
56	CO_2_Bkg_m	*Ppm*	Realtime	0.379	Avg CO concentration Hot Soak Background (t = 1494 to 1994 seconds)
57	CO_3_Exh_m	*Ppm*	Realtime	181.040	Avg CO concentration Phase 3 (t = 2037 to 2337 seconds)
58	CO_3_Bkg_m	*Ppm*	Realtime	0.379	Avg CO concentration Hot Soak Background (t = 1494 to 1994 seconds)
59	(Blank Field)				
60	CO2_1_Exh_m	*%*	Realtime	0.631	Avg CO2 concentration Phase 1 (t = 1 to 301 seconds)
61	CO2_1_Bkg_m	*%*	Realtime	0.044	Avg CO2 concentration Hot Soak Background (t = 1494 to 1994 seconds)
62	CO2_2_Exh_m	*%*	Realtime	0.723	Avg CO2 concentration Phase 2 (t = 317 to 1437 seconds)
63	CO2_2_Bkg_m	*%*	Realtime	0.044	Avg CO2 concentration Hot Soak Background (t = 1494 to 1994 seconds)
64	CO2_3_Exh_m	*%*	Realtime	0.515	Avg CO2 concentration Phase 3 (t = 2037 to 2337 seconds)
65	CO2_3_Bkg_m	*%*	Realtime	0.044	Avg CO2 concentration Hot Soak Background (t = 1494 to 1994 seconds)
66	(Blank Field)				

Data Field #	Label	Units	Source	Example Value	Comment
67	SPCO2	*%*	Constant	13.40	Engine out CO2 (%) emitted at Stochiometry = 13.4 for both INDOLENE and UNKNOWN fuels.
68	DilFac_1_m		Calculated	19.07	Dilution Factor Phase 1 = SPCO2 / {CO2_1_Exh_m + (CO_1_Exh_m * 0.0001) +(HC_1_Exh_m * 0.0001)}
69	DilFac_2_m		Calculated	16.90	Dilution Factor Phase 2 = SPCO2 / {CO2_2_Exh_m + (CO_2_Exh_m * 0.0001) +(HC_2_Exh_m * 0.0001)}
70	DilFac_3_m		Calculated	25.08	Dilution Factor Phase 3 = SPCO2 / {CO2_3_Exh_m + (CO_3_Exh_m * 0.0001) +(HC_3_Exh_m * 0.0001)}
71	(Blank Field)				
72	HC_Density	*gm/cuft*	Constant	16.33	Density of HC
73	NOx_ Density	*gm/cuft*	Constant	54.16	Density of NOx
74	CO_Density	*gm/cuft*	Constant	32.97	Density of CO
75	CO2_Density	*gm/cuft*	Constant	51.81	Density of CO2
76	HC_1_mass_m	*Gm*	Calculated	3.856	HC mass for Phase 1 = 'Vmix_1 * HC_Density * {HC_Exh_1_m - HC_Bkg_1_m * (1 - 1/ DilFac_1_m)} / 1,000,000
77	HC_2_mass_m	*Gm*	Calculated	3.576	HC mass for Phase 2 = 'Vmix_2 * HC_Density * {HC_Exh_2_m - HC_Bkg_2_m * (1 - 1/ DilFac_2_m)} / 1,000,000
78	HC_3_mass_m	*Gm*	Calculated	0.501	HC mass for Phase 3 = 'Vmix_3 * HC_Density * {HC_Exh_3_m - HC_Bkg_3_m * (1 - 1/ DilFac_3_m)} / 1,000,000
79	NOx_1_mass_m	*Gm*	Calculated	5.445	NOx mass for Phase 1 = 'Vmix_1 * NOx_Density * {NOx_Exh_1_m - NOx_Bkg_1_m * (1 - 1/ DilFac_1_m)} / 1,000,000
80	NOx_2_mass_m	*Gm*	Calculated	17.625	NOx mass for Phase 2 = 'Vmix_2 * NOx_Density * {NOx_Exh_2_m - NOx_Bkg_2_m * (1 - 1/ DilFac_2_m)} / 1,000,000
81	NOx_3_mass_m	*Gm*	Calculated	3.173	NOx mass for Phase 3 = 'Vmix_3 * NOx_Density * {NOx_Exh_3_m - NOx_Bkg_3_m * (1 - 1/ DilFac_3_m)} / 1,000,000
82	NOx_1_mass_mc	*Gm*	Calculated	5.352	NOx (corrected) mass for Phase 1 = 'Vmix_1 * NOx_Density * NOx_Corr_Fac * {NOx_Exh_1_m - NOx_Bkg_1_m * (1 - 1/ DilFac_1_m)} / 1,000,000
83	NOx_2_mass_mc	*Gm*	Calculated	17.324	NOx (corrected) mass for Phase 2 = 'Vmix_2 *

Data Field #	Label	Units	Source	Example Value	Comment
					NOx_Density * NOx_Corr_Fac * {NOx_Exh_2_m - NOx_Bkg_2_m * (1 - 1/ DilFac_2_m)} / 1,000,000
84	NOx_3_mass_ mc	*Gm*	Calculated	3.119	NOx (corrected) mass for Phase 3 = 'Vmix_3 * NOx_Density * NOx_Corr_Fac * {NOx_Exh_3_m - NOx_Bkg_3_m * (1 - 1/ DilFac_3_m)} / 1,000,000
85	CO_1_mass_m	*Gm*	Calculated	47.714	CO mass for Phase 1 = 'Vmix_1 * CO_Density * {CO_Exh_1_m - CO_Bkg_1_m * (1 - 1/ DilFac_1_m)} / 1,000,000
86	CO_2_mass_m	*Gm*	Calculated	198.734	CO mass for Phase 2 = 'Vmix_2 * CO_Density * {CO_Exh_2_m - CO_Bkg_2_m * (1 - 1/ DilFac_2_m)} / 1,000,000
87	CO_3_mass_m	*Gm*	Calculated	14.075	CO mass for Phase 3 = 'Vmix_3 * CO_Density * {CO_Exh_3_m - CO_Bkg_3_m * (1 - 1/ DilFac_3_m)} / 1,000,000
88	CO2_1_mass_m	*Gm*	Calculated	721.378	CO2 mass for Phase 1 = 'Vmix_1 * CO2_Density * {CO2_Exh_1_m - CO2_Bkg_1_m * (1 - 1/ DilFac_1_m)} / 100
89	CO2_2_mass_m	*Gm*	Calculated	3152.989	CO2 mass for Phase 2 = 'Vmix_2 * CO2_Density * {CO2_Exh_2_m - CO2_Bkg_2 _m* (1 - 1/ DilFac_2_m)} / 100
90	C2O_3_mass_m	*Gm*	Calculated	578.488	CO2 mass for Phase 3 = 'Vmix_3 * CO2_Density * {CO2_Exh_3_m - CO2_Bkg_3_m * (1 - 1/ DilFac_3_m)} / 100
91	(Blank Field)				
92	HC_1_ER_m	*gm/mile*	Calculated	3.219	HC Emission Rate for Phase 1 = HC_1_mass_m / RR_Dist_1
93	HC_2_ER_m	*gm/mile*	Calculated	0.411	HC Emission Rate for Phase 2 = HC_2_mass_m / RR_Dist_2
94	HC_3_ER_m	*gm/mile*	Calculated	0.422	HC Emission Rate for Phase 3 = HC_3_mass_m / RR_Dist_3
95	NOx_1_ER_m	*gm/mile*	Calculated	4.546	NOx Emission Rate for Phase 1 = NOx_1_mass_m / RR_Dist_1
96	NOx_2_ER_m	*gm/mile*	Calculated	2.024	NOx Emission Rate for Phase 2 = NOx_2_mass_m / RR_Dist_2
97	NOx_3_ER_m	*gm/mile*	Calculated	2.673	NOx Emission Rate for Phase 2 = NOx_2_mass_m / RR_Dist_2

Data Field #	Label	Units	Source	Example Value	Comment
98	NOx_1_ER_mc	*gm/mile*	Calculated	4.469	Corrected NOx Emission Rate for Phase 1 = NOx_1_mass_mc / RR_Dist_1
99	NOx_2_ER_mc	*gm/mile*	Calculated	1.990	Corrected NOx Emission Rate for Phase 2 = NOx_2_mass_mc / RR_Dist_2
100	NOx_3_ER_mc	*gm/mile*	Calculated	2.627	Corrected NOx Emission Rate for Phase 3 = NOx_3_mass_mc / RR_Dist_3
101	CO_1_ER_m	*gm/mile*	Calculated	39.836	CO Emission Rate for Phase 1 = CO_1_mass_m / RR_Dist_1
102	CO_2_ER_m	*gm/mile*	Calculated	22.827	CO Emission Rate for Phase 2 = CO_2_mass_m / RR_Dist_2
103	CO_3_ER_m	*gm/mile*	Calculated	11.857	CO Emission Rate for Phase 3 = CO_3_mass_m / RR_Dist_3
104	CO2_1_ER_m	*gm/mile*	Calculated	602.271	CO2 Emission Rate for Phase 1 = CO2_1_mass_m / RR_Dist_1
105	CO2_2_ER_m	*gm/mile*	Calculated	362.153	CO2 Emission Rate for Phase 2 = CO2_2_mass_m / RR_Dist_2
106	CO2_3_ER_m	*gm/mile*	Calculated	487.342	CO2 Emission Rate for Phase 3 = CO2_3_mass_m / RR_Dist_3
107	(Blank Field)				
108	HC_wt_ER_m	*gm/mile*	Calculated	0.558	Weighted HC emission rate = 0.43 *{(HC_1_mass_m +HC_2_mass_m)/ (RR_Dist_1 + RR_Dist_2)} + 0.57 * {(HC_3_mass_m + HC_2_mass_m) / (RR_Dist_3 + RR_Dist_2)}
109	NOx_wt_ER_m	*gm/mile*	Calculated	2.200	Weighted NOx emission rate = 0.43 *{(NOx_1_mass_m +NOx_2_mass_m)/ (RR_Dist_1 + RR_Dist_2)} + 0.57 * {(NOx_3_mass_m + NOx_2_mass_m) / (RR_Dist_3 + RR_Dist_2)}
110	NOx_wt_ER_mc	*gm/mile*	Calculated	2.162	Weighted NOx (corrected) emission rate = 0.43 *{(NOx_1_mass_mc +NOx_2_mass_mc)/ (RR_Dist_1 + RR_Dist_2)} + 0.57 * {(NOx_3_mass_mc + NOx_2_mass_mc) / (RR_Dist_3 + RR_Dist_2)}
111	CO_wt_ER_m	*gm/mile*	Calculated	22.961	Weighted CO emission rate = 0.43 *{(CO_1_mass_m +CO_2_mass_m)/ (RR_Dist_1 + RR_Dist_2)} + 0.57 * {(CO_3_mass_m + CO_2_mass_m) / (RR_Dist_3 + RR_Dist_2)}
112	CO2_wt_ER_m	*gm/mile*	Calculated	383.202	Weighted CO2 emission rate = 0.43 *{(CO2_1_mass_m +CO2_2_mass_m)/ (RR_Dist_1 + RR_Dist_2)} + 0.57 *

Data Field #	Label	Units	Source	Example Value	Comment
					{(CO2_3_mass_m + CO2_2_mass_m) / (RR_Dist_3 + RR_Dist_2)}
113	(Blank Field)				
114	CRHC	*Fuel Wt% C*	Constant	0.840	Weight percent carbon in fuel / 100 = 0.867 for INDOLENE and 0.840 for UNKNOWN fuels.
115	CGAL	*gmC/galFuel*	Constant	2350.000	Carbon density in fuel = 2434 for INDOLENE and 2350 for UNKNOWN fuels.
116	FE_1_m	*mpg*	Calculated	12.76	Fuel Economy for Phase 1 = GGAL / (CRHC * HC_1_ER_m + 0.429 * CO_1_ER_m + 0.273 * CO2_1_ER_m)
117	FE_2_m	*mpg*	Calculated	21.56	Fuel Economy for Phase 2 = GGAL / (CRHC * HC_2_ER_m + 0.429 * CO_2_ER_m + 0.273 * CO2_2_ER_m)
118	FE_3_m	*mpg*	Calculated	16.97	Fuel Economy for Phase 3 = GGAL / (CRHC * HC_3_ER_m + 0.429 * CO_3_ER_m + 0.273 * CO2_3_ER_m)
119	FE_wt_m	*mpg*	Calculated	20.45	Weighted Fuel Economy = GGAL / (CRHC * HC_wt_ER_m + 0.429 * CO_wt_ER_m + 0.273 * CO2_wt_ER_m)
120	(Blank Field)				
121	HC_1_Exh_b	*ppmC*	Keyboard Input	93.0	Bag HC diluted exhaust concentration for Phase 1
122	HC_1_Bkg_b	*ppmC*	Keyboard Input	4.0	Bag HC background concentration for Phase 1
123	HC_2_Exh_b	*ppmC*	Keyboard Input	30.0	Bag HC diluted exhaust concentration for Phase 2
124	HC_2_Bkg_b	*ppmC*	Keyboard Input	4.0	Bag HC background concentration for Phase 2
125	HC_3_Exh_b	*ppmC*	Keyboard Input	18.0	Bag HC diluted exhaust concentration for Phase 3
126	HC_3_Bkg_b	*ppmC*	Keyboard Input	5.0	Bag HC background concentration for Phase 3
127	(Blank Field)				
128	NOx_1_Exh_b	*Ppm*	Keyboard Input	27.7	Bag NOx diluted exhaust concentration for Phase 1
129	NOx_1_Bkg_b	*Ppm*	Keyboard Input	0.0	Bag NOx background concentration for Phase 1
130	NOx_2_Exh_b	*Ppm*	Keyboard Input	25.1	Bag NOx diluted exhaust concentration for Phase 2
131	NOx_2_Bkg_b	*Ppm*	Keyboard Input	0.1	Bag NOx background concentration for Phase 2
132	NOx_3_Exh_b	*Ppm*	Keyboard Input	23.4	Bag NOx diluted exhaust concentration for Phase 3

Data Field #	Label	Units	Source	Example Value	Comment
133	NOx_3_Bkg_b	*Ppm*	Keyboard Input	0.2	Bag NOx background concentration for Phase 3
134	(Blank Field)				
135	CO_1_Exh_b	*Ppm*	Keyboard Input	601.0	Bag CO diluted exhaust concentration for Phase 1
136	CO_1_Bkg_b	*Ppm*	Keyboard Input	0.0	Bag CO background concentration for Phase 1
137	CO_2_Exh_b	*Ppm*	Keyboard Input	661.0	Bag CO diluted exhaust concentration for Phase 2
138	CO_2_Bkg_b	*Ppm*	Keyboard Input	0.0	Bag CO background concentration for Phase 2
139	CO_3_Exh_b	*Ppm*	Keyboard Input	183.0	Bag CO diluted exhaust concentration for Phase 3
140	CO_3_Bkg_b	*Ppm*	Keyboard Input	0.0	Bag CO background concentration for Phase 3
141	(Blank Field)				
142	CO2_1_Exh_b	*%*	Keyboard Input	0.6319	Bag CO2 diluted exhaust concentration for Phase 1
143	CO2_1_Bkg_b	*%*	Keyboard Input	0.0419	Bag CO2 background concentration for Phase 1
144	CO2_2_Exh_b	*%*	Keyboard Input	0.7136	Bag CO2 diluted exhaust concentration for Phase 2
145	CO2_2_Bkg_b	*%*	Keyboard Input	0.0404	Bag CO2 background concentration for Phase 2
146	CO2_3_Exh_b	*%*	Keyboard Input	0.5300	Bag CO2 diluted exhaust concentration for Phase 3
147	CO2_3_Bkg_b	*%*	Keyboard Input	0.0449	Bag CO2 background concentration for Phase 3
148	(Blank Field)				
149	DilFac_1_b		Calculated	19.11	Dilution Factor Phase 1 = SPCO2 / {CO2_1_Exh_b + (CO_1_Exh_b * 0.0001) +(HC_1_Exh_b * 0.0001)}
150	DilFac_2_b		Calculated	17.12	Dilution Factor Phase 2 = SPCO2 / {CO2_2_Exh_b + (CO_2_Exh_b * 0.0001) +(HC_2_Exh_b * 0.0001)}
151	DilFac_3_b		Calculated	24.36	Dilution Factor Phase 3 = SPCO2 / {CO2_3_Exh_m + (CO_3_Exh_m * 0.0001) +(HC_3_Exh_m * 0.0001)}
152	(Blank Field)				
153	HC_1_mass_b	*Gm*	Calculated	3.441	HC mass for Phase 1 = 'Vmix_1 * HC_Density * {HC_Exh_1_b - HC_Bkg_1_b * (1 - 1/ DilFac_1_b)} / 1,000,000
154	HC_2_mass_b	*Gm*	Calculated	3.825	HC mass for Phase 2 = 'Vmix_2 * HC_Density * {HC_Exh_2_b - HC_Bkg_2_b * (1 - 1/ DilFac_2_b)} / 1,000,000
155	HC_3_mass_b	*Gm*	Calculated	0.509	HC mass for Phase 3 = 'Vmix_3 * HC_Density * {HC_Exh_3_b - HC_Bkg_3_b * (1 - 1/ DilFac_3_b)} /

Data Field #	Label	Units	Source	Example Value	Comment
					1,000,000
156	NOx_1_mass_b	*Gm*	Calculated	3.548	NOx mass for Phase 1 = 'Vmix_1 * NOx_Density * {NOx_Exh_1_b - NOx_Bkg_1_b * (1 - 1/ DilFac_1_b)} / 1,000,000
157	NOx_2_mass_b	*Gm*	Calculated	12.091	NOx mass for Phase 2 = 'Vmix_2 * NOx_Density * {NOx_Exh_2_b - NOx_Bkg_2_b * (1 - 1/ DilFac_2_b)} / 1,000,000
158	NOx_3_mass_b	*Gm*	Calculated	2.966	NOx mass for Phase 3 = 'Vmix_3 * NOx_Density * {NOx_Exh_3_b - NOx_Bkg_3_b * (1 - 1/ DilFac_3_b)} / 1,000,000
159	NOx_1_mass_bc	*Gm*	Calculated	3.488	NOx (corrected) mass for Phase 1 = 'Vmix_1 * NOx_Density * NOx_Corr_Fac * {NOx_Exh_1_b - NOx_Bkg_1_b * (1 - 1/ DilFac_1_b)} / 1,000,000
160	NOx_2_mass_bc	*Gm*	Calculated	11.885	NOx (corrected) mass for Phase 2 = 'Vmix_2 * NOx_Density * NOx_Corr_Fac * {NOx_Exh_2_b - NOx_Bkg_2_b * (1 - 1/ DilFac_2_b)} / 1,000,000
161	NOx_3_mass_ bc	*Gm*	Calculated	2.915	NOx (corrected) mass for Phase 3 = 'Vmix_3 * NOx_Density * NOx_Corr_Fac * {NOx_Exh_3_b - NOx_Bkg_3_b * (1 - 1/ DilFac_3_b)} / 1,000,000
162	CO_1_mass_b	*Gm*	Calculated	46.800	CO mass for Phase 1 = 'Vmix_1 * CO_Density * {CO_Exh_1_b - CO_Bkg_1_b * (1 - 1/ DilFac_1_b)} / 1,000,000
163	CO_2_mass_b	*Gm*	Calculated	194.576	CO mass for Phase 2 = 'Vmix_2 * CO_Density * {CO_Exh_2_b - CO_Bkg_2_b * (1 - 1/ DilFac_2_b)} / 1,000,000
164	CO_3_mass_b	*Gm*	Calculated	14.256	CO mass for Phase 3 = 'Vmix_3 * CO_Density * {CO_Exh_3_b - CO_Bkg_3_b * (1 - 1/ DilFac_3_b)} / 1,000,000
165	CO2_1_mass_b	*Gm*	Calculated	724.662	CO2 mass for Phase 1 = 'Vmix_1 * CO2_Density * {CO2_Exh_1_b - CO2_Bkg_1_b * (1 - 1/ DilFac_1_b)} / 100
166	CO2_2_mass_b	*Gm*	Calculated	3125.115	CO2 mass for Phase 2 = 'Vmix_2 * CO2_Density * {CO2_Exh_2_b - CO2_Bkg_2_b * (1 - 1/ DilFac_2_b)} / 100
167	C2O_3_mass_b	*Gm*	Calculated	596.042	CO2 mass for Phase 3 = 'Vmix_3 * CO2_Density * {CO2_Exh_3_b - CO2_Bkg_3_b * (1 - 1/ DilFac_3_b)} / 100

Data Field #	Label	Units	Source	Example Value	Comment
168	(Blank Field)				
169	HC_1_ER_b	*gm/mile*	Calculated	2.873	HC Emission Rate for Phase 1 = HC_1_mass_b / RR_Dist_1
170	HC_2_ER_b	*gm/mile*	Calculated	0.439	HC Emission Rate for Phase 2 = HC_2_mass_b / RR_Dist_2
171	HC_3_ER_b	*gm/mile*	Calculated	0.429	HC Emission Rate for Phase 3 = HC_3_mass_b / RR_Dist_3
172	NOx_1_ER_b	*gm/mile*	Calculated	2.963	NOx Emission Rate for Phase 1 = NOx_1_mass_b / RR_Dist_1
173	NOx_2_ER_b	*gm/mile*	Calculated	1.389	NOx Emission Rate for Phase 2 = NOx_2_mass_b / RR_Dist_2
174	NOx_3_ER_b	*gm/mile*	Calculated	2.499	NOx Emission Rate for Phase 2 = NOx_2_mass_b / RR_Dist_2
175	NOx_1_ER_bc	*gm/mile*	Calculated	2.912	Corrected NOx Emission Rate for Phase 1 = NOx_1_mass_bc / RR_Dist_1
176	NOx_2_ER_bc	*gm/mile*	Calculated	1.365	Corrected NOx Emission Rate for Phase 2 = NOx_2_mass_bc / RR_Dist_2
177	NOx_3_ER_bc	*gm/mile*	Calculated	2.456	Corrected NOx Emission Rate for Phase 3 = NOx_3_mass_bc / RR_Dist_3
178	CO_1_ER_b	*gm/mile*	Calculated	39.073	CO Emission Rate for Phase 1 = CO_1_mass_b / RR_Dist_1
179	CO_2_ER_b	*gm/mile*	Calculated	22.349	CO Emission Rate for Phase 2 = CO_2_mass_b / RR_Dist_2
180	CO_3_ER_b	*gm/mile*	Calculated	12.010	CO Emission Rate for Phase 3 = CO_3_mass_b / RR_Dist_3
181	CO2_1_ER_b	*gm/mile*	Calculated	605.013	CO2 Emission Rate for Phase 1 = CO2_1_mass_b / RR_Dist_1
182	CO2_2_ER_b	*gm/mile*	Calculated	358.952	CO2 Emission Rate for Phase 2 = CO2_2_mass_b / RR_Dist_2
183	CO2_3_ER_b	*gm/mile*	Calculated	502.130	CO2 Emission Rate for Phase 3 = CO2_3_mass_b / RR_Dist_3
184	(Blank Field)				
185	HC_wt_ER_b	*gm/mile*	Calculated	0.565	Weighted HC emission rate = 0.43 *{(HC_1_mass_b +HC_2_mass_b)/ (RR_Dist_1 + RR_Dist_2)} + 0.57 * {(HC_3_mass_b + HC_2_mass_b) / (RR_Dist_3 + RR_Dist_2)}

Data Field #	Label	Units	Source	Example Value	Comment
186	NOx_wt_ER_b	*gm/mile*	Calculated	1.547	Weighted NOx emission rate = 0.43 *{(NOx_1_mass_b +NOx_2_mass_b)/ (RR_Dist_1 + RR_Dist_2)} + 0.57 * {(NOx_3_mass_b + NOx_2_mass_b) / (RR_Dist_3 + RR_Dist_2)}
187	NOx_wt_ER_mb	*gm/mile*	Calculated	1.520	Weighted NOx (corrected) emission rate = 0.43 *{(NOx_1_mass_bc +NOx_2_mass_bc)/ (RR_Dist_1 + RR_Dist_2)} + 0.57 * {(NOx_3_mass_bc + NOx_2_mass_bc) / (RR_Dist_3 + RR_Dist_2)}
188	CO_wt_ER_b	*gm/mile*	Calculated	22.512	Weighted CO emission rate = 0.43 *{(CO_1_mass_b +CO_2_mass_b)/ (RR_Dist_1 + RR_Dist_2)} + 0.57 * {(CO_3_mass_b + CO_2_mass_b) / (RR_Dist_3 + RR_Dist_2)}
189	CO2_wt_ER_b	*gm/mile*	Calculated	381.540	Weighted CO2 emission rate = 0.43 *{(CO2_1_mass_b +CO2_2_mass_b)/ (RR_Dist_1 + RR_Dist_2)} + 0.57 * {(CO2_3_mass_b + CO2_2_mass_b) / (RR_Dist_3 + RR_Dist_2)}
190	(Blank Field)				
191	FE_1_b	*mpg*	Calculated	12.748	Fuel Economy for Phase 1 = GGAL / (CRHC * HC_1_ER_b + 0.429 * CO_1_ER_b + 0.273 * CO2_1_ER_b)
192	FE_2_b	*mpg*	Calculated	21.769	Fuel Economy for Phase 2 = GGAL / (CRHC * HC_2_ER_b + 0.429 * CO_2_ER_b + 0.273 * CO2_2_ER_b)
193	FE_3_b	*mpg*	Calculated	16.480	Fuel Economy for Phase 3 = GGAL / (CRHC * HC_3_ER_b + 0.429 * CO_3_ER_b + 0.273 * CO2_3_ER_b)
194	FE_wt_b	*mpg*	Calculated	20.561	Weighted Fuel Economy = GGAL / (CRHC * HC_wt_ER_b + 0.429 * CO_wt_ER_b + 0.273 * CO2_wt_ER_b)
195	(Blank Field)				
196	FR_Dist_1	*Miles*	Realtime	1.196	Not used - Front roll Distance Phase 1
197	FR_Dist_2	*Miles*	Realtime	8.615	Not used - Front roll Distance Phase 2
198	FR_Dist_3	*Miles*	Realtime	1.172	Not used - Front roll Distance Phase 3
199	Avg_Tork_1	*Ft-lbs*	Realtime	2.235	Not used - Average torque Phase 1
200	Avg_Tork_2	*Ft-lbs*	Realtime	6.363	Not used - Average torque Phase 2

Data Field #	Label	Units	Source	Example Value	Comment
201	Avg_Tork_3	*Ft-lbs*	Realtime	2.111	Not used - Average torque Phase 3
202	PAU Temp.	*C*	Realtime	29.78	Not used - Average dynamometer PAU temperature over entire test cycle
203	Amb. HC	*ppmC*	Realtime	2.07	Not used - Average HC concentration inside test facility over entire test cycle.

Kansas City PM Characterization Study
Final Report

Appendix G
Other Round 1 Data

Assessment and Standards Division
Office of Transportation and Air Quality
U.S. Environmental Protection Agency

Sponsors:

National Renewable Energy Laboratory, U.S. Department of Energy
Federal Highway Administration, U.S. Department of Transportation
STAPPA-ALAPCO Emission Inventory Improvement Program
Coordinating Research Council Inc. (Project No. E-69)

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EPA United States Environmental Protection Agency

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Weighted Emissions and Fuel Economy

Weighted Regulated Emissions and Fuel Economy for the Round 2 Kansas City Test Fleet.

RUN #	Veh Yr, Make, Model	Odometer	Inertia	Hp@50mph	HC	NOx	CO	CO2	Fuel Economy
		Miles	*Lbs*		*gm/mile*	*gm/mile*	*gm/mile*	*gm/mile*	*mpg*
84393	1999 Chrysler 300M	90240	3500	5.8	0.34	0.30	3.19	451.26	18.82
84394	2000 Honda Odyssey	74601	4500	9.6	0.31	0.30	5.25	532.05	15.90
84396	1995 Ford Escort	106996	2750	5.6	0.30	1.39	8.74	387.69	21.40
84397	1975 Chevrolet Silverado 20 PU	2893	4000	13.9	4.96	3.55	73.86	563.04	12.40
84398	2001 Honda Accord	62350	3500	7.8	0.20	0.16	3.07	404.32	21.01
84399	1997 Honda Accord	82926	3000	4.9	0.25	0.29	6.72	401.31	20.86
84401	1998 Plymouth Voyager	168876	4000	7.0	0.34	0.96	4.57	497.11	17.03
84402	1991 Honda Civic	220022	2500	6.5	1.02	2.62	17.42	339.37	23.27
84403	2000 Dodge Caravan	85198	3500	7.2	0.61	0.33	5.21	475.94	17.71
84404	1997 Dodge Caravan	96455	3500	7.2	0.58	0.83	5.83	520.99	16.18
84406	1995 Toyota Corolla	107983	2500	6.0	0.79	0.99	9.47	358.70	22.89
84407	1989 Pontiac GrandAm	123575	3000	5.9	2.90	4.59	24.18	368.82	20.71
84408	2002 Mercury Sable	29501	3500	6.8	0.38	0.23	0.86	488.23	17.54
84409	1999 Chevrolet Malibu	79925	3500	5.8	0.50	1.15	8.38	434.57	19.16
84411	1996 Saturn SC	78346	2500	6.0	0.53	0.84	5.42	385.40	21.76
84412	1996 Honda Civic	140479	2500	6.9	0.56	0.47	9.62	307.12	26.57
84413	1979 Ford F250 PU	5797	3500	10.5	1.88	1.42	34.23	708.01	11.21
84414	2003 Chevrolet Impala	11340	3500	2.9	0.12	0.11	1.60	451.14	18.96
84415	1999 Dodge Durango	95999	5000	16.9	0.33	1.63	8.13	717.79	11.77
84416	1998 Honda Civic	118218	2500	5.1	0.19	0.08	6.60	282.54	29.33
84418	1997 Pontiac Grand Am	58100	3000	3.8	0.24	0.90	3.92	439.87	19.27
84419	1998 Chevrolet Lumina	79187	3500	5.5	0.45	0.52	6.90	443.85	18.87
84420	2000 Honda Accord	84180	3500	7.5	0.25	0.36	5.16	381.06	22.07
84421	2000 Saturn Sedan	51721	2750	4.0	0.24	0.41	2.29	364.46	23.34
84422	1998 Jeep Cherokee	137053	3500	11.8	1.50	5.27	16.91	524.61	15.49

RUN #	Veh Yr, Make, Model	Odometer	Inertia	Hp@50mph	HC	NOx	CO	CO2	Fuel Economy
		Miles	*Lbs*		*gm/mile*	*gm/mile*	*gm/mile*	*gm/mile*	*mpg*
84424	1995 Ford Explorer	162634	4500	11.5	0.24	2.39	4.04	582.51	14.60
84425	1995 Jeep Grand Cherokee Laredo	179121	4000	13.1	2.23	5.50	16.13	535.87	15.15
84426	2001 Saturn Sedan	44251	2750	3.7	0.22	0.10	6.53	307.26	27.05
84427	2001 Mitsubishi Galant	51764	2750	3.7	0.11	0.13	0.88	355.37	24.11
84428	1998 Chevrolet Malibu	107047	3500	5.9	0.38	0.72	5.57	420.56	20.00
84430	1990 Dodge Spirit	93661	3000	8.2	0.63	1.75	16.22	391.82	20.53
84431	1991 Mercury Grand Marquis S/W	19292	4000	10.3	1.15	1.36	12.66	512.73	16.05
84432	1999 Saturn Sedan	98565	2500	5.5	0.41	0.29	2.92	301.79	27.98
84433	1997 Jeep Wrangler	97532	3500	16.1	0.28	0.32	3.62	489.05	17.37
84436	1995 Chevrolet S10 PU	124976	3500	10.8	0.37	0.64	9.30	494.16	16.88
84437	1994 Toyota Camry	131874	3500	7.2	0.30	0.34	2.59	432.41	19.68
84438	2001 Buick Century	33749	3500	5.3	0.11	0.10	2.14	440.98	19.36
84439	1995 Pontiac Bonneville	168145	3500	5.3	0.39	1.64	5.67	465.18	18.11
84440	1995 Buick Park Avenue	144956	4000	7.2	0.36	1.10	5.39	496.96	16.99
84442	1994 Toyota Camry	131894	3500	7.2	0.30	0.35	2.63	473.49	17.99
84443	1991 Geo Prizm	132326	2500	7.4	0.60	1.94	6.63	333.20	24.92
84444	2003 Chevrolet Tracker	29519	3000	12.7	0.31	0.20	1.20	451.84	18.93
84445	2001 Saturn Sedan	67290	3000	6.4	0.24	0.24	2.18	425.97	20.01
84446	2000 Toyota Sienna	137493	4000	6.5	0.76	0.63	5.18	512.24	16.47
84448	1999 Plymouth Voyager	79230	4000	6.4	0.44	0.41	6.22	524.29	16.08
84449	1994 Buick Regal	92177	3500	5.6	0.44	1.14	7.93	475.53	17.59
84451	1994 Buick Regal	92214	3500	5.6	0.40	1.25	7.13	463.18	18.10
84452	1995 Ford Taurus	139316	3500	6.5	0.27	1.10	6.27	461.35	18.24
84453	1995 Nissan Maxima	181395	3500	6.5	0.53	1.08	4.10	431.58	19.58
84455	1995 Ford Mustang	146289	3500	7.5	0.24	0.44	4.66	429.22	19.69
84456	1993 Pontiac Grand Prix	177931	3500	5.0	1.46	1.54	25.72	490.92	16.07
84457	1995 Ford Crown Vic	179731	4000	8.5	0.49	2.03	6.97	493.93	17.00

RUN #	Veh Yr, Make, Model	Odometer	Inertia	Hp@50mph	HC	NOx	CO	CO2	Fuel Economy
		Miles	*Lbs*		*gm/mile*	*gm/mile*	*gm/mile*	*gm/mile*	*mpg*
84458	1993 Ford Aerostar	147319	3500	11.1	0.69	1.31	16.85	491.60	16.55
84459	1992 Ford Aerostar	164560	3500	11.4	0.43	1.85	8.80	470.54	17.72
84462	1989 Plymouth Voyager	145307	3500	7.6	3.33	1.16	99.70	393.33	15.36
84463	1995 Ford Contour	104083	3000	5.0	0.25	0.77	7.56	367.51	22.64
84464	1994 Dodge Intrepid	145950	3500	5.1	0.61	0.89	5.95	447.10	18.78
84465	1994 Chevrolet Lumina APV	124172	4000	8.9	0.23	0.92	3.34	525.91	16.19
84467	1988 Ford Ranger PU	77528	3500	10.2	1.62	1.82	17.68	361.70	21.82
84468	1994 Chevrolet Lumina APV	124200	4000	8.9	0.23	0.78	3.54	500.24	16.99
84469	1989 Dodge Caravan	162878	3500	7.6	1.39	2.59	15.30	443.27	18.25
84470	1973 Mercedes 280 SE	86134	4000	11.4	16.18	2.14	212.80	518.00	9.54
84472	1977 Chevrolet Monte Carlo	36999	4000	11.6	4.28	2.04	59.50	492.55	14.37
84473	1996 Ford Explorer	109593	4500	11.8	0.19	0.83	3.18	577.33	14.77
84474	1988 Honda Civic	207265	2250	6.4	1.08	1.23	10.66	269.45	29.73
84475	1986 Ford Tempo	70396	2500	6.9	1.61	0.85	31.43	400.69	18.92
84477	1989 Dodge Ram 50	133981	3500	15.0	1.50	1.81	58.74	423.59	16.54
84479	1996 Dodge Caravan	118369	4000	7.2	0.39	0.77	5.40	495.16	17.05
84482	1979 Buick Lasabre	40364	3500	10.5	1.11	6.99	12.85	512.47	16.06
84483	1996 Dodge Neon	79848	2500	7.2	0.38	0.41	4.00	353.76	23.83
84484	1979 Buick Lesabre	40385	3500	10.5	1.05	7.08	12.37	509.20	16.18
84485	1991 Cadillac Fleetwood	97124	4000	6.9	1.10	1.03	25.17	573.71	13.96
84487	1992 Mazda B2200 PU	101090	3000	10.7	0.96	2.87	46.03	422.81	17.28
84488	1995 Buick Lesabre	126036	3500	7.1	0.19	0.85	3.01	473.81	17.97
84489	1987 Toyota PU	232098	2750	9.6	0.67	3.12	3.14	386.87	21.85
84490	1991 Cadillac Fleetwood	97144	4000	6.9	0.97	1.02	25.02	558.72	14.32
84492	1984 Chevy C-10 Silverado	82259	4000	15.2	1.46	1.64	21.02	547.12	14.72
84493	2004 Ford Freestar Minivan	14714	4500	10.0	0.06	0.03	0.51	464.40	18.50
84494	1997 Ford Ranger PU	118470	3500	10.9	0.22	1.20	4.63	376.85	22.37

RUN #	Veh Yr, Make, Model	Odometer	Inertia	Hp@50mph	HC	NOx	CO	CO2	Fuel Economy
		Miles	*Lbs*		*gm/mile*	*gm/mile*	*gm/mile*	*gm/mile*	*mpg*
84495	1996 GMC Sonoma PU	51863	3000	9.2	0.32	0.52	5.61	364.50	23.00
84497	1995 Toyota 4 Runner	85898	4000	12.9	0.37	0.56	7.47	568.66	14.80
84498	2001 Toyota Sienna	59734	4000	10.0	0.28	0.42	3.33	472.34	17.99
84499	1995 Acura Integra	80579	2750	7.2	0.47	0.32	8.94	349.67	23.57
84500	1998 Nissan Frontier PU	112521	3500	11.0	0.53	1.90	6.10	411.04	20.39
84502	1996 Chrysler Concorde	111502	3500	7.7	0.45	0.49	3.86	529.94	16.02
84503	2002 Ford Taurus	26406	4000	8.0	0.11	0.20	0.77	478.12	17.95
84504	2000 Chrysler Concorde	65330	3000	11.3	0.38	0.38	2.82	436.22	19.48
84505	1993 Dodge Intrepid	210298	3500	6.8	0.62	1.70	6.65	441.11	18.98
84508	1992 Honda Civic	124705	2250	4.6	0.47	0.59	11.66	274.72	29.23
84509	1992 Chevrolet Astrovan	217165	4000	12.5	2.13	3.50	17.45	518.77	15.57
84510	1994 Chevrolet Suburban	187410	5500	10.8	2.75	3.76	31.84	628.93	12.52
84512	1982 Chevrolet Caprice	88587	4000	4.6	18.05	0.70	180.26	376.77	12.03
84514	2002 Chrysler Concorde	34231	3500	7.8	0.22	0.21	1.30	472.65	18.11
84515	1999 Dodge Stratus	108838	3000	5.5	0.33	0.71	8.40	405.03	20.53
84517	1998 Dodge Caravan	80989	4000	7.9	0.40	0.66	3.62	513.63	16.54
84518	1994 Buick Skylark	200811	3000	5.4	0.58	0.75	9.26	437.18	18.98
84519	1992 Dodge Caravan	213493	3500	8.0	1.13	3.20	11.23	467.29	17.62
84520	2001 Ford Taurus	47479	3500	6.8	0.13	0.18	1.07	475.69	18.02
84521	1997 Honda Accord	101888	3000	4.9	0.25	0.49	5.06	406.63	20.72
84522	1996 Chevrolet 1500 PU	46711	4000	12.2	0.29	0.41	2.89	506.94	16.80
84524	1995 Isuzu PU	87225	3000	12.0	0.41	1.27	6.62	352.20	23.66
84526	1991 Lincoln Towncar	188033	4000	7.1	0.79	1.20	9.29	508.24	16.39
84527	1995 Dodge Ram 1500 PU	93425	4000	15.0	0.66	0.55	10.27	654.32	12.80
84528	1994 Mercury Grand Marquis	130521	4000	10.7	0.61	1.59	8.85	528.16	15.83
84529	1993 Plymouth Sundance	84652	2750	6.3	1.10	1.47	20.93	387.47	20.31
84531	1992 Geo Tracker	48704	2750	14.5	0.73	1.72	22.10	353.40	22.05

RUN #	Veh Yr, Make, Model	Odometer	Inertia	Hp@50mph	HC	NOx	CO	CO2	Fuel Economy
		Miles	*Lbs*		*gm/mile*	*gm/mile*	*gm/mile*	*gm/mile*	*mpg*
84532	2003 Pontiac Montana	49337	4500	10.1	0.21	0.26	3.84	509.28	16.68
84533	1999 Chevrolet Suburban	88900	5000	12.5	0.31	1.08	4.23	673.62	12.64
84534	1993 Subaru Legacy	114227	3500	9.0	0.58	0.71	5.24	414.02	20.30
84537	2000 Jeep Cherokee	88513	3500	12.5	0.30	0.74	4.49	535.46	15.84
84538	1998 Ford Ranger PU	48208	3500	11.7	0.14	1.11	2.79	512.19	16.65
84539	1996 Chevrolet Tahoe	69010	4500	12.5	0.61	0.76	7.53	592.89	14.19
84541	1996 Dodge Caravan	161280	4000	7.2	0.70	1.06	13.63	469.33	17.46
84542	1996 Dodge Caravan	161308	4000	7.2	0.75	1.09	14.93	481.07	16.98
84543	2000 Jeep Cherokee	88541	3500	12.5	0.24	0.76	4.07	536.32	15.84
84546	1999 Dodge Dakota PU	64155	3500	9.6	0.37	0.72	5.54	503.25	16.78
84547	1995 Toyota Corolla	103068	2750	6.0	0.39	0.42	3.77	306.40	27.46
84548	1995 Dodge Intrepid	138989	3500	5.9	0.47	0.63	3.77	429.21	19.72
84550	1988 Lincoln Continental	31667	4000	8.3	2.50	2.08	17.54	527.39	15.30
84551	2002 Isuzu Axiom	46363	4000	13.4	0.25	0.24	4.16	523.63	16.21
84552	2002 Oldsmobile Silouette	61168	4000	9.2	0.17	0.20	3.27	485.60	17.52
84554	1992 Ford F50 PU	134791	4500	14.6	0.67	1.45	9.33	613.82	13.65
84556	2001 Chrysler Town & Country	75545	4500	8.4	0.27	0.84	4.15	495.20	17.13
84557	2000 Buick Park Avenue	67099	4000	6.6	0.21	0.34	2.07	504.83	16.92
84558	2001 Chevrolet S-10 PU	106236	4000	9.8	0.65	0.37	5.84	549.97	15.34
84562	2004 Dodge Dakota PU	8627	4000	12.6	0.10	0.10	0.78	505.30	16.98
84563	2003 Ford Ranger 4X4 PU	18757	3500	11.5	0.17	0.14	1.88	528.98	16.17
84564	1998 Dodge Caravan	127230	4000	7.9	0.27	0.68	3.47	485.11	17.52
84566	1995 Honda Odyssey	109044	3500	9.8	0.51	0.50	8.00	468.35	17.84
84567	1992 Cadillac Sedan De-Ville	155895	4000	6.9	12.49	0.40	247.44	402.09	10.38
84568	1999 Ford Ranger PU	126851	3500	9.0	0.62	1.40	9.17	393.04	21.03
84569	1995 Ford Taurus	203067	3500	5.4	0.30	0.89	6.38	431.84	19.44
84570	1994 Chevrolet S10 PU	63902	3000	9.8	0.33	0.49	9.14	394.01	21.03

RUN #	Veh Yr, Make, Model	Odometer	Inertia	Hp@50mph	HC	NOx	CO	CO2	Fuel Economy
		Miles	*Lbs*		*gm/mile*	*gm/mile*	*gm/mile*	*gm/mile*	*mpg*
84572	1994 Mercury Topaz	41482	2750	7.0	0.42	1.10	8.04	409.75	20.32
84573	1993 Buick Park Avenue	74444	4000	6.1	0.22	1.01	3.09	521.44	16.34
84574	1993 Ford Taurus	39476	3500	5.5	0.35	0.89	7.84	417.99	19.95
84575	1994 Chevrolet Lumina	126825	3500	5.4	0.89	1.54	18.57	441.69	18.17
84577	1998 Ford Aerostar	0	4000	7.9	0.22	1.67	7.19	505.33	16.64
84580	2002 Chrysler Town & Country	84580	4500	11.1	0.19	0.61	3.16	513.29	16.59
84581	1995 Chevrolet Corsica	78767	3000	5.9	0.40	0.78	6.26	415.79	20.17
84582	1988 BMW 528e	287806	3500	10.7	2.08	1.37	24.52	378.95	20.31
84584	1995 Nissan PU	86705	3500	12.0	0.31	0.32	4.68	392.23	21.49
84585	1993 Ford Escort SW	99988	2750	6.6	0.15	1.83	3.98	324.07	26.02
84587	1996 Mercury Villager	166799	4000	7.9	0.64	1.12	4.87	488.31	17.29
84588	1978 Buick Regal	81379	4000	9.9	1.79	1.54	44.64	637.58	12.07
84589	2001 Saturn	56662	2750	6.1	0.14	0.17	1.49	306.50	27.83
84591	1993 Toyota 4Runner	178462	4000	12.9	0.36	1.64	7.15	552.38	15.24
84592	1979 Ford LTD	65850	4000	10.7	5.77	1.90	76.23	346.40	17.79
84593	1998 Honda Accord	75067	3000	4.0	0.13	0.16	3.31	370.68	22.88
84595	1988 Ford Escort	133085	2750	6.0	0.15	1.14	4.17	340.49	24.77
84596	1997 Ford Taurus	97601	3500	6.7	0.22	0.80	5.50	463.01	18.22
84597	1994 Pontiac Sunbird	145869	2750	5.2	0.87	0.46	17.65	355.20	22.32
84599	1998 Toyota Avalon	29575	3500	5.8	0.57	0.28	3.29	429.75	19.71
84600	1993 Ford Explorer	47980	4000	10.2	0.42	1.25	8.53	573.83	14.63
84601	1979 Buick Regal	5864	3500	11.8	4.54	2.81	61.35	481.09	14.55
84603	1979 Nissan Datsun 210 Wagon	47114	2500	9.8	2.85	3.36	13.43	311.23	25.24
84605	1977 Nissan 280Z	94782	3000	9.9	1.70	2.59	16.29	501.77	16.16
84608	1996 Nissan Quest	125651	4000	10.0	0.44	0.35	4.98	464.19	18.18
84609	1978 Buick Regal	64571	3500	10.8	3.64	2.94	45.12	490.61	15.03
84611	1989 Toyota Camry	168091	3500	8.4	0.43	1.54	6.12	448.77	18.72

RUN #	Veh Yr, Make, Model	Odometer	Inertia	Hp@50mph	HC	NOx	CO	CO2	Fuel Economy
		Miles	*Lbs*		*gm/mile*	*gm/mile*	*gm/mile*	*gm/mile*	*mpg*
84612	2000 Ford Ranger PU	33680	3500	12.0	0.14	0.55	2.09	490.19	17.43
84613	1990 Oldsmobile Delta 88	185694	3500	6.8	3.12	1.14	12.82	528.23	15.43
84614	1978 Oldsmobile Delta 88	73729	4000	8.7	4.10	2.29	45.07	551.99	13.55
84616	1999 Plymouth Voyager	113389	4000	7.2	0.15	0.25	0.99	468.89	18.28
84617	1997 Chevrolet Suburban	145147	5500	11.2	0.34	1.08	4.94	620.41	13.68
84618	1992 Plymouth Voyager	154297	4000	7.5	0.66	4.05	19.71	449.67	17.83
84620	1992 Ford Ranger PU	19758	3500	11.3	2.76	3.11	21.51	418.54	18.68
84621	1992 Ford Ranger PU	13586	3500	11.1	0.51	1.15	7.47	453.47	18.44
84622	1999 Toyota Camry	64134	3500	6.4	0.47	0.43	4.09	397.33	21.24
84623	1989 Plymouth Acclaim	164203	3000	6.9	0.82	3.44	18.47	358.92	22.05
84626	!987 Dodge D100 PU	23200	3500	13.2	1.20	1.70	36.39	431.72	17.47
84627	1987 Ford F150 PU	410	4000	10.4	14.92	3.78	69.16	552.85	12.17
84628	2002 Chevrolet Trailblazer	77758	4500	10.0	0.41	0.31	4.76	585.30	14.49
84629	1996 Acura TL2.5	117642	3500	8.1	0.40	0.17	6.73	422.92	19.80
84630	1989 Honda Accord	139963	2750	6.0	1.14	0.51	29.39	372.77	20.38
84632	1987 Ford F150 PU	428	4000	13.9	15.24	3.70	88.78	574.24	11.32
84633	1987 Volvo 740 Turbo	248178	3000	9.9	1.29	1.23	59.49	394.30	17.50
84634	1988 Plymouth Voyager	162874	4000	7.8	1.06	3.16	11.64	465.97	17.66
84635	1989 Ford Crown Vic	62847	3500	11.0	1.51	1.54	16.40	471.33	17.16
84637	1980 Oldsmobile Cutlass Supreme	79420	3500	10.5	3.79	3.91	69.56	467.34	14.63
84638	1996 Chrysler Town & Country	213656	4000	8.5	1.30	1.35	22.88	473.64	16.76
84639	1995 Cheverolet Cavalier	140500	2750	4.8	0.32	0.75	5.40	328.84	25.44
84640	1994 Ford Explorer	98974	4000	10.6	0.26	1.33	7.94	529.41	15.86
84642	1989 Dodge Spirit	139488	3000	8.4	0.54	1.50	19.26	395.15	20.16
84643	1987 Ford Escort	12845	2500	7.4	1.82	2.64	29.84	342.81	21.78
84644	2001 Nissan Pathfinder	66284	4000	15.3	0.21	0.36	3.18	530.67	16.05
84645	1993 Volvo 960	197094	3500	10.3	0.48	0.48	4.84	439.84	19.17

RUN #	Veh Yr, Make, Model	Odometer	Inertia	Hp@50mph	HC	NOx	CO	CO2	Fuel Economy
		Miles	*Lbs*		*gm/mile*	*gm/mile*	*gm/mile*	*gm/mile*	*mpg*
84646	1988 Honda Accord	209194	2750	6.4	0.70	1.41	15.78	370.72	21.65
84648	1987 Dodge Dakota PU	112838	3500	10.6	1.10	1.73	22.31	518.99	15.44
84649	1995 GMC Sonoma PU	56578	3500	9.8	0.73	0.71	7.08	465.34	17.98
84650	1990 Chevrolet Lumina APV	136313	3500	8.1	0.60	1.55	11.29	457.83	18.03
84653	1977 Chevrolet C-20 PU	37697	4000	13.9	3.91	5.20	71.68	699.01	10.45
84655	1990 Buick Electra Park Avenue	169860	3500	6.3	0.39	1.28	4.83	473.98	17.83
84656	1990 Chevrolet Lumina APV	123632	3500	8.1	0.43	1.32	8.00	428.15	19.47
84658	1989 Chevrolet Astrovan	215908	3500	12.0	0.87	2.86	11.21	382.92	21.35
84659	1988 Chrysler Le Baron	117003	3000	8.3	1.74	2.73	31.37	422.16	18.05
84660	1988 Dodge Caravan	61439	3500	8.0	1.27	3.01	7.11	459.86	18.12
84661	1990 Buick Century	148959	3000	6.8	0.29	1.34	3.69	430.31	19.70
84662	1990 Cadillac Eldorado	185384	3500	6.2	2.18	5.03	41.55	522.94	14.47
84663	1989 Chevrolet Corsica	98999	3000	5.3	0.92	1.60	12.66	377.50	21.51
84665	1989 Toyota 4X4 PU	262316	3500	10.9	0.58	2.80	12.08	508.23	16.27
84666	1988 Ford F150 PU	14075	4000	14.6	1.07	2.91	12.56	603.30	13.74
84667	1982 Ford F250 PU	85513	3500	11.9	6.90	3.31	65.84	608.67	11.74
84668	1991 Oldsmobile Delta 88	139412	3500	7.0	0.17	1.37	1.94	461.19	18.52
84669	1990 Dodge Spirit	109931	3000	8.7	1.03	2.71	20.44	398.80	19.83
84670	1989 Mercury Topaz	6137	2750	6.6	0.70	1.25	14.16	389.90	20.78
84672	1983 Toyota Tercel	87900	2250	6.7	0.41	0.91	5.95	267.15	30.99
84673	1983 GMC Vandura	52728	4500	16.2	6.61	0.65	216.76	680.41	8.27
84674	1979 Pontiac Firebird	45370	4000	10.8	2.49	2.71	42.62	503.43	14.89
84675	1993 Ford Tempo	25053	2750	6.1	0.34	2.00	4.90	397.57	21.19
84676	1990 Ford Bronco	25202	4500	13.3	0.89	2.31	17.66	516.46	15.74
84677	1988 Buick Park Avenue	146833	3500	6.3	0.27	0.61	4.17	450.50	18.80
84679	1983 Toyota PU	97635	3000	9.9	1.20	1.37	14.49	343.11	23.29
84680	1973 Chevrolet PU	57484	4000	12.6	16.97	2.37	112.12	533.55	11.30

RUN #	Veh Yr, Make, Model	Odometer	Inertia	Hp@50mph	HC	NOx	CO	CO2	Fuel Economy
		Miles	*Lbs*		*gm/mile*	*gm/mile*	*gm/mile*	*gm/mile*	*mpg*
84681	1993 Ford Tempo	25073	2750	6.1	0.31	2.10	4.10	402.94	20.98
84682	1990 Toyota Camry	138235	3500	9.0	2.40	0.90	46.46	437.65	16.62
84683	1990 Ford Ranger PU	72976	3500	11.1	1.04	2.87	12.93	405.99	20.04
84685	1988 Ford F150 PU	62947	4000	13.5	1.21	1.92	5.52	608.22	13.87
84686	1986 Ford F150 PU	94737	3500	12.5	3.26	3.92	18.29	441.90	17.91
84687	1976 Chevrolet El Camino	61809	4000	12.1	1.90	1.60	44.19	626.96	12.26
84688	1993 Ford Taurus	92978	3500	9.5	0.41	1.29	6.49	460.94	18.22
84689	1992 GMC Jimmy	90871	3500	9.5	0.26	0.67	6.79	309.46	26.82
84690	1989 Oldsmobile Cutlass Cierra	220970	3000	5.4	0.68	1.27	9.34	380.07	21.69
84692	1988 Buick Century	94555	3000	6.4	7.65	0.26	159.81	285.99	15.35
84693	1988 Ford F150 PU	97172	4000	14.6	1.01	1.92	15.65	545.57	15.02
84694	1983 Chevrolet C10 PU	98799	3500	14.0	1.92	4.45	20.78	495.45	16.12
84695	1989 Oldsmobile Cutlass Ciera	220989	3000	5.4	0.63	1.21	7.41	392.20	21.21
84696	1987 Toyota PU	169293	2750	9.6	3.74	3.61	25.34	392.74	19.38
84699	1985 Chevrolet Caprice	58223	3500	8.7	5.20	2.49	62.01	516.95	13.66
84700	1978 Ford PU	73447	4000	11.7	6.12	3.40	65.73	616.47	11.65
84701	1990 Ford F150 PU	38803	4000	13.5	0.50	2.22	3.40	395.97	21.37
84702	1989 Chevrolet G20 Van	27435	4000	16.2	1.27	1.69	12.63	590.26	14.02
84703	1987 Chevrolet Blazer	153398	3500	9.8	1.10	5.35	26.50	508.48	15.55
84705	1980 Chevrolet Malibu	31253	3500	9.5	2.26	0.79	75.66	488.70	14.01
84707	1973 Chevrolet Impala	94178	4000	11.4	2.75	2.13	38.88	676.81	11.53
84708	2003 Dodge Caravan	10200	4000	7.2	0.10	0.52	1.11	462.54	18.53
84709	1989 Ford Ranger PU	28864	3000	11.1	1.12	1.33	18.08	366.95	21.58
84710	1984 Chevrolet Monte Carlo	68810	3500	10.6	1.30	0.66	21.38	414.02	19.06
84712	1979 Chevrolet Nova	86117	3500	9.6	6.38	2.10	75.98	398.81	16.01
84713	1996 Chevrolet Blazer	94350	4000	10.7	0.36	0.61	6.19	510.93	16.50
84714	1994 Saturn SW	132333	2500	6.1	0.34	0.27	5.26	303.24	27.54

RUN #	Veh Yr, Make, Model	Odometer	Inertia	Hp@50mph	HC	NOx	CO	CO2	Fuel Economy
		Miles	*Lbs*		*gm/mile*	*gm/mile*	*gm/mile*	*gm/mile*	*mpg*
84715	1988 Mazda B2200 PU	220307	3000	10.6	2.09	1.77	38.05	362.78	20.07
84719	1990 Oldsmobile Cutlass Supreme	85449	3500	4.5	0.32	1.13	6.95	436.29	19.21
84720	1989 Chevrolet 1500 PU	140678	4000	12.8	1.82	2.99	17.69	618.05	13.21
84722	1998 Ford Windstar	99476	4000	7.9	0.18	1.46	2.16	500.17	17.08
84723	1991 Chevrolet Cavalier	182349	2750	5.8	1.95	3.72	14.57	355.49	22.39
84724	1990 Oldsmobile Cutlass Ciera	171475	3000	5.4	0.53	1.51	6.44	410.41	20.39
84726	1990 Ford Aerostar	19648	3500	10.3	0.60	1.42	15.86	455.19	17.86
84727	1982 Ford Grenada	64654	3500	10.6	0.77	1.15	14.22	515.33	15.94
84728	2002 Ford Escape 2wd	36209	3500	7.5	0.14	0.14	0.67	445.87	19.24
84729	2001 Toyota Camry	46869	3500	6.7	0.18	0.29	2.88	389.04	21.84
84730	1995 Chevrolet S10 PU	75640	3500	9.8	1.04	0.58	9.79	481.29	17.22
84732	1979 Jeep CJ76	8518	3000	10.6	3.76	4.62	69.57	443.55	15.25
84733	1998 Buick Skylark	65464	3500	5.9	0.25	0.64	2.20	451.62	18.88
84734	1993 Plymouth Voyager	166916	4000	7.3	0.59	1.61	7.89	459.29	18.18
84735	1988 Honda Accord	209393	2750	6.4	0.52	0.94	12.21	338.33	23.97
84737	1984 Chevrolet Celebrity	64091	3000	6.7	0.26	0.90	10.68	379.58	21.67
84738	1976 Pontiac Gran Prix	60909	4500	10.7	4.63	2.19	145.70	617.79	10.00
84739	1998 Mazda Protoge	88569	2750	6.8	0.53	0.78	7.78	352.39	23.50
84740	1990 Buick Lesabre	107876	3500	6.8	0.57	0.86	8.18	491.03	17.02
84743	1999 Mazda Protoge	122968	2750	6.9	0.20	1.09	5.42	296.15	28.20
84745	1990 Honda Civic	133966	2250	4.6	0.66	1.98	12.64	278.81	28.63
84748	2002 Dodge Caravan	60790	4500	9.3	0.10	0.75	1.86	492.12	17.38
84749	2001 Toyota Sienna	80227	4000	9.4	0.13	0.25	1.66	430.95	19.84
84751	1998 Ford Escort	55309	2750	6.0	0.16	1.31	5.98	333.06	25.10
84752	1978 Ford F100 PU	58917	3500	12.2	0.45	1.52	2.59	247.09	34.09
84753	2003 Dodge Caravan	47649	4500	7.9	0.13	0.20	1.05	487.95	17.57
84754	2003 Chrysler Town & Country	20787	4500	8.9	0.08	0.34	0.51	483.28	17.77

RUN #	Veh Yr, Make, Model	Odometer	Inertia	Hp@50mph	HC	NOx	CO	CO2	Fuel Economy
		Miles	*Lbs*		*gm/mile*	*gm/mile*	*gm/mile*	*gm/mile*	*mpg*
84755	2002 Honda Odyssey	60753	4500	12.7	0.10	0.13	2.40	504.12	16.94
84757	2001 Jeep Grand Cherokee	90011	4000	11.7	0.19	0.46	1.52	499.68	17.12
84758	1979 Chevrolet C10 Beauville	84025	4000	14.6	3.20	1.54	53.92	628.05	11.91
84759	2005 Ford Focus	6701	3000	11.7	0.06	0.03	1.02	359.02	23.86
84760	2004 Ford Escape	10519	3500	10.4	0.10	0.06	1.04	456.46	18.78
84761	2004 Kia Sedona	16609	5000	10.7	0.09	0.07	1.05	532.36	16.11
84763	2003 Honda Odyssey	44752	4500	12.4	0.13	0.14	1.75	514.21	16.64
84765	1985 Chevrolet Impala	75914	4000	11.1	4.28	1.53	103.88	468.18	13.35
84766	2000 Dodge Caravan	93162	4000	10.0	0.14	0.35	1.49	490.98	17.43
84767	1998 Nissan Frontier PU	107615	3500	11.0	0.36	2.11	9.87	411.01	20.13
84768	1995 Ford F150 PU	147342	4500	11.6	0.70	1.38	3.20	580.36	14.65
84770	1995 Ford F250 PU	52586	4500	11.6	0.56	2.28	5.70	609.75	13.87
84771	1994 Chevrolet Astrovan	133318	4000	12.3	3.06	2.93	22.62	469.66	16.73
84772	1992 Dodge Caravan	143971	4000	7.0	0.49	2.51	6.82	472.29	17.77
84773	1998 Toyota 4Runner	115768	4000	11.7	0.18	0.59	1.66	479.71	17.83
84774	1995 Dodge Caravan	136837	4000	7.6	0.38	0.29	3.57	456.49	18.58
84775	1997 Chevrolet Suburban	137630	5000	10.8	1.19	2.59	12.19	619.22	13.41
84777	1987 Oldsmobile Cutlass	87020	3500	9.6	0.88	3.48	15.65	464.68	17.50

Correlation Testing Data

Comparison of SEMTECH and Dyno Emission Measurement

RunID	Phase	HC (g/m)		CO (g/m)		NOx (g/m)		CO2 (g/m)		PM2.5 (mg/m)	Distance (miles)
		SMT	BKI	SMT	BKI	SMT	BKI	SMT	BKI		
84393	1	8.39	5.08	70.31	39.51	2.06	1.82	1252.15	758.15	22.65	1.19
84393	2	0.16	0.08	2.41	1.16	0.21	0.20	712.89	420.63	1.20	8.65
84393	3	0.05	0.04	4.14	1.38	0.49	0.35	1105.15	584.45	3.60	1.19
84393	A	0.58	0.34	6.07	3.17	0.33	0.30	768.10	449.54	2.48	11.04
84394	1	7.56	4.70	109.27	60.26	1.60	0.92	1461.93	851.64	79.98	1.14
84394	2	0.14	0.07	4.39	2.26	0.37	0.26	789.95	499.45	18.82	8.47
84394	3	0.08	0.06	7.65	2.92	0.87	0.37	1251.15	686.66	6.30	1.14
84394	A	0.51	0.31	9.95	5.26	0.47	0.30	855.25	530.00	21.09	10.74
84396	1	2.58	3.19	25.08	28.29	3.26	3.73	628.00	656.60	59.23	1.19
84396	2	0.13	0.12	8.77	7.68	1.21	1.24	351.21	364.62	8.26	8.63
84396	3	0.28	0.29	7.99	6.78	1.48	1.43	442.74	451.71	2.23	1.19
84396	A	0.27	0.30	9.56	8.69	1.34	1.38	371.92	385.82	10.49	11.01
84397	1	22.00	13.23	259.15	128.75	4.93	4.10	1342.98	860.53	212.62	1.21
84397	2	7.18	4.16	110.79	68.33	4.29	3.58	758.59	539.03	71.50	8.86
84397	3	16.12	8.78	191.20	98.88	3.67	2.61	1048.35	597.34	95.84	1.19
84397	A	8.56	4.94	123.99	73.51	4.28	3.54	808.69	559.58	80.42	11.26
84398	1	5.36	3.09	50.55	30.49	2.79	1.32	1431.06	736.07	34.25	1.20
84398	2	0.11	0.04	2.90	1.67	0.13	0.09	650.29	374.39	3.69	8.65
84398	3	0.03	0.02	1.32	0.52	0.11	0.10	1032.81	508.72	5.52	1.20
84398	A	0.38	0.20	5.30	3.11	0.27	0.16	717.85	402.69	5.41	11.05
84399	1	5.72	3.18	119.68	63.02	2.21	1.29	1264.16	668.49	8.85	1.19
84399	2	0.17	0.09	6.50	3.71	0.40	0.24	654.58	376.77	2.50	8.66
84399	3	0.12	0.07	4.58	2.03	0.34	0.17	1150.17	488.81	2.42	1.19
84399	A	0.46	0.25	12.26	6.68	0.49	0.29	720.62	399.66	2.82	11.05
84401	1	7.99	4.89	81.22	46.87	4.68	3.32	1419.41	823.17	36.31	1.17
84401	2	0.17	0.08	3.87	2.17	1.20	0.83	754.66	466.99	3.05	8.63
84401	3	0.43	0.22	8.54	3.62	1.30	0.82	1083.24	606.75	3.01	1.20
84401	A	0.59	0.34	8.18	4.57	1.39	0.95	811.75	495.01	4.75	11.00
84402	1	8.58	9.52	134.24	126.29	2.91	3.01	576.75	516.09	179.94	1.17
84402	2	0.66	0.52	14.09	11.17	2.78	2.55	357.68	322.40	12.28	8.62
84402	3	1.46	1.12	23.71	15.15	3.62	3.11	510.69	402.65	3.99	1.18
84402	A	1.12	1.02	20.92	17.36	2.85	2.61	379.47	337.87	20.31	10.98
84403	1	24.43	9.71	145.12	83.62	2.41	1.75	1403.08	800.46	97.40	1.19
84403	2	0.67	0.11	1.60	0.87	0.32	0.24	725.19	443.30	2.48	8.79
84403	3	0.75	0.20	6.03	2.27	0.65	0.45	1140.85	623.90	5.11	1.22
84403	A	1.90	0.60	9.31	5.20	0.45	0.33	789.19	474.11	7.52	11.20
84407	1	6.20	10.65	200.41	107.28	7.86	6.29	1091.31	616.01	469.83	1.25
84407	2	0.86	2.39	24.45	18.66	4.86	4.43	486.30	345.51	137.09	8.76
84407	3	2.62	3.28	96.83	29.52	7.34	5.17	1026.90	458.48	85.61	1.23
84407	A	1.27	2.90	39.00	24.18	5.20	4.58	557.01	367.97	151.32	11.25
84409	1	10.13	8.67	138.04	152.82	1.54	1.89	741.33	724.76	27.69	1.21
84409	2	0.08	0.04	0.42	0.28	0.94	1.15	406.54	407.18	3.25	8.69
84409	3	0.17	0.14	3.00	2.42	0.38	0.45	575.88	547.19	3.41	1.08
84409	A	0.61	0.50	7.85	8.41	0.94	1.15	434.76	432.62	4.54	10.98

RunID	Phase	HC (g/m)		CO (g/m)		NOx (g/m)		CO2 (g/m)		PM2.5 (mg/m)	Distance (miles)
		SMT	BKI	SMT	BKI	SMT	BKI	SMT	BKI		
84411	1	8.62	7.88	43.71	39.69	3.42	4.23	742.03	732.21	206.29	1.11
84411	2	0.09	0.15	0.22	3.83	0.41	0.68	145.26	360.76	81.48	8.63
84411	3	0.00	0.14	0.17	0.84	0.00	0.43	4.92	434.97	18.29	1.17
84411	A	0.52	0.53	2.42	5.39	0.54	0.84	166.12	384.08	83.29	10.91
84412	1	3.06	6.07	81.68	77.85	1.14	1.27	489.68	441.33	0.69	1.17
84412	2	0.14	0.25	2.75	5.82	0.17	0.42	166.36	292.74	2.96	8.61
84412	3	0.00	0.42	0.19	6.63	0.00	0.52	3.97	375.46	6.58	1.17
84412	A	0.28	0.56	6.64	9.57	0.21	0.47	171.91	305.99	3.09	10.95
84413	1	1.99	13.86	23.60	278.20	0.87	1.04	624.26	1168.74	66.63	1.22
84413	2	1.35	1.16	26.86	21.00	1.45	1.35	635.34	665.04	154.58	8.83
84413	3	.	1.85	.	11.77	.	2.38	.	799.21	18.28	1.17
84413	A	.	1.87	.	33.86	.	1.40	.	700.36	140.91	11.22
84414	1	1.71	1.94	26.14	28.85	0.74	0.55	891.37	865.17	12.46	1.20
84414	2	0.01	0.02	0.14	0.10	0.16	0.08	415.96	415.58	1.90	8.74
84414	3	0.00	0.01	0.07	0.04	0.22	0.11	580.10	570.85	3.53	1.23
84414	A	0.09	0.12	1.48	1.59	0.20	0.11	452.20	449.79	2.56	11.17
84415	1	3.92	4.65	86.43	103.96	3.27	3.31	1186.71	1169.20	25.18	1.25
84415	2	0.06	0.07	2.92	2.49	1.41	1.57	650.24	672.41	28.77	8.76
84415	3	0.33	0.32	6.24	4.90	0.77	0.88	897.32	878.95	6.40	1.21
84415	A	0.29	0.33	7.68	8.11	1.47	1.62	696.66	713.39	27.03	11.22
84416	1	1.66	1.84	27.24	27.28	0.34	0.32	501.60	475.00	8.69	1.17
84416	2	0.11	0.11	6.45	5.64	0.09	0.07	304.03	265.67	3.42	8.67
84416	3	0.07	0.06	5.24	4.04	0.10	0.07	401.72	342.44	5.59	1.21
84416	A	0.19	0.19	7.44	6.63	0.10	0.08	321.06	281.73	3.84	11.04
84419	1	5.70	6.03	98.88	104.30	3.21	2.77	767.50	722.94	19.09	1.22
84419	2	0.14	0.12	1.46	1.45	0.45	0.39	442.53	417.81	3.34	8.73
84419	3	0.31	0.26	2.63	1.79	0.44	0.40	608.24	540.17	5.03	1.22
84419	A	0.44	0.44	6.61	6.88	0.60	0.52	470.93	442.39	4.29	11.17
84420	1	2.54	3.72	35.21	43.96	1.37	1.39	829.11	652.32	80.85	1.24
84420	2	0.06	0.06	3.69	3.02	0.35	0.31	433.93	356.70	13.85	8.76
84420	3	0.06	0.05	4.11	2.30	0.19	0.15	643.20	459.99	8.57	1.22
84420	A	0.19	0.25	5.40	5.15	0.39	0.35	469.59	379.66	17.05	11.22
84421	1	3.12	3.60	30.09	31.69	1.69	1.63	687.08	644.40	36.56	1.19
84421	2	0.06	0.05	0.74	0.56	0.36	0.34	365.98	340.05	2.42	8.68
84421	3	0.26	0.15	3.57	2.09	0.46	0.40	544.39	446.63	2.80	1.17
84421	A	0.23	0.24	2.45	2.28	0.43	0.41	394.82	363.08	4.21	11.04
84422	1	5.56	5.23	54.79	47.44	7.56	6.94	866.21	785.14	8.44	1.18
84422	2	1.33	1.18	16.63	14.88	5.57	5.10	516.94	499.61	19.90	8.76
84422	3	3.26	2.70	23.22	18.99	6.61	5.81	689.25	613.66	10.81	1.22
84422	A	1.69	1.50	19.07	16.83	5.74	5.25	547.06	522.20	18.68	11.16
84424	1	2.56	2.43	24.78	20.77	5.44	5.37	1111.12	1009.46	5.45	1.20
84424	2	0.11	0.09	2.79	2.54	2.22	2.16	555.81	546.49	14.81	8.67
84424	3	0.56	0.51	13.71	10.28	2.88	2.83	745.28	674.49	8.85	1.17
84424	A	0.27	0.24	4.69	4.02	2.43	2.37	597.83	579.49	13.91	11.05
84425	1	10.67	8.97	90.61	67.56	8.02	7.17	1052.84	841.12	90.72	1.25
84425	2	1.82	1.73	14.08	12.73	5.91	5.33	532.29	505.45	26.26	8.72

RunID	Phase	HC (g/m)		CO (g/m)		NOx (g/m)		CO2 (g/m)		PM2.5 (mg/m)	Distance (miles)
		SMT	BKI	SMT	BKI	SMT	BKI	SMT	BKI		
84425	3	3.39	3.03	20.95	17.23	6.46	5.87	740.95	632.32	5.93	1.25
84425	A	2.40	2.21	18.67	16.01	6.07	5.47	574.97	532.63	28.28	11.22
84426	1	1.79	2.05	18.01	18.67	0.54	0.49	628.01	561.74	27.00	1.21
84426	2	0.12	0.13	6.40	6.19	0.09	0.07	319.75	285.95	5.68	8.74
84426	3	0.09	0.07	1.74	1.05	0.08	0.07	467.95	370.11	7.40	1.23
84426	A	0.20	0.22	6.68	6.48	0.11	0.10	346.19	306.34	6.91	11.19
84427	1	1.57	1.74	13.78	14.48	1.11	1.09	648.67	626.15	8.49	1.23
84427	2	0.01	0.02	0.19	0.09	0.08	0.07	352.97	331.64	1.03	8.74
84427	3	0.02	0.02	0.34	0.17	0.13	0.12	492.58	426.21	1.34	1.22
84427	A	0.10	0.11	0.92	0.86	0.14	0.13	378.39	353.87	1.45	11.19
84428	1	5.56	6.30	90.13	91.99	2.30	2.09	740.90	691.49	60.99	1.23
84428	2	0.05	0.05	0.74	0.65	0.72	0.64	401.43	394.45	15.18	8.73
84428	3	0.13	0.14	2.00	1.70	0.66	0.56	538.16	516.30	6.58	1.21
84428	A	0.35	0.38	5.61	5.57	0.80	0.71	429.14	418.70	17.01	11.17
84430	1	6.66	6.58	167.39	154.86	1.99	1.98	630.28	551.50	66.40	1.17
84430	2	0.45	0.29	12.60	8.37	1.78	1.74	426.45	374.24	22.18	8.63
84430	3	0.88	0.58	18.57	11.60	1.59	1.55	616.71	473.01	10.36	1.18
84430	A	0.80	0.63	20.97	16.13	1.78	1.74	449.98	390.15	23.64	10.98
84431	1	5.23	10.05	76.54	104.50	1.95	2.60	631.31	764.80	84.07	1.20
84431	2	0.49	0.65	4.75	8.05	1.20	1.29	465.89	483.16	25.88	8.72
84431	3	0.65	0.85	2.08	2.11	1.17	1.29	592.46	663.60	4.28	1.22
84431	A	0.86	1.15	10.00	12.64	1.25	1.36	487.00	510.38	27.39	11.13
84432	1	5.62	5.87	34.13	35.67	2.09	2.18	602.80	550.77	47.80	1.24
84432	2	0.11	0.10	1.30	1.07	0.20	0.16	313.54	281.24	4.27	8.76
84432	3	0.15	0.15	1.51	1.00	0.55	0.39	442.32	358.48	3.71	1.21
84432	A	0.41	0.41	3.05	2.91	0.32	0.29	337.72	300.92	6.55	11.20
84433	1	3.30	2.85	38.34	29.46	2.22	2.11	908.34	723.69	11.52	1.21
84433	2	0.12	0.12	2.96	2.27	0.22	0.19	503.29	465.12	30.18	8.68
84433	3	0.26	0.24	1.21	0.60	0.69	0.64	682.23	581.77	6.06	1.19
84433	A	0.30	0.28	4.68	3.58	0.35	0.32	537.00	486.68	27.54	11.07
84436	1	4.91	4.58	100.57	87.09	3.33	3.05	930.09	781.45	8.93	1.23
84436	2	0.10	0.10	4.44	4.43	0.58	0.48	502.46	464.92	3.72	8.78
84436	3	0.53	0.54	12.10	11.41	1.16	0.89	715.91	615.16	1.93	1.20
84436	A	0.38	0.36	10.11	9.28	0.77	0.64	540.07	491.97	3.87	11.22
84437	1	4.14	4.64	42.43	45.08	2.83	2.93	793.87	773.21	16.20	1.21
84437	2	0.05	0.05	0.38	0.22	0.20	0.19	400.99	403.06	1.28	8.72
84437	3	0.10	0.11	0.65	0.26	0.28	0.26	538.08	521.38	1.53	1.22
84437	A	0.27	0.30	2.61	2.58	0.35	0.34	431.28	430.76	2.08	11.15
84438	1	1.69	1.75	36.28	38.12	1.46	1.19	778.82	715.24	5.05	1.24
84438	2	0.02	0.02	0.20	0.10	0.05	0.04	439.89	412.78	2.56	8.71
84438	3	0.02	0.02	0.15	0.01	0.12	0.07	616.41	557.00	2.40	1.21
84438	A	0.11	0.11	2.10	2.13	0.13	0.10	469.97	439.08	2.68	11.16
84439	1	3.20	3.57	34.07	34.83	4.39	4.21	879.92	838.82	31.68	1.20
84439	2	0.17	0.18	4.38	3.99	1.59	1.53	443.14	431.64	6.31	8.72
84439	3	0.67	0.66	5.80	4.82	1.25	1.09	633.96	585.69	1.91	1.20
84439	A	0.37	0.39	6.03	5.65	1.71	1.63	479.21	463.43	7.32	11.12

RunID	Phase	HC (g/m)		CO (g/m)		NOx (g/m)		CO2 (g/m)		PM2.5 (mg/m)	Distance (miles)
		SMT	BKI	SMT	BKI	SMT	BKI	SMT	BKI		
84442	1	4.34	4.84	43.94	46.57	2.89	2.94	845.02	848.69	17.69	1.20
84442	2	0.05	0.05	0.32	0.20	0.24	0.21	419.03	441.75	1.72	8.68
84442	3	0.11	0.13	0.55	0.34	0.26	0.24	561.62	570.64	1.45	1.19
84442	A	0.28	0.30	2.61	2.62	0.38	0.35	451.12	471.80	2.53	11.06
84443	1	4.81	6.06	48.61	52.08	3.02	2.79	514.86	521.76	77.41	1.21
84443	2	0.32	0.27	4.32	4.17	2.03	1.83	330.46	316.83	16.61	8.76
84443	3	0.73	0.68	4.73	3.15	3.07	2.60	447.61	380.36	5.16	1.19
84443	A	0.59	0.60	6.72	6.60	2.15	1.93	348.42	331.88	19.00	11.16
84444	1	4.03	5.13	15.16	16.47	0.64	0.65	753.94	769.61	36.18	1.24
84444	2	0.06	0.04	0.44	0.36	0.16	0.17	414.49	425.67	17.99	8.74
84444	3	0.01	0.02	0.11	-0.01	0.14	0.18	511.23	506.19	5.45	1.24
84444	A	0.27	0.31	1.21	1.19	0.19	0.20	439.68	449.71	18.07	11.22
84445	1	3.80	4.29	34.51	38.72	1.08	1.15	749.39	755.23	31.19	1.18
84445	2	0.08	0.02	0.64	0.20	0.06	0.19	241.22	398.93	1.68	8.75
84445	3	0.00	0.05	0.22	0.27	0.00	0.20	24.45	503.14	2.45	1.21
84445	A	0.26	0.24	2.37	2.18	0.11	0.24	252.55	424.38	3.24	11.14
84446	1	9.65	11.57	73.02	77.07	2.13	2.12	997.08	934.34	192.76	1.20
84446	2	0.30	0.14	1.22	1.10	0.58	0.48	496.38	473.24	22.60	8.70
84446	3	0.49	0.48	3.46	2.60	1.55	1.36	720.06	654.77	6.07	1.21
84446	A	0.80	0.76	5.09	5.17	0.73	0.62	537.87	509.89	30.30	11.11
84448	1	5.90	6.66	93.92	101.45	2.35	2.07	883.12	859.36	102.70	1.20
84448	2	0.13	0.09	0.98	0.87	0.33	0.31	503.30	492.13	19.31	8.69
84448	3	0.19	0.19	2.52	1.99	0.45	0.39	674.71	647.09	6.47	1.22
84448	A	0.44	0.44	5.98	6.21	0.44	0.41	535.31	522.17	22.75	11.11
84449	1	5.73	6.63	95.32	103.37	3.19	3.02	814.13	787.95	55.87	1.22
84449	2	0.13	0.08	2.85	2.36	1.03	1.01	463.57	445.89	8.11	8.73
84449	3	0.29	0.27	7.02	5.49	1.19	1.22	627.89	586.90	1.37	1.22
84449	A	0.44	0.44	8.05	7.91	1.15	1.13	493.77	473.77	10.15	11.17
84450	1	12.65	13.31	138.09	126.25	5.32	5.02	777.00	711.39	186.76	1.21
84450	2	2.70	2.43	24.05	22.00	5.22	4.68	423.43	398.59	12.06	8.72
84450	3	4.00	3.61	32.28	25.01	7.28	6.30	608.39	537.60	7.46	1.25
84450	A	3.30	3.09	30.51	27.69	5.37	4.81	454.71	424.96	20.88	11.18
84451	1	5.23	5.52	75.65	80.77	2.99	3.27	777.86	751.03	39.06	1.19
84451	2	0.10	0.10	3.33	2.85	1.03	1.10	452.31	435.12	2.84	8.68
84451	3	0.26	0.31	6.49	5.75	1.30	1.49	604.31	578.39	1.46	1.20
84451	A	0.38	0.40	7.35	7.10	1.15	1.24	480.06	461.47	4.62	11.08
84452	1	2.96	3.07	38.13	35.22	3.07	3.20	891.29	861.97	10.30	1.15
84452	2	0.12	0.11	5.05	4.61	0.92	0.97	437.66	428.62	6.23	8.70
84452	3	0.32	0.27	8.07	6.19	1.11	1.17	599.83	554.43	1.04	1.21
84452	A	0.28	0.27	6.99	6.26	1.04	1.09	472.58	459.17	6.07	11.07
84453	1	4.85	5.26	24.15	24.70	3.77	3.79	695.89	678.96	34.87	1.22
84453	2	0.19	0.24	2.33	2.65	0.76	0.90	353.58	408.55	5.19	8.70
84453	3	0.53	0.57	6.75	6.28	1.20	1.19	509.50	506.72	1.89	1.22
84453	A	0.46	0.53	3.80	4.07	0.95	1.07	382.63	429.73	6.53	11.15
84455	1	2.77	3.05	31.59	31.60	1.01	1.00	806.58	751.45	10.96	1.22
84455	2	0.06	0.06	3.54	3.07	0.41	0.40	406.08	399.89	1.29	8.84

RunID	Phase	HC (g/m)		CO (g/m)		NOx (g/m)		CO2 (g/m)		PM2.5 (mg/m)	Distance (miles)
		SMT	BKI	SMT	BKI	SMT	BKI	SMT	BKI		
84455	3	0.37	0.34	5.43	3.98	0.49	0.47	590.94	535.62	1.83	1.22
84455	A	0.23	0.24	5.13	4.62	0.45	0.44	439.62	427.58	1.83	11.28
84456	1	16.58	11.66	175.39	119.76	5.18	4.57	1003.16	710.90	70.87	1.18
84456	2	1.19	0.70	30.82	19.54	1.34	1.35	555.14	466.17	36.65	8.66
84456	3	6.62	3.51	70.30	30.43	1.74	1.53	842.01	596.54	20.54	1.20
84456	A	2.36	1.46	41.02	25.46	1.57	1.53	598.07	487.81	37.30	11.03
84457	1	5.69	5.93	26.18	19.28	4.28	4.84	920.85	891.67	86.09	1.23
84457	2	0.17	0.15	8.75	6.05	1.48	1.80	457.77	458.35	19.08	8.71
84457	3	0.61	0.60	14.57	8.60	2.25	2.72	642.33	611.96	12.71	1.21
84457	A	0.49	0.49	10.07	6.93	1.68	2.02	494.92	492.17	22.22	11.15
84458	1	5.31	5.15	70.07	72.76	2.83	2.52	898.05	799.69	21.09	1.14
84458	2	0.41	0.40	14.21	14.05	1.23	1.16	476.51	462.23	21.19	8.67
84458	3	1.14	1.09	14.20	11.07	2.26	2.20	677.35	605.23	3.05	1.20
84458	A	0.71	0.68	17.01	16.79	1.38	1.30	511.47	489.03	19.93	11.02
84459	1	4.31	4.38	66.55	69.02	3.66	3.27	893.89	782.59	12.97	1.21
84459	2	0.14	0.13	5.40	4.89	1.80	1.66	466.42	443.56	4.46	8.72
84459	3	1.54	1.28	16.57	11.78	3.38	3.09	639.50	546.85	1.59	1.23
84459	A	0.45	0.43	9.34	8.73	2.01	1.84	500.59	468.54	4.70	11.16
84461	1	7.98	7.73	84.41	69.40	5.90	5.92	701.86	653.87	46.54	1.21
84461	2	2.46	2.22	17.97	15.05	5.49	4.94	404.78	382.08	2.98	8.72
84461	3	3.80	3.39	27.29	20.43	7.82	6.00	587.57	510.60	3.06	1.22
84461	A	2.85	2.59	22.12	18.28	5.67	5.07	433.21	405.38	5.26	11.16
84462	1	22.28	19.20	387.71	356.11	0.39	0.52	507.73	478.33	350.87	1.21
84462	2	2.62	2.51	89.08	90.28	1.09	1.07	371.45	373.72	21.90	8.69
84462	3	1.26	1.61	15.79	16.45	3.09	2.67	576.80	554.49	5.93	1.22
84462	A	3.56	3.32	99.70	99.11	1.19	1.15	393.09	391.90	38.05	11.12
84463	1	2.04	2.27	26.36	25.44	2.67	2.87	619.12	615.31	16.76	1.24
84463	2	0.12	0.10	8.09	6.39	0.53	0.64	355.14	344.76	112.62	8.76
84463	3	0.51	0.61	10.45	7.93	0.71	0.81	491.20	450.40	21.50	1.22
84463	A	0.25	0.25	9.23	7.51	0.66	0.77	378.72	366.52	101.18	11.22
84464	1	6.39	7.06	82.85	87.56	2.61	2.76	741.18	710.55	96.83	1.22
84464	2	0.22	0.18	1.39	0.98	0.68	0.72	444.39	421.62	31.12	8.70
84464	3	1.05	1.07	7.48	6.32	1.56	1.49	592.83	545.28	7.26	1.20
84464	A	0.61	0.61	6.11	5.93	0.84	0.88	470.42	445.46	32.94	11.12
84465	1	2.89	3.36	37.61	42.48	4.68	4.73	904.00	899.81	12.06	1.20
84465	2	0.04	0.03	1.12	0.85	0.67	0.70	473.37	492.16	213.26	8.70
84465	3	0.37	0.40	5.86	5.37	0.78	0.77	632.23	639.34	10.42	1.21
84465	A	0.21	0.23	3.35	3.32	0.88	0.92	506.96	523.56	188.71	11.11
84467	1	10.50	9.88	146.84	130.22	2.51	2.43	590.92	521.32	83.37	1.17
84467	2	1.49	1.04	14.71	11.48	1.74	1.74	386.36	344.11	21.02	8.56
84467	3	3.69	2.73	19.06	11.26	2.40	2.34	553.07	441.74	7.88	1.20
84467	A	2.11	1.61	21.89	17.60	1.83	1.81	408.71	360.11	23.32	10.93
84468	1	3.01	3.38	35.61	40.24	3.47	3.50	862.73	848.85	18.84	1.20
84468	2	0.04	0.03	1.44	1.15	0.58	0.63	452.81	468.40	4.61	8.65
84468	3	0.35	0.38	6.34	6.06	0.60	0.63	609.86	606.72	2.73	1.21
84468	A	0.22	0.23	3.57	3.54	0.73	0.78	485.25	498.02	5.22	11.06

RunID	Phase	HC (g/m)		CO (g/m)		NOx (g/m)		CO2 (g/m)		PM2.5 (mg/m)	Distance (miles)
		SMT	BKI	SMT	BKI	SMT	BKI	SMT	BKI		
84469	1	11.69	12.01	152.16	146.60	2.78	2.82	686.62	634.85	702.22	1.20
84469	2	0.81	0.72	9.85	7.79	2.52	2.48	431.57	422.28	105.13	8.71
84469	3	1.63	1.70	15.49	10.60	3.68	3.64	570.00	534.99	140.33	1.22
84469	A	1.44	1.38	17.70	15.24	2.62	2.58	454.60	441.30	138.65	11.13
84470	1	112.93	30.11	607.87	475.60	1.23	1.21	915.30	742.04	946.09	1.26
84470	2	56.86	14.75	204.28	185.41	2.16	2.20	543.20	491.55	315.70	8.75
84470	3	79.73	22.74	373.01	319.11	1.73	1.38	664.02	552.76	73.61	1.23
84470	A	61.47	16.14	237.74	210.51	2.08	2.09	571.61	509.39	332.68	11.24
84472	1	67.47	20.31	512.79	377.33	1.29	0.83	783.58	617.52	936.92	1.36
84472	2	5.04	3.21	54.99	39.96	1.91	2.08	512.73	474.21	40.18	8.84
84472	3	5.85	4.22	62.71	38.24	2.42	2.27	738.91	575.25	37.68	1.24
84472	A	8.72	4.26	82.10	59.14	1.91	2.02	544.44	489.49	91.37	11.43
84473	1	2.50	2.69	28.33	26.89	3.79	3.80	1066.90	1003.41	21.99	1.21
84473	2	0.06	0.04	1.88	1.57	0.68	0.63	549.09	539.87	13.15	8.67
84473	3	0.25	0.20	6.95	5.45	1.03	1.05	745.52	686.98	7.48	1.20
84473	A	0.20	0.19	3.63	3.17	0.87	0.83	590.07	574.45	13.22	11.08
84474	1	6.21	5.33	66.09	46.77	2.81	2.46	489.19	383.51	76.22	1.17
84474	2	0.99	0.79	11.57	8.54	1.16	1.13	306.23	259.16	66.56	8.61
84474	3	1.91	1.57	15.82	10.17	1.95	1.55	408.17	307.58	19.83	1.17
84474	A	1.32	1.08	14.67	10.62	1.30	1.22	322.60	268.88	63.87	10.96
84475	1	9.09	10.00	158.89	146.84	2.99	3.09	670.09	650.93	172.56	1.18
84475	2	1.24	1.04	24.05	24.67	0.70	0.71	386.16	378.82	38.58	8.67
84475	3	2.73	2.62	35.98	30.10	0.95	0.93	501.54	464.19	11.36	1.20
84475	A	1.75	1.61	31.84	31.35	0.84	0.85	408.81	398.80	43.59	11.05
84477	1	8.78	9.77	185.06	183.74	4.84	4.16	683.71	616.84	321.05	1.18
84477	2	1.05	1.04	52.69	54.35	1.69	1.56	413.02	404.45	64.27	8.62
84477	3	0.93	0.95	16.36	13.74	3.58	2.99	587.39	491.80	17.90	1.19
84477	A	1.45	1.49	57.06	58.25	1.98	1.80	439.23	421.54	74.32	10.99
84479	1	3.82	4.18	49.13	50.06	3.12	2.97	818.71	784.73	14.58	1.20
84479	2	0.17	0.16	3.18	2.76	0.64	0.63	470.68	466.26	6.14	8.72
84479	3	0.40	0.45	5.94	5.63	0.84	0.83	618.49	608.30	26.34	1.22
84479	A	0.38	0.39	5.78	5.43	0.78	0.76	499.39	492.78	7.99	11.14
84480	1	7.81	8.20	85.63	75.59	6.61	6.15	766.18	717.55	49.90	1.20
84480	2	2.45	2.35	18.92	17.11	5.70	5.20	424.64	409.46	3.99	8.68
84480	3	3.98	3.66	28.17	20.85	7.61	6.71	620.07	550.38	4.83	1.18
84480	A	2.84	2.74	23.02	20.41	5.88	5.36	455.89	435.12	6.44	11.05
84482	1	10.27	11.31	135.97	134.87	5.26	5.01	766.75	773.53	106.11	1.25
84482	2	0.54	0.47	6.17	6.03	8.40	7.01	493.39	486.94	9.25	8.76
84482	3	1.16	1.19	3.57	3.07	9.72	8.05	665.38	599.72	4.31	1.21
84482	A	1.11	1.11	13.01	12.75	8.32	6.97	520.14	510.14	14.10	11.22
84483	1	4.97	5.27	34.80	33.96	2.11	2.06	653.24	585.31	27.05	1.20
84483	2	0.15	0.11	2.76	2.38	0.29	0.28	358.31	333.05	4.07	8.71
84483	3	0.16	0.14	3.02	1.91	0.90	0.86	530.83	422.25	0.41	1.23
84483	A	0.41	0.38	4.48	3.99	0.43	0.41	386.15	352.43	5.01	11.13
84484	1	10.13	11.15	142.62	142.06	5.39	5.39	807.61	831.30	110.15	1.19
84484	2	0.53	0.46	5.78	5.49	8.58	7.12	483.53	482.37	3.19	8.75

RunID	Phase	HC (g/m)		CO (g/m)		NOx (g/m)		CO2 (g/m)		PM2.5 (mg/m)	Distance (miles)
		SMT	BKI	SMT	BKI	SMT	BKI	SMT	BKI		
84484	3	1.06	0.97	4.96	3.96	8.76	7.40	633.30	574.59	2.80	1.24
84484	A	1.06	1.04	12.85	12.39	8.43	7.05	511.04	506.80	8.66	11.18
84485	1	12.86	12.35	331.18	313.38	2.42	2.28	855.05	759.15	94.91	1.22
84485	2	0.56	0.42	10.90	8.87	0.91	0.89	590.32	545.67	16.73	8.70
84485	3	1.52	1.18	16.71	11.15	1.75	1.73	896.49	762.59	4.55	1.15
84485	A	1.28	1.10	28.15	25.09	1.04	1.02	624.86	571.32	20.05	11.07
84487	1	7.38	7.82	195.84	183.22	2.43	2.61	623.65	598.96	152.90	1.25
84487	2	0.67	0.59	45.26	40.47	2.67	2.72	407.97	400.62	15.83	8.73
84487	3	0.33	0.30	10.43	5.70	5.57	4.85	587.49	536.65	6.17	1.20
84487	A	1.01	0.96	50.98	45.73	2.86	2.86	432.14	420.65	22.53	11.18
84488	1	2.58	2.81	23.67	22.95	3.04	3.12	878.89	841.26	20.19	1.19
84488	2	0.04	0.03	2.19	1.71	0.65	0.70	448.71	440.89	1.63	8.70
84488	3	0.22	0.21	5.77	4.54	0.89	0.95	620.57	593.63	1.58	1.18
84488	A	0.19	0.19	3.56	3.00	0.79	0.84	482.94	472.03	2.58	11.08
84489	1	4.17	4.31	54.98	54.21	3.43	3.17	678.64	611.67	33.33	1.22
84489	2	0.34	0.31	0.59	0.29	3.43	3.21	386.98	363.72	14.95	8.75
84489	3	2.97	2.52	0.46	0.17	2.11	2.00	568.63	485.57	7.49	1.22
84489	A	0.73	0.67	3.44	3.12	3.34	3.12	414.93	385.26	15.40	11.19
84490	1	12.06	10.94	348.24	315.90	2.38	2.30	890.59	776.33	26.63	1.21
84490	2	0.51	0.39	10.86	8.98	0.85	0.88	572.17	529.38	2.62	8.68
84490	3	0.94	0.80	9.79	6.47	1.91	1.89	879.98	739.72	2.02	1.15
84490	A	1.13	0.97	28.26	24.95	1.00	1.02	609.41	556.44	3.84	11.04
84492	1	42.79	18.97	368.23	344.71	2.67	2.75	861.46	780.12	727.21	1.22
84492	2	0.59	0.46	3.94	3.03	1.64	1.57	551.05	519.30	16.06	8.77
84492	3	0.86	0.81	4.14	2.97	1.74	1.61	755.39	681.92	7.41	1.23
84492	A	2.83	1.46	23.16	20.95	1.70	1.63	581.85	544.35	52.72	11.21
84493	1	0.73	0.80	7.38	7.33	0.39	0.40	826.17	795.35	5.90	1.21
84493	2	0.01	0.02	0.25	0.14	0.01	0.01	440.14	435.35	0.74	8.74
84493	3	0.01	0.01	0.35	0.13	0.01	0.01	626.25	556.02	1.86	1.22
84493	A	0.05	0.06	0.63	0.51	0.03	0.03	473.60	462.63	1.09	11.18
84494	1	2.70	2.92	23.98	19.82	2.26	2.28	642.09	582.78	11.94	1.17
84494	2	0.06	0.07	4.11	3.71	1.16	1.13	376.53	358.76	2.20	8.64
84494	3	0.21	0.19	5.86	4.24	1.20	1.17	486.75	428.19	2.93	1.23
84494	A	0.21	0.22	5.27	4.58	1.22	1.19	398.22	375.23	2.75	11.04
84495	1	4.31	4.13	63.49	55.27	1.96	1.82	613.87	546.04	9.38	1.20
84495	2	0.16	0.11	3.95	2.86	0.47	0.45	368.06	346.86	1.70	8.64
84495	3	0.26	0.22	5.40	3.87	0.43	0.35	512.52	432.78	1.41	1.19
84495	A	0.38	0.32	7.18	5.67	0.55	0.52	390.95	363.23	2.08	11.04
84497	1	4.95	5.39	104.38	106.50	0.78	0.77	966.21	860.05	22.89	1.25
84497	2	0.09	0.07	3.04	1.71	0.58	0.52	560.51	541.69	26.36	8.79
84497	3	0.21	0.18	4.93	2.87	0.91	0.77	725.56	626.15	1.66	1.27
84497	A	0.36	0.37	8.60	7.42	0.61	0.55	593.97	564.85	24.40	11.31
84498	1	4.69	4.97	30.69	26.19	1.51	1.57	917.12	880.87	35.17	1.17
84498	2	0.07	0.02	2.77	2.06	0.37	0.35	455.35	437.88	9.21	8.66
84498	3	0.15	0.10	4.20	2.59	0.41	0.39	633.26	578.59	2.81	1.17
84498	A	0.32	0.28	4.33	3.33	0.43	0.42	491.62	470.13	10.10	11.01

RunID	Phase	HC (g/m)		CO (g/m)		NOx (g/m)		CO2 (g/m)		PM2.5 (mg/m)	Distance (miles)
		SMT	BKI	SMT	BKI	SMT	BKI	SMT	BKI		
84499	1	5.04	6.07	70.97	79.61	1.32	1.42	574.41	553.36	18.17	1.21
84499	2	0.16	0.16	5.39	5.14	0.28	0.26	329.41	331.55	3.92	8.67
84499	3	0.13	0.15	3.76	2.68	0.27	0.24	430.52	401.81	3.74	1.23
84499	A	0.41	0.47	8.72	8.90	0.34	0.32	349.35	348.21	4.66	11.11
84500	1	3.23	3.56	23.89	22.58	4.99	4.08	683.41	636.43	24.22	1.24
84500	2	0.32	0.32	5.53	5.00	1.78	1.74	381.26	390.30	3.83	8.74
84500	3	0.80	0.90	7.87	6.76	2.10	2.09	434.99	471.26	2.42	1.22
84500	A	0.51	0.53	6.67	6.06	1.98	1.89	401.17	409.04	4.82	11.20
84503	1	1.54	1.58	4.58	3.72	1.42	1.63	850.46	815.70	7.38	1.22
84503	2	0.02	0.03	0.83	0.54	0.12	0.12	443.34	444.55	2.60	8.75
84503	3	0.05	0.06	1.47	1.13	0.17	0.19	629.14	624.86	1.87	1.18
84503	A	0.11	0.11	1.07	0.74	0.19	0.20	477.64	476.38	2.80	11.15
84504	1	3.51	3.93	22.09	22.21	2.32	2.15	731.36	708.03	17.27	1.18
84504	2	0.20	0.18	2.01	1.75	0.32	0.28	414.76	409.97	1.79	8.72
84504	3	0.19	0.20	2.48	1.98	0.38	0.34	577.70	553.07	-0.08	1.17
84504	A	0.37	0.38	3.07	2.82	0.42	0.38	442.28	434.87	2.46	11.07
84505	1	4.57	4.84	58.90	58.32	5.43	5.17	755.05	714.39	11.46	1.14
84505	2	0.34	0.33	4.58	3.62	1.45	1.44	437.09	416.43	9.00	8.68
84505	3	1.28	1.26	9.79	7.57	2.57	2.36	608.07	532.91	1.89	1.21
84505	A	0.62	0.62	7.69	6.63	1.73	1.69	465.15	439.47	8.63	11.03
84507	1	7.61	6.79	75.83	54.66	6.25	5.96	745.09	645.15	23.59	1.21
84507	2	2.43	2.17	16.17	13.51	5.69	4.98	411.29	377.84	1.06	8.70
84507	3	3.94	3.43	28.49	20.44	7.27	6.27	620.44	517.20	3.85	1.22
84507	A	2.80	2.51	20.14	16.15	5.83	5.12	443.27	401.66	2.44	11.13
84508	1	4.36	4.85	122.88	129.88	1.31	1.35	396.15	401.82	14.37	1.18
84508	2	0.24	0.22	5.33	5.22	0.56	0.55	249.92	261.52	2.11	8.65
84508	3	0.24	0.27	5.41	4.67	0.55	0.52	337.67	334.75	1.35	1.17
84508	A	0.45	0.47	11.38	11.61	0.60	0.59	263.38	273.72	2.69	11.00
84509	1	8.21	7.76	120.40	108.71	8.09	6.86	924.96	784.89	125.94	1.25
84509	2	1.94	1.73	13.44	11.90	3.75	3.26	550.65	492.42	8.01	8.72
84509	3	3.23	2.79	17.43	13.57	4.71	3.84	773.05	617.44	4.02	1.21
84509	A	2.37	2.13	19.49	17.24	4.05	3.49	586.33	516.86	14.08	11.18
84510	1	10.38	9.96	200.10	192.17	7.00	6.34	981.22	911.32	48.13	1.24
84510	2	2.51	2.22	24.45	22.14	3.87	3.58	612.21	594.65	22.37	8.77
84510	3	4.26	3.74	34.39	29.12	4.24	3.89	848.36	793.83	2.14	1.22
84510	A	3.04	2.74	34.42	31.65	4.06	3.75	648.26	625.32	22.33	11.23
84512	1	127.53	28.76	412.26	310.92	1.64	1.34	795.00	615.13	389.15	1.33
84512	2	68.55	16.45	210.88	169.91	0.60	0.64	403.10	354.10	177.78	8.70
84512	3	73.75	27.34	264.23	184.08	0.90	0.86	565.32	422.03	70.35	1.32
84512	A	72.24	17.97	226.14	179.00	0.68	0.70	437.15	374.06	181.76	11.34
84514	1	3.56	3.75	18.86	18.31	1.53	1.41	816.78	793.32	14.74	1.19
84514	2	0.11	0.02	0.52	0.31	0.19	0.14	450.40	443.60	3.32	8.60
84514	3	0.05	-0.02	0.74	0.36	0.14	0.10	579.55	568.85	2.41	1.18
84514	A	0.29	0.21	1.49	1.26	0.26	0.21	478.55	470.46	3.85	10.97
84515	1	4.39	4.52	56.29	54.64	2.88	2.55	810.04	664.20	38.50	1.23
84515	2	0.18	0.10	7.22	5.80	0.66	0.59	446.13	380.85	3.76	8.78

RunID	Phase	HC (g/m)		CO (g/m)		NOx (g/m)		CO2 (g/m)		PM2.5 (mg/m)	Distance (miles)
		SMT	BKI	SMT	BKI	SMT	BKI	SMT	BKI		
84515	3	0.26	0.15	9.21	5.60	0.99	0.76	729.07	489.29	1.42	1.23
84515	A	0.41	0.33	9.98	8.38	0.80	0.71	485.14	403.43	5.43	11.23
84517	1	5.48	6.33	42.24	46.19	2.69	2.53	851.53	838.78	124.67	1.20
84517	2	0.11	0.06	1.29	1.15	0.60	0.56	477.64	483.29	17.14	8.72
84517	3	0.24	0.22	3.62	3.05	0.52	0.47	639.31	623.99	3.12	1.20
84517	A	0.40	0.40	3.58	3.62	0.70	0.65	508.30	511.52	21.76	11.13
84518	1	6.90	7.78	104.45	111.82	2.16	2.04	734.85	701.11	22.41	1.20
84518	2	0.22	0.13	4.29	3.38	0.66	0.67	415.32	413.07	1.42	8.71
84518	3	0.69	0.85	8.26	6.45	0.72	0.72	554.98	522.25	3.94	1.22
84518	A	0.60	0.58	9.81	9.26	0.74	0.75	441.86	435.76	2.69	11.13
84519	1	13.15	11.28	126.97	85.21	5.28	4.08	1014.21	698.30	129.25	1.20
84519	2	0.67	0.48	8.81	6.62	3.43	3.04	509.12	443.44	17.44	8.63
84519	3	1.92	1.67	19.16	13.13	5.58	4.40	768.87	566.62	13.15	1.17
84519	A	1.41	1.13	15.74	11.19	3.67	3.19	553.44	465.20	23.01	11.00
84520	1	1.65	1.75	7.57	7.71	0.79	0.83	919.02	866.40	15.22	1.22
84520	2	0.05	0.04	0.85	0.72	0.14	0.14	444.76	441.22	2.13	8.68
84520	3	0.05	0.05	0.75	0.48	0.19	0.17	619.04	589.70	0.09	1.22
84520	A	0.13	0.13	1.20	1.07	0.18	0.18	482.03	474.17	2.68	11.13
84521	1	3.01	3.46	34.16	35.48	2.82	2.97	694.79	693.07	14.39	1.19
84521	2	0.09	0.08	3.57	3.43	0.34	0.34	373.61	381.20	2.00	8.73
84521	3	0.10	0.10	3.01	2.83	0.42	0.41	519.64	490.01	1.39	1.21
84521	A	0.24	0.25	5.12	5.04	0.47	0.48	400.40	404.90	2.60	11.13
84522	1	4.21	4.35	42.17	39.29	2.29	2.32	928.65	861.85	10.50	1.24
84522	2	0.09	0.06	1.14	0.80	0.30	0.30	498.86	474.72	5.74	8.76
84522	3	0.13	0.11	1.85	1.05	0.39	0.41	701.36	616.20	2.10	1.21
84522	A	0.32	0.29	3.42	2.88	0.41	0.41	536.22	505.22	5.74	11.21
84524	1	5.09	5.91	93.99	100.53	2.04	2.14	511.12	513.99	30.01	1.27
84524	2	0.12	0.07	1.55	1.08	1.18	1.24	345.92	337.21	3.01	8.74
84524	3	0.41	0.38	3.72	2.30	0.98	1.01	446.62	402.72	-0.13	1.23
84524	A	0.41	0.41	6.75	6.58	1.22	1.27	361.99	351.43	4.26	11.23
84526	1	8.28	8.99	84.01	84.08	2.67	3.00	812.48	796.74	55.40	1.23
84526	2	0.29	0.26	5.24	4.84	0.95	1.05	474.28	477.19	53.65	8.82
84526	3	1.13	1.19	10.99	8.70	1.59	1.71	691.95	656.97	31.10	1.23
84526	A	0.77	0.79	9.82	9.29	1.08	1.20	507.29	506.58	52.17	11.28
84527	1	8.30	7.35	159.29	139.57	2.60	2.18	1259.81	980.73	30.69	1.24
84527	2	0.31	0.23	3.67	2.70	0.51	0.42	691.08	620.22	15.59	8.70
84527	3	1.18	0.85	10.77	6.23	1.15	0.98	1003.98	771.25	1.18	1.22
84527	A	0.80	0.65	12.57	10.28	0.67	0.55	743.67	650.11	15.39	11.15
84528	1	4.59	5.10	41.22	41.52	6.13	5.98	951.80	948.80	54.90	1.20
84528	2	0.36	0.30	8.97	6.83	1.23	1.33	490.58	492.34	143.40	8.71
84528	3	1.05	1.06	12.52	8.98	1.47	1.52	665.71	637.90	60.56	1.20
84528	A	0.63	0.61	10.91	8.79	1.50	1.58	526.88	526.18	133.10	11.11
84529	1	18.01	16.72	311.28	302.40	1.08	1.15	510.78	480.64	419.60	1.21
84529	2	0.48	0.22	6.27	5.25	1.55	1.46	373.17	374.49	38.97	8.77
84529	3	0.63	0.51	9.27	6.71	1.85	1.69	517.81	463.62	6.05	1.21
84529	A	1.41	1.10	22.32	20.87	1.55	1.46	390.26	386.18	56.52	11.19

RunID	Phase	HC (g/m)		CO (g/m)		NOx (g/m)		CO2 (g/m)		PM2.5 (mg/m)	Distance (miles)
		SMT	BKI	SMT	BKI	SMT	BKI	SMT	BKI		
84531	1	7.73	8.61	154.71	168.00	1.95	2.00	479.90	498.79	68.05	1.20
84531	2	0.51	0.29	14.98	14.44	1.67	1.67	341.37	339.87	16.99	8.72
84531	3	0.41	0.37	10.98	8.55	1.89	1.95	427.92	394.55	2.14	1.21
84531	A	0.88	0.73	22.05	22.00	1.70	1.71	354.69	351.92	18.61	11.12
84532	1	2.88	3.31	49.53	58.48	1.36	1.47	750.69	794.84	10.93	1.27
84532	2	0.05	0.03	0.71	0.68	0.21	0.19	471.75	479.97	5.83	8.73
84532	3	0.07	0.06	0.88	0.77	0.22	0.21	656.16	622.19	1.61	1.22
84532	A	0.21	0.21	3.57	3.84	0.28	0.26	500.88	507.07	5.81	11.21
84533	1	3.21	3.22	44.66	41.13	4.42	4.03	1151.09	1069.26	11.87	1.22
84533	2	0.15	0.13	2.45	1.99	0.96	0.90	649.80	636.21	6.47	8.74
84533	3	0.55	0.45	6.84	4.22	1.10	1.00	898.13	796.18	2.28	1.21
84533	A	0.34	0.31	4.98	4.21	1.15	1.07	693.60	670.09	6.46	11.17
84534	1	6.92	7.57	46.18	46.99	2.22	2.16	694.21	693.88	37.99	1.24
84534	2	0.23	0.16	2.94	2.60	0.58	0.57	374.93	387.00	29.12	8.70
84534	3	0.39	0.42	6.57	5.78	1.44	1.27	529.56	511.81	8.24	1.22
84534	A	0.59	0.58	5.45	5.20	0.73	0.71	402.44	412.17	28.13	11.15
84536	1	8.04	7.93	82.15	69.75	6.30	5.38	758.84	688.07	48.30	1.22
84536	2	2.52	2.33	17.32	15.13	5.40	4.59	409.04	391.94	3.88	8.66
84536	3	3.99	3.59	28.41	20.91	6.82	5.21	590.62	515.45	2.49	1.21
84536	A	2.91	2.71	21.50	18.43	5.54	4.68	440.18	416.26	6.14	11.09
84537	1	2.59	2.40	38.94	31.96	2.29	2.14	1053.99	888.38	20.12	1.21
84537	2	0.18	0.19	3.89	3.09	0.71	0.64	544.25	502.30	2.26	8.71
84537	3	0.16	0.10	2.20	1.26	1.09	0.92	779.46	656.44	2.02	1.21
84537	A	0.30	0.30	5.61	4.48	0.82	0.73	587.41	533.31	3.18	11.13
84538	1	1.91	2.00	23.36	19.23	3.67	3.55	851.10	838.89	3.50	1.20
84538	2	0.04	0.03	2.44	1.83	1.00	0.99	468.85	482.43	0.93	8.71
84538	3	0.08	0.09	2.88	2.33	0.67	0.75	625.80	607.53	1.09	1.23
84538	A	0.14	0.14	3.56	2.77	1.11	1.10	499.99	509.84	1.07	11.14
84539	1	5.14	5.39	48.04	41.98	4.61	4.10	1023.53	940.51	27.43	1.21
84539	2	0.33	0.31	6.16	5.38	0.60	0.57	572.71	560.30	2.59	8.77
84539	3	1.04	0.90	11.86	8.40	0.60	0.55	812.04	706.00	3.59	1.16
84539	A	0.63	0.61	8.76	7.49	0.82	0.75	612.67	589.85	3.95	11.14
84541	1	5.02	5.12	60.81	55.70	4.52	3.60	941.56	818.08	64.91	1.20
84541	2	0.54	0.45	14.95	11.59	1.08	0.90	506.29	438.38	3.09	8.75
84541	3	0.71	0.62	9.68	7.14	1.45	1.15	696.98	567.13	3.64	1.25
84541	A	0.79	0.70	16.98	13.57	1.29	1.05	542.43	467.28	6.33	11.20
84542	1	4.22	4.52	43.34	42.21	4.14	4.08	851.99	830.68	48.34	1.20
84542	2	0.52	0.52	14.44	13.57	0.88	0.91	428.30	447.88	2.44	8.71
84542	3	0.76	0.78	11.63	9.91	0.99	1.04	603.23	604.11	3.63	1.21
84542	A	0.73	0.74	15.74	14.81	1.06	1.08	462.55	478.70	4.91	11.13
84543	1	1.86	1.76	30.53	23.14	2.46	2.25	1030.65	873.56	12.77	1.24
84543	2	0.15	0.15	3.93	3.09	0.73	0.65	545.36	504.02	3.58	8.78
84543	3	0.18	0.17	2.43	1.25	1.13	0.85	775.20	654.46	2.35	1.23
84543	A	0.24	0.24	5.25	4.03	0.85	0.75	587.66	534.29	3.98	11.25
84544	1	8.25	7.68	83.95	64.55	6.00	5.88	725.71	658.37	47.00	1.23
84544	2	2.46	2.29	18.37	15.56	5.49	4.98	404.19	388.53	5.28	8.74

RunID	Phase	HC (g/m)		CO (g/m)		NOx (g/m)		CO2 (g/m)		PM2.5 (mg/m)	Distance (miles)
		SMT	BKI	SMT	BKI	SMT	BKI	SMT	BKI		
84544	3	4.04	3.66	32.66	23.39	7.37	6.43	599.19	532.41	5.65	1.21
84544	A	2.87	2.67	22.81	18.70	5.64	5.13	434.62	412.84	7.52	11.18
84546	1	3.86	3.64	48.23	38.92	3.42	3.23	802.76	706.48	8.20	1.20
84546	2	0.23	0.17	4.65	3.45	0.54	0.53	497.85	475.88	1.98	8.59
84546	3	0.42	0.33	9.77	6.11	1.27	1.12	769.13	658.71	7.85	1.21
84546	A	0.44	0.37	7.32	5.51	0.74	0.72	533.03	500.90	2.72	11.00
84547	1	3.69	4.73	33.96	35.99	1.88	1.97	524.58	520.34	40.26	1.21
84547	2	0.15	0.13	2.21	2.03	0.33	0.33	281.66	288.64	17.21	8.68
84547	3	0.25	0.25	2.16	1.55	0.45	0.41	355.02	352.02	6.38	1.21
84547	A	0.34	0.38	3.87	3.78	0.42	0.42	299.57	305.26	17.67	11.11
84548	1	3.40	3.69	30.29	30.37	1.88	1.83	710.42	695.01	9.46	1.22
84548	2	0.24	0.24	2.42	2.04	0.49	0.50	396.97	404.19	2.50	8.71
84548	3	0.83	0.87	6.71	5.67	1.37	1.32	552.27	516.11	2.04	1.20
84548	A	0.45	0.47	4.20	3.79	0.63	0.63	424.38	427.29	2.84	11.13
84550	1	11.03	11.13	94.84	77.88	6.84	6.87	861.48	849.30	125.34	1.16
84550	2	1.88	1.82	13.22	13.40	1.80	1.80	477.54	496.41	17.48	8.77
84550	3	4.80	4.79	28.53	25.88	2.03	1.98	654.54	649.15	8.67	1.24
84550	A	2.54	2.50	18.43	17.53	2.07	2.07	509.46	524.94	22.27	11.18
84551	1	3.44	3.84	36.05	39.26	1.05	1.14	957.85	917.08	16.49	1.24
84551	2	0.05	0.04	2.95	2.19	0.21	0.19	475.25	489.01	5.22	8.72
84551	3	0.03	0.04	1.95	1.55	0.12	0.10	597.73	616.42	2.68	1.23
84551	A	0.23	0.25	4.64	4.14	0.25	0.24	509.68	520.95	5.64	11.19
84552	1	2.54	2.88	54.01	59.17	1.80	1.69	859.71	837.67	8.72	1.19
84552	2	0.02	0.01	0.30	0.18	0.14	0.11	451.96	451.44	1.78	8.68
84552	3	0.05	0.04	0.52	0.52	0.28	0.21	665.01	625.67	0.35	1.21
84552	A	0.16	0.17	3.13	3.27	0.24	0.20	488.16	483.63	2.04	11.08
84554	1	7.34	7.12	115.03	99.78	3.22	3.27	1009.92	921.32	20.80	1.20
84554	2	0.33	0.24	4.08	3.74	1.36	1.36	605.10	583.27	14.30	8.66
84554	3	1.30	1.20	13.20	10.31	1.09	1.03	794.62	708.29	1.71	1.21
84554	A	0.76	0.67	10.46	9.22	1.44	1.44	639.27	609.71	13.76	11.08
84556	1	3.17	3.43	21.83	22.22	4.57	4.47	851.63	843.48	46.83	1.22
84556	2	0.09	0.08	3.20	3.00	0.60	0.61	446.84	461.77	2.32	8.68
84556	3	0.24	0.25	5.16	4.56	0.83	0.86	640.17	622.69	1.66	1.19
84556	A	0.27	0.27	4.32	4.12	0.83	0.83	481.60	493.01	4.63	11.09
84557	1	3.07	3.60	30.88	33.19	2.47	2.47	904.71	886.13	19.75	1.19
84557	2	0.04	0.03	0.49	0.36	0.24	0.21	474.89	469.17	1.80	8.62
84557	3	0.02	0.01	0.38	0.18	0.29	0.29	675.45	643.31	1.27	1.20
84557	A	0.20	0.21	2.07	2.06	0.36	0.34	511.55	503.02	2.70	11.01
84558	1	13.04	11.04	85.38	74.30	0.86	0.68	962.55	887.69	602.07	1.21
84558	2	0.28	0.07	2.30	2.07	0.36	0.34	528.73	513.90	4.99	8.71
84558	3	0.13	0.10	1.17	0.83	0.57	0.52	778.96	723.46	1.45	1.16
84558	A	0.96	0.65	6.70	5.77	0.40	0.37	569.08	547.54	36.01	11.08
84560	1	2.96	2.71	23.24	18.03	2.04	1.81	704.85	562.17	11.21	1.23
84560	2	0.17	0.11	2.99	1.86	0.33	0.24	425.31	326.13	6.10	8.72
84560	3	0.22	0.00	2.07	0.00	0.72	0.01	577.96	11.58	2.25	1.23
84560	A	0.32	0.24	4.01	2.59	0.45	0.31	450.99	316.54	6.10	11.18

RunID	Phase	HC (g/m)		CO (g/m)		NOx (g/m)		CO2 (g/m)		PM2.5 (mg/m)	Distance (miles)
		SMT	BKI	SMT	BKI	SMT	BKI	SMT	BKI		
84562	1	1.59	1.51	13.87	12.98	0.11	0.09	908.30	823.33	7.66	1.23
84562	2	0.03	0.02	0.19	0.07	0.12	0.10	504.23	472.54	4.41	8.66
84562	3	0.04	0.05	0.52	0.27	0.13	0.09	748.38	642.19	1.63	1.20
84562	A	0.11	0.10	0.95	0.78	0.12	0.10	543.05	503.15	4.39	11.09
84563	1	2.02	2.14	27.83	24.64	0.36	0.35	952.18	939.33	5.37	1.20
84563	2	0.07	0.06	0.89	0.66	0.13	0.14	488.11	494.00	0.73	8.70
84563	3	0.02	0.02	0.34	0.13	0.02	0.02	657.52	636.44	0.00	1.21
84563	A	0.17	0.17	2.27	1.87	0.14	0.14	524.23	527.05	0.92	11.10
84564	1	3.52	4.03	41.92	45.70	3.15	2.79	804.52	782.75	37.02	1.21
84564	2	0.06	0.04	1.15	1.00	0.58	0.56	448.03	456.51	3.70	8.68
84564	3	0.23	0.22	3.37	2.68	0.56	0.55	599.57	591.76	3.63	1.22
84564	A	0.25	0.26	3.44	3.46	0.71	0.67	477.35	483.15	5.44	11.11
84566	1	5.31	6.24	83.69	91.65	2.05	2.21	716.85	725.92	108.75	1.18
84566	2	0.23	0.20	3.73	3.54	0.37	0.39	427.71	445.41	33.83	8.73
84566	3	0.24	0.29	2.81	2.18	0.49	0.50	560.31	536.46	20.53	1.20
84566	A	0.50	0.51	7.86	7.98	0.47	0.49	452.12	466.10	36.75	11.11
84567	1	30.55	28.73	607.13	529.63	0.41	0.54	742.90	668.03	245.13	1.23
84567	2	11.10	11.19	244.47	234.76	0.14	0.30	368.57	361.91	33.16	8.70
84567	3	16.33	15.88	198.05	174.65	1.50	1.55	737.60	680.91	30.53	1.19
84567	A	12.49	12.44	260.54	246.30	0.25	0.40	413.85	400.09	44.26	11.12
84568	1	3.62	3.58	30.58	25.77	2.18	2.33	703.73	620.77	15.70	1.11
84568	2	0.54	0.42	10.65	8.04	1.38	1.34	369.43	373.28	3.55	8.62
84568	3	1.24	0.99	13.45	9.74	1.50	1.35	571.06	464.04	3.00	1.20
84568	A	0.74	0.61	11.84	9.03	1.43	1.39	400.19	391.76	4.11	10.93
84569	1	2.80	3.02	32.76	30.02	2.67	2.63	801.17	754.91	20.19	1.22
84569	2	0.16	0.13	5.50	4.91	0.76	0.78	411.43	403.27	2.60	8.60
84569	3	0.38	0.35	8.34	6.82	0.92	0.88	596.53	524.58	0.15	1.20
84569	A	0.32	0.30	7.14	6.38	0.88	0.88	444.84	430.50	3.37	11.02
84570	1	2.86	2.38	61.32	45.97	2.60	2.25	760.44	614.90	4.00	1.22
84570	2	0.28	0.18	8.62	6.58	0.43	0.40	417.64	372.92	0.87	8.72
84570	3	0.85	0.61	19.75	12.74	0.36	0.32	588.23	465.00	0.41	1.21
84570	A	0.46	0.33	12.20	9.09	0.54	0.49	447.77	392.10	1.00	11.16
84572	1	4.19	4.97	82.40	91.53	1.60	1.56	593.15	580.45	12.11	1.23
84572	2	0.14	0.12	3.50	3.29	1.05	1.07	379.24	392.25	3.25	8.72
84572	3	0.60	0.62	4.37	3.56	1.03	1.03	482.58	478.15	2.07	1.21
84572	A	0.39	0.42	7.76	8.00	1.07	1.10	397.89	408.23	3.64	11.16
84573	1	3.11	3.31	29.44	29.34	3.36	3.09	935.53	893.59	38.72	1.24
84573	2	0.04	0.03	1.82	1.56	0.85	0.84	485.95	483.48	3.04	8.69
84573	3	0.19	0.18	2.95	2.09	1.65	1.54	731.56	686.40	4.21	1.19
84573	A	0.22	0.22	3.37	3.08	1.04	1.01	526.77	519.34	5.03	11.12
84574	1	3.68	3.92	62.46	60.96	2.21	2.05	716.35	692.76	4.65	1.19
84574	2	0.10	0.09	3.55	3.40	0.80	0.79	384.10	389.79	0.87	8.69
84574	3	0.89	0.92	24.16	23.55	1.36	1.29	562.87	544.31	0.58	1.22
84574	A	0.34	0.35	8.06	7.80	0.91	0.89	413.90	416.33	1.05	11.10
84575	1	9.47	10.65	211.00	212.85	2.31	2.22	687.15	651.82	58.49	1.22
84575	2	0.34	0.25	7.68	6.39	1.42	1.42	421.86	419.84	2.93	8.75

RunID	Phase	HC (g/m)		CO (g/m)		NOx (g/m)		CO2 (g/m)		PM2.5 (mg/m)	Distance (miles)
		SMT	BKI	SMT	BKI	SMT	BKI	SMT	BKI		
84575	3	1.81	1.59	28.65	24.33	2.63	2.50	579.32	532.08	1.97	1.23
84575	A	0.92	0.89	19.86	18.51	1.55	1.54	446.92	439.91	5.78	11.19
84577	1	2.81	2.93	42.00	37.95	4.58	3.69	916.71	854.84	32.81	1.19
84577	2	0.06	0.06	6.12	5.40	1.88	1.50	482.23	471.28	4.65	8.68
84577	3	0.14	0.14	8.87	6.48	2.96	2.31	721.10	647.21	2.62	1.20
84577	A	0.21	0.22	8.18	7.16	2.10	1.67	521.50	503.33	5.97	11.07
84578	1	7.93	7.45	84.77	66.25	6.42	6.17	758.51	678.12	32.10	1.21
84578	2	2.57	2.33	18.67	15.86	5.26	4.98	414.82	392.47	3.74	8.65
84578	3	4.36	3.75	30.48	21.70	6.75	5.89	624.20	527.04	4.60	1.20
84578	A	2.97	2.70	22.94	18.92	5.42	5.10	447.29	416.83	5.29	11.06
84580	1	0.01	2.86	0.10	30.00	0.01	3.19	1.86	991.02	35.23	1.08
84580	2	0.00	0.05	0.00	1.65	0.00	0.46	0.00	474.85	8.10	8.79
84580	3	0.00	0.16	0.04	3.73	0.00	0.80	0.64	644.34	2.37	1.22
84580	A	0.00	0.19	0.01	3.12	0.00	0.61	0.13	510.78	8.98	11.08
84581	1	4.94	4.72	66.04	62.92	1.38	1.38	720.64	656.17	5.68	1.24
84581	2	0.18	0.12	3.18	2.58	0.77	0.76	400.54	391.25	0.66	8.76
84581	3	0.73	0.61	11.35	9.07	0.57	0.55	576.23	522.48	2.95	1.21
84581	A	0.47	0.40	7.08	6.24	0.79	0.78	429.74	414.46	1.09	11.21
84582	1	8.26	9.56	79.73	81.73	2.11	2.29	558.70	560.54	55.80	1.17
84582	2	1.68	1.58	23.43	21.50	1.42	1.34	359.04	361.22	13.05	8.55
84582	3	2.68	2.73	22.17	18.28	1.16	1.07	470.07	450.52	17.46	1.22
84582	A	2.09	2.07	26.27	24.39	1.44	1.37	377.35	377.87	15.57	10.94
84584	1	3.10	3.20	27.72	25.96	2.55	2.45	584.36	541.54	21.33	1.27
84584	2	0.15	0.14	3.94	3.44	0.22	0.19	371.94	374.03	5.09	8.77
84584	3	0.23	0.23	4.09	2.90	0.39	0.32	548.06	477.01	2.93	1.25
84584	A	0.32	0.31	5.25	4.62	0.36	0.32	395.96	390.46	5.82	11.29
84587	1	9.21	10.55	60.42	66.64	2.92	3.14	784.13	763.59	148.35	1.21
84587	2	0.20	0.09	1.55	1.33	0.92	0.98	444.82	463.00	4.89	8.70
84587	3	0.23	0.22	4.46	2.84	1.14	1.34	564.83	573.73	1.06	1.20
84587	A	0.68	0.64	4.86	4.85	1.04	1.12	471.10	486.39	12.14	11.11
84588	1	21.73	14.78	373.53	341.85	1.09	1.17	946.95	876.68	160.26	1.24
84588	2	1.19	0.97	30.81	27.78	1.50	1.52	620.93	607.26	11.49	8.76
84588	3	2.21	2.03	30.54	23.68	1.94	1.97	874.20	781.81	9.96	1.26
84588	A	2.35	1.78	49.00	44.23	1.51	1.53	656.38	634.10	19.30	11.26
84589	1	1.71	2.11	18.52	19.53	0.35	0.35	579.58	563.31	600.02	1.21
84589	2	0.04	0.03	0.59	0.53	0.17	0.16	282.08	286.20	1.77	8.78
84589	3	0.02	0.02	0.29	0.18	0.22	0.20	392.62	357.28	0.42	1.24
84589	A	0.12	0.14	1.51	1.50	0.18	0.17	305.59	305.68	32.80	11.23
84591	1	3.87	4.14	55.38	58.30	2.95	2.78	915.04	868.61	6.77	1.22
84591	2	0.14	0.13	5.04	4.23	1.66	1.55	511.62	522.03	24.37	8.70
84591	3	0.37	0.36	7.83	5.14	1.84	1.74	693.44	650.19	0.93	1.23
84591	A	0.36	0.36	7.94	7.16	1.74	1.63	546.21	549.47	21.79	11.15
84592	1	53.12	20.94	268.65	210.67	1.22	0.94	491.38	403.40	247.18	1.60
84592	2	9.30	5.12	78.11	73.38	2.27	1.86	362.04	335.32	74.48	10.54
84592	3	2.51	2.01	12.05	8.90	3.46	2.87	485.01	397.15	12.39	1.79
84592	A	11.23	5.76	83.51	75.85	2.31	1.89	379.45	344.28	79.12	13.93

RunID	Phase	HC (g/m)		CO (g/m)		NOx (g/m)		CO2 (g/m)		PM2.5 (mg/m)	Distance (miles)
		SMT	BKI	SMT	BKI	SMT	BKI	SMT	BKI		
84593	1	1.82	2.09	28.86	29.80	1.29	1.23	680.45	622.05	22.17	1.20
84593	2	0.05	0.02	2.08	1.89	0.10	0.11	336.81	348.89	2.37	8.64
84593	3	0.05	0.04	2.17	1.18	0.03	0.05	486.95	432.70	1.99	1.20
84593	A	0.14	0.13	3.48	3.30	0.16	0.16	365.10	369.05	3.38	11.04
84595	1	2.06	2.22	26.85	26.82	2.75	2.83	613.66	596.83	12.88	1.20
84595	2	0.05	0.04	3.72	3.06	1.06	1.05	309.79	319.63	1.57	8.63
84595	3	0.03	0.04	1.31	0.80	0.81	0.85	387.34	399.50	1.10	1.19
84595	A	0.15	0.15	4.76	4.15	1.14	1.13	331.06	339.68	2.13	11.03
84596	1	2.61	2.76	43.96	44.56	2.58	2.43	798.00	740.10	1.67	1.21
84596	2	0.08	0.07	3.41	3.28	0.64	0.67	438.02	437.63	1.89	8.68
84596	3	0.32	0.26	4.70	3.33	1.12	1.14	591.70	542.37	0.77	1.21
84596	A	0.23	0.22	5.63	5.46	0.77	0.80	467.60	460.89	1.80	11.11
84597	1	5.71	6.17	109.37	114.25	1.65	1.70	622.76	576.68	17.74	1.21
84597	2	0.57	0.55	12.54	12.57	0.36	0.35	327.84	333.74	3.69	8.74
84597	3	1.07	0.92	10.35	7.96	0.88	0.91	507.79	445.78	.	1.21
84597	A	0.87	0.87	17.46	17.55	0.46	0.46	355.75	354.16	.	11.16
84599	1	8.45	10.00	47.73	51.64	1.59	1.58	811.42	792.13	87.70	1.19
84599	2	0.15	0.05	0.94	0.67	0.20	0.20	391.20	399.59	8.61	8.76
84599	3	0.11	0.11	0.84	0.44	0.35	0.39	531.64	516.90	2.20	1.22
84599	A	0.58	0.57	3.35	3.28	0.28	0.28	422.68	427.98	12.22	11.17
84600	1	5.30	5.64	78.56	75.34	2.40	2.29	986.52	893.41	57.31	1.21
84600	2	0.14	0.10	4.99	4.61	1.19	1.14	555.32	540.20	22.18	8.75
84600	3	0.55	0.54	10.69	7.51	1.74	1.65	794.00	710.69	5.49	1.23
84600	A	0.44	0.42	9.23	8.50	1.29	1.24	594.55	570.58	22.84	11.18
84601	1	17.07	15.53	209.68	154.87	3.46	3.08	899.42	721.70	180.28	1.19
84601	2	5.01	3.82	71.14	53.92	2.76	2.70	498.02	460.62	42.57	8.69
84601	3	6.56	5.26	125.44	84.79	4.17	3.72	654.91	522.33	17.76	1.23
84601	A	5.73	4.53	81.91	61.33	2.89	2.79	529.17	478.50	47.94	11.11
84603	1	6.29	6.34	108.98	118.91	0.89	1.04	527.42	519.99	32.32	1.15
84603	2	3.29	2.42	7.87	8.02	3.27	3.44	279.52	293.65	6.41	8.62
84603	3	8.08	5.81	6.04	4.78	3.07	3.55	373.22	351.12	2.66	1.19
84603	A	3.78	2.85	12.84	13.40	3.13	3.33	298.54	309.04	7.46	10.96
84605	1	18.20	14.82	204.08	152.45	1.57	1.95	796.86	669.45	148.40	1.14
84605	2	1.63	0.81	17.10	8.94	2.44	2.61	489.41	481.38	48.49	8.63
84605	3	4.84	3.50	25.38	9.39	2.17	2.43	705.33	596.36	12.12	1.19
84605	A	2.69	1.70	27.17	16.19	2.38	2.57	519.96	498.77	50.99	10.96
84606	1	9.23	9.35	96.47	79.62	5.91	5.62	748.72	679.46	51.20	1.18
84606	2	2.35	2.26	18.53	16.45	5.15	4.82	402.34	391.20	3.23	8.66
84606	3	3.96	3.58	31.44	21.77	6.88	5.96	602.65	510.53	3.62	1.21
84606	A	2.82	2.72	23.48	20.08	5.31	4.94	434.25	414.42	5.73	11.05
84609	1	24.39	16.28	158.74	99.24	2.87	2.69	934.84	676.56	100.22	1.25
84609	2	4.56	2.88	51.87	42.62	3.05	2.96	546.07	468.65	22.75	8.72
84609	3	5.46	3.46	42.26	28.83	3.14	2.61	871.73	593.44	2.79	1.19
84609	A	5.69	3.64	56.98	44.72	3.05	2.92	589.28	488.40	25.56	11.16
84611	1	5.33	6.63	70.55	83.29	3.43	3.27	727.76	727.69	39.63	1.21
84611	2	0.12	0.07	1.88	1.77	1.42	1.41	409.15	424.40	3.68	8.68

RunID	Phase	HC (g/m)		CO (g/m)		NOx (g/m)		CO2 (g/m)		PM2.5 (mg/m)	Distance (miles)
		SMT	BKI	SMT	BKI	SMT	BKI	SMT	BKI		
84611	3	0.21	0.23	3.13	2.57	2.02	1.87	531.73	519.40	1.53	1.19
84611	A	0.40	0.43	5.58	6.11	1.57	1.54	434.32	446.87	5.42	11.08
84612	1	0.11	2.08	0.80	19.42	0.06	1.28	30.07	818.39	2.94	1.22
84612	2	0.03	0.03	1.27	1.20	0.24	0.53	377.18	459.70	0.56	8.81
84612	3	0.03	0.04	0.43	0.12	0.21	0.20	633.33	609.92	1.50	1.19
84612	A	0.03	0.14	1.19	2.08	0.23	0.55	376.53	488.62	0.75	11.22
84616	1	1.73	1.87	12.48	11.97	2.22	2.18	796.07	770.26	4.66	1.15
84616	2	0.03	0.05	0.41	0.26	0.13	0.13	427.68	440.01	0.78	8.60
84616	3	0.14	0.16	2.50	2.06	0.26	0.29	591.36	585.08	1.82	1.20
84616	A	0.13	0.15	1.17	0.98	0.25	0.25	457.91	466.89	1.05	10.96
84617	1	3.49	3.36	33.94	27.29	5.12	4.54	1057.26	909.02	16.83	1.25
84617	2	0.15	0.14	4.12	3.40	0.91	0.87	621.47	588.33	5.21	8.76
84617	3	0.52	0.46	9.81	6.84	1.12	1.01	954.93	769.02	2.80	1.20
84617	A	0.35	0.34	6.11	4.92	1.15	1.07	667.77	617.99	5.67	11.21
84618	1	7.08	3.49	182.52	83.66	7.52	5.75	1194.58	666.23	19.45	1.23
84618	2	0.53	0.48	14.64	15.92	3.24	3.92	506.80	424.82	5.71	8.76
84618	3	1.62	0.75	37.95	16.56	6.77	4.26	1269.70	573.42	3.82	1.17
84618	A	0.95	0.66	25.04	19.55	3.70	4.04	594.72	447.57	6.31	11.16
84620	1	14.94	9.09	105.74	52.98	1.63	2.67	960.70	676.29	17.56	1.09
84620	2	4.36	2.31	35.55	19.06	1.91	3.13	419.91	399.81	7.94	8.57
84620	3	9.63	3.87	86.84	28.34	3.35	2.92	881.15	442.65	3.00	1.24
84620	A	5.25	2.76	42.57	21.38	2.00	3.09	478.64	416.35	8.05	10.90
84621	1	5.31	5.33	86.34	87.42	1.88	1.74	739.44	675.55	8.18	1.15
84621	2	0.21	0.19	3.45	2.93	1.06	1.09	445.89	429.86	4.27	8.73
84621	3	1.55	1.18	12.03	7.28	1.40	1.34	678.75	564.03	5.67	1.19
84621	A	0.56	0.51	8.29	7.47	1.12	1.14	476.73	451.38	4.56	11.07
84622	1	12.22	6.63	87.56	38.97	3.29	2.10	1180.31	686.31	71.43	1.17
84622	2	0.19	0.13	2.14	2.17	0.42	0.33	528.80	372.11	4.00	8.64
84622	3	0.54	0.22	8.77	2.61	1.10	0.45	1213.62	479.37	6.44	1.18
84622	A	0.83	0.47	6.99	4.09	0.61	0.43	609.37	395.53	7.62	10.98
84623	1	15.87	8.30	396.59	198.86	4.80	3.12	891.39	501.67	155.11	1.21
84623	2	0.82	0.39	16.90	8.27	3.41	3.43	497.47	341.74	21.02	8.68
84623	3	1.54	0.64	31.04	10.23	7.26	3.67	1168.03	446.51	6.81	1.19
84623	A	1.66	0.82	37.82	18.40	3.75	3.43	564.77	357.33	27.09	11.08
84624	1	9.02	8.36	109.72	88.34	4.85	4.68	709.87	636.64	46.80	1.20
84624	2	2.44	2.16	20.53	17.89	4.74	4.28	394.42	372.95	1.55	8.77
84624	3	3.78	3.26	31.09	22.20	6.68	5.62	587.65	503.89	2.22	1.23
84624	A	2.87	2.56	25.89	21.85	4.88	4.40	424.38	395.84	3.93	11.21
84626	1	11.58	11.77	291.83	294.30	0.81	0.87	711.59	646.66	180.91	1.26
84626	2	0.43	0.43	19.03	19.64	1.89	1.69	431.17	414.83	11.17	8.69
84626	3	2.90	2.59	45.82	41.58	2.68	2.25	538.27	449.15	-0.49	1.20
84626	A	1.21	1.20	35.85	36.13	1.89	1.69	454.01	429.85	19.60	11.15
84627	1	93.36	31.68	265.84	206.90	3.50	3.77	837.52	662.71	199.52	1.17
84627	2	31.11	12.78	71.50	57.39	3.75	3.69	622.29	539.75	242.74	8.71
84627	3	62.25	27.95	139.19	106.19	3.87	4.10	688.57	554.90	125.74	1.26
84627	A	36.53	14.84	86.27	68.54	3.75	3.72	638.02	547.12	232.12	11.15

RunID	Phase	HC (g/m)		CO (g/m)		NOx (g/m)		CO2 (g/m)		PM2.5 (mg/m)	Distance (miles)
		SMT	BKI	SMT	BKI	SMT	BKI	SMT	BKI		
84628	1	6.66	6.63	50.17	51.28	0.84	0.87	1032.95	990.97	64.23	1.24
84628	2	0.12	0.06	2.33	2.11	0.30	0.28	533.72	545.81	12.17	8.68
84628	3	0.05	0.06	2.75	1.91	0.25	0.24	767.50	723.54	6.74	1.23
84628	A	0.46	0.41	4.92	4.74	0.32	0.31	576.61	582.37	14.58	11.16
84629	1	5.32	6.03	61.44	68.37	1.55	1.49	765.56	731.11	21.38	1.05
84629	2	0.16	0.13	4.12	4.01	0.12	0.10	406.67	399.03	4.56	8.61
84629	3	0.04	0.04	0.67	0.44	0.12	0.10	536.47	492.35	1.93	1.21
84629	A	0.40	0.40	6.58	6.78	0.19	0.17	432.73	421.14	5.16	10.87
84630	1	11.41	12.54	225.28	225.01	0.54	0.67	505.54	476.63	44.11	1.20
84630	2	0.75	0.54	21.21	19.64	0.46	0.47	382.62	358.74	7.57	8.64
84630	3	0.25	0.20	5.82	3.87	1.03	0.89	542.21	452.28	23.06	1.20
84630	A	1.28	1.14	30.95	29.30	0.50	0.51	400.17	371.43	10.56	11.04
84632	1	95.50	31.43	289.21	227.16	3.11	3.23	776.72	632.48	165.03	1.21
84632	2	35.98	13.26	102.24	83.83	3.57	3.49	637.13	555.86	98.68	8.78
84632	3	57.42	27.71	56.74	36.39	6.24	5.90	863.28	673.25	57.43	1.15
84632	A	40.53	15.16	108.94	88.15	3.73	3.63	659.57	567.58	99.41	11.13
84633	1	5.88	5.14	141.42	120.40	1.73	1.69	685.05	542.73	.	1.28
84633	2	1.20	1.10	63.14	59.25	1.17	1.12	403.19	374.56	.	8.80
84633	3	0.80	0.65	13.28	8.42	2.43	2.20	629.00	496.36	.	1.24
84633	A	1.42	1.29	63.89	59.03	1.29	1.23	433.92	392.32	.	11.32
84634	1	8.61	9.62	89.41	86.27	4.56	3.99	772.92	698.27	158.66	1.18
84634	2	0.53	0.48	7.52	7.03	3.65	2.99	443.79	440.67	15.52	8.57
84634	3	2.65	2.07	17.98	13.02	4.70	4.43	635.43	585.95	18.72	1.18
84634	A	1.10	1.06	12.48	11.56	3.77	3.14	473.99	464.05	23.18	10.92
84635	1	8.25	8.35	110.37	94.56	3.48	3.68	779.87	733.45	206.47	1.26
84635	2	1.22	1.06	14.13	12.16	1.35	1.42	453.77	447.08	55.01	9.11
84635	3	2.30	2.08	14.17	10.53	1.28	1.36	601.50	550.24	94.86	1.36
84635	A	1.67	1.51	19.13	16.34	1.45	1.53	481.67	469.67	65.85	11.73
84637	1	26.33	21.72	527.52	438.92	1.87	1.40	577.17	514.47	1654.02	1.27
84637	2	2.83	2.69	48.44	49.11	4.14	3.98	443.87	454.28	65.06	8.89
84637	3	3.37	3.50	39.64	36.09	5.02	4.57	607.07	567.15	15.25	1.23
84637	A	4.13	3.78	73.58	69.22	4.08	3.89	462.42	465.32	146.94	11.39
84638	1	5.72	5.78	73.85	70.18	2.90	2.96	817.57	771.69	13.86	1.19
84638	2	1.11	1.01	21.47	20.25	1.18	1.25	437.21	445.23	2.00	8.63
84638	3	1.70	1.55	22.91	17.83	1.17	1.29	610.36	582.65	1.39	1.21
84638	A	1.39	1.29	24.27	22.69	1.27	1.34	468.83	471.90	2.57	11.03
84639	1	3.86	3.99	62.67	61.95	2.26	2.22	543.98	484.65	7.97	1.16
84639	2	0.13	0.09	3.00	2.17	0.58	0.62	337.34	313.92	1.44	8.51
84639	3	0.52	0.43	7.55	4.52	1.22	1.26	479.50	389.68	1.75	1.15
84639	A	0.35	0.32	6.37	5.41	0.71	0.75	357.61	327.89	1.80	10.82
84640	1	2.97	3.06	35.85	30.10	3.30	3.23	932.59	877.25	0.00	1.21
84640	2	0.10	0.08	7.58	6.41	1.20	1.21	495.62	497.82	.	8.74
84640	3	0.43	0.39	14.17	10.42	1.03	1.18	672.51	627.16	.	1.22
84640	A	0.27	0.26	9.53	7.92	1.30	1.32	531.04	526.67	.	11.17
84642	1	5.23	5.57	172.83	160.46	1.83	1.91	595.88	549.83	36.66	1.21
84642	2	0.34	0.25	13.50	11.43	1.54	1.47	402.35	378.73	4.06	8.63

RunID	Phase	HC (g/m)		CO (g/m)		NOx (g/m)		CO2 (g/m)		PM2.5 (mg/m)	Distance (miles)
		SMT	BKI	SMT	BKI	SMT	BKI	SMT	BKI		
84642	3	0.47	0.32	15.00	9.12	1.44	1.38	601.61	466.65	4.00	1.18
84642	A	0.60	0.54	22.01	19.15	1.55	1.49	426.25	393.81	5.78	11.02
84643	1	10.12	10.40	176.30	161.76	2.19	2.19	519.12	467.52	459.38	1.13
84643	2	1.51	1.32	26.09	23.26	2.81	2.67	352.31	330.86	136.54	8.48
84643	3	2.08	1.93	21.21	15.91	2.76	2.51	469.79	390.90	35.88	1.14
84643	A	1.98	1.81	33.33	29.75	2.78	2.63	368.63	341.79	146.04	10.75
84644	1	2.95	3.02	24.80	26.62	1.81	1.62	857.67	784.30	16.88	1.26
84644	2	0.07	0.05	2.04	1.83	0.30	0.29	509.64	506.34	4.55	8.77
84644	3	0.04	0.03	2.39	1.87	0.23	0.25	664.07	607.94	2.12	1.22
84644	A	0.23	0.21	3.30	3.17	0.38	0.36	539.31	528.40	5.05	11.24
84645	1	7.58	7.98	79.86	75.85	0.84	1.13	740.25	691.16	23.98	1.23
84645	2	0.07	0.05	0.94	0.73	0.41	0.42	419.43	414.38	5.66	8.70
84645	3	0.19	0.17	3.21	2.14	0.74	0.73	594.85	545.17	1.74	1.19
84645	A	0.48	0.48	5.28	4.82	0.46	0.48	448.69	438.10	6.37	11.12
84646	1	6.95	6.07	142.28	116.08	1.98	1.97	636.11	507.63	15.14	1.16
84646	2	0.46	0.37	13.07	10.30	1.30	1.29	418.27	357.05	6.00	8.59
84646	3	1.07	0.89	16.20	10.01	2.41	2.46	537.75	419.88	3.13	1.21
84646	A	0.84	0.70	19.91	15.70	1.42	1.41	437.79	369.17	6.27	10.95
84648	1	7.05	7.08	75.60	69.45	2.56	2.94	825.05	750.31	43.39	1.21
84648	2	0.74	0.71	17.70	18.64	1.84	1.68	503.19	494.91	39.18	8.73
84648	3	1.27	1.38	31.87	29.78	1.28	1.17	654.29	594.15	6.85	1.24
84648	A	1.11	1.09	21.77	22.08	1.84	1.71	530.95	515.29	37.11	11.17
84649	1	13.35	11.55	127.95	93.66	2.21	1.98	917.93	660.42	26.99	1.21
84649	2	0.17	0.10	2.71	1.98	0.71	0.63	526.31	445.29	5.61	8.65
84649	3	0.79	0.48	9.65	5.40	0.92	0.73	743.76	541.82	2.06	1.21
84649	A	0.91	0.73	9.82	7.07	0.81	0.71	562.10	463.40	6.49	11.07
84650	1	8.01	7.32	137.75	117.17	3.95	4.09	770.78	686.16	33.90	1.18
84650	2	0.20	0.16	5.48	4.84	1.31	1.35	452.02	434.87	6.46	8.76
84650	3	1.47	1.29	18.59	14.61	2.29	2.20	648.79	553.00	3.21	1.20
84650	A	0.69	0.60	13.19	11.24	1.51	1.55	481.95	455.82	7.63	11.15
84651	1	9.77	9.58	101.18	82.64	5.13	5.48	766.92	691.08	71.62	1.18
84651	2	2.55	2.30	19.61	17.09	4.41	4.50	407.49	388.32	4.27	8.67
84651	3	4.16	3.66	32.27	23.05	5.90	5.65	599.09	513.51	5.51	1.20
84651	A	3.03	2.77	24.70	20.88	4.55	4.63	439.31	412.64	7.82	11.06
84653	1	18.19	15.05	471.03	424.59	1.85	2.00	927.10	827.81	595.95	1.25
84653	2	4.93	3.11	64.39	49.43	6.06	5.29	715.27	675.31	89.23	8.69
84653	3	7.18	5.34	111.37	77.11	5.66	5.17	875.32	742.87	14.56	1.20
84653	A	5.79	3.91	89.24	71.68	5.81	5.10	737.72	688.25	111.61	11.15
84655	1	3.88	4.16	30.28	29.73	4.65	4.66	860.07	794.85	20.72	1.22
84655	2	0.14	0.13	2.98	3.12	1.05	1.05	449.09	443.65	4.73	8.66
84655	3	0.78	0.77	7.84	6.82	1.59	1.58	644.25	589.76	1.48	1.19
84655	A	0.38	0.39	4.75	4.79	1.28	1.28	484.11	472.30	5.35	11.07
84656	1	6.62	5.76	103.25	77.32	3.35	3.58	777.61	658.59	26.59	1.17
84656	2	0.12	0.09	4.33	3.70	1.07	1.11	421.31	405.04	7.12	8.62
84656	3	0.72	0.69	13.75	10.43	2.30	2.22	597.50	518.71	3.26	1.24
84656	A	0.50	0.43	10.14	7.96	1.28	1.31	452.44	426.19	7.84	11.03

RunID	Phase	HC (g/m)		CO (g/m)		NOx (g/m)		CO2 (g/m)		PM2.5 (mg/m)	Distance (miles)
		SMT	BKI	SMT	BKI	SMT	BKI	SMT	BKI		
84658	1	5.40	5.92	99.31	98.33	4.04	4.02	584.81	541.68	92.75	1.46
84658	2	0.55	0.52	6.83	5.67	2.83	2.69	379.61	363.62	1.30	9.29
84658	3	0.85	0.88	8.52	7.17	4.35	3.91	519.42	471.08	1.57	1.30
84658	A	0.85	0.86	12.34	11.18	3.00	2.85	401.29	381.53	6.65	12.05
84659	1	9.71	8.90	181.32	167.06	3.16	3.37	643.05	572.30	66.92	1.15
84659	2	2.71	1.36	29.98	24.59	3.03	2.71	409.89	401.52	12.81	8.67
84659	3	1.53	1.28	19.30	14.75	2.35	2.34	637.36	555.71	12.87	1.18
84659	A	2.98	1.73	36.83	31.08	2.99	2.72	437.14	420.67	15.53	11.00
84660	1	8.85	9.61	51.84	48.80	4.39	4.74	724.09	684.11	717.53	1.15
84660	2	0.81	0.70	5.22	4.44	2.69	2.80	442.51	438.16	127.94	8.64
84660	3	2.55	2.40	14.19	10.33	3.78	4.26	582.53	539.93	119.92	1.21
84660	A	1.34	1.27	8.20	7.09	2.85	3.00	466.47	457.67	157.13	10.99
84661	1	3.47	3.40	33.72	26.81	4.09	4.21	776.47	707.21	20.70	1.23
84661	2	0.09	0.06	2.41	1.92	1.10	1.13	417.05	403.95	3.17	8.75
84661	3	0.92	0.78	11.72	8.18	1.82	1.76	603.69	525.81	2.83	1.21
84661	A	0.32	0.29	4.71	3.67	1.31	1.34	448.87	428.46	4.07	11.18
84662	1	14.31	14.25	388.31	356.11	1.98	2.21	786.02	724.97	57.88	1.23
84662	2	1.69	1.35	26.38	23.49	5.32	5.00	527.26	496.81	17.84	8.65
84662	3	3.65	3.16	32.41	24.91	7.94	7.22	779.37	658.46	4.76	1.21
84662	A	2.49	2.17	45.92	41.43	5.32	5.01	558.34	520.33	19.07	11.09
84663	1	6.03	5.87	93.38	82.67	2.28	2.33	679.69	568.80	63.57	1.20
84663	2	0.76	0.56	12.60	8.80	1.48	1.52	414.57	360.32	19.97	8.70
84663	3	2.16	1.63	14.52	7.95	2.20	1.99	605.53	434.18	19.72	1.19
84663	A	1.13	0.91	16.97	12.60	1.57	1.60	441.54	376.29	22.22	11.10
84665	1	7.68	7.95	157.71	151.10	2.79	2.83	923.47	785.62	65.48	1.26
84665	2	0.19	0.13	4.38	3.87	2.80	2.74	511.27	482.71	7.22	8.78
84665	3	0.52	0.49	9.68	7.27	3.56	3.36	667.57	572.57	2.69	1.25
84665	A	0.61	0.58	12.99	12.07	2.86	2.79	544.58	505.47	10.04	11.29
84666	1	9.39	10.59	181.08	183.35	3.10	3.43	905.29	888.81	44.48	1.28
84666	2	0.48	0.42	1.95	1.86	2.90	2.91	557.76	571.10	11.30	8.74
84666	3	1.59	1.77	13.75	12.93	2.10	2.22	761.15	739.51	6.41	1.22
84666	A	1.04	1.07	12.48	12.56	2.85	2.89	590.71	600.24	12.77	11.24
84667	1	23.02	21.24	189.01	150.71	2.64	2.88	971.73	801.11	76.53	1.14
84667	2	6.33	5.55	57.10	56.99	3.36	3.34	605.79	592.25	9.29	8.68
84667	3	15.11	13.56	134.70	115.15	2.63	2.82	733.73	627.70	5.60	1.19
84667	A	7.77	6.88	69.05	65.68	3.27	3.29	632.92	605.14	12.39	11.02
84668	1	2.49	2.43	18.02	16.09	3.78	3.63	884.02	795.54	14.91	1.19
84668	2	0.04	0.03	1.31	1.10	1.31	1.22	450.90	429.65	1.75	8.70
84668	3	0.21	0.18	2.69	1.71	1.58	1.42	656.15	585.70	1.98	1.19
84668	A	0.17	0.17	2.26	1.92	1.46	1.36	487.41	459.26	2.45	11.08
84669	1	8.99	10.41	221.73	220.93	1.78	2.01	563.11	521.27	170.39	1.18
84669	2	0.83	0.51	12.15	9.11	2.64	2.77	409.18	384.34	20.56	8.70
84669	3	0.90	0.67	21.20	13.74	2.11	2.39	550.73	467.96	4.91	1.21
84669	A	1.25	1.03	23.53	20.32	2.56	2.70	426.87	397.18	27.15	11.09
84670	1	6.09	6.75	122.00	122.11	2.01	1.94	632.65	556.34	28.83	1.19
84670	2	0.44	0.34	9.64	8.26	1.13	1.16	404.00	372.57	10.04	8.63

RunID	Phase	HC (g/m)		CO (g/m)		NOx (g/m)		CO2 (g/m)		PM2.5 (mg/m)	Distance (miles)
		SMT	BKI	SMT	BKI	SMT	BKI	SMT	BKI		
84670	3	0.67	0.60	8.32	6.73	1.88	1.80	578.96	462.87	3.51	1.20
84670	A	0.76	0.70	15.52	14.10	1.22	1.25	428.30	388.45	10.56	11.02
84672	1	4.74	4.94	42.04	35.50	1.19	1.32	453.51	383.35	14.98	1.19
84672	2	0.17	0.15	5.25	4.45	0.87	0.89	278.13	256.27	4.29	8.55
84672	3	0.32	0.30	3.57	2.02	0.84	0.88	385.78	299.32	5.15	1.21
84672	A	0.42	0.41	7.05	5.91	0.88	0.91	294.79	265.97	4.91	10.95
84673	1	36.22	21.42	660.09	483.62	0.76	0.44	994.63	891.61	1437.93	1.19
84673	2	12.07	5.88	303.38	209.21	2.83	0.60	664.26	644.25	0.00	8.34
84673	3	2.36	2.52	58.30	57.64	1.57	1.47	972.15	880.18	97.74	1.19
84673	A	12.67	6.47	305.06	213.11	2.63	0.65	703.78	674.27	83.99	10.72
84674	1	11.46	8.97	227.56	181.82	2.82	2.93	930.10	807.66	48.46	1.20
84674	2	2.63	2.04	36.46	33.78	2.52	2.65	504.89	471.11	6.73	8.62
84674	3	4.09	3.26	64.05	45.88	2.94	3.06	764.44	642.79	7.65	1.21
84674	A	3.19	2.49	48.33	42.38	2.56	2.70	545.13	500.75	8.98	11.02
84675	1	3.63	4.09	46.55	53.60	3.42	3.62	603.95	581.54	8.21	1.17
84675	2	0.12	0.10	2.59	2.11	1.77	1.87	380.96	378.41	4.12	8.59
84675	3	0.50	0.54	4.68	3.45	2.13	2.32	498.07	480.49	0.94	1.17
84675	A	0.33	0.34	5.00	4.86	1.88	1.99	400.47	395.88	4.11	10.93
84676	1	8.92	8.70	174.08	156.43	1.72	2.14	661.31	634.56	25.59	1.32
84676	2	0.50	0.41	9.85	9.62	2.22	2.33	522.95	501.75	8.25	9.07
84676	3	0.77	0.72	12.65	8.42	1.86	1.91	653.30	564.47	2.53	1.35
84676	A	0.99	0.89	19.21	17.58	2.16	2.29	540.03	513.65	8.78	11.74
84677	1	2.95	3.00	30.85	27.89	2.70	2.69	813.18	739.59	14.36	1.18
84677	2	0.10	0.10	2.93	2.77	0.49	0.46	446.53	422.91	1.47	8.69
84677	3	0.47	0.43	5.24	3.88	0.98	0.85	639.55	563.08	-0.02	1.20
84677	A	0.28	0.27	4.52	4.14	0.64	0.60	478.77	448.88	2.03	11.07
84679	1	12.17	11.74	110.30	90.22	2.03	2.31	561.96	451.46	72.75	1.20
84679	2	0.80	0.59	14.04	10.71	1.23	1.28	369.01	331.12	4.34	8.80
84679	3	1.25	1.07	8.58	5.33	1.80	1.67	534.65	392.73	4.45	1.28
84679	A	1.42	1.20	18.60	14.41	1.31	1.36	390.69	341.77	7.87	11.27
84680	1	167.51	30.97	679.36	464.14	3.14	0.28	724.79	518.69	1199.80	1.21
84680	2	45.99	15.39	115.69	91.68	1.71	2.45	607.51	525.02	398.09	8.80
84680	3	69.49	26.29	172.66	96.87	2.26	2.40	502.26	565.88	67.13	1.20
84680	A	53.89	16.94	148.84	111.35	1.82	2.34	606.50	527.49	417.10	11.20
84681	1	2.95	3.61	40.23	49.37	3.58	4.14	591.01	598.49	.	1.21
84681	2	0.12	0.09	1.83	1.46	1.77	2.02	386.50	383.57	.	8.69
84681	3	0.50	0.52	4.19	3.10	2.10	2.24	514.53	480.19	.	1.21
84681	A	0.29	0.31	4.02	4.09	1.88	2.15	406.11	401.57	.	11.11
84682	1	10.57	13.14	205.52	219.76	0.64	0.76	695.72	688.57	64.47	1.15
84682	2	1.70	1.62	29.05	28.22	0.96	0.96	414.53	422.17	18.69	8.61
84682	3	3.94	4.38	153.23	149.63	0.21	0.23	443.15	431.45	5.40	1.18
84682	A	2.30	2.39	46.58	46.27	0.90	0.90	430.75	436.33	20.09	10.94
84683	1	5.12	5.71	74.15	73.86	3.20	4.14	563.63	597.00	14.39	1.24
84683	2	0.76	0.61	11.24	9.05	2.61	2.69	408.17	388.12	9.07	8.66
84683	3	3.18	2.86	17.41	13.60	4.02	4.13	503.21	462.87	6.53	1.20
84683	A	1.18	1.04	15.28	12.86	2.74	2.87	423.70	404.59	9.18	11.11

RunID	Phase	HC (g/m)		CO (g/m)		NOx (g/m)		CO2 (g/m)		PM2.5 (mg/m)	Distance (miles)
		SMT	BKI	SMT	BKI	SMT	BKI	SMT	BKI		
84685	1	9.31	7.58	108.31	85.68	5.67	5.61	1000.80	877.61	11.51	1.17
84685	2	0.94	0.58	0.55	0.27	1.60	1.68	608.79	579.10	73.90	8.68
84685	3	5.57	4.50	16.35	12.78	1.87	1.96	792.37	715.07	5.80	1.20
84685	A	1.69	1.21	7.12	5.50	1.83	1.90	641.39	603.75	66.01	11.05
84686	1	63.20	19.83	347.95	239.44	2.07	2.07	681.01	487.70	282.24	1.32
84686	2	3.10	2.12	6.16	4.71	4.77	4.04	511.44	426.94	12.38	8.86
84686	3	5.37	4.39	16.85	11.84	4.54	3.57	740.82	558.12	10.98	1.26
84686	A	6.62	3.27	26.05	18.29	4.61	3.90	537.08	439.63	27.30	11.44
84687	1	21.99	17.34	491.79	410.84	0.37	0.65	987.71	841.38	332.42	1.25
84687	2	1.17	0.97	26.17	22.88	1.69	1.61	645.94	599.90	16.50	8.75
84687	3	1.75	1.56	32.76	25.25	2.12	1.93	884.30	735.29	3.39	1.27
84687	A	2.33	1.90	51.55	43.90	1.65	1.58	681.37	622.69	32.52	11.27
84688	1	4.55	4.54	68.63	64.76	1.94	1.91	800.15	695.22	14.51	1.23
84688	2	0.16	0.14	3.27	3.14	1.19	1.17	462.20	436.74	10.56	8.67
84688	3	0.60	0.66	4.69	3.73	2.24	2.13	614.17	560.54	4.66	1.21
84688	A	0.42	0.41	6.86	6.47	1.30	1.28	490.93	459.18	10.36	11.11
84689	1	2.37	2.56	40.08	36.04	3.17	3.04	591.27	512.62	35.13	1.25
84689	2	0.11	0.11	5.03	4.78	0.51	0.52	302.39	289.16	0.59	8.77
84689	3	0.42	0.44	10.04	8.58	0.74	0.71	438.99	389.13	0.39	1.25
84689	A	0.26	0.26	7.26	6.72	0.67	0.67	327.55	308.20	2.43	11.26
84690	1	4.23	5.09	58.78	62.07	3.82	4.27	621.87	620.34	7.02	1.19
84690	2	0.41	0.33	6.56	5.72	0.83	1.03	352.24	358.13	1.69	8.73
84690	3	1.69	1.78	16.03	15.07	1.64	1.97	438.94	452.21	2.26	1.23
84690	A	0.70	0.68	9.95	9.29	1.05	1.26	372.43	378.31	2.00	11.15
84692	1	8.77	9.61	148.10	127.49	2.13	2.72	600.00	591.79	12.12	1.17
84692	2	6.86	7.36	160.52	159.67	0.11	0.11	267.37	260.90	20.25	8.51
84692	3	8.07	9.36	181.83	174.43	0.17	0.33	355.00	357.29	9.71	1.14
84692	A	7.05	7.62	161.33	158.99	0.22	0.26	290.43	284.65	19.12	10.83
84693	1	8.41	8.99	174.35	157.11	2.50	2.71	806.29	731.22	15.70	1.21
84693	2	0.58	0.48	7.54	7.31	1.79	1.86	528.55	520.10	5.30	8.65
84693	3	1.56	1.66	15.32	13.22	1.78	1.93	747.64	697.83	2.44	1.16
84693	A	1.06	1.00	16.73	15.58	1.83	1.91	557.86	543.17	5.66	11.02
84694	1	28.22	20.46	260.99	180.97	2.86	2.65	1054.62	733.92	252.00	1.12
84694	2	1.59	0.95	15.81	12.60	5.18	4.50	550.83	467.53	15.93	8.75
84694	3	1.67	1.11	16.16	10.78	5.82	4.81	843.20	641.76	5.16	1.22
84694	A	2.91	1.91	27.93	20.69	5.11	4.43	596.16	492.64	26.68	11.09
84695	1	3.91	4.70	52.61	52.93	3.68	4.09	634.69	641.19	6.84	1.21
84695	2	0.42	0.29	5.97	4.29	0.78	0.98	364.56	370.04	1.86	8.73
84695	3	1.81	1.84	14.98	11.69	1.64	1.86	458.59	459.82	1.84	1.26
84695	A	0.71	0.63	9.06	7.38	1.00	1.20	385.47	390.72	2.12	11.20
84696	1	17.85	13.95	141.65	117.44	3.38	3.85	767.71	605.06	372.17	1.20
84696	2	5.47	3.06	25.38	20.10	3.34	3.60	452.99	376.68	35.71	8.73
84696	3	6.36	4.68	27.93	21.19	3.47	3.46	517.76	414.95	14.43	1.17
84696	A	6.17	3.73	31.60	25.23	3.35	3.60	473.70	391.13	51.72	11.10
84697	1	2.26	8.23	101.79	73.10	5.89	5.96	815.75	670.52	35.40	1.21
84697	2	1.19	2.41	22.34	17.52	4.67	4.78	458.85	391.96	3.14	8.66

RunID	Phase	HC (g/m)		CO (g/m)		NOx (g/m)		CO2 (g/m)		PM2.5 (mg/m)	Distance (miles)
		SMT	BKI	SMT	BKI	SMT	BKI	SMT	BKI		
84697	3	1.73	3.91	37.67	24.26	6.25	5.88	654.52	516.64	4.33	1.22
84697	A	1.28	2.82	27.62	20.92	4.85	4.92	491.50	415.37	4.92	11.09
84699	1	86.34	31.47	268.94	222.75	2.50	3.00	1366.88	1082.48	1039.01	0.83
84699	2	5.08	4.01	65.72	54.05	1.96	2.45	507.50	482.88	124.74	8.75
84699	3	7.38	6.08	113.53	75.82	2.68	2.57	817.42	614.02	116.94	1.24
84699	A	8.22	5.18	76.51	61.85	2.03	2.48	560.64	514.41	158.21	10.81
84700	1	23.96	14.53	253.82	178.08	2.39	2.36	1195.56	956.32	57.97	1.22
84700	2	7.19	5.51	66.87	59.49	3.29	3.40	618.27	583.58	73.83	8.65
84700	3	9.10	7.13	84.89	55.85	4.37	3.91	916.39	719.53	17.43	1.23
84700	A	8.22	6.11	78.09	65.54	3.31	3.38	669.95	613.09	68.99	11.10
84701	1	3.64	3.71	51.42	43.10	4.14	4.43	693.03	632.37	12.52	1.32
84701	2	0.26	0.23	0.53	0.64	1.88	2.00	372.74	372.62	12.07	9.06
84701	3	1.23	1.27	8.33	6.69	2.92	3.06	511.32	476.61	5.05	1.30
84701	A	0.51	0.49	3.85	3.39	2.07	2.21	399.99	394.25	11.59	11.69
84702	1	8.27	8.24	121.19	109.01	6.30	6.27	1067.73	935.84	108.38	1.19
84702	2	0.93	0.83	9.37	7.29	1.30	1.38	608.48	558.11	3.07	8.68
84702	3	1.95	1.58	13.97	7.66	2.16	2.12	923.65	699.45	3.18	1.21
84702	A	1.38	1.27	15.46	12.60	1.61	1.69	653.84	587.59	8.53	11.09
84703	1	7.86	7.48	163.53	135.44	8.53	7.56	869.76	755.44	37.38	1.24
84703	2	0.81	0.68	22.39	20.43	5.26	4.98	494.70	484.06	10.31	8.77
84703	3	1.54	1.37	22.07	17.34	8.88	7.96	686.67	590.00	2.38	1.24
84703	A	1.23	1.09	29.87	26.32	5.69	5.33	528.25	505.96	11.19	11.24
84705	1	8.96	9.32	173.90	158.69	1.85	1.88	771.56	730.49	123.22	1.18
84705	2	1.85	1.73	64.53	69.64	0.70	0.73	470.20	466.84	23.15	8.65
84705	3	4.14	3.60	91.40	87.73	0.74	0.70	623.87	554.95	7.34	1.17
84705	A	2.37	2.25	72.01	75.48	0.76	0.78	496.27	486.48	27.23	11.01
84707	1	46.15	21.04	251.01	199.76	1.96	2.24	1508.67	1205.81	284.48	0.94
84707	2	2.87	1.87	36.08	31.20	1.93	2.08	665.57	637.28	72.45	8.79
84707	3	3.51	3.12	44.84	36.06	2.32	2.26	876.03	764.51	26.93	1.23
84707	A	4.63	2.75	45.21	38.52	1.95	2.10	713.34	669.72	78.06	10.96
84708	1	1.22	1.24	16.89	16.84	1.33	1.14	802.18	763.79	44.84	1.19
84708	2	0.03	0.03	0.39	0.23	0.51	0.49	453.55	433.13	9.64	8.67
84708	3	0.05	0.05	0.90	0.54	0.43	0.31	647.63	587.31	5.74	1.20
84708	A	0.10	0.10	1.28	1.11	0.55	0.51	485.14	460.99	11.19	11.07
84709	1	9.46	8.39	141.94	123.39	1.71	1.72	575.53	469.85	15.16	1.19
84709	2	1.01	0.68	15.47	12.51	1.29	1.30	409.26	355.10	2.78	8.65
84709	3	1.66	1.25	12.58	8.69	1.45	1.36	596.09	415.00	1.94	1.19
84709	A	1.49	1.12	21.79	18.00	1.32	1.33	430.60	365.17	3.37	11.02
84710	1	34.43	18.16	320.35	311.27	0.39	0.53	515.43	465.44	641.87	1.26
84710	2	0.48	0.31	5.09	4.53	0.64	0.68	393.53	398.82	5.32	8.68
84710	3	0.54	0.51	5.88	5.63	0.55	0.47	598.26	544.44	4.45	1.18
84710	A	2.33	1.29	22.28	21.31	0.62	0.66	414.17	412.37	39.89	11.12
84712	1	95.00	30.70	362.00	282.05	0.85	0.95	596.39	472.23	354.72	1.18
84712	2	8.31	4.93	65.69	65.61	1.79	2.14	391.85	385.02	13.72	8.56
84712	3	6.85	6.17	54.78	47.15	2.45	2.35	549.26	493.08	6.82	1.16
84712	A	12.63	6.36	80.06	75.65	1.79	2.09	413.05	396.93	30.98	10.91

RunID	Phase	HC (g/m)		CO (g/m)		NOx (g/m)		CO2 (g/m)		PM2.5 (mg/m)	Distance (miles)
		SMT	BKI	SMT	BKI	SMT	BKI	SMT	BKI		
84713	1	2.93	2.81	31.51	27.77	3.02	3.21	898.15	828.73	6.81	1.20
84713	2	0.26	0.21	5.89	4.92	0.45	0.48	475.74	480.23	2.22	8.67
84713	3	0.48	0.40	7.60	5.51	0.19	0.25	686.57	626.28	2.00	1.20
84713	A	0.41	0.36	7.34	6.16	0.57	0.60	512.17	508.62	2.45	11.07
84714	1	2.31	3.21	25.28	33.58	1.32	1.93	454.49	503.13	82.13	1.20
84714	2	0.25	0.19	3.99	3.83	0.15	0.17	302.52	286.39	6.69	8.66
84714	3	0.13	0.11	2.06	1.50	0.31	0.32	421.45	353.94	3.84	1.22
84714	A	0.35	0.34	4.99	5.23	0.22	0.27	318.77	302.51	10.46	11.08
84715	1	17.68	19.56	229.62	225.19	0.57	0.95	488.88	435.97	517.55	1.23
84715	2	1.62	1.10	29.81	28.78	1.64	1.79	374.50	351.50	35.20	8.71
84715	3	1.27	1.10	13.67	10.55	1.93	1.99	510.70	423.01	13.33	1.24
84715	A	2.46	2.08	39.40	37.92	1.61	1.76	390.35	361.07	59.26	11.18
84719	1	4.79	4.17	74.93	64.11	4.13	4.35	886.61	726.34	8.09	1.16
84719	2	0.12	0.07	4.00	3.33	0.90	0.92	450.05	410.10	0.82	8.60
84719	3	1.13	0.74	16.80	10.36	1.31	1.34	709.14	528.14	1.53	1.17
84719	A	0.43	0.32	8.49	6.92	1.09	1.12	489.94	434.34	1.24	10.93
84720	1	12.20	11.80	144.11	128.79	7.01	7.01	997.72	896.73	94.36	1.19
84720	2	1.46	1.24	12.67	11.93	2.75	2.78	653.41	595.09	5.33	8.81
84720	3	1.94	1.71	11.08	7.67	2.57	2.41	848.27	651.64	0.93	1.27
84720	A	2.05	1.81	19.36	17.63	2.95	2.97	685.23	614.65	9.57	11.27
84722	1	3.26	2.79	32.94	29.05	2.60	2.25	965.16	823.77	20.36	1.20
84722	2	0.04	0.03	0.72	0.62	1.63	1.42	487.45	470.93	1.94	8.70
84722	3	0.10	0.08	2.15	1.41	1.72	1.27	750.82	601.14	1.58	1.21
84722	A	0.21	0.18	2.50	2.15	1.69	1.45	530.69	498.32	2.87	11.11
84723	1	6.26	5.29	100.46	83.10	3.85	4.39	616.27	530.38	40.62	1.23
84723	2	2.08	1.69	13.47	10.27	3.18	3.60	371.63	336.11	9.87	8.72
84723	3	3.49	2.55	25.54	15.22	4.81	4.58	599.18	442.16	3.55	1.24
84723	A	2.40	1.95	18.95	14.48	3.33	3.71	400.78	353.94	11.05	11.19
84724	1	7.12	5.50	72.02	52.74	2.36	2.65	821.23	624.00	21.98	1.25
84724	2	0.29	0.17	4.75	3.48	1.34	1.36	439.02	388.16	3.38	8.71
84724	3	1.76	1.16	12.50	7.20	2.60	2.43	700.33	495.53	2.37	1.23
84724	A	0.76	0.52	8.91	6.40	1.48	1.51	477.91	408.42	4.31	11.19
84726	1	6.01	4.60	95.30	67.25	2.89	3.15	931.16	744.39	12.66	1.17
84726	2	0.39	0.34	14.42	13.02	1.33	1.26	500.95	428.46	2.43	8.60
84726	3	1.14	0.92	18.75	12.15	2.44	2.20	769.46	555.40	1.07	1.16
84726	A	0.73	0.59	18.88	15.75	1.49	1.42	541.37	453.30	2.86	10.93
84727	1	4.33	3.79	46.41	37.64	2.23	2.35	884.55	804.29	29.59	1.23
84727	2	0.42	0.46	8.86	9.50	1.03	1.05	503.37	492.82	37.41	8.67
84727	3	2.88	2.41	51.51	53.57	1.21	1.27	574.17	517.91	4.54	1.16
84727	A	0.80	0.77	13.76	13.98	1.11	1.14	528.49	511.19	34.79	11.07
84728	1	2.26	2.11	10.84	8.73	0.67	0.99	839.36	758.48	27.03	1.18
84728	2	0.04	0.04	0.42	0.23	0.05	0.09	427.93	415.46	4.86	8.68
84728	3	0.02	0.02	0.36	0.21	0.09	0.11	670.24	567.66	3.34	1.22
84728	A	0.16	0.14	0.95	0.67	0.09	0.14	466.10	443.83	5.89	11.08
84729	1	2.37	2.47	6.17	5.99	0.81	0.96	653.47	721.70	6.97	1.16
84729	2	0.07	0.06	3.13	2.89	0.26	0.25	291.03	362.55	1.89	8.67

RunID	Phase	HC (g/m)		CO (g/m)		NOx (g/m)		CO2 (g/m)		PM2.5 (mg/m)	Distance (miles)
		SMT	BKI	SMT	BKI	SMT	BKI	SMT	BKI		
84729	3	0.04	0.04	0.35	0.18	0.25	0.22	429.51	459.01	1.63	1.18
84729	A	0.18	0.18	3.09	2.86	0.29	0.29	319.05	387.32	2.13	11.01
84730	1	6.71	6.44	89.34	80.46	2.88	2.93	851.10	701.89	31.97	1.25
84730	2	0.82	0.51	7.18	4.62	0.45	0.44	499.83	456.33	4.48	8.72
84730	3	4.69	3.64	31.65	20.33	0.57	0.51	741.73	595.97	13.22	1.21
84730	A	1.40	1.04	13.25	9.79	0.59	0.58	535.18	479.25	6.57	11.18
84732	1	18.04	11.55	172.13	119.00	3.90	5.00	715.45	589.75	13.29	1.19
84732	2	4.00	3.20	75.62	64.53	4.07	4.62	454.61	427.61	7.38	8.56
84732	3	5.98	4.80	129.58	91.74	3.45	3.93	628.07	497.79	8.63	1.18
84732	A	4.86	3.75	84.37	69.27	4.02	4.59	480.18	440.96	7.78	10.93
84733	1	3.59	3.49	33.63	32.84	2.54	2.63	748.22	706.12	5.86	1.18
84733	2	0.09	0.07	0.53	0.41	0.50	0.48	456.25	427.06	1.19	8.66
84733	3	0.22	0.19	2.44	2.17	1.46	1.17	605.13	551.56	1.34	1.18
84733	A	0.28	0.25	2.39	2.20	0.67	0.64	481.69	449.98	1.44	11.03
84734	1	6.30	5.53	32.27	24.98	2.99	3.26	853.28	713.17	22.96	1.16
84734	2	0.31	0.29	7.10	7.00	1.45	1.48	461.28	432.71	2.66	8.58
84734	3	0.66	0.64	8.36	6.20	2.16	2.06	693.79	587.36	1.38	1.17
84734	A	0.65	0.58	8.48	7.86	1.58	1.61	497.26	457.62	3.61	10.91
84737	1	1.96	2.47	24.24	25.71	1.58	1.86	591.45	617.43	35.05	1.23
84737	2	0.16	0.13	10.48	10.32	0.86	0.81	397.25	356.75	9.04	8.74
84737	3	0.20	0.16	3.48	2.20	1.33	1.24	570.49	466.95	4.39	1.21
84737	A	0.25	0.26	10.72	10.58	0.93	0.89	419.50	378.23	10.10	11.18
84738	1	16.03	14.49	399.83	370.05	0.79	1.27	938.26	881.36	69.84	1.37
84738	2	4.78	3.94	140.71	130.96	1.78	2.17	608.56	584.36	12.51	8.98
84738	3	6.47	5.02	197.91	140.80	2.95	2.96	976.90	779.96	4.66	1.22
84738	A	5.53	4.62	159.32	145.23	1.81	2.17	652.37	614.61	15.24	11.57
84739	1	4.69	5.76	26.04	29.90	1.64	2.12	496.71	548.22	104.99	1.18
84739	2	0.28	0.24	6.98	6.63	0.63	0.71	278.70	332.52	19.25	8.64
84739	3	0.36	0.29	7.43	4.78	0.63	0.63	499.38	435.46	7.14	1.18
84739	A	0.51	0.53	7.99	7.71	0.68	0.78	305.08	350.72	22.84	11.00
84740	1	3.21	3.01	27.15	22.16	4.02	3.98	945.29	827.77	28.59	1.22
84740	2	0.46	0.37	8.33	6.85	0.67	0.69	495.28	460.19	5.64	8.72
84740	3	1.50	1.27	17.10	13.36	0.64	0.68	687.95	591.67	3.60	1.22
84740	A	0.68	0.57	9.94	8.11	0.85	0.86	532.50	488.72	6.71	11.15
84741	1	8.69	7.92	85.84	62.04	5.44	5.69	740.86	627.60	38.55	1.21
84741	2	2.92	2.39	20.09	15.78	4.63	4.75	440.52	384.35	2.71	8.71
84741	3	4.32	3.70	31.00	21.66	6.21	5.95	619.51	511.17	3.11	1.23
84741	A	3.32	2.77	24.33	18.62	4.79	4.88	469.02	406.04	4.61	11.16
84743	1	1.46	2.37	16.66	23.74	1.71	2.36	347.33	431.91	11.45	1.18
84743	2	0.11	0.07	4.66	4.23	0.76	1.00	263.25	283.02	0.58	8.60
84743	3	.	0.20	.	6.43	.	1.23	.	346.65	1.20	1.18
84743	A	.	0.20	.	5.39	.	1.09	.	295.12	1.19	10.96
84745	1	4.52	5.18	68.96	66.27	2.01	2.47	401.11	418.16	110.69	1.25
84745	2	0.48	0.38	11.86	9.38	1.95	1.91	284.15	264.16	12.00	8.75
84745	3	0.78	0.70	14.33	10.31	2.52	2.33	394.12	336.59	2.22	1.23
84745	A	0.72	0.66	15.11	12.51	2.00	1.97	298.20	277.54	16.61	11.24

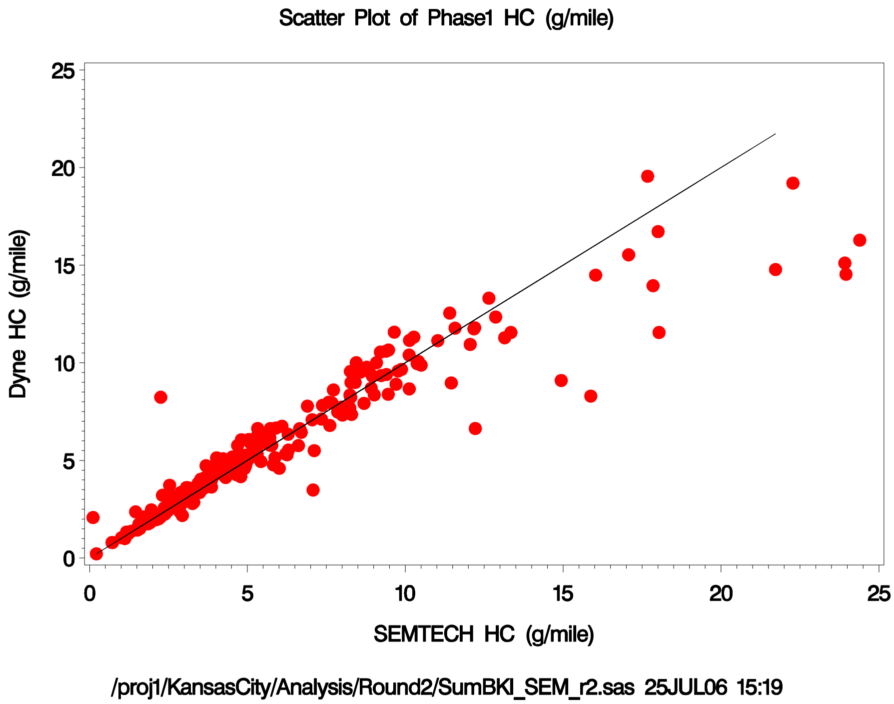
RunID	Phase	HC (g/m)		CO (g/m)		NOx (g/m)		CO2 (g/m)		PM2.5 (mg/m)	Distance (miles)
		SMT	BKI	SMT	BKI	SMT	BKI	SMT	BKI		
84747	1	1.07	1.00	12.11	6.64	2.24	2.00	882.35	598.43	10.97	1.21
84747	2	0.02	-0.02	0.67	-1.08	0.39	0.40	494.00	382.97	4.03	8.69
84747	3	0.31	-8.34	4.08	-333.19	0.03	-3.86	5577.02	-14533.98	.	0.01
84747	A	0.08	0.03	1.27	-0.93	0.49	0.48	519.53	382.85	.	9.91
84748	1	1.14	1.09	9.93	7.56	2.85	2.49	912.01	791.43	7.60	1.20
84748	2	0.04	0.04	1.93	1.41	0.62	0.66	497.14	461.55	1.29	8.67
84748	3	0.10	0.10	4.00	3.12	0.55	0.53	745.92	625.10	1.27	1.18
84748	A	0.10	0.10	2.49	1.85	0.73	0.75	535.67	489.93	1.62	11.05
84749	1	2.11	1.97	20.33	14.08	1.34	1.41	818.27	712.75	3.69	1.19
84749	2	0.03	0.02	1.27	0.85	0.16	0.17	436.06	405.11	0.86	8.65
84749	3	0.18	0.16	3.77	2.33	0.56	0.46	644.49	521.45	2.56	1.21
84749	A	0.15	0.13	2.43	1.64	0.25	0.25	470.47	429.24	1.13	11.05
84751	1	1.12	1.00	10.75	8.98	1.76	1.90	531.60	513.45	0.73	1.20
84751	2	0.11	0.11	6.71	6.00	1.12	1.29	290.88	316.54	3.24	8.65
84751	3	0.08	0.09	3.86	3.13	0.96	1.11	362.84	391.37	0.56	1.20
84751	A	0.16	0.16	6.72	5.96	1.14	1.31	308.51	332.03	2.92	11.05
84752	1	2.09	2.65	6.82	6.27	1.85	1.82	392.48	367.02	4.91	1.19
84752	2	0.28	0.30	2.61	2.43	1.51	1.48	239.56	235.52	6.78	8.74
84752	3	0.81	0.77	2.20	1.51	1.89	1.81	328.10	291.01	2.34	1.18
84752	A	0.41	0.45	2.80	2.57	1.56	1.52	253.43	246.05	6.38	11.10
84753	1	1.67	1.68	10.32	8.80	1.58	1.46	799.20	730.61	21.47	1.20
84753	2	0.05	0.04	0.85	0.62	0.15	0.14	486.89	460.63	5.53	8.65
84753	3	0.06	0.06	1.04	0.54	0.08	0.06	735.95	615.04	2.47	1.21
84753	A	0.14	0.13	1.36	1.04	0.22	0.20	520.58	485.51	6.15	11.05
84754	1	1.02	1.04	6.66	5.87	1.74	1.55	772.98	697.19	11.21	1.25
84754	2	0.02	0.02	0.41	0.19	0.28	0.28	482.12	458.78	3.06	8.58
84754	3	0.03	0.03	0.87	0.36	0.22	0.16	747.67	590.66	1.24	1.20
84754	A	0.08	0.08	0.78	0.51	0.36	0.34	516.47	481.02	3.38	11.03
84755	1	1.52	1.43	15.77	14.25	0.44	0.41	943.18	846.16	3.97	1.24
84755	2	0.02	0.02	1.69	1.78	0.13	0.11	472.27	473.26	3.04	8.75
84755	3	0.04	0.03	1.96	1.08	0.10	0.09	648.58	597.32	0.05	1.23
84755	A	0.10	0.10	2.45	2.40	0.14	0.12	509.45	501.79	2.88	11.21
84757	1	1.33	1.37	10.50	8.65	1.25	1.24	938.49	832.04	4.42	1.22
84757	2	0.12	0.12	1.48	1.14	0.44	0.42	488.84	466.33	1.93	8.69
84757	3	0.17	0.18	1.81	0.87	0.50	0.46	767.94	644.68	1.31	1.20
84757	A	0.18	0.19	1.98	1.52	0.49	0.46	531.78	498.01	2.02	11.11
84758	1	10.41	10.07	129.11	109.31	4.91	5.35	1002.75	928.79	101.02	1.20
84758	2	3.25	2.83	52.24	52.08	1.17	1.33	625.18	597.05	12.86	8.59
84758	3	2.80	2.48	32.93	30.14	1.39	1.22	912.19	734.74	0.89	1.20
84758	A	3.59	3.19	54.92	53.57	1.38	1.53	665.06	624.18	16.66	10.99
84759	1	0.22	0.22	0.82	0.71	0.11	0.09	566.14	594.77	2.82	1.12
84759	2	0.05	0.05	1.30	1.10	0.03	0.03	330.57	340.74	0.71	8.45
84759	3	0.00	0.00	0.33	0.17	0.01	0.01	453.35	400.06	0.30	1.19
84759	A	0.05	0.05	1.21	1.02	0.03	0.03	351.05	357.69	0.79	10.75
84760	1	0.71	0.80	2.31	2.13	0.19	0.21	805.89	743.64	3.87	1.16
84760	2	0.06	0.06	1.25	1.05	0.05	0.05	446.82	429.22	1.31	8.52

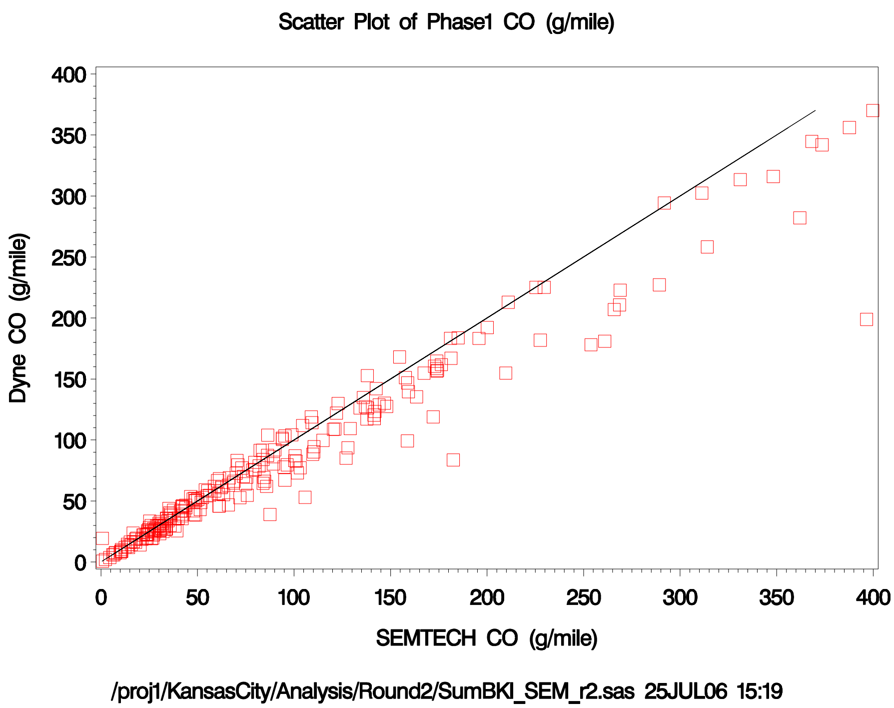
RunID	Phase	HC (g/m)		CO (g/m)		NOx (g/m)		CO2 (g/m)		PM2.5 (mg/m)	Distance (miles)
		SMT	BKI	SMT	BKI	SMT	BKI	SMT	BKI		
84760	3	0.01	0.00	0.12	0.00	0.03	0.05	625.38	558.99	1.56	1.17
84760	A	0.09	0.09	1.23	1.03	0.05	0.06	477.75	454.34	1.46	10.85
84761	1	1.17	1.33	10.67	10.23	0.45	0.45	851.61	853.29	7.26	1.17
84761	2	0.02	0.02	0.58	0.44	0.06	0.05	486.47	500.63	2.35	8.70
84761	3	0.07	0.06	2.72	1.82	0.03	0.02	693.58	667.91	0.92	1.12
84761	A	0.08	0.09	1.23	1.03	0.08	0.07	518.77	529.55	2.51	10.99
84763	1	1.92	1.81	14.37	12.05	0.37	0.37	964.13	898.68	3.17	1.19
84763	2	0.04	0.03	1.36	1.20	0.11	0.12	472.95	478.55	3.90	8.68
84763	3	0.03	0.02	1.45	0.86	0.22	0.24	675.11	636.26	-1.09	1.21
84763	A	0.13	0.12	2.04	1.74	0.13	0.14	512.35	511.31	3.51	11.08
84765	1	23.92	15.11	314.05	258.26	1.30	1.74	820.18	665.78	268.16	1.22
84765	2	4.94	3.53	102.03	95.36	1.25	1.49	480.16	445.12	97.99	8.74
84765	3	7.38	5.36	107.56	85.92	1.49	1.67	676.89	575.77	22.35	1.20
84765	A	6.11	4.27	113.55	103.26	1.27	1.52	511.56	465.69	101.74	11.16
84766	1	2.18	2.01	21.19	18.63	2.06	2.33	818.51	761.54	10.88	1.16
84766	2	0.04	0.03	0.53	0.43	0.23	0.23	480.50	462.75	1.51	8.59
84766	3	0.15	0.14	3.37	2.20	0.36	0.38	710.00	618.51	-1.87	1.17
84766	A	0.16	0.14	1.78	1.49	0.33	0.35	513.45	488.72	1.76	10.92
84767	1	2.94	2.18	39.33	25.53	4.63	3.74	876.11	577.47	7.86	1.15
84767	2	0.32	0.22	12.39	8.82	2.14	1.98	509.65	393.53	2.88	8.54
84767	3	1.26	0.71	18.13	10.13	2.83	2.35	810.11	481.48	1.34	1.17
84767	A	0.51	0.36	14.16	9.77	2.31	2.09	549.19	408.99	3.03	10.87
84768	1	5.00	4.98	48.75	50.54	3.77	4.18	929.30	872.56	8.04	1.16
84768	2	0.49	0.39	0.49	0.33	1.14	1.20	569.80	551.49	7.62	8.55
84768	3	1.94	1.57	6.02	4.64	1.55	1.53	781.87	689.18	-0.90	1.13
84768	A	0.81	0.70	3.34	3.20	1.30	1.37	602.31	577.16	7.08	10.84
84770	1	5.77	5.77	81.94	78.73	5.51	5.74	972.46	893.54	26.48	1.30
84770	2	0.23	0.18	0.59	0.51	2.05	2.12	601.71	581.25	25.24	8.78
84770	3	1.13	1.15	12.28	12.21	1.09	1.27	746.19	676.92	2.25	1.29
84770	A	0.60	0.56	5.90	5.69	2.17	2.26	632.53	605.50	23.63	11.37
84771	1	9.40	9.40	136.99	127.31	5.24	5.30	783.11	705.07	80.56	1.18
84771	2	3.11	2.59	19.28	15.69	2.46	2.74	471.70	445.75	44.41	8.75
84771	3	4.98	4.12	42.23	31.36	3.33	3.37	657.57	568.65	26.45	1.20
84771	A	3.57	3.05	27.01	22.49	2.66	2.92	500.77	467.51	45.02	11.14
84772	1	5.43	4.94	49.04	38.56	5.00	5.37	792.62	721.65	18.50	1.19
84772	2	0.25	0.20	5.59	4.84	2.24	2.25	439.48	447.63	6.08	8.71
84772	3	0.78	0.78	9.69	7.70	3.62	3.51	586.23	570.83	1.56	1.21
84772	A	0.56	0.49	8.13	6.79	2.48	2.50	467.98	470.37	6.41	11.11
84773	1	2.40	2.26	24.28	22.70	2.03	2.29	840.68	754.53	1.89	1.23
84773	2	0.10	0.07	0.84	0.46	0.42	0.44	498.59	454.52	1.61	8.73
84773	3	0.07	0.07	1.01	0.53	1.25	1.15	688.70	549.38	0.54	1.24
84773	A	0.22	0.18	2.09	1.65	0.57	0.59	530.19	477.23	1.55	11.21
84774	1	4.66	4.26	26.83	19.68	3.14	3.17	882.85	727.33	29.91	1.20
84774	2	0.18	0.15	3.60	2.55	0.70	0.14	469.12	429.42	2.74	8.68
84774	3	0.45	0.39	7.34	4.21	1.28	0.00	696.22	567.16	-0.22	1.20
84774	A	0.43	0.38	5.07	3.55	0.87	0.29	506.34	454.49	3.95	11.08

RunID	Phase	HC (g/m)		CO (g/m)		NOx (g/m)		CO2 (g/m)		PM2.5 (mg/m)	Distance (miles)
		SMT	BKI	SMT	BKI	SMT	BKI	SMT	BKI		
84775	1	5.82	4.77	61.15	45.78	5.88	5.35	1149.82	943.21	11.65	1.21
84775	2	1.06	0.93	11.46	9.94	2.43	2.39	639.82	584.13	3.68	8.60
84775	3	2.10	1.75	18.81	13.94	3.30	2.96	957.77	777.30	-1.37	1.15
84775	A	1.38	1.19	14.56	12.12	2.67	2.58	687.87	616.25	3.76	10.96
84777	1	9.88	9.66	173.99	164.67	2.00	2.09	766.98	702.27	42.83	1.21
84777	2	0.35	0.34	5.59	5.16	3.50	3.61	441.77	438.76	1.78	8.85
84777	3	1.20	1.26	38.04	36.88	2.91	2.80	662.20	591.19	-1.83	1.21
84777	A	0.91	0.88	16.56	15.58	3.38	3.48	473.78	462.83	3.65	11.27

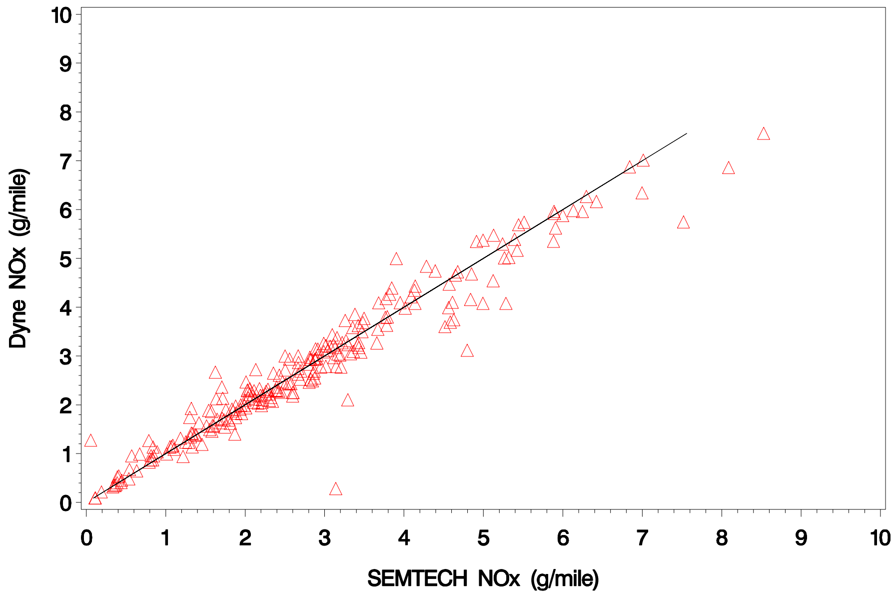
Plots of Dynamometer Measurements vs. SEMTECH Measurements

In the following plots of emissions by test phase, the symbols and colors used vary. Phase 1 emissions are depicted in red, phase 2 emissions in green, and phase 3 emissions in brown. HC, CO, NOx, and CO2 are depicted using dots, squares, triangles, and circle-crosses, respectively. Note that the 1:1 line depicted is for reference purposes; it is not a regression line.



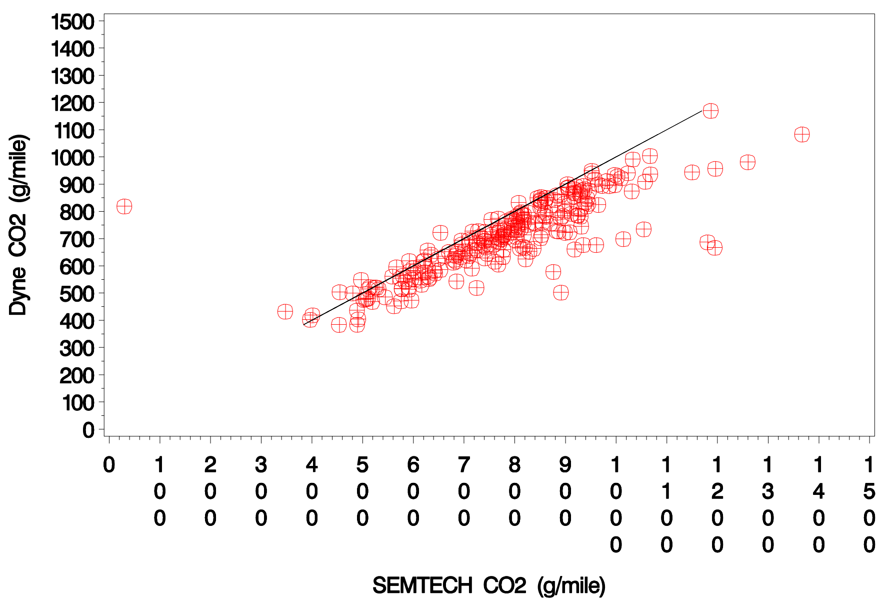


Scatter Plot of Phase1 NOx (g/mile)



/proj1/KansasCity/Analysis/Round2/SumBKI_SEM_r2.sas 25JUL06 15:19

Scatter Plot of Phase1 CO2 (g/mile)



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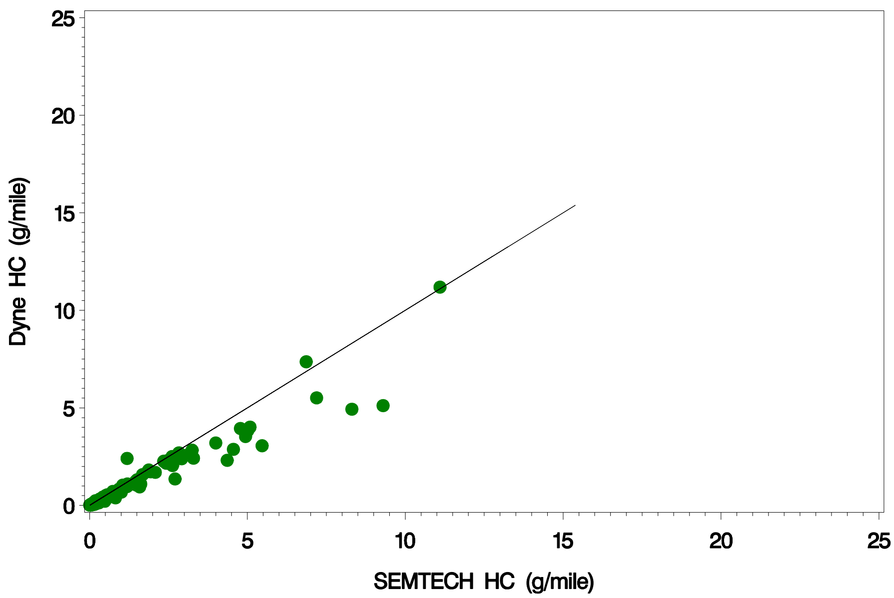
Scatter Plot of Phase2 HC (g/mile)



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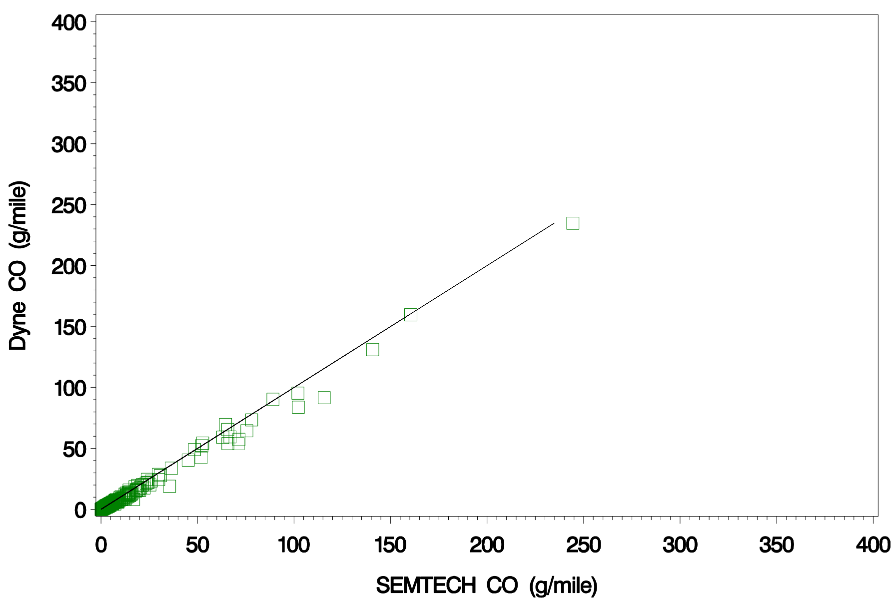
Scatter Plot of Phase2 CO (g/mile)



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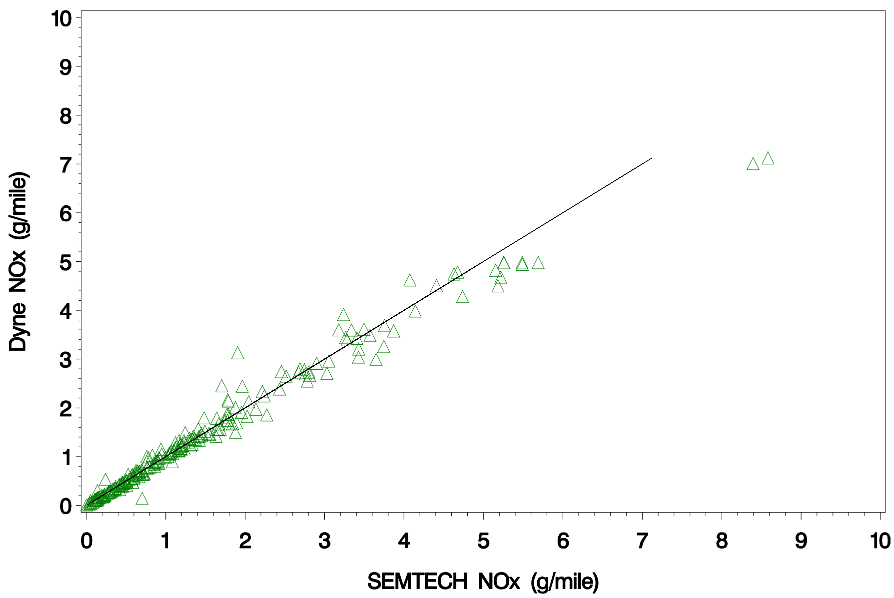
Scatter Plot of Phase2 NOx (g/mile)



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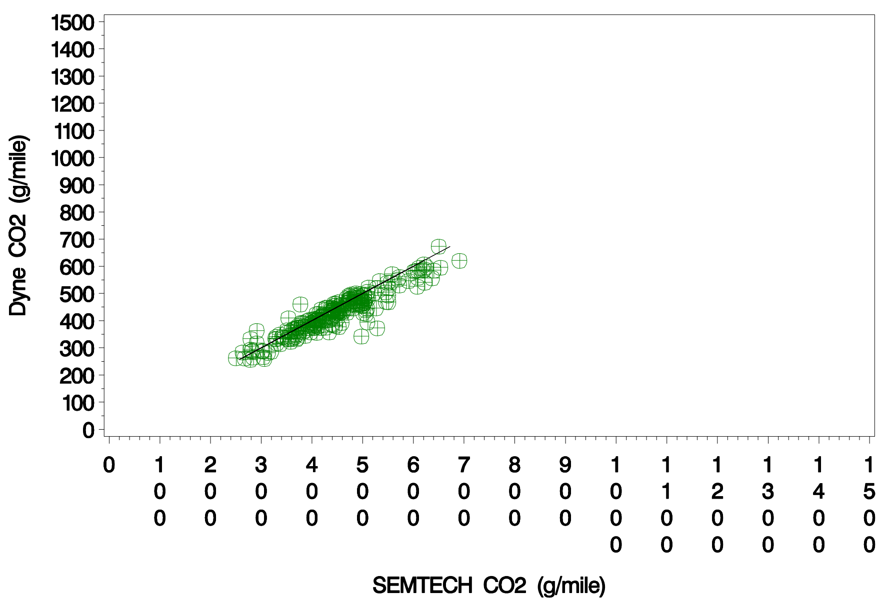
Scatter Plot of Phase2 CO2 (g/mile)



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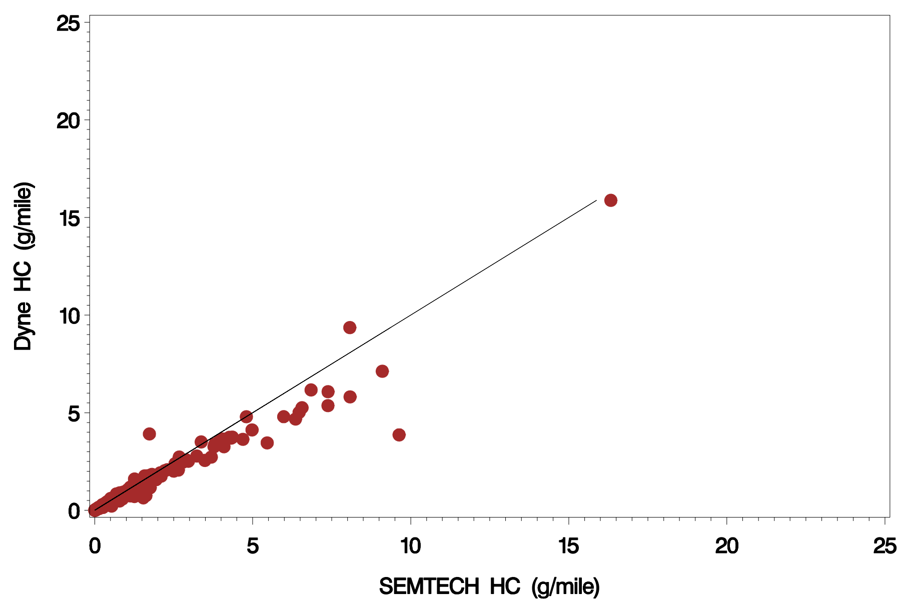
Scatter Plot of Phase3 HC (g/mile)



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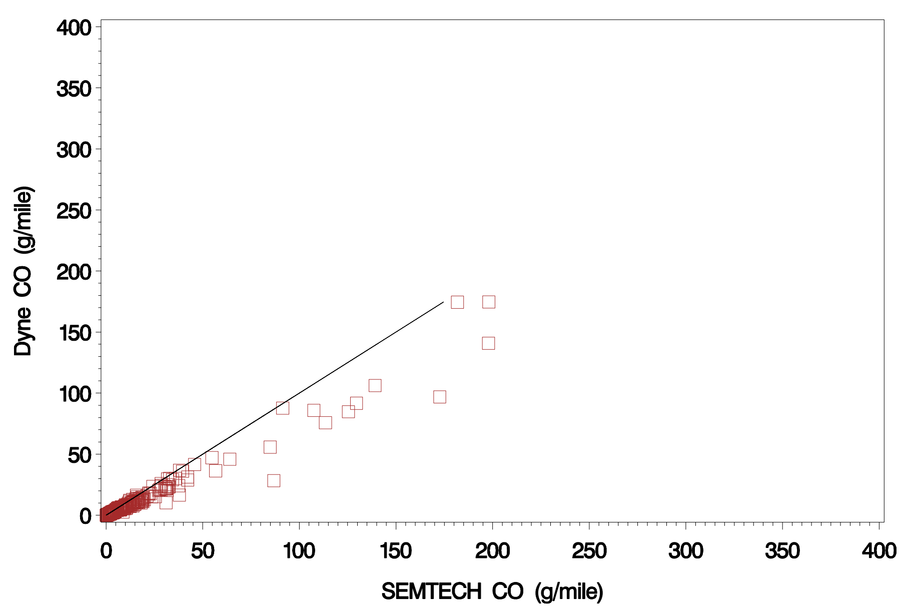
Scatter Plot of Phase3 CO (g/mile)



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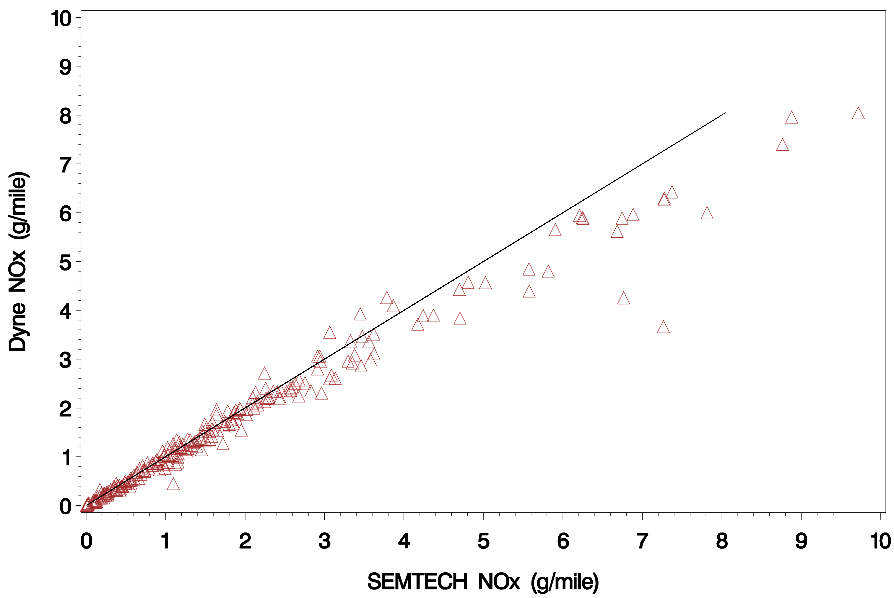
Scatter Plot of Phase3 NOx (g/mile)



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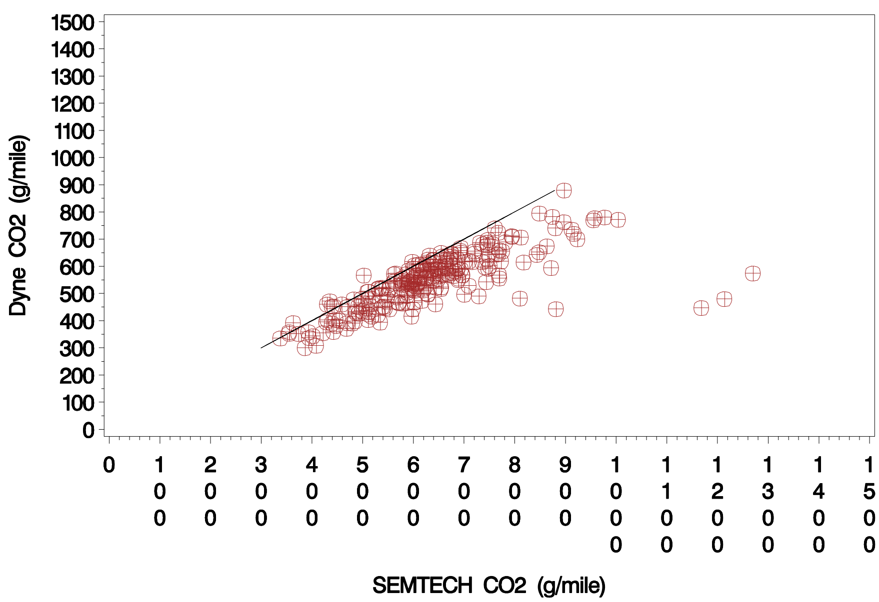
Scatter Plot of Phase3 CO2 (g/mile)



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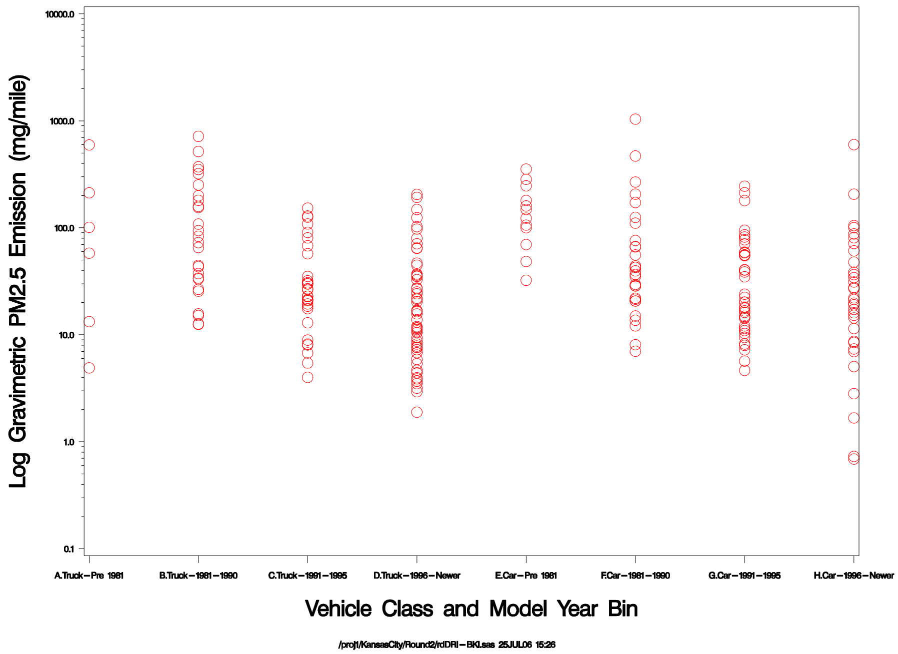
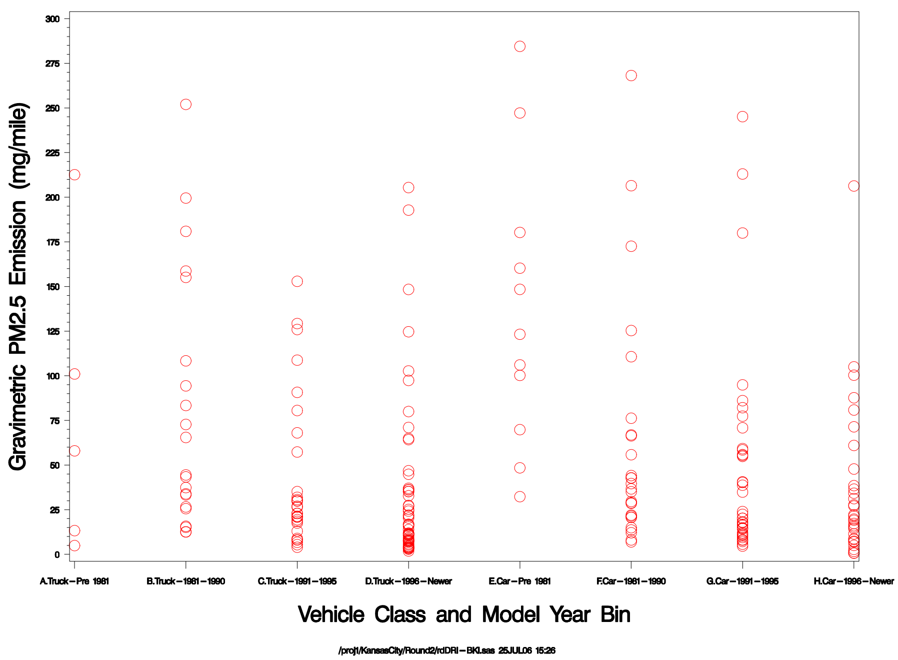
Plots of Dynamometer Measurements and $PM_{2.5}$ Measured by Gravimetric Mass-DRI

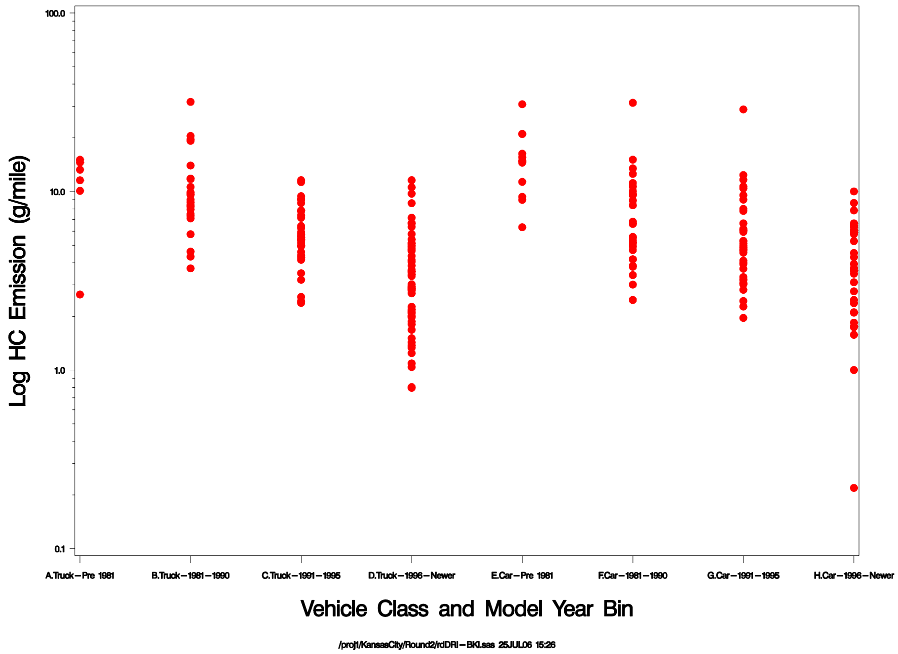
Bag 1– Cold Start (Log Scale)



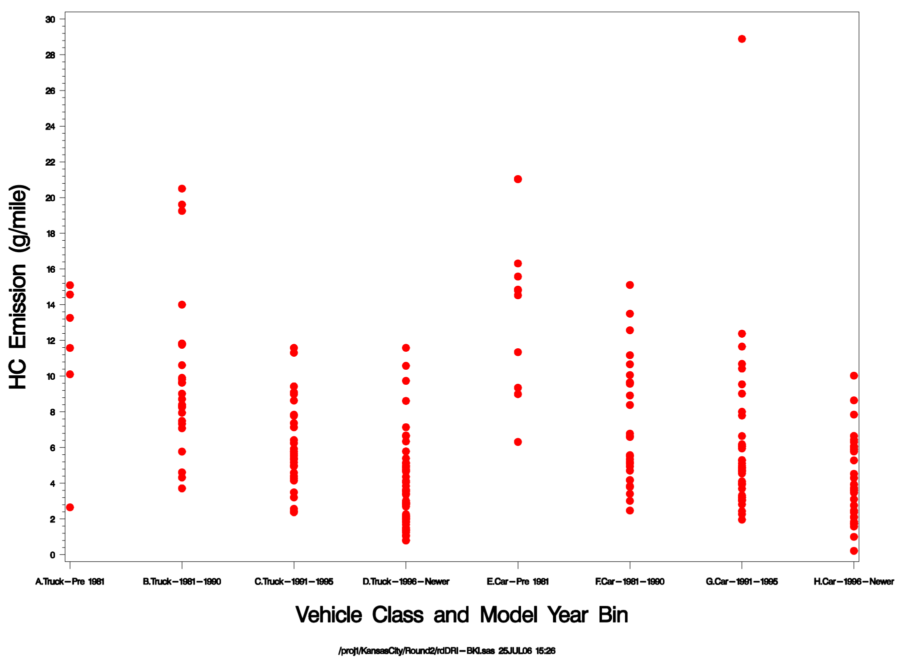
Bag 1– Cold Start (Linear Scale)

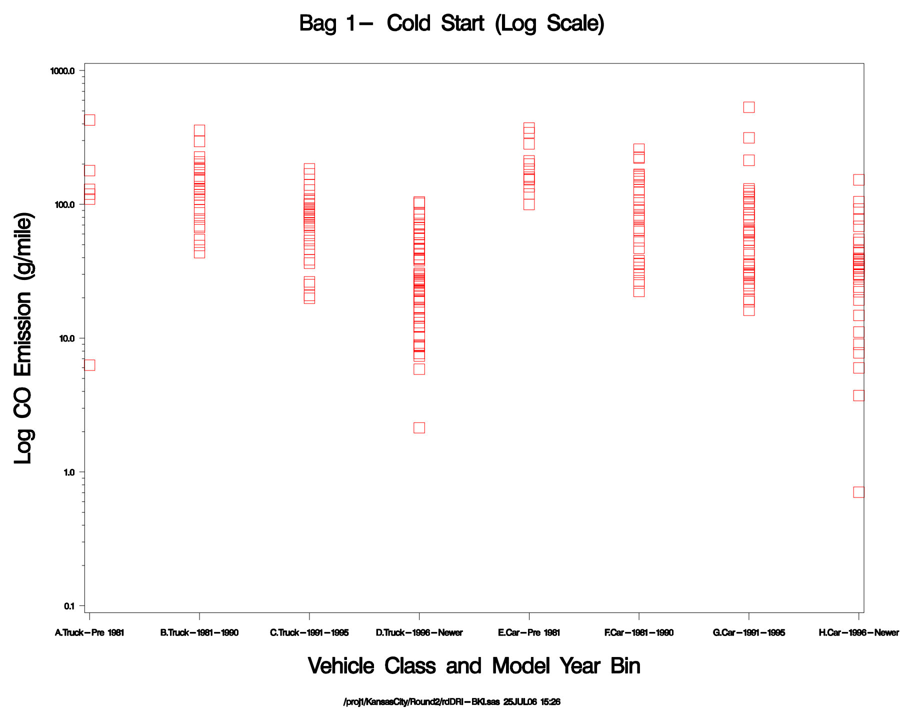


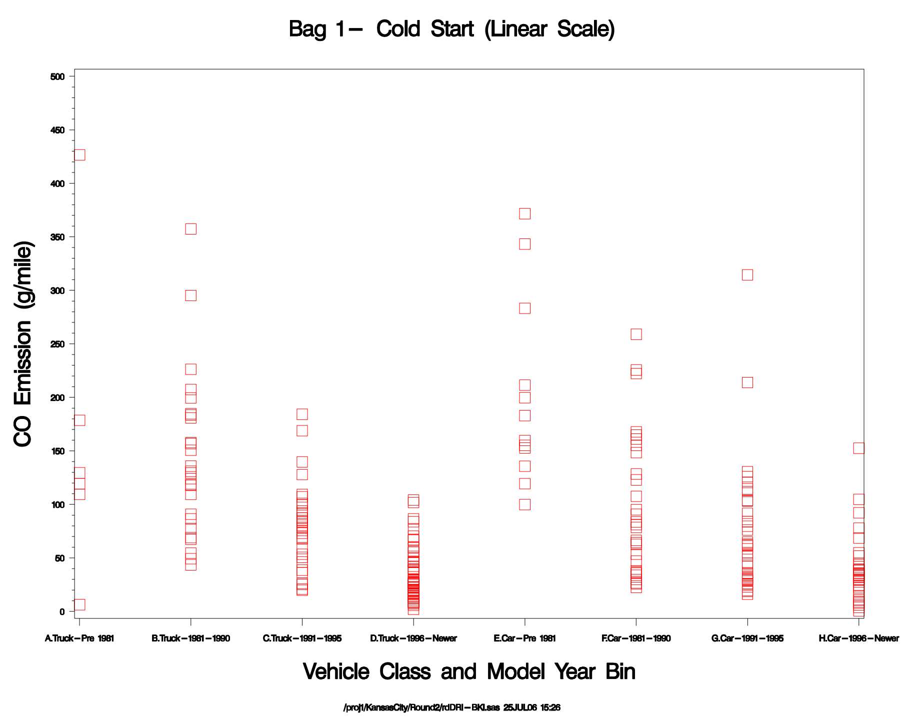
Bag 1– Cold Start (Log Scale)



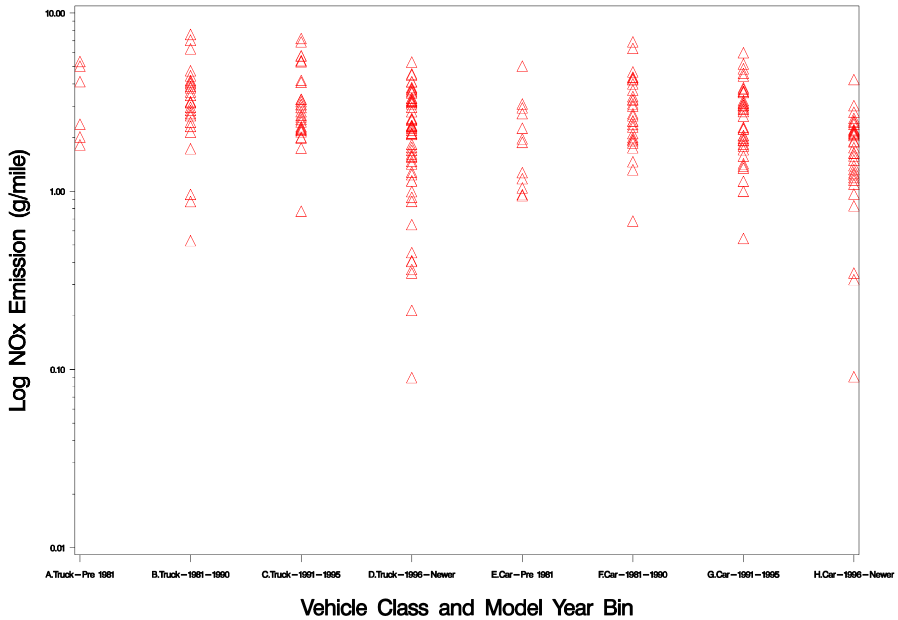
Bag 1– Cold Start (Linear Scale)




Bag 1– Cold Start (Log Scale)
Log CO Emission (g/mile)
1000.0
100.0
10.0
1.0
0.1
A.Truck–Pre 1981
B.Truck–1981–1990
C.Truck–1991–1995
D.Truck–1996–Newer
E.Car–Pre 1981
F.Car–1981–1990
G.Car–1991–1995
H.Car–1996–Newer
Vehicle Class and Model Year Bin
/projt/KansasCity/Round2/rdDRI–BKL.sas 25JUL06 15:26


Bag 1– Cold Start (Linear Scale)
CO Emission (g/mile)
500
450
400
350
300
250
200
150
100
50
0
A.Truck–Pre 1981
B.Truck–1981–1990
C.Truck–1991–1995
D.Truck–1996–Newer
E.Car–Pre 1981
F.Car–1981–1990
G.Car–1991–1995
H.Car–1996–Newer
Vehicle Class and Model Year Bin
/projt/KansasCity/Round2/rdDRI–BKL.sas 25JUL06 15:26

Bag 1– Cold Start (Log Scale)



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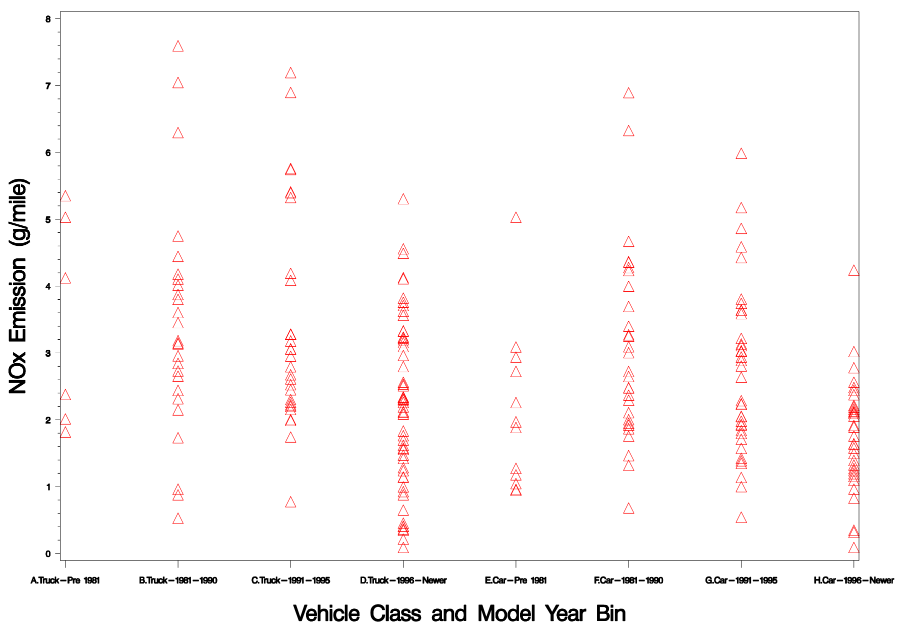
Bag 1– Cold Start (Linear Scale)



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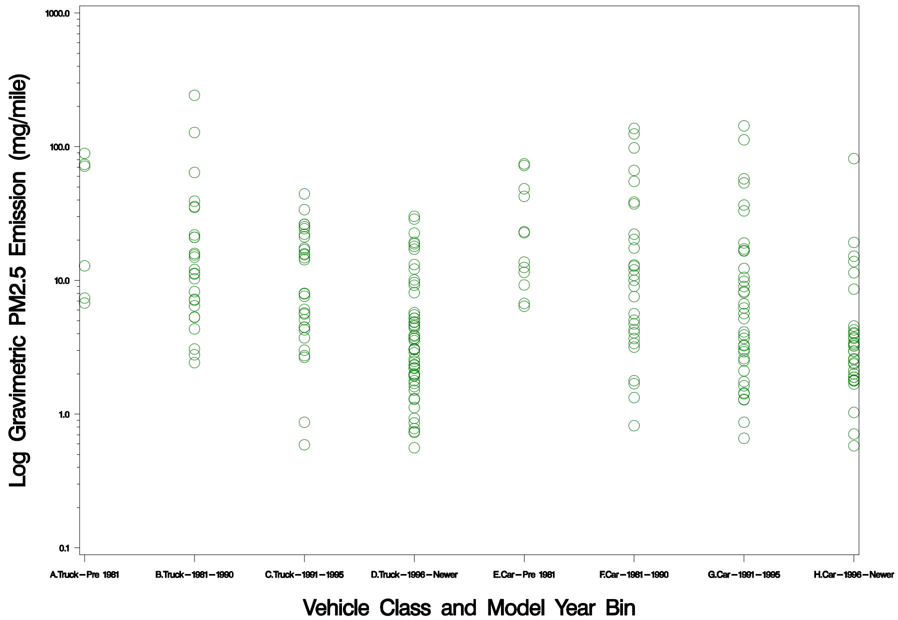
Bag 2– Transient (Log Scale)



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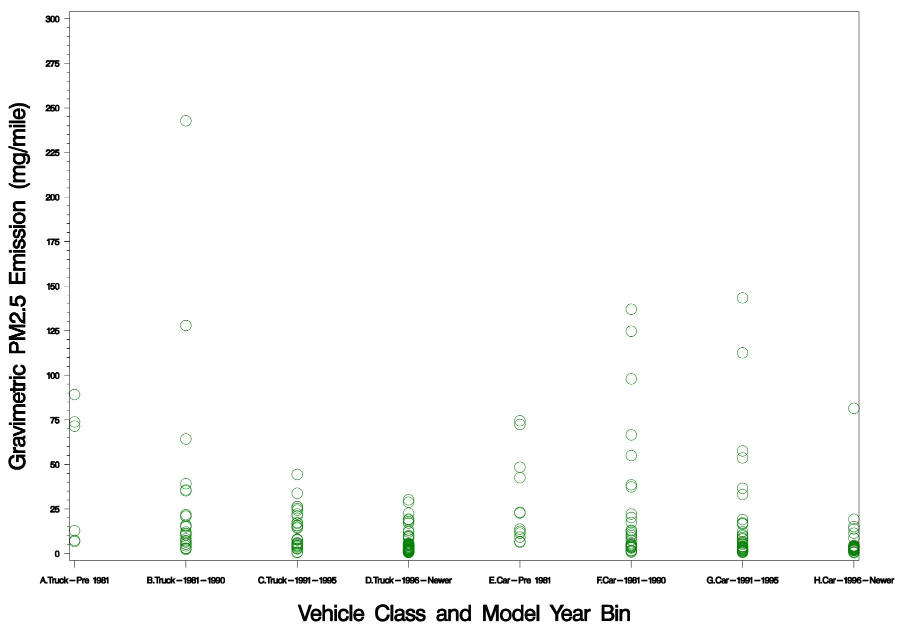
Bag 2– Transient (Linear Scale)



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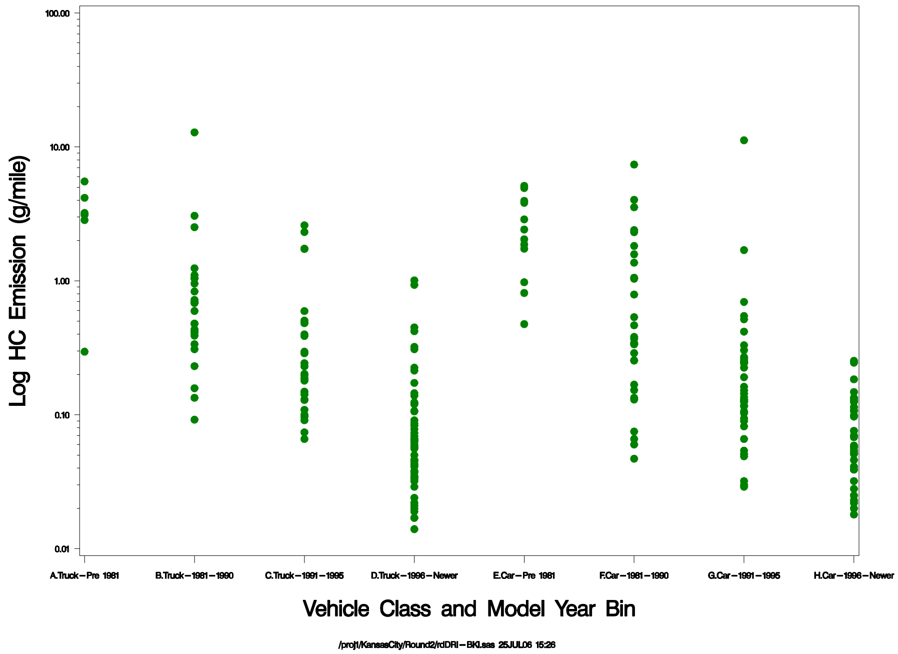
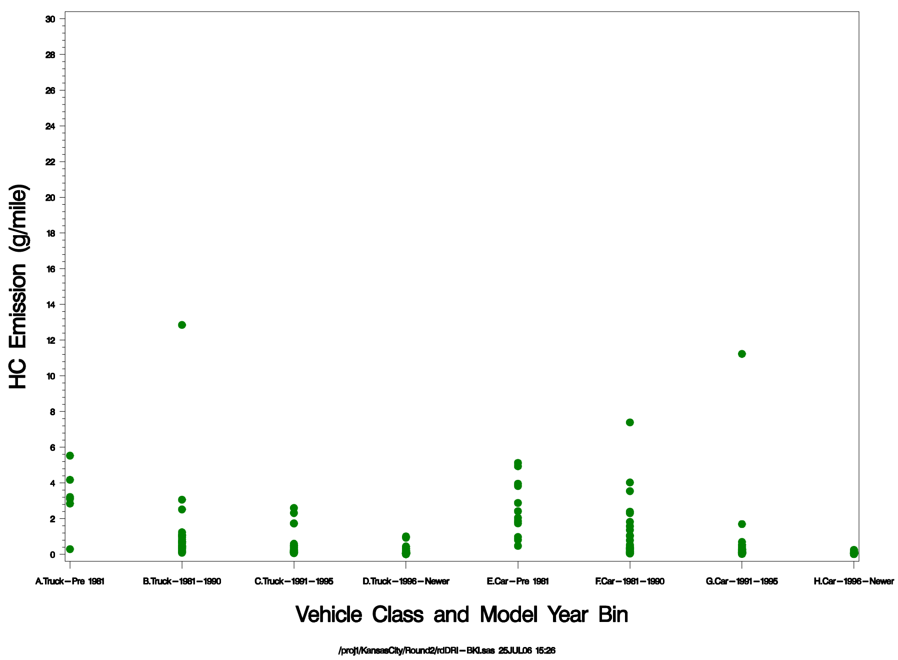
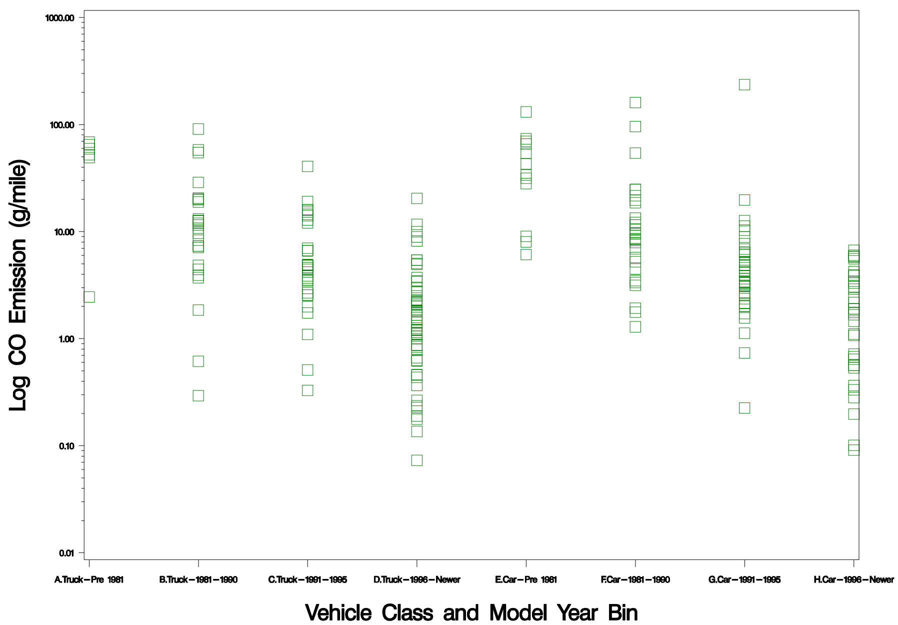
Bag 2– Transient (Log Scale)



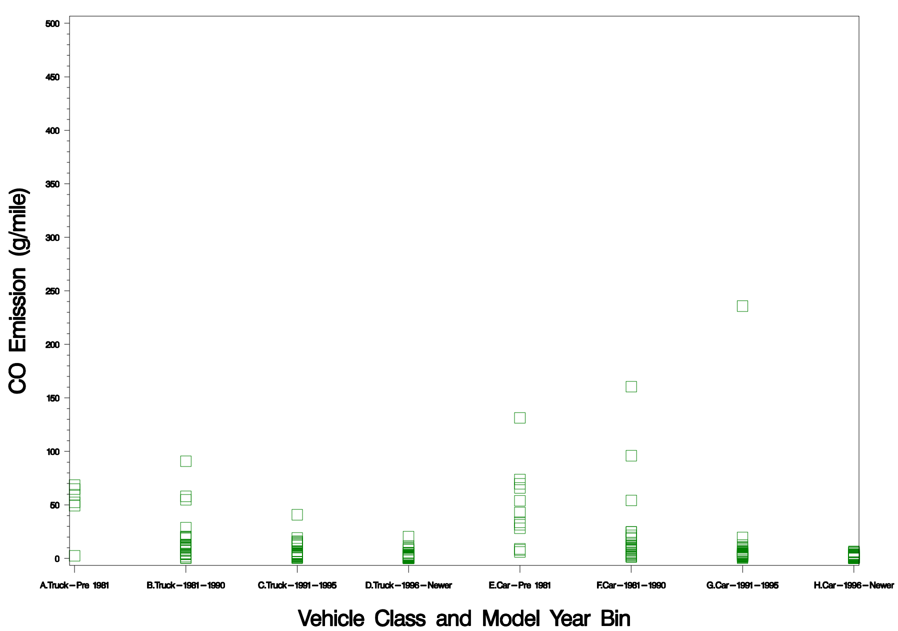
Bag 2– Transient (Linear Scale)



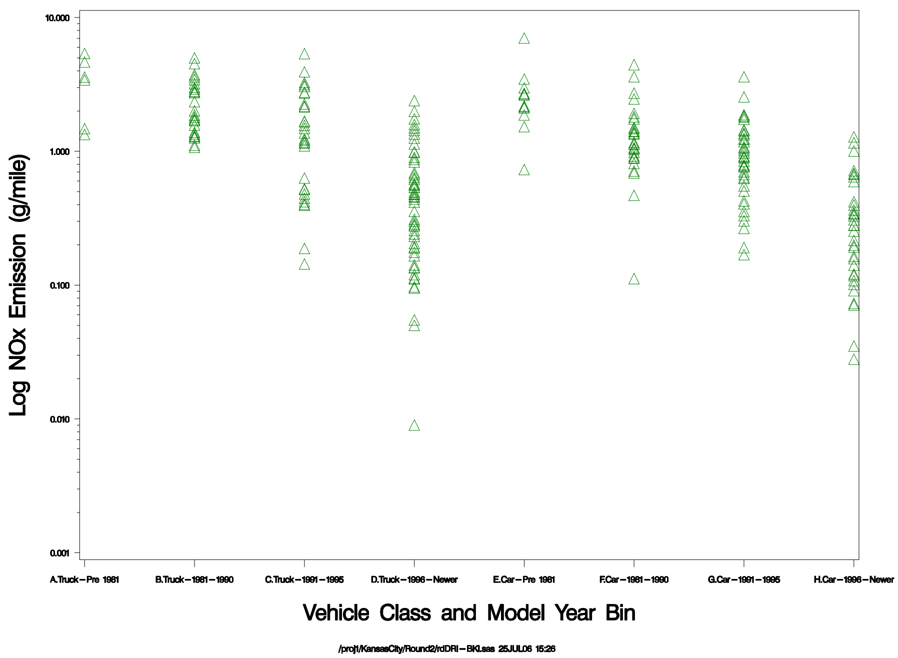
Bag 2– Transient (Log Scale)



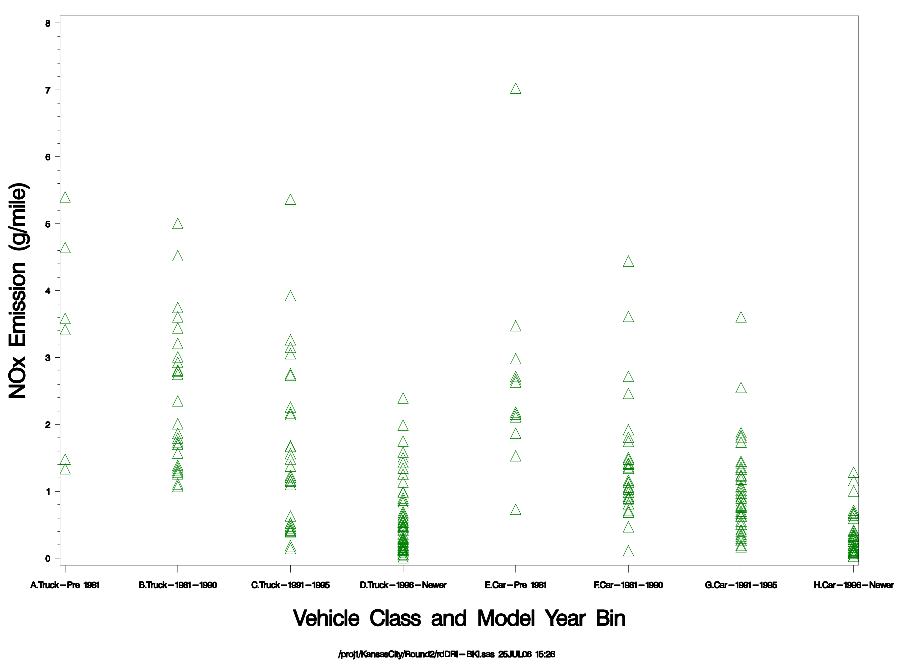
Bag 2– Transient (Linear Scale)

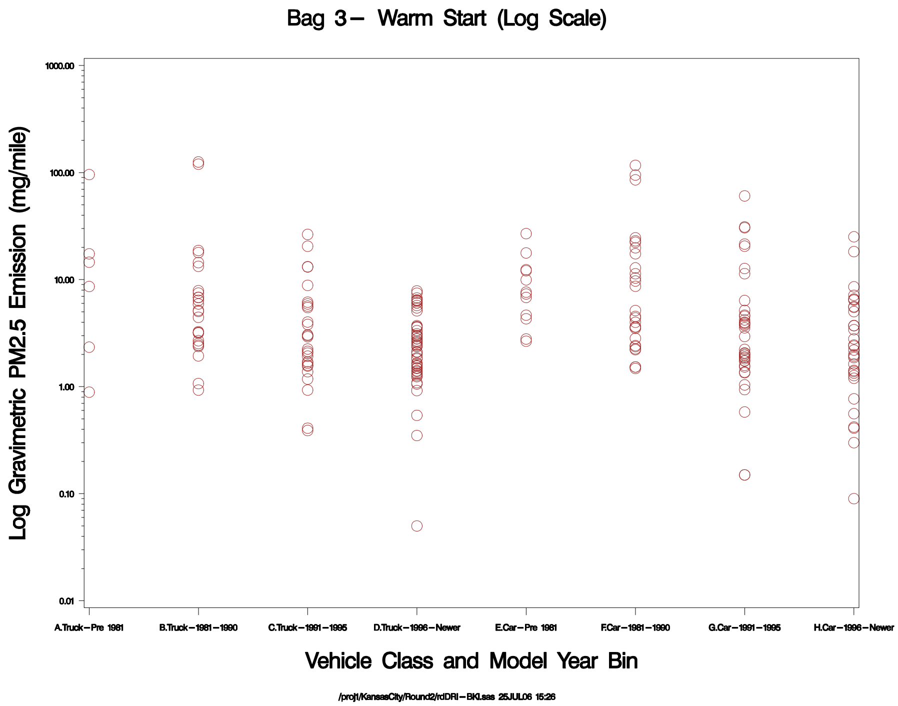


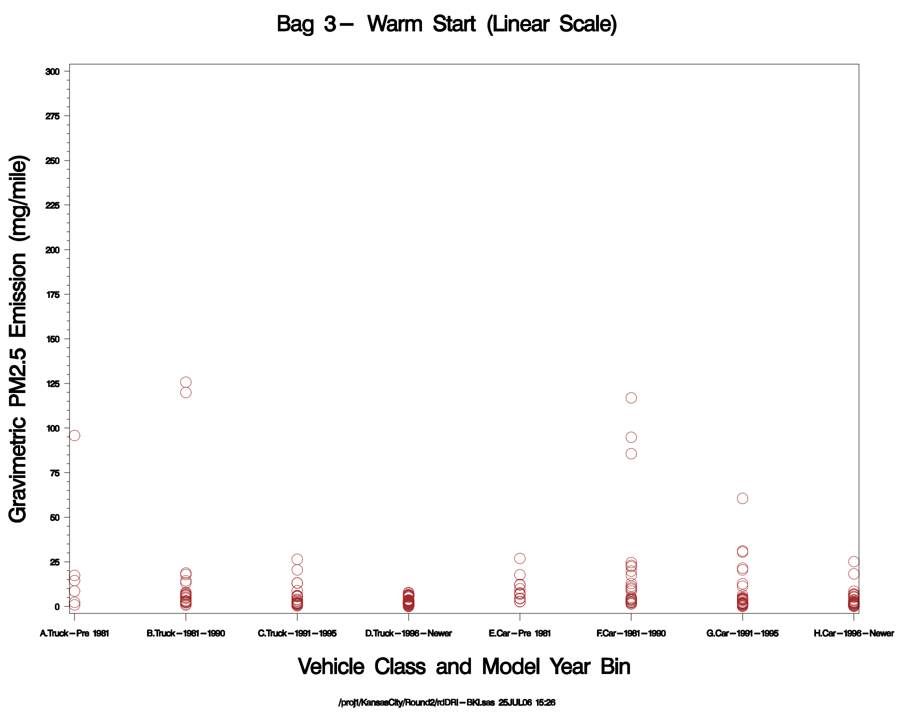
Bag 2 – Transient (Log Scale)



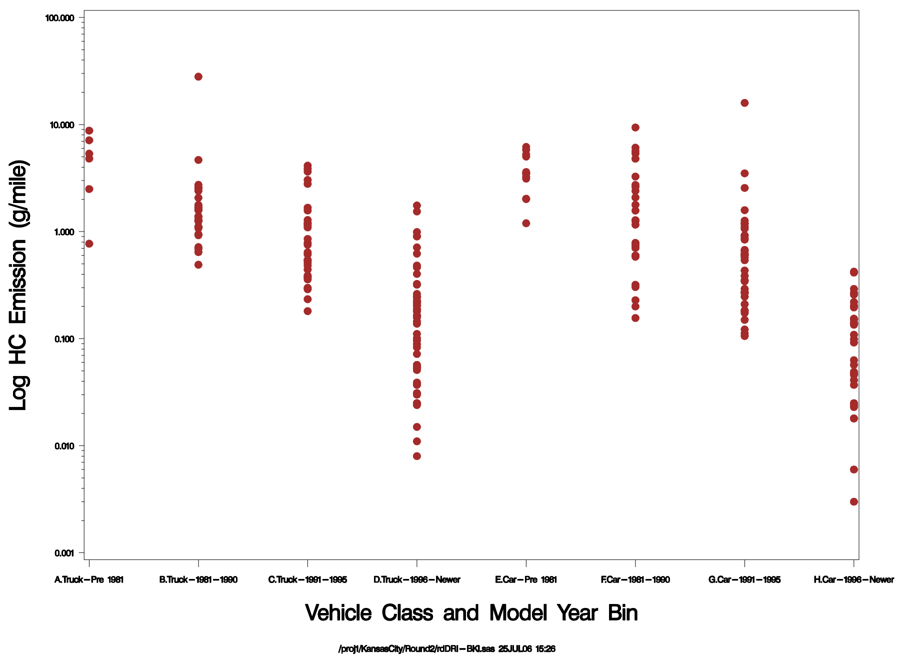
Bag 2 – Transient (Linear Scale)



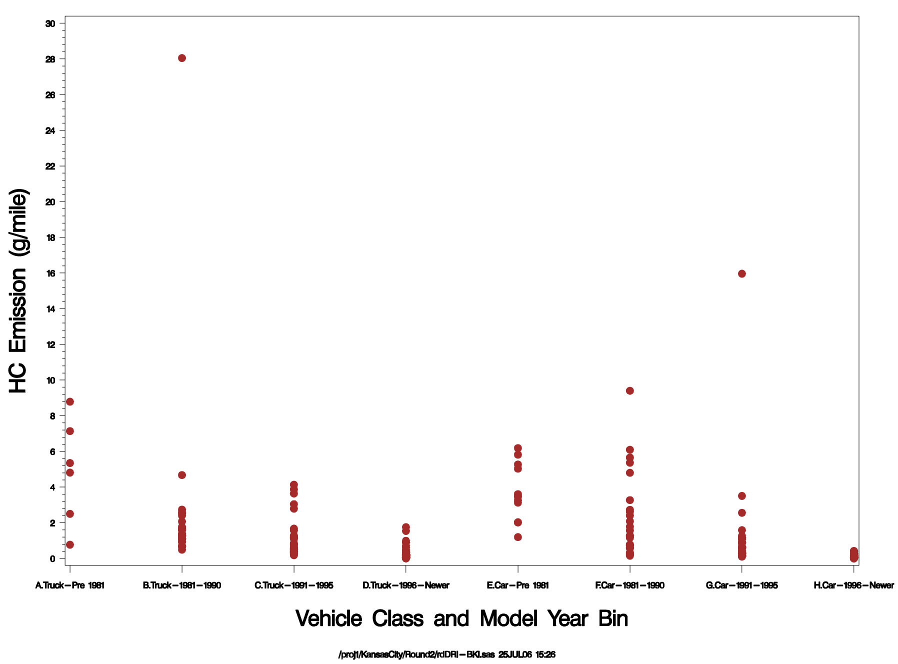

Bag 3− Warm Start (Log Scale)
Log Gravimetric PM2.5 Emission (mg/mile)
1000.00
100.00
10.00
1.00
0.10
0.01
A.Truck−Pre 1981
B.Truck−1981−1990
C.Truck−1991−1995
D.Truck−1996−Newer
E.Car−Pre 1981
F.Car−1981−1990
G.Car−1991−1995
H.Car−1996−Newer
Vehicle Class and Model Year Bin


Bag 3− Warm Start (Linear Scale)
Gravimetric PM2.5 Emission (mg/mile)
300
275
250
225
200
175
150
125
100
75
50
25
0
A.Truck−Pre 1981
B.Truck−1981−1990
C.Truck−1991−1995
D.Truck−1996−Newer
E.Car−Pre 1981
F.Car−1981−1990
G.Car−1991−1995
H.Car−1996−Newer
Vehicle Class and Model Year Bin

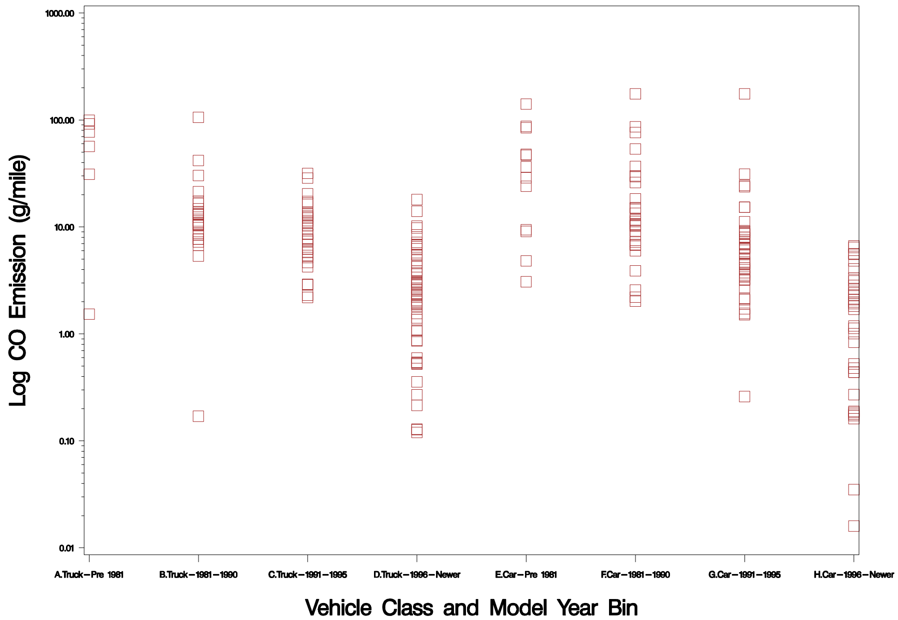
Bag 3– Warm Start (Log Scale)



Bag 3– Warm Start (Linear Scale)



Bag 3– Warm Start (Log Scale)



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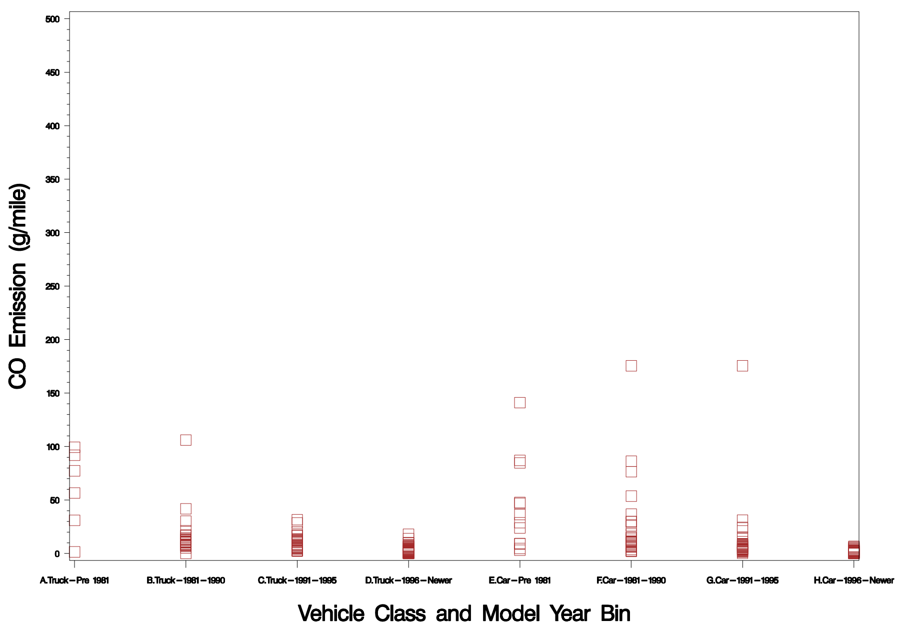
Bag 3– Warm Start (Linear Scale)



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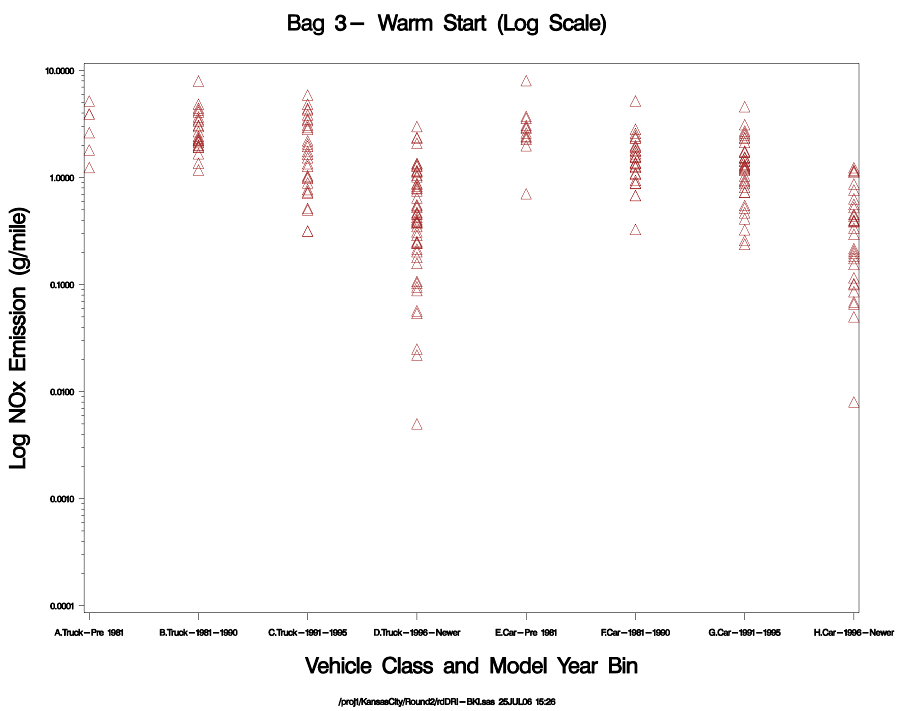
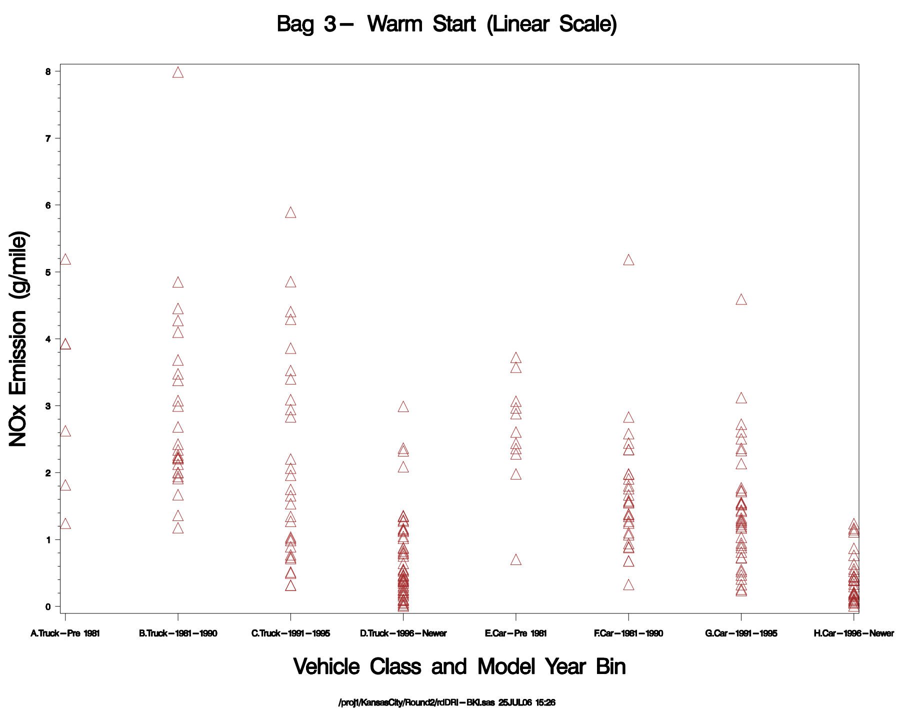
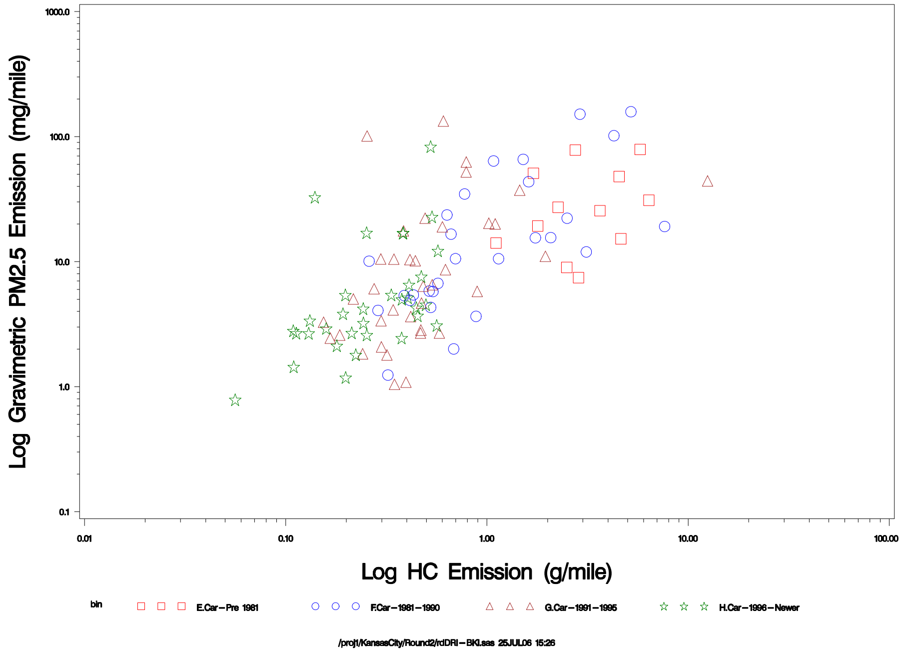

Bag 3 – Warm Start (Log Scale)
Log NOx Emission (g/mile)
10.0000
1.0000
0.1000
0.0100
0.0010
0.0001
A.Truck – Pre 1981
B.Truck – 1981 – 1990
C.Truck – 1991 – 1995
D.Truck – 1996 – Newer
E.Car – Pre 1981
F.Car – 1981 – 1990
G.Car – 1991 – 1995
H.Car – 1996 – Newer
Vehicle Class and Model Year Bin

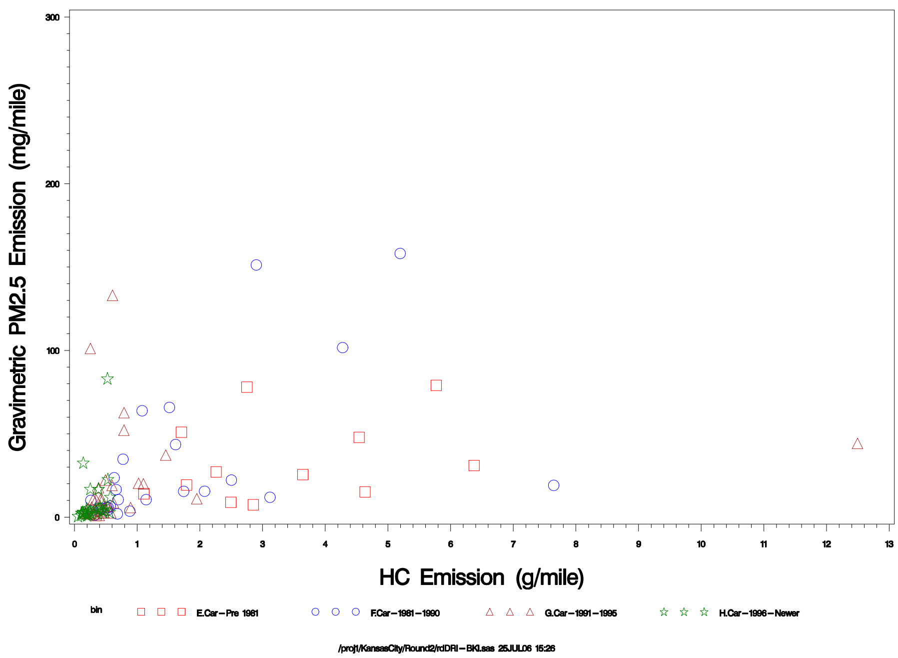

Bag 3 – Warm Start (Linear Scale)
NOx Emission (g/mile)
8
7
6
5
4
3
2
1
0
A.Truck – Pre 1981
B.Truck – 1981 – 1990
C.Truck – 1991 – 1995
D.Truck – 1996 – Newer
E.Car – Pre 1981
F.Car – 1981 – 1990
G.Car – 1991 – 1995
H.Car – 1996 – Newer
Vehicle Class and Model Year Bin

Scatter Plots of Dynamometer Measurements vs. $PM_{2.5}$ Measured by Gravimetric Mass-DRI

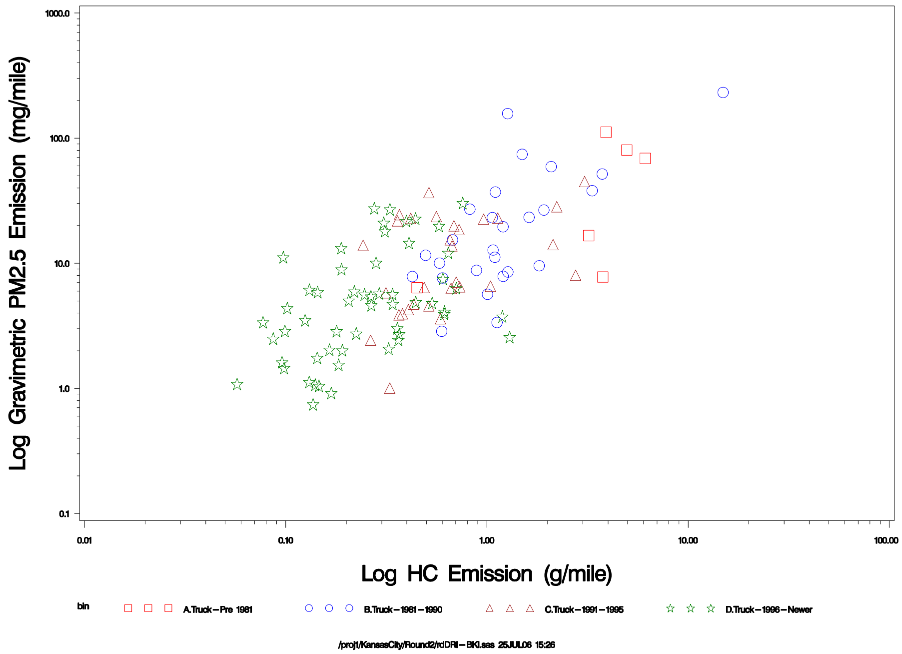
Scatter Plot of Composite PM2.5 vs Composite HC (Log Scale) – CAR



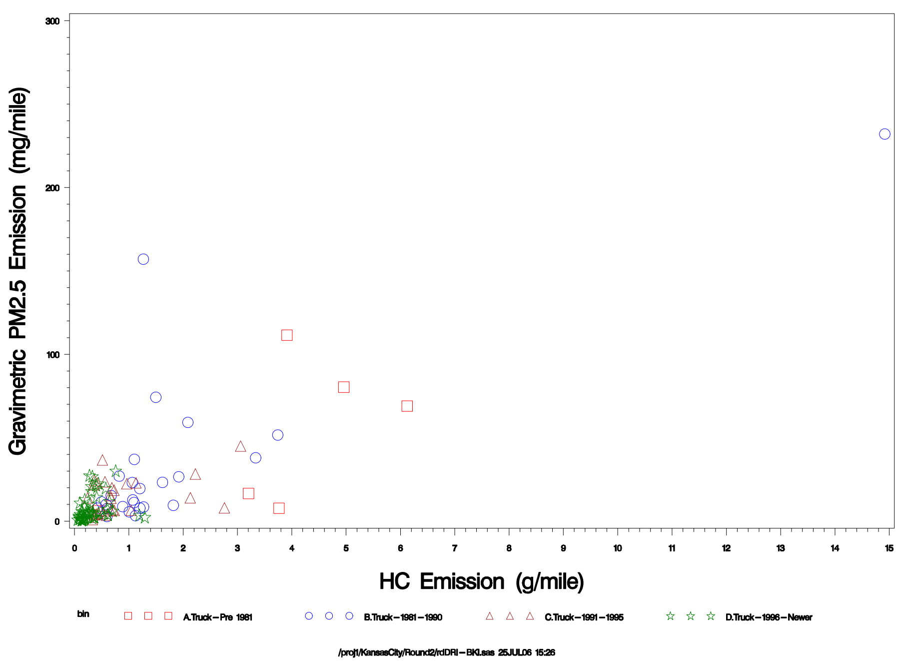
Scatter Plot of Composite PM2.5 vs Composite HC (Linear Scale) – CAR



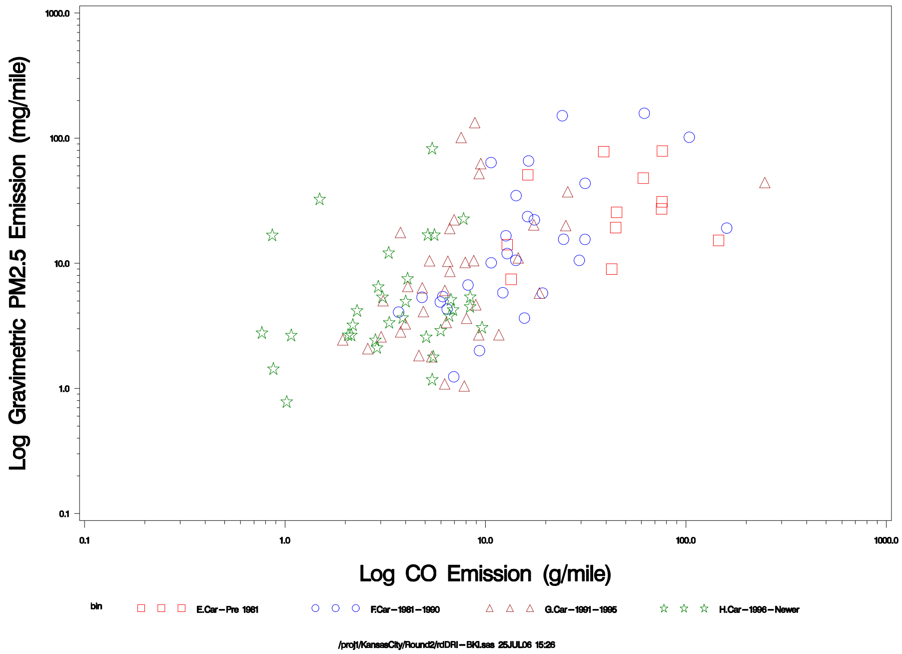
Scatter Plot of Composite PM2.5 vs Composite HC (Log Scale) – TRUCK



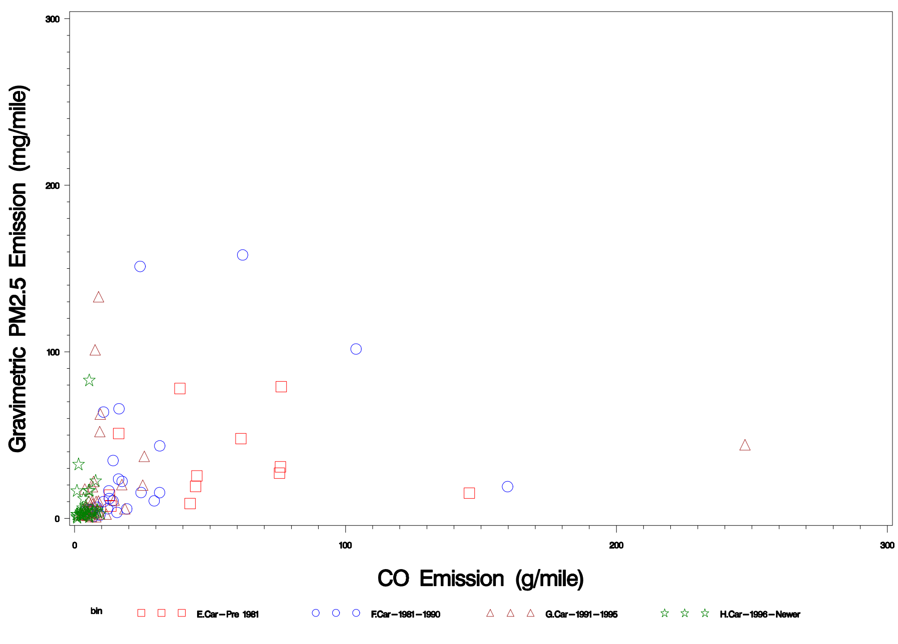
Scatter Plot of Composite PM2.5 vs Composite HC (Linear Scale) – TRUCK



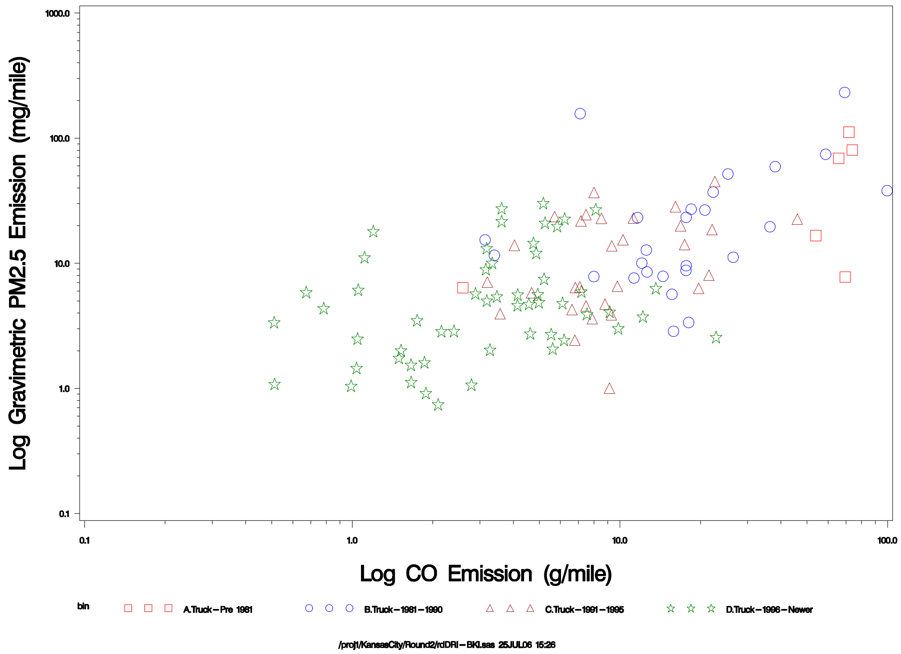
Scatter Plot of Composite PM2.5 vs Composite CO (Log Scale) – CAR



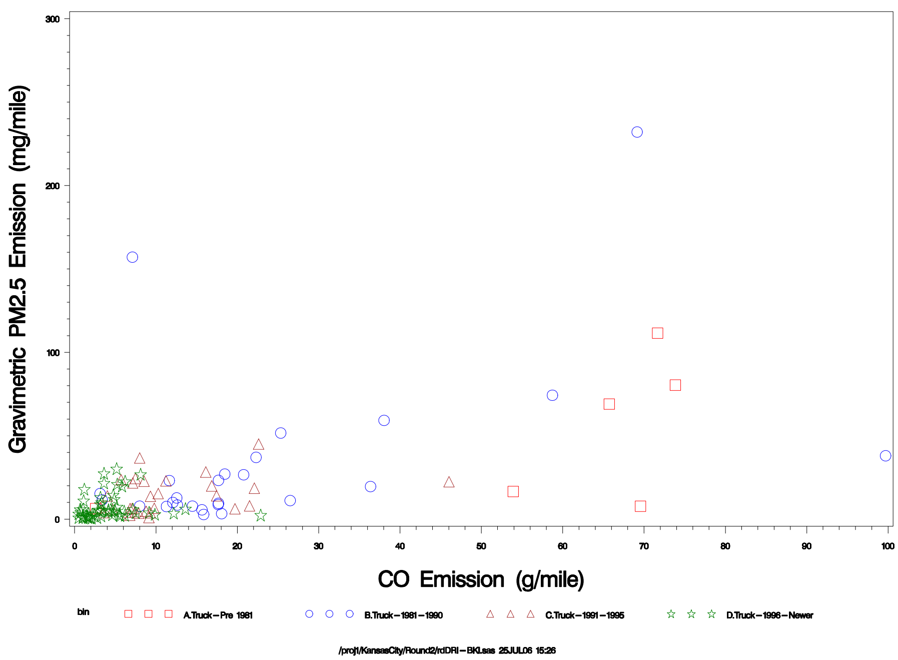
Scatter Plot of Composite PM2.5 vs Composite CO (Linear Scale) – CAR



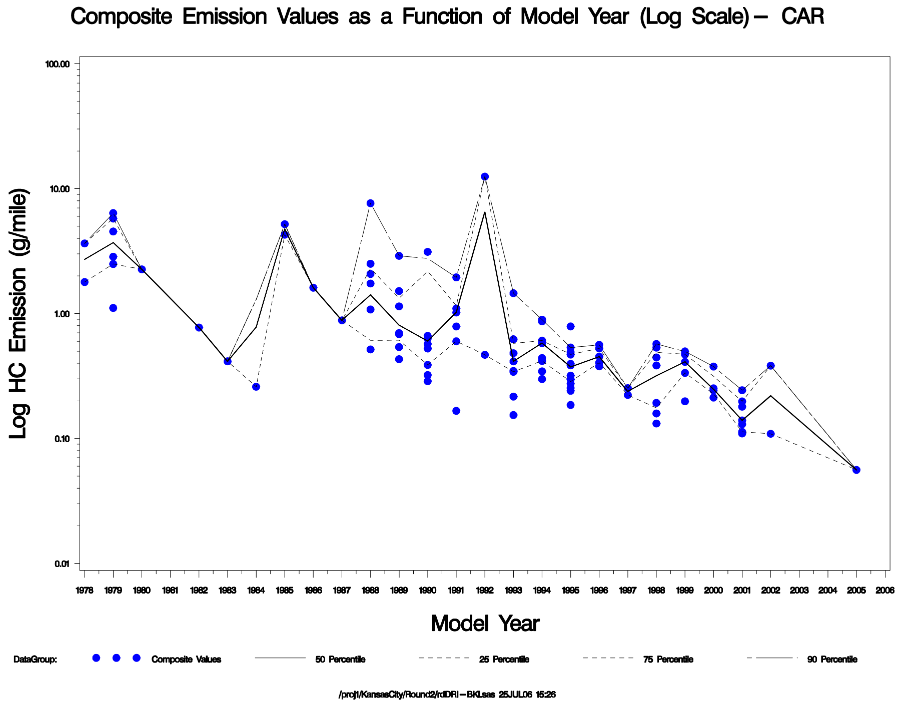
Scatter Plot of Composite PM2.5 vs Composite CO (Log Scale) – TRUCK

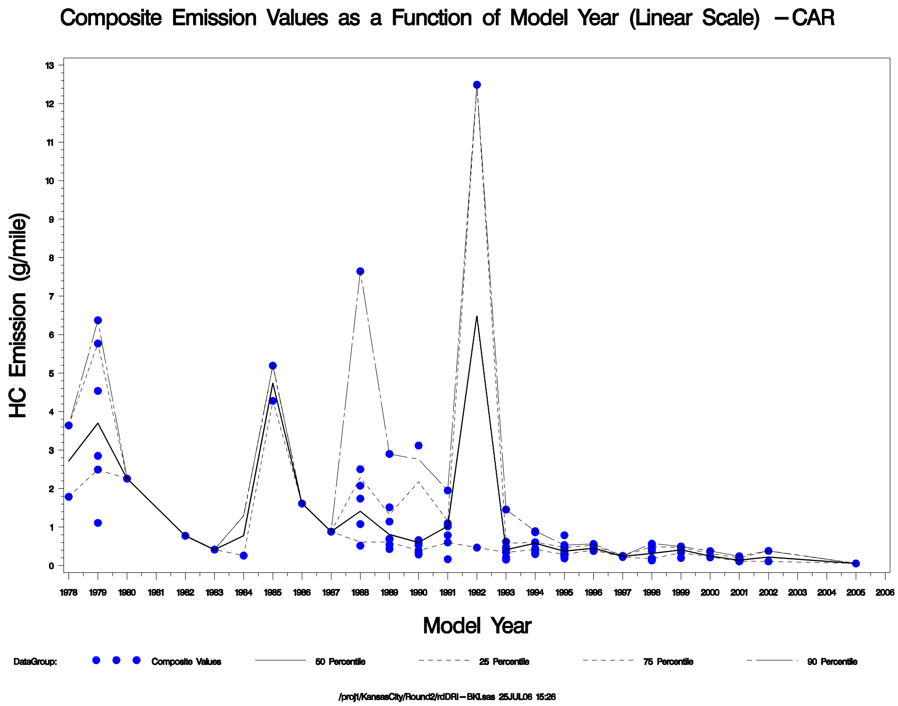


Scatter Plot of Composite PM2.5 vs Composite CO (Linear Scale) – TRUCK

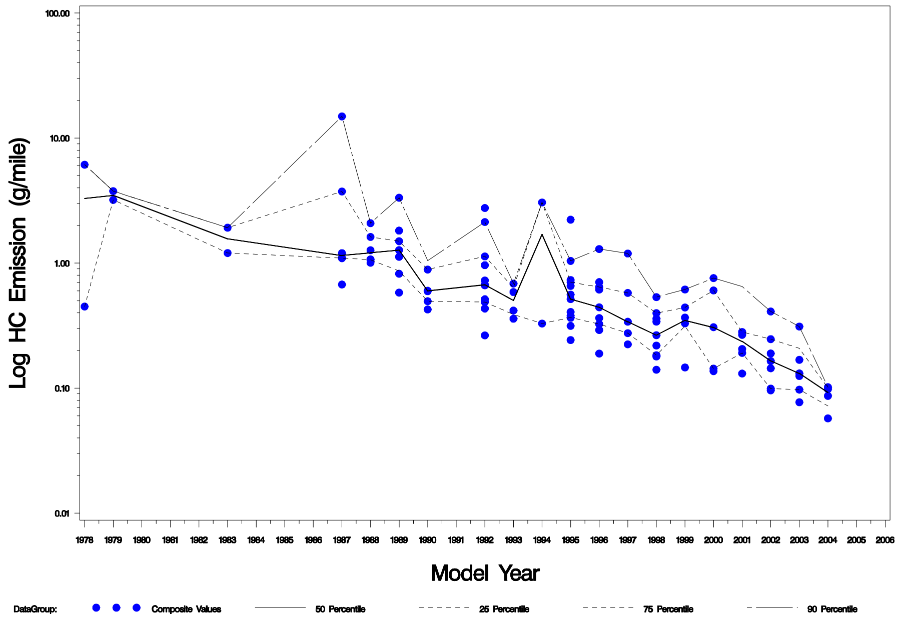


Plots of Dynamometer Measurements as a Function of Model Year





Composite Emission Values as a Function of Model Year (Log Scale) – TRUCK



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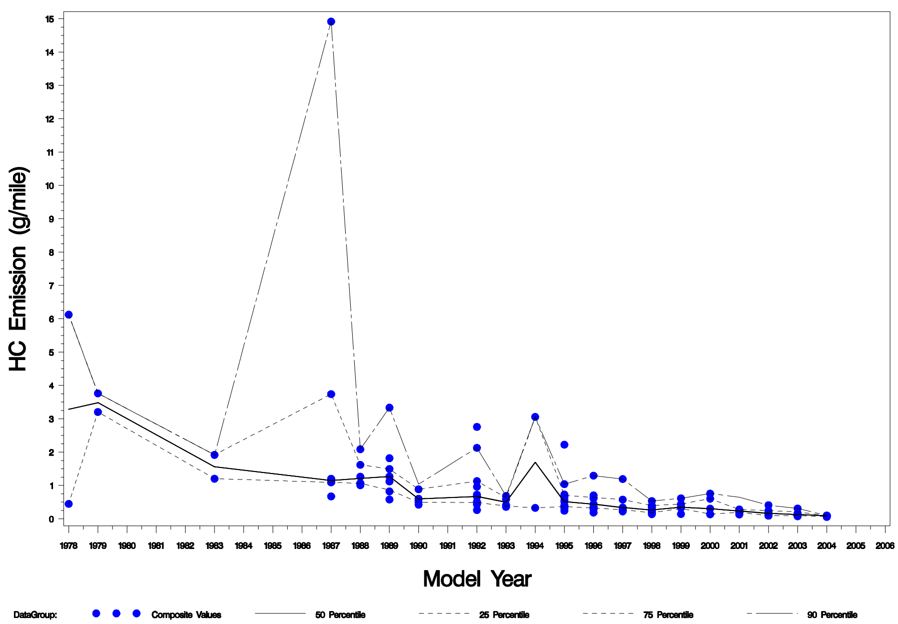
Composite Emission Values as a Function of Model Year (Linear Scale) – TRUCK



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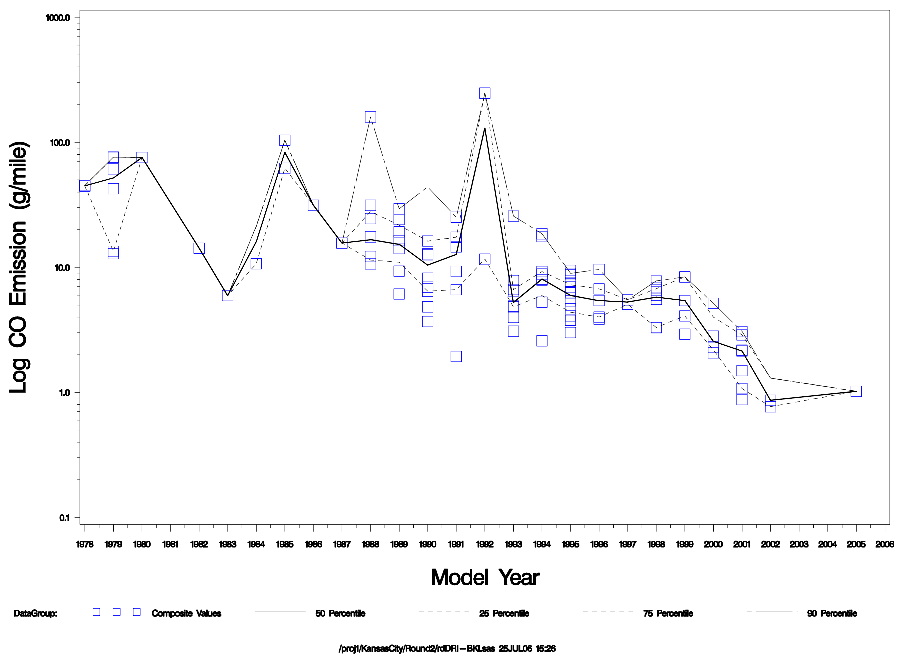
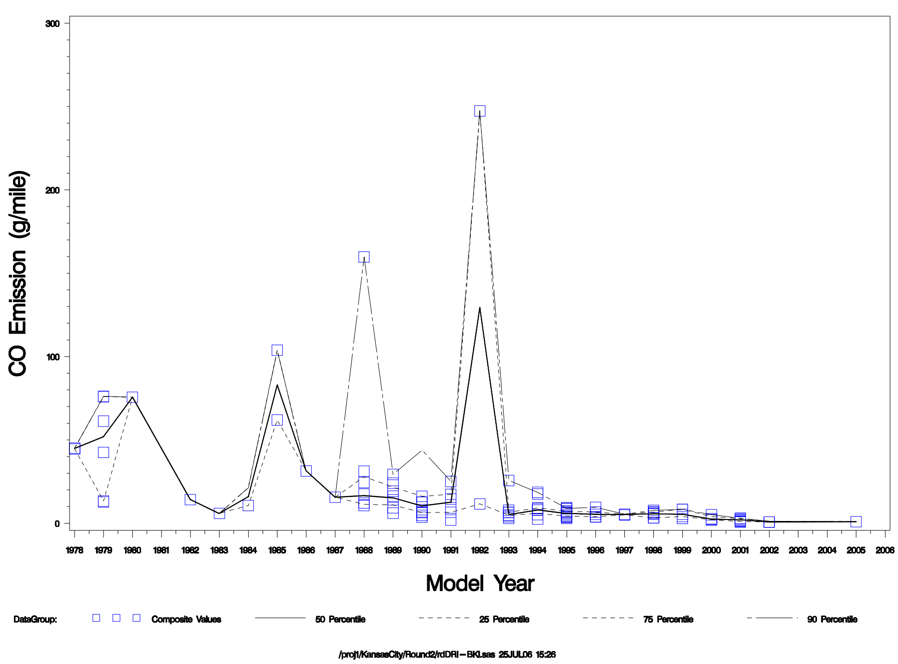
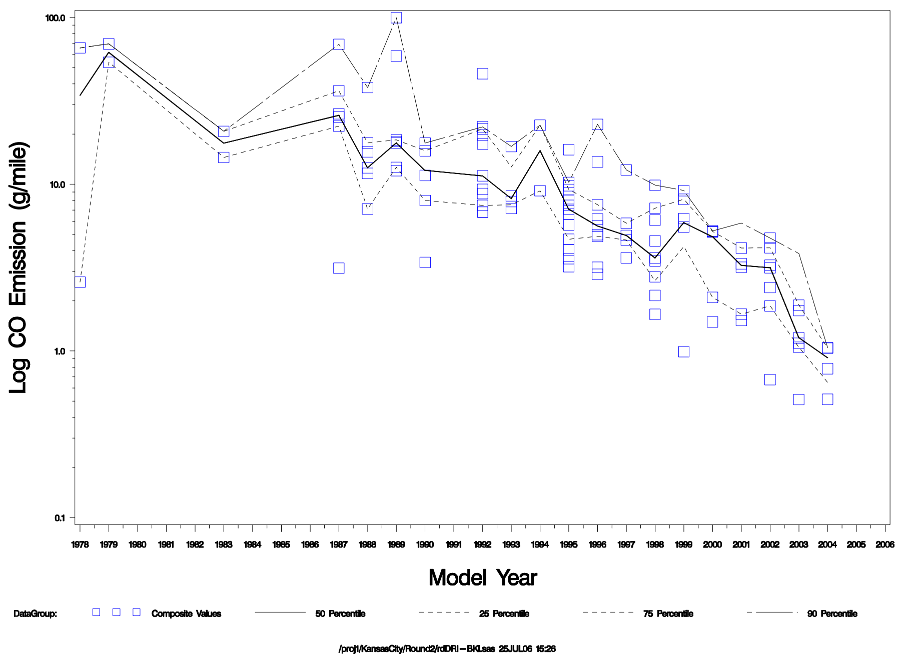
Composite Emission Values as a Function of Model Year (Log Scale) – CAR



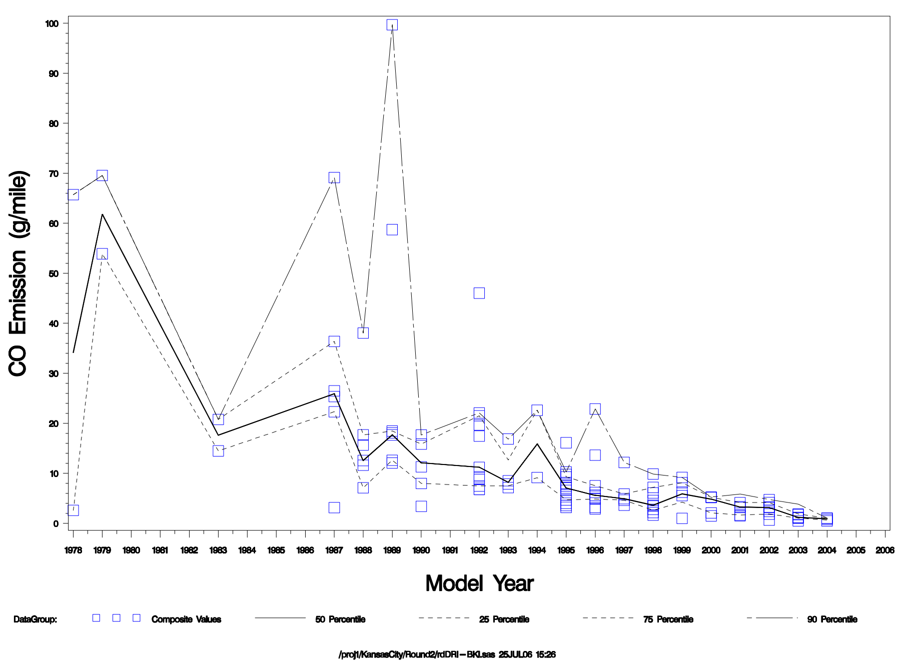
Composite Emission Values as a Function of Model Year (Linear Scale) – CAR



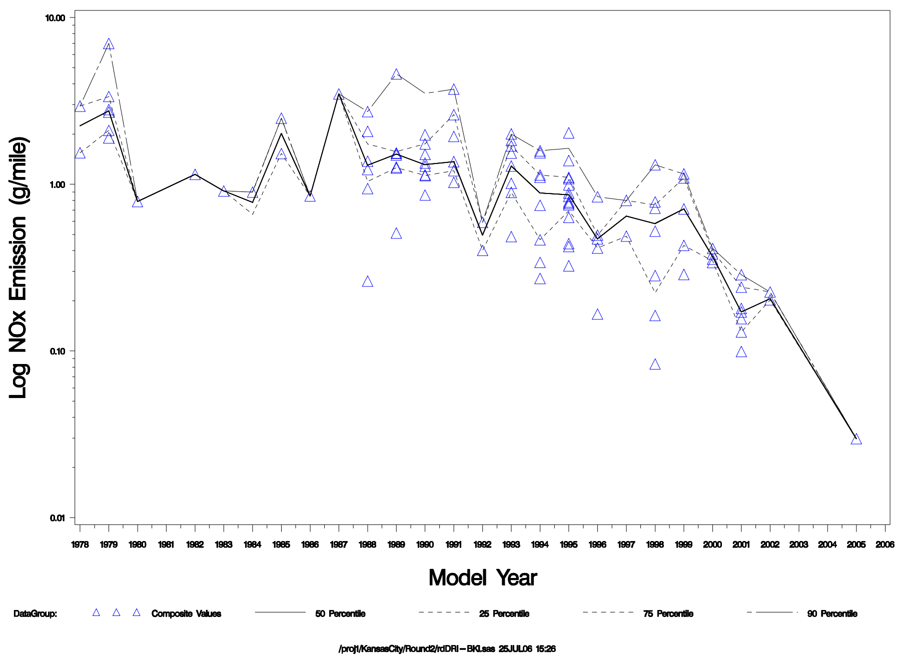
Composite Emission Values as a Function of Model Year (Log Scale) – TRUCK



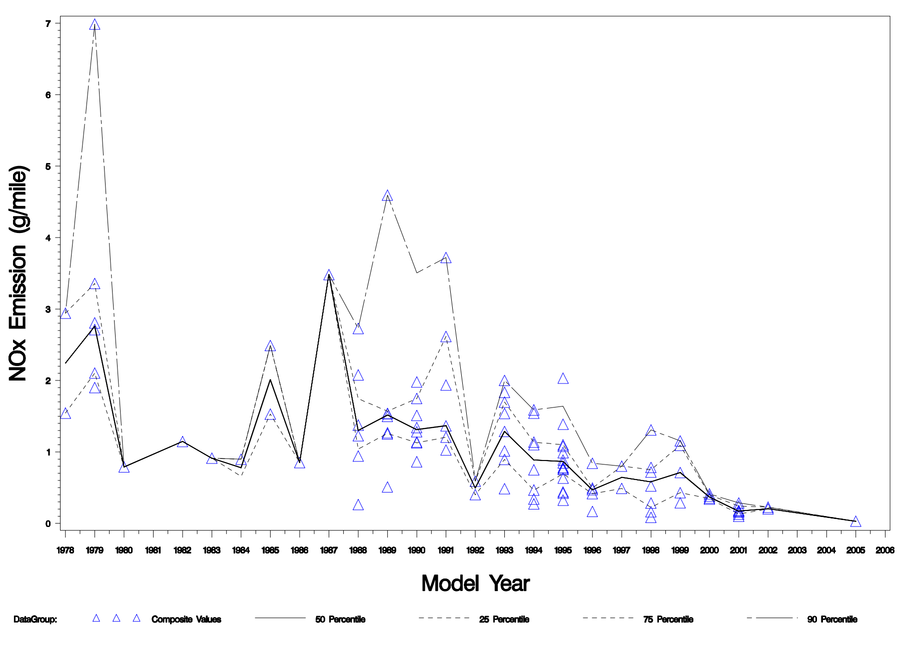
Composite Emission Values as a Function of Model Year (Linear Scale) – TRUCK



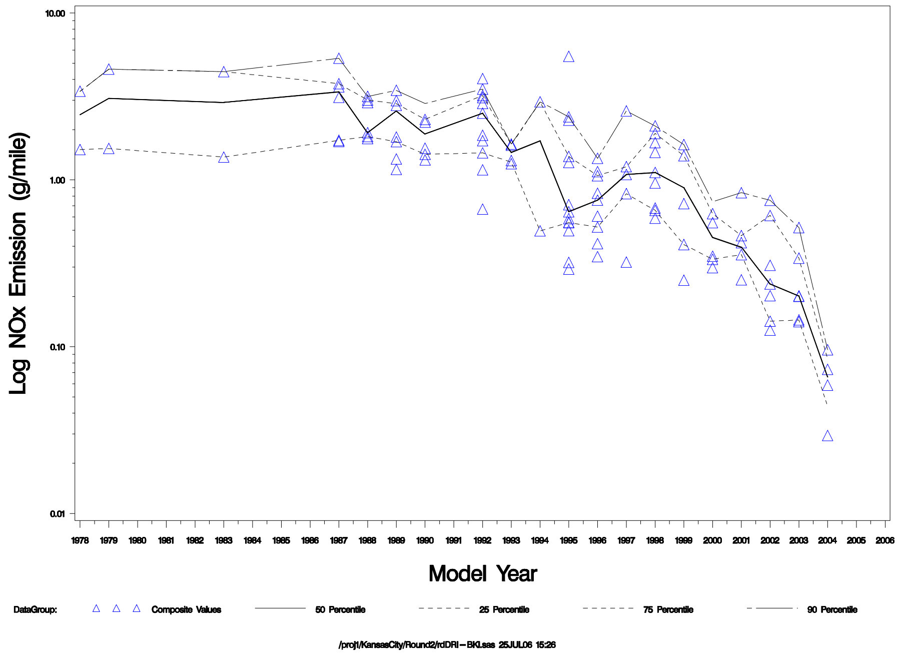
Composite Emission Values as a Function of Model Year (Log Scale) – CAR



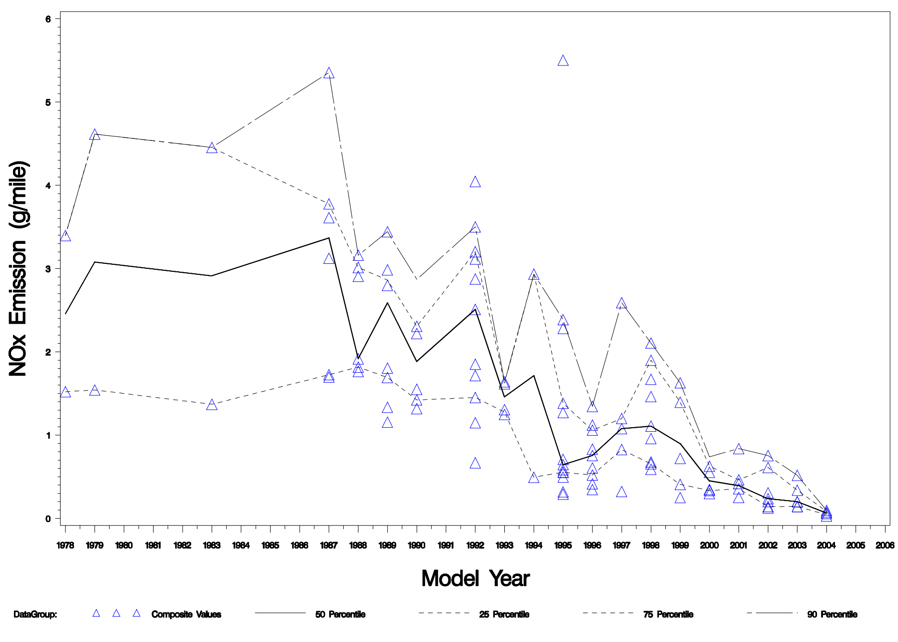
Composite Emission Values as a Function of Model Year (Linear Scale) – CAR



Composite Emission Values as a Function of Model Year (Log Scale) – TRUCK



Composite Emission Values as a Function of Model Year (Linear Scale) – TRUCK



Kansas City PM Characterization Study

Final Report

Appendix H
Other Round 2 Data

Assessment and Standards Division
Office of Transportation and Air Quality
U.S. Environmental Protection Agency

Sponsors:

National Renewable Energy Laboratory, U.S. Department of Energy
Federal Highway Administration, U.S. Department of Transportation
STAPPA-ALAPCO Emission Inventory Improvement Program
Coordinating Research Council Inc. (Project No. E-69)

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Revised April 2008 by EPA staff

EPA United States Environmental Protection Agency

EPA420-R-08-009
April 2008

Weighted Emissions and Fuel Economy

Weighted Regulated Emissions and Fuel Economy for the Round 1 Kansas City Test Fleet.

Run #	Veh Yr, Make, Model	Odometer	Inertia	Hp@50mph	HC	NOx	CO	CO2	Fuel Economy
		Miles	Lbs		gm/mile	gm/mile	gm/mile	gm/mile	mpg
84032	2001 Chevrolet Cavalier	57066	3000	6.4	0.124	0.10	0.43	361.4	23.75
84034	1999 IsuzuTrooper	63387	4500	14.8	0.122	0.47	2.18	506.3	16.88
84035	2001 GMC Yukon	75374	5500	18.8	0.292	0.52	3.54	704.4	12.11
84036	1995 Ford Escort	102663	2750	5.6	0.197	1.64	6.70	349.6	23.86
84037	1979 Ford F250	02285	3500	10.5	1.557	1.26	32.78	667.6	11.89
84039	2001 Ford F150	48831	5500	16.2	0.219	0.18	2.07	674.6	12.69
84040	1990 Dodge Spirit	109270	3000	8.7	0.358	2.40	8.98	407.7	20.35
84042	1996 Honda Civic	131492	2500	6.9	0.313	0.63	4.76	319.3	26.27
84043	1991 Honda Civic	216571	2500	6.9	0.570	2.33	10.46	289.5	27.97
84047	1996 Mazda 626	26614	3000	7.7	0.143	0.07	0.87	439.4	19.51
84048	1989 Dodge Caravan	161033	3500	7.6	1.104	3.44	9.09	422.1	19.57
84050	2002 Honda Civic	50405	3000	5.3	0.079	0.06	2.89	366.9	23.16
84051	1995 Chevy Corsica	111484	3000	5.9	0.175	0.86	5.17	361.2	23.27
84052	1988 Olds Cutlass	81545	3000	6.4	0.469	2.11	5.25	460.4	18.31
84054	1995 GMC Jimmy	102924	3500	10.7	0.208	1.11	2.84	511.6	16.66
84055	1998 Jeep Cherokee	131884	3500	11.8	1.066	4.15	9.77	507.5	16.36
84056	2002 Nissan Frontier P/U	38153	4500	16.5	0.105	0.30	3.47	535.0	15.92
84057	2001 Saturn SL1	51541	2500	6.1	0.517	0.10	16.26	281.4	27.90
84058	1999 Chysler 300M	73246	3500	5.8	0.130	0.33	0.92	461.2	18.59
84061	1990 Chevy Cavalier	81297	2750	5.6	0.536	1.07	4.90	352.5	23.79
84063	1998 Saturn SC	74642	2500	6.0	0.135	0.56	0.79	341.7	25.07
84064	1994 Mercury Villager	131405	4000	8.4	0.277	1.28	3.40	444.1	19.12
84066	1995 Jeep Wrangler	71165	3000	15.7	0.467	0.38	15.86	437.5	18.56
84067	1995 Dodge Caravan	138912	4000	7.0	0.438	1.58	5.54	446.3	18.86
84068	2001 Toyota Solara	48090	3500	7.0	0.109	0.32	2.01	465.7	18.35
84069	1997 Dodge Caravan Sport	90070	3500	7.2	0.214	0.68	1.44	446.5	19.15
84071	1989 Pontiac Grand Am	116827	3000	5.9	2.231	5.35	11.26	341.2	23.53
84072	2003 Chevy S_10 P/U	19374	3500	12.0	0.095	0.19	0.54	515.0	16.68
84073	1995 Chevy Blazer	100766	3500	10.7	0.395	1.44	6.09	457.5	18.38
84074	1986 Nissan P/U	138620	3500	11.4	0.358	4.53	12.23	390.8	20.94
84076	1968 FordMustang	98864	3000	8.0	4.724	3.37	68.23	477.5	14.36
84077	1999 Honda Civic	76504	2500	5.1	0.072	0.21	3.18	264.2	31.95
84078	1997 Honda Accord	79593	3000	4.9	0.122	0.31	2.76	382.0	22.26
84079	1989 Honda Accord	209991	2750	6.0	1.863	0.98	64.21	370.4	18.04
84082	2003 Ford Taurus	25287	3500	6.8	0.059	0.11	0.44	458.9	18.72
84083	2000 Honda Accord	77962	3000	7.8	0.087	0.18	3.13	368.6	23.03
84084	1998 Chevy Malibu	99436	3000	5.8	0.122	0.65	1.02	414.7	20.66

Run #	Veh Yr, Make, Model	Odometer	Inertia	Hp@50mph	HC	NOx	CO	CO2	Fuel Economy
		Miles	Lbs		gm/mile	gm/mile	gm/mile	gm/mile	mpg
84086	2004 Honda Odyssey	21035	4500	12.0	0.097	0.11	1.34	509.9	16.80
84087	2000 Hyundai Tiburon	89226	3000	5.9	0.115	0.36	1.11	396.0	21.62
84088	1998 Chevrolet Lumina	70740	3500	5.5	0.235	0.54	2.34	448.2	19.02
84090	1999 Ford Mustang	39505	3500	9.7	0.130	0.35	1.21	469.4	18.25
84091	1991 Cadillac Seville	70502	3500	6.2	0.284	0.72	5.53	521.9	16.20
84092	1999 Saturn	53427	2500	5.5	0.065	0.89	0.50	314.9	27.25
84093	1997 Nissan Sentra	119201	2750	7.0	0.191	0.60	1.52	367.8	23.22
84094	1993 Ford Explorer	120280	4000	10.2	0.303	1.90	8.50	513.9	16.30
84096	1999 Isuzu Rodeo	114937	4000	14.0	1.044	1.63	10.30	489.9	16.90
84097	2002 Mercury Sable	24589	3500	6.8	0.077	0.09	0.20	436.6	19.69
84098	1999 Ford Ranger	91045	3500	12.1	0.161	0.36	1.39	486.2	17.61
84099	1999 Toyota Avalon	114759	3500	5.9	0.318	0.38	1.75	413.8	20.62
84101	2004 Toyota Camry	169043	3500	7.2	0.558	2.16	22.96	383.2	20.45
84102	1998 Honda Civic	149665	2500	5.1	0.189	0.59	7.15	253.9	32.39
84103	2000 Nissan Maxima	74273	3500	7.4	0.172	0.48	1.00	426.3	20.09
84105	1997 Toyota Corolla	146471	2750	7.8	0.324	0.54	4.39	301.7	27.80
84107	1989 Buick LeSabre	108562	3500	7.0	0.266	0.74	3.81	453.5	18.70
84108	1990 Honda Civic	214131	2500	6.5	0.644	2.66	12.27	325.4	24.83
84113	1993 Pontiac Grand Prix	172185	3500	5.0	0.887	1.73	19.54	435.5	18.36
84119	1995 Jeep Cherokee	171701	4000	13.1	1.838	5.77	14.08	510.1	16.00
84121	2001 Volvo S80	55523	4000	4.0	0.079	0.08	0.40	456.8	18.81
84122	1999 Dodge Caravan	104207	4000	7.3	0.164	0.34	1.31	474.0	18.06
84125	1995 Ford Explorer	160621	4500	11.5	0.219	2.24	6.12	544.8	15.51
84126	1988 Ford Thunderbird	178221	3500	9.1	0.847	1.73	11.69	510.8	16.19
84127	2000 Chrysler Town and Country	85431	4500	9.3	0.218	0.44	2.36	554.4	15.41
84128	2000 Toyota Camry	48465	3500	7.3	0.244	0.46	3.05	402.2	21.11
84129	1999 Toyota Celica GT	72233	3000	6.5	0.242	0.44	3.29	371.4	22.81
84131	1997 Chevy Cavalier	128172	3000	5.4	0.151	0.59	3.75	363.7	23.26
84133	1998 Buick Century	71195	3500	5.9	0.149	0.35	1.25	441.8	19.38
84134	1997 Mercury Grand Marquis	74497	4000	9.5	0.280	1.62	8.33	522.1	16.06
84135	1993 Ford Probe	129131	3000	8.1	0.431	0.57	5.04	388.4	21.65
84138	1995 Ford Bronco	198053	5000	10.7	0.538	2.50	6.92	648.1	13.03
84139	1999 Ford Escort	66820	2750	5.6	0.080	0.72	3.49	336.0	25.19
84140	2002 Chevy Blazer	35072	3500	11.3	0.090	0.22	1.02	508.2	16.88
84141	1990 Honda Accord	170433	3000	5.9	0.442	0.97	6.65	368.1	22.66
84144	1993 Plymouth Voyager	170027	4000	7.3	0.844	2.03	8.24	452.1	18.41
84145	1990 Jeep Cherokee	261848	3500	10.8	1.154	2.07	13.76	280.7	28.14
84146	1988 Ford Ranger	74743	3500	10.2	1.184	1.63	9.86	378.0	21.67
84148	1991 Dodge Dynasty	91324	3000	6.8	1.165	3.45	7.71	431.5	19.25
84149	2002 Ford Escort SE	26748	3000	7.3	0.078	0.09	0.71	342.8	25.01
84150	2000 Honda Odyssey	68979	4500	9.6	0.161	0.37	4.54	515.0	16.47
84153	2000 Ford F150 PU	61040	4500	16.9	0.116	0.41	0.66	573.4	14.98
84154	1979 Ford F150 PU	53503	3500	11.7	12.132	4.69	113.51	572.0	10.93
84157	1994 Nissan Sentra	127063	2750	7.1	0.462	0.82	5.66	298.4	27.88

Run #	Veh Yr, Make, Model	Odometer	Inertia	Hp@50mph	HC	NOx	CO	CO2	Fuel Economy
		Miles	Lbs		gm/mile	gm/mile	gm/mile	gm/mile	mpg
84160	2001 Ford Focus	52253	3000	7.3	0.125	0.35	2.09	383.7	22.22
84161	1997 Volvo 850	65093	3500	6.0	0.245	0.79	1.00	482.7	17.75
84162	1983 Chrysler Lebaron	43291	2750	5.5	0.475	0.81	24.26	425.9	18.49
84164	1999 Plymouth Voyager	74703	4000	6.6	0.188	0.27	1.46	456.6	18.74
84165	1991 Mazda Protege	185576	2750	7.9	3.395	4.42	13.01	314.7	24.91
84167	1999 Ford Ranger P/U	92926	3500	11.4	0.294	0.61	5.65	415.7	20.23
84168	1996 Buick Regal Grand Sport	139861	3500	5.6	0.145	0.78	1.98	448.6	19.04
84171	1988 Honda Civic DX	205828	2250	6.4	1.186	1.37	14.86	278.1	28.21
84172	1986 Cadillac Cimmaron	17610	3000	5.9	0.454	0.94	5.75	431.4	19.48
84173	1996 Mercury Sable	110411	3500	6.9	0.468	1.12	5.20	377.9	22.21
84174	1994 Mercury Topaz	32694	3000	6.1	0.368	1.30	1.67	534.5	15.99
84178	1997 Toyota Camry	129432	3500	7.3	0.228	0.61	2.68	398.6	21.33
84179	1998 Jeep Cherokee	82874	3500	11.8	0.490	1.29	6.71	501.0	16.78
84182	1995 Ford Thunderbird	135049	4000	10.6	0.467	1.41	12.13	565.3	14.70
84183	2000 Toyota Corolla	70126	2750	7.5	0.144	0.59	1.55	333.8	25.57
84184	2000 Honda Civic	40410	2750	7.0	0.152	0.11	7.08	321.8	25.82
84185	1996 Toyota Corolla	148865	2750	6.6	0.358	0.68	4.87	310.8	26.94
84188	1977 Chevy Monte Carlo	35553	4000	11.6	4.706	2.12	66.09	504.6	13.82
84189	1984 Ford F150 Pickup	72318	3500	12.9	18.474	1.50	199.74	349.1	11.96
84191	2000 Toyota Camry	47780	3500	7.3	0.218	0.38	2.13	381.5	22.33
84192	2001 GMC Sonoma	60059	3500	11.3	0.067	0.19	1.09	505.6	16.96
84193	2001 Hyundai Sante Fe	70621	4000	8.7	0.102	0.56	2.99	436.0	19.52
84195	1999 Chevy Lumina	42985	3500	5.4	0.135	0.40	1.01	450.6	19.02
84196	1993 GMC Safari	283231	4000	12.5	2.068	3.04	15.06	477.9	16.95
84197	1990 Buick Regal	103881	3000	6.8	0.352	2.07	6.53	422.6	19.84
84201	1985 Chev S10	30305	3000	10.4	5.676	3.47	78.62	416.6	15.44
84205	1998 Ford F150	98670	4500	13.3	0.144	0.56	3.59	606.3	14.06
84206	1994 Chevy P/U	99225	4000	12.2	0.807	0.66	13.11	578.7	14.30
84208	1989 Lincoln Towncar	82512	4000	12.7	2.217	3.90	28.56	502.7	15.53
84209	1996 Dodge Stratus	126733	3000	7.5	0.518	3.77	12.39	406.7	20.12
84210	1988 Mazda MX6	222715	3000	6.8	0.821	2.87	11.59	340.6	23.83
84211	1986 Ford Tempo	60031	2500	6.9	0.463	1.04	9.69	419.2	19.75
84213	1985 Olds Regency 98	188058	3500	7.9	0.597	0.98	23.60	555.2	14.49
84214	1994 Pontiac Bonneville	125226	3500	5.3	0.154	0.63	1.93	493.8	17.31
84215	1992 Nissan Maxima	53987	3500	8.5	0.193	0.63	2.05	453.0	18.84
84216	1990 Ford F150 P/U	7131	4000	15.5	0.511	2.29	1.37	561.0	15.24
84219	1994 Chrysler Concorde	169018	3500	7.8	1.002	2.42	9.15	446.0	18.57
84220	1992 Ford Escort	12788	2750	6.4	1.368	1.26	49.94	326.0	21.06
84221	1985 Ford LTD Crown Victoria	100260	3500	9.3	1.276	0.74	27.44	544.5	14.55
84223	2005 Dodge Caravan	18159	4000	8.0	0.051	0.17	0.68	478.5	17.95
84224	2002 Ford Taurus	72468	3500	6.5	0.062	0.13	0.53	440.3	19.51
84225	2000 Honda Civic LX	35766	2750	7.0	0.120	0.09	7.07	302.7	27.39
84227	1997 Buick Century	86430	3500	5.9	0.168	0.41	1.30	429.0	19.95
84228	1992 Pontiac Grand Am	140191	3000	4.7	1.249	1.46	33.01	424.1	17.94

Run #	Veh Yr, Make, Model	Odometer	Inertia	Hp@50mph	HC	NOx	CO	CO2	Fuel Economy
		Miles	Lbs		gm/mile	gm/mile	gm/mile	gm/mile	mpg
84229	2000 Olds Silhouette	85292	4000	11.5	0.156	0.48	1.40	546.8	15.67
84230	1993 Nissan Sentra	87073	2500	6.2	0.314	0.51	7.48	336.2	24.67
84231	1994 Olds Eighty Eight	128014	3500	6.5	0.186	0.40	2.09	484.8	17.62
84233	1989 Toyota Corolla	181875	2500	5.9	0.846	1.49	13.29	309.5	25.85
84234	1991 VW Cabriolet	63829	2750	8.0	0.229	1.04	3.26	337.4	25.08
84235	1990 Geo Prizm	176712	2500	6.9	2.145	4.98	14.26	310.2	25.38
84236	1992 Olds Achieva	177104	3000	4.9	0.461	2.34	6.69	395.9	21.11
84238	1988 Pontiac 6000 Wagon	133737	3500	6.8	0.719	1.60	6.85	419.2	19.92
84239	1987 Ford Taurus	33610	3000	6.9	0.415	1.38	7.47	499.3	16.80
84240	1998 Infiniti I30	50005	3500	6.4	0.184	0.25	0.58	432.2	19.85
84241	1998 Ford Contour	118535	3000	4.8	0.605	0.36	22.17	418.0	18.93
84242	1997 Plymouth Voyager	70430	3500	6.7	0.248	0.43	1.34	454.4	18.82
84244	1992 Ford Escort	11345	2750	7.4	1.561	2.83	20.24	329.0	23.55
84245	1987 Honda Accord	19268	2750	6.0	3.011	2.16	18.35	385.4	20.33
84246	1994 Eagle Talon	109747	3500	10.6	0.731	1.22	10.72	496.2	16.70
84248	1987 Ford Ranger	1705	3000	10.4	1.083	1.64	8.67	437.7	18.93
84250	1987 Ford Escort	78217	2500	7.4	2.935	2.57	27.34	317.7	23.29
84252	2001 Ford Taurus	30917	3500	6.8	0.163	0.06	1.24	470.0	18.22
84253	1997 Mercury Sable	104330	3500	8.0	0.210	0.93	5.06	446.2	18.93
84256	1989 Chevy S10 P/U	174034	3000	10.4	0.425	1.44	8.88	447.8	18.59
84257	1983 Volvo GL	184224	3000	10.5	0.556	2.20	5.71	466.9	18.02
84261	1989 Toyota Camry	269020	3500	7.7	1.218	2.01	11.74	170.7	44.62
84263	1989 Dodge Ram P/U	132325	3500	15.0	1.209	2.59	43.05	398.7	18.31
84265	1984 Buick Century	1878	3000	7.3	11.214	1.24	135.03	521.1	11.21
84266	2000 Kia Sephia	58660	2750	6.3	0.090	0.14	0.32	361.7	23.75
84267	1989 Chevrolet Cavalier	58439	2750	6.7	0.336	1.19	5.59	376.8	22.26
84268	1994 Ford F150 P/U	169749	4500	12.9	0.725	3.84	2.75	591.6	14.39
84270	1986 Mercury Grand Marquis	36277	4000	10.7	0.949	1.72	11.19	500.9	16.51
84271	1979 Buick LeSabre	37608	3500	10.5	1.283	7.53	11.88	508.1	16.22
84272	2001 Honda Accord	39702	3500	7.8	0.076	0.08	1.14	426.5	20.09
84274	1995 Ford Aspire	188078	2250	6.1	0.501	1.88	7.33	307.3	26.87
84276	1989 Buick Park Avenue	128607	3500	6.0	0.207	1.12	2.49	467.7	18.23
84277	1978 MG MGB	42926	2750	6.1	14.547	1.03	150.16	267.5	15.70
84278	1990 GMC Jimmy	130254	3500	14.5	0.571	0.63	10.77	426.7	19.33
84279	2001 Toyota Camry 3.0L	61415	4000	7.0	0.114	0.18	4.11	470.0	18.05
84280	1999 Ford Escort	74102	2750	4.9	0.079	0.65	2.94	315.3	26.89
84281	1995 Chevy Suburban	73848	5000	10.8	0.469	1.22	11.19	660.0	12.68
84283	1986 Dodge P/U	47582	3500	12.8	5.775	1.65	79.25	433.1	14.96
84284	1987 Chevy Caprice Wagon	29828	4500	9.6	1.318	4.59	29.82	520.2	15.07
84285	2000 Honda Civic	46677	2750	7.0	0.131	0.14	5.75	339.5	24.67
84286	1997 Olds. Silhouette	111026	4000	10.1	0.230	2.22	5.18	535.5	15.81
84287	!995 GMC Sierra P/U	171370	4000	12.2	0.639	1.56	7.60	492.0	17.02
84289	1984 Olds Custom Cruiser Wagon	8983	4500	11.6	4.981	4.96	69.64	458.7	14.75
84291	1997 Honda Civic	75783	2500	5.0	0.277	0.36	4.36	285.0	29.41

Run #	Veh Yr, Make, Model	Odometer	Inertia	Hp@50mph	HC	NOx	CO	CO2	Fuel Economy
		Miles	Lbs		gm/mile	gm/mile	gm/mile	gm/mile	mpg
84292	1997 Toyota Camry	127414	3500	7.3	0.282	0.77	7.67	414.6	20.14
84293	1984 Volvo GL Wagon	299703	3000	10.7	1.102	2.56	10.11	410.3	20.04
84295	1987 Chevy Caprice Classic	85915	4000	9.7	4.017	2.56	44.97	501.6	14.72
84296	1998 Honda Civic	115370	2500	5.1	0.093	0.08	3.67	277.4	30.37
84297	1996 Dodge Stratus	146579	3000	7.5	0.359	0.63	8.55	389.7	21.30
84298	1999 Dodge Durango	92681	5000	16.9	0.235	0.87	7.69	702.4	12.04
84300	1990 Buick Lesabre	59413	3500	6.8	0.183	0.39	1.89	461.6	18.50
84301	1989 Pontiac Grand Prix	149395	3500	4.5	3.365	1.66	32.08	470.3	16.21
84302	1993 Ford F150 P/U	184984	4500	12.8	0.534	1.91	6.20	539.1	15.64
84303	2002 Olds Silhouette	40271	4500	16.2	0.073	0.25	0.76	519.6	16.52
84304	2001 Honda Civic	49751	2750	8.0	0.051	0.15	1.08	329.6	25.97
84305	1999 Chevy Malibu	76627	3500	5.8	0.130	0.53	1.71	411.4	20.77
84307	1992 Honda Accord	74582	3000	5.7	0.217	0.60	3.61	394.6	21.47
84309	1973 Mercedes 280 SE	81588	4000	11.4	9.252	2.16	174.36	507.2	10.63
84310	2003 Chevy Venture	24915	4500	16.2	0.073	0.22	0.83	534.6	16.05
84311	1989 Toyota Corolla	80749	2500	5.9	0.394	1.13	11.50	332.5	24.47
84314	1989 Plymouth Sundance	144672	2750	6.9	0.697	2.38	18.96	361.9	21.86
84315	1991 Plymouth Voyager	158771	3500	7.6	0.990	1.93	6.74	370.9	22.38
84316	1996 Dodge Avenger	124729	3000	4.4	0.859	0.77	7.94	349.0	23.64
84317	2000 Nissan Altima	95313	3500	7.9	0.133	0.88	5.95	416.0	20.22
84318	1997 Nissan Sentra	154255	2750	7.0	0.286	1.08	3.84	340.6	24.77
84319	1998 Toyota Camry	127663	3500	6.4	0.209	0.63	2.59	389.5	21.84
84322	1990 Toyota Camry	202804	3000	5.9	0.299	1.28	7.47	314.1	26.34
84323	2004 Kia Rio Cinco	6260	2750	6.7	0.037	0.05	0.60	324.7	26.42
84324	1999 Toyota Camry	60286	3500	6.4	0.247	0.47	4.91	405.6	20.79
84325	1998 Nissan Maxima	111655	3000	6.1	0.410	0.41	2.16	405.9	20.97
84327	1998 Ford Taurus	77804	3500	5.0	0.124	0.26	1.86	442.9	19.29
84329	1997 Jeep Wrangler	94832	3500	16.1	0.204	0.27	2.22	509.1	16.77
84330	2004 Chevrolet Cavalier	8420	3000	3.9	0.078	0.03	0.63	348.9	24.58
84334	1990 Chevrolet Caprice Estate Wagon	72464	4500	9.6	3.097	1.93	59.03	618.4	11.94
84335	1988 Mercury Grand Marquis	87717	4000	12.5	0.665	1.19	4.84	513.9	16.44
84336	1987 Toyota P/U	225176	2750	9.6	0.591	3.37	1.11	381.5	22.36
84337	2003 Ford Ranger P/U	11678	3500	4.1	0.066	0.19	0.45	479.2	17.93
84338	2001 Saturn	63172	3000	6.4	0.060	0.09	0.56	383.4	22.39
84339	1999 Plymouth Grand Voyager	75489	4000	6.6	0.186	0.39	1.28	504.1	16.99
84342	1994 Toyota Camry	128229	3500	7.2	0.186	0.33	1.32	452.1	18.93
84343	2004 Kia Sedona	6344	4000	6.8	0.050	0.00	0.55	516.6	16.63
84344	2000 Toyota Sienna	131771	4000	6.5	0.380	0.65	2.25	526.6	16.20
84347	1995 Toyota Corolla	106201	2500	6.0	0.355	0.86	5.18	339.7	24.67
84349	2003 Chevrolet Tracker	22365	3000	12.7	0.097	0.19	0.48	428.9	20.02
84351	1996 Ford Contour	98572	3000	5.6	0.186	0.42	6.33	377.3	22.20
84353	1993 Saturn Wagon	220839	3000	4.8	0.620	0.97	11.63	321.1	25.22
84354	1989 Ford F150	61510	4000	15.3	1.374	5.85	6.79	599.2	14.02
84355	2001 Chevrolet Lumina	57829	3500	7.0	0.072	0.23	1.07	452.4	18.95

Run #	Veh Yr, Make, Model	Odometer	Inertia	Hp@50mph	HC	NOx	CO	CO2	Fuel Economy
		Miles	Lbs		gm/mile	gm/mile	gm/mile	gm/mile	mpg
84356	1997 Pontiac Grand Am	120921	3000	3.8	0.187	1.37	5.10	371.7	22.63
84357	1995 Mercury Tracer	146970	2750	4.5	1.086	0.57	44.54	304.5	22.78
84359	1992 Toyota Corolla	84923	2750	8.6	0.205	1.10	3.16	339.1	24.98
84361	2002 Nissan Maxima	80356	3500	5.0	0.095	0.09	1.11	445.1	19.25
84362	1998 Ford Taurus	91855	3500	5.0	0.130	0.17	1.59	419.9	20.36
84363	1996 Toyota Corolla	288784	2750	6.6	0.651	1.49	7.27	325.0	25.44
84365	1993 Ford Taurus	69365	3500	5.5	0.309	0.66	6.42	483.6	17.40
84366	1989 Olds Cutlass Wagon	118187	3000	5.7	0.231	0.75	3.30	417.1	20.35
84367	1980Mercedes 450 SEL	185888	4000	8.3	15.310	0.25	268.12	323.0	10.88
84368	1997 Saturn SL	170227	2500	6.7	0.242	0.55	1.67	313.0	27.21
84369	1996 Volvo 850 Wagon	81784	3500	7.3	0.288	1.38	4.79	475.0	17.81
84370	1995 Ford Taurus	70394	3500	5.4	0.157	0.55	2.19	427.2	19.97
84372	1994 Toyota Camry	88215	3500	7.2	0.218	0.24	1.23	409.1	20.91
84373	1990 Chevrolet Astrovan	235476	4000	12.0	6.621	0.52	166.23	379.7	13.02
84375	2001 Ford Windstar	37923	4500	10.1	0.057	0.19	1.24	506.7	16.92
84376	2000 Honda Odyssey	117948	4500	9.6	0.850	0.62	13.90	503.0	16.32
84377	1997 Honda Accord	77801	3000	4.9	0.120	0.23	1.32	344.5	24.81
84379	1998 Pontiac Grand Am	75722	3000	4.4	0.144	0.55	5.63	427.9	19.69
84380	1995 Lincoln Continental	100959	4000	5.7	0.411	1.00	4.70	427.0	19.76
84381	1994 Mercury Marquis	127784	4000	10.7	0.494	0.95	6.55	478.2	17.57
84382	1999 VW Cabrio	38317	3000	6.9	0.131	0.36	2.11	355.5	23.96
84383	1996 Toyota Camry	164875	3500	6.9	0.085	0.31	2.27	400.9	21.27
84384	1996 Geo Prizm	169535	2750	7.0	0.559	1.01	7.65	324.9	25.42
84386	1990 Nissan Maxima	258738	2750	5.8	0.574	0.76	4.60	398.4	21.13

Correlation Testing Data

Comparison of SEMTECH and Dyno Emission Measurement

RunID	Phase	HC (g/m)		CO (g/m)		NOx (g/m)		CO2 (g/m)		PM2.5 (mg/m)	Distance (miles)
		SMT	BKI	SMT	BKI	SMT	BKI	SMT	BKI		
84032	1	0.53	2.36	7.21	7.77	0.53	0.63	584.67	586.11	15.86	1.12
84032	2	0.02	0.01	0.14	0.05	0.05	0.05	338.13	338.79	1.61	8.59
84032	3	0.05	0.03	0.15	0.11	0.33	0.40	460.53	462.20	6.00	1.19
84032	A	0.05	0.12	0.49	0.43	0.09	0.10	358.89	359.64	2.62	10.91
84034	1	0.57	1.09	4.14	3.45	1.43	1.50	848.87	836.92	9.26	1.20
84034	2	0.07	0.07	3.15	2.14	0.49	0.40	523.01	472.95	2.19	8.72
84034	3	0.09	0.07	2.01	1.33	0.51	0.44	712.83	631.57	4.24	1.22
84034	A	0.10	0.12	3.12	2.15	0.54	0.46	553.22	502.92	2.70	11.13
84035	1	1.10	2.22	12.39	12.25	2.56	2.80	1079.75	1053.73	6.32	1.20
84035	2	0.21	0.18	4.67	3.16	0.47	0.39	809.65	665.10	6.27	8.64
84035	3	0.18	0.19	1.21	0.74	0.39	0.39	893.91	838.55	0.96	1.20
84035	A	0.26	0.29	4.84	3.47	0.58	0.51	829.64	697.48	5.91	11.03
84036	1	1.74	1.79	15.03	12.97	2.78	2.86	616.58	577.11	6.60	1.18
84036	2	0.10	0.10	7.03	6.34	1.58	1.56	314.28	326.66	1.63	8.63
84036	3	0.31	0.26	7.59	5.66	1.55	1.56	514.53	442.04	0.73	1.18
84036	A	0.20	0.20	7.48	6.64	1.64	1.63	343.57	347.55	1.82	10.99
84037	1	8.98	9.33	157.35	154.15	1.38	1.45	971.63	935.24	11.88	1.20
84037	2	1.78	1.02	49.48	25.05	1.84	1.15	1016.34	635.31	9.52	8.67
84037	3	2.15	2.44	33.06	32.90	2.50	2.38	806.51	757.62	2.56	1.19
84037	A	2.18	1.55	54.00	32.34	1.86	1.25	999.49	659.41	9.16	11.06
84039	1	1.38	1.70	10.33	10.69	0.67	0.71	956.87	1005.49	7.83	1.23
84039	2	0.10	0.14	2.04	1.64	0.22	0.16	658.23	635.99	2.39	8.76
84039	3	0.08	0.12	1.09	0.73	0.02	0.01	857.38	833.81	2.19	1.19
84039	A	0.17	0.22	2.42	2.05	0.23	0.18	687.53	668.97	2.66	11.17
84040	1	1.88	1.91	23.61	20.81	3.56	3.81	624.56	599.08	2.53	1.17
84040	2	0.29	0.25	9.56	8.07	2.48	2.32	395.08	387.23	4.96	8.55
84040	3	0.76	0.57	16.07	11.23	2.15	2.20	572.60	599.08	2.53	1.17
84040	A	0.40	0.36	10.73	8.95	2.51	2.38	419.13	405.32	4.84	10.89
84042	1	3.03	3.04	16.66	15.25	2.87	2.82	519.65	470.51	15.37	1.14
84042	2	0.15	0.15	4.81	4.17	0.55	0.51	300.54	305.30	1.80	8.65
84042	3	0.53	0.39	6.91	4.38	0.68	0.60	456.19	373.53	4.66	1.16
84042	A	0.32	0.31	5.54	4.74	0.67	0.63	322.05	318.20	2.68	10.96
84043	1	2.89	2.96	23.68	20.48	2.70	3.14	441.70	405.65	5.89	1.22
84043	2	0.47	0.41	11.47	9.81	2.41	2.26	309.64	277.19	3.57	8.62
84043	3	1.01	0.74	14.70	10.28	2.54	2.31	476.13	339.91	0.87	1.19
84043	A	0.63	0.57	12.34	10.41	2.43	2.31	328.11	288.37	3.50	11.03
84047	1	1.38	1.79	4.78	5.27	0.56	0.70	670.92	710.46	9.67	1.18
84047	2	0.04	0.04	0.52	0.41	0.05	0.04	404.65	413.05	1.10	8.64
84047	3	0.19	0.19	4.27	3.39	0.02	0.00	523.51	540.98	3.27	1.19
84047	A	0.12	0.14	1.00	0.87	0.07	0.07	426.67	437.27	1.69	11.01
84048	1	6.19	6.61	17.30	15.82	6.33	6.73	613.59	607.88	239.55	1.19
84048	2	0.59	0.72	8.74	8.29	3.07	3.07	378.71	399.16	47.17	8.64
84048	3	1.67	1.77	17.27	13.54	4.90	5.27	578.25	538.36	89.24	1.18
84048	A	0.95	1.10	9.77	9.04	3.36	3.41	404.66	419.55	60.03	11.01

RunID	Phase	HC (g/m)		CO (g/m)		NOx (g/m)		CO2 (g/m)		PM2.5 (mg/m)	Distance (miles)
		SMT	BKI	SMT	BKI	SMT	BKI	SMT	BKI		
84050	1	1.02	0.98	14.07	11.56	0.44	0.45	661.16	579.28	1.73	1.18
84050	2	0.02	0.03	2.68	2.36	0.05	0.03	394.99	345.72	1.53	8.66
84050	3	0.05	0.04	3.94	2.94	0.08	0.03	600.97	453.41	1.58	1.18
84050	A	0.07	0.08	3.35	2.88	0.07	0.06	422.82	365.13	1.55	11.01
84051	1	1.67	1.69	22.01	19.78	2.89	3.12	579.39	548.13	0.53	1.18
84051	2	0.07	0.08	4.02	4.21	0.71	0.73	312.83	341.88	0.55	8.61
84051	3	0.33	0.28	8.37	6.22	0.74	0.81	515.12	449.61	0.43	1.16
84051	A	0.17	0.18	5.25	5.15	0.83	0.86	340.36	359.84	0.54	10.95
84052	1	3.54	3.68	24.79	22.90	4.00	4.05	722.87	696.45	6.27	1.19
84052	2	0.24	0.21	5.05	4.05	1.96	1.91	470.72	430.18	5.47	8.71
84052	3	1.29	1.35	8.11	6.95	2.82	3.01	652.76	631.04	5.59	1.19
84052	A	0.48	0.47	6.28	5.22	2.13	2.10	496.24	457.68	5.52	11.09
84054	1	2.74	2.92	25.78	24.00	3.64	3.75	745.11	732.62	7.50	1.20
84054	2	0.04	0.04	1.62	1.40	1.01	0.93	494.26	483.33	1.22	8.57
84054	3	0.23	0.24	5.62	4.86	1.29	1.29	682.47	646.47	16.58	1.18
84054	A	0.19	0.21	3.16	2.83	1.17	1.10	520.38	507.74	2.60	10.95
84055	1	2.89	2.93	25.06	23.41	5.42	5.26	856.50	786.43	5.07	1.21
84055	2	0.90	0.86	10.44	8.57	4.99	4.03	572.19	476.31	4.64	8.65
84055	3	2.28	2.16	16.32	13.58	4.84	4.56	729.99	641.51	7.21	1.19
84055	A	1.10	1.06	11.62	9.70	5.00	4.13	598.08	504.10	4.84	11.05
84056	1	0.57	0.69	4.00	4.35	0.63	0.81	749.34	813.63	2.28	1.18
84056	2	0.08	0.07	4.01	3.51	0.30	0.27	509.49	505.05	1.45	8.62
84056	3	0.08	0.06	1.83	1.69	0.23	0.24	667.51	652.20	0.53	1.19
84056	A	0.10	0.10	3.86	3.43	0.31	0.30	532.78	531.17	1.43	10.99
84057	1	0.34	0.40	2.61	2.60	0.97	0.94	493.85	465.98	1.99	1.18
84057	2	0.54	0.55	17.95	17.52	0.06	0.05	253.61	264.70	1.15	8.64
84057	3	0.20	0.21	9.17	9.20	0.02	0.01	381.88	342.36	0.93	1.20
84057	A	0.51	0.51	16.55	16.17	0.10	0.09	274.90	280.47	1.17	11.02
84058	1	1.79	2.01	8.74	9.15	1.34	1.59	687.11	723.18	1.79	1.16
84058	2	0.03	0.03	0.47	0.39	0.23	0.25	429.74	431.38	1.06	8.63
84058	3	0.03	0.05	1.55	1.57	0.37	0.45	582.43	624.35	0.83	1.17
84058	A	0.12	0.13	0.97	0.92	0.29	0.33	453.18	459.34	1.08	10.96
84060	1	0.97	1.15	7.15	7.82	1.04	1.14	783.31	801.38	1.46	1.18
84060	2	0.03	0.02	0.45	0.33	0.93	0.90	418.65	441.95	1.06	8.59
84060	3	0.33	0.30	4.98	4.49	1.28	1.22	659.86	612.09	0.42	1.18
84060	A	0.10	0.10	1.11	1.00	0.96	0.93	454.28	472.34	1.04	10.95
84061	1	2.64	2.44	22.30	17.66	2.23	2.28	642.39	525.64	4.63	1.16
84061	2	0.42	0.38	4.79	4.05	0.98	0.94	375.25	332.48	1.35	8.62
84061	3	1.28	1.09	7.91	5.85	1.90	1.78	661.00	453.24	1.59	1.19
84061	A	0.59	0.53	5.90	4.87	1.11	1.06	408.73	350.69	1.53	10.97
84062	1	0.80	0.91	6.27	6.84	1.38	1.58	791.19	819.89	2.58	1.17
84062	2	0.02	0.01	0.30	0.20	0.82	0.87	406.40	449.28	1.04	8.61
84062	3	0.12	0.13	1.79	1.53	1.06	1.06	646.36	614.59	3.40	1.18
84062	A	0.07	0.07	0.71	0.64	0.86	0.92	442.69	479.74	1.28	10.97

RunID	Phase	HC (g/m)		CO (g/m)		NOx (g/m)		CO2 (g/m)		PM2.5 (mg/m)	Distance (miles)
		SMT	BKI	SMT	BKI	SMT	BKI	SMT	BKI		
84063	1	1.88	1.90	5.45	5.03	4.31	4.34	596.93	547.42	3.90	1.19
84063	2	0.03	0.03	0.36	0.50	0.33	0.34	282.37	323.17	2.06	8.65
84063	3	0.13	0.11	1.61	1.14	0.43	0.44	447.23	398.35	1.33	1.18
84063	A	0.13	0.13	0.71	0.78	0.54	0.55	310.08	340.02	2.11	11.03
84064	1	3.17	3.42	16.65	15.65	5.01	5.64	700.59	701.62	2.88	1.17
84064	2	0.09	0.08	3.33	2.63	1.00	1.00	395.52	415.91	0.48	8.63
84064	3	0.42	0.42	4.61	3.45	1.42	1.44	624.03	577.38	-0.56	1.18
84064	A	0.27	0.28	4.10	3.36	1.23	1.27	426.96	441.66	0.53	10.98
84066	1	2.93	2.72	33.03	26.24	1.80	1.76	703.09	585.20	2.44	1.19
84066	2	1.07	0.34	29.21	15.52	0.53	0.29	668.03	418.83	7.02	8.59
84066	3	0.36	0.34	8.26	6.29	0.50	0.40	704.36	523.08	1.71	1.18
84066	A	1.12	0.46	27.96	15.44	0.59	0.37	672.38	434.73	6.42	10.97
84067	1	3.11	3.28	18.92	17.01	3.86	4.32	668.66	672.55	4.31	1.19
84067	2	0.22	0.24	5.08	4.68	1.32	1.39	398.11	419.32	1.76	8.65
84067	3	0.64	0.77	7.99	7.47	1.76	1.86	600.11	587.91	1.95	1.17
84067	A	0.40	0.44	5.99	5.51	1.48	1.58	425.97	443.94	1.90	11.01
84068	1	1.21	1.38	7.87	7.60	1.40	1.82	765.86	787.08	2.69	1.17
84068	2	0.03	0.03	2.23	1.76	0.23	0.23	407.80	433.48	0.23	8.63
84068	3	0.09	0.11	0.81	0.54	0.23	0.30	620.12	602.44	0.38	1.18
84068	A	0.09	0.11	2.42	1.97	0.29	0.32	440.70	463.20	0.36	10.98
84069	1	2.39	2.55	16.72	15.40	2.80	3.12	682.98	688.80	2.29	1.20
84069	2	0.06	0.07	0.57	0.54	0.48	0.51	378.15	418.70	0.45	8.64
84069	3	0.21	0.23	2.60	2.24	0.86	0.93	593.22	587.64	0.15	1.18
84069	A	0.20	0.21	1.56	1.44	0.63	0.68	408.86	444.44	0.53	11.02
84071	1	6.45	4.62	34.71	21.97	3.36	6.86	721.07	525.68	72.64	1.20
84071	2	2.29	2.00	12.53	10.15	3.64	5.09	377.35	320.91	34.89	8.68
84071	3	4.28	3.27	24.20	16.65	4.44	6.66	621.86	443.14	58.50	1.20
84071	A	2.63	2.23	14.42	11.21	3.68	5.29	410.91	340.00	38.48	11.07
84072	1	1.03	1.31	6.83	7.71	0.68	0.74	875.23	885.01	2.74	1.18
84072	2	0.02	0.03	0.28	0.15	0.17	0.17	458.76	479.75	1.55	8.64
84072	3	0.03	0.02	0.33	0.14	0.03	0.03	663.60	647.54	1.05	1.20
84072	A	0.07	0.10	0.63	0.54	0.19	0.19	494.59	512.39	1.57	11.02
84073	1	4.43	4.26	61.16	58.73	4.18	4.17	711.77	686.39	6.24	1.18
84073	2	0.12	0.13	2.47	2.89	1.23	1.25	409.87	431.75	3.01	8.67
84073	3	0.71	0.83	9.03	7.49	1.80	1.81	623.49	592.39	1.07	1.17
84073	A	0.38	0.39	5.93	6.07	1.42	1.44	439.84	455.74	3.05	11.02
84074	1	4.11	3.04	53.18	36.36	8.73	7.32	763.90	606.18	21.91	1.20
84074	2	0.29	0.19	16.28	10.82	5.99	4.34	486.82	368.73	5.98	8.64
84074	3	0.65	0.47	16.50	10.92	5.85	4.76	659.23	479.46	0.64	1.18
84074	A	0.51	0.36	18.22	12.17	6.12	4.52	512.97	388.82	6.45	11.02
84076	1	14.08	13.62	217.35	195.51	2.44	2.05	722.49	653.31	56.60	1.16
84076	2	4.24	4.03	53.15	58.36	4.04	3.42	498.53	456.20	14.49	8.65
84076	3	6.12	6.69	105.31	95.12	2.89	3.37	554.53	572.73	5.91	1.20
84076	A	4.88	4.70	65.22	67.86	3.88	3.34	513.96	474.27	16.08	11.00

RunID	Phase	HC (g/m)		CO (g/m)		NOx (g/m)		CO2 (g/m)		PM2.5 (mg/m)	Distance (miles)
		SMT	BKI	SMT	BKI	SMT	BKI	SMT	BKI		
84077	1	0.83	0.89	6.77	6.80	1.33	1.56	442.15	435.48	2.81	1.17
84077	2	0.04	0.03	3.24	3.17	0.12	0.12	235.64	248.02	0.75	8.65
84077	3	0.04	0.02	0.66	0.44	0.24	0.24	327.15	329.13	0.88	1.18
84077	A	0.08	0.07	3.24	3.17	0.19	0.20	252.50	263.19	0.87	11.00
84078	1	1.35	1.47	16.17	16.79	1.58	1.73	633.67	616.78	0.02	1.17
84078	2	0.05	0.05	1.52	2.05	0.24	0.23	323.25	357.64	0.51	8.63
84078	3	0.07	0.04	1.48	1.27	0.26	0.27	535.53	492.73	0.98	1.19
84078	A	0.12	0.12	2.27	2.75	0.31	0.31	353.85	380.25	0.51	10.99
84079	1	18.29	15.83	386.54	271.47	0.92	0.96	704.67	502.85	286.59	1.16
84079	2	1.67	1.01	88.08	52.66	1.65	0.92	673.70	351.55	19.72	8.59
84079	3	2.94	2.34	61.31	51.17	2.01	1.71	676.51	478.69	6.42	1.17
84079	A	2.60	1.86	101.49	63.78	1.64	0.98	675.47	368.01	32.48	10.93
84081	1	5.04	5.35	36.90	34.95	7.10	6.88	658.16	653.31	5.45	1.18
84081	2	2.07	2.10	14.75	13.29	6.44	5.54	400.34	384.22	1.28	8.64
84081	3	3.30	3.55	21.86	20.33	7.04	7.07	556.98	544.60	0.54	1.17
84081	A	2.31	2.36	16.38	14.89	6.51	5.71	424.33	409.04	1.44	10.99
84082	1	0.52	0.73	3.16	3.80	0.21	0.21	762.61	793.14	3.69	1.17
84082	2	0.02	0.02	0.29	0.16	0.10	0.10	414.55	426.49	0.71	8.64
84082	3	0.10	0.07	1.80	1.59	0.09	0.09	614.18	593.51	3.12	1.18
84082	A	0.05	0.06	0.55	0.44	0.11	0.11	446.18	456.78	1.03	10.99
84083	1	0.98	1.05	13.43	13.30	0.88	0.81	655.20	583.79	4.18	1.18
84083	2	0.03	0.03	2.32	2.61	0.18	0.16	332.82	345.71	0.62	8.63
84083	3	0.08	0.05	2.35	2.02	0.04	0.03	559.66	472.03	0.75	1.19
84083	A	0.09	0.09	2.89	3.12	0.20	0.18	365.09	366.75	0.81	11.00
84084	1	1.69	1.90	13.45	14.14	2.70	2.64	673.20	683.10	0.66	1.19
84084	2	0.02	0.02	0.31	0.24	0.64	0.54	367.67	388.32	0.66	8.63
84084	3	0.08	0.08	1.37	1.12	0.47	0.43	560.65	528.13	0.80	1.19
84084	A	0.11	0.12	1.07	1.02	0.74	0.65	396.86	413.29	0.67	11.00
84086	1	1.50	1.55	6.64	6.89	0.77	0.88	1009.42	1007.97	15.26	1.07
84086	2	0.03	0.03	1.17	1.13	0.07	0.07	503.47	469.96	2.14	8.56
84086	3	0.03	0.01	0.25	0.06	0.12	0.14	614.67	617.44	0.63	1.19
84086	A	0.10	0.10	1.36	1.33	0.10	0.11	535.43	505.90	2.66	10.82
84087	1	1.72	1.78	10.70	10.34	1.18	1.08	665.10	624.05	11.26	1.18
84087	2	0.03	0.02	0.74	0.62	0.35	0.31	350.55	371.50	1.30	8.65
84087	3	0.04	0.03	0.69	0.48	0.47	0.42	575.65	514.68	0.50	1.18
84087	A	0.12	0.11	1.26	1.11	0.40	0.35	382.21	394.33	1.76	11.01
84088	1	2.10	2.13	11.66	11.37	3.44	2.55	692.20	687.52	1.98	1.18
84088	2	0.10	0.11	1.56	1.70	1.24	0.42	382.31	420.79	1.20	8.63
84088	3	0.35	0.36	3.65	3.47	1.08	0.43	595.54	587.04	1.61	1.18
84088	A	0.22	0.23	2.23	2.32	1.35	0.53	413.00	446.05	1.27	11.00
84090	1	1.63	1.93	11.37	11.62	1.58	1.35	727.62	753.58	4.23	1.19
84090	2	0.02	0.02	0.65	0.53	0.26	0.26	435.30	441.95	0.50	8.69
84090	3	0.14	0.16	2.18	2.01	0.72	0.76	558.00	584.52	-0.07	1.20
84090	A	0.11	0.13	1.31	1.21	0.36	0.35	458.94	467.92	0.65	11.08

RunID	Phase	HC (g/m)		CO (g/m)		NOx (g/m)		CO2 (g/m)		PM2.5 (mg/m)	Distance (miles)
		SMT	BKI	SMT	BKI	SMT	BKI	SMT	BKI		
84091	1	3.73	3.85	59.03	59.71	0.62	0.56	893.49	859.77	1.51	1.18
84091	2	0.05	0.07	2.55	2.45	0.82	0.69	481.64	484.44	0.95	8.61
84091	3	0.27	0.30	4.40	3.80	1.32	1.22	748.61	708.24	1.40	1.18
84091	A	0.26	0.28	5.61	5.52	0.84	0.72	521.32	519.31	1.01	10.98
84092	1	0.80	0.88	8.00	8.43	1.74	1.56	511.66	489.37	2.65	1.17
84092	2	0.01	0.02	0.11	0.06	0.93	0.84	262.28	298.65	1.27	8.65
84092	3	0.05	0.06	0.38	0.19	1.00	0.91	413.34	378.78	2.31	1.18
84092	A	0.05	0.07	0.54	0.50	0.97	0.88	285.43	313.93	1.41	11.00
84093	1	1.49	1.61	4.33	4.56	1.35	1.26	650.56	630.15	3.27	1.18
84093	2	0.05	0.04	1.33	1.30	0.64	0.56	306.70	344.45	1.19	8.61
84093	3	0.46	1.01	2.16	1.84	0.69	0.59	458.20	448.33	1.07	1.18
84093	A	0.15	0.19	1.54	1.50	0.68	0.60	334.93	366.35	1.29	10.97
84094	1	2.70	3.26	29.38	29.14	4.06	3.76	788.53	805.57	1.56	1.16
84094	2	0.13	0.12	8.49	7.20	2.37	1.75	496.61	481.35	2.08	8.64
84094	3	0.45	0.49	10.01	8.42	2.65	2.30	659.61	665.20	1.57	1.18
84094	A	0.28	0.30	9.66	8.40	2.47	1.89	522.59	510.49	2.02	10.98
84096	1	5.19	6.00	28.90	29.00	3.31	3.37	723.71	761.18	14.14	1.16
84096	2	0.57	0.58	8.29	8.20	1.82	1.52	480.22	461.38	4.40	8.67
84096	3	2.69	3.27	24.81	22.80	1.78	1.58	698.98	612.32	7.42	1.17
84096	A	0.95	1.04	10.44	10.25	1.89	1.62	507.19	486.87	5.10	11.01
84097	1	0.93	1.14	1.34	1.22	0.63	0.67	723.43	743.59	4.07	1.20
84097	2	0.01	0.02	0.23	0.12	0.07	0.06	408.18	408.34	0.45	8.64
84097	3	0.03	0.04	0.55	0.46	0.02	0.03	482.71	545.77	2.45	1.18
84097	A	0.06	0.08	0.31	0.20	0.09	0.09	429.70	435.30	0.78	11.02
84098	1	2.00	2.14	13.20	13.85	2.18	1.90	767.51	770.11	3.05	1.18
84098	2	0.05	0.04	0.87	0.62	0.31	0.27	439.63	456.43	0.34	8.64
84098	3	0.26	0.26	2.38	1.76	0.31	0.36	619.62	621.82	1.53	1.17
84098	A	0.16	0.16	1.61	1.38	0.41	0.36	468.78	483.86	0.56	10.99
84099	1	3.62	3.93	13.82	14.01	2.87	2.67	742.87	729.78	14.89	1.16
84099	2	0.11	0.11	1.16	1.04	0.25	0.22	341.81	383.52	2.76	8.59
84099	3	0.31	0.32	1.80	1.49	0.71	0.62	545.80	540.10	1.62	1.16
84099	A	0.30	0.32	1.85	1.74	0.42	0.38	376.14	411.83	3.30	10.91
84101	1	3.09	3.21	40.75	39.65	4.96	4.46	636.89	599.91	38.03	1.20
84101	2	0.43	0.41	26.39	22.57	2.41	1.98	353.81	360.17	9.07	8.69
84101	3	0.43	0.42	13.98	11.78	2.94	2.61	530.93	485.53	3.04	1.19
84101	A	0.56	0.55	26.29	22.72	2.58	2.16	380.55	381.24	10.17	11.07
84102	1	1.25	1.31	16.79	15.58	3.12	2.83	388.21	380.64	2.67	1.17
84102	2	0.11	0.12	6.72	6.69	0.53	0.46	234.09	240.12	0.56	8.65
84102	3	0.21	0.23	6.65	6.38	0.58	0.55	296.33	321.70	0.66	1.19
84102	A	0.18	0.19	7.23	7.13	0.67	0.59	246.24	252.93	0.68	11.00
84103	1	2.02	2.28	9.47	10.19	1.86	1.82	679.39	705.38	2.21	1.17
84103	2	0.05	0.05	0.52	0.41	0.47	0.39	399.77	398.24	0.33	8.65
84103	3	0.17	0.19	1.95	1.72	0.73	0.66	535.91	548.69	0.28	1.18
84103	A	0.16	0.17	1.08	1.00	0.56	0.48	423.43	424.34	0.42	11.01

RunID	Phase	HC (g/m)		CO (g/m)		NOx (g/m)		CO2 (g/m)		PM2.5 (mg/m)	Distance (miles)
		SMT	BKI	SMT	BKI	SMT	BKI	SMT	BKI		
84104	1	2.04	2.29	10.81	11.01	2.87	2.66	746.19	753.50	3.72	1.19
84104	2	0.06	0.05	1.43	1.45	0.72	0.59	438.74	464.06	1.53	8.64
84104	3	0.28	0.27	4.86	4.50	1.01	0.86	671.97	633.61	0.92	1.19
84104	A	0.18	0.18	2.16	2.16	0.86	0.71	470.87	490.80	1.60	11.02
84105	1	3.12	3.18	23.16	22.03	2.38	2.11	485.44	431.15	4.88	1.18
84105	2	0.15	0.16	3.90	3.53	0.46	0.43	264.91	288.90	1.04	8.63
84105	3	0.28	0.28	2.21	1.62	0.90	0.77	411.39	353.26	0.86	1.18
84105	A	0.31	0.32	4.77	4.36	0.59	0.54	286.23	300.67	1.22	10.99
84107	1	2.44	2.86	9.78	9.97	2.59	2.39	765.51	757.31	8.85	1.19
84107	2	0.10	0.10	3.56	3.28	0.76	0.63	422.48	421.88	3.78	8.66
84107	3	0.46	0.48	6.10	5.48	0.87	0.83	629.22	597.25	2.04	1.19
84107	A	0.25	0.27	4.06	3.78	0.86	0.73	454.52	451.40	3.92	11.03
84108	1	3.34	2.66	30.20	21.67	4.96	4.11	620.02	494.13	11.57	1.15
84108	2	0.48	0.49	13.03	11.64	3.01	2.54	322.89	308.32	2.76	8.64
84108	3	1.21	1.09	16.60	12.62	3.58	2.98	498.31	399.39	-0.21	1.18
84108	A	0.68	0.64	14.14	12.21	3.15	2.65	349.93	323.96	3.00	10.97
84109	1	1.95	2.10	11.78	11.53	2.81	2.58	740.65	728.32	3.34	1.18
84109	2	0.05	0.05	1.29	1.21	0.75	0.62	437.03	448.84	1.06	8.62
84109	3	0.26	0.27	4.67	4.27	1.13	0.95	666.46	622.67	0.13	1.18
84109	A	0.16	0.17	2.07	1.96	0.88	0.75	468.47	475.23	1.11	10.98
84110	1	1.79	1.87	11.17	10.47	2.21	2.06	543.92	541.22	4.03	1.18
84110	2	0.06	0.06	4.80	4.64	0.52	0.48	325.82	330.77	9.31	8.65
84110	3	0.56	0.64	7.34	6.16	0.82	0.79	458.33	437.36	23.99	1.19
84110	A	0.19	0.19	5.31	5.04	0.63	0.58	346.26	349.00	10.05	11.02
84111	1	1.71	1.83	14.20	13.38	3.53	3.30	687.48	698.37	47.71	1.20
84111	2	0.07	0.06	1.76	1.57	0.91	0.76	421.53	438.99	1.78	8.74
84111	3	0.36	0.30	4.10	3.76	1.10	0.97	626.69	612.26	1.05	1.20
84111	A	0.18	0.17	2.57	2.33	1.06	0.91	449.39	464.32	4.11	11.14
84115	1	2.19	2.29	15.30	10.85	1.64	2.11	559.47	562.20	7.18	1.17
84115	2	0.09	0.08	7.30	5.53	0.49	0.59	342.64	343.38	7.87	8.64
84115	3	0.36	0.68	9.24	7.10	0.93	1.06	453.97	455.96	5.12	1.19
84115	A	0.22	0.23	7.84	5.92	0.58	0.70	361.49	362.39	7.64	11.00
84116	1	1.89	2.20	17.31	15.07	2.98	3.44	701.37	704.34	3.13	1.18
84116	2	0.09	0.06	1.91	1.49	0.63	0.74	443.02	443.91	1.80	8.65
84116	3	0.47	0.43	5.29	4.91	0.85	1.20	556.87	559.89	1.28	1.20
84116	A	0.21	0.20	2.94	2.43	0.77	0.91	464.24	465.33	1.83	11.03
84119	1	3.82	4.87	27.91	32.72	6.66	7.02	794.85	798.55	-2.48	1.17
84119	2	1.37	1.56	11.80	12.07	5.63	5.59	478.00	479.23	7.18	8.65
84119	3	2.43	3.05	20.83	24.16	5.44	6.19	632.55	636.02	-0.65	1.19
84119	A	1.57	1.83	13.25	13.96	5.67	5.70	504.90	506.36	6.14	11.00
84121	1	0.92	1.05	4.65	3.82	1.14	1.13	746.76	749.90	0.26	1.15
84121	2	0.01	0.02	0.25	0.17	0.01	0.02	424.21	425.12	0.76	8.60
84121	3	0.07	0.09	0.68	0.77	0.00	0.01	607.44	609.37	-0.02	1.17
84121	A	0.06	0.08	0.50	0.39	0.06	0.08	453.09	454.15	0.68	10.92

RunID	Phase	HC (g/m)		CO (g/m)		NOx (g/m)		CO2 (g/m)		PM2.5 (mg/m)	Distance (miles)
		SMT	BKI	SMT	BKI	SMT	BKI	SMT	BKI		
84122	1	1.82	2.18	13.77	14.61	1.96	2.17	736.43	739.78	5.23	1.18
84122	2	0.04	0.04	0.51	0.42	0.24	0.22	442.77	443.67	1.68	8.62
84122	3	0.16	0.21	1.22	2.58	0.49	0.53	615.12	617.51	0.86	1.18
84122	A	0.14	0.17	1.25	1.31	0.35	0.34	469.83	470.91	1.81	10.98
84123	1	1.98	2.11	34.72	28.94	1.10	1.14	416.18	417.92	3.95	1.18
84123	2	0.78	0.82	26.81	26.05	1.00	1.03	251.14	251.75	3.52	8.67
84123	3	0.99	1.15	17.38	22.33	1.18	1.14	317.55	318.39	2.56	1.21
84123	A	0.85	0.91	26.57	25.94	1.02	1.04	264.32	264.99	3.47	11.06
84126	1	4.01	4.62	30.80	26.36	2.87	3.77	772.66	775.82	9.73	1.17
84126	2	0.55	0.57	8.76	10.63	1.48	1.64	480.96	482.23	2.59	8.67
84126	3	1.35	1.47	11.55	12.48	1.13	1.30	624.38	627.24	2.27	1.19
84126	A	0.78	0.84	10.08	11.56	1.53	1.73	505.74	507.19	2.93	11.02
84128	1	2.41	2.66	16.95	17.95	2.22	2.37	691.05	694.92	10.36	1.16
84128	2	0.11	0.10	1.92	2.25	0.29	0.31	376.60	377.44	4.28	8.63
84128	3	0.27	0.27	2.69	2.02	0.69	0.86	475.81	477.66	1.60	1.17
84128	A	0.24	0.24	2.74	3.03	0.41	0.45	399.38	400.40	4.40	10.95
84129	1	2.08	2.43	26.68	30.13	1.33	1.45	526.74	528.68	10.27	1.15
84129	2	0.11	0.13	1.86	1.82	0.32	0.37	351.80	352.44	2.21	8.56
84129	3	0.09	0.10	1.74	1.98	0.35	0.52	476.05	478.70	0.27	1.12
84129	A	0.21	0.24	3.12	3.27	0.38	0.43	368.91	369.72	2.49	10.83
84131	1	1.64	1.88	23.79	21.68	2.25	2.56	625.03	627.89	1.85	1.18
84131	2	0.05	0.05	3.34	2.78	0.44	0.46	340.32	340.89	2.33	8.59
84131	3	0.12	0.14	3.44	2.29	0.55	0.80	435.26	436.58	0.40	1.17
84131	A	0.14	0.15	4.41	3.73	0.55	0.59	361.60	362.30	2.17	10.94
84132	1	3.83	4.41	27.37	27.16	3.49	3.84	691.82	693.33	15.18	1.22
84132	2	0.70	0.74	10.30	9.14	2.24	2.36	441.05	441.81	3.57	8.73
84132	3	2.46	2.89	25.35	28.65	2.20	2.87	535.14	536.59	6.38	1.19
84132	A	0.99	1.08	12.24	11.43	2.30	2.47	460.73	461.58	4.38	11.15
84133	1	1.74	1.92	12.34	12.22	2.19	2.57	737.44	741.14	3.09	1.18
84133	2	0.05	0.03	0.36	0.25	0.20	0.23	410.83	411.59	0.69	8.62
84133	3	0.27	0.33	4.30	5.72	0.18	0.21	571.26	573.95	1.43	1.18
84133	A	0.15	0.15	1.25	1.25	0.30	0.35	438.83	439.81	0.86	10.99
84134	1	2.87	3.76	29.01	29.02	2.73	2.82	817.17	850.61	6.24	1.20
84134	2	0.08	0.07	7.83	6.74	1.56	1.49	493.87	487.13	1.89	8.70
84134	3	0.40	0.36	13.75	12.43	2.04	2.32	708.48	688.14	0.43	1.19
84134	A	0.25	0.28	9.34	8.29	1.66	1.61	525.48	519.88	2.02	11.09
84135	1	4.33	4.81	37.49	37.59	3.77	3.71	622.05	602.30	16.34	1.15
84135	2	0.17	0.18	2.79	3.19	0.42	0.39	327.25	368.51	1.37	8.60
84135	3	0.39	0.38	4.90	4.40	0.52	0.50	482.32	462.73	2.69	1.18
84135	A	0.40	0.43	4.70	5.02	0.59	0.57	352.89	386.86	2.22	10.93
84137	1	1.63	4.19	10.04	22.93	0.99	3.56	298.13	675.31	6.11	1.20
84137	2	0.28	0.77	3.50	8.89	0.53	2.27	159.78	444.00	4.55	8.73
84137	3	1.07	2.19	8.33	16.73	0.91	2.84	294.90	550.24	2.02	1.20
84137	A	0.40	1.04	4.17	10.16	0.58	2.37	176.30	463.33	4.46	11.13

RunID	Phase	HC (g/m)		CO (g/m)		NOx (g/m)		CO2 (g/m)		PM2.5 (mg/m)	Distance (miles)
		SMT	BKI	SMT	BKI	SMT	BKI	SMT	BKI		
84140	1	1.00	1.19	6.47	6.66	0.51	0.50	847.47	850.53	3.39	1.19
84140	2	0.03	0.03	0.75	0.74	0.23	0.21	421.90	473.66	0.91	8.60
84140	3	0.03	0.03	0.30	0.15	0.02	0.02	653.78	647.27	-1.13	1.19
84140	A	0.08	0.09	1.02	1.01	0.23	0.21	460.13	505.35	0.90	10.99
84145	1	4.53	4.76	49.57	48.86	2.97	2.72	412.36	411.73	3.60	1.19
84145	2	0.85	0.86	12.27	11.15	2.34	2.00	266.72	264.00	1.16	8.66
84145	3	1.97	2.16	20.74	19.89	2.64	2.42	376.55	378.50	1.35	1.20
84145	A	1.12	1.15	14.79	13.71	2.39	2.07	281.88	279.58	1.30	11.05
84146	1	5.19	4.61	21.48	16.88	4.70	4.24	708.18	583.89	6.76	1.14
84146	2	1.15	0.87	12.03	9.26	1.78	1.45	422.89	357.36	10.20	8.62
84146	3	3.46	2.61	18.40	11.28	2.35	1.89	666.57	468.84	-1.96	1.17
84146	A	1.51	1.18	12.94	9.78	1.97	1.62	453.86	376.33	9.20	10.93
84148	1	13.31	7.24	57.86	27.15	9.74	4.25	2986.14	623.53	51.84	1.20
84148	2	0.83	0.65	7.28	5.19	4.17	3.17	402.84	410.74	47.58	8.67
84148	3	6.97	3.10	116.69	24.27	3.57	6.12	336.26	516.52	25.61	1.20
84148	A	1.91	1.16	17.53	7.67	4.42	3.43	533.70	429.21	46.28	11.07
84149	1	0.80	1.14	3.44	4.68	0.16	0.24	488.88	556.24	4.63	1.20
84149	2	0.02	0.02	0.59	0.53	0.07	0.08	271.66	323.19	0.71	8.68
84149	3	0.03	0.01	0.16	0.02	0.05	0.05	428.21	414.37	0.85	1.20
84149	A	0.07	0.08	0.71	0.71	0.07	0.09	293.88	341.68	0.92	11.07
84150	1	2.09	2.12	17.78	14.60	1.31	1.47	863.68	842.34	12.89	1.15
84150	2	0.06	0.06	4.08	4.11	0.33	0.31	477.44	478.36	4.15	8.61
84150	3	0.05	0.04	1.89	1.27	0.36	0.37	687.09	690.02	6.36	1.19
84150	A	0.16	0.16	4.60	4.44	0.38	0.37	511.06	511.43	4.74	10.95
84151	1	1.07	1.09	9.32	8.56	1.43	1.38	685.41	628.53	7.47	1.17
84151	2	0.03	0.04	1.48	3.15	0.15	0.15	340.11	377.71	1.34	8.67
84151	3	0.04	0.03	1.93	1.57	0.09	0.07	576.08	512.45	-0.97	1.18
84151	A	0.08	0.09	1.92	3.32	0.21	0.21	373.98	399.82	1.50	11.03
84153	1	1.46	1.71	10.13	10.20	1.00	0.89	854.42	864.09	32.37	1.15
84153	2	0.03	0.02	0.25	0.07	0.48	0.39	548.14	543.41	5.42	8.58
84153	3	0.17	0.17	1.44	1.20	0.23	0.19	694.98	693.49	6.72	1.16
84153	A	0.11	0.12	0.83	0.66	0.49	0.40	573.64	569.86	6.87	10.88
84154	1	36.04	24.65	385.29	252.57	4.90	4.21	1101.41	773.18	163.38	1.15
84154	2	22.30	11.10	167.55	104.83	6.96	4.69	935.44	553.38	80.53	8.44
84154	3	21.18	14.65	128.56	104.03	4.47	3.42	766.04	537.18	15.38	1.15
84154	A	23.02	12.04	177.32	112.41	6.65	4.58	932.19	563.62	80.35	10.74
84156	1	0.94	1.06	7.32	7.47	1.25	1.26	664.98	638.42	7.92	1.19
84156	2	0.07	0.06	5.06	4.73	0.19	0.17	327.45	370.29	1.69	8.66
84156	3	0.04	0.02	2.00	1.46	0.12	0.10	567.46	499.16	2.43	1.19
84156	A	0.11	0.11	4.96	4.64	0.24	0.22	361.58	393.14	2.07	11.05
84157	1	4.52	3.84	22.48	16.70	2.60	2.55	480.94	417.84	7.76	1.19
84157	2	0.27	0.25	5.57	4.98	0.72	0.67	286.72	285.45	2.45	8.66
84157	3	0.19	0.55	1.84	5.61	0.46	1.41	70.73	356.38	5.67	1.19
84157	A	0.49	0.46	6.19	5.64	0.80	0.82	281.97	297.23	2.95	11.04

RunID	Phase	HC (g/m)		CO (g/m)		NOx (g/m)		CO2 (g/m)		PM2.5 (mg/m)	Distance (miles)
		SMT	BKI	SMT	BKI	SMT	BKI	SMT	BKI		
84160	1	1.16	1.34	4.13	4.48	0.46	0.51	715.35	647.40	1.29	1.18
84160	2	0.07	0.06	2.32	2.06	0.41	0.35	362.19	361.46	0.48	8.64
84160	3	0.05	0.04	0.62	0.40	0.18	0.15	562.52	449.32	1.93	1.18
84160	A	0.13	0.12	2.29	2.07	0.39	0.35	394.08	382.20	0.62	11.00
84161	1	3.50	3.70	7.71	7.74	0.81	1.03	847.26	850.38	18.97	1.15
84161	2	0.06	0.06	0.64	0.66	0.76	0.78	448.39	449.99	6.22	8.62
84161	3	0.07	0.08	0.44	0.10	0.52	0.62	583.50	585.81	1.30	1.21
84161	A	0.23	0.25	0.99	0.98	0.75	0.78	478.11	479.84	6.52	10.99
84162	1	4.29	3.64	153.51	129.37	2.88	2.60	713.69	653.94	15.11	1.18
84162	2	0.46	0.30	22.28	19.31	1.26	0.69	721.88	401.99	27.92	8.58
84162	3	0.39	0.33	4.32	4.14	1.18	0.96	577.64	516.93	2.82	1.17
84162	A	0.65	0.47	27.86	23.98	1.34	0.81	711.57	422.92	25.54	10.93
84164	1	2.46	2.61	17.69	18.20	1.95	1.98	696.78	710.32	7.83	1.20
84164	2	0.05	0.05	0.49	0.39	0.16	0.16	376.62	428.71	0.99	8.72
84164	3	0.17	0.16	2.71	2.34	0.35	0.34	595.32	582.72	-0.59	1.22
84164	A	0.18	0.19	1.54	1.46	0.27	0.26	408.60	454.16	1.23	11.15
84165	1	7.62	6.94	32.92	27.26	5.42	4.93	542.84	479.72	30.51	1.17
84165	2	3.15	3.08	12.76	12.17	4.66	4.34	301.38	299.36	19.93	8.59
84165	3	5.89	4.70	15.87	12.44	5.37	4.86	440.77	374.54	3.96	1.18
84165	A	3.57	3.39	14.02	12.96	4.75	4.40	323.41	313.81	19.37	10.94
84166	1	3.31	3.44	19.72	19.11	2.97	2.96	695.81	693.40	2.08	1.15
84166	2	0.16	0.13	7.20	6.45	1.22	1.11	405.86	411.80	0.37	8.63
84166	3	0.67	0.69	7.08	6.23	1.71	1.70	567.18	543.06	3.13	1.18
84166	A	0.36	0.34	7.82	7.07	1.35	1.24	431.62	435.04	0.65	10.96
84168	1	1.77	2.07	15.42	14.06	1.80	2.01	738.23	740.83	2.11	1.20
84168	2	0.03	0.02	1.34	1.21	0.68	0.67	417.32	418.73	0.21	8.69
84168	3	0.12	0.24	1.90	2.55	1.01	1.17	582.46	584.72	-1.03	1.19
84168	A	0.12	0.14	2.11	1.97	0.76	0.78	445.32	446.85	0.23	11.08
84169	1	2.35	2.69	20.01	17.76	2.26	3.04	696.15	698.60	0.67	1.17
84169	2	0.11	0.09	5.17	3.94	1.04	1.17	401.34	402.66	0.14	8.64
84169	3	0.57	0.69	6.50	6.08	1.02	1.44	522.52	524.54	-1.04	1.18
84169	A	0.26	0.27	6.02	4.80	1.10	1.28	424.72	426.15	0.09	10.98
84171	1	29.32	4.16	196.69	22.67	12.97	2.46	2314.63	413.44	44.50	1.14
84171	2	1.29	0.99	19.86	14.54	1.48	1.30	341.43	266.39	42.99	8.60
84171	3	2.22	1.42	23.84	12.33	2.00	1.44	495.09	317.61	10.22	1.19
84171	A	2.77	1.18	29.06	14.79	2.09	1.37	451.70	277.37	40.79	10.93
84172	1	1.96	4.33	6.71	22.34	0.16	2.43	86.29	686.25	27.09	1.20
84172	2	0.29	0.22	6.59	4.66	0.83	0.87	490.58	404.58	13.58	8.65
84172	3	0.53	0.48	8.86	6.59	0.65	0.65	539.56	539.31	2.26	1.18
84172	A	0.39	0.45	6.75	5.72	0.78	0.93	472.75	428.61	13.51	11.03
84173	1	5.14	5.88	15.96	16.33	2.54	2.65	615.91	644.76	16.77	1.18
84173	2	0.16	0.14	4.68	4.46	1.07	1.02	333.19	350.11	0.75	8.57
84173	3	0.55	0.60	6.27	6.02	1.23	1.22	472.36	512.46	-1.95	1.19
84173	A	0.45	0.47	5.38	5.18	1.16	1.12	357.56	376.71	1.39	10.94

RunID	Phase	HC (g/m)		CO (g/m)		NOx (g/m)		CO2 (g/m)		PM2.5 (mg/m)	Distance (miles)
		SMT	BKI	SMT	BKI	SMT	BKI	SMT	BKI		
84174	1	4.18	4.71	7.34	7.34	1.49	1.37	882.04	827.64	4.33	1.22
84174	2	0.12	0.10	1.80	1.27	1.55	1.28	498.61	498.86	4.15	8.68
84174	3	0.46	0.46	2.74	2.08	1.47	1.34	782.93	724.27	-0.79	1.21
84174	A	0.36	0.37	2.16	1.65	1.54	1.29	538.76	532.00	3.81	11.11
84175	1	6.07	6.29	33.70	33.67	2.91	2.64	730.00	701.51	20.52	1.19
84175	2	0.90	0.84	5.69	5.24	1.94	1.59	434.37	421.83	2.91	8.60
84175	3	2.89	2.74	21.83	20.05	2.74	2.51	594.52	566.51	0.82	1.18
84175	A	1.31	1.26	8.27	7.75	2.05	1.71	460.86	446.42	3.69	10.97
84177	1	5.13	5.34	33.65	32.11	6.88	7.07	629.00	666.30	5.31	1.17
84177	2	2.06	2.07	14.02	13.48	5.75	5.38	372.86	383.39	1.00	8.64
84177	3	3.33	3.59	21.98	21.63	6.18	6.58	510.40	535.89	1.20	1.19
84177	A	2.31	2.35	15.58	15.00	5.84	5.55	395.52	408.46	1.24	11.00
84178	1	2.07	2.20	12.36	12.57	2.93	2.85	650.21	654.94	8.73	1.18
84178	2	0.10	0.10	2.30	2.02	0.49	0.45	335.72	374.23	0.77	8.63
84178	3	0.38	0.41	4.33	3.55	1.05	1.02	510.39	492.40	0.00	1.16
84178	A	0.22	0.23	2.96	2.67	0.65	0.61	363.72	396.68	1.13	10.96
84179	1	2.32	2.38	20.13	18.41	3.10	2.87	861.92	824.73	2.21	1.20
84179	2	0.36	0.36	6.58	5.97	1.45	1.15	473.35	467.44	1.86	8.69
84179	3	0.64	0.63	8.22	6.76	2.00	1.68	703.93	647.54	2.61	1.20
84179	A	0.48	0.49	7.40	6.67	1.57	1.28	509.54	498.51	1.93	11.09
84180	1	5.18	5.61	19.27	17.76	4.44	4.04	708.39	705.50	25.90	1.16
84180	2	0.98	0.97	9.25	8.11	2.17	1.83	432.86	439.59	8.96	8.56
84180	3	2.79	2.73	16.47	15.03	2.93	2.64	637.35	608.94	1.44	1.19
84180	A	1.32	1.33	10.27	9.09	2.34	2.00	461.23	465.02	9.30	10.91
84182	1	4.19	4.40	63.05	65.17	3.96	3.54	847.85	861.45	25.31	1.17
84182	2	0.35	0.20	16.00	8.46	2.38	1.20	909.37	529.87	11.48	8.63
84182	3	0.98	0.98	23.14	18.22	2.97	2.35	869.17	760.09	9.45	1.18
84182	A	0.71	0.47	20.37	12.04	2.55	1.40	900.91	562.68	12.05	10.98
84183	1	1.95	1.94	12.08	9.77	1.39	1.32	572.61	525.15	1.53	1.17
84183	2	0.04	0.04	1.09	0.95	0.50	0.54	267.31	315.09	1.03	8.67
84183	3	0.27	0.18	4.52	3.00	0.74	0.73	472.88	408.83	-1.78	1.20
84183	A	0.15	0.14	1.89	1.54	0.57	0.59	297.19	332.35	0.86	11.04
84184	1	1.40	1.37	11.79	11.46	0.35	0.31	574.79	524.72	3.81	1.18
84184	2	0.10	0.09	8.55	7.30	0.10	0.08	274.22	301.42	1.91	8.65
84184	3	0.03	0.02	0.83	0.56	0.38	0.29	481.15	414.72	0.45	1.19
84184	A	0.16	0.15	8.19	7.05	0.13	0.11	303.94	320.72	1.90	11.01
84185	1	2.54	2.70	14.05	13.46	2.55	2.20	497.80	439.96	6.16	1.18
84185	2	0.21	0.21	4.87	4.44	0.65	0.57	278.19	297.19	3.36	8.62
84185	3	0.46	0.48	4.30	3.56	1.08	0.84	429.55	369.98	0.02	1.16
84185	A	0.34	0.36	5.31	4.85	0.78	0.68	299.76	309.48	3.28	10.95
84187	1	5.09	5.34	32.64	31.23	7.57	7.57	621.04	659.96	5.14	1.20
84187	2	2.06	2.13	15.98	15.26	6.99	6.37	387.53	405.57	1.47	8.66
84187	3	3.28	3.51	20.42	20.00	7.85	7.97	544.32	574.61	1.34	1.19
84187	A	2.30	2.39	17.16	16.43	7.08	6.54	410.54	430.52	1.66	11.05

RunID	Phase	HC (g/m)		CO (g/m)		NOx (g/m)		CO2 (g/m)		PM2.5 (mg/m)	Distance (miles)
		SMT	BKI	SMT	BKI	SMT	BKI	SMT	BKI		
84188	1	16.17	12.95	207.51	163.52	2.28	2.11	912.05	780.49	326.39	1.24
84188	2	6.16	4.13	79.78	59.19	2.73	2.09	603.20	473.71	25.64	8.69
84188	3	5.82	5.08	80.61	67.12	2.42	2.29	693.17	611.57	9.66	1.21
84188	A	6.68	4.67	86.71	65.36	2.69	2.10	626.10	499.83	40.68	11.14
84189	1	3.30	33.15	252.83	202.14	5.25	4.34	674.38	569.42	662.61	1.12
84189	2	2.09	16.60	243.52	192.37	1.75	1.33	401.33	325.32	261.48	8.56
84189	3	3.52	31.09	373.03	272.68	2.48	1.67	611.33	465.91	345.43	1.18
84189	A	2.25	18.42	252.90	198.38	1.98	1.51	429.35	347.12	287.15	10.86
84191	1	2.73	2.47	16.38	15.75	2.32	2.30	642.93	631.40	4.37	1.17
84191	2	0.18	0.08	1.46	1.34	0.24	0.24	322.72	357.76	2.17	8.65
84191	3	0.35	0.27	2.82	1.94	0.71	0.70	507.09	477.44	1.11	1.17
84191	A	0.32	0.22	2.32	2.11	0.38	0.38	351.62	379.88	2.21	10.99
84192	1	0.73	0.76	5.56	6.09	0.54	0.52	836.69	869.81	0.30	1.16
84192	2	0.06	0.03	0.91	0.88	0.18	0.17	424.89	471.13	5.90	8.66
84192	3	0.06	0.02	0.22	-0.01	0.24	0.23	638.84	639.64	0.02	1.18
84192	A	0.09	0.07	1.10	1.09	0.21	0.19	460.46	502.92	5.21	11.00
84193	1	0.81	1.33	9.78	9.16	1.82	1.90	725.25	739.98	8.90	1.19
84193	2	0.05	0.04	3.18	2.63	0.48	0.48	373.27	407.31	5.88	8.67
84193	3	0.04	0.02	3.18	2.51	0.60	0.50	569.65	545.96	2.45	1.19
84193	A	0.09	0.10	3.52	2.97	0.56	0.56	405.09	434.16	5.80	11.05
84195	1	0.85	1.90	11.98	11.96	2.64	2.42	692.47	702.22	1.97	1.17
84195	2	0.03	0.02	0.22	0.13	0.39	0.29	377.03	423.12	0.37	8.64
84195	3	0.18	0.24	4.32	4.01	0.37	0.29	590.98	579.11	1.47	1.18
84195	A	0.09	0.13	1.10	1.00	0.51	0.40	407.91	448.15	0.53	10.99
84196	1	2.03	5.90	60.99	61.44	5.26	4.86	745.97	735.04	1.31	1.25
84196	2	1.14	1.77	13.07	12.31	3.27	2.81	456.01	450.06	3.96	8.82
84196	3	1.65	2.71	14.78	12.94	5.06	4.31	652.97	593.84	64.48	1.24
84196	A	1.23	2.06	15.75	14.98	3.50	3.03	485.34	475.38	8.06	11.31
84197	1	3.31	4.00	22.30	22.23	4.48	4.49	672.00	694.42	3.62	1.20
84197	2	0.12	0.10	5.35	5.43	1.88	1.85	328.23	394.44	0.73	8.64
84197	3	0.60	0.70	9.22	8.38	3.00	2.99	526.75	544.68	1.47	1.19
84197	A	0.32	0.35	6.51	6.51	2.09	2.07	360.07	420.63	0.93	11.04
84198	1	3.68	3.97	25.70	25.09	1.70	1.76	543.37	561.76	9.10	1.20
84198	2	0.18	0.18	2.39	3.50	0.49	0.50	260.98	325.91	1.78	8.65
84198	3	0.81	0.72	9.00	7.61	0.75	0.72	453.39	449.92	1.05	1.19
84198	A	0.41	0.42	4.07	4.92	0.58	0.58	289.04	346.82	2.12	11.04
84200	1	4.10	4.62	34.35	34.84	1.62	1.66	549.39	566.46	15.32	1.20
84200	2	0.21	0.20	3.49	4.46	0.62	0.61	267.90	335.91	3.15	8.67
84200	3	0.91	0.89	8.59	7.50	0.62	0.60	445.17	445.80	2.35	1.21
84200	A	0.46	0.48	5.45	6.26	0.67	0.66	294.91	355.58	3.73	11.07
84201	1	11.30	11.09	102.78	84.49	4.56	4.26	659.12	617.00	28.36	1.21
84201	2	5.54	5.24	66.27	74.52	3.99	3.46	413.78	397.26	1.04	8.68
84201	3	7.14	6.77	132.85	120.34	3.22	3.08	509.68	471.29	147.72	1.19
84201	A	5.95	5.66	72.76	78.19	3.97	3.47	433.29	413.92	12.54	11.08

RunID	Phase	HC (g/m)		CO (g/m)		NOx (g/m)		CO2 (g/m)		PM2.5 (mg/m)	Distance (miles)
		SMT	BKI	SMT	BKI	SMT	BKI	SMT	BKI		
84205	1	1.36	1.58	8.20	8.17	2.25	2.07	910.18	946.31	16.02	1.18
84205	2	0.08	0.06	4.26	3.27	0.70	0.48	582.16	571.36	8.61	8.69
84205	3	0.12	0.11	3.09	2.77	0.64	0.50	746.47	727.23	1.25	1.21
84205	A	0.15	0.14	4.38	3.49	0.77	0.56	610.43	601.46	8.48	11.08
84206	1	5.82	5.73	83.59	83.84	2.46	1.97	845.60	849.19	3.07	1.19
84206	2	0.52	0.45	9.40	8.52	0.80	0.57	546.39	546.54	1.24	8.58
84206	3	1.63	1.60	18.18	16.70	0.93	0.72	753.98	728.67	1.51	1.17
84206	A	0.87	0.80	13.89	13.02	0.89	0.65	576.25	574.84	1.36	10.94
84208	1	7.23	8.00	60.46	59.79	7.41	6.36	760.92	774.31	209.50	1.19
84208	2	1.84	1.75	28.50	25.74	4.49	3.71	487.97	472.51	42.76	8.65
84208	3	3.45	3.75	41.75	39.20	5.10	4.50	645.47	652.55	86.98	1.18
84208	A	2.23	2.21	31.08	28.44	4.68	3.90	513.00	500.58	54.47	11.03
84209	1	1.44	2.17	25.25	21.04	6.85	6.32	714.79	632.47	3.69	1.19
84209	2	0.42	0.42	10.38	12.00	4.12	3.46	367.44	382.70	2.15	8.67
84209	3	0.58	0.52	15.82	10.00	6.23	5.76	599.24	513.09	-1.74	1.19
84209	A	0.48	0.52	11.52	12.33	4.41	3.77	401.39	404.63	1.96	11.05
84210	1	1.63	5.40	51.25	47.47	5.53	4.92	562.56	524.53	101.68	1.13
84210	2	0.61	0.50	9.73	8.97	3.09	2.74	318.78	321.49	7.26	8.60
84210	3	1.20	1.58	20.38	18.45	3.48	3.06	460.84	429.59	8.66	1.15
84210	A	0.70	0.82	12.51	11.52	3.24	2.87	340.46	338.87	12.06	10.88
84211	1	1.70	3.01	40.01	37.27	2.16	1.94	715.82	682.37	14.21	1.17
84211	2	0.32	0.24	9.25	7.77	1.12	0.95	406.82	393.29	34.91	8.54
84211	3	1.14	1.36	14.04	12.06	1.71	1.52	534.52	514.69	7.31	1.17
84211	A	0.45	0.46	11.18	9.59	1.22	1.04	431.67	416.66	31.94	10.89
84213	1	1.95	3.58	49.63	45.96	3.21	2.78	881.42	864.66	6.10	1.19
84213	2	0.56	0.39	31.33	22.41	1.10	0.84	529.62	521.13	6.33	8.64
84213	3	1.17	0.96	19.53	16.38	1.69	1.37	774.44	701.66	2.54	1.19
84213	A	0.68	0.59	31.47	23.22	1.25	0.97	564.77	551.42	6.06	11.02
84214	1	0.91	2.06	8.57	8.47	3.43	2.67	864.38	766.77	21.30	1.14
84214	2	0.00	0.04	1.69	1.51	0.68	0.50	437.47	461.30	6.26	8.66
84214	3	0.02	0.17	2.55	2.43	1.27	0.83	783.76	670.25	2.19	1.19
84214	A	0.05	0.15	2.09	1.92	0.85	0.63	479.04	490.94	6.73	10.99
84215	1	1.22	2.72	14.28	12.92	4.98	3.99	686.42	669.62	3.11	1.19
84215	2	0.04	0.05	1.90	1.50	0.65	0.47	414.67	427.58	3.98	8.64
84215	3	0.00	0.03	0.73	0.51	0.09	0.09	585.37	569.96	1.56	1.20
84215	A	0.10	0.19	2.46	2.03	0.84	0.63	440.71	450.10	3.77	11.03
84218	1	1.30	5.43	7.36	27.19	4.48	7.27	214.91	668.85	4.59	1.18
84218	2	0.41	2.26	2.92	13.58	1.59	6.14	78.14	398.89	0.61	8.61
84218	3	0.51	3.80	2.97	20.05	1.84	8.01	95.97	580.22	1.40	1.18
84218	A	0.46	2.53	3.15	14.72	1.75	6.33	86.17	425.28	0.87	10.96
84229	1	0.08	2.29	1.87	23.21	1.48	3.70	1164.31	821.41	4.32	1.20
84229	2	0.05	0.03	1.61	0.19	0.74	0.31	812.09	522.05	7.07	8.66
84229	3	.	0.08	.	0.24	.	0.30	.	608.60	2.82	1.22
84229	A	.	0.15	.	1.39	.	0.48	.	543.76	6.63	11.08

RunID	Phase	HC (g/m)		CO (g/m)		NOx (g/m)		CO2 (g/m)		PM2.5 (mg/m)	Distance (miles)
		SMT	BKI	SMT	BKI	SMT	BKI	SMT	BKI		
84242	1	1.25	3.00	13.89	13.97	2.83	2.15	701.16	714.87	14.47	1.21
84242	2	0.08	0.09	0.54	0.52	0.45	0.30	395.38	425.98	1.38	8.66
84242	3	0.17	0.21	2.39	2.12	1.01	0.73	602.11	582.96	-0.33	1.20
84242	A	0.15	0.25	1.37	1.34	0.62	0.43	425.81	452.08	1.95	11.07
84244	1	1.38	5.09	56.83	51.87	3.05	3.67	492.42	459.64	8.11	1.19
84244	2	0.91	1.29	22.17	18.95	3.04	2.89	353.73	314.27	24.58	8.68
84244	3	1.14	2.29	12.71	11.65	3.79	3.64	426.71	403.22	1.35	1.20
84244	A	0.95	1.56	23.32	20.15	3.09	2.98	365.96	327.95	22.12	11.07
84245	1	1.30	3.08	23.55	19.90	4.38	3.31	620.61	521.54	5.74	1.18
84245	2	1.11	2.89	27.67	18.42	3.28	1.96	572.90	370.19	54.41	8.66
84245	3	1.27	3.91	16.58	12.14	4.73	3.41	596.02	435.62	6.40	1.22
84245	A	1.13	2.97	26.69	18.05	3.44	2.13	576.97	382.58	48.53	11.05
84246	1	1.59	5.07	18.43	18.40	2.64	2.50	710.55	679.23	38.30	1.17
84246	2	0.53	0.50	13.35	10.76	1.62	1.11	483.74	472.71	23.71	8.59
84246	3	0.45	0.39	2.19	1.98	1.84	1.50	628.29	621.74	9.94	1.20
84246	A	0.58	0.73	12.84	10.54	1.68	1.21	505.35	493.75	23.50	10.96
84250	1	1.62	7.94	99.65	65.43	3.71	3.81	532.42	464.26	14.89	1.14
84250	2	0.87	2.29	24.99	22.35	2.66	2.52	323.93	303.67	10.32	8.52
84250	3	1.36	7.34	95.48	61.82	2.22	2.32	433.99	371.83	4.17	1.17
84250	A	0.95	2.93	33.67	27.26	2.68	2.57	342.18	316.52	10.13	10.83
84252	1	0.70	1.95	2.90	3.12	0.47	0.39	789.09	804.96	8.28	1.20
84252	2	0.09	0.06	1.26	1.15	0.08	0.03	433.07	437.71	0.43	8.65
84252	3	0.07	0.07	1.06	0.94	0.11	0.08	586.89	596.28	-1.09	1.19
84252	A	0.12	0.16	1.33	1.24	0.11	0.06	462.30	467.93	0.74	11.05
84253	1	1.06	2.15	27.37	25.79	2.63	2.25	731.56	720.26	5.87	1.16
84253	2	0.08	0.08	4.54	3.76	0.97	0.82	424.73	419.55	1.23	8.64
84253	3	0.25	0.43	7.11	6.11	1.43	1.27	590.09	557.80	1.45	1.18
84253	A	0.14	0.21	5.88	5.04	1.08	0.92	451.60	444.32	1.48	10.98
84256	1	1.75	4.70	89.04	71.54	2.74	2.55	734.37	704.72	48.11	1.25
84256	2	0.11	0.13	4.65	4.40	1.47	1.36	398.69	417.71	4.18	8.72
84256	3	0.57	0.88	16.15	16.62	1.61	1.50	619.42	594.94	0.80	1.21
84256	A	0.23	0.42	9.99	8.86	1.54	1.44	432.05	445.46	6.31	11.17
84257	1	1.60	4.34	38.53	33.19	3.48	3.25	767.76	678.37	-1.33	1.19
84257	2	0.27	0.26	4.01	3.65	2.37	2.00	441.52	442.26	4.49	8.66
84257	3	1.18	1.43	13.71	10.98	4.32	3.76	698.08	581.00	3.64	1.18
84257	A	0.40	0.55	6.47	5.69	2.56	2.19	476.04	464.02	4.13	11.03
84258	1	2.30	2.66	8.42	8.19	4.04	3.38	787.33	831.13	6.93	1.20
84258	2	0.12	0.13	3.40	3.68	1.90	1.35	425.75	452.16	5.05	8.65
84258	3	0.48	0.55	7.69	8.33	2.27	1.82	624.83	620.66	0.59	1.18
84258	A	0.26	0.29	3.96	4.23	2.04	1.49	458.31	483.61	4.84	11.03
84259	1	6.03	6.17	39.86	38.12	6.95	7.74	647.38	684.21	7.58	1.18
84259	2	2.21	2.17	13.84	13.47	5.82	5.95	380.46	392.90	0.80	8.65
84259	3	3.42	3.54	21.27	21.39	6.24	7.12	497.51	520.83	2.00	1.18
84259	A	2.49	2.47	15.68	15.28	5.91	6.12	402.19	416.70	1.23	11.01

RunID	Phase	HC (g/m)		CO (g/m)		NOx (g/m)		CO2 (g/m)		PM2.5 (mg/m)	Distance (miles)
		SMT	BKI	SMT	BKI	SMT	BKI	SMT	BKI		
84261	1	2.07	3.62	12.68	13.44	3.89	4.07	327.84	354.63	20.40	1.15
84261	2	0.72	1.00	11.09	11.67	1.72	1.79	138.23	152.96	9.14	8.71
84261	3	1.82	2.37	10.06	10.61	3.20	3.25	237.16	256.62	6.91	1.17
84261	A	0.87	1.22	11.10	11.69	1.93	2.00	154.42	170.06	9.55	11.03
84262	1	1.65	4.60	29.44	26.27	2.95	2.79	779.85	792.37	7.33	1.19
84262	2	0.18	0.17	7.79	6.97	1.69	1.56	431.32	457.31	3.30	8.63
84262	3	0.58	0.65	13.54	11.95	2.28	0.81	640.75	627.91	1.23	1.19
84262	A	0.28	0.44	9.32	8.32	1.80	1.57	463.88	486.53	3.36	11.01
84263	1	1.64	4.07	59.16	56.59	7.49	7.53	602.51	596.23	60.10	1.18
84263	2	0.81	1.05	55.04	44.09	2.25	2.18	365.17	378.89	18.28	8.63
84263	3	0.83	1.01	14.96	14.04	4.43	3.97	503.76	466.64	7.37	1.23
84263	A	0.86	1.20	52.41	42.59	2.68	2.58	387.27	396.37	19.66	11.04
84265	1	2.82	24.96	226.45	200.03	2.31	2.58	836.88	771.55	86.02	1.19
84265	2	0.68	10.01	39.25	129.88	0.53	1.12	243.91	486.25	166.92	8.61
84265	3	2.59	14.68	168.03	118.87	2.09	1.59	907.52	697.45	33.45	1.19
84265	A	0.92	11.11	57.84	132.78	0.73	1.23	320.45	515.74	153.49	10.99
84266	1	0.63	1.65	3.23	3.42	0.82	0.93	604.08	571.90	5.55	1.22
84266	2	0.02	0.00	0.25	0.14	0.08	0.08	290.47	339.48	2.13	8.74
84266	3	0.01	-0.01	0.12	-0.07	0.19	0.23	487.99	457.67	1.08	1.21
84266	A	0.05	0.09	0.40	0.30	0.13	0.14	320.85	359.95	2.24	11.17
84267	1	1.41	3.01	35.85	32.69	3.09	2.86	702.52	605.76	9.53	1.18
84267	2	0.14	0.15	4.13	3.94	1.12	1.05	332.97	352.50	3.28	8.63
84267	3	0.69	0.71	6.71	5.93	1.89	1.71	560.70	489.06	2.70	1.18
84267	A	0.24	0.34	5.95	5.56	1.28	1.19	367.62	374.95	3.57	10.98
84268	1	2.28	5.75	26.78	25.97	4.83	4.45	949.25	931.87	23.54	1.21
84268	2	0.31	0.32	1.23	0.71	4.49	3.69	599.79	554.46	27.18	8.75
84268	3	1.52	2.06	12.29	10.75	5.75	4.91	771.92	729.75	8.25	1.20
84268	A	0.50	0.72	3.31	2.72	4.59	3.81	629.69	586.28	25.69	11.16
84270	1	2.25	4.45	26.13	25.23	3.95	3.88	824.57	841.95	14.32	1.21
84270	2	0.59	0.69	11.29	10.19	1.76	1.58	474.39	463.99	26.61	8.75
84270	3	1.02	1.45	12.65	11.97	1.96	1.84	647.65	665.12	5.05	1.21
84270	A	0.71	0.94	12.16	11.10	1.89	1.71	504.60	497.67	24.48	11.17
84271	1	2.42	9.51	63.71	51.86	8.65	7.78	863.85	807.49	57.37	1.21
84271	2	0.75	0.77	10.56	9.52	9.18	7.45	516.64	482.49	2.81	8.69
84271	3	1.28	1.58	10.84	10.48	9.58	8.19	637.21	588.64	3.35	0.97
84271	A	0.86	1.28	13.26	11.80	9.17	7.51	540.77	505.67	5.70	10.87
84272	1	1.12	1.15	9.15	9.72	0.77	0.90	742.88	707.71	6.58	1.19
84272	2	0.02	0.02	0.55	0.67	0.04	0.03	375.97	399.27	1.66	8.67
84272	3	0.01	0.01	0.98	0.71	0.09	0.07	582.88	527.90	1.89	1.20
84272	A	0.08	0.08	1.03	1.14	0.08	0.08	409.29	424.22	1.93	11.06
84274	1	4.10	3.69	19.27	17.13	3.14	2.83	567.10	485.33	32.42	1.16
84274	2	0.32	0.31	7.87	7.03	2.04	1.80	263.23	292.17	4.25	8.63
84274	3	0.71	0.60	4.79	3.30	2.61	2.07	457.56	348.10	2.00	1.19
84274	A	0.53	0.50	8.24	7.29	2.14	1.87	292.09	305.88	5.53	10.98

RunID	Phase	HC (g/m)		CO (g/m)		NOx (g/m)		CO2 (g/m)		PM2.5 (mg/m)	Distance (miles)
		SMT	BKI	SMT	BKI	SMT	BKI	SMT	BKI		
84276	1	2.64	2.75	13.37	11.83	2.73	2.54	852.63	810.33	13.54	1.19
84276	2	0.04	0.04	1.53	1.50	1.29	1.03	434.43	432.97	1.29	8.64
84276	3	0.49	0.46	9.03	7.85	1.43	1.24	692.53	617.44	1.37	1.21
84276	A	0.20	0.21	2.67	2.48	1.38	1.12	474.20	465.55	1.93	11.04
84277	1	28.38	23.77	407.51	182.70	1.42	1.53	689.78	383.25	250.94	1.17
84277	2	18.34	13.03	288.70	145.32	1.21	1.00	490.81	257.17	266.07	8.66
84277	3	28.16	26.65	441.69	175.14	0.74	0.88	582.32	285.13	200.66	1.15
84277	A	19.51	14.49	304.96	149.22	1.19	1.02	507.06	265.49	260.93	10.98
84278	1	5.62	5.59	88.74	84.34	1.88	1.87	618.90	616.14	40.24	1.17
84278	2	0.24	0.19	5.78	5.47	0.71	0.59	423.10	405.79	10.44	8.61
84278	3	1.66	1.72	23.87	23.07	0.36	0.26	528.23	518.67	3.22	1.18
84278	A	0.61	0.57	11.29	10.73	0.74	0.63	440.40	424.36	11.48	10.96
84279	1	0.60	1.25	4.13	4.42	0.85	1.01	768.47	798.12	3.32	1.17
84279	2	0.06	0.05	5.93	4.27	0.16	0.12	407.43	435.95	4.95	8.62
84279	3	0.08	0.08	0.74	0.51	0.23	0.23	660.58	621.07	3.30	1.17
84279	A	0.09	0.11	5.48	4.02	0.20	0.18	443.29	467.22	4.75	10.97
84280	1	1.08	1.11	16.29	13.17	1.63	1.63	469.86	446.57	3.07	1.23
84280	2	0.02	0.02	2.57	2.34	0.65	0.60	283.98	299.70	0.90	8.80
84280	3	0.03	0.04	3.12	2.73	0.60	0.55	447.92	397.93	1.27	1.24
84280	A	0.08	0.08	3.34	2.93	0.70	0.65	305.53	314.33	1.04	11.26
84281	1	4.87	4.59	77.37	72.81	5.27	4.79	1029.78	976.74	9.19	1.20
84281	2	0.19	0.19	8.03	6.77	1.36	1.02	679.69	621.70	10.37	8.64
84281	3	0.88	0.89	22.92	19.90	1.29	1.02	897.81	816.85	3.80	1.18
84281	A	0.49	0.47	12.69	11.12	1.56	1.22	713.07	653.66	9.86	11.02
84283	1	27.02	23.07	328.09	306.28	1.72	1.79	582.77	540.81	180.44	1.19
84283	2	6.15	4.07	88.20	58.54	2.50	1.64	684.68	425.12	69.56	8.62
84283	3	14.31	14.11	175.73	162.76	1.76	1.62	451.80	406.45	28.77	1.18
84283	A	7.79	5.75	106.71	78.62	2.41	1.65	663.41	429.87	72.54	11.00
84284	1	5.41	5.28	58.24	48.77	7.17	6.73	832.99	773.46	20.33	1.21
84284	2	1.01	0.85	36.54	24.98	5.67	4.49	523.02	489.24	80.00	8.63
84284	3	4.13	4.02	77.01	69.34	5.09	4.11	763.71	666.60	15.13	1.20
84284	A	1.46	1.31	40.52	29.33	5.71	4.58	556.28	516.67	72.32	11.04
84285	1	0.84	1.09	6.34	7.59	1.03	1.26	483.66	524.68	6.17	1.19
84285	2	0.08	0.08	6.26	5.92	0.07	0.07	272.92	318.32	1.87	8.67
84285	3	0.01	0.02	1.50	1.48	0.10	0.08	440.31	447.43	0.00	1.19
84285	A	0.12	0.13	5.94	5.70	0.12	0.14	295.44	337.93	1.96	11.05
84286	1	1.87	2.64	28.38	27.59	5.61	4.98	847.06	829.06	4.49	1.19
84286	2	0.05	0.04	2.59	2.37	2.15	1.71	507.13	489.64	2.66	8.69
84286	3	0.96	0.84	25.50	24.85	8.09	6.71	856.70	862.91	4.03	1.13
84286	A	0.20	0.23	5.43	5.15	2.72	2.21	547.65	531.74	2.84	11.02
84287	1	7.18	4.72	47.15	30.33	3.68	3.06	902.88	721.90	19.71	1.15
84287	2	0.84	0.38	9.48	5.79	2.65	1.46	706.77	463.90	51.96	8.60
84287	3	1.42	0.97	20.27	13.80	2.21	1.60	773.39	633.25	21.98	1.15
84287	A	1.20	0.64	12.12	7.57	2.67	1.55	721.21	488.37	48.31	10.90

RunID	Phase	HC (g/m)		CO (g/m)		NOx (g/m)		CO2 (g/m)		PM2.5 (mg/m)	Distance (miles)
		SMT	BKI	SMT	BKI	SMT	BKI	SMT	BKI		
84289	1	10.71	10.32	119.84	102.83	8.70	8.24	835.49	758.39	51.78	1.17
84289	2	4.78	4.12	75.01	64.36	5.35	4.73	484.38	428.56	181.78	8.63
84289	3	13.24	11.68	109.94	103.79	5.94	5.34	656.18	581.92	15.34	1.18
84289	A	5.66	4.96	79.72	69.04	5.56	4.96	514.29	456.03	163.71	10.98
84290	1	5.07	5.20	35.33	29.58	7.43	6.95	677.75	639.47	8.01	1.18
84290	2	2.10	2.15	15.05	13.11	6.97	6.03	411.65	380.71	4.01	8.62
84290	3	3.43	3.48	23.70	19.62	7.82	7.20	586.50	533.41	36.51	1.20
84290	A	2.34	2.40	16.70	14.42	7.05	6.16	437.55	404.72	6.47	10.99
84291	1	1.91	2.67	9.53	12.50	1.97	2.26	352.67	405.31	7.31	1.21
84291	2	0.11	0.13	3.11	3.87	0.26	0.25	209.42	271.19	5.40	8.69
84291	3	0.26	0.32	4.49	4.21	0.32	0.26	376.37	352.31	4.23	1.20
84291	A	0.21	0.28	3.54	4.34	0.35	0.36	228.46	283.81	5.42	11.09
84292	1	2.34	2.41	13.67	12.74	4.04	3.77	720.64	666.03	61.79	1.18
84292	2	0.17	0.15	10.35	7.55	0.75	0.57	402.94	389.18	9.14	8.61
84292	3	0.30	0.30	4.26	3.32	1.21	0.97	593.72	511.81	1.62	1.18
84292	A	0.29	0.28	10.10	7.53	0.95	0.76	432.66	411.99	11.35	10.98
84293	1	6.78	5.76	48.47	39.34	3.26	2.81	747.61	569.08	9.20	1.17
84293	2	0.83	0.73	9.46	8.04	3.10	2.51	448.38	390.55	6.51	8.64
84293	3	2.24	2.36	16.20	14.13	3.18	2.77	621.65	513.87	1745.37	1.20
84293	A	1.23	1.10	11.93	10.07	3.11	2.55	475.82	408.26	127.11	11.01
84295	1	23.48	17.61	141.60	115.18	3.09	2.71	862.29	747.36	461.01	1.14
84295	2	7.02	3.15	42.77	38.38	3.23	2.44	530.01	471.13	36.48	8.69
84295	3	10.59	5.04	88.90	75.21	4.88	3.68	767.70	668.67	40.62	1.19
84295	A	8.09	4.00	50.87	44.74	3.34	2.54	562.93	498.48	57.90	11.02
84296	1	0.53	0.88	6.53	7.75	0.24	0.35	372.42	429.11	6.83	1.19
84296	2	0.05	0.05	3.52	3.50	0.06	0.06	239.83	262.57	2.95	8.65
84296	3	0.04	0.04	3.01	2.59	0.11	0.10	401.51	336.58	1.23	1.17
84296	A	0.08	0.09	3.64	3.66	0.07	0.08	257.72	276.26	3.03	11.01
84297	1	2.57	2.67	20.28	19.09	1.78	.	700.39	611.41	3.71	1.17
84297	2	0.24	0.23	8.73	8.16	0.81	.	374.92	366.09	1.74	8.52
84297	3	0.30	0.25	6.51	4.95	0.73	.	645.36	494.39	-0.02	1.19
84297	A	0.37	0.36	9.17	8.50	0.86	.	410.81	387.82	1.72	10.89
84298	1	2.25	2.44	36.45	36.88	2.63	2.34	1243.05	1114.30	4.59	1.20
84298	2	0.13	0.09	8.82	5.91	1.06	0.76	872.42	656.36	30.19	8.63
84298	3	0.39	0.38	7.30	6.16	1.19	1.06	995.82	869.06	2.01	1.18
84298	A	0.26	0.23	10.17	7.55	1.15	0.86	900.28	694.88	26.93	11.00
84300	1	2.15	2.33	16.73	16.33	1.37	1.48	754.34	740.48	6.59	1.17
84300	2	0.05	0.05	0.97	0.95	0.36	0.32	425.99	431.93	0.88	8.63
84300	3	0.22	0.22	3.72	3.03	0.44	0.45	631.31	603.95	2.31	1.18
84300	A	0.17	0.18	1.96	1.88	0.42	0.39	456.95	459.54	1.27	10.98
84301	1	16.60	17.11	62.68	55.07	4.35	4.17	872.61	721.46	12.74	1.19
84301	2	4.16	2.21	59.65	30.19	2.52	1.39	825.85	440.80	9.88	8.70
84301	3	8.65	7.54	43.42	34.88	3.72	3.21	738.13	612.17	5.16	1.19
84301	A	5.12	3.35	58.69	31.80	2.70	1.66	822.24	467.13	9.71	11.08

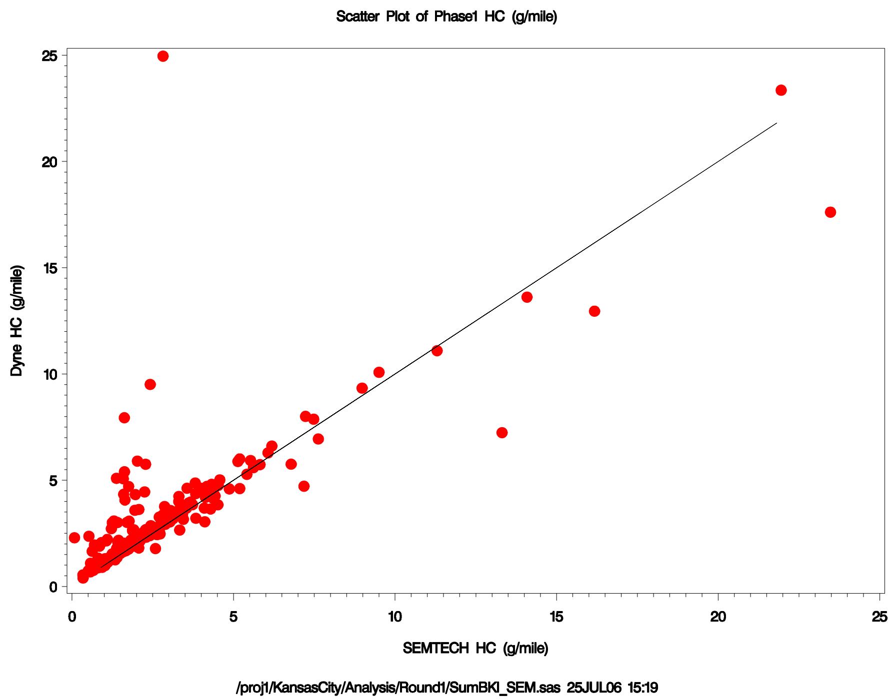
RunID	Phase	HC (g/m)		CO (g/m)		NOx (g/m)		CO2 (g/m)		PM2.5 (mg/m)	Distance (miles)
		SMT	BKI	SMT	BKI	SMT	BKI	SMT	BKI		
84302	1	2.83	3.16	29.50	29.18	3.05	3.04	851.06	837.37	7.12	1.21
84302	2	0.30	0.31	4.95	4.23	2.10	1.81	547.73	507.43	7.07	8.70
84302	3	1.21	1.40	13.20	12.79	2.17	2.11	693.69	659.69	6.63	1.21
84302	A	0.50	0.53	6.81	6.14	2.16	1.90	573.72	535.35	7.04	11.12
84303	1	0.94	1.12	8.04	9.05	1.62	1.64	784.78	798.50	3.01	1.19
84303	2	0.01	0.02	0.49	0.30	0.25	0.16	567.73	489.65	2.42	8.67
84303	3	0.01	0.01	0.41	0.22	0.27	0.24	609.59	639.17	3.01	1.20
84303	A	0.06	0.07	0.88	0.75	0.32	0.25	581.99	516.09	2.49	11.06
84304	1	0.51	0.74	3.27	3.72	0.61	0.84	519.16	509.48	2.94	1.19
84304	2	0.01	0.01	1.08	0.97	0.12	0.10	284.98	312.94	2.18	8.67
84304	3	0.01	0.01	0.74	0.40	0.22	0.19	494.55	387.60	0.67	1.19
84304	A	0.04	0.05	1.17	1.07	0.15	0.15	311.60	328.26	2.12	11.05
84305	1	1.82	1.99	24.12	25.45	2.42	2.40	660.45	662.09	1.77	1.19
84305	2	0.02	0.02	0.41	0.34	0.48	0.42	375.56	385.42	1.27	8.69
84305	3	0.10	0.10	1.48	1.19	0.38	0.38	565.05	530.70	0.78	1.19
84305	A	0.12	0.13	1.72	1.70	0.58	0.52	403.45	409.78	1.27	11.07
84307	1	2.10	2.44	20.61	19.89	3.76	3.80	633.22	612.02	6.63	1.16
84307	2	0.09	0.09	2.86	2.72	0.40	0.40	355.73	371.59	1.39	8.62
84307	3	0.12	0.12	3.42	2.76	0.87	0.74	574.48	501.98	1.48	1.19
84307	A	0.20	0.22	3.81	3.60	0.60	0.60	385.04	392.86	1.67	10.97
84308	1	2.19	2.52	20.08	20.29	4.18	4.07	659.07	648.44	6.90	1.17
84308	2	0.12	0.12	7.51	7.20	2.21	1.91	378.97	387.23	3.96	8.62
84308	3	0.38	0.39	10.76	9.57	2.32	2.08	554.52	511.68	1.84	1.21
84308	A	0.25	0.27	8.39	8.04	2.32	2.04	405.69	409.38	3.96	11.00
84309	1	26.00	21.81	561.82	442.72	1.41	1.61	984.45	769.78	134.20	1.18
84309	2	11.10	8.32	214.80	155.37	2.51	2.17	671.10	478.69	40.23	8.66
84309	3	12.34	10.99	242.08	196.63	2.31	2.20	719.75	603.34	16.98	1.20
84309	A	11.96	9.21	234.68	173.08	2.44	2.14	690.72	502.38	43.46	11.04
84310	1	0.98	1.03	12.34	11.35	1.17	1.11	852.70	821.22	13.31	1.20
84310	2	0.04	0.02	0.41	0.22	0.25	0.17	622.50	503.75	5.87	8.67
84310	3	0.08	0.07	0.61	0.49	0.21	0.17	647.53	650.77	1.11	1.21
84310	A	0.09	0.07	1.05	0.82	0.30	0.22	636.26	530.59	5.92	11.08
84311	1	2.99	3.42	49.55	50.02	2.55	2.89	448.13	479.10	26.82	1.19
84311	2	0.21	0.23	9.45	9.77	1.03	1.02	255.31	316.91	8.64	8.64
84311	3	0.23	0.24	4.07	3.75	1.28	1.24	428.94	402.02	2.04	1.18
84311	A	0.36	0.39	11.17	11.45	1.13	1.13	277.29	331.19	9.14	11.01
84312	1	1.68	1.93	18.87	19.24	3.92	3.76	640.53	633.92	1.32	1.19
84312	2	0.11	0.10	7.03	6.87	2.20	1.88	374.23	381.34	0.86	8.62
84312	3	0.38	0.40	11.48	10.35	2.63	2.16	576.32	523.90	2.58	1.19
84312	A	0.21	0.22	7.96	7.76	2.32	2.00	402.17	404.40	1.00	11.01
84314	1	4.37	4.15	56.55	45.70	4.22	3.78	616.98	534.70	11.49	1.19
84314	2	0.54	0.47	21.46	17.17	2.82	2.31	355.99	343.10	3.46	8.60
84314	3	1.21	0.88	30.99	19.39	2.65	2.21	590.57	452.79	1.19	1.20
84314	A	0.79	0.69	23.95	18.81	2.88	2.38	385.99	360.73	3.72	10.99

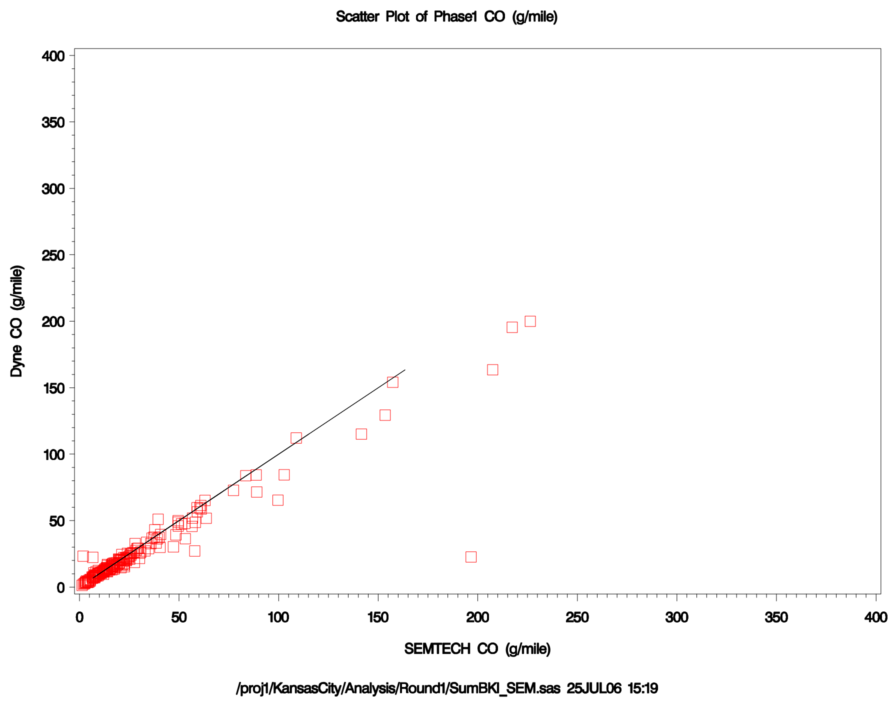
RunID	Phase	HC (g/m)		CO (g/m)		NOx (g/m)		CO2 (g/m)		PM2.5 (mg/m)	Distance (miles)
		SMT	BKI	SMT	BKI	SMT	BKI	SMT	BKI		
84315	1	5.53	5.93	22.57	19.73	4.59	4.15	604.79	555.30	105.79	1.14
84315	2	0.53	0.62	5.49	5.34	1.96	1.71	330.68	350.33	56.11	8.58
84315	3	1.85	2.02	16.70	14.49	3.70	3.22	516.00	476.53	86.61	1.17
84315	A	0.88	0.99	7.13	6.70	2.21	1.93	357.28	369.35	60.71	10.90
84316	1	4.58	5.02	24.36	21.46	3.26	2.87	587.59	534.01	52.72	1.18
84316	2	0.58	0.59	8.21	7.22	0.74	0.62	340.56	328.44	51.09	8.58
84316	3	1.19	1.15	8.12	6.43	1.37	1.01	543.90	448.47	27.97	1.19
84316	A	0.83	0.86	9.04	7.90	0.92	0.76	367.52	347.47	49.57	10.95
84318	1	1.42	2.10	7.52	9.19	1.89	2.28	414.14	494.57	6.64	1.20
84318	2	0.14	0.18	2.59	3.47	0.89	1.01	245.28	323.60	3.48	8.63
84318	3	0.22	0.27	4.13	4.31	1.04	1.05	390.71	419.10	1.77	1.20
84318	A	0.21	0.28	2.95	3.83	0.96	1.08	264.34	339.20	3.53	11.03
84319	1	2.14	2.22	15.31	13.32	3.43	3.47	680.09	621.45	12.30	1.16
84319	2	0.08	0.08	2.09	1.85	0.47	0.44	365.81	367.45	3.92	8.63
84319	3	0.38	0.36	5.40	3.97	1.14	0.94	604.62	475.46	0.31	1.19
84319	A	0.21	0.21	2.99	2.58	0.66	0.62	398.40	387.87	4.10	10.99
84321	1	2.53	2.74	15.16	13.81	4.12	4.09	754.62	740.64	3.06	1.18
84321	2	0.06	0.05	0.34	0.25	0.29	0.26	401.93	402.30	1.39	8.66
84321	3	0.15	0.16	0.84	0.51	0.48	0.53	601.76	560.62	0.40	1.18
84321	A	0.19	0.20	1.14	0.97	0.50	0.48	433.83	430.66	1.41	11.02
84322	1	2.14	2.26	18.44	16.08	2.43	2.21	532.31	469.70	7.78	1.20
84322	2	0.20	0.18	8.16	7.02	1.40	1.19	346.28	298.07	10.49	8.76
84322	3	0.27	0.26	7.75	6.40	2.07	1.75	484.08	387.04	4.70	1.19
84322	A	0.30	0.30	8.67	7.44	1.50	1.28	365.19	313.03	9.96	11.15
84324	1	2.48	2.51	23.49	22.08	2.52	2.51	705.06	652.23	7.69	1.17
84324	2	0.12	0.11	4.70	4.02	0.33	0.34	372.09	381.81	3.01	8.63
84324	3	0.27	0.29	3.21	2.71	0.66	0.62	603.50	499.23	0.73	1.18
84324	A	0.25	0.25	5.57	4.86	0.46	0.47	405.25	403.80	3.10	10.99
84325	1	3.31	4.24	6.55	6.66	2.43	2.67	601.86	644.62	14.00	1.20
84325	2	0.21	0.18	1.75	1.78	0.30	0.27	377.28	380.26	2.49	8.64
84325	3	0.34	0.42	3.46	3.33	0.49	0.53	481.26	524.24	2.13	1.18
84325	A	0.38	0.41	2.12	2.14	0.42	0.41	396.19	404.01	3.06	11.02
84327	1	1.59	1.65	12.58	12.83	1.55	1.50	760.85	747.09	2.39	1.19
84327	2	0.04	0.03	1.61	1.26	0.21	0.17	413.89	412.13	0.49	8.63
84327	3	0.13	0.15	1.39	1.14	0.56	0.47	604.59	585.98	0.29	1.18
84327	A	0.12	0.12	2.17	1.85	0.31	0.26	445.01	441.46	0.57	11.00
84328	1	2.81	2.92	15.16	14.08	4.37	4.10	767.11	750.80	2.59	1.18
84328	2	0.06	0.05	0.34	0.22	0.44	0.25	397.17	396.20	0.38	8.62
84328	3	0.17	0.19	0.84	0.36	0.95	0.55	586.04	549.71	-0.47	1.19
84328	A	0.21	0.21	1.14	0.94	0.68	0.47	429.30	425.13	0.44	10.99
84329	1	2.29	2.32	19.95	18.23	2.09	1.86	833.24	764.60	-1.21	1.17
84329	2	0.11	0.08	2.70	1.39	0.30	0.14	685.50	479.97	12.06	8.65
84329	3	0.20	0.20	1.22	0.51	0.97	0.72	710.83	639.13	2.07	1.20
84329	A	0.23	0.20	3.49	2.19	0.44	0.27	694.82	505.63	10.69	11.02

RunID	Phase	HC (g/m)		CO (g/m)		NOx (g/m)		CO2 (g/m)		PM2.5 (mg/m)	Distance (miles)
		SMT	BKI	SMT	BKI	SMT	BKI	SMT	BKI		
84355	1	0.65	0.94	7.25	10.70	1.71	1.90	628.39	731.92	2.21	1.23
84355	2	0.02	0.02	0.54	0.49	0.16	0.14	392.33	425.20	1.00	8.75
84355	3	0.03	0.04	0.76	0.74	0.17	0.16	533.20	550.15	1.48	1.22
84355	A	0.05	0.07	0.92	1.05	0.25	0.23	414.86	450.20	1.10	11.21
84356	1	1.91	2.27	21.33	24.56	4.15	4.36	641.45	686.57	7.63	1.22
84356	2	0.06	0.06	3.80	3.90	1.15	1.16	326.86	341.59	3.85	8.76
84356	3	0.17	0.17	5.48	5.17	1.63	1.60	501.60	490.41	0.86	1.21
84356	A	0.17	0.19	4.85	5.07	1.34	1.36	355.85	370.06	3.84	11.19
84357	1	1.76	1.76	20.91	20.24	2.09	2.09	536.58	504.72	5.97	1.20
84357	2	0.72	0.67	44.99	47.99	0.39	0.41	278.80	284.72	8.28	8.69
84357	3	3.35	5.38	15.37	13.80	1.40	1.38	416.54	379.05	5.39	1.22
84357	A	0.96	1.06	41.62	44.14	0.55	0.56	302.17	302.85	7.96	11.12
84359	1	2.59	1.78	22.57	15.36	2.31	2.29	760.69	507.45	5.13	1.24
84359	2	0.09	0.10	2.58	2.48	0.96	0.97	389.94	322.90	5.69	8.79
84359	3	0.38	0.29	4.03	1.94	2.07	1.85	580.64	395.92	-0.30	1.23
84359	A	0.24	0.20	3.75	3.13	1.11	1.10	422.94	337.80	5.24	11.26
84360	1	5.36	5.44	32.75	31.28	5.75	7.86	683.84	658.38	6.38	1.20
84360	2	2.17	2.05	14.00	12.91	4.64	6.24	398.71	381.41	0.63	8.74
84360	3	3.68	3.52	23.58	20.96	5.97	7.98	592.59	538.64	1.42	1.22
84360	A	2.44	2.33	15.65	14.43	4.79	6.45	427.20	406.81	0.98	11.17

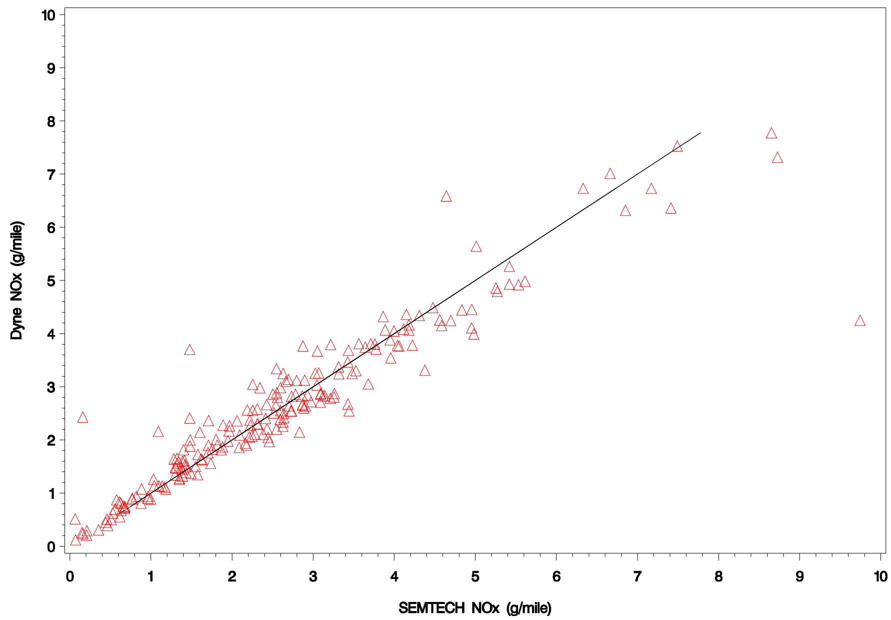
Plots of Dynamometer Measurements vs. SEMTECH Measurements

In the following plots of emissions by test phase, the symbols and colors used vary. Phase 1 emissions are depicted in red, phase 2 emissions in green, and phase 3 emissions in brown. HC, CO, NOx, and CO2 are depicted using dots, squares, triangles, and circle-crosses, respectively. Note that the 1:1 line depicted is for reference purposes; it is not a regression line.





Scatter Plot of Phase1 NOx (g/mile)



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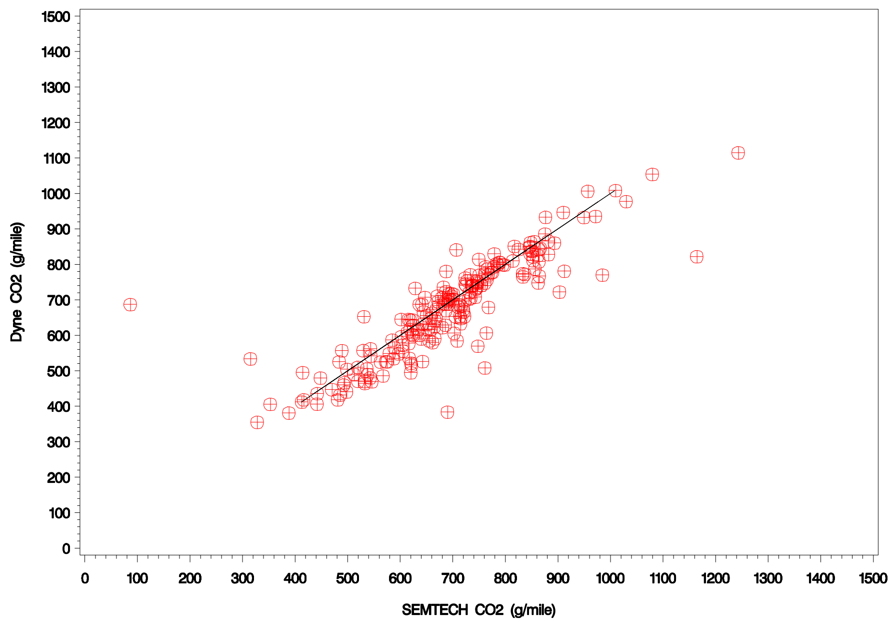
Scatter Plot of Phase1 CO2 (g/mile)



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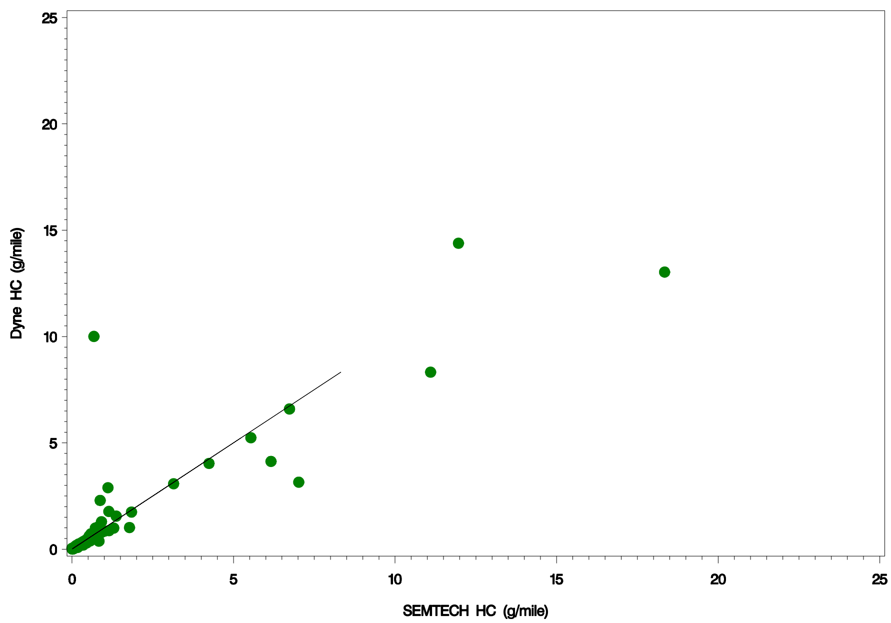
Scatter Plot of Phase2 HC (g/mile)



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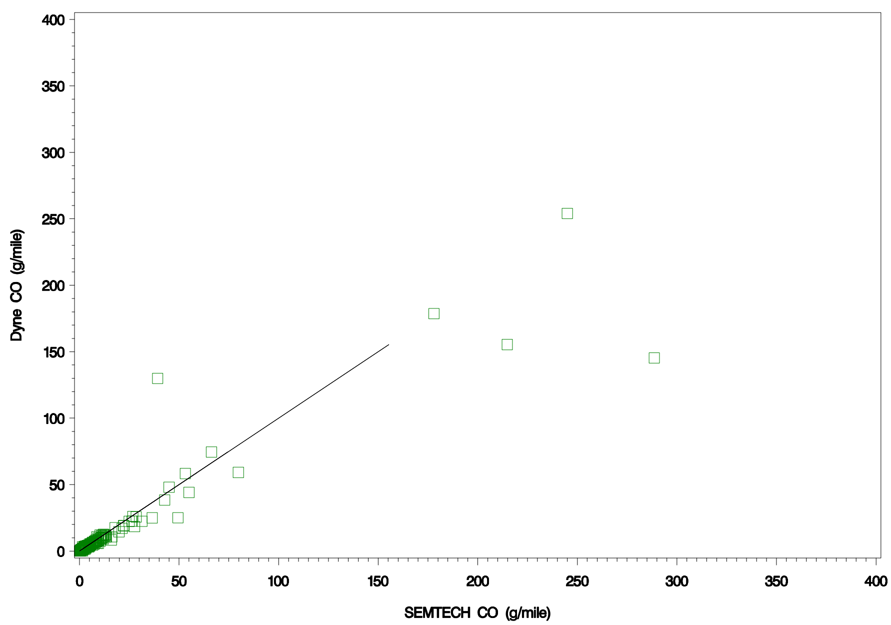
Scatter Plot of Phase2 CO (g/mile)



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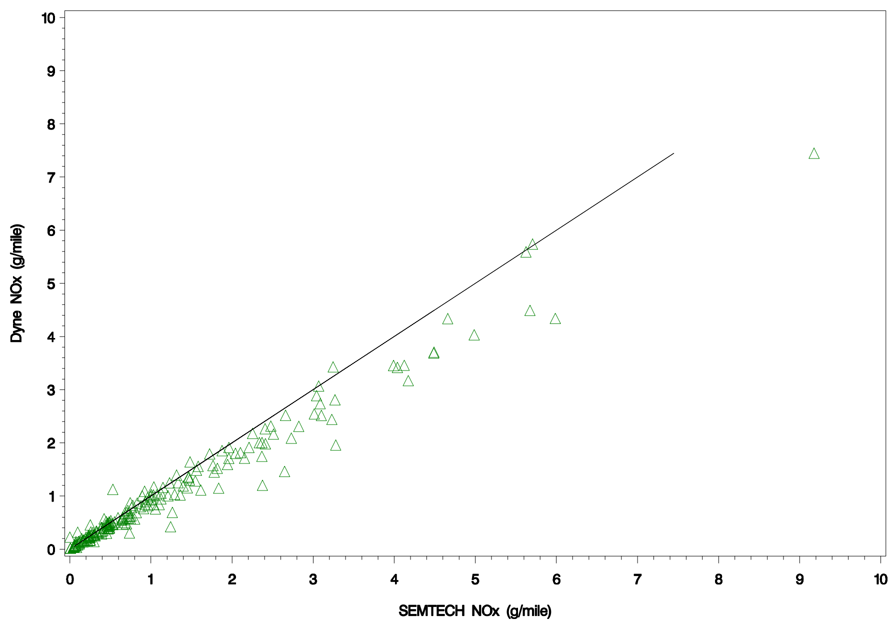
Scatter Plot of Phase2 NOx (g/mile)



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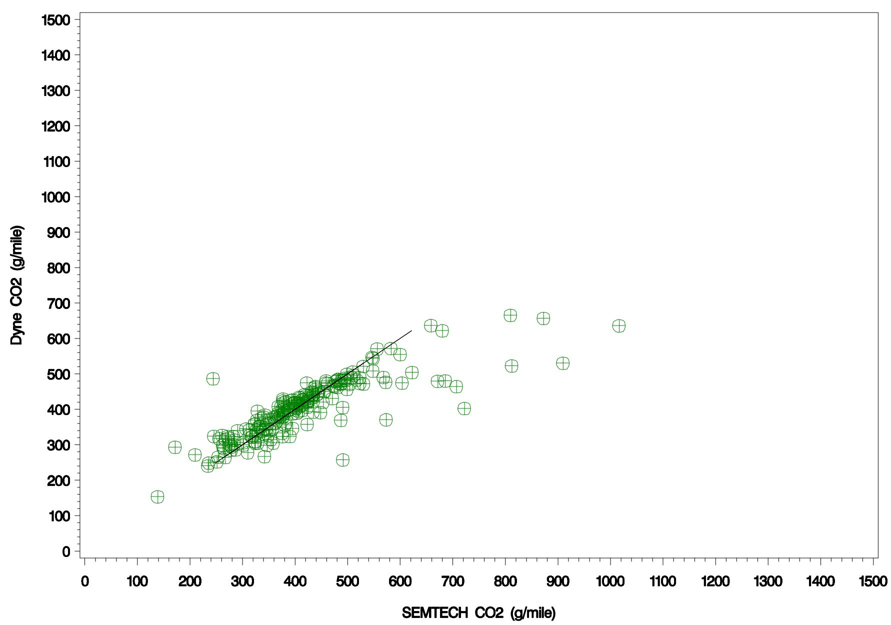
Scatter Plot of Phase2 CO2 (g/mile)



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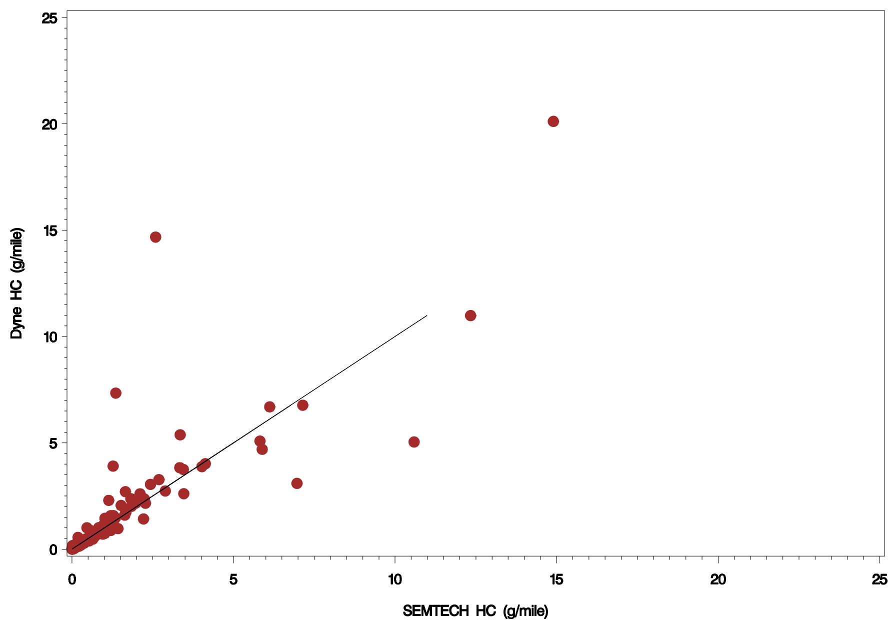
Scatter Plot of Phase3 HC (g/mile)



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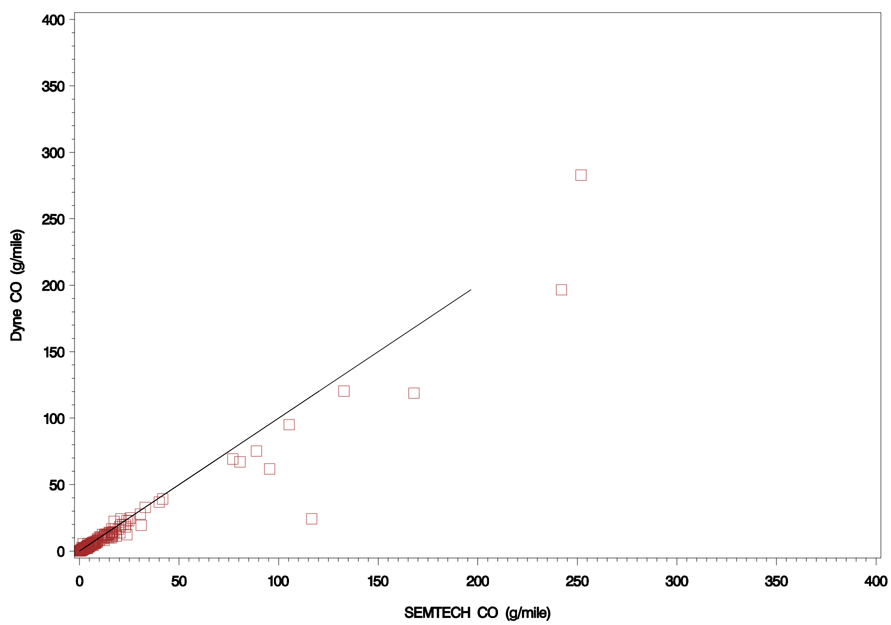
Scatter Plot of Phase3 CO (g/mile)



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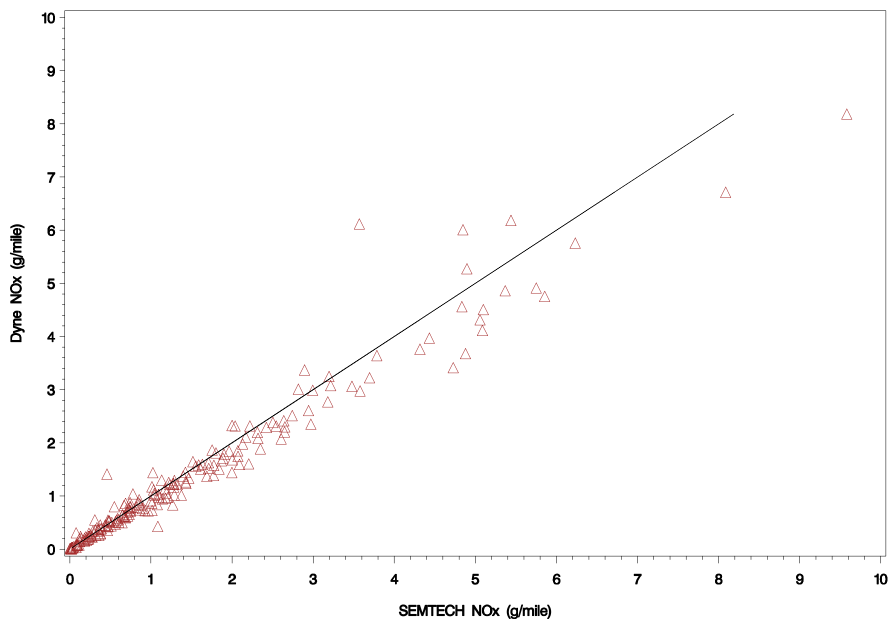
Scatter Plot of Phase3 NOx (g/mile)



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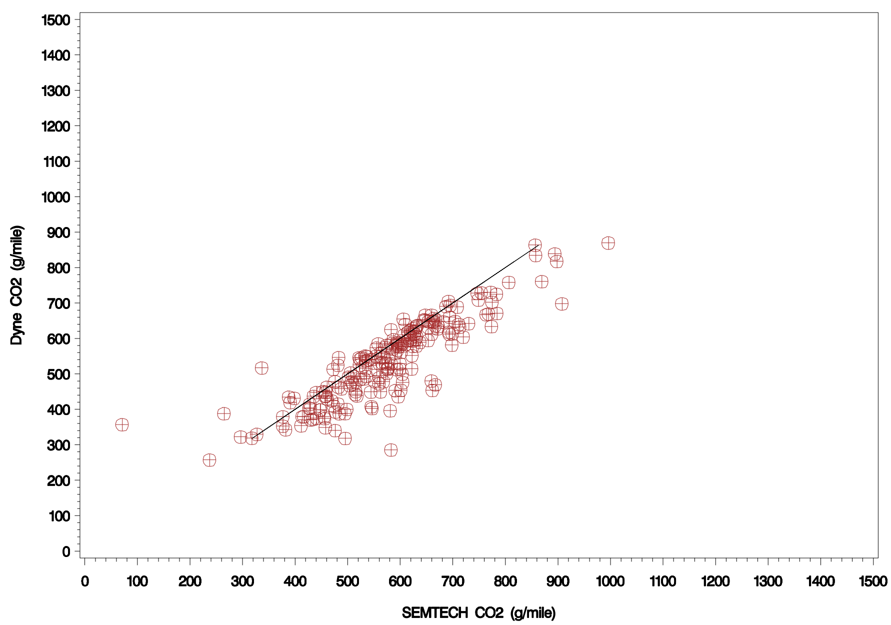
Scatter Plot of Phase3 CO2 (g/mile)



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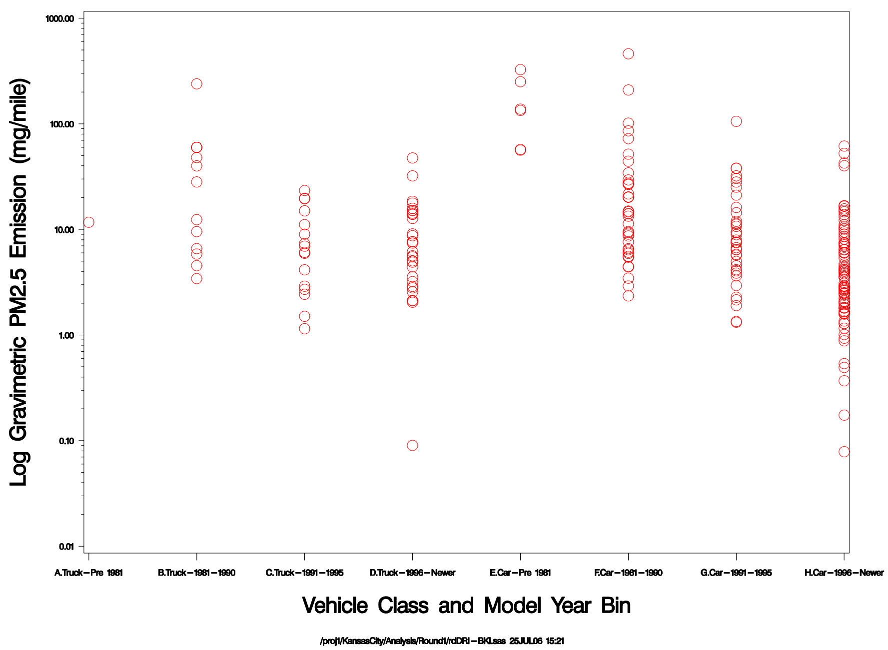
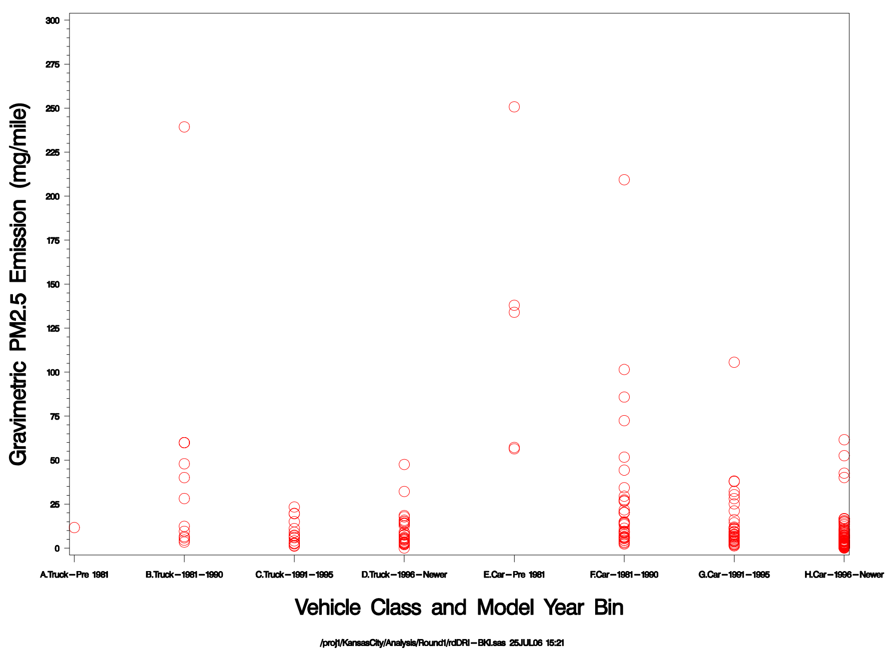
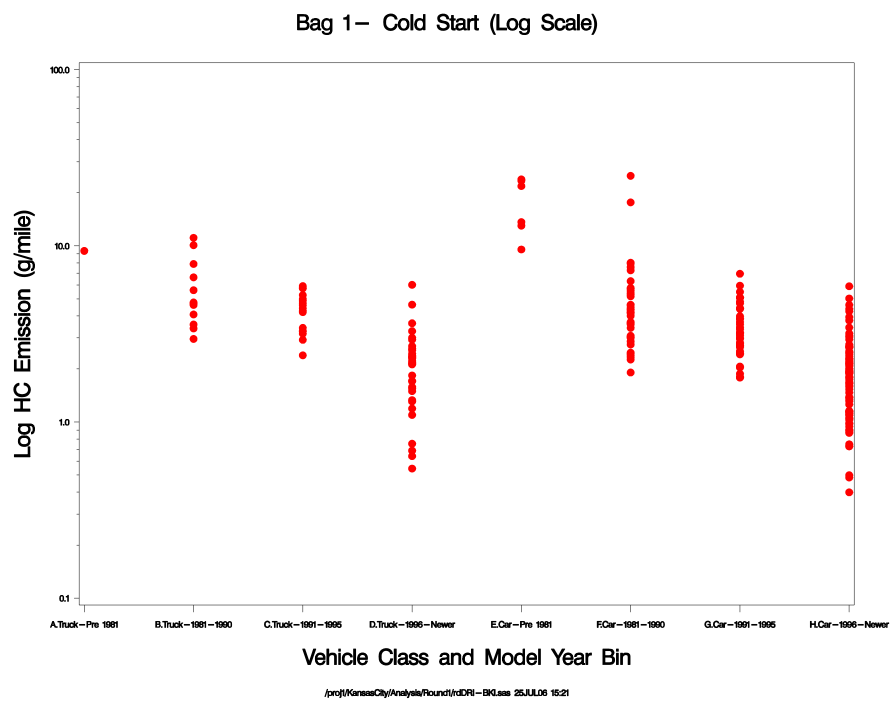
Plots of Dynamometer Measurements and $PM_{2.5}$ Measured by Gravimetric Mass-DRI

Bag 1– Cold Start (Log Scale)

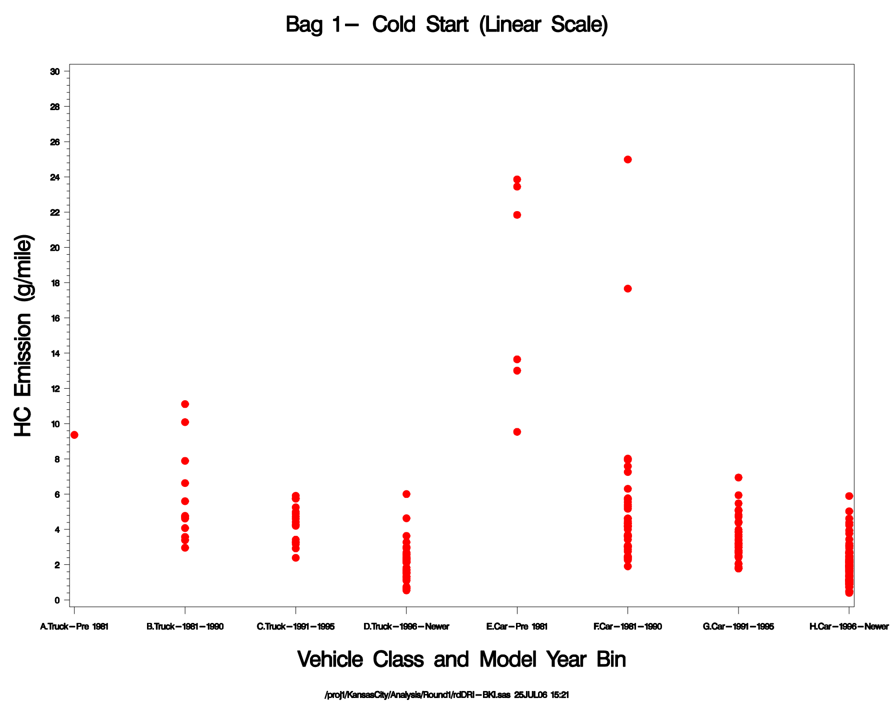


Bag 1– Cold Start (Linear Scale)



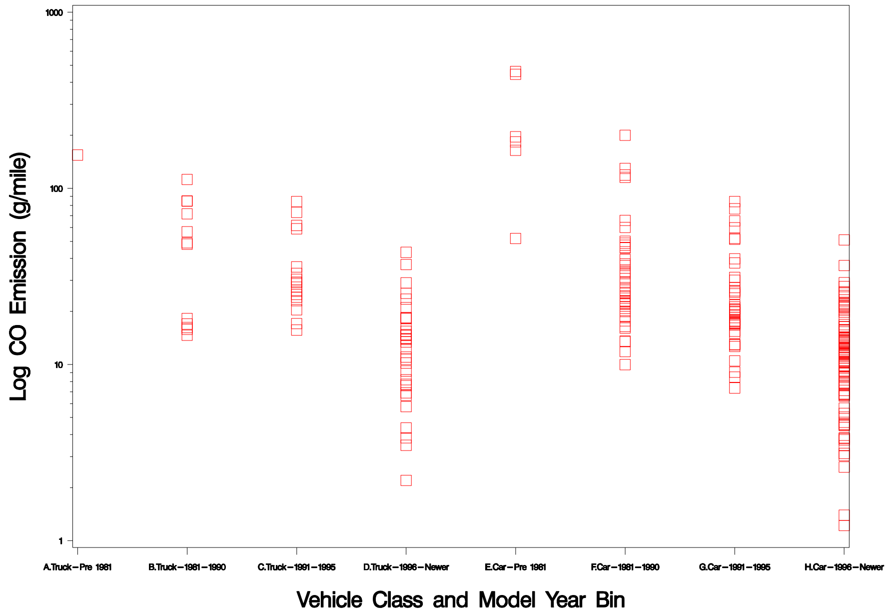


Bag 1– Cold Start (Log Scale)
Log HC Emission (g/mile)
100.0
10.0
1.0
0.1
A.Truck–Pre 1981
B.Truck–1981–1990
C.Truck–1991–1995
D.Truck–1996–Newer
E.Car–Pre 1981
F.Car–1981–1990
G.Car–1991–1995
H.Car–1996–Newer
Vehicle Class and Model Year Bin



Bag 1– Cold Start (Linear Scale)
HC Emission (g/mile)
30
28
26
24
22
20
18
16
14
12
10
8
6
4
2
0
A.Truck–Pre 1981
B.Truck–1981–1990
C.Truck–1991–1995
D.Truck–1996–Newer
E.Car–Pre 1981
F.Car–1981–1990
G.Car–1991–1995
H.Car–1996–Newer
Vehicle Class and Model Year Bin

Bag 1– Cold Start (Log Scale)



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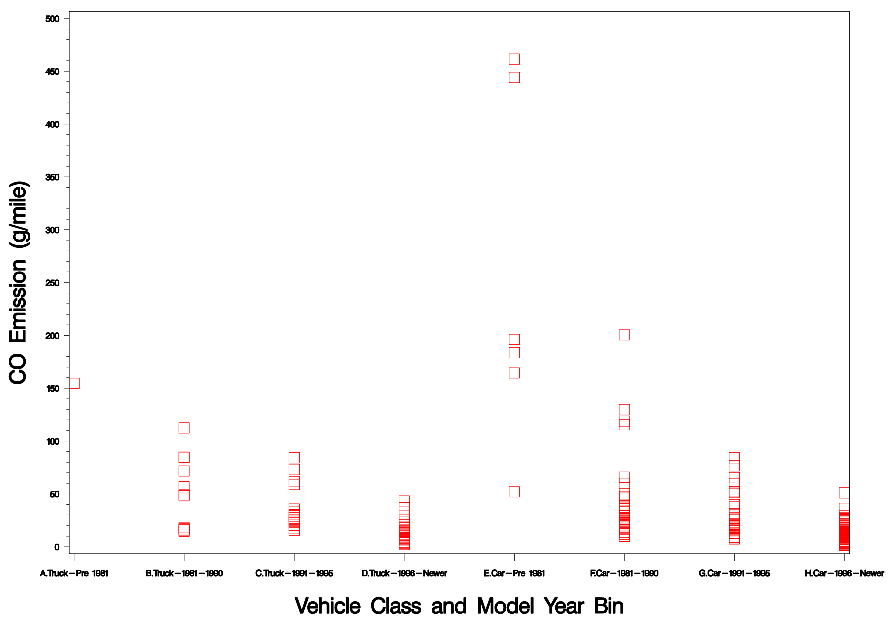
Bag 1– Cold Start (Linear Scale)



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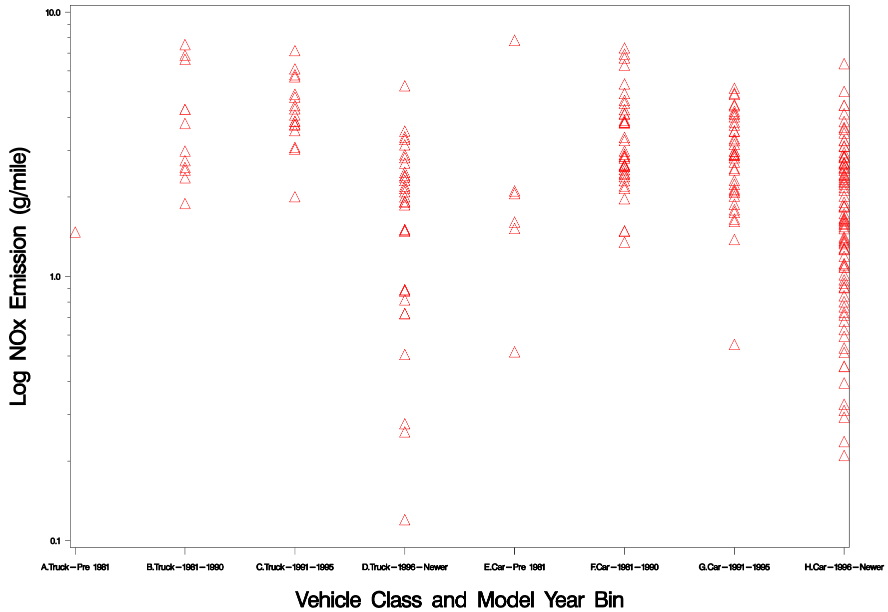
Bag 1– Cold Start (Log Scale)



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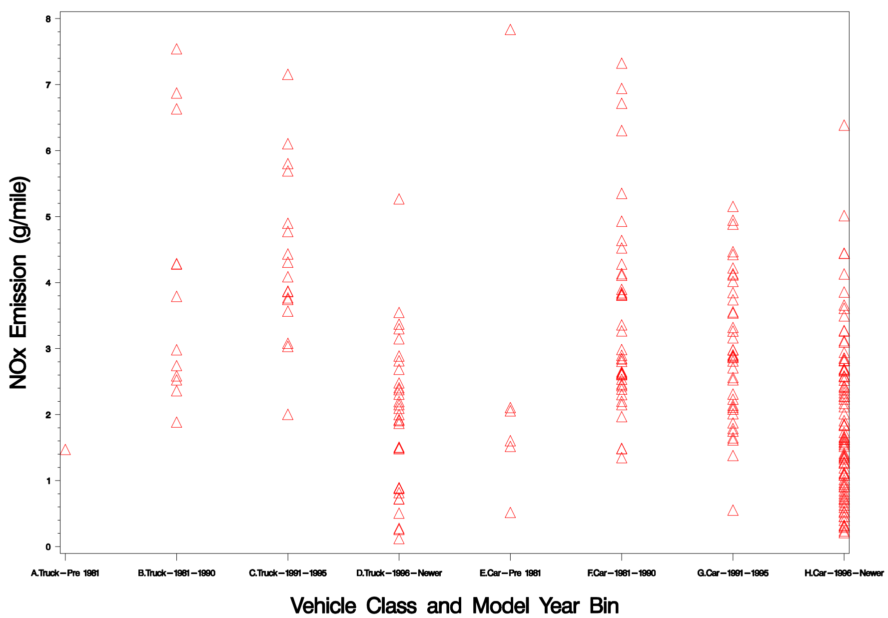
Bag 1– Cold Start (Linear Scale)



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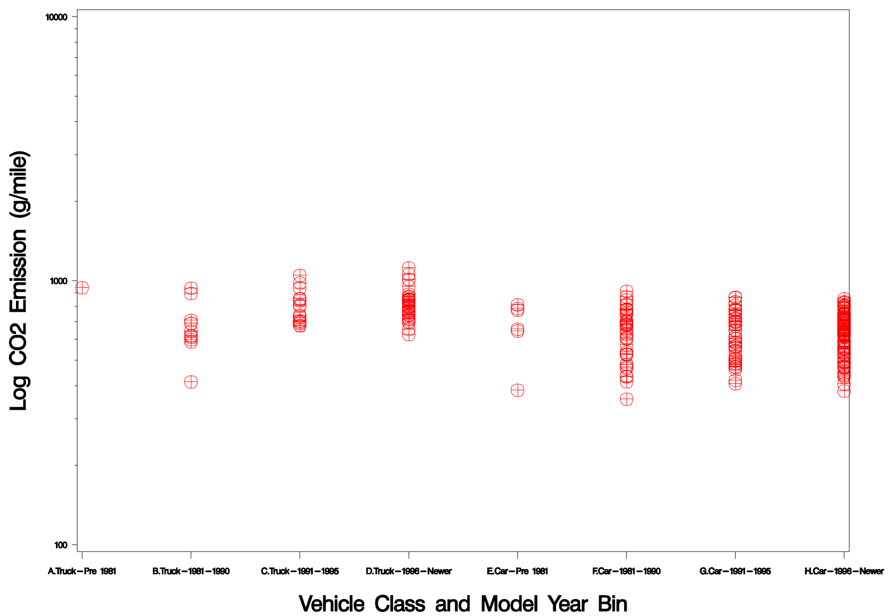
Bag 1– Cold Start (Log Scale)



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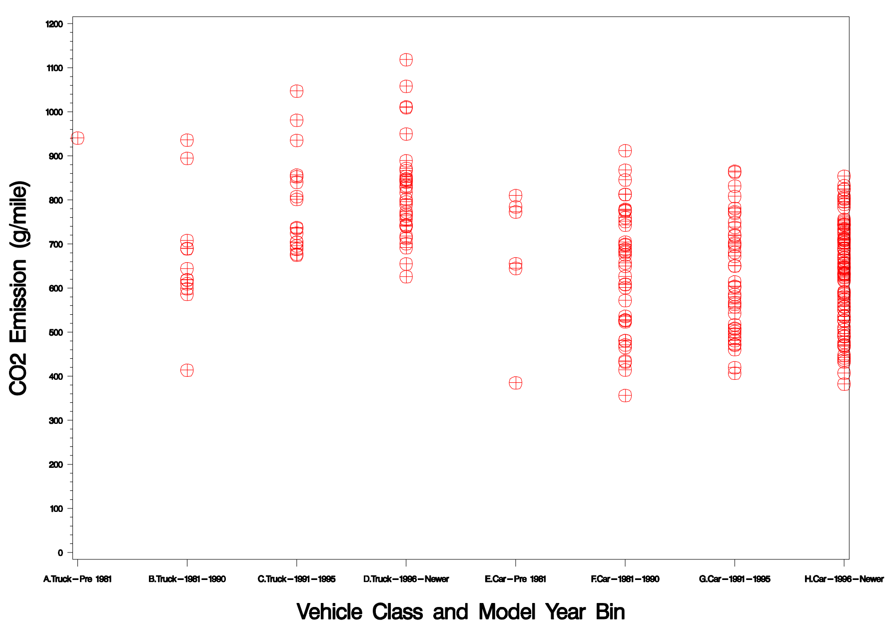
Bag 1– Cold Start (Linear Scale)



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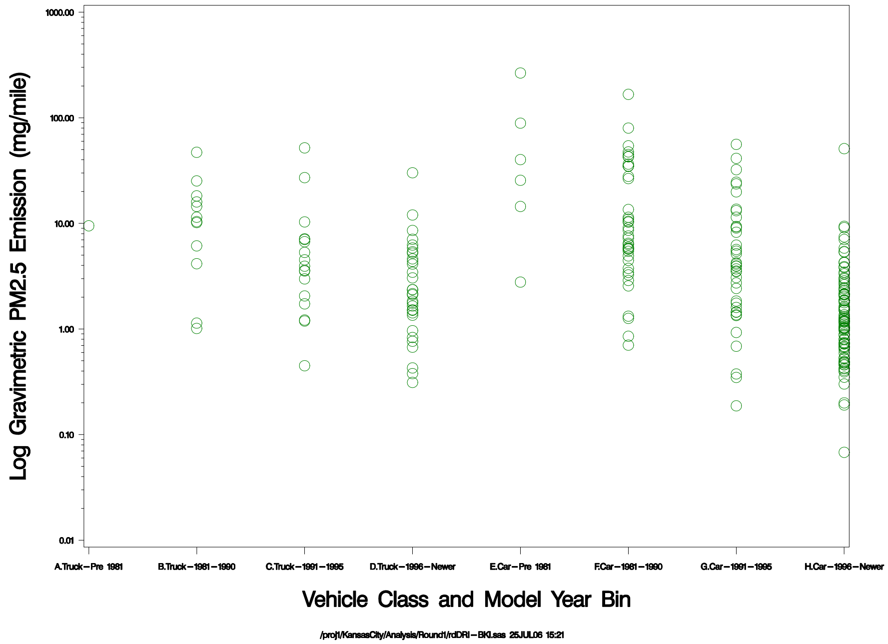
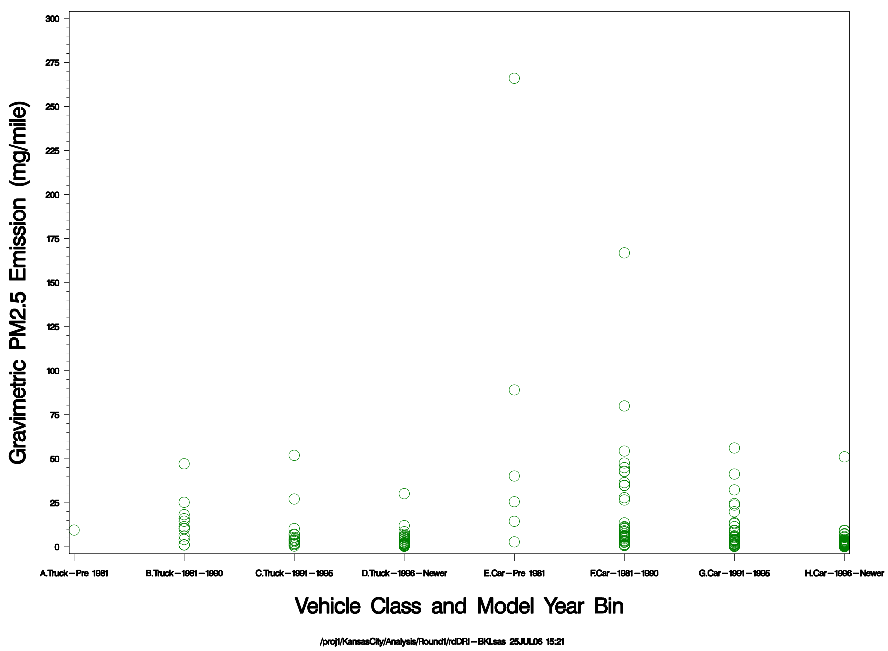
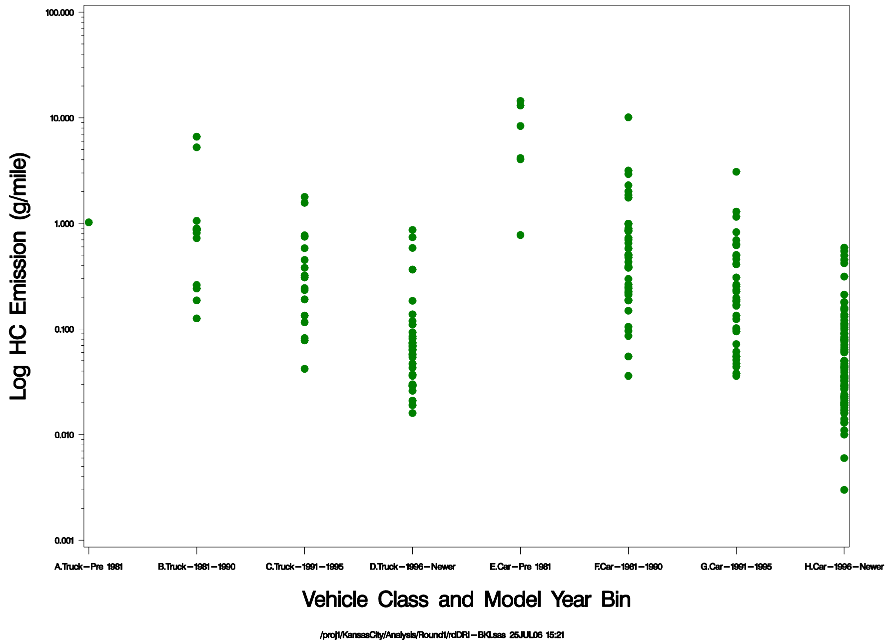
Bag 2– Transient (Log Scale)



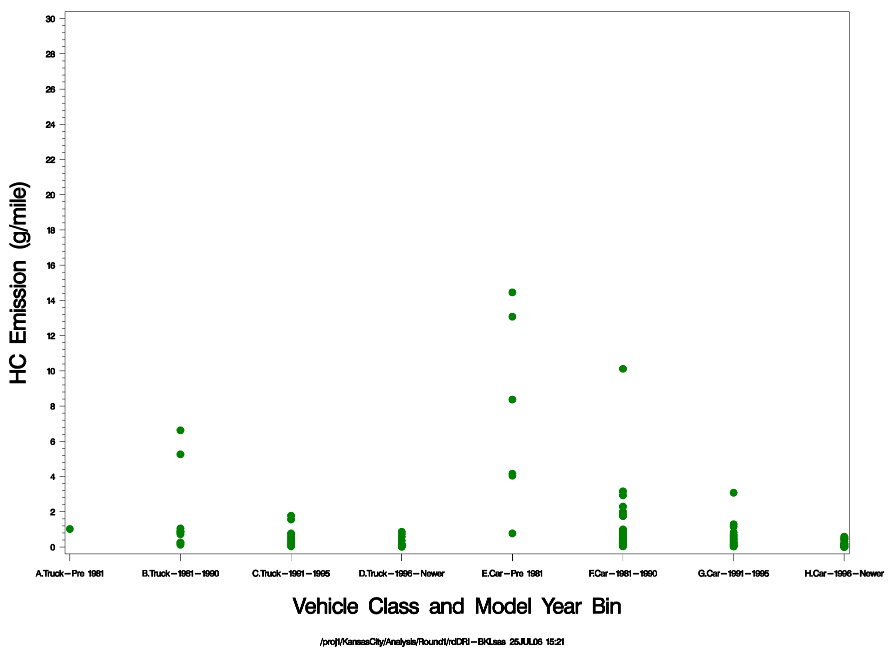
Bag 2– Transient (Linear Scale)

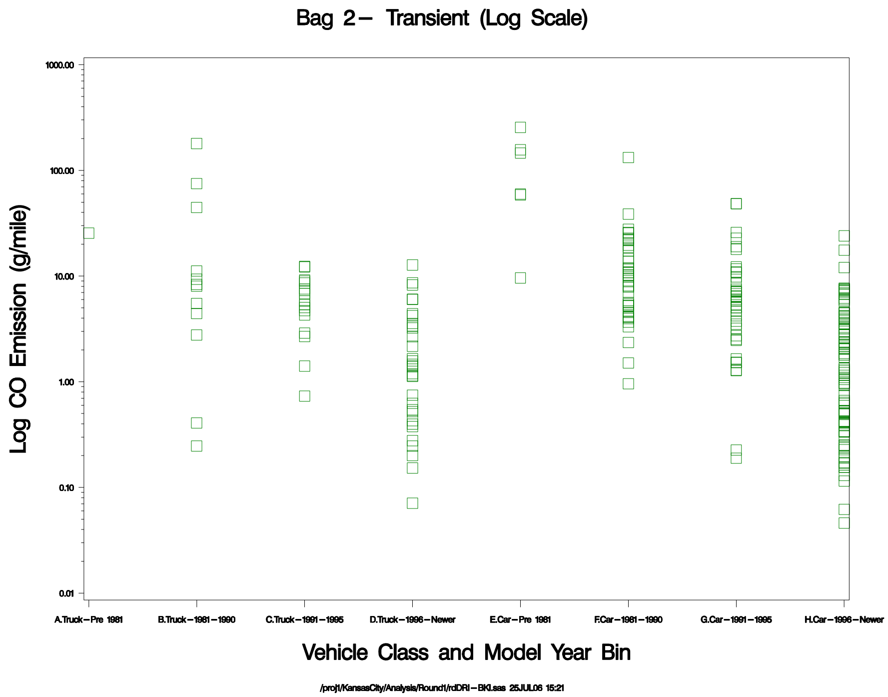


Bag 2– Transient (Log Scale)



Bag 2– Transient (Linear Scale)




Bag 2– Transient (Log Scale)
Log CO Emission (g/mile)
1000.00
100.00
10.00
1.00
0.10
0.01
A.Truck–Pre 1981
B.Truck–1981–1990
C.Truck–1991–1995
D.Truck–1996–Newer
E.Car–Pre 1981
F.Car–1981–1990
G.Car–1991–1995
H.Car–1996–Newer
Vehicle Class and Model Year Bin
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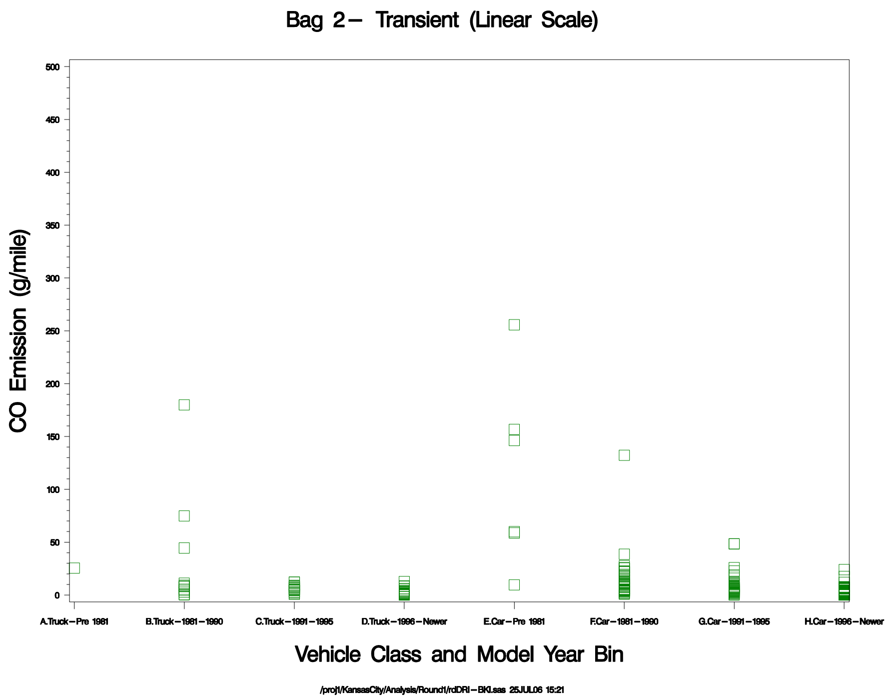
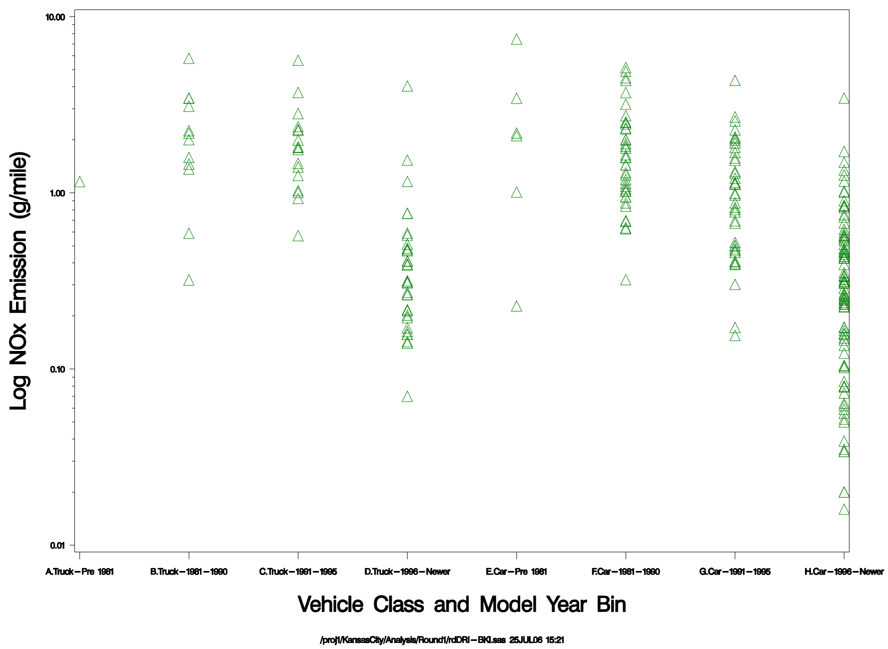
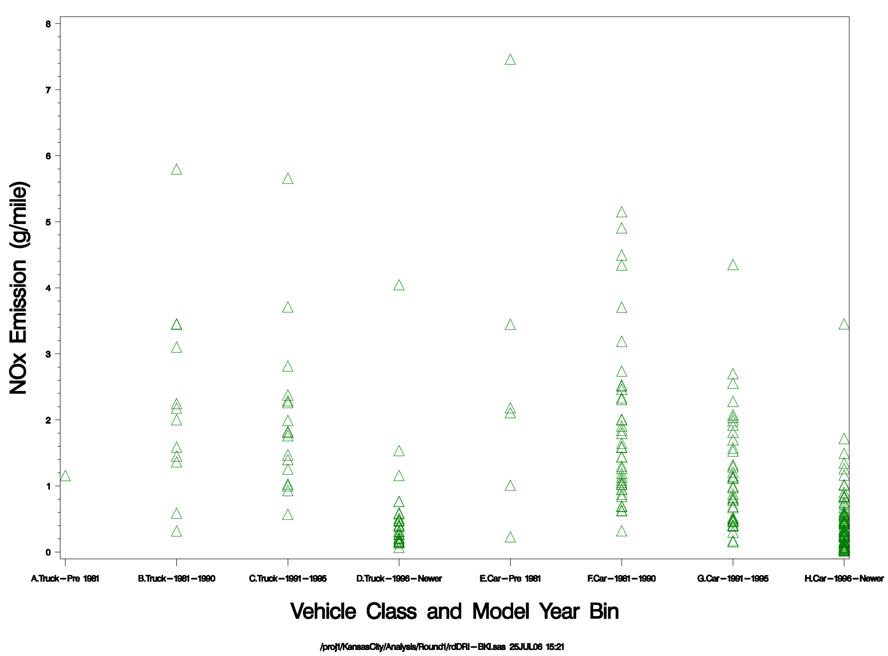
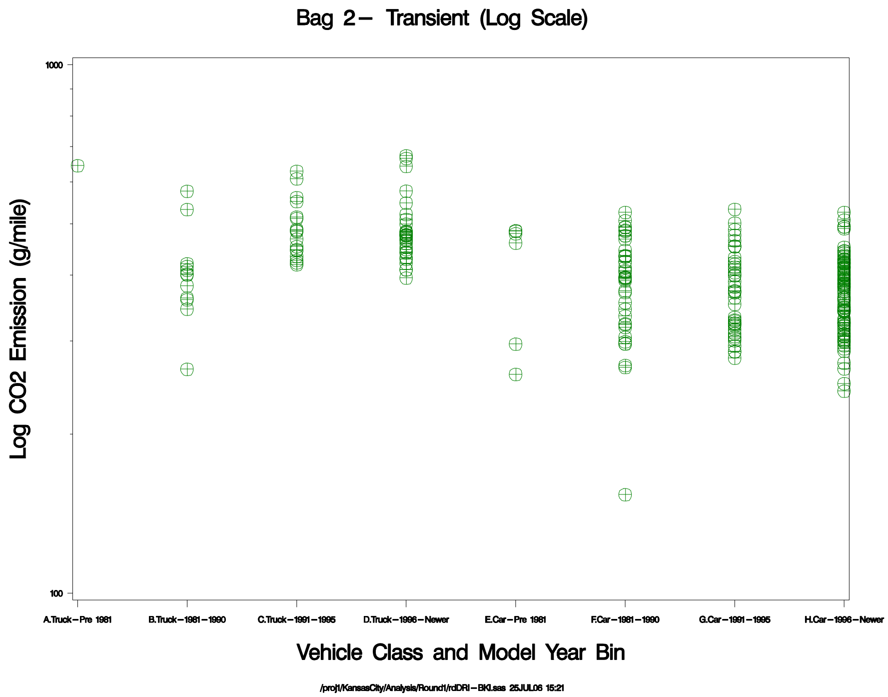

Bag 2– Transient (Linear Scale)
CO Emission (g/mile)
500
450
400
350
300
250
200
150
100
50
0
A.Truck–Pre 1981
B.Truck–1981–1990
C.Truck–1991–1995
D.Truck–1996–Newer
E.Car–Pre 1981
F.Car–1981–1990
G.Car–1991–1995
H.Car–1996–Newer
Vehicle Class and Model Year Bin
/proj/KansasCity/Analysis/Round1/rdDRI–BKl.sas 25JUL06 15:21

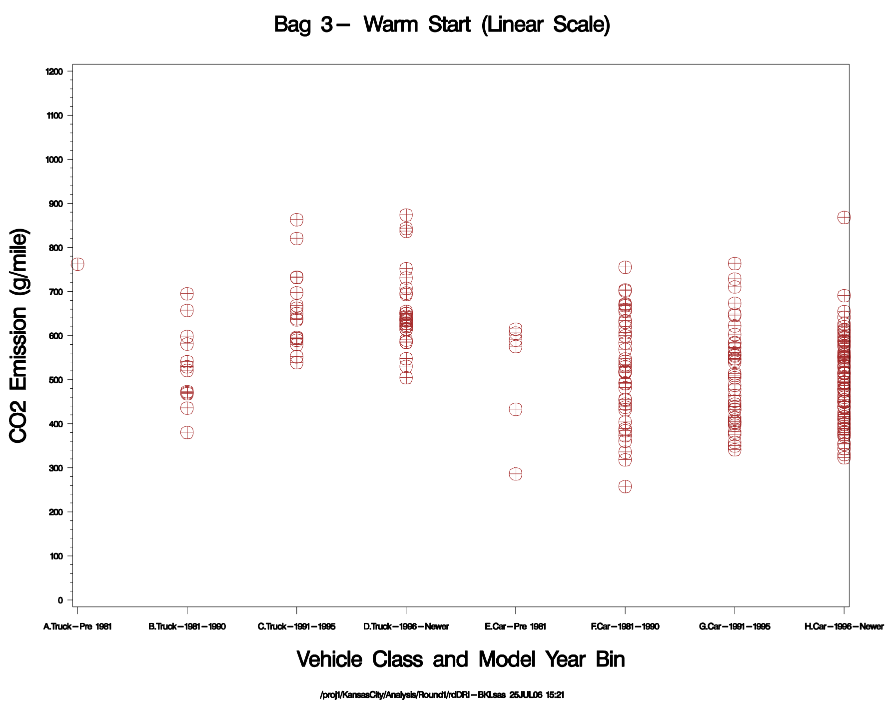
Bag 2– Transient (Log Scale)



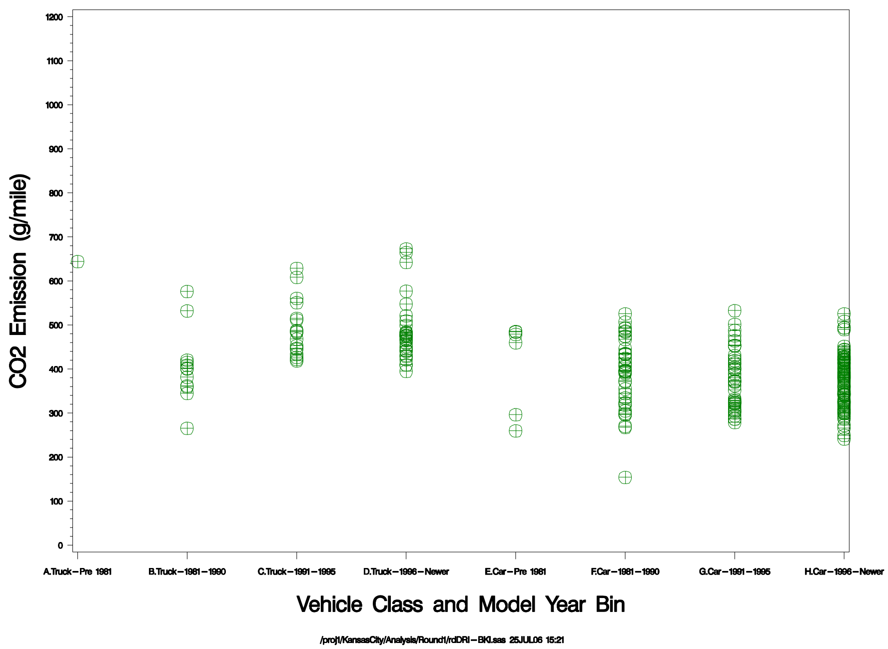
Bag 2– Transient (Linear Scale)



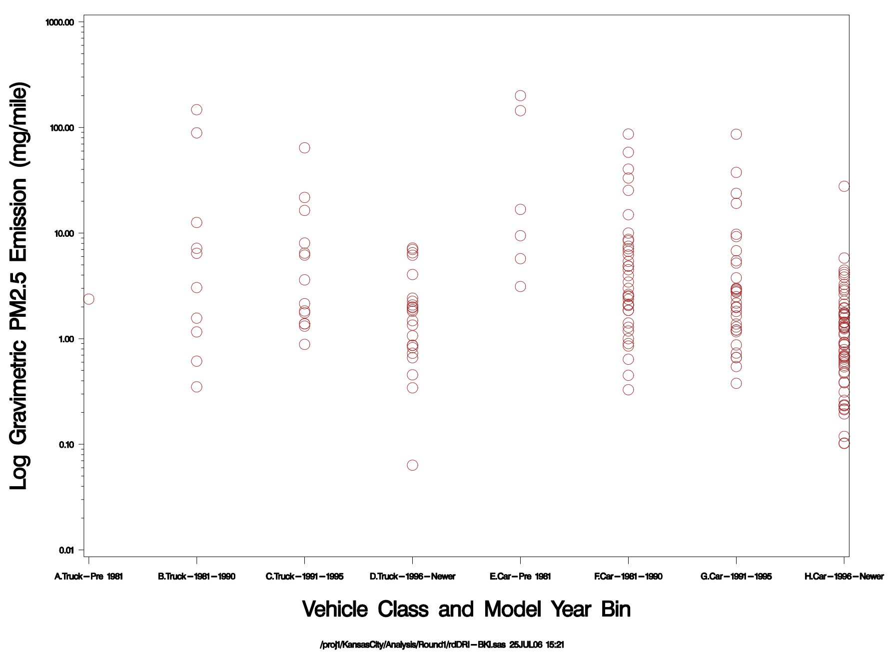

Bag 2 – Transient (Log Scale)
Log CO2 Emission (g/mile)
1000
100
A.Truck – Pre 1981
B.Truck – 1981 – 1990
C.Truck – 1991 – 1995
D.Truck – 1996 – Newer
E.Car – Pre 1981
F.Car – 1981 – 1990
G.Car – 1991 – 1995
H.Car – 1996 – Newer
Vehicle Class and Model Year Bin


Bag 3 – Warm Start (Linear Scale)
CO2 Emission (g/mile)
1200
1100
1000
900
800
700
600
500
400
300
200
100
0
A.Truck – Pre 1981
B.Truck – 1981 – 1990
C.Truck – 1991 – 1995
D.Truck – 1996 – Newer
E.Car – Pre 1981
F.Car – 1981 – 1990
G.Car – 1991 – 1995
H.Car – 1996 – Newer
Vehicle Class and Model Year Bin

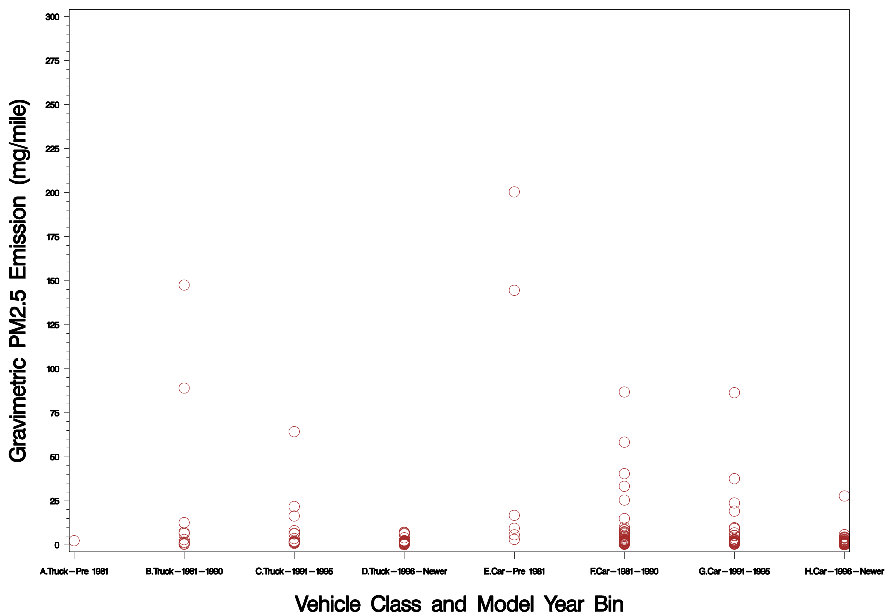
Bag 2 – Transient (Linear Scale)



Bag 3 – Warm Start (Log Scale)



Bag 3— Warm Start (Linear Scale)



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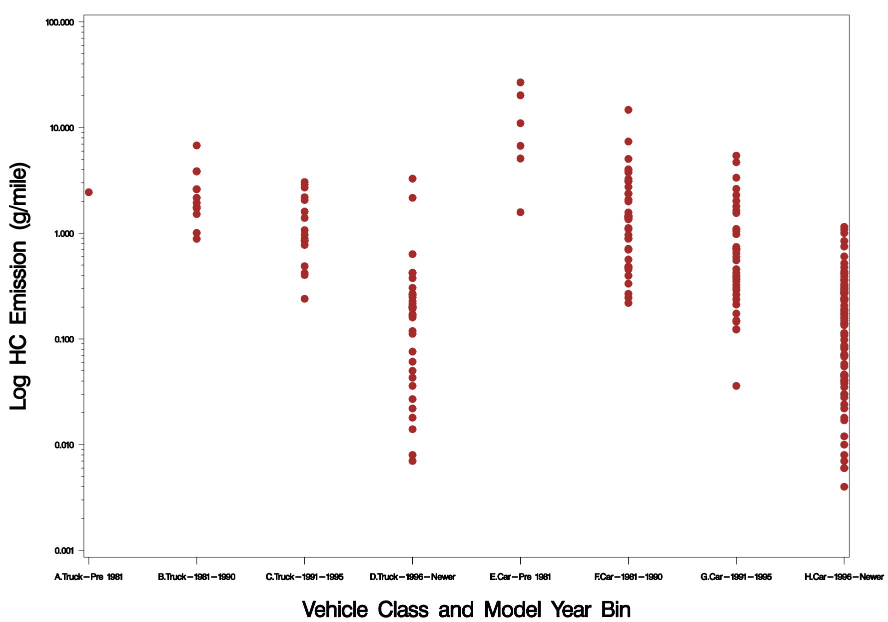
Bag 3— Warm Start (Log Scale)



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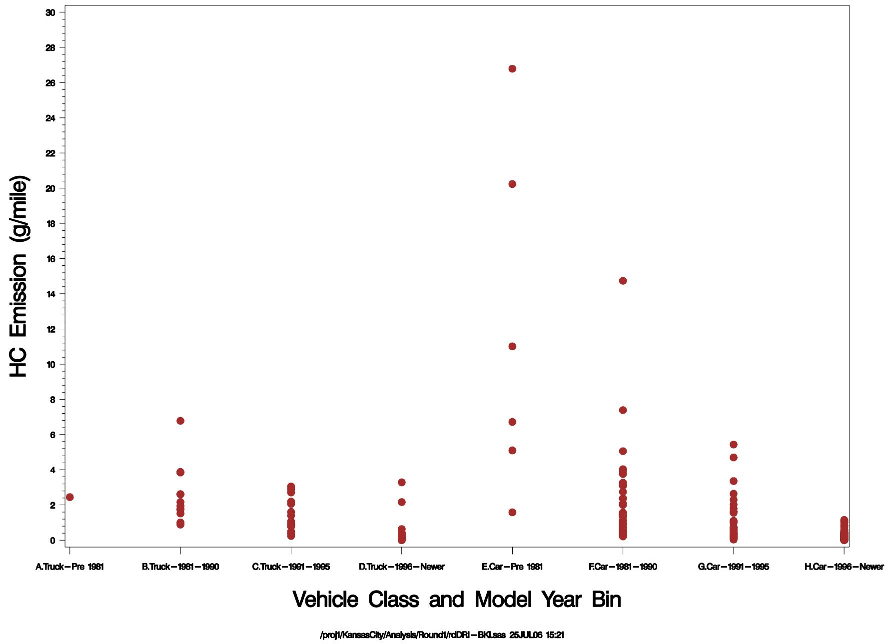
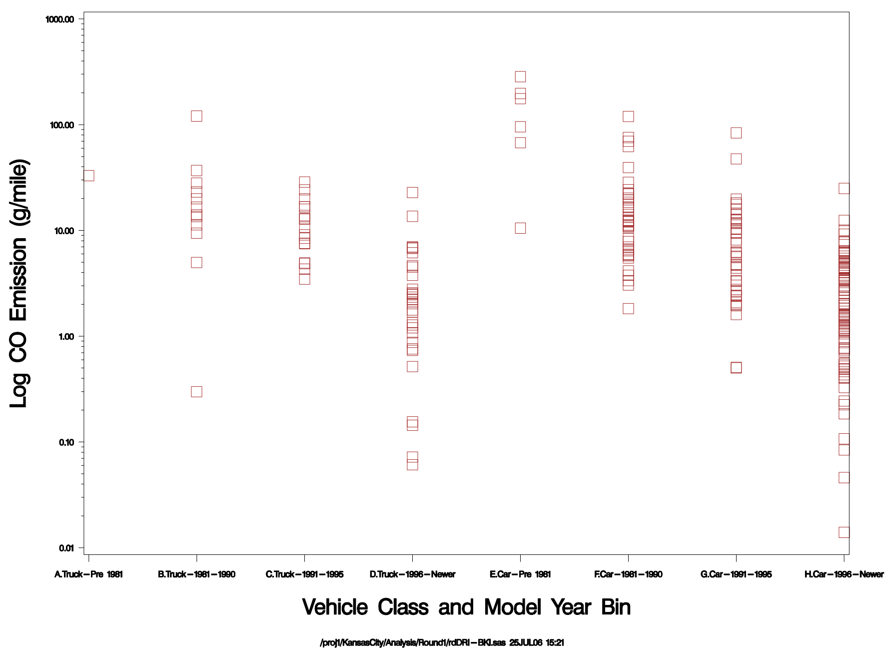
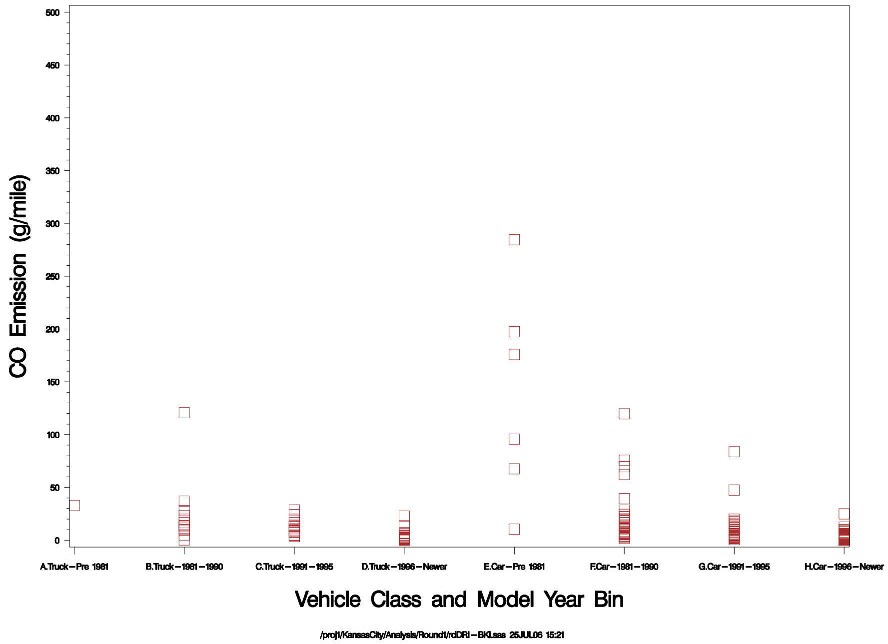
Bag 3— Warm Start (Linear Scale)



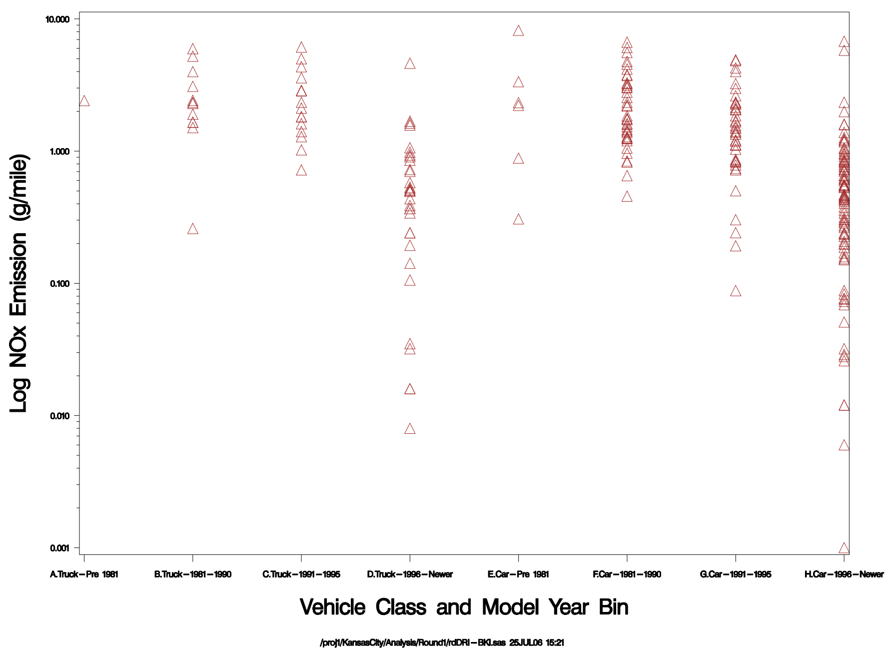
Bag 3— Warm Start (Log Scale)



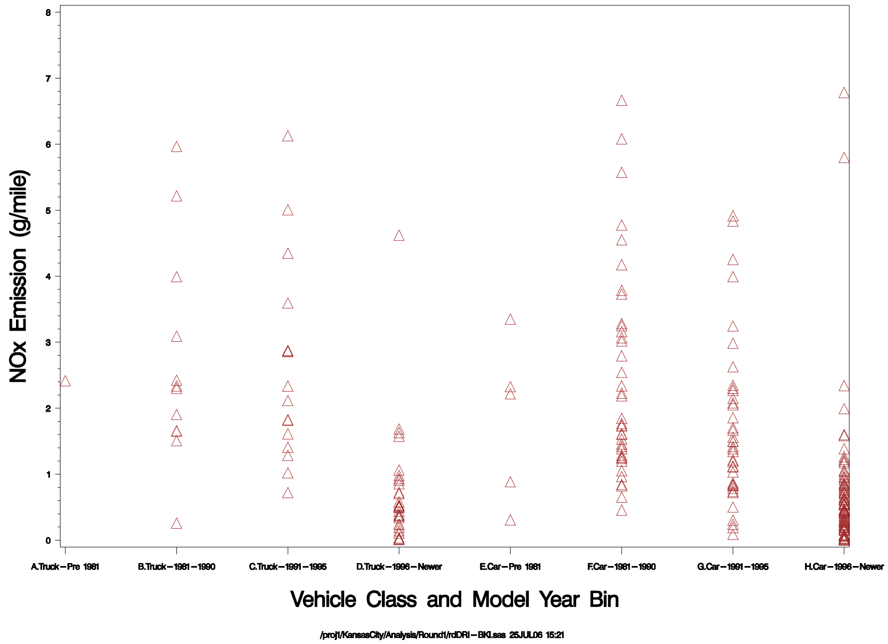
Bag 3– Warm Start (Linear Scale)



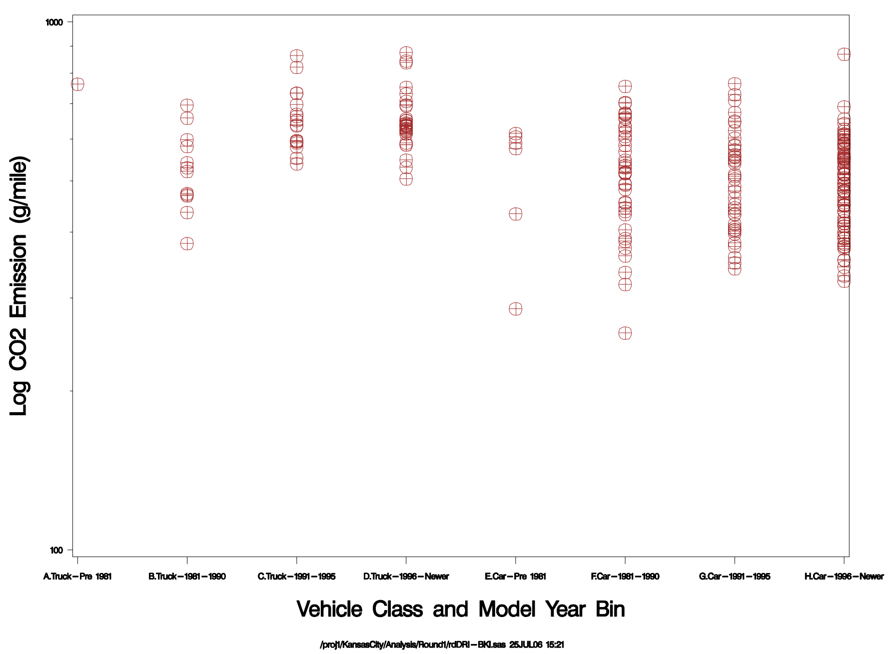
Bag 3– Warm Start (Log Scale)



Bag 3– Warm Start (Linear Scale)

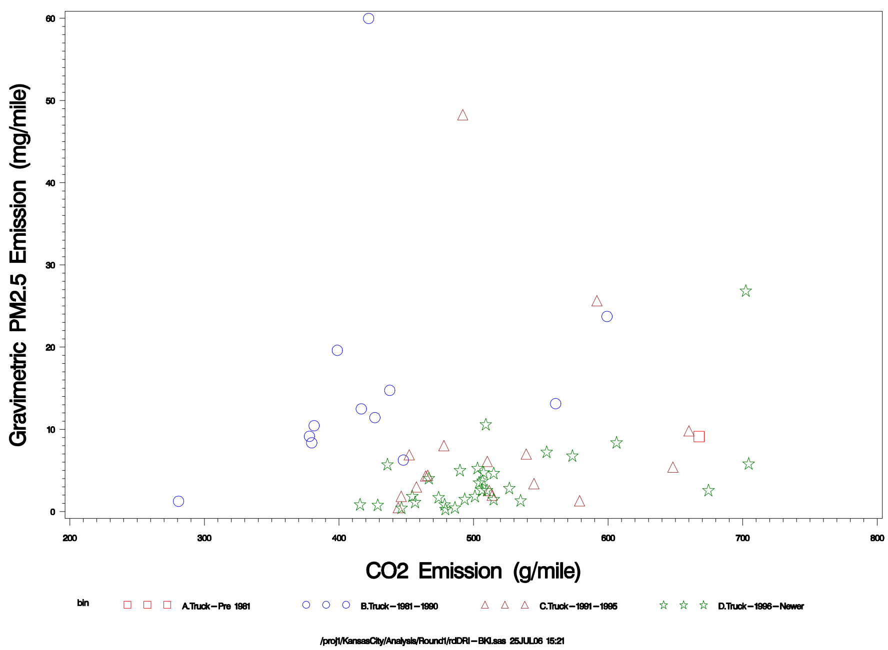


Bag 3– Warm Start (Log Scale)

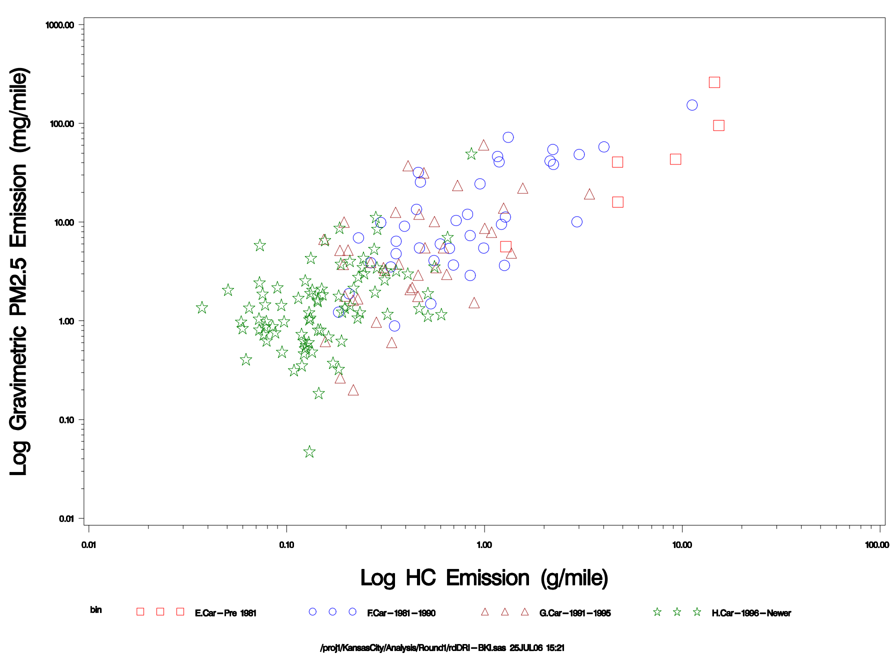


Scatter Plots of Dynamometer Measurements vs. $PM_{2.5}$ Measured by Gravimetric Mass-DRI

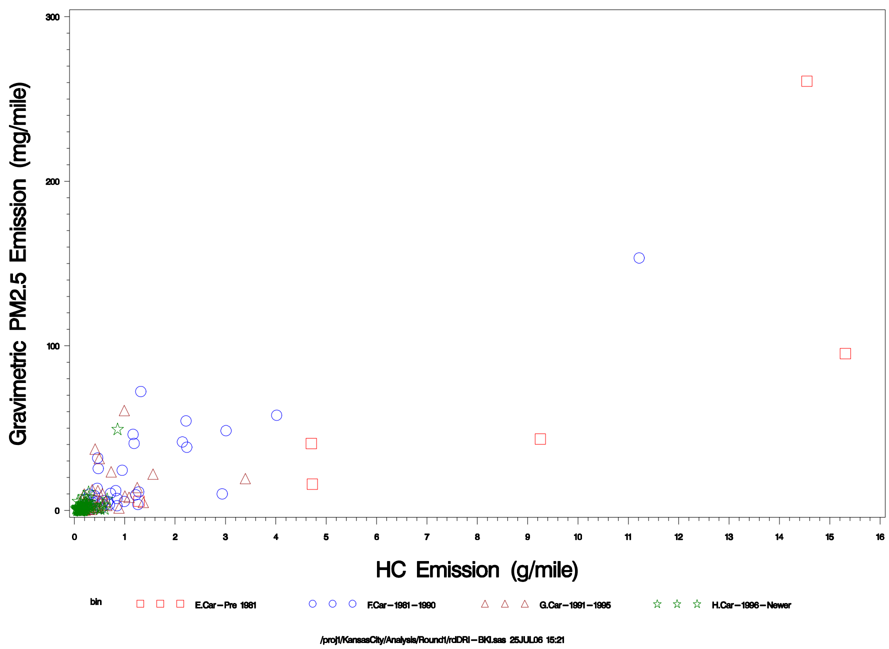
Scatter Plot of Composite PM2.5 vs Composite CO2 (Linear Scale) – TRUCK



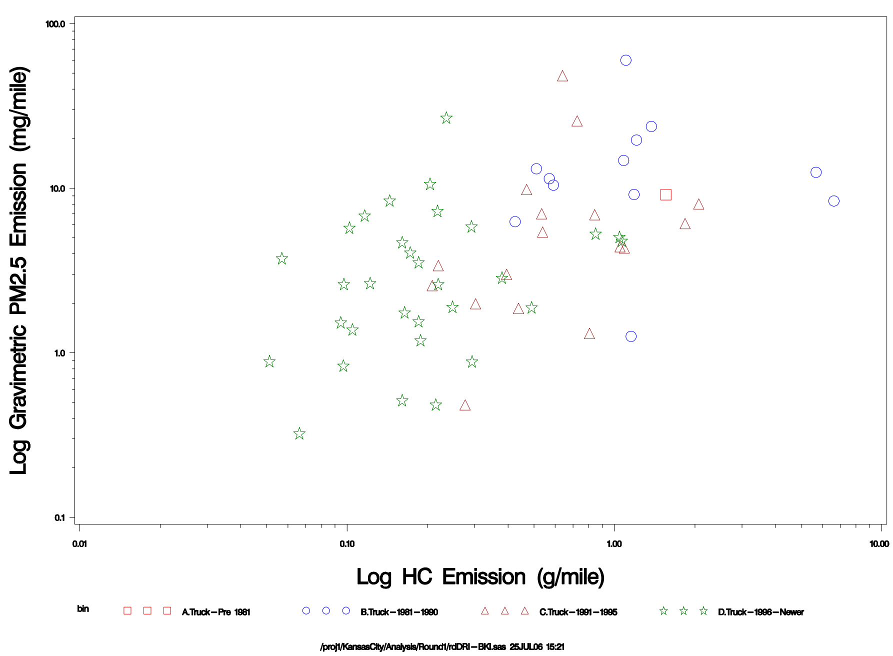
Scatter Plot of Composite PM2.5 vs Composite HC (Log Scale) – CAR



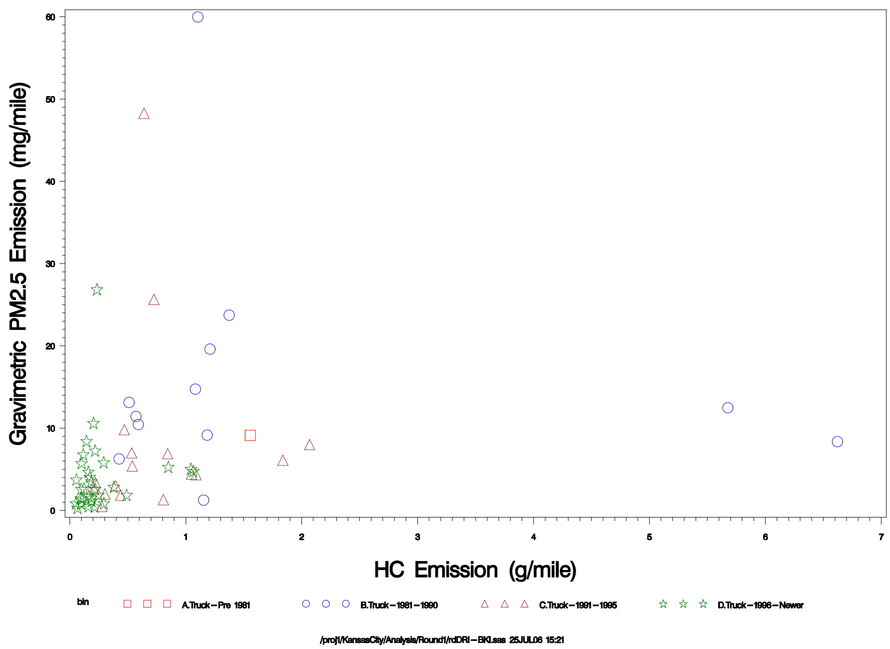
Scatter Plot of Composite PM2.5 vs Composite HC (Linear Scale) – CAR



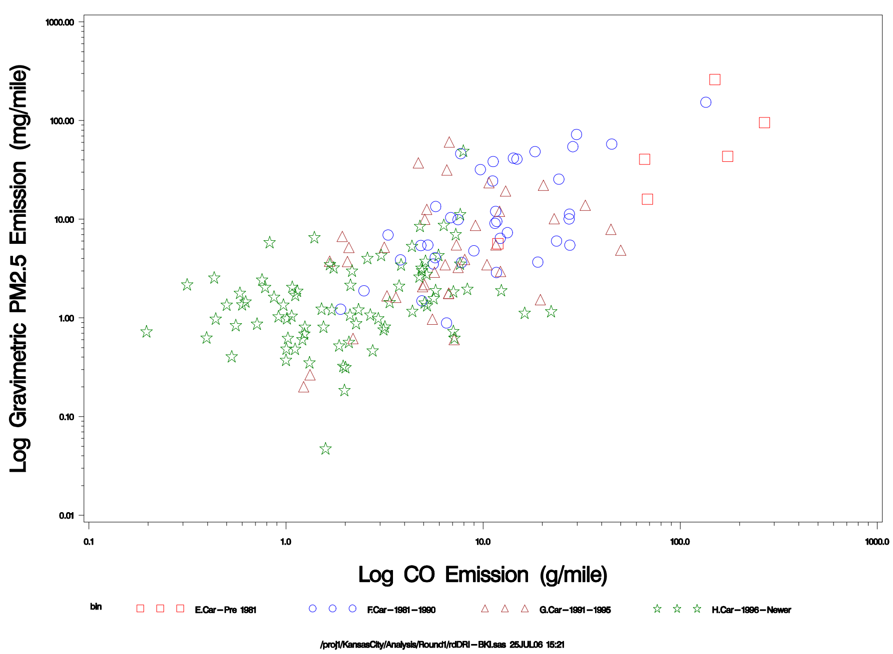
Scatter Plot of Composite PM2.5 vs Composite HC (Log Scale) – TRUCK



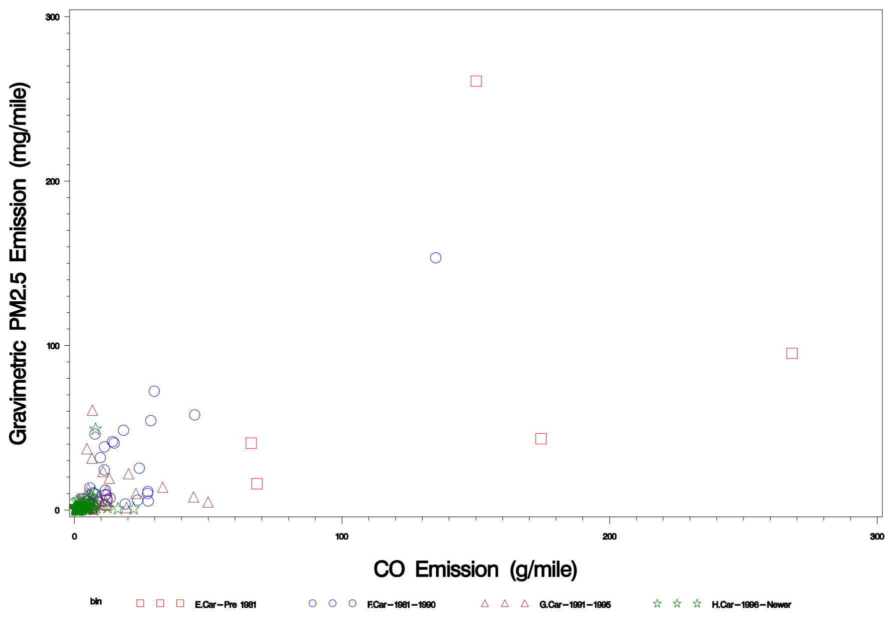
Scatter Plot of Composite PM2.5 vs Composite HC (Linear Scale) – TRUCK



Scatter Plot of Composite PM2.5 vs Composite CO (Log Scale) – CAR



Scatter Plot of Composite PM2.5 vs Composite CO (Linear Scale) – CAR



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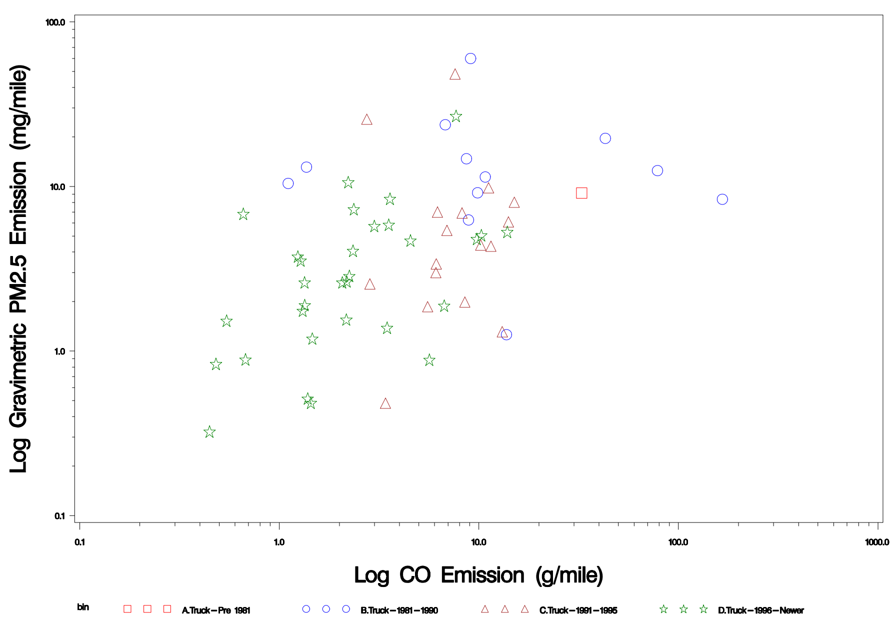
Scatter Plot of Composite PM2.5 vs Composite CO (Log Scale) – TRUCK



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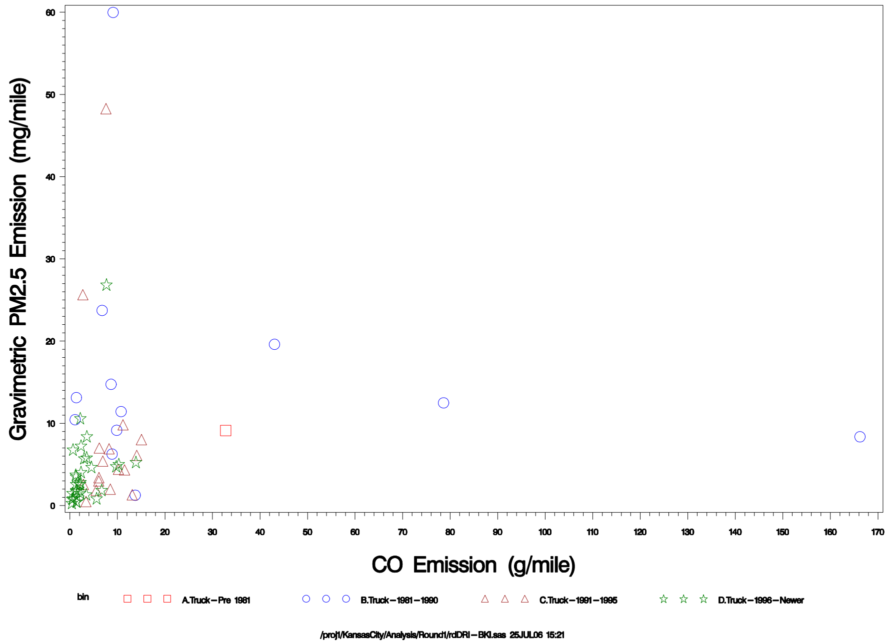
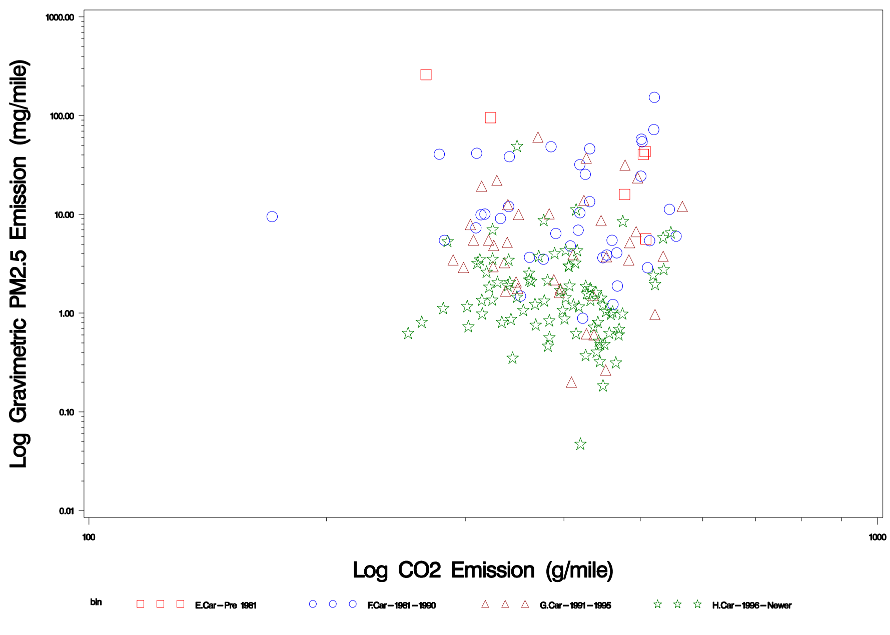
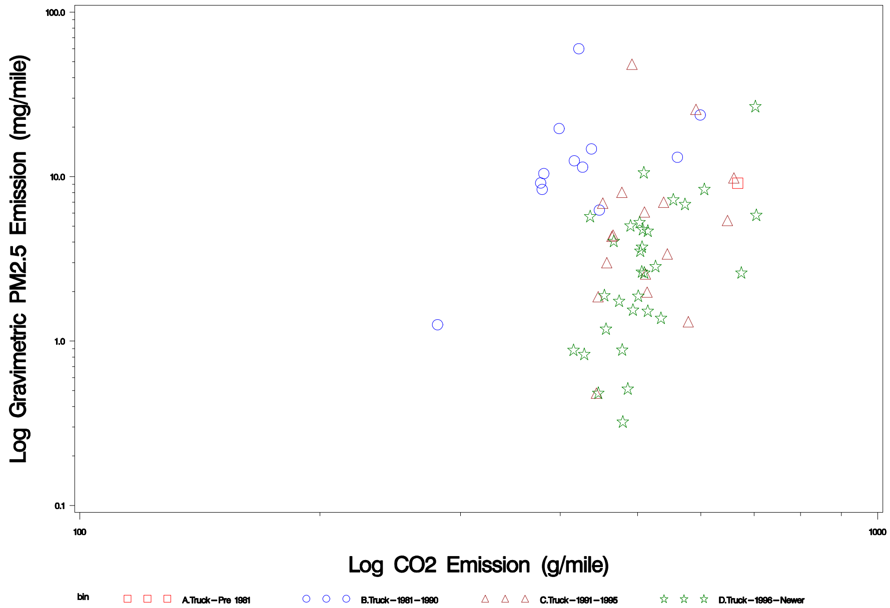
Scatter Plot of Composite PM2.5 vs Composite CO (Linear Scale) – TRUCK



Scatter Plot of Composite PM2.5 vs Composite CO2 (Log Scale) – CAR



Scatter Plot of Composite PM2.5 vs Composite CO2 (Log Scale) – TRUCK



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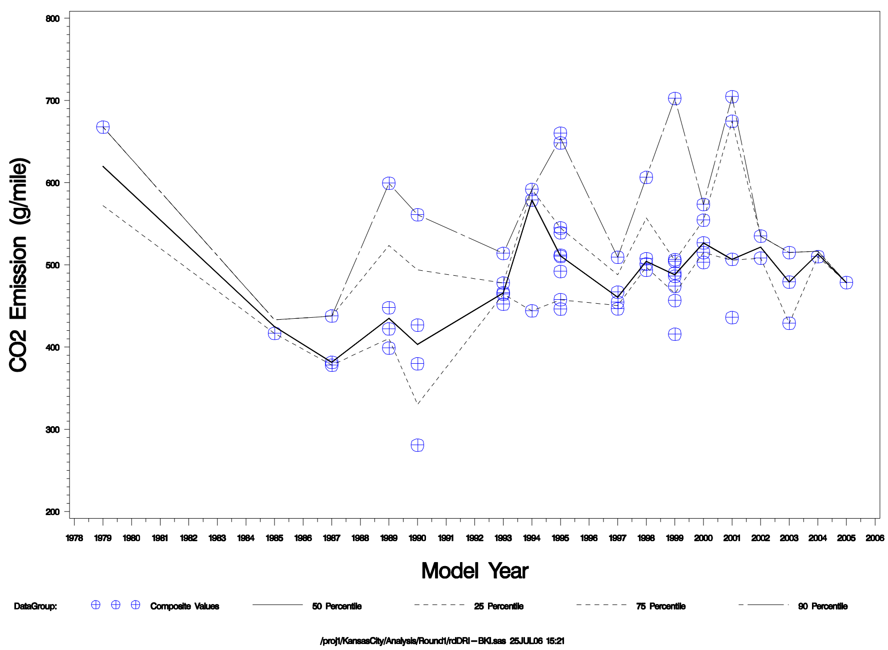
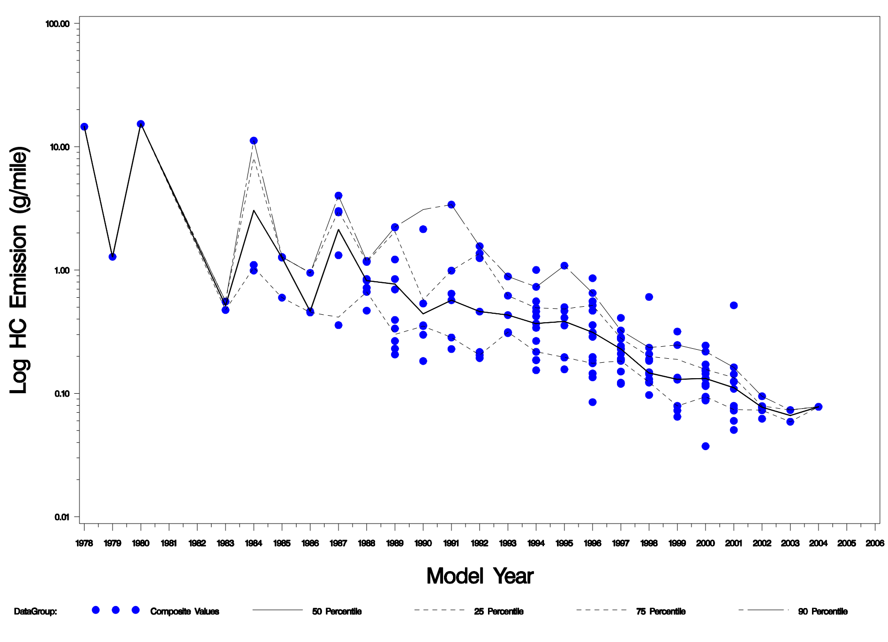
Plots of Dynamometer Measurements as a Function of Model Year

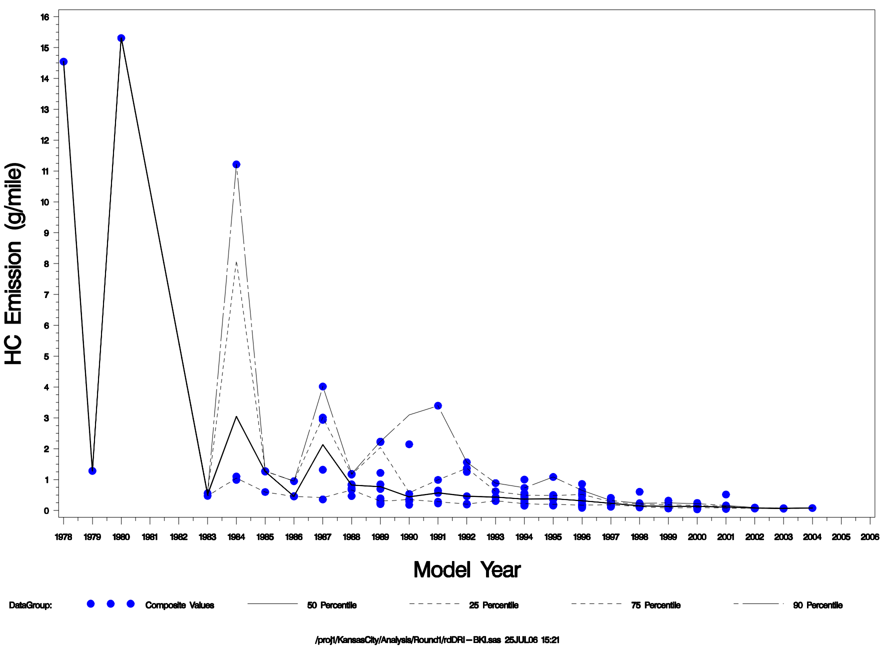
Composite Emission Values as a Function of Model Year (Linear Scale) – TRUCK



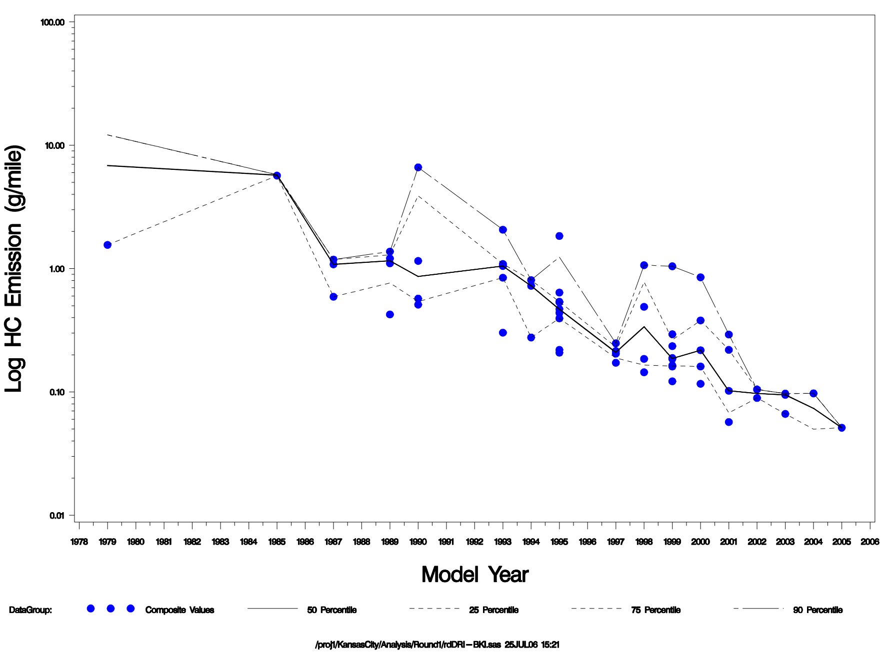
Composite Emission Values as a Function of Model Year (Log Scale) – CAR



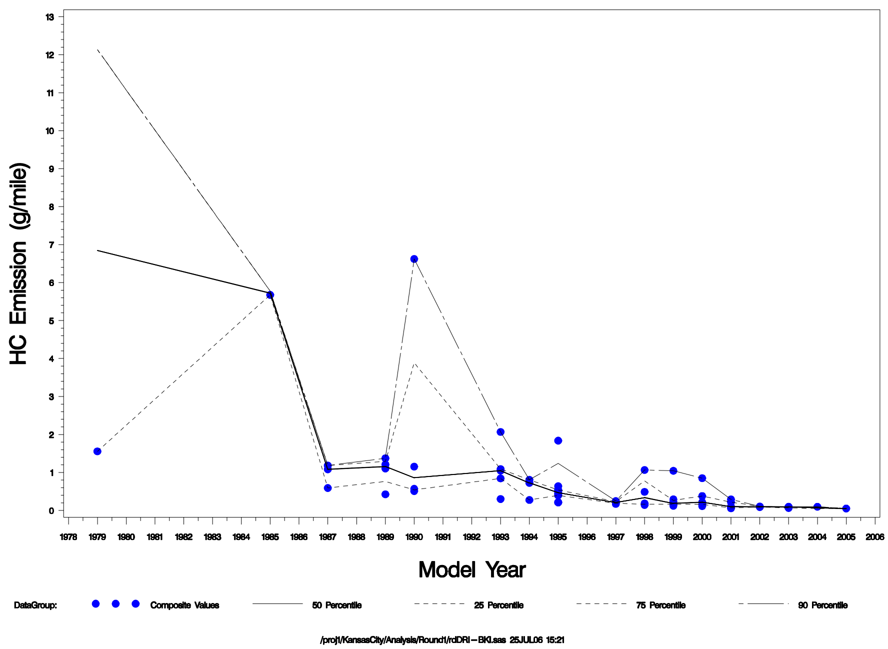
Composite Emission Values as a Function of Model Year (Linear Scale) – CAR



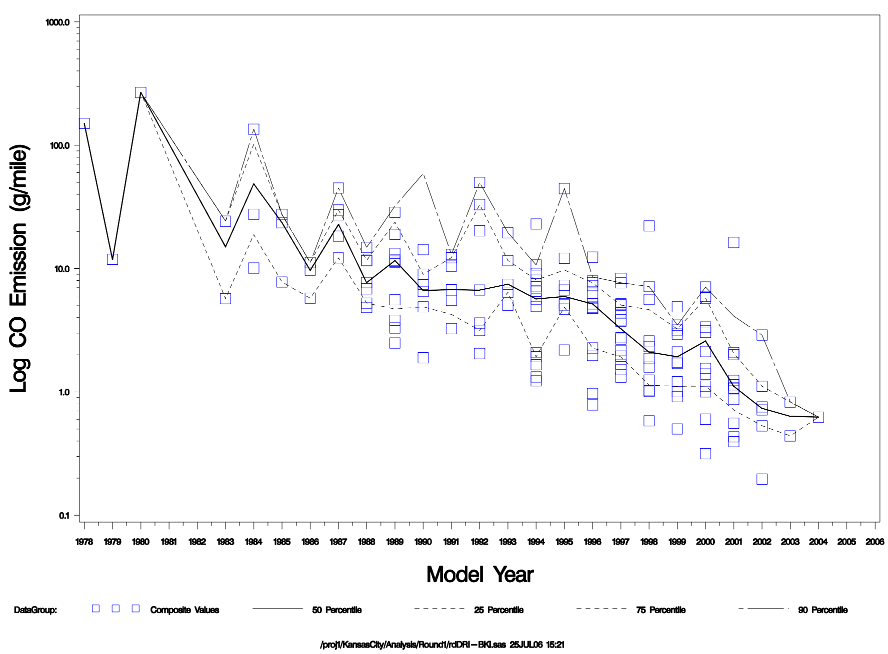
Composite Emission Values as a Function of Model Year (Log Scale) – TRUCK



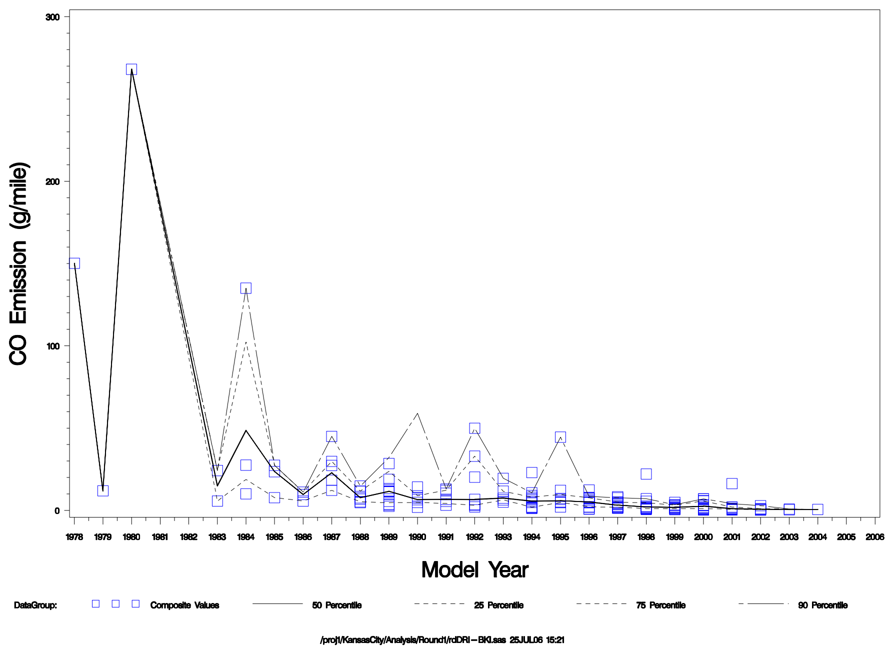
Composite Emission Values as a Function of Model Year (Linear Scale) – TRUCK



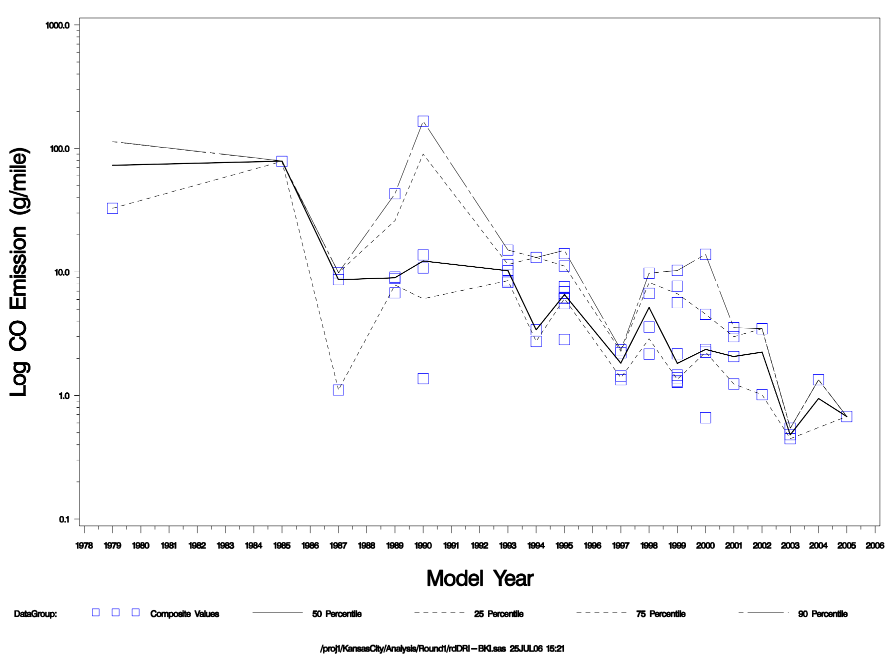
Composite Emission Values as a Function of Model Year (Log Scale) – CAR



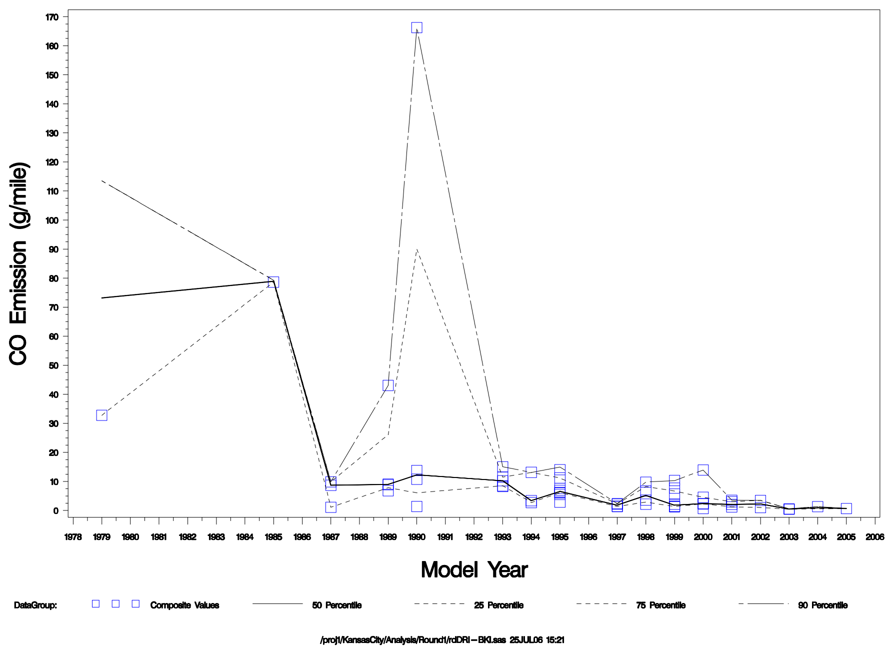
Composite Emission Values as a Function of Model Year (Linear Scale) – CAR



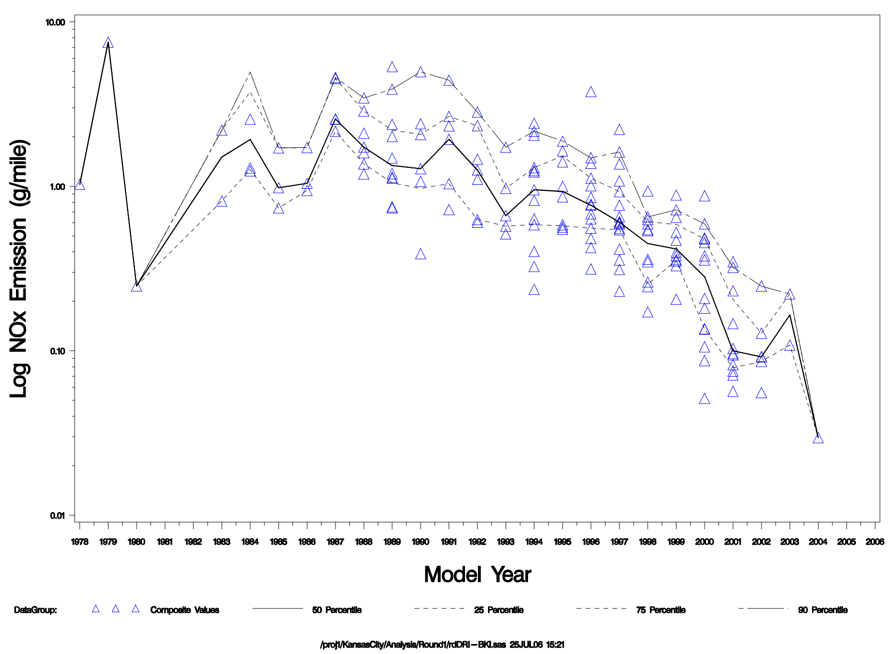
Composite Emission Values as a Function of Model Year (Log Scale) – TRUCK



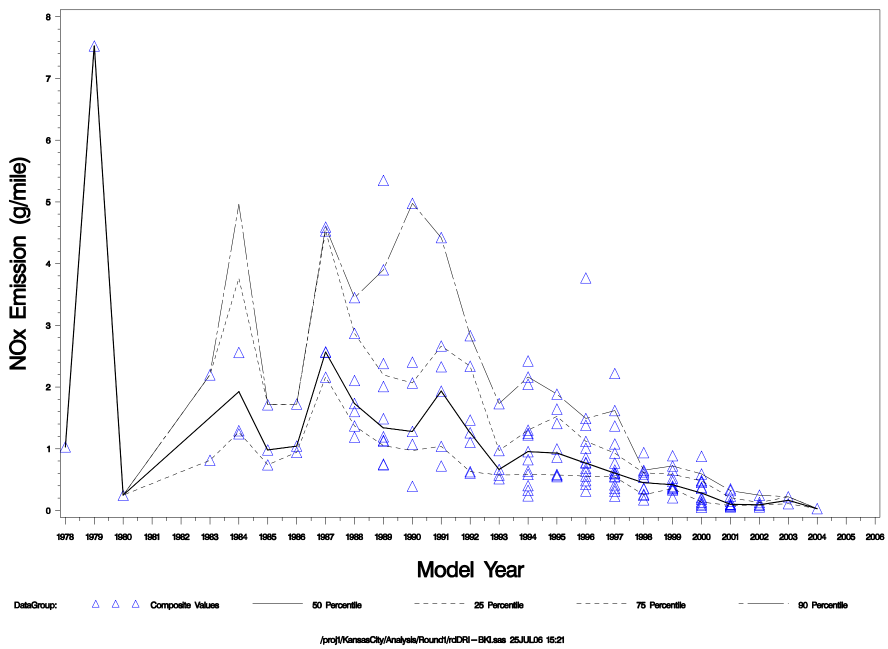
Composite Emission Values as a Function of Model Year (Linear Scale) – TRUCK



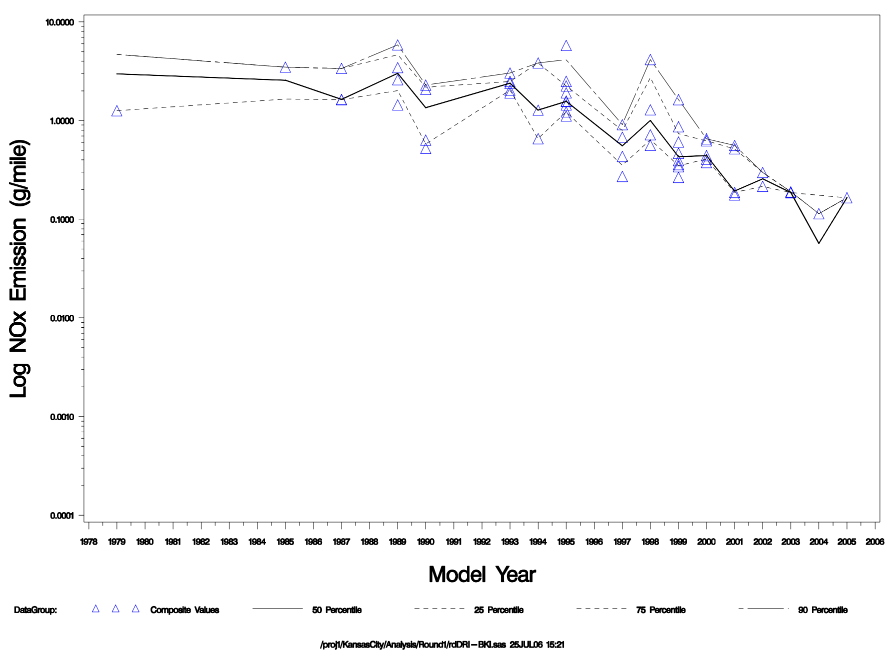
Composite Emission Values as a Function of Model Year (Log Scale) – CAR



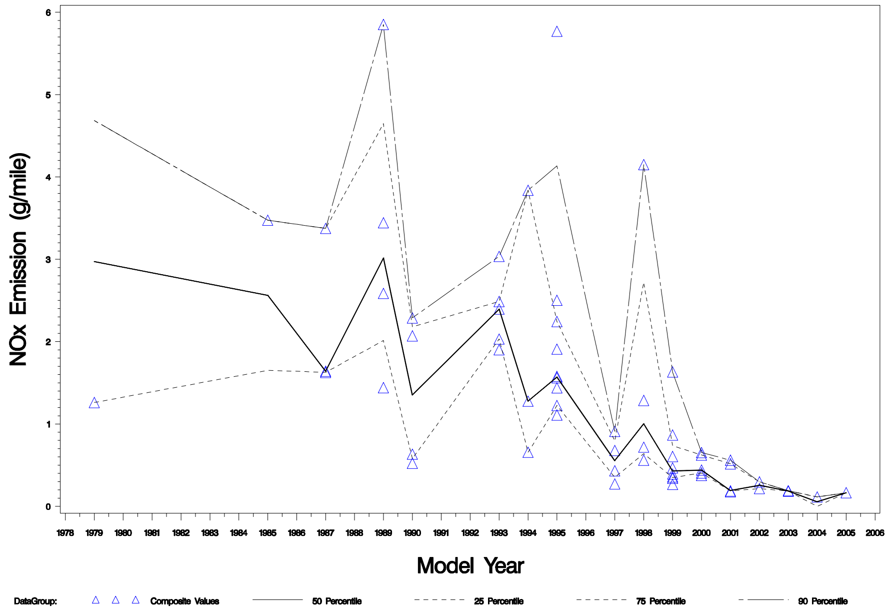
Composite Emission Values as a Function of Model Year (Linear Scale) – CAR



Composite Emission Values as a Function of Model Year (Log Scale) – TRUCK



Composite Emission Values as a Function of Model Year (Linear Scale) – TRUCK



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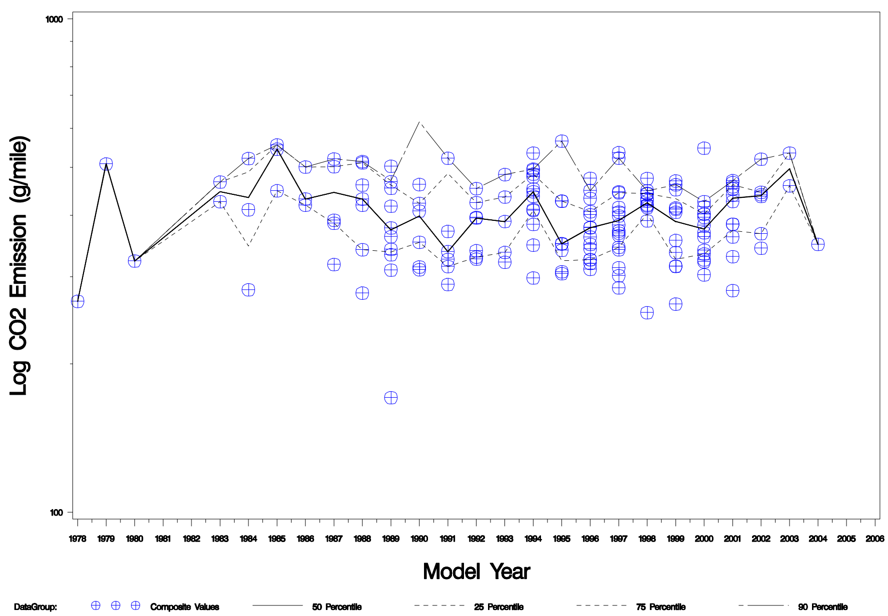
Composite Emission Values as a Function of Model Year (Log Scale) – CAR



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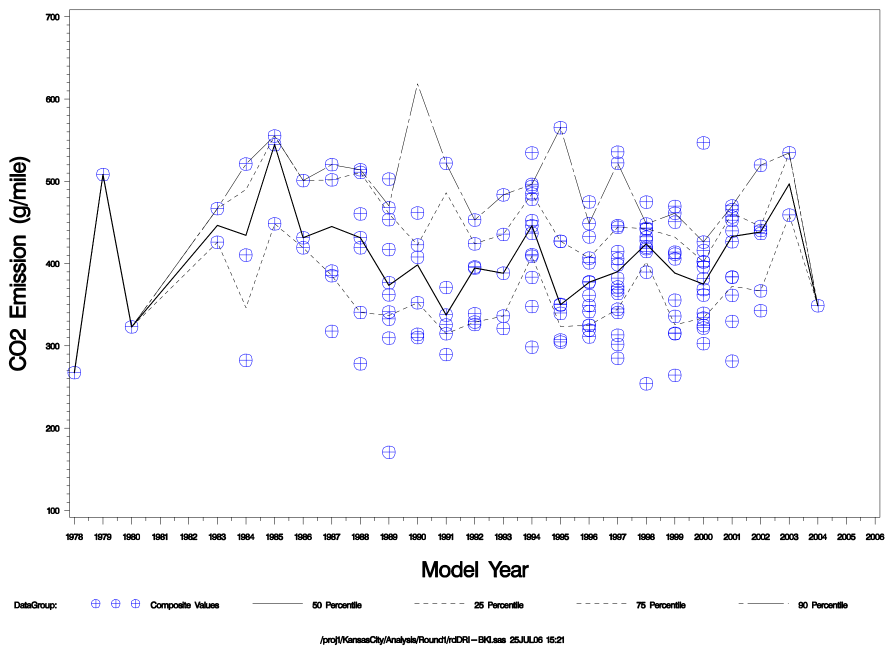
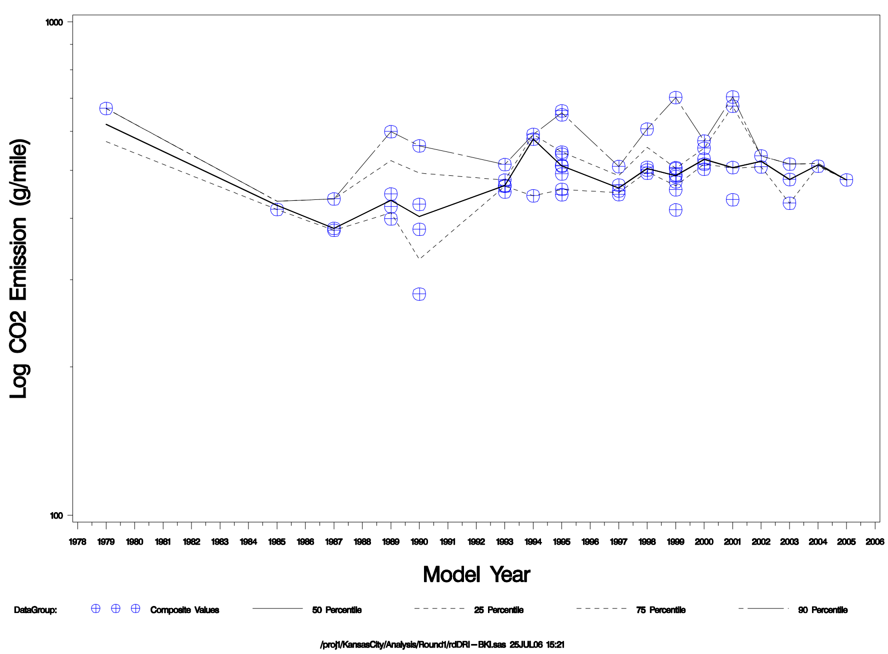
Composite Emission Values as a Function of Model Year (Linear Scale) – CAR



Composite Emission Values as a Function of Model Year (Log Scale) – TRUCK



Kansas City PM Characterization Study

Final Report

Appendix I
Install Guidelines

Assessment and Standards Division
Office of Transportation and Air Quality
U.S. Environmental Protection Agency

Sponsors:

National Renewable Energy Laboratory, U.S. Department of Energy
Federal Highway Administration, U.S. Department of Transportation
STAPPA-ALAPCO Emission Inventory Improvement Program
Coordinating Research Council Inc. (Project No. E-69)

Prepared for EPA by
Eastern Research Group, Incorporated
Austin, TX

Bevilacqua-Knight Incorporated
Oakland, CA

NuStats LLC
Austin, TX

Desert Research Institute
Reno, NV

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Revised April 2008 by EPA staff

United States
Environmental Protection
Agency

EPA420-R-08-009
April 2008

SEMTECH Installation Guidelines for the Kansas City Study
Part A: Task Instructions

Important Operation Notes:

Whenever updating SEMTECH firmware, individual bench firmware must be manually updated after the main flash card firmware is updated (i.e., the NDIV AMBII bench firmware must be manually updated through the Tech Support/Maintenance/Firmware update menu). This is not prompted, and not automatic.

Never insert or remove a memory card when the SEMTECH is powered up.

Never interchange memory cards between SEMTECH units without first reformatting the card.

Always back up all data on a memory card before reformatting the card.

When a memory card is first used in a SEMTECH, it must either be new or be reformatted.

To reformat a card, use a PCMCIA flashcard adaptor in a laptop's port. Open "my computer", and select the drive that represents the flash card. Then, in the file menu, select "format". Format as "FAT16", **NOT** "FAT32" ("FAT32" will probably be the default, and "FAT16" will probably just be listed as "FAT").

#	Task	Description
1	Connect power to SEMTECH	Connect power cable to SEMTECH.
2	Turn SEMTECH on	Press the front panel main power switch (to begin the 1-hour warm-up process).
3	Connect host computer	***Home / N/A*** If not already logged on, initialize SENSOR Tech PC software on host computer. Establish communications between host computer and SEMTECH unit with Ethernet cable or wireless connection.
4	Check FID pressure regulator	FID pressure regulator should read 30 PSIG. ENSURE the right nylon washer is used (not the seal cap that comes with the refilled FID bottles).
5	Open FID fuel supply	***N/A / N/A*** Open the FID cover on the back of the SEMTECH and open main FID gas bottle valve.
6	Verify FID fuel pressure	***Status / Summary*** Verify FID fuel pressure shown on summary screen is greater than 100 psig, and record FID fuel pressure on data collection sheet. Replace bottle if necessary (usage rate is 200 psig/hour) using guidelines in Section 7.6. If bottle replacement is necessary, ensure output pressure as shown on FID regulator is 30 psig. **Note: FID output pressure is critical as it affects HC reading.**

7	FID leak check	***Status / Summary*** Perform FID leak check by closing main FID bottle valve and measuring pressure drop. The displayed pressure should not drop by more than 1% in 30 seconds. If unit passes leak check, reopen main bottle valve, then close FID cover on back of unit. Otherwise, repair system and recheck.
8	Record system data	***Status / Summary*** Record the independently measured ambient temperature and relative humidity on the data collection sheet. Note that these measurements should be taken at the front of the vehicle (air introduced to engine). 9.1
9	Verify system pressures (FID off)	***Status / Flow*** SEMTECH system pressures are provided on the unit's "Flow" screen. Check to see no cap is on the ambient port at the back of the SEMTECH, and ensure that the various ports are open and able to flow. Quick disconnects should be depressed to allow a free flow of gasses on each port tested. Ensure SEMTECH system pressures at points shown as P1, P2, and P3 on SEMTECH flow diagram are within acceptable ranges for the various input flows (ambient, sample, span, and zero) and record values on the data collection sheet. Toggle between "ambient", "sample", "span", and "zero" inputs using the sample input button on the lower right of the flow screen. The "Allowable ∆P (mbar)" column in each table indicates the maximum allowable pressure drop (below ambient pressure) for each system location (disregard pressures for the shaded cells). If pressures drop below these limits, service unit as outlined in Section 12 of the SEMTECH user's manual.

Flow Point	Ambient Port	Sample Port	Zero Port	Span Port
	Allowable Pressure Drop (mbar)	Allowable Pressure Drop (mbar)	Allowable Pressure Drop (mbar)	Allowable Pressure Drop (mbar)
P1	-200	-300		
P2	-250	-250	-250	-250
P3	-250	-250	-250	-250

10	Perform a leak check	***System Setup / Leak Test*** Using the supplied soft plastic cap (or other appropriate device), seal the end of the ¼" sample port line to perform a leak check. On the host computer, select the "Start" button to initiate the leak test. The system will automatically perform the leak test and display the results. If the unit fails the leak check, repair as necessary. Once the unit has successfully completed the leak test, connect the ¼" sample port line to the exhaust flow port.
11	Verify analyzer sample rates	***System Setup / Configure 1*** Ensure the system's sample rates are set to the appropriate values (system control = 1000 ms, FID = 500 ms, NDIR=1200, NDUV = 500 ms.

12	Ignite FID	***System Setup / Configure 1*** Check the FID temperature using the Status/Summary screen. If the FID oven is 170 deg C or hotter, the FID may be ignited (ignition may be performed at lower temperatures, but fuel is then wasted during warm-up). To ignite the FID, select the flame "on" button. Approximately 15 minutes are required for the FID to come to equilibrium after the flame is ignited.
13	Install SEMTECH in vehicle	Move SEMTECH to vehicle. Ensure all necessary connections, lines, wires, etc. are installed and routed securely. Secure SEMTECH and battery in trunk.
14	Install FID exhaust and drain tubes	Attach the flexible tubing to the FID exhaust port and the ambient air port on the back of the unit. Route the tubing out of the trunk, and away from the vehicle's exhaust.
15	Install GPS receiver	Install magnetic GPS unit to top of vehicle, and connect GPS wiring to front of SEMTECH.
16	Install weather probe	Install the weather probe on roof or back window of vehicle using provided suction-cup. Connect wiring to front of the SEMTECH.
17	Install vehicle interface cable	Connect the SEMTECH to the vehicle's OBDII diagnostic link connector (DLC) with the supplied cable (running the cable past the back seat). The DLC is typically located under the vehicle's instrument panel, within arm's reach of the steering wheel.
18	Install exhaust flow meter tube and flow meter	Install external exhaust tube to bumper of vehicle and connect to tailpipe with appropriate adaptors and hardware. Note that the two flow meter connectors should be near the tube's outlet, and the sample port should be closer to the vehicle exhaust system than the flow meter connectors. Connect the flow meter to the SEMTECH with the two electrical lines. Connect the ¼" sample port line to the exhaust tube port. Note: Use 2" pitot tube flowmeters for engines < 3L, and 2.5" pitot tube flowmeters for engines > 3L. Ensure diameter of all tubing leading to flowmeter is equivalent to or great than diameter of the flowmeter.
19	Connect Power Supply	Connect power supply to battery, then plug charger in. Power supply should be used during warm-up and calibration.
20	Install trunk latch	Install the extended trunk latch to prevent trunk from closing on cables.

21	Establish vehicle interface (VI) communication	***System Setup / Configure 1*** On 1996 and newer vehicles, select the appropriate SEMTECH connector port (VI). Select the "Edit PIDs" button at the bottom of the screen, and verify the "LD OBDII" option is highlighted. Once LD OBDII is selected, use "set group" to save the LD PIDs. Then, determine the appropriate OBDII communication protocol for the vehicle, using handheld scanner info or guidelines in Part B of this document. To select the protocol, use the "Protocol" button's drop-down menu. After the protocol is selected, start the vehicle to ensure communication is established (as evidenced by a live data stream display shown on the "Vehicle Interface" screen.) If communication is not established, try another possible protocol. Several attempts may be necessary. Indicate which protocol is used (or indicate if the vehicle will not communicate) below. If communication isn't established, it may be necessary to pull the DLC connector off the vehicle for at least 10 seconds to allow the system to reset (probably after each time a new protocol is attempted). Also, if the SEMTECH is switched from AUX2 to VI or from VI to AUX2, the SEMTECH must be shut down and restarted to reset.
22	Set auxiliary inputs / outputs	***System Setup / Configure 2*** Set conditions for auxiliary inputs and outputs in the Configure 2 screen. At a minimum, this involves turning the GPS receiver on, and setting the units desired for CO measurement display. Input and/or output triggers may also be set in this screen, as well as ranges for analog outputs.
23	Review collected parameters	***Test / Road Test*** Switch the SEMTECH to the "Road Test" menu and review the display screen to ensure all desired information is available for recording.
24	Check for system faults and warnings	***Status / Faults*** Use the "System Information Bar" at the bottom of the SEMTECH screen to determine if system faults or warnings are present. If any faults or warnings are present, review and correct the faults and warnings listed in the "faults" display screen.
25	Verify battery voltage	***Status / Summary*** Temporarily remove power supply from battery and verify the battery voltage is sufficient for the testing to be performed (voltage should be over 13 volts). Record battery voltage in the space above. Replace the battery with a charged unit, if necessary. Immediately after checking voltage, replace power supply to avoid draining the battery during FID warm-up.

26	Set transport delays and other test parameters	***Test / Test Setup*** Under the "Settings" tab, use the "Edit Test Configuration" button to set the NDIR, NDUV, SCB, FID, methane FID, and EFM transport delays to 6, 6, 0, 5, 5, and 0, respectively (for the pitot tube flowmeter). Set all pollutant detection limits to zero, and set the "Calculation Control" parameters to the appropriate configuration (mass emission calc from flow meter, vehicle speed from GPS, and engine speed from ECM). Set calculation limits for engine speed at 1000 RPM/s, vehicle speed at 21.0 mph/s, fuel rate at 0.050 gal/s, and fuel specific dropout at 0.50 %C. Don't enter independent weather station data, unless the SEMTECH's weather station probe isn't used for some reason. Set the fuel H/C ratio at 1.8, and the fuel specific gravity at 0.744. For the NMHC cutter for the methane FID, enter the CH4 (propane) cut as 1.0 and the C2H6 (ethane) as 0.015. Then, select the "open marker window", and move this marker window to the upper right-hand of the screen for future use in setting markers in the recorded data file.
27	Configure analog inputs	***Test / Test Setup*** Still within the "Edit Test Configuration" window, select the "Analog Inputs" tab and configure all analog input data as appropriate.
29	Enter test identification info	***Test / Test Setup*** Still within the "Edit Test Configuration" window, select the "Test Info" tab and enter test identification information. Use the "Scratch Pad" to record any unique test conditions or situations and all appropriate test details. Also record the flowmeter ID # in the scratch pad.
28	Establish post-processing output groups	***Test / Test Setup*** Still within the "Edit Test Configuration" window, select the "Outputs" tab and ensure "select all" is select for output post-processing.
30	Save setup	***Test / Test Setup*** After all test setup parameters are selected, switch back to the "Setup" tab, and click on the "Save" button. **IMPORTANT: All test settings will be lost unless the data is saved**.
31	Verify warm-up	***Status / Summary*** Use the "System Information Bar" at the bottom of the SEMTECH screen to determine if warm-up has been completed, and view details in the "Status / Summary" screen. When the SEMTECH indicates warm-up is complete, record the FID oven temperature and chiller temperature on the data collection sheet.
32	Record zero, audit and span gas bottle information	Record cylinder numbers for the zero, audit and span gasses on the data collection sheet. Begin the session manager. Note that gas concentrations that may be used for the various audits and spans are provided in the "Calibration and Audit Gas Blend Ranges" section in Part C of this document.

33	Perform a zero calibration	***System Setup / Zero*** Once the system is fully warmed up, and the FID has been burning for at least 15 minutes, the system may be zeroed (ensure your session is started). To prepare for a zero, hook the zero gas bottle to the zero port on the front panel of the unit, open the zero air valve, and adjust the pressure regulator to approximately 30 psig. Then, on the SEMTECH display, select all gas channels (except CH4, methane, which would be measured by the additional methane FID), select the zero port, then click the zero button. Note the HC (ppmC3) is ppm HC expressed as propane, measured by NDIR, and the THC (PPM) is total hydrocarbon measured by the FID). After the zero calibration is complete, close the zero bottle valve and disconnect the zero air tube from the SEMTECH zero port. Note: do not zero on ambient air, as this will result in decreased accuracy of CO_2 readings.
34	Perform a gas audit	***System Setup / Audit*** After the zero calibration has been completed, the gas audit may be performed. To prepare for a gas audit, determine the proper gas range (use high concentration range for 1995 and older vehicles, low concentration range for 1996 and newer vehicles), hook the audit gas bottle to the span port on the front panel of the unit, open the audit gas bottle valve, and adjust the pressure regulator to approximately 30 psig. Then, on the SEMTECH display, select all gasses to be audited (excluding O_2 and CH4, the methane FID), enter the bottle concentrations for each of the gasses, and select the appropriate type of hydrocarbon gas (i.e., methane or propane). Note the HC (ppmC3) is ppm HC expressed as propane, measured by NDIR, and the THC (PPM) is total hydrocarbon measured by the FID). Select the “span” port, and click the start button to initiate the audit. If unit fails the audit, perform a span calibration (described below) and then re-audit. After the gas audit is complete, close the audit bottle valve and disconnect the audit gas tube from the SEMTECH span port.
35	Perform an O_2 audit	***System Setup / Audit*** After the gas audit has been completed, perform an O_2 audit. To perform an O_2 audit, select O_2 on the SEMTECH unit, enter 20.9 % as the O_2 concentration, and select “ambient” as the port (if not automatic). Begin the audit by selecting the start button. If unit fails the O_2 audit, perform a span calibration (described below) and then re-audit.

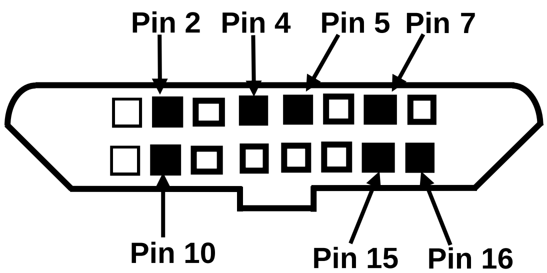
36	Perform a span calibration	***System Setup / Span*** If the unit fails any part of the gas or O_2 audit, a span calibration must be performed to recalibrate the unit. To prepare for a span calibration, determine the proper gas range (use high concentration range for 1995 and older vehicles, low concentration range for 1996 and newer vehicles), hook the appropriate span gas bottle to the span port on the front panel of the unit (see "Calibration and Audit Gas Blend Ranges" section at the end of this checklist to determine the appropriate span gas), open the span gas bottle valve, and adjust the pressure regulator to approximately 30 psig. Select the appropriate THC FID range for the span calibration (under the "Settings/Configure 1" menu). Then, on the SEMTECH display, select all gasses to be spanned (excluding O_2 and CH4, the methane FID), enter the bottle concentrations for each of the gasses, select the appropriate type of hydrocarbon gas (i.e., methane or propane), and select the appropriate span range (guidelines are listed in Part C of this document). Note the HC (ppmC3) is ppm HC expressed as propane, measured by NDIR, and the THC (PPM) is total hydrocarbon measured by the FID). Select the "span" port, and click the start button to initiate the span calibration. If unit fails the calibration, perform necessary repairs, re-zero, and then perform another span calibration. After the span calibration is complete, close the span calibration bottle valve and disconnect the span gas tube from the SEMTECH span port.
37	Perform an O_2 calibration	***System Setup / Span*** After the span calibration has been completed, perform an O_2 calibration. To perform an O_2 calibration, select O_2 on the SEMTECH unit, enter 20.9 % as the O_2 concentration, and select "ambient" as the port (if not automatic). Click the start button to begin the calibration. If unit fails the O_2 calibration, perform necessary repairs, re-zero, and then perform another O_2 calibration. After the span and O_2 calibrations are complete, perform gas and O_2 follow-up audits.
38	Perform a gas re-audit	***System Setup / Audit*** This post-calibration audit only needs to be performed if unit fails original audit and a span calibration is performed. Use "gas audit" procedures outlined above.
39	Perform an O_2 re-audit	***System Setup / Audit*** This post-calibration audit only needs to be performed if unit fails original audit and an O_2 calibration is performed. Use "O_2 audit" procedures outlined above.
40	Prepare vehicle for testing	Remove the power supply, extension cord, and any other connections external to the vehicle. Walk around and inspect the vehicle to make sure nothing is being overlooked. Verify suction cups and external exhaust pipe are still secure. Latch the trunk with the latch extension.
41	Switch input from ambient to exhaust sample	***Test / Test Setup*** Prior to starting the test, change the source input from "Ambient Air" to "Sample", using the input source selection button displayed at the lower right corner of the screen.

42	Begin recording test record	***Test / Test Setup*** Begin recording data by clicking the “Start” button on the Test Setup screen.
43	Set proper HC range	Immediately before testing, start the vehicle, note the HC reading (in the road test screen), and write the HC reading (PPM) on the first page of the vehicle information packet (to help dyne SEMTECH folks set it properly). Then, select the appropriate THC FID range for the vehicle (under the “Settings/Configure 1” menu). Nearly all vehicles will have HC readings over 1000 PPM (some only at cold-start), so generally the range is either going to be set at 10,000 or 40,000 (some vehicles ARE over 10,000). NOTE: range setting can be changed AFTER the session is started, and even after a test is started. Please watch the road test screen during testing. If readings max out in the road test screen, switch to the next higher range.
44	Conduct testing	Conduct drive (or dyne) testing as required. Watch the CO and CO2 readings in the road test screen during testing. If the sum of the CO and CO2 readings is less than 13, generally excessive dilution is occurring (hybrids may be exception). Also check road test screen for GPS, VI, exhaust flow, exhaust flow temp, weather station, aux temp, and HC range. Using the emissions screen, evaluate cumulative MPG values after a short drive.
45	Set post-test time-alignment stamp	After all testing has been completed, but before stopping data collection, turn the vehicle off, wait for a few seconds, then start the vehicle up again. This provides a second (post-test) time-alignment stamp for all recorded parameters.
46	Perform a gas audit	***System Setup / Audit*** Immediately after testing has been completed, and before any equipment is removed from the vehicle, perform a post-test gas audit. This step is necessary in order to help quantify analyzer drift during testing. Use “gas audit” procedures outlined above.
47	Backup and transfer data	Test data should be copied to a remote, non-volatile medium and archived.
48	Recharge batteries	After testing is concluded, ensure all batteries are charged for future testing. (Note: Make sure a powered-on SEMTECH is not connected to the power supply while charging batteries. The power supply is unable to charge batteries and power the SEMTECH unit concurrently.

SEMTECH Installation Guidelines for the Kansas City Study
Part B: Selection of OBDII Communication Protocol for VI

Try to find the correct communication protocol using the “OBDII Generic Communication Protocols by Manufacturer” table. If the vehicle is not listed, or if communication is not established, the general guidance below may be of benefit.

The image below indicates pin locations on a typical OBDII connector. Metal contacts in these pin locations, as described in the table below, can sometimes be used to determine the communication protocol used by the vehicle.



Communication Protocol	Pin Locations and Typical Manufacturers
SAE-J1850 VPW (Variable Pulse Width)	**Pins 2, 4, 5, and 16 (NOT 10)** General Motors vehicles (including Buick, Cadillac, Chevrolet, GMC, Olds, Pontiac, Saturn), some “older” Chrysler vehicles (96-99) and select other vehicles (‘03 Chrysler PT Cruiser, ‘02 Dodge Neon, ’98 Isuzo Trooper, ’03 Jeep Liberty, and ’97 Toyota Corolla)
SAE-J1850 PWM (Pulse Width Modulation)	**Pins 2, 4, 5, 10, and 16** Generally “older” (96-99) Ford vehicles (including Mercury and the Mazda B-Series pickups and Tribute)
ISO-9141-2	**Pins 4, 5, 7, 16, and sometimes 15** Typically newer Chrysler, Ford, European, and most Asian vehicles (such as Acura, Audi, BMW, Citroen, Fiat, Honda, Hyundai, Infiniti, Jaguar, Kia, Land Rover, Mazda, Mercedes-Benz, Mini, Mitsubishi, Nissan, Open, Peugeot, Renault, Saab, Subaru, Suzuki, Toyota, Volkswagen, Volvo, and some oddballs such as ’96 Chrysler vans, ’97 Chev Camaro, various Dodge vehicles, some Jeep Grand Cherokees, and the ’96 Geo Metro)
ISO-14230 (Keyword Protocol 2000)	**Pins 4, 5, 7, 16, and sometimes 15** This will probably not be too common. If found, perhaps newer Chrysler, Ford, European, and Asian vehicles.
ISO-11898 (Controller Area Network)	A few manufacturers, such as Ford, Saturn (Ion), Saab (9-3), and Mazda began phasing CAN into their fleets in 2003. CAN may also be found in select model year 2004 vehicles manufactured by Bentley, Chrysler, Ford (family), GM (family), Saab, Mazda, Mercedes, Toyota/Lexus, and Volvo.
ISO-15765 (Controller Area Network)	
SAE-J1939 (Controller Area Network)	This is primarily used on heavy-duty vehicles
SAE-J1708	This is primarily used on heavy-duty vehicles

SEMTECH Installation Guidelines for the Kansas City Study
Part C: Audit and Span Gas Information

Calibration and Audit Gas Blend Ranges

Low-range gasses – Use blends similar to that shown in the table below when auditing and span calibrating the SEMTECH for testing newer, low-emitting vehicles.

Gas	Audit Gas Blend	Span Cal Gas Blend
HC	30 to 50 ppm (propane) (or 90 – 150 ppm THC)	200 – 300 ppm (propane) (or 600 – 900 ppm THC)
CO	200 – 400 ppm	1,200 – 1,400 ppm
CO_2	4 – 6 %	12 – 14 %
NO_x	200 – 400 ppm	1,500 – 2,000 ppm

High-range gasses – Use blends similar to those shown in the table below when auditing and span calibrating the SEMTECH for testing older, potentially higher-emitting vehicles. Note that these are standardized BAR97 blends.

Gas	Audit Gas Blend (BAR97 Low)	Span Cal Gas Blend (BAR97 High)
HC	300 ppm (propane) (or 900 ppm THC)	3,200 ppm (propane) (or 9,600 ppm THC)
CO	0.5% (5,000 ppm)	8%
CO_2	6 %	12 %
NO_x	300 ppm	3,000 ppm

Note: When performing a span calibration, use the span range appropriate for the HC concentration in the blend being used. The range selected should be within 15% of the HC concentration in the gas blend. Use the 1,000 ppm range for the low-range gas span, and the 10,000 ppm range for the high-range gas span.

Note: To convert from a percentage to PPM, multiply by 10,000

SEMTECH Installation Guidelines for the Kansas City Study
Part D: Performing Visual Inspections of Emissions Equipment

For 1970 and newer vehicles, an emissions control component inspection should begin with a review of the vehicle's "vehicle emissions control" (VEC) label. If present, this will be located in the engine compartment, generally on the underside of the hood. The VEC label lists the vehicle's type of emissions certification, vehicle model year, and the pollution control components that were originally present on the vehicle. After the VEC label has been reviewed, the components should be physically inspected, to ensure they appear functional and have not been removed (removal is common for older vehicles).

Positive Crankcase Ventilation (PCV) System

Inspect engines for rubber lines ≈ 5/8" in diameter running from the valve cover to the intake manifold, intake air plenum, or air filter assembly. If these are present, the engine is probably equipped with a PCV valve. Verify by looking for the valve inserted into one of the hoses going into the valve cover.

Thermostatic Air Cleaner (TAC) System

Generally present on carbureted vehicles (although some throttle-body injected vehicles may be equipped with a TAC system). A TAC system may be identified by a flexible tube approximately 2" in diameter routed from an exhaust manifold to the air cleaner's inlet snorkel. Note damaged/missing tubing or snorkel valves.

Air Injection System (AIS)

This is generally either an air pump mounted on the front of the engine and driven by a belt or a "pulse air valve" box also mounted near the front of the engine. Either system will have tubes leading from the pump (or valve) to the exhaust manifold or exhaust pipe. Please note missing belts or damaged/missing tubing, since these will render the system inoperable.

Exhaust Gas Recirculation (ERG) System

The EGR valve is usually located on intake manifold or intake air plenum, with an external metal tube often connecting a point on the exhaust manifold to the EGR valve. The EGR valve is generally 2" to 3" high and 2" to 3" in diameter and will have either a vacuum diaphragm or an electronic solenoid.

Evaporative Emissions Control System (EECS)

Generally the best way to determine if a vehicle has an EECS is by reading the VEC label. The EECS is a combination of tubing, canisters, and valves attached to the fuel tank and fuel lines to control evaporative emissions. If information cannot be obtained from the vehicles' VEC, indicate "unknown" on the data collection sheet.

Catalytic Converter

The catalytic converter is located in the exhaust system upstream of the muffler. Unlike mufflers, which generally have square ends, catalytic converters are typically tapered at their ends. On newer vehicles, catalytic converters are typically integrated with or directly behind the exhaust manifold.

Fuel Fill Pipe Restrictor

This is simply a thin metal ring inside the fuel filler neck inlet (to prevent use of large-diameter leaded fuel nozzle). Remove fuel cap to verify presence of a fill pipe restrictor.

Oxygen Sensors

These are designated as O2 or HO2S on VEC labels. Fuel injected vehicles (including TBI & TPI) will be equipped with oxygen sensors. Verify presence at an O2 sensor by inspecting the exhaust system upstream of the catalytic converter. The O2 sensor will be located in the exhaust manifold or pipe directly after the manifold. The sensor will generally be the size of a spark plug and have one or more wires coming from it. Please note any missing oxygen sensors or damaged/disconnected wiring.

SEMTECH Installation Guidelines for the Kansas City Study
Part E: How to Configure Host Computer to Communication With the SEMTECH through an Ethernet Cable

These are based on XP operating systems. Other systems may vary somewhat.

Select “My Computer” Icon on desktop

Select “Control Panel” when the “My Computer” screen pops up

Select the “Network Connections” icon in the “Control Panel” screen

Either create new connection (LAN, NOT wireless) or open existing LAN connection

Ensure “Internet Protocol” TCP/IP is checked, and highlighted

Once the “Internet Protocol TCP/IP” is highlighted, select “Properties”

Select “Use the following IP address”, and enter “10.10.1.#”, where number is the last 2 digits of the SEMTECH’s IP address (use NO leading zeros). If the SEMTECH’s IP address is unknown, this may be assigned. Don’t assign it “55” (since this is the default for new units), and don’t assign it to be the same as any of the other SEMTECHs (otherwise wireless communication will be screwed up). Then, enter “255.255.255.0” for the subnet mask. ” Leave everything else on the screen (such as default gateway, preferred DNS server, etc.) blank. Select “Use the following DNS server addresses”, but leave all rows blank. Select “OK”, and exit the connection screens.

If after SEMTECH login the host does not recognize the SEMTECH, try creating a connection manually by right-clicking on the connection icon on the lower right of the screen.

Kansas City PM Characterization Study

Final Report

Appendix J
Round 2 SEMTECH Checklist

Assessment and Standards Division
Office of Transportation and Air Quality
U.S. Environmental Protection Agency

Sponsors:

National Renewable Energy Laboratory, U.S. Department of Energy
Federal Highway Administration, U.S. Department of Transportation
STAPPA-ALAPCO Emission Inventory Improvement Program
Coordinating Research Council Inc. (Project No. E-69)

Prepared for EPA by
Eastern Research Group, Incorporated
Austin, TX

Bevilacqua-Knight Incorporated
Oakland, CA

NuStats LLC
Austin, TX

Desert Research Institute
Reno, NV

EPA Contract No. GS 10F-0036K

October 27,2006
Revised April 2008 by EPA staff

EPA United States Environmental Protection Agency

EPA420-R-08-009
April 2008

Vehicle License__________________ **Date**_________________

VEHICLE INFORMATION PACKET FOR KC 480 VEHICLE STUDY ROUND 2 TESTING

General Vehicle Information Packet Cover sheet

Make: ________________ Model: _____________________ Model Year: ______________

Color: ________________ # of doors: ______________

BKI Information Below

BKI Run Number(s):			

Fuel Collected? ❑ Yes ❑ No Oil Collected? ❑ Yes ❑ No

Test Inertia: _____________________ Test HP ____________________

Smoke Observation: ❑ None ❑ Light ❑ Medium ❑ Heavy

Did MIL illuminate during testing? Yes / No If "Yes", please note date(s) and time(s), download the trouble codes, and list the trouble codes on the next page.

____

____

____

____

Vehicle License_______________ **Date**_____________

KC 480 Vehicle Study SEMTECH Round 2 Testing
General Vehicle Information

ERG staff to perform OBDII scans and record OBDII information

---

Pre-Testing OBDII Check

Please list communication protocol shown on code reader display: ____________________

Turn vehicle on. Is MIL light on? (check engine, service ***engine*** soon) ❑ Yes ❑ No

Downloaded MIL Status: ❑ MIL Commanded on ❑ MIL Commanded off

Please indicate which OBDII monitors are ***NOT*** ready: ❑ Evap system ❑ EGR

❑ Catalyst ❑ Ox Sensor Other(s): ____________________________ ❑ None

Confirmed Codes:	**P**	**P**	**P**
	P	**P**	❑ None
Pending Codes:	**P**	**P**	**P**
	P	**P**	❑ None

Post-Testing OBDII Check (only if MIL illuminates during testing)

Turn vehicle on. Is MIL light on? (check engine, service ***engine*** soon) ❑ Yes ❑ No

Downloaded MIL Status: ❑ MIL Commanded on ❑ MIL Commanded off

Please indicate which OBDII monitors are ***NOT*** ready: ❑ Evap system ❑ EGR

❑ Catalyst ❑ Ox Sensor Other(s): ____________________________ ❑ None

Confirmed Codes:	**P**	**P**	**P**
	P	**P**	❑ None
Pending Codes:	**P**	**P**	**P**
	P	**P**	❑ None

Vehicle License______________ **Date**____________

KC 480 Vehicle Study SEMTECH Round 2 Testing
General Vehicle Information

Odometer: ____________ (Miles / Km) Air Conditioning? Yes / No

VIN: | | | | | | | | | | | | | | | | | |

Vehicle Type: ❑ Car ❑ Truck ❑ Van ❑ SUV

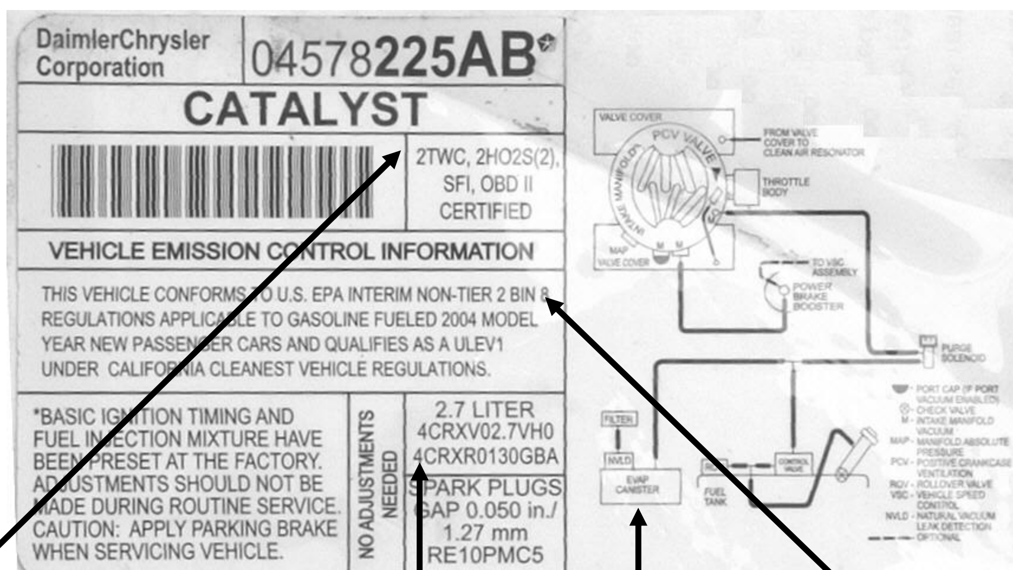
Mfr Date (on doorjamb) ___/____ ***Total*** GVWR (on doorjamb): _________ Lbs / kg

Drive Type: ❑ FWD ❑ RWD ❑ On-demand 4WD ❑ Full-time 4WD

❑ Automatic transmission	❑ Manual transmission
❑ With overdrive ❑ Without overdrive	Circle # of Forward Gears: 3 4 5 6, Unk

Engine and Emission Survey Information

(note: the majority of the following information is listed on the underhood emissions certification decal, as shown below. Use Part D of the “Installation Guidelines” for additional info on visually confirming items.)



This box lists the emission control components: 2TWC = catalytic converters (dual three-way); 2HO2S = oxygen sensors (two heated ox sensors); SFI = port injection (sequential fuel injection). Look here also for “PCV”, AIR, TAC, and EGR.

This box lists the displacement (2.7 L), engine family (top #), and evaporative family (bottom #).

This area shows the engine’s vacuum routing. Look here for evaporative system (including the words “evap” and or “canister”). Also check for PCV and EGR.

This box lists engine certification year (2004) and certification level (Tier 2, Bin 8, California ULEV1)

Vehicle License_______________ **Date**_____________

KC 480 Vehicle Study SEMTECH Round 2 Testing
General Vehicle Information

of Cylinders: ________ Displacement: _______________ In^3 L

Note: The underhood label will list the displacement, but probably not the # of cylinders. The # of ignition wires may indicate the number of cylinders. If you're not certain, just leave "# of cylinders" blank.

Engine Certification Year _______________ ❑ OBD I ❑ OBD II ❑ No OBD

Emissions Cert: ❑ USEPA ❑ California ❑ Canada

Other certification info from hood sticker (i.e., Tier 2, ULEV, etc.) _______________________

System	Yes	No	Unk	System	Yes	No	Unk
Positive Crankcase Ventilation (*listed as "PCV" on label*)	❑	❑	❑	Evaporative Emissions Control System (*Diagram will be on label, if present. Look for words "evap canister"*)	❑	❑	❑
Thermostatic Air Cleaner Assembly (*listed as "TAC" on label. Verify assembly is still present.*)	❑	❑	❑	Catalytic Converter (*listed as "CAT", "TWC", etc. on label. Visually verify presence of cat under vehicle.*)	❑	❑	❑
Air Injection (*listed as "AIR" on label. Verify system is still present.*)	❑	❑	❑	Fuel Fillpipe Restrictor *(Remove fuel cap to verify)*	❑	❑	❑
Exhaust Gas Recirculation (*listed as "EGR" on label, verify still present if vehicle is older than 1996.*)	❑	❑	❑	Oxygen Sensor (*listed as "Ox", "O2", or "HO2S" on label. Verify presence if vehicle is older than 1996.*)	❑	❑	❑

Engine Family (top # on sticker) ________________________________

Evaporative Family (bottom # on sticker) ________________________________

Fuel Delivery: ❑ Carb ❑ Port Fuel-Injected ❑ Throttle-body ❑ Hybrid

Note: Port fuel-injected vehicles will have "MPI", "SFI", "MPFI" listed on underhood sticker. Note that the presence of the words "throttle-body" on label does not mean the vehicle has "throttle-body" fuel delivery (throttle-body on the label generally refers to point of air delivery). Please leave fuel delivery blank if not certain.

Air Intake: ❑ Normal ❑ Turbocharged ❑ Supercharged

Part 1: SEMTECH Installation for Round 2 Preconditioning Drives Data Collection Sheet

Date __ __ / __ __ / __ __   Vehicle License:____________________

Installation Tech: ____________________   PEM Serial Number __ __ __ - __ __ __ __

SEMTECH System Information

SEMTECH Status Summary Screen					
FID Fuel Pressure:	___________	(psig)	Battery Voltage:	___________	(V)
Independent Weather Station Data					
Ambient Temperature:	___________	(deg C)	Relative Humidity:	___________	(%)
SEMTECH Status Summary Screen (After warmup is complete)					
FID Oven Temperature:	___________	(deg C)	Chiller Temp:	___________	(deg C)
SEMTECH System Pressures					
$P_{ambient}$	___________				
P_1 ___________ (mbar)	P_2 ___________ (mbar)	P_3 ___________ (mbar)			

OBDII Communication Protocol for Vehicle Interface

Note: use the "AutoXray" OBDII scanner to determine type of communication protocol. If that is unsuccessful, use Part B of the "Installation Guidelines".

❑ SAE-J1850 VPW	❑ SAE-J1850 PWM	❑ ISO-14230	❑ ISO-9141-2
❑ ISO-11898	❑ ISO-15765	❑ SAE-J1939	❑ SAE-J1708
❑ Vehicle will not communicate using any of the above communication protocols.			

Zero, Audit, and Span Cylinder Numbers

Zero gas cylinder ID #	Audit Gas Cylinder ID #	Span Gas Cylinder ID #

Part 1: SEMTECH Installation for Round 2 Preconditioning Drives
Installation Checklist

Vehicle License__________________

✔	#	Task
❑	1 2 12 13 19	Install SEMTECH & battery in trunk, connect power supply, turn SEMTECH on. Ensure positive battery terminal is covered with boot.
❑	4, 5, 14	Install FID drain and autozero (ambient) tubes, run outside trunk
❑	15	Install GPS (wipe base clean)
❑	16	Install weather probe
❑	17	Install VI (where it won't be kicked)
❑	18	Install and purge correct size flow meter and ***matched*** control box. Ensure shielding is away from battery.
❑	N/A	Plug in external thermocouple
❑	3	Logon with host computer
❑	N/A	Verify comm. with right SEMTECH
❑	10	Perform a SEMTECH leak check
❑	11	Verify analyzer sample intervals are system control = 1000 ms, FID = 500 ms, NDIR=1200, NDUV = 500 ms.
❑	21	Acquire VI
❑	43	Set HC range to 10,000.
❑	22	Acquire GPS, aux temp, & flowmeter. Set CO units to PPM.
❑	N/A	In Config 3, enable autozero (all but CH4), 120 mins, 5 ppm drift)
❑	7	Close FID bottle, then do a ***FID*** leak check (<1 psi/minute decay)
❑	25	Disconnect power supply, verify and record battery voltage
❑	8	Record ambient conditions
❑	9	Ensure P1, P2, P3 are within 200 psi

✔	#	Task
❑	12	Open FID bottle, Ignite FID (15 minutes before testing). Check FID pressure, replace if under 200 PSI. Ensure outlet regulator is set to 30 PSI output.
❑	N/A	Ensure EXFM box pressure/temp LEDs are off, and autozero is on
❑	26	Set transport delays (6,6,0,5,5,0), mass calc from flow meter, speed from GPS, RPM from ECM. Calc limits @ 1000 RPM/s, 21.0 mph/s, 0.050 gal/s, & 0.50 %C. HC ratio @ 1.8 & SG @ 0.744.
❑	28 29 30	Enter test info, flowmeter ID #, notes, select all post-processing output groups, save setup and exit
❑	44	Start vehicle & verify data in road test screen
❑	NA	Use "ST_PLATE_precond" for filename
❑	24 31	Check for system faults and warnings, verify warm-up, record temperatures
❑	NA	After installation review, begin session mgr
❑	32	Record cylinder numbers on sheet
❑	33	Perform a zero calibration
❑	34- 39	Perform gas and O_2 audits (and calibrations and reaudits, if needed).
❑	42	START THE TEST (in the session manager)
❑	40	Prepare vehicle for testing, close trunk, have picture taken of flowmeter setup
❑	N/A	Do precond run, watch road test screen
❑	46	After precond run, stop test, do a post-test audit and then a zero (zero on ambient)
❑	NA	Stop and close the session manager, turn FID off
❑	N/A	Remove equipment, purge flowmeter, charge battery
❑	N/A	Ensure test file is uploaded

Part 2: SEMTECH Installation for Round 2 Dyne Sampling Data Collection Sheet

Date __ __ / __ __ / __ __ Vehicle License____________________

Installation Tech: ____________________ PEM Serial Number __ __ __ - __ __ __ __

SEMTECH System Information

SEMTECH Status Summary Screen					
FID Fuel Pressure:	____________	(psig)			
Independent Weather Station Data					
Ambient Temperature:	____________	(deg C)	Relative Humidity:	___________	(%)
SEMTECH Status Summary Screen (After warmup is complete)					
FID Oven Temperature:	____________	(deg C)	Chiller Temp:	___________	(deg C)
SEMTECH System Pressures					
$P_{ambient}$	_______________				
P_1 _______________ (mbar)	P_2	_____________ (mbar)	P_3	_____________	(mbar)

OBDII Communication Protocol for Vehicle Interface

Note: use the "AutoXray" OBDII scanner to determine type of communication protocol. If that is unsuccessful, use Part B of the "Installation Guidelines".

❏ SAE-J1850 VPW	❏ SAE-J1850 PWM	❏ ISO-14230	❏ ISO-9141-2
❏ ISO-11898	❏ ISO-15765	❏ SAE-J1939	❏ SAE-J1708
❏ Vehicle will not communicate using any of the above communication protocols.			

Zero, Audit, and Span Gas Information

Zero gas cylinder ID #	Audit Gas Cylinder ID #	Span Gas Cylinder ID #

Part 2: SEMTECH Installation for Round 2 Dyne Sampling
Installation Checklist

Vehicle License ___________________

✔	#	Task	✔	#	Task
❑	16	Ensure weather probe & external temp thermocouple are hooked up	❑	26	Set transport delays (6,6,0,5,5,0), mass calc from flow meter, speed from ECM, RPM from ECM. Calc limits @ 1000 RPM/s, 21.0 mph/s, 0.050 gal/s, & 0.50 %C. HC ratio @ 1.8 & SG @ 0.744.
❑	17	Install VI (where it won't be kicked)	❑	28 29 30	Enter test info, flowmeter ID #, notes, select all post-processing output groups, save setup and exit
❑	18	Install and purge correct size flow meter & ***matched*** control box.	❑	44	In Road Test screen, ensure VI is acquired, exhaust flowmeter temp is valid, and weather station and aux temp data is acquired
			❑	NA	Use "ST_PLATE_run #" for filename
❑	10	Perform a SEMTECH leak check	❑	24 31	Check for system faults and warnings, verify warm-up, record temperatures
❑	11	Verify analyzer sample intervals are system control = 1000 ms, FID = 500 ms, NDIR=1200, NDUV = 500 ms.	❑	NA	Begin the session manager
❑	21	Acquire VI	❑	32	Record cylinder numbers on sheet
❑	43	Set HC range to 10,000.	❑	33	Perform a zero calibration
❑	22	Acquire aux temp & flowmeter. Set CO units to PPM.	❑	34-39	Perform gas and O_2 audits (and calibrations and reaudits, if needed).
❑	8	Write ambient conditions	❑	42	START THE TEST (in the session manager)
❑	9	Ensure P1, P2, P3 are within 200 psi	❑	44	During dyne run, watch road test screen for dilution, HC range, etc. Adjust HC range as needed, but don't peg readings.
❑	12	Open FID bottle, Ignite FID (15 minutes before testing)	❑	46	After dyne run, stop test, do a post-test audit and then a zero (zero on ambient)
❑	N/A	Ensure EXFM box pressure/temp LEDs are off, and autozero is on	❑	NA	Stop and close the session manager, turn FID off
			❑	N/A	Purge flowmeter after each run.
			❑	N/A	Ensure test files are uploaded (daily is OK)

Part 3: SEMTECH Installation for Round 2 Vehicle Driveaways Data Collection Sheet

Date __ __ / __ __ / __ __ Vehicle License___________________

Installation Tech: ___________________ PEM Serial Number __ __ __ - __ __ __ __

SEMTECH System Information

SEMTECH Status Summary Screen					
FID Fuel Pressure:	________	(psig)	Battery Voltage:	________	(V)
Independent Weather Station Data					
Ambient Temperature:	________	(deg C)	Relative Humidity:	________	(%)
SEMTECH Status Summary Screen (After warmup is complete)					
FID Oven Temperature:	________	(deg C)	Chiller Temp:	________	(deg C)
SEMTECH System Pressures					
$P_{ambient}$	________				
P_1 ________ (mbar)	P_2	________ (mbar)	P_3	________	(mbar)

OBDII Communication Protocol for Vehicle Interface

Note: use the "AutoXray" OBDII scanner to determine type of communication protocol. If that is unsuccessful, use Part B of the "Installation Guidelines".

❑ SAE-J1850 VPW	❑ SAE-J1850 PWM	❑ ISO-14230	❑ ISO-9141-2
❑ ISO-11898	❑ ISO-15765	❑ SAE-J1939	❑ SAE-J1708
❑ Vehicle will not communicate using any of the above communication protocols.			

Zero, Audit, and Span Gas Information

Zero gas cylinder ID #	Audit Gas Cylinder ID #	Span Gas Cylinder ID #

Part 3: SEMTECH Installation for Round 2 Vehicle Driveaways
Installation Checklist

Vehicle License ______________

✔	#	Task
❑	1 2 12 13 19	Install SEMTECH & 2 batteries in trunk, connect power supply, turn SEMTECH on. Ensure positive battery terminals are covered with boots.
❑	4, 5, 14	***Replace*** FID bottle (outlet @ 30 psi), open FID fuel supply, Install FID drain and autozero (ambient) tubes, run outside trunk
❑	15	Install GPS (wipe base clean first)
❑	16	Install weather probe
❑	17	Install VI (where it won't be kicked)
❑	18	Install and purge correct size flow meter & ***matched*** control box. Ensure shielding is away from batteries.
❑	N/A	Plug in external thermocouple
❑	3	Logon with host computer
❑	N/A	Verify comm. with right SEMTECH
❑	10	Perform a SEMTECH leak check
❑	11	Verify analyzer sample intervals are system control = 1000 ms, FID = 500 ms, NDIR=1200, NDUV = 500 ms.
❑	21	Acquire VI
❑	43	Set HC range to 10,000.
❑	22	Acquire GPS, aux temp, & flowmeter. Set CO units to PPM, set FID to "auto".
❑	N/A	In Config 3, enable autozero (all but CH4), 120 mins, 5 ppm drift)
❑	7	Close FID bottle, then do a ***FID*** leak check (<1 psi/minute decay)
❑	25	Disconnect power supply, verify and write battery voltage of both batteries
❑	8	Record ambient conditions

✔	#	Task
❑	9	Ensure P1, P2, P3 are within 200 psi
❑	12	Open FID bottle, Ignite FID (15 minutes before testing)
❑	N/A	Ensure EXFM box pressure/temp LEDs are off, and autozero is on
❑	26	Set transport delays (6,6,0,5,5,0), mass calc from flow meter, speed from GPS, RPM from ECM. Calc limits @ 1000 RPM/s, 21.0 mph/s, 0.050 gal/s, & 0.50 %C. HC ratio @ 1.8 & SG @ 0.744.
❑	28 29 30	Enter test info, flowmeter ID #, notes, select all post-processing output groups, save setup and exit
❑	44	Start vehicle & verify data in road test screen
❑	NA	Use "ST_PLATE_driveaway" for filename
❑	24 31	Check for system faults and warnings, verify warm-up, record temperatures
❑	NA	After installation review, begin session mgr
❑	32	Record cylinder numbers on sheet
❑	33	Perform a zero calibration
❑	34- 39	Perform gas and O_2 audits (and calibrations and reaudits, if needed).
❑	42	START THE TEST (in the session manager)
❑	40	Prepare vehicle for testing, connect 2nd battery, pull charger, run Ethernet cord out trunk, close trunk, seal, etc.
❑	N/A	Have picture taken of flowmeter setup
❑	N/A	When vehicle returns, remove equipment, purge flowmeter, charge batteries
❑	N/A	Ensure test file is uploaded

Part 4: SEMTECH Installation for *Replicate* Round 2 Precond Drives Data Collection Sheet

Date __ __ / __ __ / __ __ Vehicle License__________________

Installation Tech: ___________________ PEM Serial Number __ __ __ - __ __ __ __

SEMTECH System Information

SEMTECH Status Summary Screen

FID Fuel Pressure: ___________ (psig) Battery Voltage: __________ (V)

Independent Weather Station Data

Ambient Temperature: ___________ (deg C) Relative Humidity: __________ (%)

SEMTECH Status Summary Screen (After warmup is complete)

FID Oven Temperature: ___________ (deg C) Chiller Temp: __________ (deg C)

SEMTECH System Pressures

$P_{ambient}$ ______________

P_1 ______________ (mbar) P_2 ____________ (mbar) P_3 ____________ (mbar)

OBDII Communication Protocol for Vehicle Interface

Note: use the "AutoXray" OBDII scanner to determine type of communication protocol. If that is unsuccessful, use Part B of the "Installation Guidelines".

- ❏ SAE-J1850 VPW
- ❏ SAE-J1850 PWM
- ❏ ISO-14230
- ❏ ISO-9141-2
- ❏ ISO-11898
- ❏ ISO-15765
- ❏ SAE-J1939
- ❏ SAE-J1708
- ❏ Vehicle will not communicate using any of the above communication protocols.

Zero, Audit, and Span Gas Information

Zero gas cylinder ID #	Audit Gas Cylinder ID #	Span Gas Cylinder ID #

Part 4: SEMTECH Installation for *Replicate* Round 2 Precond Drives
Installation Checklist

Vehicle License_________________

✔	#	Task
❑	1 2 12 13 19	Install SEMTECH & battery in trunk, connect power supply, turn SEMTECH on. Ensure positive battery terminal is covered with boot.
❑	4, 5, 14	Install FID drain and autozero (ambient) tubes, run outside trunk
❑	15	Install GPS (wipe base clean)
❑	16	Install weather probe
❑	17	Install VI (where it won't be kicked)
❑	18	Install and purge correct size flow meter and ***matched*** control box. Ensure shielding is away from battery.
❑	N/A	Plug in external thermocouple
❑	3	Logon with host computer
❑	N/A	Verify comm. with right SEMTECH
❑	10	Perform a SEMTECH leak check
❑	11	Verify analyzer sample intervals are system control = 1000 ms, FID = 500 ms, NDIR=1200, NDUV = 500 ms.
❑	21	Acquire VI
❑	43	Set HC range to 10,000.
❑	22	Acquire GPS, aux temp, & flowmeter. Set CO units to PPM.
❑	N/A	In Config 3, enable autozero (all but CH4), 120 mins, 5 ppm drift)
❑	7	Close FID bottle, then do a ***FID*** leak check (<1 psi/minute decay)
❑	25	Disconnect power supply, verify and record battery voltage
❑	8	Record ambient conditions
❑	9	Ensure P1, P2, P3 are within 200 psi

✔	#	Task
❑	12	Open FID bottle, Ignite FID (15 minutes before testing). Check FID pressure, replace if under 200 PSI. Ensure outlet regulator is set to 30 PSI output.
❑	N/A	Ensure EXFM box pressure/temp LEDs are off, and autozero is on
❑	26	Set transport delays (6,6,0,5,5,0), mass calc from flow meter, speed from GPS, RPM from ECM. Calc limits @ 1000 RPM/s, 21.0 mph/s, 0.050 gal/s, & 0.50 %C. HC ratio @ 1.8 & SG @ 0.744.
❑	28 29 30	Enter test info, flowmeter ID #, notes, select all post-processing output groups, save setup and exit
❑	44	Start vehicle & verify data in road test screen
❑	NA	Use "ST_PLATE_precond_rep" for filename
❑	24 31	Check for system faults and warnings, verify warm-up, record temperatures
❑	NA	After installation review, begin session mgr
❑	32	Record cylinder numbers on sheet
❑	33	Perform a zero calibration
❑	34- 39	Perform gas and O_2 audits (and calibrations and reaudits, if needed).
❑	42	START THE TEST (in the session manager)
❑	40	Prepare vehicle for testing, close trunk, have picture taken of flowmeter setup
❑	N/A	Do precond run, watch road test screen
❑	46	After precond run, stop test, do a post-test audit and then a zero (zero on ambient)
❑	NA	Stop and close the session manager, turn FID off
❑	N/A	Remove equipment, purge flowmeter, charge battery
❑	N/A	Ensure test file is uploaded

Part 5: SEMTECH Installation for *Replicate* Round 2 Dyne Sampling Data Collection Sheet

Date __ __ / __ __ / __ __ Vehicle License___________________

Installation Tech: ___________________ PEM Serial Number __ __ __ - __ __ __ __

SEMTECH System Information

SEMTECH Status Summary Screen

FID Fuel Pressure: ____________ (psig)

Independent Weather Station Data

Ambient Temperature: ____________ (deg C) Relative Humidity: ____________ (%)

SEMTECH Status Summary Screen (After warmup is complete)

FID Oven Temperature: ____________ (deg C) Chiller Temp: ____________ (deg C)

SEMTECH System Pressures

$P_{ambient}$ ______________

P_1 ______________ (mbar) P_2 ______________ (mbar) P_3 ______________ (mbar)

OBDII Communication Protocol for Vehicle Interface

Note: use the "AutoXray" OBDII scanner to determine type of communication protocol. If that is unsuccessful, use Part B of the "Installation Guidelines".

❑ SAE-J1850 VPW ❑ SAE-J1850 PWM ❑ ISO-14230 ❑ ISO-9141-2

❑ ISO-11898 ❑ ISO-15765 ❑ SAE-J1939 ❑ SAE-J1708

❑ Vehicle will not communicate using any of the above communication protocols.

Zero, Audit, and Span Gas Information

Zero gas cylinder ID #	Audit Gas Cylinder ID #	Span Gas Cylinder ID #

Part 5: SEMTECH Installation for *Replicate* Round 2 Dyne Sampling Installation Checklist

Vehicle License ________________

✔	#	Task
❑	16	Ensure weather probe & external temp thermocouple are hooked up
❑	17	Install VI (where it won't be kicked)
❑	18	Install and purge correct size flow meter & ***matched*** control box.
❑	10	Perform a SEMTECH leak check
❑	11	Verify analyzer sample intervals are system control = 1000 ms, FID = 500 ms, NDIR=1200, NDUV = 500 ms.
❑	21	Acquire VI
❑	43	Set HC range to 10,000.
❑	22	Acquire aux temp & flowmeter. Set CO units to PPM.
❑	8	Write ambient conditions
❑	9	Ensure P1, P2, P3 are within 200 psi
❑	12	Open FID bottle, Ignite FID (15 minutes before testing)
❑	N/A	Ensure EXFM box pressure/temp LEDs are off, and autozero is on

✔	#	Task
❑	26	Set transport delays (6,6,0,5,5,0), mass calc from flow meter, speed from ECM, RPM from ECM. Calc limits @ 1000 RPM/s, 21.0 mph/s, 0.050 gal/s, & 0.50 %C. HC ratio @ 1.8 & SG @ 0.744.
❑	28 29 30	Enter test info, flowmeter ID #, notes, select all post-processing output groups, save setup and exit
❑	44	In Road Test screen, ensure VI is acquired, exhaust flowmeter temp is valid, and weather station and aux temp data is acquired
❑	NA	Use "ST_PLATE_run #_rep" for filename
❑	24 31	Check for system faults and warnings, verify warm-up, record temperatures
❑	NA	Begin the session manager
❑	32	Record cylinder numbers on sheet
❑	33	Perform a zero calibration
❑	34-39	Perform gas and O_2 audits (and calibrations and reaudits, if needed).
❑	42	START THE TEST (in the session manager)
❑	44	During dyne run, watch road test screen for dilution, HC range, etc. Adjust HC range as needed, but don't peg readings.
❑	46	After dyne run, stop test, do a post-test audit and then a zero (zero on ambient)
❑	NA	Stop and close the session manager, turn FID off
❑	N/A	Purge flowmeter after each run.
❑	N/A	Ensure test files are uploaded (daily is OK)

Kansas City PM Characterization Study

Final Report

Appendix K
Revised Conditioning Routes for Final Round 2 Report

Assessment and Standards Division
Office of Transportation and Air Quality
U.S. Environmental Protection Agency

Sponsors:

National Renewable Energy Laboratory, U.S. Department of Energy
Federal Highway Administration, U.S. Department of Transportation
STAPPA-ALAPCO Emission Inventory Improvement Program
Coordinating Research Council Inc. (Project No. E-69)

Prepared for EPA by
Eastern Research Group, Incorporated
Austin, TX

Bevilacqua-Knight Incorporated
Oakland, CA

NuStats LLC
Austin, TX

Desert Research Institute
Reno, NV

EPA Contract No. GS 10F-0036K

October 27,2006
Revised April 2008 by EPA staff

United States
Environmental Protection
Agency

EPA420-R-08-009
April 2008

Two potential conditioning routes were established, Route A and Route B. Route A is the shorter of the two routes, being ~ 8 miles in length. Route A consists of a single heavy acceleration to enter the freeway and ~1.5 miles of high speed driving, 1.5 miles of moderate speeds, and the rest stop and go driving. Route B involved more high speed and moderate speed driving with a total length of ~ 18.6 mi.

Specifics for each route are given below from the test facility at 6636 Berger Ave, Kansas City, Kansas, 66111.

Route A (8.2 miles)

1. From 6636 Berger Ave test facility, left onto Berger Ave, then immediate left (east) onto KAW (32).

2. Eastbound on KAW ~ 0.3 mi and turn left (north) onto 65th St.

3. Northbound on 65th St ~ 0.50 mi and turn left (northwest) onto Turner-Diagonal Parkway (132).

4. Westbound on 132 ~ 1.4 mi and turn left (west) onto State Avenue .

5. Westbound on State Ave ~ 1.5 mi and turn left (south) onto 82nd St.

6. Southbound on 82nd St ~ 0.50 mi and turn left (east) onto Tauromee Ave.

6. Eastbound on Tauromee ~0.50 mi and turn right (south) onto 78th St.

7. Southbound on 78th ~ 1.5 mi and turn left (east) onto Kansas Ave.

8. Eastbound on Kansas Ave ~ 1.4 mi and turn left (north) onto 68th St.

9. Northbound on 68th St ~ 0.2 mi and turn right (east) onto Berger Ave.

10. Eastbound on Berger Ave ~ 0.2 mi and turn left into 6636 Berger test facility.

Route B (18.6 miles)

1. From 6636 Berger Ave test facility, left onto Berger Ave, then immediate left (east) onto KAW (32).

2. Eastbound on KAW ~ 0.3 mi and turn left (north) onto 65th St.

3. Northbound on 65th St ~ 0.50 mi and turn left (northwest) onto Turner-Diagonal Parkway (132).

4. Westbound on 132 ~ 0.9 mi and exit left onto westbound I-70

5. Westbound on I-70 ~ 3.7 miles, turn right onto northbound I-435

6. Northbound I-435 ~ 0.9 mi and exit at State Ave.

7. Take cloverleaf back onto I-435 southbound (0.6 mi)

8. Southbound I-435 ~ 0.8 mi, exit to eastbound I-70

9. Eastbound I-70 ~ 3.9 mi and turn left (north) onto Turner-Diagonal Parkway (132).

10. Northbound on 132 ~ 0.9 mi and turn left (west) onto State Avenue

11. Westbound on State Ave. ~ 1.5 mi and turn left (south) onto 82nd St.

12. Southbound on 82nd St ~ 0.6 miles and turn left (east) onto Tauromee Ave.

13. Eastbound on Tauromee ~ 0.5 mi and turn right (south) onto 78th St.

14. Southbound on 78th St ~ 1.6 miles and turn left (east) onto Kansas Ave.

15. Eastbound on Kansas Ave ~ 1.4 mi and turn left (north) onto 68th St.

16. Northbound on 68th St ~ 0.2 mi and turn right (east) onto Berger Ave.

17. Eastbound on Berger Ave ~ 0.2 miles to 6636 Berger Ave. test facility

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Appendix L
PEMS Fuel Economy
Calculation Equations Only

Assessment and Standards Division
Office of Transportation and Air Quality
U.S. Environmental Protection Agency

Sponsors:

National Renewable Energy Laboratory, U.S. Department of Energy
Federal Highway Administration, U.S. Department of Transportation
STAPPA-ALAPCO Emission Inventory Improvement Program
Coordinating Research Council Inc. (Project No. E-69)

Prepared for EPA by
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Reno, NV

EPA Contract No. GS 10F-0036K

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Agency

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The following equations are used by the SEMTECH-G in calculating emissions and fuel economy. These equations are presented in Revision 2.2 of the SEMTECH-G User Manual. Additional details regarding computations performed by the SEMTECH-G may be found in the SEMTECH-G User's Manual.,

- **Dry-to-wet conversion factor**, $K_w = 1 - [H_2 0]_{\text{condensed}}$

where $[H_2 0]_{condensed} = [H_2 0]_{exhaust} - [H_2 0]_{residual}$

- **Standard Volumetric Exhaust Flow Rate**:

$$V_{std} = \frac{\dot{m}}{\rho_{std}}$$

where

$$\rho_{std}\ (g/l) = \frac{P}{R_{exhaust} T} = \frac{1 atm}{R_{exhaust}(293^{\circ}K)}$$

$$R_{exhaust}\left(\frac{l-atm}{g-{}^{\circ}K}\right) = \frac{R^{\circ}}{MW_{exhaust}} = \frac{0.0821\left(\frac{l-atm}{mol-{}^{\circ}K}\right)}{MW_{exhaust}\ (g/mol)}$$

and

$$MW_{exhaust} = \frac{1}{100}\Sigma\left[[CO_2]\bullet 44.01 + [O_2]\bullet 32.0 + [N_2]_{\bullet 28.013 + [H_2 0]\bullet 18.105}\right]$$

- **Instantaneous Mass Emissions**

$$\text{Pollutant}\ (grams/\text{sec}) = \frac{[\text{Pollutant}]_{wet}}{100}\ x\, V_{std}\ x\ \rho_{CO2,std}$$

- **NOx Humidity Correction Factor**

$$Kh = \frac{1}{[1 - .0047\ x\ (h - 75)]}$$

where h is the absolute humidity in grains/lb of dry air, given by:

$$h = \frac{43.478\,(RH)\,(P_s)}{P_{baro} - P_s\ (RH/100)}$$

where RH is the relative humidity (%) and $P_{s,}$ the saturation vapor pressure in mm-Hg at the engine intake air dry-bulb temperature, is empirically derived using the following equation from the ASCE Manuals and Reports on Engineering Practice No. 70, 1990 (Jensen, et al).

$$P_s(kPa) = EXP\left[\frac{16.78 T_{sample} - 116.9}{T_{sample} + 237.3}\right]$$

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Appendix M
Offsite Quality Assurance and Analysis

Assessment and Standards Division
Office of Transportation and Air Quality
U.S. Environmental Protection Agency

Sponsors:

National Renewable Energy Laboratory, U.S. Department of Energy
Federal Highway Administration, U.S. Department of Transportation
STAPPA-ALAPCO Emission Inventory Improvement Program
Coordinating Research Council Inc. (Project No. E-69)

Prepared for EPA by
Eastern Research Group, Incorporated
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Desert Research Institute
Reno, NV

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EPA United States Environmental Protection Agency

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PEMS Data integrity and quality check queries

ID	Query	Pre-test fields	Test record columns	Criteria
1	Collect test times	"Test Start Time" and "Test End Time"	N/A	These will be used in audit queries
2	If MY > 1995, has VI been collected?	"Vehicle Interface Type"	"Vehicle Responding"	If enabled/collected, OK Else, flag
3	Are transport delays appropriate?	"AMBII Delay(s)", "NDUV Delay(s)", "SCB Delay(s)", THC "FID Delay(s)", "Methabe FID Delays", "Flow Meter Delay(s)"	N/A	Values should be 6,6,0,5,5,0, respectively
4	Is test duration appropriate?	N/A – NOTE: don't use "Test Duration(s)" field	Test time (i.e., total # of seconds after CO + CO_2 is > 5)	For Precond runs: If duration is < 1000, flag For Dyne testing: If duration is < 2340, flag For Driveaways: If duration is < 18000, flag
5	Is correct speed used?	iVEH_SPEED_USED	N/A	For Precond runs: If not equal to "iGPS_GROUND_SPEED", flag For Dyne testing: N/A For Driveaways: If not equal to "iGPS_GROUND_SPEED", flag
6	Is test distance appropriate?	"Total Distance Traveled (mi)" (for Precond runs and driveaways)	"External Analog Input 3" (for dyne testing)	For Precond runs: if "Total Distance Traveled (mi)" < 7.5, flag For Dyne testing: if total distance determined using converted "External Analog Input 3" < 9.7 miles For Driveaways: If "Total Distance Traveled (mi)" < 10, flag
7	Does the test have faults/warnings?	"Faults:", "Warnings:"	N/A	If yes, list faults and warnings by test id
8	Is test preceded by a "passed" audit?	"Audit"	N/A	Using test times previously collected, find last audit immediately before test. If no audit, or audit has a failure, flag
9	Is test followed by a "passed" audit?	"Audit"	N/A	For precond runs and dyne testing, using test times previously collected, find audit performed after test. If no audit, or audit has a failure, flag. Disregard for driveaways.
10	Are pre-test and post-test gas audit values correct?	"Audit"	N/A	Ensure gas bottle values are within range for all pollutants (CO=200 $\pm$ 5, CO_2=6 $\pm$ 0.1, NOx=300 $\pm$ 5, THC = 50 $\pm$ .2)
11	Is dilution reasonable?	N/A	"CO", "CO2" % (wet corrected	If CO + CO2 < 13, flag
12	Is flow collected?	N/A	"Exhaust Mass Flow Rate"	If all = zero or null, flag

ID	Query	Pre-test fields	Test record columns	Criteria
13	Is post-processor version correct?	"Post-Processor DLL Version"	N/A	5.4
14	Max, avg, mean mass flow rate by displacement plots and output file	"Engine Displacement"	"Corrected mass flow rate (kg/hr)", "iGPS_ground _speed" (control, precond, dway), "iSCB_EAI3" (dyne)	For each test record, drop all obs with speed < 1 mph Calculate max, avg, and mean mass flow rate for each test Print 3 scatter plots, x-axis is displacement (L), y-axis is mass flow rate. Output CSV file with test ID, max, avg, mean mass flow rates, displacement (to find records that should be manually reviewed)
15	Avg mpg by displacement and output plots	"Engine Displacement", "Overall Fuel Economy (mpg)"	N/A	For each test record, either use mpg from pre-test, or the one we calculate with independent equation. Print scatter plot with x-axis displacement, y-axis is fuel economy. Output CSV file with test ID, fuel economy, displacement.

ID	Query	Pre-test fields	Test record columns	Criteria
16	Test value output for tests with suspect mileage values	"Engine Displacement", "Overall Fuel Economy (mpg)", "Total Distance Traveled (mi)"	"iGPS_ground _speed" (control, precond, dway), "iSCB_EAI3" (dyne)	For each test record, either use mpg from pre-test info, or the one we calculate with independent equation. Then, for various engine size groupings, we'll do a mpg range screening. If the values fall outside the screening range, we'll want to do some calcs and output test info and the calculated values to a CSV file for manual review. Record suspect if A < disp <B and MPG < Y or MPG is > Z, . Perhaps for 1st groups, then do the following: <2 L, 20 mpg to 30 mpg 2L to 2.5L, 15 mpg to 25 mpg 2.5L to 3L, 10 mpg to 20 mpg 3L to 3.5L, 10 mpg to 20 mpg 3.5L to 4L, 10 mpg to 20 mpg 4L to 4.5L, 10 mpg to 20 mpg 4.5L to 5L, 10 mpg to 20 mpg >5L, 10 mpg to 20 mpg We will need to tweak engine/mpg groupings to set appropriate screening limits. Maybe do a proc freq of mpg by displacement group to get initial settings. For each record that falls outside limits, drop all obs with speed < 1 mph and with a corrected exhaust flow rate column (icMASS_FLOW, kg/hr) less than 10 kg/hr. Calculate/output to CSV test ID, MY, make, model, displacement, mpg, total dist traveled, and then max and averages for: iCO2zw (%) + iCOzw (%), icMASS_FLOW, iFLOW_EX_TEMP, iFLOW_UP_PRESS, AF_Calc, Lambda.

PEMS results analysis

• Query A:
The intent of this query is to distinguish between the preconditioning portion and the actual driveaway portion of the driveaway files (when precond and driveaway both exist and are in the same test file)

Precond run start time:
Start of precond run should first second by second records where CO+CO2 > 5 and speed >1

Precond run end time:
The first observation where
If "Cumulative Distance (actual)" (iCALCSUM_Dc) is greater than 7
And if "Ground Speed" (iGPS_GROUND_SPEED) has been ***less than 1*** for at least 5 seconds
And if "iGPS_LAT (deg) is between 39.08999 and 39.0908,
And if "iGPS_LON (deg) is between –94.731 and –94.734,
The preceding portion of the test is the preconditioning run, and the remaining portion of the test is the driveaway

Please provide precond start time, precond end time, precond miles, and precond time duration for each run.

Please provide a plot of speed vs. # of seconds for each of the above tests (one plot for each test record, not broken into segments).
Please also provide the plots with only the first 6000 seconds plotted.

• Query B:
The intent of this query is to determine the fuel economy and emissions for the preconditioning segment of driveaway runs. Then, determine fuel economy and emissions for the remainder (driveaway portion) of the test.

For tests that meet the conditions of Query A, please list the test file name, and then for each segment (precond and driveaway) please list total number of seconds, cumulative distance (iCALCSUM_Dc), cumulative fuel economy (iCALCSUM_Wcmpg) and cumulative emissions (iCALCSUM_CO2cm, iCALCSUM_Cocm, iCALCSUM_kNOcm, iCALCSUM_HCcm) that is listed on the last valid line of the test segment. In other words, the above values will be listed for both the preconditioning segment and the driveaway segment as determined using Query A.

Note that since cumulative driveaway value includes precond segment, this is being differentiated using the following eqn:

$$\begin{aligned} FE_{driveaway} &= [Miles_{total} \text{ x } FE_{overall}] - [Miles_{precond} \text{ x } FE_{precond}] / [Miles_{total} - Miles_{precond}] \\ &= [Gallons_{total} - Gallons_{precond}] / [Miles_{driveaway}] \\ &= [Gallons_{driveaway}] / [Miles_{driveaway}] \end{aligned}$$

• Query C:
The intent of this query is to independently calculate fuel economy from the SEMTECH record fields and compare it with the pre-test SEMTECH mpg values for each SEMTECH test record (Round 2 dyne SEMTECH, Round 2 precond, Round 2 driveaway, Round 1.5)

Fuel Economy = 2421 / ((CO_2 x 0.273) + (HC x 0.866) + (CO x 0.429))
= 2421 / ((iCALCSUM_CO2cm x 0.273) + (iCALCSUM_HCcm x 0.866) + (iCALCSUM_COcm x 0.429)) where iCALCSUM units are taken from the last valid line of the test record and are in g/mi.

For each record, please list the record name, fuel economy calculated above and the fuel economy listed in the pre-test info.

• Query D:
Please read in the control vehicle runs (located at G:\KansasCity\SEMTECH\Round1_5\ControlVehicle\KC Rnd 15 control run csvs).
Should be same format as what you've already read in.

Please determine the preconditioning start and end times using the logic defined above. Then, for these control runs, please provide a csv file that lists for each test record the test ID, vehicle ID, "SEMTECH Serial Number" (from pre-test info), HC, CO, CO2, NOx g/mile emissions, cumulative distance, and fuel economy (mpg) for the preconditioning run.

Please provide a line plot of fuel economy (left axis) by control run # (horizontal axis test date as label) for all the control runs (one plot with 37 data points).

Please provide plots (by pollutant) of g/mi emissions (left axis) by control run # (horizontal axis with test date as label) for all control runs (four plots with 37 data points each

Kansas City PM Characterization Study

Final Report

Appendix N
Onsite Quality Assurance and Analysis

Assessment and Standards Division
Office of Transportation and Air Quality
U.S. Environmental Protection Agency

Sponsors:

National Renewable Energy Laboratory, U.S. Department of Energy
Federal Highway Administration, U.S. Department of Transportation
STAPPA-ALAPCO Emission Inventory Improvement Program
Coordinating Research Council Inc. (Project No. E-69)

Prepared for EPA by
Eastern Research Group, Incorporated
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NuStats LLC
Austin, TX

Desert Research Institute
Reno, NV

EPA Contract No. GS 10F-0036K

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EPA United States Environmental Protection Agency

EPA420-R-08-009
April 2008

Notes for Proper SEMTECH Installation, Testing, and Post-Test Procedures
GENERAL

- Ensure power supplies are hooked up and functioning during test preparations (this will help ensure battery voltages are adequate for testing)
- Ensure test is conducted in a relatively short amount of time after the FID is ignited, and ensure the FID flame is turned off after the post-test audit is conducted (this will minimize the rate of depletion of the mini-FID cylinders)
- However, ensure the FID flame has been on for at least 15 minutes before the pre-test zero and audit are conducted (this will help ensure the FID chamber is stabilized, and therefore reduce measurement error)
- Ensure exhaust flow tube is oriented such that sample port is closest to tailpipe
- Ensure all malfunctioning equipment is labeled, logged, and removed from service

SOFTWARE SETUP BEFORE "SESSION MANAGER" – These steps help reduce wasted setup time and wasted test records, since none of these settings may be altered after the "Session Manager" is started.

- Verify GPS, flow meter, and VI (if applicable) values through "Road Test" screen (emissions cannot be calculated without these parameters)
- Ensure all "Test Setup" values (such as transport delays, calc input settings, upper detection range(10k), and vehicle info and notes) are correct. Ensure the correct filename is entered (this ensures appropriate default settings are set in the file, and it eliminates the time required to identify proper filenames and rename files during post-processing)

DURING "SESSION MANAGER"

- Ensure the "Session Manager" (and all associated activities) are conducted in the proper sequence (this helps ensure test records contain all pre and post-test audits and calibrations and also ensures all test files can be processed). The proper sequence is:
    - Ensure all pre-test settings are correct (use "Road Test" screen)
    - Open session manager window
    - Perform "Test Setup" using "Setup" button (this may also be done before opening the "Session Manager" window)
    - Click the Session Manager "Start" button to start the session manager
    - Conduct a pre-test zero
    - Conduct a pre-test audit (see notes below)
    - Conduct a pre-test span ***(only if audit fails)***
    - Conduct a pre-test re-audit ***(only if a span was conducted)***
    - Immediately before the test is started, review the "Road Test" screen to ensure GPS, flow meter, and VI (if applicable) data is still being collected by the SEMTECH
    - Click the test "Start" button to start the test
    - Do the preconditioning drive
    - Click the test "Stop" button to stop the test when the driver returns from the drive
    - Conduct a post-test audit – don't worry about it if it fails!
    - Conduct a post-test zero
    - Click the Session Manager "Stop" button to stop the session manager
    - "Close" the Session Manager" window
    - Upload, process, and analyzer the test file (see SEMTECH file collection SOPs)
- For spans and audits: Ensure the correct ports and gasses are used, ensure the correct bottle concentrations are entered, ensure the "THC" gas is set to "propane" **before** the gas concentration is entered (so the concentration is not improperly converted), ensure the upper detection range is appropriate, and ensure any failed pre-test audits are followed by a span and a re-audit (ensures equipment is properly calibrated before testing)

Immediately Before Vehicle Leaves Checklist

- ❑ Ensure laptop is communicating with the correct SEMTECH
- ❑ Flip FID to "On", then back to "Auto"
- ❑ Verify autozero is enabled
- ❑ Ensure HC range is 10000
- ❑ Ensure installer is entering info for correct vehicle
- ❑ Ensure correct software and firmware are in use
- ❑ Check test settings in setup menu are correct
- ❑ Check road test screen for to check for the following:
  - ❑ GPS and VI are being collected
  - ❑ exhaust flow is valid *(> 2 kg/hr)*
  - ❑ exhaust flow temp is valid *(ambient if vehicle is off, 20 C and up if on)*
  - ❑ ambient temp and RH is reasonable *(same as independent weather station)*
  - ❑ aux temp is reasonable *(close to ambient temp)*
  - ❑ CO_2 >13 (hybrid may be exception of running on electric)
  - ❑ FID fuel pressure is sufficient *(>1300 psi)*
  - ❑ Chiller and heated FID temperatures are OK *(chiller ≈ 4 C, FID ≈ 193 C)*
- ❑ Disconnect power supply, hook in 2nd battery, check voltage
- ❑ Ensure VI cable isn't where it will be kicked off or is in the way of driver
- ❑ Ensure no warnings (i.e., temp or pressure) are displayed on flowmeter transducer box
- ❑ Ensure flowmeter is matched to correct box
- ❑ Verify flowmeter is installed in proper direction
- ❑ Verify the flowmeter has been purged
- ❑ Ensure the SEMTECH has passed a leak check
- ❑ Ensure 2.5" flowmeters used for 3.0 L and larger engines, 2" flowmeters for under 3.0 L
- ❑ Ensure all tubing leading to flowmeter has an equal or greater diameter than that of the flowmeter
- ❑ Ensure tubing has sufficient ground clearance
- ❑ Ensure flowmeter box is placed securely (not on top of SEMTECH)
- ❑ Ensure metalized flowmeter tubing sheath isn't touching battery terminals
- ❑ Ensure boots are on battery terminals
- ❑ Ensure foam is stuffed in trunk lid or hatch gaps, & Ethernet cord is coming out of trunk
- ❑ Ensure test is started (within the session manager)
- ❑ Ensure event marker is set right before preconditioning run
- ❑ Ensure picture has been taken of flowmeter and tubing setup
- ❑ Pull on exhaust tubing setup to make sure all tube connections & flowmeter are secure
- ❑ After preconditioning run, stop the event marker and do the mass emissions rates & mpg analysis

AFTER TESTING IS COMPLETE, TEST STOPPED, & "SESSION MANAGER" IS CLOSED

- Turn FID flame off (helps conserve FID fuel)
- Hook up power supply (to help ensure battery voltage is adequate for next test), purge flowmeter

Rcommended SEMTECH Test Record Review (after testing is completed)

- ❑ Verify a zero and an audit are conducted before the test record was created
- ❑ Verify the pre-test audit is either passed or followed by a span and another audit
- ❑ Ensure test is preceded by a "passed" audit
- ❑ Ensure correct gas concentrations are entered for audits
- ❑ Ensure correct gas concentrations are entered for spans
- ❑ Ensure propane is used for all audits and spans
- ❑ Ensure correct sample ports are used for audits and spans
- ❑ Verify post-test audit was conducted (use test start/end times)
- ❑ Verify cumulative emissions are provided (ensures GPS and flowmeter)
- ❑ Verify upper concentration limit is appropriate for the vehicle that was tested
- ❑ Check for any faults and warnings
- ❑ Check for appropriate software and firmware versions
- ❑ Sanity check on total distance traveled
- ❑ Sanity check on total test duration
- ❑ Verify transport delays applied to test are appropriate
- ❑ Verify VI is gathered for 1996 and newer vehicles
- ❑ Verify flow meter ID number is in test record

Kansas City PM Characterization Study

Final Report

Appendix O
Round 1 Dynamometer PEMS
Quality Control Summary

Assessment and Standards Division
Office of Transportation and Air Quality
U.S. Environmental Protection Agency

Sponsors:

National Renewable Energy Laboratory, U.S. Department of Energy
Federal Highway Administration, U.S. Department of Transportation
STAPPA-ALAPCO Emission Inventory Improvement Program
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EPA Contract No. GS 10F-0036K

October 27,2006
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United States
Environmental Protection
Agency

EPA420-R-08-009
April 2008

Run#	Disp	Disp Bin	Make	Model	Model Year	Missing data	Flow Flag	Dilution Flag	Exh Temp Flag	Ambient Temp Flag	Suspect Data	Data Review Comments
84032	2.2	2.1 to 2.5	Chevrolet	Cavalier	2001		x		x		x	No flowmeter flow or temp data.
84034	3.5	3.1 to 3.5	Isuzu	Trooper	1999							
84035	5.3	5.1 to 6.0	GMC	Yukon XL	2001							
84036	1.9	1.6 to 2.0	Ford	Escort LX	1995							
84037	5.8	5.1 to 6.0	Ford	F-250	1979							
84039	5.4	5.1 to 6.0	Ford	F-150 XLT	2001							
84040	2.5	2.1 to 2.5	Dodge	Spirit	1990							
84042	1.6	1.6 to 2.0	Honda	Civic	1996							
84043	1.5	0 to 1.6	Honda	Civic	1991							
84047	2.5	2.1 to 2.5	Mazda	626	2001							
84048	3	2.6 to 3.0	Dodge	Caravan SE	1989							
84050	2	1.6 to 2.0	Honda	Civic SI	2002				x			Avg exhaust temp is high (450F)
84051	2.2	2.1 to 2.5	Chevrolet	Corsica	1996							
84052	3.8	3.5 to 4.0	Oldsmobile	Cutlass Ciera	1988							
84054	4.3	4.1 to 5.0	GMC	Jimmy	1995							
84055	4	3.5 to 4.0	Jeep	Cherokee Sport	1998							
84056	3.3	3.1 to 3.5	Nissan	Frontier	2002							
84057	1.9	1.6 to 2.0	GM	Saturn	2001							
84058	3.5	3.1 to 3.5	Chrysler	300	1999				x			Avg exhaust temp is low (250C)
84060	3.8	3.5 to 4.0	Buick	LeSabre	1998							
84061	2.2	2.1 to 2.5	Chevrolet	Cavalier	1990							
84062	3.8	3.5 to 4.0	Buick	LeSabre	1998							
84063	1.9	1.6 to 2.0	GM-Saturn	Saturn	1996							
84064	3	2.6 to 3.0	Mercury	Villager LS	1994							
84066	2.5	2.1 to 2.5	Jeep	Wrangler	1995				x			Avg exhaust temp is high (480C)
84067	3.3	3.1 to 3.5	Dodge	Caravan	1995							
84068	3	2.6 to 3.0	Toyota	Solara SLE	2001							
84069	3.3	3.1 to 3.5	Dodge	Grand Caravan Spor	1997							
84071	2.3	2.1 to 2.5	GM	Pontiac Grand Am	1989							
84072	4.3	4.1 to 5.0	Chevrolet	S-10	2003							
84073	4.3	4.1 to 5.0	Chevrolet	Blazer	1995							
84074	2.6	2.6 to 3.0	Nissan	Pickup	1987				x			Avg exhaust temp is high (450C)
84076	4.9	4.1 to 5.0	Ford	Mustang	1968							
84077	1.6	1.6 to 2.0	Honda	Civic EX	1999			x				Suspect diltion: Avg CO + CO2 = 9.06%
84078	2.2	2.1 to 2.5	Honda	Accord	1997							
84079	2	1.6 to 2.0	Honda	Accord LX	1989		x		x		x	Average exhaust flow is > 2x average for all other similar displacement vehicles, avg exhaust temp is high (525C)
84081	3	2.6 to 3.0	Ford	Taurus	1988							
84082	3	2.6 to 3.0	Ford	Taurus SES	2003							
84083	2.3	2.1 to 2.5	Honda	Accord EX	2000							
84084	3.1	3.1 to 3.5	Chevrolet	Malibu LS	1998							
84086	3.5	3.1 to 3.5	Honda	Odyssey	2004				x			Avg exhaust temp is high (480C)
84087	2	1.6 to 2.0	Hyundai	Tiburon	2000							
84088	3.1	3.1 to 3.5	Chevrolet	Lumina	1998							
84090	4.6	4.1 to 5.0	Ford	Mustang	1999				x			Avg exhaust temp is low (210C)
84091	4.9	4.1 to 5.0	Cadillac	Seville	1991							

Run#	Disp	Disp Bin	Make	Model	Model Year	Missing data	Flow Flag	Dilution Flag	Exh Temp Flag	Ambient Temp Flag	Suspect Data	Data Review Comments
84092	1.9	1.6 to 2.0	Saturn	SL1	1999							
84093	1.6	1.6 to 2.0	Nissan	Sentra GXE	1997							
84094	4	3.5 to 4.0	Ford	Explorer	1993							
84096	3.2	3.1 to 3.5	Isuzu	Rodeo SL	1999							
84097	3	2.6 to 3.0	Mercury	Sable LS	2002							
84098	3	2.6 to 3.0	Ford	Ranger	1999							
84099	3	2.6 to 3.0	Toyota	Avalon	1999							
84101	3	2.6 to 3.0	Toyota	Camry	1994							
84102	1.6	1.6 to 2.0	Honda	Civic	1999			x				Suspect diltion : Avg CO + CO2 = 8.77
84103	3	2.6 to 3.0	Nissan	Maxima	2000							
84104	3.3	3.1 to 3.5	Plymouth	Voyager	1998							
84105	1.8	1.6 to 2.0	Toyota	Corolla	1997							
84107	3.8	3.5 to 4.0	Buick	LeSabre	1989							
84108	1.5	0 to 1.6	Honda	Civic DX	1991							
84109	3.3	3.1 to 3.5	Plymouth	Voyager	1998							
84110	2	1.6 to 2.0	Ford	Contour	1995							
84111	4.3	4.1 to 5.0	Chevy	S-10	1996							
84113	3.1	3.1 to 3.5	Pontiac	Grand Prix	1993	x					x	File is missing or contains invalid test data
84114	3	2.6 to 3.0	Ford	Taurus	1988	x					x	File is missing or contains invalid test data
84115	2	1.6 to 2.0	Ford	Contour	1995		x		x		x	No flowmeter exhaust or temp data.
84116	4.3	4.1 to 5.0	Chevy	S-10	1996		x		x		x	No flowmeter flow or temp data.
84119	4	3.5 to 4.0	Jeep	Grand Cherokee	1995		x		x		x	No flowmeter flow or temp data.
84120	1.5	0 to 1.6	Honda	Civic	1984	x					x	File is missing or contains invalid test data
84121	2.9	2.6 to 3.0	Volvo	S80	2001		x		x		x	No flowmeter flow or temp data.
84122	3.3	3.1 to 3.5	Dodge	Grand Caravan SE	1999		x		x		x	No flowmeter flow or temp data.
84123	1.5	0 to 1.6	Honda	Civic	1984		x		x		x	No flowmeter data.
84125	4	3.5 to 4.0	Ford	Explorer XLT	1995	x					x	File is missing or contains invalid test data
84126	3.8	3.5 to 4.0	Ford	Thunderbird	1988		x	x	x		x	No flowmeter mass flow rate data. Avg dilution = 10.8%
84127	3.3	3.1 to 3.5	Chrysler	Town & Country	2000	x					x	File is missing or contains invalid test data
84128	2.2	2.1 to 2.5	Toyota	Camry LE	2000		x		x		x	No flowmeter flow or temp data.
84129	2.2	2.1 to 2.5	Toyota	Celica	1999		x		x		x	No flowmeter flow or temp data.
84131	2.2	2.1 to 2.5	Chevrolet	Cavalier	1997		x		x		x	No flowmeter flow or temp data.
84132	4	3.5 to 4.0	Jeep	Cherokee Sport	1993		x		x		x	No flowmeter flow or temp data.
84133	3.1	3.1 to 3.5	Buick	Century Limited	1998		x		x		x	No flowmeter flow or temp data.
84134	4.6	4.1 to 5.0	Mercury	Grand Marquis GS	1997							
84135	2.5	2.1 to 2.5	Ford	Probe	1993							
84137	4	3.5 to 4.0	Jeep	Cherokee Sport	1993		x		x		x	Average exhaust flow is > 50% less than average for all other similar displacement vehicles
84138	5.8	5.1 to 6.0	Ford	Bronco	1995	x					x	File is missing or contains invalid test data
84139	2	1.6 to 2.0	Ford	Escort ZX2	1999	x					x	File is missing or contains invalid test data
84140	4.3	4.1 to 5.0	Chevrolet	Blazer LS	2002							
84141	2.2	2.1 to 2.5	Honda	Accord	1990	x					x	File is missing or contains invalid test data
84143	3	2.6 to 3.0	Ford	Taurus	1988	x					x	File is missing or contains invalid test data
84144	3	2.6 to 3.0	Plymouth	Voyager	1993	x					x	File is missing or contains invalid test data
84145	4	3.5 to 4.0	Jeep	Cherokee	1990			x				Suspect diltion : Avg CO + CO2 = 8.45%
84146	2.3	2.1 to 2.5	Ford	Ranger XLT	1988							
84148	3.3	3.1 to 3.5	Dodge	Dynasty	1988		x		x		x	Average exhaust flow is > 50% more than average for all other similar displacement vehicles. Avg exhaust temp is low (100C)
84149	2	1.6 to 2.0	Ford	Escort	2002							
84150	3.5	3.1 to 3.5	Honda	Odyssey	2000		x		x		x	No flowmeter mass flow rate data.
84151	2.3	2.1 to 2.5	Honda	Accord	2000							
84153	4.2	4.1 to 5.0	Ford	F150	2000				x			Avg exhaust temp is low (250C)

Run#	Disp	Disp Bin	Make	Model	Model Year	Missing data	Flow Flag	Dilution Flag	Exh Temp Flag	Ambient Temp Flag	Suspect Data	Data Review Comments
84154	4.9	4.1 to 5.0	Ford	F150	1979		x				x	Average exhaust flow is > 50% more than average for all other similar displacement vehicles
84156	2.3	2.1 to 2.5	Honda	Accord	2000							
84157	1.6	1.6 to 2.0	Nissan	Sentra	1994							
84160	2	1.6 to 2.0	Ford	Focus SE	2001							
84161	2.4	2.1 to 2.5	Volvo	850	1997		x		x		x	No flowmeter flow or temp data.
84162	2.6	2.6 to 3.0	Chrysler	LeBaron	1983		x		x		x	Average exhaust flow is > 50% more than average for all other similar displacement vehicles, avg exhaust temp is high (500C)
84164	3.3	3.1 to 3.5	Plymouth	Voyager	1999							
84165	1.8	1.6 to 2.0	Mazda	Protégé	1991							
84166	2.3	2.1 to 2.5	Mercury	Topaz GS	1994							
84167	3	2.6 to 3.0	Ford	Ranger	1999	x					x	File is missing or contains invalid test data
84168	3.8	3.5 to 4.0	Buick	Regal	1996		x		x		x	No flowmeter flow or temp data.
84169	2.3	2.1 to 2.5	Mercury	Topaz GS	1994		x		x		x	No flowmeter flow or temp data.
84171	1.5	0 to 1.6	Honda	Civic DX	1988		x				x	Average exhaust flow is > 2x average for all other similar displacement vehicles
84172	2.8	2.6 to 3.0	Cadillac	Cimmaron	1986							
84173	3	2.6 to 3.0	Mercury	Sable	1996			x	x		x	Suspect diltion: Avg CO + CO2 = 9.01%, avg exhaust temp is low (185C)
84174	2.3	2.1 to 2.5	Mercury	Topaz	1994		x				x	Average exhaust flow is > 50% more than average for all other similar displacement vehicles
84175	3.8	3.5 to 4.0	Pontiac	Bonneville	1988							
84177	3	2.6 to 3.0	Ford	Taurus	1988							
84178	2.2	2.1 to 2.5	Toyota	Camry	1997							
84179	4	3.5 to 4.0	Jeep	Cherokee	1998							
84180	3.8	3.5 to 4.0	Pontiac	Bonneville	1988							
84182	4.6	4.1 to 5.0	Ford	Thunderbird LX	1995				x			Avg exhaust temp is low (280C)
84183	1.8	1.6 to 2.0	Toyota	Corolla	2000							
84184	1.6	1.6 to 2.0	Honda	Civic	2000							
84185	1.8	1.6 to 2.0	Toyota	Corolla	1996							
84187	3	2.6 to 3.0	Ford	Taurus	1988							
84188	5	4.1 to 5.0	Chevy	Monte Carlo	1977							
84189	4.9	4.1 to 5.0	Ford	F150	1984							
84191	2.2	2.1 to 2.5	Toyota	Camry	2000							
84192	4.3	4.1 to 5.0	GMC	Sonoma SLS	2001							
84193	2.4	2.1 to 2.5	Hyundai	Santa Fe	2001							
84195	3.1	3.1 to 3.5	Chevy	Lumina	1999							
84196	4.3	4.1 to 5.0	GMC	Safari	1993							
84197	3.1	3.1 to 3.5	Buick	Regal	1990							
84198	1.9	1.6 to 2.0	Saturn	SL1	1994							
84200	1.9	1.6 to 2.0	Saturn	SL1	1994							
84201	2.8	2.6 to 3.0	Chevy	S-10 Truck	1985							
84205	4.2	4.1 to 5.0	Ford	F150 Truck	1998							
84206	5.7	5.1 to 6.0	Chevrolet	C 1500	1994							
84208	5	4.1 to 5.0	Lincoln	Towncar	1989				x		x	Avg exhaust temp is low (200C)
84209	2.4	2.1 to 2.5	Dodge	Stratus ES	1996							
84210	2.2	2.1 to 2.5	Mazda	MX-6	1988							
84211	2.3	2.1 to 2.5	Ford	Tempo	1986							
84213	3.8	3.5 to 4.0	Oldsmobile	Ninety Eight Regenc	1985							
84214	3.8	3.5 to 4.0	Pontiac	Bonneville	1994							
84215	3	2.6 to 3.0	Nissan	Maxima	1992							
84218	3	2.6 to 3.0	Ford	Taurus	1988			x			x	Suspect diltion: Avg CO + CO2 = 2.24%
84219	3.5	3.1 to 3.5	Chrysler	Concord	1994	x					x	File is missing or contains invalid test data
84220	1.9	1.6 to 2.0	Ford	Escort	1992	x					x	File is missing or contains invalid test data

Run#	Disp	Disp Bin	Make	Model	Model Year	Missing data	Flow Flag	Dilution Flag	Exh Temp Flag	Ambient Temp Flag	Suspect Data	Data Review Comments
84221	5	4.1 to 5.0	Ford	Crown Victoria	1985	x					x	File is missing or contains invalid test data
84223	3.8	3.5 to 4.0	Dodge	Grand Caravan	2005	x					x	File is missing or contains invalid test data
84224	3	2.6 to 3.0	Ford	Taurus	2002	x					x	File is missing or contains invalid test data
84225	1.6	1.6 to 2.0	Honda	Civic	2000	x					x	File is missing or contains invalid test data
84227	3.1	3.1 to 3.5	Buick	Century	1997	x					x	File is missing or contains invalid test data
84228	2.3	2.1 to 2.5	Pontiac	Grand Am	1992	x					x	File is missing or contains invalid test data
84229	3.4	3.1 to 3.5	Oldsmobile	Silhouette	2000			x			x	Suspect diltion: Avg CO + CO2 = 1.04%
84230	1.3	0 to 1.6	Nissan	Sentra	1993	x					x	File is missing or contains invalid test data
84231	3.8	3.5 to 4.0	Oldsmobile	Eighty-Eight	1994	x					x	File is missing or contains invalid test data
84233	1.6	1.6 to 2.0	Toyota	Corolla	1989	x					x	File is missing or contains invalid test data
84234	1.8	1.6 to 2.0	Volkswagon	Cabriolet	1991	x					x	File is missing or contains invalid test data
84235	1.6	1.6 to 2.0	Geo	Prism	1990	x					x	File is missing or contains invalid test data
84236	2.3	2.1 to 2.5	Oldsmobile	Achieva	1992	x					x	File is missing or contains invalid test data
84238	2.8	2.6 to 3.0	Pontiac	6000	1988	x					x	File is missing or contains invalid test data
84240	3	2.6 to 3.0	Infiniti	I30	1998	x					x	File is missing or contains invalid test data
84241	2.5	2.1 to 2.5	Ford	Contour	1998	x					x	File is missing or contains invalid test data
84242	3.3	3.1 to 3.5	Plymouth	Voyager	1997							
84244	1.8	1.6 to 2.0	Ford	Escort	1993							
84245	2	1.6 to 2.0	Honda	Accord	1987		x		x		x	Average exhaust flow is > 50% more than average for all other similar displacement vehicles, max exhaust temp very high too (800C)
84246	1.8	1.6 to 2.0	Eagle	Talon	1994				x			Avg exhaust temp is high (460C)
84248	2.9	2.6 to 3.0	Ford	Ranger	1987							
84250	1.9	1.6 to 2.0	Ford	Escort	1987							
84252	3	2.6 to 3.0	Ford	Taurus	2001							
84253	3	2.6 to 3.0	Mercury	Sable	1997							
84254	3.8	3.5 to 4.0	Buick	Regal	1992							
84256	4.3	4.1 to 5.0	Chevy	S-10	1989							
84257	2.3	2.1 to 2.5	Volvo	240 GL	1983							
84258	3.8	3.5 to 4.0	Oldsmobile	Delta 88	1991							
84259	3	2.6 to 3.0	Ford	Taurus	1988							
84261	2	1.6 to 2.0	Toyota	Camry	1989		x	x	x		x	Average exhaust flow is > 50% more than average for all other similar displacement vehicles, dilution suspect (CO+CO2 = 4.3%). Avg exhaust temp is low (190C)
84262	3.8	3.5 to 4.0	Oldsmobile	Delta 88	1991							
84263	2	1.6 to 2.0	Dodge	Ram 50	1989							
84265	3	2.6 to 3.0	Buick	Century	1984							
84266	1.8	1.6 to 2.0	Kia	Sephia	2000							
84267	2	1.6 to 2.0	Chevy	Cavalier	1989							
84268	5	4.1 to 5.0	Ford	F150	1994			x				Suspect diltion: Avg CO + CO2 = 10.05%
84270	5	4.1 to 5.0	Mercury	Grand Marquis	1986			x				Suspect diltion: Avg CO + CO2 = 10.35%
84271	4.9	4.1 to 5.0	Buick	LeSabre	1979							
84272	3	2.6 to 3.0	Honda	Accord	2001							
84274	1.3	0 to 1.6	Ford	Aspire	1995							
84276	3.8	3.5 to 4.0	Buick	Electra Park Ave	1989							
84277	1.8	1.6 to 2.0	MG	MG	1978		x		x		x	Average exhaust flow is > 2x average for all other similar displacement vehicles, avg exhaust temp is high (480C)
84278	4.3	4.1 to 5.0	GMC	Jimmy	1990			x				Suspect diltion : Avg CO + CO2 = 8.45%
84279	3	2.6 to 3.0	Toyota	Camry	2001							
84280	2	1.6 to 2.0	Ford	Escort	1999							
84281	5.7	5.1 to 6.0	Chevy	Suburban	1995							
84283	3.7	3.5 to 4.0	Dodge	Ram	1986		x	x			x	Average exhaust flow is > 2x average for all other similar displacement vehicles. Avg dilution = 10.4%
84284	5	4.1 to 5.0	Chevrolet	:aprice Classic Wago	1987							

Run#	Disp	Disp Bin	Make	Model	Model Year	Missing data	Flow Flag	Dilution Flag	Exh Temp Flag	Ambient Temp Flag	Suspect Data	Data Review Comments
84285	1.6	1.6 to 2.0	Honda	Civic	2000							
84286	3.4	3.1 to 3.5	Oldsmobile	Silhouette	1997							
84287	4.3	4.1 to 5.0	GMC	Sierra	1995				x		x	Avg exhaust temp is high (510C)
84289	5	4.1 to 5.0	Oldsmobile	om Cruiser Station W	1984							
84290	3	2.6 to 3.0	Ford	Taurus	1988							
84291	1.6	1.6 to 2.0	Honda	Civic	1997							
84292	2.2	2.1 to 2.5	Toyota	Camry	1997							
84293	2.3	2.1 to 2.5	Volvo	GL	1984							
84295	5	4.1 to 5.0	Chevy	Caprice	1987							
84296	1.6	1.6 to 2.0	Honda	Civic	1998							
84297	2.4	2.1 to 2.5	Dodge	Stratus	1996							
84298	5.9	5.1 to 6.0	Dodge	Durango	1999							
84300	3.8	3.5 to 4.0	Buick	LeSabre	1990							
84301	3.1	3.1 to 3.5	Pontiac	Grand Prix	1989		x		x		x	Average exhaust flow is > 50% more than average for all other similar displacement vehicles. Avg exhaust temp is low (530C)
84302	4.9	4.1 to 5.0	Ford	F150	1993			x				Suspect diltion : Avg CO + CO2 = 10.10%
84303	3.4	3.1 to 3.5	Oldsmobile	Silhouette	2002				x			Avg exhaust temp is high (480C)
84304	1.7	1.6 to 2.0	Honda	Civic	2001				x			Avg exhaust temp is high (470C)
84305	3.1	3.1 to 3.5	Chevrolet	Malibu	1999							
84307	2.2	2.1 to 2.5	Honda	Accord	1992							
84308	2.3	2.1 to 2.5	Pontiac	Grand Am	1994							
84309	4.5	4.1 to 5.0	Mercedes	280 SE	1973							
84310	3.4	3.1 to 3.5	Chevy	Venture	2003		x		x		x	Average exhaust flow is approx 50% more than average for all other similar displacement vehicles, avg exh temp is high (490C)
84311	1.6	1.6 to 2.0	Toyota	Corolla	1989							
84312	2.3	2.1 to 2.5	Pontiac	Grand Am	1994							
84314	2.2	2.1 to 2.5	Plymouth	Sundance	1989							
84315	3	2.6 to 3.0	Plymouth	Voyager	1991							
84316	2	1.6 to 2.0	Dodge	Avenger	1996							
84317	2.4	2.1 to 2.5	Nissan	Altima	2000	x					x	File is missing or contains invalid test data
84318	1.6	1.6 to 2.0	Nissan	Sentra	1997							
84319	2.2	2.1 to 2.5	Toyota	Camry	1998							
84321	3	2.6 to 3.0	Toyota	Avalon	1996							
84322	2	1.6 to 2.0	Toyota	Camry	1990							
84323	1.6	1.6 to 2.0	Kia	Rio	2004	x					x	File is missing or contains invalid test data
84324	2.2	2.1 to 2.5	Toyota	Camry	1999							
84325	3	2.6 to 3.0	Nissan	Maxima	1997							
84327	3	2.6 to 3.0	Ford	Taurus	1998							
84328	3	2.6 to 3.0	Toyota	Avalon	1996							
84329	4	3.5 to 4.0	Jeep	Wrangler	1997		x				x	Average exhaust flow is > 50% more than average for all other similar displacement vehicles
84330	2.2	2.1 to 2.5	Chevy	Cavalier	2004							

Run#	Disp	Disp Bin	Make	Model	Model Year	Missing data	Flow Flag	Dilution Flag	Exh Temp Flag	Ambient Temp Flag	Suspect Data	Data Review Comments
84331	2.4	2.1 to 2.5	Saturn	Sedan	2001							
84332	2.4	2.1 to 2.5	Pontiac	Grand Am SE	1997		x				x	Average exhaust flow is > 50% less than average for all other similar displacement vehicles
84334	5	4.1 to 5.0	Chevrolet	Caprice-estate	1990							
84335	5	4.1 to 5.0	Mercury	Grand Marquis	1988			x				Suspect diltion : Avg CO + CO2 = 10.46%
84336	2.4	2.1 to 2.5	Toyota	Pickup	1987				x			Avg exhaust temp is high (490C)
84337	4	3.5 to 4.0	Ford	Ranger	2003							
84338	2.4	2.1 to 2.5	Saturn	Sedan	2001							
84339	3.8	3.5 to 4.0	Plymouth	Voyager	1999							
84341	2.4	2.1 to 2.5	Pontiac	Grand Am SE	1997							
84342	3	2.6 to 3.0	Toyota	Camry	1994							
84343	3.5	3.1 to 3.5	Kia	Sedona	2004							
84344	3	2.6 to 3.0	Toyota	Sienna	2000				x			Avg exhaust temp is high (440C)
84345	3.1	3.1 to 3.5	GM/Chevy	Lumina	1997							
84347	1.6	0 to 1.6	Toyota	Corolla	1995							Missing delays, fuel SG, etc.
84348	3	2.6 to 3.0	Ford	Taurus	1988							
84349	2.5	2.1 to 2.5	Chevrolet	Tracker	2003							
84350	3.1	3.1 to 3.5	GM/Chevy	Lumina	1997							
84351	2	1.6 to 2.0	Ford	Contour	1996							
84353	1.9	1.6 to 2.0	Saturn	Wagon	1993							
84354	4.9	4.1 to 5.0	Ford	F150	1989			x				Suspect diltion : Avg CO + CO2 = 9.71%
84355	3.1	3.1 to 3.5	Chevrolet	Lumina	2001							
84356	2.4	2.1 to 2.5	Pontiac	Grand Am	1997							
84357	1.9	1.6 to 2.0	Mercury	Tracer	1995							
84359	1.6	1.6 to 2.0	Toyota	Corolla	1992							
84360	3	2.6 to 3.0	Ford	Taurus	1988							
84361	3.5	3.1 to 3.5	Nissan	Maxima	2002							
84362	3	2.6 to 3.0	Ford	Taurus SE	1998							
84363	1.8	1.6 to 2.0	Toyota	Corolla	1996							
84365	3.8	3.5 to 4.0	Ford	Taurus	1993							
84366	3.3	3.1 to 3.5	Oldsmobile	Cutlass Wagon	1989				x			Avg exhaust temp is high (490C)
84367	4.5	4.1 to 5.0	Mercedes	Sel	1980							
84368	1.9	1.6 to 2.0	Saturn	SL1	1997							
84369	2.3	2.1 to 2.5	Volvo	850 Turbo	1996				x		x	Avg exhaust temp is high (490C)
84370	3	2.6 to 3.0	Ford	Taurus	1995							
84372	3	2.6 to 3.0	Toyota	Camry	1994			x				Suspect diltion : Avg CO + CO2 = 8.73%
84373	4.3	4.1 to 5.0	Chevrolet	Astro	1990							
84374	3	2.6 to 3.0	Ford	Taurus	1988							
84375	3.8	3.5 to 4.0	Ford	Windstar	2001							
84376	3.5	3.1 to 3.5	Honda	Odyssey	2000							
84377	2.2	2.1 to 2.5	Honda	Accord	1997							
84379	2.4	2.1 to 2.5	Pontiac	Grand Am GT	1998							
84380	4.6	4.1 to 5.0	Lincoln	Continental	1995				x		x	Avg exhaust temp is low (190C)
84381	4.6	4.1 to 5.0	Mercury	Marquis	1994							
84382	2	1.6 to 2.0	Volkswagon	Cabrio	1999							
84383	2.2	2.1 to 2.5	Toyota	Camry	1996							
84384	1.6	0 to 1.6	GEO	Prism	1996							Missing delays, fuel SG, etc.
84386	3	2.6 to 3.0	Nissan	Maxima	1990							
84387	3	2.6 to 3.0	Ford	Taurus	1988							

Kansas City PM Characterization Study

Final Report

Appendix P
Round 2 Dynamometer PEMS Quality Control Summary

Assessment and Standards Division
Office of Transportation and Air Quality
U.S. Environmental Protection Agency

Sponsors:

National Renewable Energy Laboratory, U.S. Department of Energy
Federal Highway Administration, U.S. Department of Transportation
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Run#	Disp	Disp Bin	Make	Model	Model Year	Missing data	Flow Flag	Dilution Flag	Exh Temp Flag	Ambient Temp Flag	Suspect Data	Data Review Comments
84393	3.5	3.1 to 3.5	Chrysler	300M	1999		x		x		x	Average exh flow is approx 50% higher than other vehicles with similar displacements, avg exh temp is low (120C)
84394	3.5	3.1 to 3.5	Honda	Odyssey	2000		x		x		x	Average exh flow is > 50% higher than other vehicles with similar displacements, avg exh temp is low (240C)
84396	1.9	1.6 to 2.0	Ford	Escort LX	1995							
84397	5.7	5.1 to 6.0	Chevrolet	Silverado	1976		x		x		x	Average exh flow is approx 50% higher than other vehicles with similar displacements, avg exh temp is low (190C)
84398	2.3	2.1 to 2.5	Honda	Accord	2001		x		x		x	Average exh flow is > 50% higher than other vehicles with similar displacements, avg exh temp is low (230C)
84399	2.2	2.1 to 2.5	Honda	Accord	1997		x		x		x	Average exh flow is > 50% higher than other vehicles with similar displacements, avg exh temp is low (220C)
84401	3.3	3.1 to 3.5	Plymouth	Voyager	1998		x		x		x	Average exh flow is > 50% higher than other vehicles with similar displacements, avg exh temp is low (220C)
84402	1.5	0 to 1.6	Honda	Civic	1991							
84403	3	2.6 to 3.0	Dodge	Caravan	2000		x		x		x	Average exh flow is > 50% higher than other vehicles with similar displacements, avg exh temp is low (230C)
84406	1.6	1.6 to 2.0	Toyota	Corolla	1995	x					x	File is missing or contains invalid test data.
84407	2.3	2.1 to 2.5	Pontiac	Grand AM	1989		x	x	x		x	Average exh flow is > 50% higher than other vehicles with similar displacements, dilution suspect (avg CO+CO2 = 10.3%)., avg exh temp is low (200C)
84409	3.1	3.1 to 3.5	Chevrolet	Malibu	1999							
84411	1.9	1.6 to 2.0	Saturn		1996			x			x	Suspect dilution (avg CO + CO2 = 5.19%)
84412	1.6	1.6 to 2.0	Honda	Civic	1996			x			x	Suspect dilution (avg CO + CO2 = 6.54%)
84413	5.7	5.1 to 6.0	Ford	F250	1979			x	x		x	Suspect dilution : Avg CO + CO2 = 8.6%, avg exh temp is high (530C)
84414	3.8	3.5 to 4.0	Chevrolet	Impala	2003							
84415	5.9	5.1 to 6.0	Dodge	Durango	1999				x			Avg exh temp is high (490C)
84416	1.6	1.6 to 2.0	Honda	Civic	1998							
84419	3.1	3.1 to 3.5	Chevrolet	Lumina	1998							
84420	2.3	2.1 to 2.5	Honda	Accord	2000							
84421	2.2	2.1 to 2.5	Saturn	LS1	2000							
84422	4	3.5 to 4.0	Jeep	Cherokee	1998							
84424	4	3.5 to 4.0	Ford	Explorer	1995				x		x	Avg exhaust temp is high (510C)
84425	4	3.5 to 4.0	Jeep	Grand Cherokee	1995				x		x	Avg exhaust temp is high (510C)
84426	1.9	1.6 to 2.0	Saturn	SC2	2001							
84427	2.4	2.1 to 2.5	Mitsubishi	Galant	2001							
84428	3.1	3.1 to 3.5	Chevy	Malibu	1998							
84430	2.5	2.1 to 2.5	Dodge	Spirit	1990							
84431	5	4.1 to 5.0	Mercury	Grand Marquis Stat	1991			x				Suspect diltion : Avg CO + CO2 = 10.5%
84432	1.9	1.6 to 2.0	Saturn	Sedan	1999							
84433	4	3.5 to 4.0	Jeep	Wrangler	1997							
84434	3.8	3.5 to 4.0										
84436	4.3	4.1 to 5.0	Chevrolet	S-10	1995							
84437	3	2.6 to 3.0	Toyota	Camry	1994							
84438	3.1	3.1 to 3.5	Buick	Century	2001							
84439	3.8	3.5 to 4.0	Pontiac	Bonneville	1995							
84442	3	2.6 to 3.0	Toyota	Camry	1994							
84443	1.6	1.6 to 2.0	Geo	Prizm	1991							erroneous aux temp (not a data issue)
84444	2.5	2.1 to 2.5	Chevrolet	Tracker	2003							
84445	2.2	2.1 to 2.5	Saturn	Sedan	2001			x			x	Suspect diltion : Avg CO + CO2 = 7.6%, erroneous aux temp (not a data issue)
84446	3	2.6 to 3.0	Toyota	Sienna	2000							erroneous aux temp (not a data issue)
84448	3.8	3.5 to 4.0	Plymouth	Voyager	1999							erroneous aux temp (not a data issue)
84449	3.1	3.1 to 3.5	Buick	Regal	1994							erroneous aux temp (not a data issue)
84450	3.1	3.1 to 3.5	Ford	Taurus	1988				x			Avg exh temp is low (290C), erroenous aux temp (not a data issue)
84451	3.1	3.1 to 3.5	Buick	Regal	1994							erroneous aux temp (not a data issue)
84452	3	2.6 to 3.0	Ford	Taurus	1995							erroneous aux temp (not a data issue)
84453	3	2.6 to 3.0	Nissan	Maxima	1995							erroneous aux temp (not a data issue)
84455	3.8	3.5 to 4.0	Ford	Mustang	1995							erroneous aux temp (not a data issue)

Run#	Disp	Disp Bin	Make	Model	Model Year	Missing data	Flow Flag	Dilution Flag	Exh Temp Flag	Ambient Temp Flag	Suspect Data	Data Review Comments
84456	3.1	3.1 to 3.5	Pontiac	Grand Prix Le	1993				x		x	Avg exhaust temp is high (550C), erroneous aux temp (not a data issue)
84457	4.6	4.1 to 5.0	Ford	Crown Victoria	1995							
84458	3	2.6 to 3.0	Ford	Aerostar	1993							erroneous aux temp (not a data issue)
84459	3	2.6 to 3.0	Ford	Aerostar	1992							
84461	3	2.6 to 3.0	Ford	Taurus	1988							
84462	3	2.6 to 3.0	Plymouth	Voyager	1989							
84463	2	1.6 to 2.0	Ford	Contour	1995							
84464	3.3	3.1 to 3.5	Dodge	Intrepid	1994							
84465	3.8	3.5 to 4.0	Chevy	Lumina LS	1994							
84467	2.3	2.1 to 2.5	Ford	Ranger	1988							
84468	3.8	3.5 to 4.0	Chevy	Lumina LS	1994							
84469	3	2.6 to 3.0	Dodge	Caravan	1989							
84470	4.5	4.1 to 5.0	Mercedes	280 SE	1973		x		x		x	Average exh flow is approx 50% higher than other vehicles with similar displacements, avg exh temp is high (560C)
84472	5	4.1 to 5.0	Chevrolet	Monte Carlo	1977				x		x	Avg exh temp is high (510C)
84473	4	3.5 to 4.0	Ford	Explorer	1996							
84474	1.5	0 to 1.6	Honda	Civic	1988							
84475	2.3	2.1 to 2.5	Ford	Tempo	1986				x			Avg exhaust temp is high (470C)
84477	4	3.5 to 4.0	Dodge	Ram	1989							
84479	3.3	3.1 to 3.5	Dodge	Caravan	1996							
84480	3	2.6 to 3.0	Ford	Taurus	1988							
84482	4.9	4.1 to 5.0	Buick	Lasabre	1979							
84483	2	1.6 to 2.0	Dodge	Neon	1996							
84484	4.9	4.1 to 5.0	Buick	Lasabre	1979				x			Avg exh temp is low (290C)
84485	4.9	4.1 to 5.0	Cadillac	Fleetwood	1991							
84487	2.2	2.1 to 2.5	Mazda	B2200	1992				x			Avg exhaust temp is high (470C)
84488	3.8	3.5 to 4.0	Buick	Lesabre	1995							
84489	2.4	2.1 to 2.5	Toyota	Truck	1987			x	x			Suspect diltion : Avg CO + CO2 = 9.7%, avg exh temp is high (470C)
84490	4.9	4.1 to 5.0	Cadillac	Fleetwood	1991							
84492	5	4.1 to 5.0	Chevy	C10 Silverado	1984							
84493	4.2	4.1 to 5.0	Ford	Freestar SEL	2004							
84494	2.3	2.1 to 2.5	Ford	Ranger XLT	1997							
84495	2.2	2.1 to 2.5	GMC	Sonoma	1996							
84497	3	2.6 to 3.0	Toyota	4Runner SR5	1995				x		x	Avg exhaust temp is high (515C)
84498	3	2.6 to 3.0	Toyota	Sienna XLE	2001							
84499	1.8	1.6 to 2.0	Acura	Integra	1995							
84500	2.4	2.1 to 2.5	Nissan	Frontier	1998							
84502	3.5	3.1 to 3.5	Chrysler	Concord	1996	x	x	x			x	File is missing or contains invalid test data.
84503	3	2.6 to 3.0	Ford	Taurus	2002							
84504	3.2	3.1 to 3.5	Chrysler	Concord LXI	2000				x			Avg exh temp is low (230C)
84505	3.3	3.1 to 3.5	Dodge	Intrepid	1993							
84507	3	2.6 to 3.0	Ford	Taurus	1988							
84508	1.5	0 to 1.6	Honda	Civic	1992							
84509	4.3	4.1 to 5.0	Chevrolet	Astrovan	1992							
84510	5.7	5.1 to 6.0	Chevy	Suburban	1994							
84512	4.4	4.1 to 5.0	Chevy	Caprice	1982							
84514	3.5	3.1 to 3.5	Chrysler	Concorde	2002				x			Avg exh temp is low (270C)
84515	2.4	2.1 to 2.5	Dodge	Stratus	1999							erroneous aux temp (not a data issue)
84517	3.3	3.1 to 3.5	Dodge	Grand Caravan	1998							erroneous aux temp (not a data issue)
84518	3.1	3.1 to 3.5	Buick	Skylark	1994							
84519	3	2.6 to 3.0	Dodge	Caravan	1992							
84520	3	2.6 to 3.0	Ford	Taurus	2001							
84521	2.2	2.1 to 2.5	Honda	Accord	1997							erroneous aux temp (not a data issue)
84522	4.3	4.1 to 5.0	Chevy	C1500	1996							

Run#	Disp	Disp Bin	Make	Model	Model Year	Missing data	Flow Flag	Dilution Flag	Exh Temp Flag	Ambient Temp Flag	Suspect Data	Data Review Comments
84524	2.3	2.1 to 2.5	Isuzu	Pickup	1995							erroneous aux temp (not a data issue)
84526	4.6	4.1 to 5.0	Lincoln	Towncar	1991							
84527	5.9	5.1 to 6.0	Dodge	Ram PU	1995							
84528	4.6	4.1 to 5.0	Mercury	Grand Marquis	1994							
84529	2.5	2.1 to 2.5	Plymouth	Sundance	1992							
84531	1.6	1.6 to 2.0	Geo	Tracker	1992				x			Avg exhaust temp is high (450C)
84532	3.4	3.1 to 3.5	Pontiac	Montana	2003							
84533	5.7	5.1 to 6.0	Chevy	Suburban	1999							
84534	2.2	2.1 to 2.5	Subaru	Legacy Wagon	1993							erroneous aux temp (not a data issue)
84536	3	2.6 to 3.0	Ford	Taurus	1988							
84537	4	3.5 to 4.0	Jeep	Cherokee Sport	2000							
84538	4	3.5 to 4.0	Ford	Ranger	1998							
84539	5.7	5.1 to 6.0	Chevy	Tahoe	1996							
84541	3.3	3.1 to 3.5	Dodge	Grand Caravan	1996							
84542	3.3	3.1 to 3.5	Dodge	Grand Caravan	1996							
84543	4	3.5 to 4.0	Jeep	Cherokee Sport	2000							
84544	3	2.6 to 3.0	Ford	Taurus	1988							
84546	3.9	3.5 to 4.0	Dodge	Dakota	1999							
84547	1.8	1.6 to 2.0	Toyota	Corolla	1995							
84548	3.3	3.1 to 3.5	Dodge	Intrepid	1995							
84550	5	4.1 to 5.0	Lincoln	Town Car	1988			x				Suspect dilution : Avg CO + CO2 = 10.7%, erroneous aux temp (not a data issue)
84551	3.5	3.1 to 3.5	Isuzu	Axiom	2002							
84552	3.4	3.1 to 3.5	Olds	Silhoutte	2002							
84554	4.9	4.1 to 5.0	Ford	F150	1992							
84556	3.3	3.1 to 3.5	Chrysler	Town & Country LX	2001							
84557	3.8	3.5 to 4.0	Buick	Park Avenue	2000							
84558	4.3	4.1 to 5.0	Chevy	S-10	2001							
84560	2.5	2.1 to 2.5	Dodge	Dakota	1998							
84561	5	4.1 to 5.0	Ford	Country Squire	1986			x	x			Suspect dilution : Avg CO + CO2 = 9.0%, avg exh temp is low (290C)
84562	3.7	3.5 to 4.0	Dodge	Dakota	2004							
84563	4	3.5 to 4.0	Ford	Ranger	2002							
84564	3.3	3.1 to 3.5	Dodge	Grand Caravan	1998							
84566	2.2	2.1 to 2.5	Honda	Odyssey	1995							
84567	4.9	4.1 to 5.0	Cadillac	Sedan Deville	1992							
84568	2.3	2.1 to 2.5	Ford	Ranger	1996							
84569	3	2.6 to 3.0	Ford	Taurus	1995							
84570	2.2	2.1 to 2.5	Chevrolet	S-10 Pick up	1994							
84572	2.3	2.1 to 2.5	Mercury	Topaz	1994							
84573	3.8	3.5 to 4.0	Buick	Park Avenue	1993							
84574	3.8	3.5 to 4.0	Ford	Taurus	1993							
84575	3.1	3.1 to 3.5	Chevrolet	Lumina	1994							
84577	3.8	3.5 to 4.0	Ford	Windstar	1998							
84578	3	2.6 to 3.0	Ford	Taurus	1988							
84580	3.8	3.5 to 4.0	Chrysler	Town & Country	2002		x				x	No appreciable measured exhaust flow
84581	3.1	3.1 to 3.5	Chevy	Corsica	1995							
84582	2.7	2.6 to 3.0	BMW	528e	1988							erroneous aux temp (not a data issue)
84584	2.4	2.1 to 2.5	Nissan	Pickup XE	1995							erroneous aux temp (not a data issue)
84587	3	2.6 to 3.0	Mercury	Villager	1997							erroneous aux temp (not a data issue)
84588	5.7	5.1 to 6.0	Buick	Lesabre	1978							
84589	1.9	1.6 to 2.0	Saturn	SL 2	2001							
84591	3	2.6 to 3.0	Toyota	4 Runner	1993				x			Avg exhaust temp is high (480C)
84592	5.7	5.1 to 6.0	Ford	LTD	1979							
84593	2.3	2.1 to 2.5	Honda	Accord EX	1998							
84595	2	1.6 to 2.0	Ford	Escort SE	1998							

Run#	Disp	Disp Bin	Make	Model	Model Year	Missing data	Flow Flag	Dilution Flag	Exh Temp Flag	Ambient Temp Flag	Suspect Data	Data Review Comments
84596	3	2.6 to 3.0	Ford	Taurus GL	1997							
84597	2	1.6 to 2.0	Pontiac	Sunbird	1994							
84599	3	2.6 to 3.0	Toyota	Avalon	1998							
84600	4	3.5 to 4.0	Ford	Explorer	1993							
84601	3.8	3.5 to 4.0	Buick	Regal	1979							
84603	1.4	0 to 1.6	Datsun	210 Wagon	1979			x	x			Avg exhaust temp is high (450C), suspect dilution, avg CO + CO2 = 8.6%
84605	2.8	2.6 to 3.0	Datsun	280Z	1977				x		x	Avg exhaust temp is high (611C)
84606	3	2.6 to 3.0	Ford	Taurus	1988							
84608	3	2.6 to 3.0	Nissan	Quest	1996		x				x	No appreciable measured exhaust flow
84609	5	4.1 to 5.0	Buick	Regal	1978							
84611	2.5	2.1 to 2.5	Toyota	Camry	1989							
84612	4	3.5 to 4.0	Ford	Ranger XLT	2000							
84616	3.3	3.1 to 3.5	Plymouth	Voyager	1999							
84617	5.7	5.1 to 6.0	Chevy	Suburban	1997				x			Avg exh temp is low (260C)
84618	2.5	2.1 to 2.5	Plymouth	Voyager	1992				x			Avg exhaust temp is low (220C)
84620	2.3	2.1 to 2.5	Ford	Ranger XLT	1992				x			Avg exhaust temp is low (250C)
84621	3	2.6 to 3.0	Ford	Ranger	1992							
84622	2.2	2.1 to 2.5	Toyota	Camry	1999				x			Avg exhaust temp is low (220C)
84623	2.5	2.1 to 2.5	Plymouth	Acclaim	1989				x			Avg exhaust temp is low (220C)
84624	3	2.6 to 3.0	Ford	Taurus	1988							
84626	3.7	3.5 to 4.0	Dodge	Ram Pickup	1987							
84627	4.9	4.1 to 5.0	Ford	F-150	1987				x			Avg exh temp is high (520C)
84628	4.2	4.1 to 5.0	Chevy	Trail Blazer	2002							
84629	2.5	2.1 to 2.5	Acura	2.5 TL	1996							
84630	2	1.6 to 2.0	Honda	Accord SEi	1989							
84632	4.9	4.1 to 5.0	Ford	F-150	1987							
84633	2.7	2.6 to 3.0	Volvo	740 Turbo	1987							
84634	3	2.6 to 3.0	Plymouth	Voyager SE	1988							
84635	5	4.1 to 5.0	Ford	Crown Victoria LTD	1989							
84637	5	4.1 to 5.0	Oldsmobile	Cutlass	Supreme							
84638	3.8	3.5 to 4.0	Chrysler	Town & Country	1996							
84639	2.2	2.1 to 2.5	Chevy	Cavalier	1995							
84640	4	3.5 to 4.0	Ford	Explorer	1994							
84642	2.5	2.1 to 2.5	Dodge	Spirit	1989							
84643	1.9	1.6 to 2.0	Ford	Escort	1987							
84644	3.5	3.1 to 3.5	Nissan	Pathfinder	2001							
84645	2.9	2.6 to 3.0	Volvo	960	1993							
84646	2	1.6 to 2.0	Honda	Accord LXI	1988							
84648	3.9	3.5 to 4.0	Dodge	SE Dakota	1987			x				Suspect diltion : Avg CO + CO2 = 10.4%
84649	4.3	4.1 to 5.0	GMC	Sonoma	1995							
84650	3.1	3.1 to 3.5	Chevy	Lumina APV	1990							
84651	3	2.6 to 3.0	Ford	Taurus	1988							
84653	5.7	5.1 to 6.0	Chevrolet	C20 Pickup	1977				x		x	Avg exh temp is high (500C)
84654	3.3	3.1 to 3.5	Oldsmobile	Cutlass	1990							
84655	3.8	3.5 to 4.0	Buick	Park Avenue Electra	1990							
84656	3.1	3.1 to 3.5	Chevy	Lumina	1990							
84658	4.3	4.1 to 5.0	Chevy	Astrovan	1989							
84659	2.5	2.1 to 2.5	Chrysler	LeBaron	1988							
84660	3	2.6 to 3.0	Dodge	Caravan SE	1988							
84661	3.3	3.1 to 3.5	Buick	Century	1990							
84662	4.5	4.1 to 5.0	Cadillac	Eldorado	1990							
84663	2	1.6 to 2.0	Chevrolet	Corsica	1989							
84665	3	2.6 to 3.0	Toyota	Pickup	1989				x			Avg exhaust temp is high (470C)
84666	5	4.1 to 5.0	Ford	F-150	1988							

Run#	Disp	Disp Bin	Make	Model	Model Year	Missing data	Flow Flag	Dilution Flag	Exh Temp Flag	Ambient Temp Flag	Suspect Data	Data Review Comments
84667	5.8	5.1 to 6.0	Ford	F250 Pickup	1982							
84668	3.8	3.5 to 4.0	Oldsmobile	Delta 88	1991							
84669	2.5	2.1 to 2.5	Dodge	Spirit	1990							
84670	2.3	2.1 to 2.5	Mercury	Topaz	1989							
84672	1.6	1.6 to 2.0	Toyota	Tercel SR5	1983			x				Suspect dilution (avg CO + CO2 = 9.83%)
84673	5	4.1 to 5.0	GMC	Vandura	1983		x		x		x	Average exh flow is > 50% higher than other vehicles with similar displacements, avg exh temp is high (630C)
84674	6.6	> 6.0	Pontiac	Firebird	1979							
84675	2.3	2.1 to 2.5	Ford	Tempo	1993							
84676	5	4.1 to 5.0	Ford	Bronco	1990							
84677	3.8	3.5 to 4.0	Buick	Park Avenue	1989							
84679	2.2	2.1 to 2.5	Toyota	Pickup	1983							
84680	5	4.1 to 5.0	Chevrolet	Cheyenne Pickup	1973							
84681	2.3	2.1 to 2.5	Ford	Tempo	1993							
84681	5	4.1 to 5.0	Ford	Tempo	1993							
84682	2.5	2.1 to 2.5	Toyota	Camry	1990							
84683	2.9	2.6 to 3.0	Ford	Ranger	1990							
84685	4.9	4.1 to 5.0	Ford	F-150	1988			x	x			Suspect dilution : Avg CO + CO2 = 9.85%, avg exh temp is high 490C)
84686	4.9	4.1 to 5.0	Ford	F-150	1986							
84687	5.7	5.1 to 6.0	Chevy	El Camino	1976				x		x	Avg exh temp is high (490C)
84688	3	2.6 to 3.0	Ford	Taurus	1993							
84689	4.3	4.1 to 5.0	GMC	Jimmy	1992			x				Suspect dilution : Avg CO + CO2 = 9.39%
84690	2.8	2.6 to 3.0	Oldsmobile	Cutlass	1989							
84692	2.8	2.6 to 3.0	Buick	Century	1988							
84693	4.9	4.1 to 5.0	Ford	F-150	1988							
84694	4.1	4.1 to 5.0	Chevrolet	C-10	1983							
84695	2.8	2.6 to 3.0	Oldsmobile	Cutlass	1989							
84696	2.4	2.1 to 2.5	Toyota	Pickup 4x4 Turbo	1987							
84697	3	2.6 to 3.0	Ford	Taurus	1988							
84699	5	4.1 to 5.0	Chevrolet	Caprice	1985							
84700	6.5	> 6.0	Ford	F-150	1978							
84701	4.9	4.1 to 5.0	Ford	F-150	1990			x				Suspect dilution : Avg CO + CO2 = 9.0%
84702	5.7	5.1 to 6.0	Chevy	G20 Van	1989							
84703	2.8	2.6 to 3.0	Chevy	Blazer 4x4	1987							
84705	3.8	3.5 to 4.0	Chevy	Malibu	1980							
84706	4.1	4.1 to 5.0	Chevrolet	Nova	1976			x	x		x	Suspect dilution : Avg CO + CO2 = 6.5%, avg exh temp is low (190C)
84707	5.7	5.1 to 6.0	Chevy	Impala	1973				x		x	Avg exh temp is high (560C)
84708	3.8	3.5 to 4.0	Dodge	Caravan ES	2003							
84709	2.3	2.1 to 2.5	Ford	Ranger XLT	1989							
84710	5	4.1 to 5.0	Chevy	Monte Carlo	1984							
84712	4.1	4.1 to 5.0	Chevrolet	Nova	1976				x			Avg exh temp is low (290C)
84713	4.3	4.1 to 5.0	Chevrolet	Blazer	1996							
84714	1.9	1.6 to 2.0	Saturn	Station Wagon	1994							
84715	2.2	2.1 to 2.5	Mazda	B2200	1988							
84717	2.4	2.1 to 2.5	Ford	Mustang	1979							
84719	3.1	3.1 to 3.5	Oldsmobile	Cutlass	1990							
84720	5	4.1 to 5.0	Chevy	Silverado 1500	1989							
84722	3.8	3.5 to 4.0	Ford	Windstar	1998							
84723	2.2	2.1 to 2.5	Chevy	Cavalier	1991							
84724	3.3	3.1 to 3.5	Oldsmobile	Cutlass Cierra	1990							
84726	3	2.6 to 3.0	Ford	Aerostar	1990							
84727	3.3	3.1 to 3.5	Ford	Granada	1982			x	x		x	Suspect diltion : Avg CO + CO2 = 9.6%, avg exh temp is high (550C)
84728	3	2.6 to 3.0	Ford	Escape	2002							
84729	2.2	2.1 to 2.5	Toyota	Camry	2001							

Run#	Disp	Disp Bin	Make	Model	Model Year	Missing data	Flow Flag	Dilution Flag	Exh Temp Flag	Ambient Temp Flag	Suspect Data	Data Review Comments
84730	4.3	4.1 to 5.0	Chevrolet	S-10 LS	1995							
84732	4.2	4.1 to 5.0	Jeep	CJ-7	1979							
84733	3.1	3.1 to 3.5	Buick	Skylark	1998							
84734	3	2.6 to 3.0	Plymouth	Voyager	1993							
84735	2	1.6 to 2.0	Honda	Accord	1988	x					x	File is missing or contains invalid test data.
84737	2.5	2.1 to 2.5	Chevrolet	Celebrity	1984							
84738	5.7	5.1 to 6.0	Pontiac	Grand Prix	1976							
84739	1.5	0 to 1.6	Mazda	Protégé	1998							
84740	3.8	3.5 to 4.0	Buick	LeSabre	1990							
84741	3	2.6 to 3.0	Ford	Taurus	1988							
84743	1.6	1.6 to 2.0	Mazda	Protégé	1999							
84745	1.5	0 to 1.6	Honda	Civic	1990							
84747	3.3	3.1 to 3.5	Dodge	Grand Caravan	2003							
84748	3.3	3.1 to 3.5	Dodge	Grand Caravan	2002							
84749	3	2.6 to 3.0	Toyota	Sienna LE	2001							
84751	2	1.6 to 2.0	Ford	Escort	1998							
84752	4.9	4.1 to 5.0	Ford	F 100 Ranger	1978			x			x	Suspect dilution : Avg CO + CO2 = 5.99%
84753	3.3	3.1 to 3.5	Dodge	Grand Caravan	2003							
84754	3.3	3.1 to 3.5	Plymouth	Voyager	2003							
84755	3.5	3.1 to 3.5	Honda	Odyssey	2002							
84757	4	3.5 to 4.0	Jeep	Cherokee 4x4	2001							
84758	5.7	5.1 to 6.0	Chevy	Beauville 10	1979							
84759	2	1.6 to 2.0	Ford	Focus	2005							
84760	3	2.6 to 3.0	Ford	Escape	2005							
84761	3.5	3.1 to 3.5	Kia	Sedona	2004							
84763	3.5	3.1 to 3.5	Honda	Odyssey	2003							
84765	4.3	4.1 to 5.0	Chev	Impala	1985							
84766	3.3	3.1 to 3.5	Dodge	Grand Caravan Spo	2000							
84767	2.4	2.1 to 2.5	Nissan	Frontier	1998							
84768	4.9	4.1 to 5.0	Ford	F-150 XL	1995			x				Suspect dilution : Avg CO + CO2 = 9.7%
84770	4.9	4.1 to 5.0	Ford	F-250	1995			x				Suspect dilution : Avg CO + CO2 = 10.5%
84771	4.3	4.1 to 5.0	Chev	Astro Van	1994							
84772	3.3	3.1 to 3.5	Dodge	Caravan SE	1992							
84773	3.4	3.1 to 3.5	Toyota	Forerunner	1998							
84774	3	2.6 to 3.0	Dodge	Caravan	1995							
84775	5.7	5.1 to 6.0	Chevrolet	Suburban	1997							
84777	5	4.1 to 5.0	Oldsmobile	Cutlass Supreme	1987			x				Suspect dilution : Avg CO + CO2 =10.8 %

Kansas City PM Characterization Study

Final Report

Appendix Q
Round 1 Conditioning Run
Quality Control

Assessment and Standards Division
Office of Transportation and Air Quality
U.S. Environmental Protection Agency

Sponsors:

National Renewable Energy Laboratory, U.S. Department of Energy
Federal Highway Administration, U.S. Department of Transportation
STAPPA-ALAPCO Emission Inventory Improvement Program
Coordinating Research Council Inc. (Project No. E-69)

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Agency

EPA420-R-08-009
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CTR_TST_ID	Disp	Disp Bin	Make	Model	Model Year	Test Date	Missing data	Flow Flag	Dilution Flag	Exh Temp Flag	Ambient Temp Flag	Suspect Data	Data Review Comments
C_KS1_002_1	2.3	2.1 to 2.5	FORD	F150	1979	8/9/2004	x					x	Test record has missing or invalid data
C_KS1_003_1	5.2	5.1 to 6.0	DODGE	RAM250	1994	7/13/2004							
C_KS1_004_1	3.5	3.1 to 3.5	ISUZU	TROOPER	1999	7/13/2004	x					x	Test record has missing or invalid data
C_KS1_004_2	3.5	3.1 to 3.5	ISUZU	TROOPER	1999	7/13/2004							
C_KS1_005_1	5.3	5.1 to 6.0	GMC	YUKON XL	2001	7/13/2004							
C_KS1_006_1	1.9	1.6 to 2.0	FORD	ESCORT LX	1995	7/14/2004							
C_KS1_007_1	5.7	5.1 to 6.0	FORD	F-250	1979	7/14/2004				x			Average exhaust temp (440C) is 30 % higher than similar displacement vehicles
C_KS1_009_1	2.2	2.1 to 2.5	TOYOTA	RAV4	2000	7/14/2004							
C_KS1_010_1	2.5	2.1 to 2.5	DODGE	SPIRIT	1990	7/15/2004							
C_KS1_011_1	5.4	5.1 to 6.0	FORD	F-150 XLT	2001	7/15/2004							
C_KS1_013_1	1.6	0 to 1.6	HONDA	CIVIC	1996	7/16/2004							
C_KS1_017_1	2.5	2.1 to 2.5	MAZDA	626	2001	7/17/2004							Avg exhaust temp (210C) is 30% lower than similar displacement vehicles
C_KS1_018_1	3	2.6 to 3.0	DODGE	CARAVAN SE	1989	7/17/2004							
C_KS1_020_1	2.2	2.1 to 2.5	CHEVROLET	CORSICA	1996	7/19/2004							
C_KS1_021_1	2	1.6 to 2.0	HONDA	CIVIC SI	2002	7/19/2004				x			Average exhaust temp (340C) is 30% higher than similar displacement vehicles
C_KS1_022_1	4.2	4.1 to 5.0	GMC	JIMMY	1995	7/19/2004							
C_KS1_023_1	3.8	3.5 to 4.0	OLDSMOBILE	CUTLASS CIER/	1988	7/19/2004							
C_KS1_024_1	4	3.5 to 4.0	JEEP	CHEROKEE SP(	1998	7/19/2004	x					x	Test record has missing or invalid data
C_KS1_024_2	4	3.5 to 4.0	JEEP	CHEROKEE SP(	1998	7/19/2004							
C_KS1_025_1	2.2	2.1 to 2.5	CHEVROLET	CAVALIER	1990	7/20/2004							
C_KS1_026_1	3.5	3.1 to 3.5	CHRYSLER	300	1999	7/20/2004							Avg exhaust temp (210C) is 40% lower than similar displacement vehicles
C_KS1_027_1	1.9	1.6 to 2.0	GMC	SATURN	2001	7/20/2004							
C_KS1_028_1	3.8	3.5 to 4.0	BUICK	LESABRE	1998	7/21/2004							
C_KS1_028_2	3.8	3.5 to 4.0	BUICK	LESABRE	1998	7/20/2004							
C_KS1_028_3	3.8	3.5 to 4.0	BUICK	LESABRE	1998	7/20/2004	x					x	Test record has missing or invalid data
C_KS1_030_1	3.3	3.1 to 3.5	NISSAN	FRONTIER	2002	7/20/2004							
C_KS1_032_1	1.9	1.6 to 2.0	SATURN	SATURN	1996	7/21/2004				x			Average exhaust temp (380C) is 45% higher than similar displacement vehicles
C_KS1_033_1	3.3	3.1 to 3.5	DODGE	CARAVAN	1995	7/21/2004							
C_KS1_035_1	2.5	2.1 to 2.5	MERCURY	VILLAGER LS	1994	7/21/2004				x			Average exhaust temp (360C) is 25 % higher than similar displacement vehicles
C_KS1_036_1	2.5	2.1 to 2.5	JEEP	WRANGLER	1995	7/21/2004				x			Average exhaust temp (490C) is 70 % higher than similar displacement vehicles
C_KS1_037_1	2.3	2.1 to 2.5	GMC	PONTIAC GRAN	1989	7/22/2004							
C_KS1_040_1	3	2.6 to 3.0	TOYOTA	SOLARA SLE	2001	7/22/2004							
C_KS1_041_1	3.3	3.1 to 3.5	DODGE	GRAND CARAV/	1997	7/22/2004							
C_KS1_043_1	4.3	4.1 to 5.0	CHEVROLET	BLAZER	1995	7/23/2004							
C_KS1_044_1	4.3	4.1 to 5.0	CHEVROLET	S-10	2003	7/23/2004							
C_KS1_049_1	5	4.1 to 5.0	LINCOLN	TOWNCAR	1990	7/26/2004			x	x		x	Suspect diltion: Avg CO + CO2 = 9.15%, & avg exhaust temp (530C) is 70 % higher than similar displacement vehicles
C_KS1_050_1	1.6	0 to 1.6	HONDA	CIVIC EX	1999	7/24/2004	x					x	Test record has missing or invalid data
C_KS1_051_1	2.2	2.1 to 2.5	HONDA	ACCORD	1997	7/24/2004							
C_KS1_052_1	2	1.6 to 2.0	HONDA	ACCORD LX	1989	7/24/2004		x		x		x	Average exhaust flow is approx 50% higher than average for all other similar displacement vehicles, Average exhaust temp (420C) is 60% higher than similar displacement vehicles
C_KS1_056_1	2.2	2.1 to 2.5	HONDA	ACCORD EX	2000	7/26/2004							
C_KS1_056_2	2.2	2.1 to 2.5	HONDA	ACCORD EX	2000	7/26/2004	x					x	Test record has missing or invalid data
C_KS1_057_1	3	2.6 to 3.0	FORD	TAURUS SES	2003	7/26/2004							
C_KS1_057_2	3	2.6 to 3.0	FORD	TAURUS SES	2003	7/26/2004	x					x	Test record has missing or invalid data
C_KS1_058_1	3.1	3.1 to 3.5	CHEVROLET	MALIBU LS	1998	7/26/2004							

CTR_TST_ID	Disp	Disp Bin	Make	Model	Model Year	Test Date	Missing data	Flow Flag	Dilution Flag	Exh Temp Flag	Ambient Temp Flag	Suspect Data	Data Review Comments
C_KS1_061_1	3.5	3.1 to 3.5	HONDA	ODYSSEY	2004	7/27/2004				x			Average exhaust temp (420C) is 30 % higher than similar displacement vehicles
C_KS1_062_1	3.5	3.1 to 3.5	NISSAN	PATHFINDER LE	2003	7/27/2004	x					x	Test record has missing or invalid data
C_KS1_063_1	3.1	3.1 to 3.5	CHEVROLET	LUMINA	1998	7/27/2004							
C_KS1_064_1	4.6	4.1 to 5.0	FORD	MUSTANG	1999	7/27/2004							Avg exhaust temp (210C) is 30% lower than similar displacement vehicles
C_KS1_065_1	2	1.6 to 2.0	HYUNDAI	TIBURON	2000	7/27/2004							
C_KS1_066_1	4.9	4.1 to 5.0	CADILLAC	SEVILLE	1991	7/27/2004							
C_KS1_067_1	1.9	1.6 to 2.0	SATURN	SL1	1999	7/28/2004							
C_KS1_067_2	1.9	1.6 to 2.0	SATURN	SL1	1999	7/28/2004	x					x	Test record has missing or invalid data
C_KS1_068_1	4	3.5 to 4.0	FORD	EXPLORER	1993	7/28/2004				x			Average exhaust temp (410C) is 30 % higher than similar displacement vehicles
C_KS1_069_1	3.2	3.1 to 3.5	ISUZU	RODEO SL	1999	7/28/2004							
C_KS1_071_1	2	1.6 to 2.0	TOYOTA	RAV4	2000	7/28/2004							
C_KS1_072_1	1.6	1.6 to 2.0	NISSAN	SENTRA GXE	1997	7/28/2004				x			Average exhaust temp (340C) is 30 % higher than similar displacement vehicles
C_KS1_073_1	3	2.6 to 3.0	FORD	RANGER	1999	7/29/2004				x			Average exhaust temp (360C) is 30 % higher than similar displacement vehicles,
C_KS1_074_1	3	2.6 to 3.0	MERCURY	SABLE LS	2002	7/29/2004							
C_KS1_075_1	2.2	2.1 to 2.5	TOYOTA	CAMRY	1994	7/29/2004							
C_KS1_076_1	1.5	0 to 1.6	HONDA	CIVIC	1984	8/3/2004							
C_KS1_076_2	1.5	0 to 1.6	HONDA	CIVIC	1984		x					x	Test record has missing or invalid data
C_KS1_077_1	3	2.6 to 3.0	TOYOTA	AVALON	1999	7/29/2004							
C_KS1_078_1	1.5	0 to 1.6	HONDA	CIVIC DX	1991	7/30/2004							
C_KS1_078_2	1.5	0 to 1.6	HONDA	CIVIC DX	1991	7/30/2004	x					x	Test record has missing or invalid data
C_KS1_080_1	4	3.5 to 4.0	JEEP	GRAND CHERO	1995	8/2/2004		x		x		x	Average exhaust flow is > 50% lower than average for all other similar displacement vehicles, & avg exhaust temp (450C) is 40 % higher than similar displacement vehicles
C_KS1_081_1	5.2	5.1 to 6.0	DODGE	RAM LE	1991	8/2/2004			x				Suspect diltion: Avg CO + CO2 = 10.60%
C_KS1_082_1	1.6	0 to 1.6	TOYOTA	COROLLA	1997	7/30/2004							
C_KS1_083_1	3	2.6 to 3.0	NISSAN	MAXIMA	2000	7/30/2004							
C_KS1_085_1	5	4.1 to 5.0	FORD	F-150	1995	7/31/2004							Suspect diltion: Avg CO + CO2 = 10.35%
C_KS1_086_1	2	1.6 to 2.0	FORD	CONTOUR	1995	7/31/2004							
C_KS1_088_1	4.3	4.1 to 5.0	CHEVROLET	S-10	1996	7/31/2004							
C_KS1_090_1	3.1	3.1 to 3.5	PONTIAC	GRAND PRIX	1993	7/31/2004							
C_KS1_092_1	4	3.5 to 4.0	FORD	EXPLORER	2000	8/2/2004				x			Average exhaust temp (410C) is 30 % higher than similar displacement vehicles
C_KS1_093_1	5.3	5.1 to 6.0	CHEVROLET	SILVERADO	2002	8/2/2004							
C_KS1_094_1	3.3	3.1 to 3.5	PLYMOUTH	VOYAGER	1998	8/3/2004	x					x	Test record has missing or invalid data
C_KS1_094_2	3.3	3.1 to 3.5	PLYMOUTH	VOYAGER	1998	7/30/2004							
C_KS1_095_1	3.8	3.5 to 4.0	BUICK	LESABRE	1989	7/30/2004							
C_KS1_096_1	2.2	2.1 to 2.5	SUBARU	OUTBACK LEGA	1996	7/29/2004							
C_KS1_097_1	3.8	3.5 to 4.0	FORD	THUNDERBIRD	1988	8/3/2004			x			x	Suspect diltion: Avg CO + CO2 = 5.75%
C_KS1_098_1	4	3.5 to 4.0	FORD	EXPLORER XLT	1995	8/3/2004				x			Average exhaust temp (450C) is 40 % higher than similar displacement vehicles
C_KS1_099_1	2.9	2.6 to 3.0	VOLVO	S80	2001	8/3/2004				x			Average exhaust temp (380C) is 40 % higher than similar displacement vehicles,
C_KS1_100_1	1.8	1.6 to 2.0	MAZDA	PROTÉGÉ	1991	8/11/2004						x	Avg exhaust temp (180C) is 30% lower than similar displacement vehicles
C_KS1_1012_1	3	2.6 to 3.0	NISSAN	MAXIMA	1992	8/24/2004		x				x	No exhaust flow recorded.
C_KS1_102_1	3.3	3.1 to 3.5	DODGE	GRAND CARAV/	1999	8/3/2004							
C_KS1_103_1	3.3	3.1 to 3.5	CHRYSLER	TOWN & COUNT	2000	8/4/2004							
C_KS1_104_1	2.2	2.1 to 2.5	TOYOTA	CELICA	1999	8/4/2004		x	x		x	x	Both min and max exhaust flows are way out of range, average is in range, average ambient temp value is erroneous (228C)

CTR_TST_ID	Disp	Disp Bin	Make	Model	Model Year	Test Date	Missing data	Flow Flag	Dilution Flag	Exh Temp Flag	Ambient Temp Flag	Suspect Data	Data Review Comments
C_KS1_105_1	4	3.5 to 4.0	JEEP	CHEROKEE SP(	1993	8/6/2004							
C_KS1_105_2	4	3.5 to 4.0	JEEP	CHEROKEE SP(	1993	8/4/2004							
C_KS1_107_1	2.2	2.1 to 2.5	TOYOTA	CAMRY LE	2000	8/4/2004							
C_KS1_108_1	2.2	2.1 to 2.5	CHEVROLET	CAVALIER	1997	8/4/2004							
C_KS1_109_1	4.6	4.1 to 5.0	MERCURY	GRAND MARQU	1997	8/5/2004							Avg exhaust temp (220C) is 30% lower than similar displacement vehicles
C_KS1_110_1	3.1	3.1 to 3.5	BUICK	CENTURY LIMIT	1998	8/5/2004							
C_KS1_110_2	3.1	3.1 to 3.5	BUICK	CENTURY LIMIT	1998	8/5/2004	x					x	Test record has missing or invalid data
C_KS1_112_1	2.5	2.1 to 2.5	FORD	PROBE	1993	8/5/2004							
C_KS1_113_1	5.8	5.1 to 6.0	FORD	BRONCO	1995	8/5/2004			x				Suspect diltion: Avg CO + CO2 = 10.63%
C_KS1_114_1	2.7	2.6 to 3.0	CHRYSLER	CONCORD	2000	8/5/2004							Avg exhaust temp (200C) is 30% lower than similar displacement vehicles
C_KS1_116_1	2	1.6 to 2.0	FORD	ESCORT ZX2	1999	8/6/2004							
C_KS1_117_1	4.3	4.1 to 5.0	CHEVROLET	BLAZER LS	2002	8/6/2004							
C_KS1_118_1	4.3	4.1 to 5.0	LINCOLN	TOWNCAR	1987	8/6/2004							
C_KS1_120_1	2.2	2.1 to 2.5	HONDA	ACCORD	1990	8/6/2004							
C_KS1_121_1	3.3	3.1 to 3.5	DODGE	DYNASTY	1988	8/7/2004							
C_KS1_123_1	4	3.5 to 4.0	JEEP	CHEROKEE	1990	8/7/2004			x			x	Suspect diltion: Avg CO + CO2 = 10.62%
C_KS1_124_1	2	1.6 to 2.0	FORD	ESCORT	2002	8/9/2004							
C_KS1_126_1	3	2.6 to 3.0	PLYMOUTH	VOYAGER	1993	8/7/2004	x					x	Test record has missing or invalid data
C_KS1_127_1	3.5	3.1 to 3.5	HONDA	ODYSSEY	2000	8/9/2004							
C_KS1_128_1	2.3	2.1 to 2.5	HONDA	ACCORD	2000	8/9/2004							
C_KS1_129_1	4.2	4.1 to 5.0	FORD	F150	2000	8/9/2004							
C_KS1_132_1	2.3	2.1 to 2.5	FORD	RANGER XLT	1988	8/7/2004							
C_KS1_133_1	2.3	2.1 to 2.5	HONDA	ACCORD LX	2001	8/10/2004							
C_KS1_134_1	2.3	2.1 to 2.5	NISSAN	SENTRA	1994	8/10/2004		x	x			x	No exhaust flow recorded. & suspect dilution (avg CO+CO2 = 10.9%), & avg exhaust temp (190C) is 30% lower than similar displacement vehicles
C_KS1_134_2	1.6	1.6 to 2.0	NISSAN	SENTRA	1994	8/11/2004							
C_KS1_138_1	2.6	2.6 to 3.0	CHRYSLER	LEBARON	1983	8/10/2004		x		x		x	Average exhaust flow is > 50% higher than average for all other similar displacement vehicles, & avg exhaust temp (610C) is 120 % higher than similar displacement vehicles
C_KS1_139_1	2.4	2.1 to 2.5	VOLVO	850	1997	8/11/2004				x			Average exhaust temp (360C) is 30 % higher than similar displacement vehicles
C_KS1_140_1	2.3	2.1 to 2.5	MERCURY	TOPAZ GS	1994	8/13/2004							
C_KS1_140_2	2.3	2.1 to 2.5	MERCURY	TOPAZ GS	1994	8/11/2004							
C_KS1_141_1	2	1.6 to 2.0	FORD	FOCUS SE	2001	8/11/2004							
C_KS1_142_1	3.3	3.1 to 3.5	PLYMOUTH	VOYAGER	1999	8/11/2004							
C_KS1_147_1	1.5	0 to 1.6	HONDA	CIVIC DX	1988	8/12/2004							
C_KS1_148_1	3.8	3.5 to 4.0	BUICK	REGAL	1996	8/12/2004							
C_KS1_149_1	2.8	2.6 to 3.0	CADILLAC	CIMMARON	1986	8/12/2004							
C_KS1_150_1	3	2.6 to 3.0	FORD	RANGER	1999	8/12/2004							
C_KS1_151_1	3.8	3.5 to 4.0	PONTIAC	BONNEVILLE	1988	8/14/2004	x					x	Test record has missing or invalid data
C_KS1_152_1	2.3	2.1 to 2.5	MERCURY	TOPAZ	1994	8/13/2004							
C_KS1_153_1	3	2.6 to 3.0	MERCURY	SABLE	1996	8/13/2004		x				x	Average exhaust flow is > 50% lower than average for all other similar displacement vehicles, & avg exhaust temp (140C) is 50% lower than similar displacement vehicles
C_KS1_154_1	4	3.5 to 4.0	JEEP	CHEROKEE	1998	8/14/2004							
C_KS1_159_1	4.6	4.1 to 5.0	FORD	THUNDERBIRD	1995	8/14/2004		x				x	Average exhaust flow is > 50% lower than average for all other similar displacement vehicles, & avg exhaust temp (170C) is 40% lower than similar displacement vehicles
C_KS1_160_1	2.2	2.1 to 2.5	TOYOTA	CAMRY	1997	8/14/2004							Avg exhaust temp (210C) is 30% lower than similar displacement vehicles
C_KS1_164_1	1.8	1.6 to 2.0	TOYOTA	COROLLA	1996	8/16/2004					x	x	Average ambient temp erroneous (-32C)

CTR_TST_ID	Disp	Disp Bin	Make	Model	Model Year	Test Date	Missing data	Flow Flag	Dilution Flag	Exh Temp Flag	Ambient Temp Flag	Suspect Data	Data Review Comments
C_KS1_165_1	1.6	1.6 to 2.0	HONDA	CIVIC	2000	8/16/2004							
C_KS1_166_1	2.2	2.1 to 2.5	TOYOTA	CAMRY	2000	8/18/2004							
C_KS1_167_1	1.8	1.6 to 2.0	TOYOTA	COROLLA	2000	8/16/2004							
C_KS1_167_2	1.8	1.6 to 2.0	TOYOTA	COROLLA	2000	8/16/2004	x					x	Test record has missing or invalid data
C_KS1_171_1	2.5	2.1 to 2.5	SUBARU	OUTBACK	2000	8/17/2004		x	x	x		x	Average exhaust flow is > 50% higher than average for all other similar displacement vehicles & suspect dilution (avg CO+CO2 = 10.6%), & avg exhaust temp (450C) is 60 % higher than similar displacement vehicles
C_KS1_171_2	2.5	2.1 to 2.5	SUBARU	OUTBACK	2000	8/17/2004	x					x	Test record has missing or invalid data
C_KS1_173_1	5	4.1 to 5.0	CHEVROLET	MONTE CARLO	1977	8/17/2004							
C_KS1_175_1	2.4	2.1 to 2.5	HYUNDAI	SANTA FE	2001	8/18/2004							
C_KS1_178_1	2.2	2.1 to 2.5	CHEVROLET	LUMINA	1999	8/18/2004				x		x	Average exhaust temp (360C) is 25 % higher than similar displacement vehicles, average ambient temp erroneous (-16C)
C_KS1_179_1	4.3	4.1 to 5.0	GMC	SAFARI	1993	8/18/2004							
C_KS1_180_1	4.3	4.1 to 5.0	GMC	SONOMA SLS	2001	8/18/2004	x					x	Test record has missing or invalid data
C_KS1_180_2	4.3	4.1 to 5.0	GMC	SONOMA SLS	2001	8/18/2004				x			Average exhaust temp (390C) is 30 % higher than similar displacement vehicles
C_KS1_181_1	3.1	3.1 to 3.5	SATURN	SL1	1994	8/20/2004							
C_KS1_182_1	3.1	3.1 to 3.5	BUICK	REGAL	1990		x					x	Test record has missing or invalid data
C_KS1_187_1	4.3	4.1 to 5.0	CHEVROLET	ASTRO VAN	1991	8/20/2004					x		average ambient temp erroneous (-29C)
C_KS1_188_1	5	4.1 to 5.0					x					x	Test record has missing or invalid data
C_KS1_189_1	2.8	2.6 to 3.0	CHEVROLET	S-10 TRUCK	1985	8/20/2004							
C_KS1_193_1	5.8	5.1 to 6.0	FORD	ECONOLINE	1983	8/21/2004		x	x			x	Average exhaust flow is > 50% lower than average for all other similar displacement vehicles & suspect dilution (avg CO+CO2 = 4.15%)
C_KS1_194_1	5	4.1 to 5.0	LINCOLN	TOWNCAR	1989	8/21/2004						x	Avg exhaust temp (140C) is 50% lower than similar displacement vehicles
C_KS1_195_1	4.2	4.1 to 5.0	FORD	F150 TRUCK	1998	8/21/2004							
C_KS1_196_1	4.2	4.1 to 5.0	FORD	WINDSTAR	1999	8/21/2004							
C_KS1_197_1	5.7	5.1 to 6.0	CHEVROLET	C 1500	1994	8/21/2004							
C_KS1_199_1	2.4	2.1 to 2.5	DODGE	STRATUS ES	1996	8/23/2004							
C_KS1_201_1	2.2	2.1 to 2.5	MAZDA	MX-6	1988	8/23/2004							
C_KS1_203_1	3.8	3.5 to 4.0	OLDSMOBILE	NINETY EIGHT I	1985	8/23/2004							
C_KS1_204_1	5	4.1 to 5.0	LINCOLN	TOWNCAR	1987	8/23/2004			x			x	Suspect diltion: Avg CO + CO2 = 8.78%
C_KS1_207_1	3.8	3.5 to 4.0	PONTIAC	BONNEVILLE	1994	8/25/2004							
C_KS1_208_1	4.9	4.1 to 5.0	FORD	F150	1990	8/25/2004		x	x			x	No exhaust flow recorded & suspect dilution (avg CO+CO2 = 8.91%)
C_KS1_210_1	3	2.6 to 3.0	FORD	TAURUS	2002	8/26/2004							
C_KS1_212_1	3.5	3.1 to 3.5	CHRYSLER	CONCORD	1994	8/25/2004						x	Avg exhaust temp (190C) is 40% lower than similar displacement vehicles
C_KS1_212_2	3.5	3.1 to 3.5	CHRYSLER	CONCORD	1994	8/25/2004						x	Avg exhaust temp (190C) is 40% lower than similar displacement vehicles
C_KS1_213_1	3.8	3.5 to 4.0	OLDSMOBILE	EIGHTY-EIGHT	1994	8/27/2004							
C_KS1_215_1	5	4.1 to 5.0	FORD	CROWN VICTOI	1985	8/26/2004							
C_KS1_219_1	1.6	1.6 to 2.0	HONDA	CIVIC	2000	8/26/2004							
C_KS1_221_1	3.1	3.1 to 3.5	BUICK	CENTURY	1997	8/26/2004		x				x	No exhaust flow recorded.
C_KS1_222_1	2.3	2.1 to 2.5	PONTIAC	GRAND AM	1992	8/26/2004							
C_KS1_223_1	3.8	3.5 to 4.0	DODGE	GRAND CARAV/	2005	8/26/2004							
C_KS1_225_1	1.6	0 to 1.6	TOYOTA	COROLLA	1989	8/27/2004							
C_KS1_226_1	1.3	0 to 1.6	NISSAN	SENTRA	1993	8/27/2004							
C_KS1_226_2	1.3	0 to 1.6	NISSAN	SENTRA	1993	8/27/2004	x					x	Test record has missing or invalid data
C_KS1_228_1	3.4	3.1 to 3.5	OLDSMOBILE	SILHOUETTE	2000	8/27/2004							

CTR_TST_ID	Disp	Disp Bin	Make	Model	Model Year	Test Date	Missing data	Flow Flag	Dilution Flag	Exh Temp Flag	Ambient Temp Flag	Suspect Data	Data Review Comments
C_KS1_233_1	3	2.6 to 3.0	FORD	TAURUS	1987	8/28/2004		x	x			x	Average exhaust flow is > 50% lower than average for all other similar displacement vehicles & suspect dilution (avg CO+CO2 =0.8%), & avg exhaust temp (90 C) is 70% lower than similar displacement vehicles
C_KS1_233_2	3	2.6 to 3.0	FORD	TAURUS	1987	8/28/2004							
C_KS1_234_1	4.9	4.1 to 5.0	FORD	F150 4X2	1987	8/28/2004							
C_KS1_235_1	2.8	2.6 to 3.0	PONTIAC	6000	1988	8/28/2004							
C_KS1_236_1	2.3	2.1 to 2.5	OLDSMOBILE	ACHIEVA	1992	8/28/2004							
C_KS1_236_2	1.9	1.6 to 2.0	OLDSMOBILE	ACHIEVA	1992		x					x	Test record has missing or invalid data
C_KS1_237_1	1.6	0 to 1.6	GEO	PRISM	1990	8/28/2004							
C_KS1_239_1	1.8	1.6 to 2.0	FORD	ESCORT	1993	8/30/2004		x				x	Average exhaust flow is > 50% lower than average for all other similar displacement vehicles, & avg exhaust temp (160C) is 40% lower than similar displacement vehicles
C_KS1_240_1	2.5	2.1 to 2.5	FORD	CONTOUR	1998	8/30/2004						x	Avg exhaust temp (190C) is 30% lower than similar displacement vehicles
C_KS1_241_1	4.9	4.1 to 5.0	CADILLAC	SEDAN DE VILL	1993	8/30/2004							
C_KS1_243_1	2	1.6 to 2.0	HONDA	ACCORD	1987	8/30/2004			x				Suspect diltion: Avg CO + CO2 = 10.96%
C_KS1_244_1	3	2.6 to 3.0	INFINITI	I30	1998	8/30/2004		x				x	Average exhaust flow is > 50% lower than average for all other similar displacement vehicles
C_KS1_245_1	3.3	3.1 to 3.5	PLYMOUTH	VOYAGER	1997	8/30/2004							
C_KS1_246_1	1.8	1.6 to 2.0	EAGLE	TALON	1994	8/31/2004				x			Average exhaust temp (330C) is 30 % higher than similar displacement vehicles
C_KS1_247_1	2.9	2.6 to 3.0	FORD	RANGER	1987	8/31/2004							
C_KS1_248_1	2.3	2.1 to 2.5	VOLVO	240 GL	1983	8/31/2004							
C_KS1_249_1	4.3	4.1 to 5.0	CHEVROLET	S-10	1989	8/31/2004							
C_KS1_250_1	1.9	1.6 to 2.0	FORD	ESCORT	1987	8/31/2004						x	Avg exhaust temp (160C) is 40% lower than similar displacement vehicles
C_KS1_253_1	3.8	3.5 to 4.0	BUICK	REGAL	1992	9/1/2004							
C_KS1_254_1	3	2.6 to 3.0	MERCURY	SABLE	1997	9/1/2004		x				x	Average exhaust flow is > 50% lower than average for all other similar displacement vehicles
C_KS1_255_1	3	2.6 to 3.0	FORD	TAURUS	2001	9/1/2004							
C_KS1_259_1	2.5	2.1 to 2.5	PLYMOUTH	ACCLAIM	1990	9/1/2004		x				x	Average exhaust flow is > 50% lower than average for all other similar displacement vehicles
C_KS1_282_1	3.8	3.5 to 4.0	OLDSMOBILE	DELTA 88	1991	9/8/2004							Avg exhaust temp (230C) is 30% lower than similar displacement vehicles
C_KS1_290_1	2.3	2.1 to 2.5	DODGE	RAM 50	1989	9/8/2004							
C_KS1_294_1	3	2.6 to 3.0	BUICK	CENTURY	1984	9/8/2004		x		x		x	Average exhaust flow is > 50% higher than average for all other similar displacement vehicles, & avg exhaust temp (530C) is 95 % higher than similar displacement vehicles
C_KS1_297_1	1.8	1.6 to 2.0	KIA	SEPHIA	2000	9/9/2004							
C_KS1_298_1	2	1.6 to 2.0	CHEVROLET	CAVALIER	1989	9/9/2004			x				Suspect diltion: Avg CO + CO2 = 10.71%
C_KS1_299_1	4.9	4.1 to 5.0	BUICK	LESABRE	1979	9/9/2004							Avg exhaust temp (220C) is 30% lower than similar displacement vehicles
C_KS1_300_1	5	4.1 to 5.0	FORD	F150	1994	9/9/2004		x	x			x	Average exhaust flow is > 50% higher than average for all other similar displacement vehicles & suspect dilution (avg CO+CO2 = 9.98%)
C_KS1_301_1	5	4.1 to 5.0	MERCURY	GRAND MARQU	1986	9/9/2004			x				Suspect diltion: Avg CO + CO2 = 10.02%
C_KS1_302_1	3.8	3.5 to 4.0	BUICK	ELECTRA PARK	1989	9/10/2004							
C_KS1_304_1	1.3	0 to 1.6	FORD	ASPIRE	1995	9/10/2004							
C_KS1_305_1	3.8	3.5 to 4.0	HONDA	ACCORD	2001	9/10/2004							
C_KS1_306_1	4	3.5 to 4.0	JEEP	GRAND CHERO	1995	9/11/2004		x		x		x	Average exhaust flow is > 50% higher than average for all other similar displacement vehicles, & avg exhaust temp (530C) is 70 % higher than similar displacement vehicles
C_KS1_307_1	4.3	4.1 to 5.0	GMC	JIMMY	1990	9/10/2004							

CTR_TST_ID	Disp	Disp Bin	Make	Model	Model Year	Test Date	Missing data	Flow Flag	Dilution Flag	Exh Temp Flag	Ambient Temp Flag	Suspect Data	Data Review Comments
C_KS1_308_1	1.8	1.6 to 2.0	MG	MG	1978	9/10/2004		x		x		x	Average exhaust flow is > 50% higher than average for all other similar displacement vehicles, & avg exhaust temp (330C) is 30 % higher than similar displacement vehicles
C_KS1_309_1	3.4	3.1 to 3.5	OLDSMOBILE	SILHOUETTE	1997		x					x	Test record has missing or invalid data
C_KS1_312_1	1.6	1.6 to 2.0	HONDA	CIVIC	2000	9/14/2004							
C_KS1_314_1	4.3	4.1 to 5.0	GMC	SIERRA	1995	9/13/2004				x		x	Average exhaust temp (510C) is 70 % higher than similar displacement vehicles
C_KS1_316_1	1.6	1.6 to 2.0	HONDA	CIVIC	1997	9/14/2004							
C_KS1_317_1	5	4.1 to 5.0	OLDSMOBILE	CUSTOM CRUIS	1984	9/13/2004							
C_KS1_318_1	2.3	2.1 to 2.5	VOLVO	GL	1984	9/14/2004							
C_KS1_319_1	5	4.1 to 5.0	CHEVROLET	CAPRICE	1987	9/14/2004							
C_KS1_321_1	5.9	5.1 to 6.0	DODGE	RAM	1997	9/14/2004		x		x		x	Average exhaust flow is > 50% higher than average for all other similar displacement vehicles, & avg exhaust temp (460C) is 40 % higher than similar displacement vehicles
C_KS1_322_1	4.9	4.1 to 5.0	FORD	F150	1993	9/15/2004			x				Suspect diltion: Avg CO + CO2 = 9.87%
C_KS1_323_1	3.1	3.1 to 3.5	PONTIAC	GRAND PRIX	1989	9/15/2004		x				x	Average exhaust flow is approx 50% higher than average for all other similar displacement vehicles
C_KS1_324_1	3.8	3.5 to 4.0	BUICK	LESABRE	1990	9/15/2004							
C_KS1_325_1	2.4	2.1 to 2.5	DODGE	STRATUS	1996	9/15/2004							
C_KS1_326_1	2.5	2.1 to 2.5	TOYOTA	CAMRY	1997	9/14/2004							
C_KS1_327_1	5.9	5.1 to 6.0	DODGE	DURANGO	1999	9/15/2004				x			Average exhaust temp (490C) is 40 % higher than similar displacement vehicles
C_KS1_328_1	1.6	1.6 to 2.0	HONDA	CIVIC	1998	9/15/2004							
C_KS1_329_1	1.7	1.6 to 2.0	HONDA	CIVIC	2001	9/15/2004				x			Average exhaust temp (390C) is 50 % higher than similar displacement vehicles
C_KS1_329_2	1.7	1.6 to 2.0	HONDA	CIVIC	2001	9/15/2004				x			Average exhaust temp (390C) is 50 % higher than similar displacement vehicles
C_KS1_330_1	2.2	2.1 to 2.5	HONDA	ACCORD	1992	9/16/2004							
C_KS1_331_1	2.3	2.1 to 2.5	PONTIAC	GRAND AM	1994	9/16/2004							
C_KS1_332_1	3.1	3.1 to 3.5	CHEVROLET	MALIBU	1999	9/16/2004							
C_KS1_333_1	3.4	3.1 to 3.5	OLDSMOBILE	SILHOUETTE	2002	9/16/2004				x			Average exhaust temp (440C) is 40 % higher than similar displacement vehicles
C_KS1_335_1	4.5	4.1 to 5.0	M.BENZ	280 SE	1973	9/16/2004							
C_KS1_336_1	5.7	5.1 to 6.0	CHEVROLET	G-20	1993	9/16/2004			x			x	Suspect diltion: Avg CO + CO2 = 8.19%, & avg exhaust temp (250C) is 30% lower than similar displacement vehicles
C_KS1_337_1	4.6	4.1 to 5.0	FORD	F150	1997	9/20/2004		x		x		x	Average exhaust flow is approx 50% higher than average for all other similar displacement vehicles, & avg exhaust temp (440C) is 50 % higher than similar displacement vehicles
C_KS1_338_1	3.4	3.1 to 3.5	CHEVROLET	VENTURE	2003	9/17/2004							
C_KS1_339_1	3	2.6 to 3.0	PLYMOUTH	VOYAGER	1991	9/17/2004							
C_KS1_341_1	2	1.6 to 2.0	DODGE	AVENGER	1996	9/17/2004							
C_KS1_343_1	1.6	1.6 to 2.0	TOYOTA	COROLLA	1989	9/17/2004							
C_KS1_344_1	3	2.6 to 3.0	NISSAN	SENTRA	1997	9/18/2004							
C_KS1_346_1	2	1.6 to 2.0	TOYOTA	CAMRY	1990	9/18/2004							
C_KS1_347_1	2.4	2.1 to 2.5	NISSAN	ALTIMA	2000	9/18/2004							
C_KS1_348_1	2.3	2.1 to 2.5	PLYMOUTH	SUNDANCE	1989	9/17/2004							
C_KS1_349_1	3.8	3.5 to 4.0	FORD	WINDSTAR	2001	9/29/2004							
C_KS1_350_1	3	2.6 to 3.0	TOYOTA	AVALON	1996	9/18/2004							
C_KS1_350_2	3	2.6 to 3.0	TOYOTA	AVALON	1996	9/20/2004							
C_KS1_351_1	3	2.6 to 3.0	NISSAN	MAXIMA	1997	9/20/2004							
C_KS1_352_1	2.2	2.1 to 2.5	TOYOTA	CAMRY	1999	9/20/2004							
C_KS1_354_1	3	2.6 to 3.0	FORD	TAURUS	1998	9/20/2004							
C_KS1_355_1	4	3.5 to 4.0	JEEP	WRANGLER	1997	9/20/2004							
C_KS1_356_1	1.6	1.6 to 2.0	KIA	RIO	2004	9/20/2004							

CTR_TST_ID	Disp	Disp Bin	Make	Model	Model Year	Test Date	Missing data	Flow Flag	Dilution Flag	Exh Temp Flag	Ambient Temp Flag	Suspect Data	Data Review Comments
C_KS1_358_1	5	4.1 to 5.0	CHEVROLET	CAPRICE-ESTA	1990	9/21/2004			x				Suspect diltion: Avg CO + CO2 = 10.60%
C_KS1_359_1	5	4.1 to 5.0	MERCURY	GRAND MARQU	1988	9/21/2004		x	x			x	Average exhaust flow is > 50% lower than average for all other similar displacement vehicles & suspect dilution (avg CO+CO2 = 9.71%), & avg exhaust temp (230C) is 30% lower than similar displacement vehicles
C_KS1_360_1	2.4	2.1 to 2.5	TOYOTA	PICKUP	1987	9/20/2004			x	x			Suspect diltion: Avg CO + CO2 =10.3 %, & avg exhaust temp (430C) is 25 % higher than similar displacement vehicles
C_KS1_361_1	2.2	2.1 to 2.5	CHEVROLET	CAVALIER	2004	9/21/2004							
C_KS1_363_1	2.4	2.1 to 2.5	PONTIAC	GRAND AM SE	1997	9/22/2004							
C_KS1_363_2	2.4	2.1 to 2.5	PONTIAC	GRAND AM SE	1997	9/21/2004							
C_KS1_364_1	2.4	2.1 to 2.5	SATURN	SEDAN	2001	9/21/2004							
C_KS1_364_2	2.4	2.1 to 2.5	SATURN	SEDAN	2001	9/21/2004							Avg exhaust temp (200C) is 30% lower than similar displacement vehicles
C_KS1_367_1	3.8	3.5 to 4.0	PLYMOUTH	VOYAGER	1999	9/22/2004							
C_KS1_368_1	3	2.6 to 3.0	TOYOTA	CAMRY	1994	9/22/2004						x	Avg exhaust temp (190C) is 30% lower than similar displacement vehicles
C_KS1_369_1	4	3.5 to 4.0	FORD	RANGER	2003	9/22/2004							
C_KS1_369_2	4	3.5 to 4.0	FORD	RANGER	2003	9/22/2004							
C_KS1_372_1	3.5	3.1 to 3.5	KIA	SEDONA	2004	9/23/2004							
C_KS1_373_1	1.6	1.6 to 2.0	TOYOTA	COROLLA	1995	9/23/2004							
C_KS1_373_2	1.6	1.6 to 2.0	TOYOTA	COROLLA	1995	9/23/2004							
C_KS1_374_1	3	2.6 to 3.0	TOYOTA	SIENNA	2000	9/23/2004							
C_KS1_377_1	2.5	2.1 to 2.5	OLDSMOBILE	CUTLASS	1987	9/23/2004							
C_KS1_379_1	3.1	3.1 to 3.5	CHEVROLET	LUMINA	1997	9/24/2004							
C_KS1_381_1	2	1.6 to 2.0	FORD	CONTOUR	1996	9/24/2004						x	Avg exhaust temp (190C) is 30% lower than similar displacement vehicles
C_KS1_381_2	2	1.6 to 2.0	FORD	CONTOUR	1996	9/24/2004						x	Avg exhaust temp (190C) is 30% lower than similar displacement vehicles
C_KS1_383_1	4.9	4.1 to 5.0	FORD	F150	1989	9/24/2004			x				Suspect diltion: Avg CO + CO2 = 9.59%
C_KS1_383_2	4.9	4.1 to 5.0	FORD	F150	1989	9/24/2004			x				Suspect diltion: Avg CO + CO2 = 9.27%
C_KS1_384_1	1.9	1.6 to 2.0	SATURN	WAGON	1993	9/24/2004							
C_KS1_385_1	2.5	2.1 to 2.5	CHEVROLET	TRACKER	2003	9/24/2004							
C_KS1_386_1	5	4.1 to 5.0	CHEVROLET	CAPRICE CLAS	1987	9/11/2004							
C_KS1_386_2	5	4.1 to 5.0	CHEVROLET	CAPRICE CLAS	1987	9/11/2004							
C_KS1_387_1	2	1.6 to 2.0	FORD	ESCORT	1999	9/11/2004							
C_KS1_388_1	3	2.6 to 3.0	TOYOTA	CAMRY	2001	9/11/2004							
C_KS1_389_1	3.7	3.5 to 4.0	DODGE	RAM	1986	9/11/2004			x				Suspect diltion: Avg CO + CO2 = 10.71%
C_KS1_390_1	5.7	5.1 to 6.0	CHEVROLET	SUBURBAN	1995	9/11/2004							
C_KS1_394_1	1.6	1.6 to 2.0	TOYOTA	COROLLA	1992	9/25/2004							
C_KS1_394_2	1.6	1.6 to 2.0	TOYOTA	COROLLA	1992	9/25/2004							
C_KS1_395_1	2.4	2.1 to 2.5	PONTIAC	GRAND AM	1997	9/25/2004							
C_KS1_398_1	1.9	1.6 to 2.0	MERCURY	TRACER	1995	9/25/2004							
C_KS1_399_1	3.1	3.1 to 3.5	CHEVROLET	LUMINA	2001	9/25/2004							Avg exhaust temp (200C) is 40% lower than similar displacement vehicles
C_KS1_416_1	3	2.6 to 3.0	FORD	TAURUS SE	1998	9/27/2004							
C_KS1_417_1	1.8	1.6 to 2.0	TOYOTA	COROLLA	1996	9/27/2004							
C_KS1_419_1	3.5	3.1 to 3.5	NISSAN	MAXIMA	2002	9/27/2004							Avg exhaust temp (210C) is 30% lower than similar displacement vehicles
C_KS1_420_1	4.5	4.1 to 5.0	M.BENZ	SEL	1980	9/27/2004							
C_KS1_420_2	4.5	4.1 to 5.0	M.BENZ	SEL	1980	9/27/2004							
C_KS1_421_1	3.8	3.5 to 4.0	FORD	TAURUS	1993	9/27/2004							
C_KS1_424_1	4.3	4.1 to 5.0	CHEVROLET	ASTRO	1990	9/28/2004							Avg exhaust temp (220C) is 30% lower than similar displacement vehicles
C_KS1_424_2	4.3	4.1 to 5.0	CHEVROLET	ASTRO	1990	9/28/2004							

CTR_TST_ID	Disp	Disp Bin	Make	Model	Model Year	Test Date	Missing data	Flow Flag	Dilution Flag	Exh Temp Flag	Ambient Temp Flag	Suspect Data	Data Review Comments
C_KS1_425_1	2.3	2.1 to 2.5	VOLVO	850 TURBO	1996	9/28/2004		x				x	Average exhaust flow is > 50% lower than average for all other similar displacement vehicles
C_KS1_425_2	2.3	2.1 to 2.5	VOLVO	850 TURBO	1996	9/28/2004		x				x	Average exhaust flow is approx 50% lower than average for all other similar displacement vehicles
C_KS1_426_1	3	2.6 to 3.0	TOYOTA	CAMRY	1994	9/28/2004						x	Avg exhaust temp (190C) is 30% lower than similar displacement vehicles
C_KS1_427_1	1.9	1.6 to 2.0	SATURN	SL1	1997	9/28/2004							
C_KS1_428_1	3	2.6 to 3.0	FORD	TAURUS	1995	9/28/2004							
C_KS1_429_1	3.3	3.1 to 3.5	OLDSMOBILE	CUTLASS WAG(	1989	9/27/2004							
C_KS1_429_2	3.3	3.1 to 3.5	OLDSMOBILE	CUTLASS WAG(	1989	9/27/2004							
C_KS1_430_1	3.5	3.1 to 3.5	HONDA	ODYSSEY	2000	9/29/2004							
C_KS1_432_1	4.6	4.1 to 5.0	LINCOLN	CONTINENTAL	1995	9/29/2004						x	Avg exhaust temp (150C) is 50% lower than similar displacement vehicles
C_KS1_433_1	4.9	4.1 to 5.0	FORD	F-150	1989	9/29/2004		x	x			x	Average exhaust flow is > 50% higher than average for all other similar displacement vehicles & suspect dilution (avg CO+CO2 = 10.03%)
C_KS1_434_1	4.6	4.1 to 5.0	MERCURY	MARQUIS	1994	9/29/2004							Avg exhaust temp (210C) is 30% lower than similar displacement vehicles
C_KS1_436_1	2.4	2.1 to 2.5	PONTIAC	GRAND AM GT	1998	9/29/2004						x	Avg exhaust temp (160C) is 40% lower than similar displacement vehicles
C_KS1_437_1	2.2	2.1 to 2.5	TOYOTA	CAMRY	1996	9/30/2004							Avg exhaust temp (200C) is 30% lower than similar displacement vehicles
C_KS1_437_2	2.2	2.1 to 2.5	TOYOTA	CAMRY	1996	9/30/2004	x					x	Test record has missing or invalid data
C_KS1_438_1	2.2	2.1 to 2.5	CHEVROLET	AVALANCHE	2002	9/30/2004		x		x		x	Average exhaust flow is > 2x higher than average for all other similar displacement vehicles, & avg exhaust temp (400C) is 40 % higher than similar displacement vehicles
C_KS1_439_1	1.6	0 to 1.6	GEO	PRISM	1996	9/30/2004							
C_KS1_440_1	5	4.1 to 5.0	FORD	BRONCO	1990	9/30/2004				x		x	Average exhaust temp (520C) is 70 % higher than similar displacement vehicles
C_KS1_441_1	2.1	2.1 to 2.5	HONDA	ACCORD	1997	9/29/2004							
C_KS1_442_1	3	2.6 to 3.0	NISSAN	MAXIMA	1990	9/30/2004							
C_KS1_443_1	2	1.6 to 2.0	VW	CABRIO	1999	9/30/2004							
C_KS1_982_1	2.2	2.1 to 2.5	TOYOTA	CAMRY	1998	9/18/2004							

Kansas City PM Characterization Study

Final Report

Appendix R
Round 1 Driveaway
Quality Control

Assessment and Standards Division
Office of Transportation and Air Quality
U.S. Environmental Protection Agency

Sponsors:

National Renewable Energy Laboratory, U.S. Department of Energy
Federal Highway Administration, U.S. Department of Transportation
STAPPA-ALAPCO Emission Inventory Improvement Program
Coordinating Research Council Inc. (Project No. E-69)

Prepared for EPA by
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Desert Research Institute
Reno, NV

EPA Contract No. GS 10F-0036K

October 27,2006
Revised April 2008 by EPA staff

EPA United States Environmental Protection Agency

EPA420-R-08-009
April 2008

CTR_TST_ID	Disp	Disp Bin	Make	Model	Model Year	Date	Missing data	Flow Flag	Dilution Flag	Exh Temp Flag	Ambient Temp Flag	Suspect Data
D_KS1_036_1	2.5	2.1 to 2.5	JEEP	WRANGLER	1995	7/23/2004						
D_KS1_095_1	3.8	3.5 to 4.0	BUICK	LESABRE	1989	8/2/2004						
D_KS1_096_1	2.2	2.1 to 2.5	SUBARU	OUTBACK LEGA	1996	7/29/2004						
D_KS1_097_1	3.8	3.5 to 4.0	FORD	THUNDERBIRD	1988	8/5/2004						
D_KS1_124_1	2	1.6 to 2.0	FORD	ESCORT	2002	8/10/2004						
D_KS1_134_1	1.6	1.6 to 2.0	NISSAN	SENTRA	1994	8/11/2004						
D_KS1_138_1	2.6	2.6 to 3.0	CHRYSLER	LEBARON	1983	8/12/2004		x		x		x
D_KS1_149_1	2.8	2.6 to 3.0	CADILLAC	CIMMARON	1986	8/13/2004						
D_KS1_200_1	2.3	2.1 to 2.5	FORD	TEMPO	1986	8/24/2004						
D_KS1_203_1	3.8	3.5 to 4.0	OLDSMOBILE	NINETY EIGHT F	1985	8/24/2004			x			x
D_KS1_254_1	3	2.6 to 3.0	MERCURY	SABLE	1997	9/2/2004			x			
D_KS1_282_1	3.8	3.5 to 4.0	OLDSMOBILE	DELTA 88	1991	9/10/2004						
D_KS1_317_1	5	4.1 to 5.0	OLDSMOBILE	CUSTOM CRUIS	1984	9/15/2004						
D_KS1_386_1	5	4.1 to 5.0	CHEVROLET	CAPRICE CLAS	1987	9/14/2004						
D_KS1_1012_1	3	2.6 to 3.0	NISSAN	MAXIMA	1992	8/25/2004		x	x			x

Data Review Comments

Average exhaust flow is > 50% higher than average for all other similar displacement vehicles. Max ehxuast temp erroneous (2500C), avg exhaust temp (490C) is 30% higher than similar displacement vehicles

Suspect dilution: Avg CO + CO2 = 3.9%

Suspect dilution: Avg CO + CO2 = 10.7%

Average exhaust flow is > 50% lower than average for all other similar displacement vehicles, dilution indicates no sample (avg CO + CO2 = 0.13%)

Kansas City PM Characterization Study
Final Report

Appendix S
Round 1 Dynamometer Test Issues

Assessment and Standards Division
Office of Transportation and Air Quality
U.S. Environmental Protection Agency

Sponsors:

National Renewable Energy Laboratory, U.S. Department of Energy
Federal Highway Administration, U.S. Department of Transportation
STAPPA-ALAPCO Emission Inventory Improvement Program
Coordinating Research Council Inc. (Project No. E-69)

Prepared for EPA by
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EPA Contract No. GS 10F-0036K

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EPA United States Environmental Protection Agency

EPA420-R-08-009
April 2008

Run #	Veh Yr, Make, Model	Odometer (Miles)	Inertia (Lbs)	Hp@50mph	Time	Date	Dyne Test Issues	Suspect Data
84032	2001 Chevrolet Cavalier	57066	3000	6.4	10:57 a.m.	07/14/2004	Traction Control (TCS) engaged 100 sec PH1 & 3,	
84034	1999 IsuzuTrooper	63387	4500	14.8	2:15 p.m.	07/14/2004		
84035	2001 GMC Yukon	75374	5500	18.8	4:00 p.m.	07/14/2004	Phase 2 dilution temp over 50C.	
84036	1995 Ford Escort	102663	2750	5.6	9:13 a.m.	07/15/2004		
84037	1979 Ford F250	02285	3500	10.5	10:50 a.m.	07/15/2004	Phase 2 dilution temp over 50C.	
84039	2001 Ford F150	48831	5500	16.2	9:20 a.m.	07/16/2004		
84040	1990 Dodge Spirit	109270	3000	8.7	11:03 a.m.	07/16/2004		
84042	1996 Honda Civic	131492	2500	6.9	9:20 a.m.	07/17/2004	Engine stalled several times.	
84043	1991 Honda Civic	216571	2500	6.9	10:37 a.m.	07/17/2004		
84047	1996 Mazda 626	26614	3000	7.7	9:31 a.m.	07/19/2004		
84048	1989 Dodge Caravan	161033	3500	7.6	11:00 a.m.	07/19/2004		
84050	2002 Honda Civic	50405	3000	5.3	8:09 a.m.	07/20/2004		
84051	1995 Chevy Corsica	111484	3000	5.9	9:32 a.m.	07/20/2004	Torque data voided due to negative baseline drift. Vehicle A/C was on during test (switch was broken).	
84052	1988 Olds Cutlass	81545	3000	6.4	11:01 a.m.	07/20/2004	Error in real-time torque measurment corrected during data processing.	
84054	1995 GMC Jimmy	102924	3500	10.7	2:03 p.m.	07/20/2004	Error in real-time torque measurment corrected during data processing.	
84055	1998 Jeep Cherokee	131884	3500	11.8	3:36 p.m.	07/20/2004	Error in real-time torque measurment corrected during data processing.	
84056	2002 Nissan Frontier P/U	38153	4500	16.5	8:20 a.m.	07/21/2004	Error in real-time torque measurment corrected during data processing.	
84057	2001 Saturn SL1	51541	2500	6.1	9:45 a.m.	07/21/2004	Error in real-time torque measurment corrected during data processing.	
84058	1999 Chysler 300M	73246	3500	5.8	11:04 a.m.	07/21/2004	Error in real-time torque measurment corrected during data processing.	
84060	1998 Buick LeSabre	45455	3500	5.9	2:00 p.m.	07/21/2004	Error in real-time torque measurment corrected during data processing.	
84061	1990 Chevy Cavalier	81297	2750	5.6	3:28 p.m.	07/21/2004	Error in real-time torque measurment corrected during data processing.	
84062	1998 Buick Lesabre	45483	3500	5.9	8:20 a.m.	07/22/2004	Error in real-time torque measurment corrected during data processing.	
84063	1998 Saturn SC	74642	2500	6.0	9:30 a.m.	07/22/2004	Error in real-time torque measurment corrected during data processing.	
84064	1994 Mercury Villager	131405	4000	8.4	11:00 a.m.	07/22/2004	Error in real-time torque measurment corrected during data processing.	
84066	1995 Jeep Wrangler	71165	3000	15.7	2:07 p.m.	07/22/2004	No tunnel heater for this test. Difficult shifting vehicle from 4th to 5th. Error in real-time torque measurment corrected during data processing.	x
84067	1995 Dodge Caravan	138912	4000	7.0	3:45 p.m.	07/22/2004	Error in real-time torque measurment corrected during data processing.	
84068	2001 Toyota Solara	48090	3500	7.0	8:26 a.m.	07/23/2004	Error in real-time torque measurment corrected during data processing.	
84069	1997 Dodge Caravan Sport	90070	3500	7.2	9:58 a.m.	07/23/2004	Error in real-time torque measurment corrected during data processing.	
84071	1989 Pontiac Grand Am	116827	3000	5.9	12:35 p.m.	07/23/2004	Error in real-time torque measurment corrected during data processing.	

Run #	Veh Yr, Make, Model	Odometer	Inertia	Hp@50mph	Time	Date	Dyne Test Issues	Suspect Data
84072	2003 Chevy S-10 P/U	19374	3500	12.0	8:33 a.m.	07/24/2004	Zero Drift on Torque Readout. Error in real-time torque measurment corrected during data processing.	
84073	1995 Chevy Blazer	100766	3500	10.7	10:09 a.m.	07/24/2004	Phase 3 torque baseline corrected due to drift during soak. Error in real-time torque measurment corrected during data processing.	
84074	1986 Nissan P/U	138620	3500	11.4	11:30 a.m.	07/24/2004	Error in real-time torque measurment corrected during data processing.	
84076	1968 FordMustang	98864	3000	8.0	2:30 p.m.	07/24/2004	Error in real-time torque measurment corrected during data processing.	
84077	1999 Honda Civic	76504	2500	5.1	8:10 a.m.	07/26/2004	Vehicle had exhaust leaks, possible dilution.	
84078	1997 Honda Accord	79593	3000	4.9	9:32 a.m.	07/26/2004		
84079	1989 Honda Accord	209991	2750	6.0	11:08 a.m.	07/26/2004	First 630 seconds of run invalid (diluted exhaust was inadvertently sampled into the ambient monitor)	x
84081	1988 Ford Taurus	13139	3500	4.0	2:01 p.m.	07/26/2004		
84082	2003 Ford Taurus	25287	3500	6.8	8:14 a.m.	07/27/2004		
84083	2000 Honda Accord	77962	3000	7.8	9:41 a.m.	07/27/2004		
84084	1998 Chevy Malibu	99436	3000	5.8	11:04 a.m.	07/27/2004		
84086	2004 Honda Odyssey	21035	4500	12.0	8:15 a.m.	07/28/2004	Vehicle's traction control system was engaged during first minute of phase 1.	
84087	2000 Hyundai Tiburon	89226	3000	5.9	9:41 a.m.	07/28/2004		
84088	1998 Chevrolet Lumina	70740	3500	5.5	11:03 a.m.	07/28/2004		
84090	1999 Ford Mustang	39505	3500	9.7	1:47 p.m.	07/28/2004		
84091	1991 Cadillac Seville	70502	3500	6.2	3:04 p.m.	07/28/2004		
84092	1999 Saturn	53427	2500	5.5	8:11 a.m.	07/29/2004		
84093	1997 Nissan Sentra	119201	2750	7.0	9:36 a.m.	07/29/2004		
84094	1993 Ford Explorer	120280	4000	10.2	11:09 a.m.	07/29/2004		
84096	1999 Isuzu Rodeo	114937	4000	14.0	2:06 p.m.	07/29/2004		
84097	2002 Mercury Sable	24589	3500	6.8	8:02 a.m.	07/30/2004		
84098	1999 Ford Ranger	91045	3500	12.1	9:22 a.m.	07/30/2004		
84099	1999 Toyota Avalon	114759	3500	5.9	10:43 a.m.	07/30/2004		
84101	2004 Toyota Camry	169043	3500	7.2	1:22 p.m.	07/30/2004		
84102	1998 Honda Civic	149665	2500	5.1	2:41 p.m.	07/30/2004		
84103	2000 Nissan Maxima	74273	3500	7.4	8:10 a.m.	07/31/2004		
84104	1998 Plymouth Voyager	163238	4000	7.0	9:45 a.m.	07/31/2004		
84105	1997 Toyota Corolla	146471	2750	7.8	11:02 a.m.	07/31/2004		
84107	1989 Buick LeSabre	108562	3500	7.0	1:35 p.m.	07/31/2004		
84108	1990 Honda Civic	214131	2500	6.5	3:00 p.m.	07/31/2004		
84109	1998 Plymouth Voyager	163258	4000	7.0	8:30 a.m.	08/02/2004	Duplicate test. HP set at 7.0 but read 3.4 after test. Phase 3 torque baseline corrected due to drift during soak.	x
84110	1995 Ford Contour	102084	3000	5.0	9:57 a.m.	08/02/2004		
84111	1996 Chevrolet S-10 P/U	112263	3500	9.3	11:00 a.m.	08/02/2004		
84113	1993 Pontiac Grand Prix	172185	3500	5.0	1:42 p.m.	08/02/2004		
84114	1988 Ford Taurus	13158	3500	4.0	3:07 p.m.	8/02/2004		
84115	1995 Ford Contour	102096	3000	5.0	8:00 a.m.	08/03/2004		
84116	1996 Chevrolet S-10 P/U	112276	3500	9.3	9:40 a.m.	08/03/2004	Duplicate test. Braking violations during testing.	
84119	1995 Jeep Cherokee	171701	4000	13.1	12:42 p.m.	08/03/2004		

Run #	Veh Yr, Make, Model	Odometer	Inertia	Hp@50mph	Time	Date	Dyne Test Issues	Suspect Data
84120	1984 Honda Civic	87570	2250	7.2	2:30 p.m.	08/03/2004		
84121	2001 Volvo S80	55523	4000	4.0	8:05 a.m.	08/04/2004		
84122	1999 Dodge Caravan	104207	4000	7.3	9:30 a.m.	08/04/2004		
84123	1984 Honda Civic	87590	2250	7.2	10:30 a.m.	08/04/2004		
84125	1995 Ford Explorer	160621	4500	11.5	1:05 p.m.	08/04/2004		
84126	1988 Ford Thunderbird	178221	3500	9.1	2:55 p.m.	08/04/2004	Braking violations during testing.	
84127	00 Chrysler Town and Coun	85431	4500	9.3	8:12 a.m.	08/05/2004	Bags were being evacuated for the first 30 seconds of phase 1	
84128	2000 Toyota Camry	48465	3500	7.3	9:30 a.m.	08/05/2004	Vehicle difficult to start at beginning of test.	
84129	1999 Toyota Celica GT	72233	3000	6.5	10:10 a.m.	08/05/2004	Drive trace violations due to sticky throttle and drive trace display monitor failure at the start of phase 3.	x
84131	1997 Chevy Cavalier	128172	3000	5.4	1:18 p.m.	08`/05/2004		
84132	1993 Cherokee Sport	172409	3500	15.6	2:15 p.m.	08/05/2004	Braking violations during testing.	
84133	1998 Buick Century	71195	3500	5.9	8:10 a.m.	08/6/2004		
84134	1997 Mercury Grand Marquis	74497	4000	9.5	9:30 a.m.	8/06/2004	Vehicle difficult to start at beginning of test.	
84135	1993 Ford Probe	129131	3000	8.1	10:45 a.m.	08/06/2004		
84137	1993 Jeep Cherokee	172421	3500	15.6	1:30 p.m.	08/06/2004	Vehicle tie-down straps too tight at start of phase 1, loosened 60 to 90 seconds into test.	
84138	1995 Ford Bronco	198053	5000	10.7	3:00 p.m.	08/06/2004	Braking violations during testing, Phase 2 dilution temp over 50C.	
84139	1999 Ford Escort	66820	2750	5.6	8:23 a.m.	08/07/2004	Tire/roller slippage at start of test.	
84140	2002 Chevy Blazer	35072	3500	11.3	9:45 a.m.	08/07/2004		
84141	1990 Honda Accord	170433	3000	5.9	11:00 a.m.	08/07/2004	lbs).	x
84143	1988 Ford Taurus	13170	3500	4.0	2:15 p.m.	08/07/2004		
84144	1993 Plymouth Voyager	170027	4000	7.3	8:10 a.m.	08/09/2004		
84145	1990 Jeep Cherokee	261848	3500	10.8	9:30 a.m.	08/09/2004	Vehicle stalled during phase 1, possible dilution due to exhaust leaks.	
84146	1988 Ford Ranger	74743	3500	10.2	10:46 a.m.	08/09/2004	Torque meter read 4.6 bias prior to test, reset before test began.	
84148	1991 Dodge Dynasty	91324	3000	6.8	1:30 p.m.	08/09/2004		
84149	2002 Ford Escort SE	26748	3000	7.3	8:30 a.m.	08/10/2004		
84150	2000 Honda Odyssey	68979	4500	9.6	9:50 a.m.	08/10/2004		
84151	2000 Honda Accord	76178	3500	7.5	11:08 a.m.	08/10/2004		
84153	2000 Ford F150 PU	61040	4500	16.9	1:50 p.m.	08/10/2004	Tire/roller slippage at start of test.	
84154	1979 Ford F150 PU	53503	3500	11.7	3:15 p.m.	08/10/2004	Drive trace violations. Real-time phase 1 HC pegged. Tailpipe fell off during soak, first 90 seconds of phase 3 lost. Phase 2 dilution temp over 50C.	x
84156	2000 Honda Accord	76191	3500	7.5	9:05 a.m.	08/11/2004	No tedlar bag data for phases 1 or 2.	
84157	1994 Nissan Sentra	127063	2750	7.1	10:55 a.m.	08/11/2004		
84160	2001 Ford Focus	52253	3000	7.3	8:22 a.m.	08/12/2004		
84161	1997 Volvo 850	65093	3500	6.0	9:30 a.m.	08/12/2004	Silicone boot used to connect exhuast to dilution tunnel began smoking at the end of phase 2.	x
84162	1983 Chrysler Lebaron	43291	2750	5.5	10:50 a.m.	08/12/2004		
84164	1999 Plymouth Voyager	74703	4000	6.6	1:35 p.m.	08/12/2004		
84165	1991 Mazda Protege	185576	2750	7.9	3:20 p.m..	08/12/2004		
84166	1994 Mercury Topaz	9950	3000	6.1	4:23 p.m.	08/12/2004		
84167	1999 Ford Ranger P/U	92926	3500	11.4	8:25 a.m.	08/13/2004		

Run #	Veh Yr, Make, Model	Odometer	Inertia	Hp@50mph	Time	Date	Dyne Test Issues	Suspect Data
84168	996 Buick Regal Grand Spo	139861	3500	5.6	9:30 a.m.	08/13/2004		
84169	1994 Mercury Topaz	9961	3000	6.1	11:00 a.m.	08/13/2004		
84171	1988 Honda Civic DX	205828	2250	6.4	1:22 p.m.	08/13/2004	Vehicle stalled twice during phase 2.	
84172	1986 Cadillac Cimmaron	17610	3000	5.9	2:30 p.m.	08/13/2004		
84173	1996 Mercury Sable	110411	3500	6.9	8:15 a.m.	08/14/2004		
84174	1994 Mercury Topaz	32694	3000	6.1	9:30 a.m.	08/14/2004	Possible drive trace violation during phase 2 (driver switched at 700 seconds).	
84175	1988 Pontiac Bonneville	236760	3500	8.5	10:45 a.m.	08/14/2004		
84177	1988 Ford Taurus	13189	3500	4.0	1:54 p.m.	08/14/2004		
84178	1997 Toyota Camry	129432	3500	7.3	8:15 a.m.	08/16/2004		
84179	1998 Jeep Cherokee	82874	3500	11.8	9:30 a.m.	08/16/2004	Braking violations during testing.	
84180	!988 Pontiac Bonneville	236790	3500	8.5	10:42 a.m.	08/16/2004	Vehicle stalled at beginning of phase 1.	
84182	1995 Ford Thunderbird	135049	4000	10.6	1:30 p.m.	08/16/2004	Braking violations during testing.	
84183	2000 Toyota Corolla	70126	2750	7.5	8:15 a.m.	08/17/2004		
84184	2000 Honda Civic	40410	2750	7.0	9:30 a.m.	08/17/2004		
84185	1996 Toyota Corolla	148865	2750	6.6	11:00 a.m.	08/17/2004		
84187	1988 Ford Taurus	13208	3500	4.0	8:10 a.m.	08/18/2004	Torque zero drifting, and phase 2 drive trace violations due to trace monitor failure.	x
84188	1977 Chevy Monte Carlo	35553?35553	4000	11.6	9:30 a.m.	08/18/2004	Braking violations during testing.	
84189	1984 Ford F150 Pickup	72318	3500	12.9	11:05 a.m.	08/18/2004	Possible dilution due to exhaust leaks. Vehicle stalled during phase 2 (770 seconds). Realtime HC pegged for most of test.	x
84191	2000 Toyota Camry	47780	3500	7.3	8:15 a.m.	08/19/2004		
84192	2001 GMC Sonoma	60059	3500	11.3	9:34 a.m.	08/19/2004	Testsed at 3500 lb inertia instead of 4500 lb inertia specified for this engine code.	x
84193	2001 Hyundai Sante Fe	70621	4000	8.7	11:00 a.m.	08/19/2004		
84195	1999 Chevy Lumina	42985	3500	5.4	1:57 p.m.	08/19/2004		
84196	1993 GMC Safari	283231	4000	12.5	3:20 p.m.	08/19/2004	Braking violations during testing.	
84197	1990 Buick Regal	103881	3000	6.8	8:33 a.m.	08/20/2004	Vehicle difficult to start at beginning of test.	
84198	1994 Saturn SL1	116791	2500	4.7	9:51 a.m.	08/20/2004		
84200	1994 Saturn SL1	116822	2500	4.7	8:07 a.m.	08/21/2004		
84201	1985 Chev S10	30305	3000	10.4	9:30 a.m.	08/21/2004	No bag data for phases 1 and 2. Braking violations during testing.	
84205	1998 Ford F150	98670	4500	13.3	9:23 a.m.	08/23/2004		
84206	1994 Chevy P/U	99225	4000	12.2	10:40 a.m.	08/23/2004		
84208	1989 Lincoln Towncar	82512	4000	12.7	1:20 p.m.	08/23/2004		
84209	1996 Dodge Stratus	126733	3000	7.5	8:23 a.m.	08/24/2004		
84210	1988 Mazda MX6	222715	3000	6.8	9:47 a.m.	08/24/2004		
84211	1986 Ford Tempo	60031	2500	6.9	11:03 a.m.	08/24/2004		
84213	1985 Olds Regency 98	188058	3500	7.9	1:44 p.m.	08/24/2004		
84214	1994 Pontiac Bonneville	125226	3500	5.3	8:12 a.m.	08/25/2004	Vehicle started approximately 20 seconds into Phase 1. Phase 3 torque baseline corrected due to drift during soak.	
84215	1992 Nissan Maxima	53987	3500	8.5	9:30 a.m.	08/25/2004	Phase 3 torque baseline corrected due to drift during soak.	
84216	1990 Ford F150 P/U	7131	4000	15.5	10:53 a.m.	08/25/2004	Phase 2 dilution temp over 50C.	
84218	1988 Ford Taurus	13239	3500	4.0	2:00 p.m.	08/25/2004		

Run #	Veh Yr, Make, Model	Odometer	Inertia	Hp@50mph	Time	Date	Dyne Test Issues	Suspect Data
84219	1994 Chrysler Concorde	169018	3500	7.8	8:16 a.m.	08/26/2004		
84220	1992 Ford Escort	12788	2750	6.4	9:34 a.m.	08/26/2004		
84221	985 Ford LTD Crown Victori	100260	3500	9.3	11:00 a.m.	08/26/2004	Phase 2 dilution temp over 50C.	
84223	2005 Dodge Caravan	18159	4000	8.0	8:09 a.m.	08/27/2004		
84224	2002 Ford Taurus	72468	3500	6.5	9:27 a.m.	08/27/2004		
84225	2000 Honda Civic LX	35766	2750	7.0	10:35 a.m.	08/27/2004		
84227	1997 Buick Century	86430	3500	5.9	1:08 p.m.	08/27/2004		
84228	1992 Pontiac Grand Am	140191	3000	4.7	2:20 p.m.	08/27/2004	Vehicle stalled once during Phase 2.	
84229	2000 Olds Silhouette	85292	4000	11.5	8:55 a.m.	08/28/2004		
84230	1993 Nissan Sentra	87073	2500	6.2	10:11 a.m.	08/28/2004		
84231	1994 Olds Eighty Eight	128014	3500	6.5	11:28 a.m.	08/28/2004		
84233	1989 Toyota Corolla	181875	2500	5.9	2:05 p.m.	08/28/2004		
84234	1991 VW Cabriolet	63829	2750	8.0	8:11 a.m.	08/30/2004		
84235	1990 Geo Prizm	176712	2500	6.9	9:25 a.m.	08/30/2004	Bag 1 did not fill. Also, engine stalled at 10 seconds.	
84236	1992 Olds Achieva	177104	3000	4.9	10:47 a.m.	08/30/2004		
84238	1988 Pontiac 6000 Wagon	133737	3500	6.8	1:53 p.m.	08/30/2004	Possible dilution due to exhaust leak. Vehicle stalled twice during idle portion of test.	
84239	1987 Ford Taurus	33610	3000	6.9	3:10 p.m.	08/30/2004	Test stopped during Phase 2 at 1300 seconds.	x
84240	1998 Infiniti I30	50005	3500	6.4	8:26 a.m.	08/31/2004		
84241	1998 Ford Contour	118535	3000	4.8	9:43 a.m.	08/31/2004		
84242	1997 Plymouth Voyager	70430	3500	6.7	11:08 a.m.	08/31/2004		
84244	1992 Ford Escort	11345	2750	7.4	1:56 p.m.	08/31/2004		
84245	1987 Honda Accord	19268	2750	6.0	3:37 p.m.	08/31/2004		
84246	1994 Eagle Talon	109747	3500	10.6	8:14 a.m.	09/01/2004	Vehicle stalled 10 seconds into Phase 1.	
84248	1987 Ford Ranger	1705	3000	10.4	10:52 a.m.	09/01/2004	Possible braking violations.	
84250	1987 Ford Escort	78217	2500	7.4	1:16 p.m.	09/01/2004		
84252	2001 Ford Taurus	30917	3500	6.8	8:10 a.m.	09/02/2004		
84253	1997 Mercury Sable	104330	3500	8.0	9:27 a.m.	09/02/2004		
84256	1989 Chevy S10 P/U	174034	3000	10.4	1:22 p.m.	09/02/2004	Tire/roller slippage at start of test.	
84257	1983 Volvo GL	184224	3000	10.5	2:44 p.m.	09/02/2004		
84258	1991 Olds Delta 88	226269	3500	7.0	8:45 a.m.	09/08/2004	Invalid RH readings, corrected using airport data.	x
84259	1988 Ford Taurus	13250	3500	4.0	10:00 a.m.	09/08/2004		
84261	1989 Toyota Camry	269020	3500	7.7	8:17 a.m.	09/09/2004	Possible dilution due to exhaust leak. Possible trace violation due to clutch slippage.	
84262	1991 Olds Delta 88	227290	3500	7.0	9:30 a.m.	09/09/2004	Vehicle run at 3000 lbs for the first 700 seconds of this duplicate test.	x
84263	1989 Dodge Ram P/U	132325	3500	15.0	10:58 a.m.	09/09/2004		
84265	1984 Buick Century	1878	3000	7.3	1:30 p.m.	09/09/2004	Phase 2 dilution temp over 50C.	
84266	2000 Kia Sephia	58660	2750	6.3	8:13 a.m.	09/10/2004		
84267	1989 Chevrolet Cavalier	58439	2750	6.7	9:38 a.m.	09/10/2004		
84268	1994 Ford F150 P/U	169749	4500	12.9	10:50 a.m.	09/10/2004		
84270	1986 Mercury Grand Marqui	36277	4000	10.7	1:21 p.m.	09/10/2004		
84271	1979 Buick LeSabre	37608	3500	10.5	2:55 p.m.	09/10/2004	Ignition switch stuck at beginning of Phase 3.	
84272	2001 Honda Accord	39702	3500	7.8	8:31 a.m.	09/11/2004		
84274	1995 Ford Aspire	188078	2250	6.1	10:00 a.m.	09/11/2004		
84276	1989 Buick Park Avenue	128607	3500	6.0	12:26 p.m.	09/11/2004		

Run #	Veh Yr, Make, Model	Odometer	Inertia	Hp@50mph	Time	Date	Dyne Test Issues	Suspect Data
84277	1978 MG MGB	42926	2750	6.1	1:44 p.m.	09/11/2004		
84278	1990 GMC Jimmy	130254	3500	14.5	3:21 p.m.	09/11/2004	No bag data available.	
84279	2001 Toyota Camry 3.0L	61415	4000	7.0	8:42 a.m.	09/13/2004	Torque zero board dislodged for Phase 2 of test through end of test.	x
84280	1999 Ford Escort	74102	2750	4.9	10:00 a.m.	09/13/2004	Vehicle stalled 230 into Phase 1.	
84281	1995 Chevy Suburban	73848	5000	10.8	11:18 a.m.	09/13/2004	Braking violations during testing.	
84283	1986 Dodge P/U	47582	3500	12.8	1:50 p.m.	09/13/2004	Real-time HC pegged during Phase 1.	x
84284	1987 Chevy Caprice Wagon	29828	4500	9.6	3:30 p.m.	09/13/2004	Possible dilution due to exhaust leaks.	
84285	2000 Honda Civic	46677	2750	7.0	8:28 a.m.	09/14/2004		
84286	1997 Olds. Silhouette	111026	4000	10.1	9:30 a.m.	09/14/2004	Driving violations at start of Phase 3 due to automatic engagement of traction control. Vehicle restart during Phase 3 to reset.	
84287	!995 GMC Sierra P/U	171370	4000	12.2	10:59 a.m.	09/14/2004		
84289	34 Olds Custom Cruiser Wag	8983	4500	11.6	1:55 p.m.	09/14/2004	Phase 1 driving violations due to vehicle stalling. Possible dilution due to exhaust leaks, real-time HC saturation.	x
84290	!988 Ford Taurus	13266	3500	4.0	3:18 p.m.	09/14/2004		
84291	1997 Honda Civic	75783	2500	5.0	8:21 a.m.	09/15/2004		
84292	1997 Toyota Camry	127414	3500	7.3	9:30 a.m.	09/15/2004		
84293	1984 Volvo GL Wagon	299703	3000	10.7	10:53 a.m.	09/15/2004	Vehicle stalled during Phase 1.	
84295	1987 Chevy Caprice Classic	85915	4000	9.7	2:07 p.m.	09/15/2004	Vehicle stalled during Phase 1. Possible dilution due to exhaust leaks.	
84296	1998 Honda Civic	115370	2500	5.1	8:23 a.m.	09/16/2004	Possible high background concentration due to truck running outside building. Vehicle stalled during Phase 1.	x
84297	1996 Dodge Stratus	146579	3000	7.5	9:48 a.m.	09/16/2004	Ozonator air ran out during Phases 2 and 3, modal NOx invalid for these two phases.	x
84298	1999 Dodge Durango	92681	5000	16.9	11:05 a.m.	09/16/2004		
84300	1990 Buick Lesabre	59413	3500	6.8	1:35 p.m.	09/16/2004		
84301	1989 Pontiac Grand Prix	149395	3500	4.5	3:00 p.m.	09/16/2004	Real-time HC pegged during Phase 1.	x
84302	1993 Ford F150 P/U	184984	4500	12.8	4:25 p.m.	09/16/2004	Braking violations during testing.	
84303	2002 Olds Silhouette	40271	4500	16.2	8:08 a.m.	09/17/2004	Traction control engaged 1st 40 seconds of bag 1.	
84304	2001 Honda Civic	49751	2750	8.0	9:25 a.m.	09/17/2004		
84305	1999 Chevy Malibu	76627	3500	5.8	10:43 a.m.	09/17/2004		
84307	1992 Honda Accord	74582	3000	5.7	1:20 p.m.	09/17/2004		
84308	1994 Pontiac Grand Am	101526	3000	5.4	2:30 p.m.	09/17/2004		
84309	1973 Mercedes 280 SE	81588	4000	11.4	3:55 p.m.	09/17/2004	Braking violations during testing.	
84310	2003 Chevy Venture	24915	4500	16.2	8:00 a.m.	09/18/2004		
84311	1989 Toyota Corolla	80749	2500	5.9	9:10 a.m.	09/18/2004		
84312	1994 Pontiac Grand Am	101538	3000	5.4	10:30 a.m.	09/18/2004		
84314	1989 Plymouth Sundance	144672	2750	6.9	1:00 p.m.	09/18/2004		
84315	1991 Plymouth Voyager	158771	3500	7.6	2:15 p.m.	09/18/2004	Possible dilution due to exhaust leaks.	
84316	1996 Dodge Avenger	124729	3000	4.4	3:38 p.m.	09/18/2004		
84317	2000 Nissan Altima	95313	3500	7.9	8:06 a.m.	08/21/2004		
84318	1997 Nissan Sentra	154255	2750	7.0	9:18 a.m.	08/21/2004		
84319	1998 Toyota Camry	127663	3500	6.4	10:38 a.m.	08/21/2004		
84321	1996 Toyota Avalon	108189	3500	6.2	1:21 p.m.	08/21/2004		
84322	1990 Toyota Camry	202804	3000	5.9	2:40 p.m.	09/21/2004		

Run #	Veh Yr, Make, Model	Odometer	Inertia	Hp@50mph	Time	Date	Dyne Test Issues	Suspect Data
84323	2004 Kia Rio Cinco	6260	2750	6.7	8:00 a.m.	09/21/2004		
84324	1999 Toyota Camry	60286	3500	6.4	9:12 a.m.	09/21/2004		
84325	1998 Nissan Maxima	111655	3000	6.1	10:28 a.m.	09/21/2004		
84327	1998 Ford Taurus	77804	3500	5.0	12:47 p.m.	09/21/2004		
84328	1996 Toyota Avalon	108210	3500	6.2	1:57 p.m.	09/21/2004		
84329	1997 Jeep Wrangler	94832	3500	16.1	3:11 p.m.	09/21/2004		
84330	2004 Chevrolet Cavalier	8420	3000	3.9	8:08 a.m.	09/22/2004		
84332	1997 Pontiac Grand Am	57230	3000	3.8	10:35 a.m.	09/22/2004	HC2 not responding.	x
84334	Chevrolet Caprice Estate W	72464	4500	9.6	1:01 p.m.	09/22/2004	Possible high background concentration due to smoke from under hood.	x
84335	1988 Mercury Grand Marqui	87717	4000	12.5	2:15 p.m.	09/22/2004		
84336	1987 Toyota P/U	225176	2750	9.6	3:34 p.m.	09/22/2004	Braking violations during testing.	
84337	2003 Ford Ranger P/U	11678	3500	4.1	8:10 a.m.	09/23/2004		
84338	2001 Saturn	63172	3000	6.4	9:24 a.m.	09/23/2004		
84339	999 Plymouth Grand Voyag	75489	4000	6.6	10:30 a.m.	09/23/2004		
84341	1997 Pontiac Grand Am	57260	3000	3.8	2:02 p.m.	09/23/2004		
84342	1994 Toyota Camry	128229	3500	7.2	3:14 p.m.	09/23/2004		
84343	2004 Kia Sedona	6344	4000	6.8	8:20 a.m.	09/24/2004	Ozonator air ran out during test, modal NOx invalid for entire test.	x
84344	2000 Toyota Sienna	131771	4000	6.5	9:43 a.m.	09/24/2004		
84345	1997 Chevrolet Lumina	133436	3500	5.3	10:55 a.m.	09/24/2004		
84347	1995 Toyota Corolla	106201	2500	6.0	1:16 p.m.	09/24/2004		
84348	1988 Ford Taurus	13303	3500	4.0	2:54 p.m.	09/24/2004		
84349	2003 Chevrolet Tracker	22365	3000	12.7	8:10 a.m.	09/25/2004		
84350	1997 Chevrolet Lumina	133465	3500	5.3	9:30 a.m.	09/25/2004		
84351	1996 Ford Contour	98572	3000	5.6	10:46 a.m.	09/25/2004		
84353	1993 Saturn Wagon	220839	3000	4.8	1:27 p.m.	09/25/2004		
84354	1989 Ford F150	61510	4000	15.3	2:52 p.m.	09/25/2004	Phase 2 dilution temp over 50C.	
84355	2001 Chevrolet Lumina	57829	3500	7.0	8:07 a.m.	09/27/2004		
84356	1997 Pontiac Grand Am	120921	3000	3.8	9:22 a.m.	09/27/2004		
84357	1995 Mercury Tracer	146970	2750	4.5	10:52 a.m.	09/27/2004	Possible dilution due to exhaust leak. Plug wires disconnected at 700 seconds, reconnected at first idle of phase 3.	
84359	1992 Toyota Corolla	84923	2750	8.6	1:22 p.m.	09/27/2004		
84360	1988 Ford Taurus	13323	3500	4.0	2:36 p.m.	09/27/2004		
84361	2002 Nissan Maxima	80356	3500	5.0	8:13 a.m.	09/28/2004		
84362	1998 Ford Taurus	91855	3500	5.0	9:29 a.m.	09/28/2004		
84363	1996 Toyota Corolla	288784	2750	6.6	10.44 a.m.	09/28/2004		
84365	1993 Ford Taurus	69365	3500	5.5	1:30 p.m.	09/28/2004		
84366	1989 Olds Cutlass Wagon	118187	3000	5.7	2:52 p.m.	09/28/2004		
84367	1980Mercedes 450 SEL	185888	4000	8.3	4:10 p.m.	09/28/2004		
84368	1997 Saturn SL	170227	2500	6.7	8:08 a.m.	09/29/2004		
84369	1996 Volvo 850 Wagon	81784	3500	7.3	9:33 a.m.	09/29/2004		
84370	1995 Ford Taurus	70394	3500	5.4	11:01 a.m.	09/29/2004		
84372	1994 Toyota Camry	88215	3500	7.2	1:40 p.m.	09/29/2004		
84373	1990 Chevrolet Astrovan	235476	4000	12.0	3:00 p.m.	09/29/2004		

Run #	Veh Yr, Make, Model	Odometer	Inertia	Hp@50mph	Time	Date	Dyne Test Issues	Suspect Data
84374	1988 Ford Taurus	13352	3500	4.0	5:00 p.m.	09/29/2004		
84375	2001 Ford Windstar	37923	4500	10.1	8:11 a.m.	09/30/2004		
84376	2000 Honda Odyssey	117948	4500	9.6	9:24 a.m.	09/30/2004		
84377	1997 Honda Accord	77801	3000	4.9	10:52 a.m.	09/30/2004		
84379	1998 Pontiac Grand Am	75722	3000	4.4	1:20 p.m.	09/30/2004		
84380	1995 Lincoln Continental	100959	4000	5.7	2:58 p.m.	09/30/2004		
84381	1994 Mercury Marquis	127784	4000	10.7	4:12 p.m.	09/30/2004		
84382	1999 VW Cabrio	38317	3000	6.9	8:15 a.m.	10/01/2004		
84383	1996 Toyota Camry	164875	3500	6.9	9:30 a.m.	10/01/2004		
84384	1996 Geo Prizm	169535	2750	7.0	10:50 a.m.	10/01/2004		
84386	1990 Nissan Maxima	258738	2750	5.8	1:10 p.m.	10/01/2004	Vehicle would not go into gear for first 2 minutes.	x
84387	1988 Ford Taurus	13370	3500	4.0	3:15 p.m.	10/01/2004		
84388	2001 Toyota Camry	na	3000	6.7	11:30 a.m.	10/02/2004	Disregard, test is for PEMS flowmeter evaluation.	
84389	2001 Toyota Camry	na	3000	6.7	12:30 p.m.	10/02/2004	Disregard, test is for PEMS flowmeter evaluation.	
84390	2001 Toyota Camry	na	3000	6.7	1:30 p.m.	10/02/2004	Disregard, test is for PEMS flowmeter evaluation.	
84391	2001 Toyota Camry	na	3000	6.7	2:45 p.m.	10/02/2004	Disregard, test is for PEMS flowmeter evaluation.	
84392	na	na	na	na	4:00 p.m.	10/02/2004	Disregard, dilution tunnel injections.	

Run #	Veh Yr, Make, Model	Odometer	Inertia	Hp@50mph	Time	Date	Dyne Test Issues	Suspect Data

Kansas City PM Characterization Study

Final Report

Appendix T
Round 2 Conditioning Run
Quality Control

Assessment and Standards Division
Office of Transportation and Air Quality
U.S. Environmental Protection Agency

Sponsors:

National Renewable Energy Laboratory, U.S. Department of Energy
Federal Highway Administration, U.S. Department of Transportation
STAPPA-ALAPCO Emission Inventory Improvement Program
Coordinating Research Council Inc. (Project No. E-69)

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United States
Environmental Protection
Agency

EPA420-R-08-009
April 2008

CTR_TST_ID	Disp	Disp Bin	Make	Model	Model Year	Test Date	Missing data	Flow Flag	Dilution Flag	Exh Temp Flag	Ambient Temp Flag	Suspect Data	Data Review Comments
C_KS2_453_1	3.5	3.1 to 3.5	HONDA	ODYSSEY	2002	4/4/2005							
C_KS2_462_1	3.5	3.1 to 3.5	KIA	SEDONA	2004	4/5/2005							
C_KS2_484_1	3.8	3.5 to 4.0	CHRYSLER	TOWN & CC	2002	2/22/2005							
C_KS2_491_1	3.5	3.1 to 3.5	HONDA	ODYSSEY	2003	4/5/2005							
C_KS2_495_1	4	3.5 to 4.0	JEEP	CHEROKEE	2001	4/4/2005							
C_KS2_511_1	3	2.6 to 3.0	TOYOTA	SIENNA LE	2001	4/2/2005							
C_KS2_518_1	3.3	3.1 to 3.5	DODGE	GRAND CAI	2002	4/2/2005							
C_KS2_521_1	3.8	3.5 to 4.0	MITSUBISHI	MONTERO	2003	2/7/2005			x				Suspect dilution: Avg CO + CO2 = 10.1%
C_KS2_530_1	1.9	1.6 to 2.0	FORD	ESCORT LX	1995	1/11/2005							
C_KS2_531_1	3.5	3.1 to 3.5	CHEVROLET	SILVERADC	1976	1/11/2005		x				x	Average exhaust flow is > 50% higher than average for all other similar displacement vehicles.
C_KS2_532_1	3.5	3.1 to 3.5	CHRYSLER	300M	1999	1/11/2005							
C_KS2_533_1	3.5	3.1 to 3.5	HONDA	ODYSSEY	2000	1/11/2005							
C_KS2_534_1	2.2	2.1 to 2.5	HONDA	ACCORD	1997	1/12/2005							
C_KS2_537_1	3.3	3.1 to 3.5	PLYMOUTH	VOYAGER	1998	1/12/2005							
C_KS2_538_1	2.3	2.1 to 2.5	HONDA	ACCORD	2001	1/12/2005							
C_KS2_539_1	1.5	0 to 1.6	HONDA	CIVIC	1991	1/12/2005							
C_KS2_540_1	1.6	1.6 to 2.0	TOYOTA	COROLLA	1995	1/13/2005							
C_KS2_541_1	3.3	3.1 to 3.5	DODGE	CARAVAN	1997	1/13/2005							
C_KS2_542_1	2.3	2.1 to 2.5	PONTIAC	GRAND AM	1989	1/13/2005							
C_KS2_543_1	3	2.6 to 3.0	DODGE	CARAVAN	2000	1/13/2005		x				x	Average exhaust flow is > 50% higher than average for all other similar displacement vehicles.
C_KS2_544_1	3	2.6 to 3.0	MERCURY	SABLE	2002	1/14/2005							
C_KS2_545_1	5.7	5.1 to 6.0	FORD	F250	1979	1/14/2005							
C_KS2_546_1	3.1	3.1 to 3.5	CHEVROLET	MALIBU	1999	1/14/2005							
C_KS2_547_1	1.6	1.6 to 2.0	HONDA	CIVIC	1996	1/14/2005							
C_KS2_548_1	1.9	1.6 to 2.0	SATURN	NULL	1996	1/14/2005							
C_KS2_549_1	3.1	3.1 to 3.5	CHEVROLET	LUMINA	1998	1/15/2005							
C_KS2_550_1	2.4	2.1 to 2.5	PONTIAC	GRAND AM	1997	1/15/2005							aux temp erroneous (215C), not a data issue
C_KS2_551_1	3.8	3.5 to 4.0	CHEVROLET	IMPALA	2003	1/15/2005							
C_KS2_552_1	5.9	5.1 to 6.0	DODGE	DURANGO	1999	1/15/2005		x		x		x	Exhast temp is 20% lower and exhaust flow is 40% higher than similar displacement vehicles
C_KS2_553_1	1.6	1.6 to 2.0	HONDA	CIVIC	1998	1/15/2005							
C_KS2_555_1	4	3.5 to 4.0	JEEP	GRAND CHI	1995	1/17/2005							
C_KS2_556_1	2.3	2.1 to 2.5	HONDA	ACCORD	2000	1/17/2005							
C_KS2_557_1	4	3.5 to 4.0	FORD	EXPLORER	1995	1/17/2005							
C_KS2_558_1	2.2	2.1 to 2.5	SATURN	LS1	2000	1/17/2005							
C_KS2_559_1	4	3.5 to 4.0	JEEP	CHEROKEE	1998	1/17/2005		x				x	Average exhaust flow is > 50% higher than average for all other similar displacement vehicles.
C_KS2_562_1	3.1	3.1 to 3.5	CHEVROLET	MALIBU	1998	1/18/2005							
C_KS2_563_1	2.5	2.1 to 2.5	DODGE	SPIRIT	1990	1/18/2005							
C_KS2_564_1	1.9	1.6 to 2.0	SATURN	SC2	2001	1/18/2005							
C_KS2_565_1	2.4	2.1 to 2.5	MITSUBISHI	GALANT	2001	1/18/2005							
C_KS2_566_1	5	4.1 to 5.0	MERCURY	GRAND MAI	1991	1/18/2005			x	x		x	Suspect dilution: Avg CO + CO2 = 7.8%, avg exhaust temp (100C) is 60% lower than similar displacement vehicles.
C_KS2_567_1	4	3.5 to 4.0	JEEP	WRANGLEF	1997	1/19/2005							
C_KS2_567_2	4	3.5 to 4.0	JEEP	WRANGLEF	1997	1/19/2005			x				Suspect dilution: Avg CO + CO2 = 9.5%
C_KS2_567_3	4	3.5 to 4.0	JEEP	WRANGLEF	1997	1/19/2005			x				Suspect dilution: Avg CO + CO2 = 9.6%
C_KS2_568_1	3	2.6 to 3.0	TOYOTA	CAMRY	1994	1/20/2005							
C_KS2_569_1	4.3	4.1 to 5.0	CHEVROLET	S-10	1995	1/19/2005							
C_KS2_570_1	1.9	1.6 to 2.0	SATURN	SEDAN	1999	1/19/2005							
C_KS2_571_1	3.8	3.5 to 4.0	BUICK	PARK AVEN	1995	1/19/2005			x	x			Suspect dilution: Avg CO + CO2 = 10.9%, avg exhaust temp (130C) is 40% lower than similar displacement vehicles.
C_KS2_572_1	5.3	5.1 to 6.0	CHEVROLET	SILVERADC	2002	1/20/2005			x				Suspect dilution: Avg CO + CO2 = 10.9%
C_KS2_574_1	3.1	3.1 to 3.5	BUICK	CENTURY	2001	1/20/2005							
C_KS2_575_1	4.6	4.1 to 5.0	FORD	F150	2001	1/20/2005			x				Suspect dilution: Avg CO + CO2 = 10.8%
C_KS2_576_1	1.6	1.6 to 2.0	GEO	PRIZM	1991	1/20/2005							
C_KS2_577_1	3.8	3.5 to 4.0	PONTIAC	BONNEVILL	1995	1/20/2005				x			Avg exhaust temp (130C) is 40% lower than similar displacement vehicles.
C_KS2_579_1	3	2.6 to 3.0	TOYOTA	SIENNA	2000	1/21/2005		x				x	Average exhaust flow is > 50% higher than average for all other similar displacement vehicles.
C_KS2_580_1	3.8	3.5 to 4.0	PLYMOUTH	VOYAGER	1999	1/21/2005							
C_KS2_581_1	2.2	2.1 to 2.5	SATURN	SEDAN	2001	1/21/2005							

CTR_TST_ID	Disp	Disp Bin	Make	Model	Model Year	Test Date	Missing data	Flow Flag	Dilution Flag	Exh Temp Flag	Ambient Temp Flag	Suspect Data	Data Review Comments
C_KS2_582_1	2.5	2.1 to 2.5	CHEVROLET	TRACKER	2003	1/21/2005							
C_KS2_583_1	3.1	3.1 to 3.5	BUICK	REGAL	1994	1/22/2005				x			Avg exhaust temp (130C) is 50% lower than similar displacement vehicles.
C_KS2_583_2	3.1	3.1 to 3.5	BUICK	REGAL	1994	1/21/2005				x			Avg exhaust temp (130C) is 50% lower than similar displacement vehicles.
C_KS2_584_1	3	2.6 to 3.0	NISSAN	MAXIMA	1995	1/22/2005							
C_KS2_585_1	3	2.6 to 3.0	FORD	TAURUS	1995	1/22/2005							
C_KS2_586_1	3.1	3.1 to 3.5	PONTIAC	GRAND PRI	1993	1/22/2005		x				x	Average exhaust flow is > 50% higher than average for all other similar displacement vehicles.
C_KS2_593_1	3	2.6 to 3.0	FORD	AEROSTAR	1993	1/25/2005			x				Suspect dilution: Avg CO + CO2 = 10.9%
C_KS2_594_1	3	2.6 to 3.0	PLYMOUTH	VOYAGER	1989	1/25/2005				x			avg exhaust temp (130C) is 40% lower than similar displacement vehicles.
C_KS2_595_1	2.3	2.1 to 2.5	FORD	RANGER	1988	1/26/2005							
C_KS2_596_1	4.6	4.1 to 5.0	FORD	CROWN VIC	1995	1/25/2005				x			Avg exhaust temp (100C) is 60% lower than similar displacement vehicles.
C_KS2_597_1	3	2.6 to 3.0	FORD	AEROSTAR	1992	1/25/2005							
C_KS2_599_1	3.8	3.5 to 4.0	CHEVROLET	LUMINA LS	1994	1/27/2005							
C_KS2_599_2	3.8	3.5 to 4.0	CHEVROLET	LUMINA LS	1994	1/26/2005							Aux temp suspect (41C), not a data issue
C_KS2_600_1	2	1.6 to 2.0	FORD	CONTOUR	1995	1/26/2005							Aux temp erroneous (190C), not a data issue
C_KS2_602_1	3.3	3.1 to 3.5	DODGE	INTREPID	1994	1/26/2005		x		x		x	Average exhaust flow is > 50% higher than average for all other similar displacement vehicles, avg exhaust temp (110C) is 50% lower than similar displacement vehicles.
C_KS2_605_1	3	2.6 to 3.0	DODGE	CARAVAN	1989	1/27/2005							
C_KS2_606_1	5	4.1 to 5.0	CHEVROLET	SILVERADC	1996	1/27/2005		x				x	Average exhaust flow is > 50% higher than average for all other similar displacement vehicles.
C_KS2_607_1	2.3	2.1 to 2.5	FORD	TEMPO	1986	1/28/2005							
C_KS2_608_1	4.5	4.1 to 5.0	M.BENZ	280 SE	1973	1/27/2005			x				Suspect dilution: Avg CO + CO2 = 9.7%
C_KS2_609_1	5	4.1 to 5.0	CHEVROLET	MONTE CAI	1977	1/27/2005							
C_KS2_611_1	4	3.5 to 4.0	FORD	EXPLORER	1996	1/28/2005							
C_KS2_612_1	2	1.6 to 2.0	DODGE	RAM	1989	1/28/2005							
C_KS2_614_1	1.5	0 to 1.6	HONDA	CIVIC	1988	1/28/2005							
C_KS2_616_1	4	3.5 to 4.0	JEEP	CHEROKEE	1998	1/29/2005		x				x	Average exhaust flow is > 50% higher than average for all other similar displacement vehicles.
C_KS2_617_1	2	1.6 to 2.0	DODGE	NEON	1996	1/29/2005							
C_KS2_618_1	4.9	4.1 to 5.0	BUICK	LASABRE	1979	1/29/2005				x			Avg exhaust temp (100C) is 60% lower than similar displacement vehicles.
C_KS2_619_1	3.3	3.1 to 3.5	DODGE	CARAVAN	1996	1/29/2005		x				x	Average exhaust flow is > 50% higher than average for all other similar displacement vehicles.
C_KS2_622_1	2.1	2.1 to 2.5	MAZDA	B2200	1992	1/31/2005							
C_KS2_623_1	4.9	4.1 to 5.0	CADILLAC	FLEETWOO	1991	2/1/2005							
C_KS2_623_2	4.9	4.1 to 5.0	CADILLAC	FLEETWOO	1991	1/31/2005						x	Ambient temp erroneous (avg of -40C)
C_KS2_624_1	2.3	2.1 to 2.5	FORD	RANGER	1990	1/31/2005							
C_KS2_624_2	2.3	2.1 to 2.5	FORD	RANGER	1990	1/31/2005							
C_KS2_625_1	4.2	4.1 to 5.0	BUICK	RAINER	2004	2/2/2005		x		x		x	Avg exhaust temp (200C) is 30% lower than similar displacement vehicles, avg exhaust flow is 30% higher than similar displacement vehicles.
C_KS2_626_1	2.4	2.1 to 2.5	TOYOTA	TRUCK	1987	2/2/2005			x	x			Suspect dilution: Avg CO + CO2 = 8.4%, avg exhaust temp (410C) is 70% higher than similar displacement vehicle.
C_KS2_627_1	3.8	3.5 to 4.0	BUICK	LESABRE	1995	2/2/2005							
C_KS2_627_2	3.8	3.5 to 4.0	BUICK	LESABRE	1995	2/2/2005							
C_KS2_627_3	3.8	3.5 to 4.0	BUICK	LESABRE	1995	2/1/2005				x			Avg exhaust temp (120C) is 50% lower than similar displacement vehicles.
C_KS2_628_1	5	4.1 to 5.0	CHEVROLET	C10 SILVER	1984	2/1/2005		x				x	Average exhaust flow is > 50% higher than average for all other similar displacement vehicles.
C_KS2_631_1	2.3	2.1 to 2.5	FORD	RANGER XL	1997	2/2/2005							
C_KS2_632_1	2.2	2.1 to 2.5	GMC	SONOMA	1996	2/2/2005							
C_KS2_633_1	4.2	4.1 to 5.0	FORD	FREESTAR	2004	2/2/2005							
C_KS2_634_1	3	2.6 to 3.0	TOYOTA	4RUNNER S	1995	2/2/2005		x			x	x	Average exhaust flow is > 50% higher than average for all other similar displacement vehicles, ambient temp suspect (avg T of -40C)
C_KS2_635_1	5.7	5.1 to 6.0	CHEVROLET	SUBURBAN	1995	2/2/2005							
C_KS2_638_1	3	2.6 to 3.0	TOYOTA	SIENNA XLE	2001	2/3/2005							
C_KS2_639_1	1.8	1.6 to 2.0	ACURA	INTEGRA	1995	2/3/2005							
C_KS2_640_1	2.4	2.1 to 2.5	NISSAN	FRONTIER	1998	2/3/2005							
C_KS2_641_1	3.5	3.1 to 3.5	CHRYSLER	CONCORD	1996	2/3/2005							
C_KS2_642_1	3	2.6 to 3.0	FORD	TAURUS	2002	2/4/2005							
C_KS2_643_1	3.2	3.1 to 3.5	CHRYSLER	CONCORD	2000	2/4/2005				x		x	Avg exhaust temp (90C) is 60% lower than similar displacement vehicles.
C_KS2_644_1	3.3	3.1 to 3.5	DODGE	INTREPID	1993	2/4/2005							
C_KS2_644_2	3.3	3.1 to 3.5	DODGE	INTREPID	1993	2/4/2005							
C_KS2_645_1	5	4.1 to 5.0	FORD	F150	1989	2/4/2005				x		x	Avg exhaust temp (510C) is 80% higher than similar displacement vehicles.
C_KS2_646_1	4.3	4.1 to 5.0	CHEVROLET	ASTROVAN	1992	2/5/2005				x			Avg exhaust temp (130C) is 50% lowerr than similar displacement vehicles.

CTR_TST_ID	Disp	Disp Bin	Make	Model	Model Year	Test Date	Missing data	Flow Flag	Dilution Flag	Exh Temp Flag	Ambient Temp Flag	Suspect Data	Data Review Comments
C_KS2_647_1	5.7	5.1 to 6.0	CHEVROLET	SUBURBAN	1994	2/5/2005							
C_KS2_648_1	5.4	5.1 to 6.0	FORD	F150	2001	2/5/2005							
C_KS2_649_1	1.5	0 to 1.6	HONDA	CIVIC	1992	2/5/2005		x				x	Average exhaust flow is > 50% higher than average for all other similar displacement vehicles.
C_KS2_651_1	4.4	4.1 to 5.0	CHEVROLET	CAPRICE	1982	2/6/2005			x				Suspect dilution: Avg CO + CO2 = 11.0%
C_KS2_653_1	3.5	3.1 to 3.5	CHRYSLER	CONCORDE	2002	2/7/2005							
C_KS2_654_1	3.1	3.1 to 3.5	BUICK	SKYLARK	1994	2/7/2005							
C_KS2_655_1	4.3	4.1 to 5.0	CHEVROLET	ASTRO VAN	1993	2/8/2005							
C_KS2_656_1	3	2.6 to 3.0	DODGE	CARAVAN	1992	2/7/2005		x		x		x	Average exhaust flow is > 50% higher than average for all other similar displacement vehicles. avg exhaust temp (130C) is 40% lower than similar displacement vehicles.
C_KS2_660_1	3.3	3.1 to 3.5	DODGE	GRAND CAI	1998	2/7/2005			x			x	Suspect dilution: Avg CO + CO2 = .01% (no sampling)
C_KS2_661_1	4.6	4.1 to 5.0	LINCOLN	TOWNCAR	1991	2/10/2005							
C_KS2_662_1	2.3	2.1 to 2.5	ISUZU	PICKUP	1995	2/8/2005							
C_KS2_663_1	3	2.6 to 3.0	FORD	TAURUS	2001	2/8/2005							
C_KS2_664_1	2.2	2.1 to 2.5	HONDA	ACCORD	1997	2/9/2005							
C_KS2_665_1	3	2.6 to 3.0	DODGE	GRAND CAI	2003	4/2/2005							
C_KS2_667_1	4.3	4.1 to 5.0	CHEVROLET	C1500	1996	2/8/2005							
C_KS2_668_1	5.9	5.1 to 6.0	DODGE	RAM PU	1995	2/9/2005					x	x	Erroneous ambient temp (average of 53C)
C_KS2_670_1	1.6	1.6 to 2.0	GEO	TRACKER	1992	2/9/2005							
C_KS2_671_1	2.5	2.1 to 2.5	PLYMOUTH	SUNDANCE	1992	2/9/2005							
C_KS2_674_1	2	1.6 to 2.0	HONDA	CRV	1998	2/10/2005		x				x	Average exhaust flow is > 50% higher than average for all other similar displacement vehicles.
C_KS2_675_1	5.7	5.1 to 6.0	CHEVROLET	SUBURBAN	1999	2/10/2005							
C_KS2_676_1	2.2	2.1 to 2.5	SUBARU	LEGACY W/	1993	2/10/2005							
C_KS2_677_1	3.4	3.1 to 3.5	PONTIAC	MONTANA	2003	2/10/2005							
C_KS2_677_2	3.4	3.1 to 3.5	PONTIAC	MONTANA	2003	2/10/2005							
C_KS2_679_1	4	3.5 to 4.0	FORD	RANGER	1998	2/11/2005							
C_KS2_680_1	5.7	5.1 to 6.0	CHEVROLET	TAHOE	1996	2/11/2005							
C_KS2_681_1	3.3	3.1 to 3.5	DODGE	GRAND CAI	1996	2/12/2005							
C_KS2_681_2	3.3	3.1 to 3.5	DODGE	GRAND CAI	1996	2/11/2005							
C_KS2_681_3	3.3	3.1 to 3.5	DODGE	GRAND CAI	1996	2/11/2005		x				x	Average exhaust flow is > 50% lower than average for all other similar displacement vehicles
C_KS2_682_1	4	3.5 to 4.0	JEEP	CHEROKEE	2000	2/12/2005							
C_KS2_682_2	4	3.5 to 4.0	JEEP	CHEROKEE	2000	2/11/2005							
C_KS2_685_1	3.9	3.5 to 4.0	DODGE	DAKOTA	1999	2/14/2005							
C_KS2_686_1	1.8	1.6 to 2.0	TOYOTA	COROLLA	1995	2/14/2005			x				Suspect dilution: Avg CO + CO2 = 10.8%
C_KS2_689_1	5	4.1 to 5.0	LINCOLN	TOWN CAR	1988	2/14/2005			x				Suspect dilution: Avg CO + CO2 = 10.0%
C_KS2_689_2	5	4.1 to 5.0	LINCOLN	TOWN CAR	1988	2/14/2005	x					x	Test record has missing or invalid data
C_KS2_693_1	3.5	3.1 to 3.5	ISUZU	AXIOM	2002	2/15/2005							
C_KS2_694_1	3.4	3.1 to 3.5	OLDS	SILHOUTTE	2002	2/15/2005							
C_KS2_695_1	4.9	4.1 to 5.0	FORD	F150	1992	2/15/2005			x				Suspect dilution: Avg CO + CO2 = 10.7%
C_KS2_698_1	3.3	3.1 to 3.5	CHRYSLER	TOWN & CC	2001	2/16/2005							
C_KS2_700_1	3.8	3.5 to 4.0	BUICK	PARK AVEN	2000	2/16/2005							
C_KS2_701_1	3.9	3.5 to 4.0	DODGE	DAKOTA	1998	2/16/2005			x				Suspect dilution: Avg CO + CO2 = 10.7%
C_KS2_702_1	4.3	4.1 to 5.0	CHEVROLET	S-10	2001	2/16/2005							
C_KS2_703_1	5	4.1 to 5.0	FORD	COUNTRY S	1986	2/16/2005			x				Suspect dilution: Avg CO + CO2 = 9.1%
C_KS2_704_1	4.9	4.1 to 5.0	CADILLAC	SEDAN DEV	1992	2/17/2005							
C_KS2_705_1	3.7	3.5 to 4.0	DODGE	DAKOTA	2004	2/17/2005							
C_KS2_706_1	2.2	2.1 to 2.5	HONDA	ODYSSEY	1995	2/17/2005		x		x		x	Average exhaust flow is > 50% higher than average for all other similar displacement vehicles, avg exhaust temp (130C) is 50% lower than similar displacement vehicles.
C_KS2_707_1	3.3	3.1 to 3.5	DODGE	GRAND CAI	1998	2/17/2005			x				Suspect dilution: Avg CO + CO2 = 10.4%
C_KS2_709_1	4	3.5 to 4.0	FORD	RANGER	2002	2/17/2005		x		x		x	Average exhaust flow is > 50% lower than average for all other similar displacement vehicles, no exhaust temp measured
C_KS2_709_2	4	3.5 to 4.0	FORD	RANGER	2002	2/17/2005					x	x	Ambient temp erroneous (avg of -38C)
C_KS2_711_1	2.3	2.1 to 2.5	MERCURY	TOPAZ	1994	2/18/2005							
C_KS2_712_1	2.3	2.1 to 2.5	FORD	RANGER	1996	2/18/2005							
C_KS2_713_1	2.2	2.1 to 2.5	FORD	TAURUS	1995	2/18/2005		x		x		x	Average exhaust flow is > 50% higher than average for all other similar displacement vehicles, avg exhaust temp (110C) is 60% lower than similar displacement vehicles.
C_KS2_715_1	5.7	5.1 to 6.0	CHEVROLET	SILVERADC	1994	2/19/2005							

CTR_TST_ID	Disp	Disp Bin	Make	Model	Model Year	Test Date	Missing data	Flow Flag	Dilution Flag	Exh Temp Flag	Ambient Temp Flag	Suspect Data	Data Review Comments
C_KS2_716_1	3.8	3.5 to 4.0	FORD	TAURUS	1993	2/19/2005		x		x		x	Average exhaust flow is > 50% lower than average for all other similar displacement vehicles, no exhaust temp (C) measured
C_KS2_716_2	3.8	3.5 to 4.0	FORD	TAURUS	1993	2/19/2005							
C_KS2_718_1	3.8	3.5 to 4.0	BUICK	PARK AVEN	1993	2/19/2005							
C_KS2_719_1	3.1	3.1 to 3.5	CHEVROLET	LUMINA	1994	2/19/2005							
C_KS2_721_1	3.8	3.5 to 4.0	FORD	WINDSTAR	1998	2/21/2005							
C_KS2_721_2	3.8	3.5 to 4.0	FORD	WINDSTAR	1998	2/21/2005							
C_KS2_722_1	2.9	2.6 to 3.0	VOLVO	960	1993	3/11/2005							
C_KS2_722_2	2.9	2.6 to 3.0	VOLVO	960	1993	3/11/2005							
C_KS2_723_1	2.3	2.1 to 2.5	FORD	TEMPO	1993	3/17/2005							
C_KS2_723_2	2.3	2.1 to 2.5	FORD	TEMPO	1993	3/18/2005							
C_KS2_724_1	4.3	4.1 to 5.0	CHEVROLET	BLAZER	1996	3/24/2005							
C_KS2_725_1	3.8	3.5 to 4.0	CHRYSLER	TOWN & CC	2002	4/5/2005							
C_KS2_726_1	4.3	4.1 to 5.0	CHEVROLET	S-10 LS	1995	3/28/2005							
C_KS2_727_1	2.7	2.6 to 3.0	BMW	528E	1988	2/22/2005	x					x	Test record has missing or invalid data
C_KS2_727_2	2.7	2.6 to 3.0	BMW	528E	1988	2/22/2005			x	x			Suspect dilution: Avg CO + CO2 = 10.8%, avg exhaust temp (140C) is 40% lower than similar displacement vehicles.
C_KS2_728_1	3.1	3.1 to 3.5	CHEVROLET	CORSICA	1995	2/22/2005							
C_KS2_728_2	3.1	3.1 to 3.5	CHEVROLET	CORSICA	1995	2/22/2005		x	x	x		x	Average exhaust flow is > 50% lower than average for all other similar displacement vehicles, Suspect dilution: Avg CO + CO2 = 5.6%, , avg exhaust temp (120C) is 50% lower than similar displacement vehicles.
C_KS2_729_1	3.8	3.5 to 4.0	CHRYSLER	TOWN & CC	1996	3/10/2005							
C_KS2_731_1	1.9	1.6 to 2.0	FORD	ESCORT	1993	2/23/2005							
C_KS2_733_1	2.4	2.1 to 2.5	NISSAN	PICKUP XE	1995	2/23/2005			x				Suspect dilution: Avg CO + CO2 = 10.8%
C_KS2_734_1	3	2.6 to 3.0	PLYMOUTH	VOYAGER	1993	3/29/2005							
C_KS2_736_1	3	2.6 to 3.0	MERCURY	VILLAGER	1997	2/25/2005							
C_KS2_737_1	5.7	5.1 to 6.0	BUICK	LESABRE	1978	2/24/2005							
C_KS2_738_1	1.9	1.6 to 2.0	SATURN	SL 2	2001	2/24/2005							
C_KS2_738_2	1.9	1.6 to 2.0	SATURN	SL 2	2001	2/24/2005		x		x		x	Avg exh flow is higher and exh temp is lower than similar displacement vehicles, appears different from original run.
C_KS2_739_1	3	2.6 to 3.0	FORD	TAURUS	1993	3/19/2005							
C_KS2_740_1	3	2.6 to 3.0	FORD	ESCAPE	2002	3/21/2005							
C_KS2_743_1	5	4.1 to 5.0	FORD	LTD	1979	2/26/2005		x	x	x		x	Average exhaust flow is > 50% lower than average for all other similar displacement vehicles, Suspect dilution: Avg CO + CO2 = 2.7%, avg exhaust temp (100C) is 70% lower than similar displacement vehicles.
C_KS2_743_2	5	4.1 to 5.0	FORD	LTD	1979	2/26/2005	x					x	Test record has missing or invalid data
C_KS2_743_3	5	4.1 to 5.0	FORD	LTD	1979	2/28/2005							
C_KS2_743_4	5	4.1 to 5.0	FORD	LTD	1979	2/28/2005							
C_KS2_744_1	2.3	2.1 to 2.5	HONDA	ACCORD E)	1998	2/25/2005			x				Suspect dilution: Avg CO + CO2 = 8.3%
C_KS2_747_1	3	2.6 to 3.0	TOYOTA	4 RUNNER	1993	2/25/2005			x	x			Suspect dilution: Avg CO + CO2 = 11.0%, avg exhaust temp (390C) is 80% higher than similar displacement vehicles.
C_KS2_749_1	2	1.6 to 2.0	PONTIAC	SUNBIRD	1994	2/26/2005		x				x	Average exhaust flow is > 50% higher than average for all other similar displacement vehicles.
C_KS2_750_1	2	1.6 to 2.0	FORD	ESCORT SE	1998	2/26/2005							
C_KS2_751_1	3	2.6 to 3.0	FORD	TAURUS GL	1997	2/26/2005				x			avg exhaust temp (110C) is 50% lower than similar displacement vehicles.
C_KS2_753_1	3.8	3.5 to 4.0	FORD	WINDSTAR	1998	3/25/2005							
C_KS2_757_1	3.8	3.5 to 4.0	BUICK	REGAL	1979	2/28/2005							
C_KS2_760_1	1.5	0 to 1.6	MAZDA	PROTÉGÉ	1998	3/30/2005							
C_KS2_761_1	1.4	0 to 1.6	DATSUN	210 WAGON	1979	3/1/2005			x			x	Suspect dilution: Avg CO + CO2 = 4.6%
C_KS2_761_2	1.4	0 to 1.6	DATSUN	210 WAGON	1979	3/1/2005			x			x	Suspect dilution: Avg CO + CO2 = 8.3%
C_KS2_761_3	1.4	0 to 1.6	DATSUN	210 WAGON	1979	3/1/2005			x			x	Suspect dilution: Avg CO + CO2 = 7.6%
C_KS2_764_1	3.1	3.1 to 3.5	BUICK	SKYLARK	1998	3/29/2005							
C_KS2_767_1	2.8	2.6 to 3.0	DATSUN	280Z	1977	3/2/2005							
C_KS2_770_1	2.5	2.1 to 2.5	TOYOTA	CAMRY	1989	3/3/2005			x			x	Suspect dilution: Avg CO + CO2 = 8.3%
C_KS2_772_1	3.8	3.5 to 4.0	BUICK	REGAL	1978	3/3/2005							
C_KS2_774_1	3	2.6 to 3.0	NISSAN	QUEST	1996	3/4/2005							
C_KS2_774_2	3	2.6 to 3.0	NISSAN	QUEST	1996	3/4/2005							
C_KS2_775_1	3.8	3.5 to 4.0	OLDSMOBILE	DELTA 88	1990	3/4/2005							
C_KS2_776_1	4.9	4.1 to 5.0	FORD	F-150	1987	3/4/2005							
C_KS2_777_1	4	3.5 to 4.0	FORD	RANGER XL	2000	3/4/2005	x					x	Test record has missing or invalid data
C_KS2_778_1	7.5	> 6.0	FORD	F-250	1989	3/4/2005			x				Suspect dilution: Avg CO + CO2 = 9.5%
C_KS2_779_1	5.7	5.1 to 6.0	OLDSMOBILE	DELTA 88	1978	3/4/2005							

CTR_TST_ID	Disp	Disp Bin	Make	Model	Model Year	Test Date	Missing data	Flow Flag	Dilution Flag	Exh Temp Flag	Ambient Temp Flag	Suspect Data	Data Review Comments
C_KS2_780_1	5.7	5.1 to 6.0	CHEVROLET	SUBURBAN	1997	3/5/2005							
C_KS2_782_1	3.3	3.1 to 3.5	PLYMOUTH	VOYAGER	1999	3/5/2005							
C_KS2_782_2	3.3	3.1 to 3.5	PLYMOUTH	VOYAGER	1999	3/5/2005							
C_KS2_783_1	2.5	2.1 to 2.5	PLYMOUTH	VOYAGER	1992	3/5/2005							
C_KS2_784_1	2.3	2.1 to 2.5	FORD	RANGER XL	1992	3/5/2005							
C_KS2_785_1	3	2.6 to 3.0	FORD	RANGER	1992	3/5/2005			x	x			Suspect dilution: Avg CO + CO2 = 10.5%, avg exhaust temp (130C) is 40% lower than similar displacement vehicles.
C_KS2_787_1	1.3	0 to 1.6	VW	BEETLE	1973	3/7/2005				x		x	Avg exhaust temp (350C) is 100% higher than similar displacement vehicles
C_KS2_788_1	2.5	2.1 to 2.5	PLYMOUTH	ACCLAIM	1989	3/7/2005			x			x	Suspect dilution: Avg CO + CO2 = 7.1%
C_KS2_788_2	2.5	2.1 to 2.5	PLYMOUTH	ACCLAIM	1989	3/7/2005			x			x	Suspect dilution: Avg CO + CO2 = 7.1%
C_KS2_788_3	2.5	2.1 to 2.5	PLYMOUTH	ACCLAIM	1989	3/8/2005			x	x		x	Suspect dilution: Avg CO + CO2 = 0 % (no sampling), avg exhaust temp (100C) is 60% lower than similar displacement vehicles.
C_KS2_789_1	3.7	3.5 to 4.0	DODGE	RAM PICKU	1987	3/7/2005							
C_KS2_791_1	2.2	2.1 to 2.5	TOYOTA	CAMRY	1999	3/7/2005							
C_KS2_792_1	4.2	4.1 to 5.0	CHEVROLET	TRAIL BLAZ	2002	3/8/2005							
C_KS2_795_1	5	4.1 to 5.0	FORD	CROWN VIC	1989	3/9/2005							
C_KS2_796_1	2	1.6 to 2.0	HONDA	ACCORD SE	1989	3/8/2005			x				Suspect dilution: Avg CO + CO2 = 10.5%
C_KS2_797_1	2.5	2.1 to 2.5	ACURA	2.5 TL	1996	3/8/2005							
C_KS2_800_1	3.3	3.1 to 3.5	OLDSMOBILE	CUTLASS	1990	3/14/2005							
C_KS2_801_1	3	2.6 to 3.0	PLYMOUTH	VOYAGER S	1988	3/9/2005							
C_KS2_802_1	2.3	2.1 to 2.5	VOLVO	740 TURBO	1987	3/9/2005				x			avg exhaust temp (140C) is 40% lower than similar displacement vehicles.
C_KS2_805_1	2.2	2.1 to 2.5	CHEVROLET	CAVALIER	1995	3/10/2005	x					x	Test record has missing or invalid data
C_KS2_805_2	2.2	2.1 to 2.5	CHEVROLET	CAVALIER	1995	3/10/2005							
C_KS2_806_1	2.5	2.1 to 2.5	DODGE	SPIRIT	1989	3/10/2005		x		x		x	Average exhaust flow is > 50% higher than average for all other similar displacement vehicles, avg exhaust temp (130C) is 50% lower than similar displacement vehicles.
C_KS2_807_1	1.9	1.6 to 2.0	FORD	ESCORT	1987	3/10/2005		x		x		x	Average exhaust flow is > 50% higher than average for all other similar displacement vehicles, avg exhaust temp (130C) is 30% lower than similar displacement vehicles.
C_KS2_808_1	4	3.5 to 4.0	FORD	EXPLORER	1994	3/10/2005							
C_KS2_809_1	3.5	3.1 to 3.5	NISSAN	PATHFINDE	2001	3/11/2005							
C_KS2_809_2	3.5	3.1 to 3.5	NISSAN	PATHFINDE	2001	3/12/2005		x		x		x	Average exhaust flow is > 50% higher than average for all other similar displacement vehicles.
C_KS2_811_1	3.9	3.5 to 4.0	DODGE	SE DAKOTA	1987	3/11/2005			x	x			Suspect dilution: Avg CO + CO2 = 10.0%, avg exhaust temp (410C) is 80% higher than similar displacement vehicles.
C_KS2_813_1	2	1.6 to 2.0	HONDA	ACCORD LX	1988	3/11/2005							
C_KS2_815_1	4.3	4.1 to 5.0	GMC	SONOMA	1995	3/12/2005							
C_KS2_816_1	2.2	2.1 to 2.5	NISSAN	PICKUP	1988	3/14/2005			x				Suspect dilution: Avg CO + CO2 = 9.6%
C_KS2_818_1	3.1	3.1 to 3.5	CHEVROLET	LUMINA AP'	1990	3/12/2005							
C_KS2_820_1	3.8	3.5 to 4.0	BUICK	PARK AVEN	1990	3/14/2005							
C_KS2_821_1	2.5	2.1 to 2.5	CHRYSLER	LEBARON	1988	3/16/2005		x				x	No exhaust flow measured
C_KS2_821_2	2.5	2.1 to 2.5	CHRYSLER	LEBARON	1988	3/16/2005							
C_KS2_822_1	4.5	4.1 to 5.0	CADILLAC	ELDORADO	1990	3/15/2005							
C_KS2_823_1	3.1	3.1 to 3.5	CHEVROLET	LUMINA	1990	3/14/2005			x				Suspect dilution: Avg CO + CO2 = 10.8%
C_KS2_824_1	4.3	4.1 to 5.0	CHEVROLET	ASTROVAN	1989	3/14/2005							
C_KS2_825_1	3	2.6 to 3.0	DODGE	CARAVAN S	1988	3/14/2005							
C_KS2_826_1	5.3	5.1 to 6.0	FORD	F250 PICKU	1982	3/15/2005							
C_KS2_826_2	5.3	5.1 to 6.0	FORD	F250 PICKU	1982	3/15/2005							
C_KS2_827_1	3.3	3.1 to 3.5	BUICK	CENTURY	1990	3/15/2005							
C_KS2_827_2	3.3	3.1 to 3.5	BUICK	CENTURY	1990	3/15/2005	x					x	Test record has missing or invalid data
C_KS2_828_1	5	4.1 to 5.0	FORD	F-150	1988	3/15/2005			x				Suspect dilution: Avg CO + CO2 = 10.1%
C_KS2_829_1	3	2.6 to 3.0	TOYOTA	PICKUP	1989	3/15/2005	x					x	Test record has missing or invalid data
C_KS2_829_2	3	2.6 to 3.0	TOYOTA	PICKUP	1989	3/15/2005				x			avg exhaust temp (380C) is 70% higher than similar displacement vehicles.
C_KS2_829_3	3	2.6 to 3.0	TOYOTA	PICKUP	1989	3/15/2005		x		x		x	Average exhaust flow is > 50% lower than average for all other similar displacement vehicles, avg exhaust temp (40C) is 80% lower than similar displacement vehicles.
C_KS2_830_1	2	1.6 to 2.0	CHEVROLET	CORSICA	1989	3/15/2005							
C_KS2_833_1	2.3	2.1 to 2.5	MERCURY	TOPAZ	1989	3/16/2005							
C_KS2_834_1	1.6	1.6 to 2.0	TOYOTA	TERCEL SR	1983	3/16/2005			x				Suspect dilution: Avg CO + CO2 = 9.5%
C_KS2_835_1	2.5	2.1 to 2.5	DODGE	SPIRIT	1990	3/16/2005							
C_KS2_836_1	2	1.6 to 2.0	HONDA	ACCORD	1988	3/29/2005							
C_KS2_836_2	2	1.6 to 2.0	HONDA	ACCORD	1988	3/30/2005	x					x	Test record has missing or invalid data

CTR_TST_ID	Disp	Disp Bin	Make	Model	Model Year	Test Date	Missing data	Flow Flag	Dilution Flag	Exh Temp Flag	Ambient Temp Flag	Suspect Data	Data Review Comments
C_KS2_837_1	6.6	> 6.0	PONTIAC	FIREBIRD	1979	3/16/2005							
C_KS2_838_1	3.8	3.5 to 4.0	OLDSMOBILE	DELTA 88	1991	3/17/2005							
C_KS2_839_1	5	4.1 to 5.0	GMC	VANDURA	1983	3/16/2005				x			Avg exhaust temp (470C) is 70% higher than similar displacement vehicles.
C_KS2_840_1	5	4.1 to 5.0	FORD	BRONCO	1990	3/17/2005				x			Avg exhaust temp (470C) is 70% higher than similar displacement vehicles.
C_KS2_842_1	2.2	2.1 to 2.5	TOYOTA	PICKUP	1983	3/17/2005							
C_KS2_844_1	5	4.1 to 5.0	CADILLAC	FLEETWOO	1989	3/17/2005		x	x			x	Average exhaust flow is > 50% lower than average for all other similar displacement vehicles, Suspect dilution: Avg CO + CO2 = 10.8%
C_KS2_846_1	5	4.1 to 5.0	CHEVROLET	CHEYENNE	1973	3/17/2005		x				x	Average exhaust flow is > 50% lower than average for all other similar displacement vehicles
C_KS2_846_2	5	4.1 to 5.0	CHEVROLET	CHEYENNE	1973	3/17/2005			x			x	Suspect dilution: Avg CO + CO2 = 7.1%
C_KS2_848_1	5.7	5.1 to 6.0	CHEVROLET	EL CAMINO	1976	3/18/2005							
C_KS2_849_1	4.9	4.1 to 5.0	FORD	F-150	1986	3/18/2005			x				Suspect dilution: Avg CO + CO2 = 10.7%
C_KS2_850_1	2.9	2.6 to 3.0	FORD	RANGER	1990	3/19/2005							
C_KS2_851_1	4.9	4.1 to 5.0	FORD	F-150	1988	3/18/2005			x				Suspect dilution: Avg CO + CO2 = 9.0%
C_KS2_855_1	2.5	2.1 to 2.5	TOYOTA	CAMRY	1990	3/18/2005			x				Suspect dilution: Avg CO + CO2 = 10.5%
C_KS2_856_1	2.8	2.6 to 3.0	OLDSMOBILE	CUTLASS	1989	3/21/2005							
C_KS2_856_2	2.8	2.6 to 3.0	OLDSMOBILE	CUTLASS	1989	3/19/2005							
C_KS2_857_1	4.1	4.1 to 5.0	CHEVROLET	C-10	1983	3/19/2005							
C_KS2_858_1	5	4.1 to 5.0	FORD	F-150	1988	3/19/2005			x				Suspect dilution: Avg CO + CO2 = 9.9%
C_KS2_859_1	2.8	2.6 to 3.0	BUICK	CENTURY	1988	3/19/2005							
C_KS2_862_1	4.3	4.1 to 5.0	GMC	JIMMY	1992	3/19/2005							
C_KS2_862_2	4.3	4.1 to 5.0	GMC	JIMMY	1992	3/19/2005	x					x	Test record has missing or invalid data
C_KS2_866_1	5	4.1 to 5.0	CHEVROLET	CAPRICE	1985	3/21/2005							
C_KS2_867_1	6.5	> 6.0	FORD	F-150	1978	3/21/2005							
C_KS2_868_1	2.4	2.1 to 2.5	TOYOTA	PICKUP 4X4	1987	3/21/2005			x				Suspect dilution: Avg CO + CO2 = 10.2%
C_KS2_870_1	5	4.1 to 5.0	OLDSMOBILE	CUTLASS S	1987	4/7/2005			x				Suspect dilution: Avg CO + CO2 = 9.8%
C_KS2_870_2	5	4.1 to 5.0	OLDSMOBILE	CUTLASS S	1987	4/7/2005							
C_KS2_871_1	4.1	4.1 to 5.0	CHEVROLET	NOVA	1976	3/22/2005							
C_KS2_872_1	5.7	5.1 to 6.0	CHEVROLET	IMPALA	1973	3/22/2005				x			Avg exhaust temp (490C) is 70% higher than similar displacement vehicles.
C_KS2_873_1	4.9	4.1 to 5.0	FORD	F-150	1990	3/23/2005			x				Suspect dilution: Avg CO + CO2 = 9.0%
C_KS2_875_1	3.8	3.5 to 4.0	CHEVROLET	MALIBU	1980	3/22/2005							
C_KS2_876_1	5.7	5.1 to 6.0	CHEVROLET	G20 VAN	1989	3/22/2005			x				Suspect dilution: Avg CO + CO2 = 11.0%
C_KS2_876_2	5.7	5.1 to 6.0	CHEVROLET	G20 VAN	1989	3/22/2005							
C_KS2_877_1	2.8	2.6 to 3.0	CHEVROLET	BLAZER 4X4	1987	3/22/2005							
C_KS2_878_1	3.8	3.5 to 4.0	DODGE	CARAVAN E	2003	3/23/2005							
C_KS2_878_2	3.8	3.5 to 4.0	DODGE	CARAVAN E	2003	3/23/2005							
C_KS2_881_1	2.3	2.1 to 2.5	FORD	RANGER XL	1989	3/23/2005							
C_KS2_883_1	5	4.1 to 5.0	CHEVROLET	MONTE CAI	1984	3/23/2005							
C_KS2_885_1	1.9	1.6 to 2.0	SATURN	STATION W	1994	3/24/2005							
C_KS2_887_1	2.3	2.1 to 2.5	FORD	MUSTANG	1979	3/24/2005							
C_KS2_888_1	1.6	1.6 to 2.0	VW	THING	1974	3/24/2005							
C_KS2_889_1	2.2	2.1 to 2.5	MAZDA	B2200	1988	3/24/2005							
C_KS2_891_1	1.6	1.6 to 2.0	MAZDA	PROTÉGÉ	1999	4/1/2005							
C_KS2_894_1	5	4.1 to 5.0	CHEVROLET	SILVERADC	1989	3/25/2005							
C_KS2_894_2	5	4.1 to 5.0	CHEVROLET	SILVERADC	1989	3/25/2005							
C_KS2_895_1	3.1	3.1 to 3.5	OLDSMOBILE	CUTLASS	1990	3/25/2005							
C_KS2_897_1	4.2	4.1 to 5.0	JEEP	CJ-7	1979	3/28/2005			x				Suspect dilution: Avg CO + CO2 = 10.8%
C_KS2_898_1	2.2	2.1 to 2.5	CHEVROLET	CAVALIER	1991	3/26/2005							
C_KS2_901_1	3.3	3.1 to 3.5	OLDSMOBILE	CUTLASS C	1990	3/26/2005							
C_KS2_902_1	3.3	3.1 to 3.5	FORD	GRANADA	1982	3/26/2005			x	x			Suspect dilution: Avg CO + CO2 = 9.1%, avg exhaust temp (400C) is 70% higher than similar displacement vehicles.
C_KS2_903_1	3	2.6 to 3.0	FORD	AEROSTAR	1990	3/26/2005							
C_KS2_905_1	2.2	2.1 to 2.5	TOYOTA	CAMRY	2001	3/28/2005							
C_KS2_906_1	3	2.6 to 3.0	FORD	ESCAPE	2002	3/28/2005							
C_KS2_910_1	5.7	5.1 to 6.0	PONTIAC	GRAND PRI	1976	3/29/2005					x	x	erroneous ambient temp (average of -38C)
C_KS2_911_1	2.5	2.1 to 2.5	CHEVROLET	CELEBRITY	1984	3/29/2005							
C_KS2_915_1	1.5	0 to 1.6	HONDA	CIVIC	1990	4/1/2005			x				Suspect dilution: Avg CO + CO2 = 9.3%
C_KS2_916_1	5	4.1 to 5.0	CHEVROLET	VAN 20	1986	4/1/2005							
C_KS2_917_1	4.9	4.1 to 5.0	FORD	F 100 RANG	1978	4/2/2005			x			x	Suspect dilution: Avg CO + CO2 = 7.1%
C_KS2_918_1	2	1.6 to 2.0	FORD	ESCORT	1998	4/2/2005	x					x	Test record has missing or invalid data
C_KS2_918_2	2	1.6 to 2.0	FORD	ESCORT	1998	4/2/2005	x					x	Test record has missing or invalid data

CTR_TST_ID	Disp	Disp Bin	Make	Model	Model Year	Test Date	Missing data	Flow Flag	Dilution Flag	Exh Temp Flag	Ambient Temp Flag	Suspect Data	Data Review Comments
C_KS2_918_3	2	1.6 to 2.0	FORD	ESCORT	1998	4/2/2005							
C_KS2_922_1	5.7	5.1 to 6.0	CHEVROLET	BEAUVILLE	1979	4/4/2005							
C_KS2_923_1	3	2.6 to 3.0	FORD	ESCAPE	2005	4/5/2005							
C_KS2_924_1	2	1.6 to 2.0	FORD	FOCUS	2005	4/5/2005							
C_KS2_925_1	3.3	3.1 to 3.5	DODGE	CARAVAN S	1992	4/6/2005							
C_KS2_926_1	4.9	4.1 to 5.0	FORD	F-150 XL	1995	4/6/2005			x			x	Suspect dilution: Avg CO + CO2 = 8.7%, ambient temp error (avg is 60C)
C_KS2_927_1	4.3	4.1 to 5.0	CHEV	ASTRO VAN	1994	4/6/2005						x	Ambient temp error (avg is 60C)
C_KS2_927_2	4.3	4.1 to 5.0	CHEV	ASTRO VAN	1994	4/6/2005	x					x	Test record has missing or invalid data
C_KS2_928_1	3.3	3.1 to 3.5	DODGE	GRAND CAI	2000	4/6/2005							
C_KS2_929_1	5.7	5.1 to 6.0	CHEVROLET	SUBURBAN	1997	4/7/2005							
C_KS2_929_2	5.7	5.1 to 6.0	CHEVROLET	SUBURBAN	1997	4/7/2005							
C_KS2_930_1	3.4	3.1 to 3.5	TOYOTA	FORERUNN	1998	4/6/2005							
C_KS2_935_1	4.9	4.1 to 5.0	FORD	F-250	1995	4/6/2005			x				Suspect dilution: Avg CO + CO2 = 9.9%
C_KS2_937_1	3	2.6 to 3.0	DODGE	CARAVAN	1995	4/7/2005		x				x	Average exhaust flow is > 50% lower than average for all other similar displacement vehicles
C_KS2_937_2	3	2.6 to 3.0	DODGE	CARAVAN	1995	4/7/2005							
C_KS2_939_1	3	2.6 to 3.0	CHEVROLET	ASTROVAN	1992	4/9/2005		x					Average exhaust flow is > 50% higher than average for all other similar displacement vehicles.
C_KS2_941_1	3.3	3.1 to 3.5	PLYMOUTH	VOYAGER	1992	4/8/2005							
C_KS2_944_1	4.3	4.1 to 5.0	CHEVROLET	BLAZER 4X	1993	4/8/2005				x			Avg exhaust temp (470C) is 70% higherr than similar displacement vehicles.
C_KS2_945_1	3.3	3.1 to 3.5	CHRYSLER	VOYAGER	2002	4/8/2005							
C_KS2_946_1	2.5	2.1 to 2.5	JEEP	CHEROKEE	1996	4/8/2005							
C_KS2_950_1	5	4.1 to 5.0	FORD	CLUB WAG	1989	4/9/2005							
C_KS2_984_1	2.4	2.1 to 2.5	DODGE	STRATUS	1999	2/7/2005							
C_KS2_985_1	3.3	3.1 to 3.5	DODGE	INTREPID	1995	2/14/2005							
C_KS2_986_1	3	2.6 to 3.0	TOYOTA	AVALON	1998	2/28/2005							
C_KS2_987_1	4	3.5 to 4.0	FORD	EXPLORER	1993	2/28/2005							
C_KS2_989_1	3.3	3.1 to 3.5	DODGE	GRAND CAI	2003	4/4/2005							
C_KS2_989_2	3.3	3.1 to 3.5	DODGE	GRAND CAI	2003	4/4/2005							
C_KS2_1013_1	3	2.6 to 3.0	TOYOTA	CAMRY	1994	1/19/2005							
C_KS2_1014_1	4.6	4.1 to 5.0	MERCURY	GRAND MAI	1994	2/9/2005							

Kansas City PM Characterization Study

Final Report

Appendix U
Round 2 Driveaway
Quality Control

Assessment and Standards Division
Office of Transportation and Air Quality
U.S. Environmental Protection Agency

Sponsors:

National Renewable Energy Laboratory, U.S. Department of Energy
Federal Highway Administration, U.S. Department of Transportation
STAPPA-ALAPCO Emission Inventory Improvement Program
Coordinating Research Council Inc. (Project No. E-69)

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United States
Environmental Protection
Agency

EPA420-R-08-009
April 2008

CTR_TST_ID	Disp	Disp Bin	Make	Model	Model Year	Date	Missing data	Flow Flag	Dilution Flag	Exh Temp Flag	Ambient Temp Flag	Suspect Data	Data Review Comments
D_KS2_618_1	4.9	4.1 to 5.0	BUICK	LASABRE	1979		x					x	Test record has missing or invalid data
D_KS2_677_1	3.4	3.1 to 3.5	PONTIAC	MONTANA	2003	2/11/2005							
D_KS2_679_1	4	3.5 to 4.0	FORD	RANGER	1998	2/12/2005							
D_KS2_689_1	5	4.1 to 5.0	LINCOLN	TOWN CAR	1988	2/15/2005			x				Suspect dilution: Avg CO + CO2 = 11.0%
D_KS2_689_2	5	4.1 to 5.0	LINCOLN	TOWN CAR	1988	2/15/2005							
D_KS2_698_1	3.3	3.1 to 3.5	CHRYSLER	TOWN & CO	2001	2/17/2005							
D_KS2_698_2	3.3	3.1 to 3.5	CHRYSLER	TOWN & CO	2001	2/17/2005			x			x	Suspect dilution: Avg CO + CO2 = 2.4%
D_KS2_703_1	5	4.1 to 5.0	FORD	COUNTRY S	1986	2/17/2005			x				Suspect dilution: Avg CO + CO2 = 9.9%
D_KS2_704_1	4.9	4.1 to 5.0	CADILLAC	SEDAN DEV	1992	2/18/2005							
D_KS2_705_1	3.7	3.5 to 4.0	DODGE	DAKOTA	2004	2/18/2005							
D_KS2_711_1	2.3	2.1 to 2.5	MERCURY	TOPAZ	1994	2/19/2005							
D_KS2_722_1	2.9	2.6 to 3.0	VOLVO	960	1993	2/21/2005				x			Avg exhaust temp (440C) is 70% higherer than similar displacement vehicles
D_KS2_723_1	2.3	2.1 to 2.5	FORD	TEMPO	1993	2/21/2005							
D_KS2_724_1	4.3	4.1 to 5.0	CHEVROLET	BLAZER	1996	2/21/2005							
D_KS2_726_1	4.3	4.1 to 5.0	CHEVROLET	S-10 LS	1995	2/22/2005							
D_KS2_729_1	3.8	3.5 to 4.0	CHRYSLER	TOWN & CO	1996	2/22/2005							
D_KS2_730_1	3	2.6 to 3.0	FORD	RANGER	1994	2/23/2005			x				Suspect dilution: Avg CO + CO2 = 9.3%
D_KS2_730_2	3	2.6 to 3.0	FORD	RANGER	1994	2/23/2005							
D_KS2_734_1	3	2.6 to 3.0	PLYMOUTH	VOYAGER	1993	2/23/2005							
D_KS2_735_1	3.3	3.1 to 3.5	DODGE	CARAVAN S	1995	2/23/2005							
D_KS2_739_1	3	2.6 to 3.0	FORD	TAURUS	1993	2/24/2005							
D_KS2_739_2	3	2.6 to 3.0	FORD	TAURUS	1993	2/24/2005				x			Avg exhaust temp (120C) is 60% lower than similar displacement vehicles
D_KS2_745_1	5.4	5.1 to 6.0	FORD	ECONOLINE	2001	2/25/2005							
D_KS2_753_1	2	1.6 to 2.0	FORD	WINDSTAR	1998	2/26/2005							
D_KS2_759_1	4	3.5 to 4.0	JEEP	CHEROKEE	1988	2/28/2005							
D_KS2_760_1	1.5	0 to 1.6	MAZDA	PROTÉGÉ	1998	2/28/2005							
D_KS2_764_1	3.1	3.1 to 3.5	BUICK	SKYLARK	1998	3/1/2005							
D_KS2_766_1	5.2	5.1 to 6.0	JEEP	GRAND CHE	1993	3/1/2005							
D_KS2_769_1	1.8	1.6 to 2.0	HONDA	CIVIC	1999	3/2/2005			x				Suspect dilution: Avg CO + CO2 = 9.1%
D_KS2_770_1	2.5	2.1 to 2.5	TOYOTA	CAMRY	1989	3/5/2005							
D_KS2_773_1	4.9	4.1 to 5.0	FORD	E-150	1991	3/3/2005							

CTR_TST_ID	Disp	Disp Bin	Make	Model	Model Year	Date	Missing data	Flow Flag	Dilution Flag	Exh Temp Flag	Ambient Temp Flag	Suspect Data	Data Review Comments
D_KS2_774_1	3	2.6 to 3.0	NISSAN	QUEST	1996	3/5/2005							
D_KS2_783_1	2.5	2.1 to 2.5	PLYMOUTH	VOYAGER	1992	3/7/2005							
D_KS2_786_1	4.9	4.1 to 5.0	FORD	ECONOLINE	1996	3/8/2005			x				Suspect dilution: Avg CO + CO2 = 10.4%
D_KS2_788_1	2.5	2.1 to 2.5	PLYMOUTH	ACCLAIM	1989	3/8/2005							
D_KS2_791_1	2.2	2.1 to 2.5	TOYOTA	CAMRY	1999	3/8/2005			x				Suspect dilution: Avg CO + CO2 = 9.8%
D_KS2_792_1	4.2	4.1 to 5.0	CHEVROLET	TRAIL BLAZI	2002	3/9/2005				x			Avg exhaust temp (430C) is 50% higher than similar displacement vehicles
D_KS2_795_1	5	4.1 to 5.0	FORD	CROWN VIC	1989	3/10/2005							
D_KS2_801_1	3	2.6 to 3.0	PLYMOUTH	VOYAGER S	1988	3/10/2005							
D_KS2_805_1	2.2	2.1 to 2.5	CHEVROLET	CAVALIER	1995	3/11/2005							
D_KS2_808_1	4	3.5 to 4.0	FORD	EXPLORER	1994	3/11/2005							
D_KS2_813_1	2	1.6 to 2.0	HONDA	ACCORD LX	1988	3/13/2005							
D_KS2_818_1	3.1	3.1 to 3.5	CHEVROLET	LUMINA APV	1990	3/14/2005							erroneous aux temp (not a data issue)
D_KS2_820_1	3.8	3.5 to 4.0	BUICK	PARK AVEN	1990	3/16/2005							
D_KS2_824_1	4.3	4.1 to 5.0	CHEVROLET	ASTROVAN	1989	3/15/2005							
D_KS2_825_1	3	2.6 to 3.0	DODGE	CARAVAN S	1988	3/16/2005							
D_KS2_830_1	2	1.6 to 2.0	CHEVROLET	CORSICA	1989	3/17/2005							
D_KS2_835_1	2.5	2.1 to 2.5	DODGE	SPIRIT	1990	3/17/2005							
D_KS2_836_1	2	1.6 to 2.0	HONDA	ACCORD	1988	3/31/2005							
D_KS2_847_1	5.7	5.1 to 6.0	GMC	1500 SLE SII	1988	3/18/2005							
D_KS2_859_1	2.8	2.6 to 3.0	BUICK	CENTURY	1988	3/21/2005							
D_KS2_904_1	2.5	2.1 to 2.5	SUBARU	FORESTER	2001	3/28/2005				x			Avg exhaust temp (400C) is 50% higher than similar displacement vehicles
D_KS2_910_1	5.7	5.1 to 6.0	PONTIAC	GRAND PRI)	1976	3/30/2005							
D_KS2_913_1	3.8	3.5 to 4.0	BUICK	LESABRE	1990	3/31/2005							

Kansas City PM Characterization Study

Final Report

Appendix V
Round 2 Dynamometer
Test Issues

Assessment and Standards Division
Office of Transportation and Air Quality
U.S. Environmental Protection Agency

Sponsors:

National Renewable Energy Laboratory, U.S. Department of Energy
Federal Highway Administration, U.S. Department of Transportation
STAPPA-ALAPCO Emission Inventory Improvement Program
Coordinating Research Council Inc. (Project No. E-69)

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EPA United States Environmental Protection Agency

EPA420-R-08-009
April 2008

Run #	Veh Yr, Make, Model	Odometer *(Miles)*	Inertia *(Lbs)*	Hp@50mph	Time	Date	Dyne Test Issues	Suspect Data
84393	1999 Chrysler 300M	90240	3500	5.8	9:21 a.m.	01/12/2005	CVS bags not fully evacuated prior to start of test.	
84394	2000 Honda Odyssey	74601	4500	9.6	10:45 a.m.	01/12/2005		
84395	0.00	0	0	0.0	12:00 AM	01/12/2005		
84396	1995 Ford Escort	106996	2750	5.6	1:05 p.m.	01/12/2005		
84397	1975 Chevrolet Silverado 20 PU	2893	4000	13.9	2:45 p.m.	01/12/2005		
84398	2001 Honda Accord	62350	3500	7.8	9:20 a.m.	01/13/2005		
84399	1997 Honda Accord	82926	3000	4.9	10:45 a.m.	01/13/2005		
84400	0.00	0	0	0.0	12:00 AM	01/13/2005		
84401	1998 Plymouth Voyager	168876	4000	7.0	1:28 p.m.	01/13/2005		
84402	1991 Honda Civic	220022	2500	6.5	2:58 p.m.	01/13/2005		
84403	2000 Dodge Caravan	85198	3500	7.2	8:45 a.m.	01/14/2005		
84404	1997 Dodge Caravan	96455	3500	7.2	10:27 a.m.	01/14/2005		
84405	0.00	0	0	0.0	10:30 a.m.	01/14/2005		
84406	1995 Toyota Corolla	107983	2500	6.0	1:04 p.m.	01/14/2005		
84407	1989 Pontiac GrandAm	123575	3000	5.9	2:23 p.m.	01/14/2005		
84408	2002 Mercury Sable	29501	3500	6.8	8:29 a.m.	01/15/2005	No tunnel heater during Phase 3 of test.	
84409	1999 Chevrolet Malibu	79925	3500	5.8	10:40 a.m.	01/15/2005	CVS bags not fully evacuated prior to start of test.	
84410	0.00	0	0	0.0	12:00 AM	01/15/2005		
84411	1996 Saturn SC	78346	2500	6.0	1:14 p.m.	01/15/2005		
84412	1996 Honda Civic	140479	2500	6.9	3:00 p.m.	01/15/2005		
84413	1979 Ford F250 PU	5797	3500	10.5	4:15 p.m.	01/15/2005		
84414	2003 Chevrolet Impala	11340	3500	2.9	8:19 a.m.	01/17/2005	Possible high background concentration due to truck running outside building during Phase 1.	x
84415	1999 Dodge Durango	95999	5000	16.9	9:50 a.m.	01/17/2005		
84416	1998 Honda Civic	118218	2500	5.1	11:09 a.m.	01/17/2005		
84417	0.00	0	0	0.0	11:00 a.m.	01/17/2005		
84418	1997 Pontiac Grand Am	58100	3000	3.8	1:47 p.m.	01/17/2005	Generator stopped at start of Phase 3, so no tunnel heater during Phase 3.	
84419	1998 Chevrolet Lumina	79187	3500	5.5	4:05 p.m.	01/17/2005		
84420	2000 Honda Accord	84180	3500	7.5	8:11 a.m.	01/18/2005		
84421	2000 Saturn Sedan	51721	2750	4.0	9:26 a.m.	01/18/2005		
84422	1998 Jeep Cherokee	137053	3500	11.8	10:51 a.m.	01/18/2005	Possible high background concentration due to truck running outside building.	x
84423	0.00	0	0	0.0	11: a.m.	01/18/2005		
84424	1995 Ford Explorer	162634	4500	11.5	1:19 p.m.	01/18/2005		
84425	1995 Jeep Grand Cherokee Laredo	179121	4000	13.1	2:45 p.m.	01/18/2005		
84426	2001 Saturn Sedan	44251	2750	3.7	8:10 a.m.	01/19/2005		
84427	2001 Mitsubishi Galant	51764	2750	3.7	9:52 a.m.	01/19/2005		
84428	1998 Chevrolet Malibu	107047	3500	5.9	11:14 a.m.	01/19/2005		
84429	0.00	0	0	0.0	12 p.m.	01/19/2005		
84430	1990 Dodge Spirit	93661	3000	8.2	1:47 p.m.	01/19/2005	CVS bags not fully evacuated prior to start of test.	
84431	1991 Mercury Grand Marquis S/W	19292	4000	10.3	3:15 p.m.	01/19/2005	Possible high background concentration due to oil burning on exhaust system.	x
84432	1999 Saturn Sedan	98565	2500	5.5	8:09 a.m.	01/20/2005		
84433	1997 Jeep Wrangler	97532	3500	16.1	9:40 a.m.	01/20/2005		
84434	QAZ044	0	Void	0.0	10:55 a.m.	01/20/2005	Real-time computer rebooted 850 seconds into test.	x
84435	0.00	0	0	0.0	11:30 a.m.	01/20/2005		
84436	1995 Chevrolet S10 PU	124976	3500	10.8	1:02 p.m.	01/20/2005	Possible drive trace violations due to bad brakes.	
84437	1994 Toyota Camry	131874	3500	7.2	2:20 p.m.	01/20/2005		
84438	2001 Buick Century	33749	3500	5.3	8:08 a.m.	01/21/2005		
84439	1995 Pontiac Bonneville	168145	3500	5.3	9:22 a.m.	01/21/2005	Possible high background concentration due to oil burning on exhaust system.	x

Run #	Veh Yr, Make, Model	Odometer	Inertia	Hp@50mph	Time	Date	Dyne Test Issues	Suspect Data
84440	1995 Buick Park Avenue	144956	4000	7.2	10:39 a.m.	01/21/2005	Possible high background concentration due to oil burning on exhaust system.	x
84441	0.00	0	0	0.0	11:15 a.m.	01/21/2005		
84442	1994 Toyota Camry	131894	3500	7.2	1:20 p.m.	01/21/2005		
84443	1991 Geo Prizm	132326	2500	7.4	2:27 p.m.	01/21/2005		
84444	2003 Chevrolet Tracker	29519	3000	12.7	8:10 a.m.	01/22/2005		
84445	2001 Saturn Sedan	67290	3000	6.4	9:39 a.m.	01/22/2005		
84446	2000 Toyota Sienna	137493	4000	6.5	10:56 a.m.	01/22/2005		
84447	0.00	0	0	0.0	11:39 a.m.	01/22/2005		
84448	1999 Plymouth Voyager	79230	4000	6.4	1:25 p.m.	01/22/2005	Possible dilution due to exhaust leak.	
84449	1994 Buick Regal	92177	3500	5.6	2:40 p.m.	01/22/2005	Loading suspect due to excessive PAU dyno noise.	
84450	1988 Ford Taurus	13729	3500	4.0	4:00 p.m.	01/22/2005	Loading suspect due to excessive PAU dyno noise.	
84451	1994 Buick Regal	92214	3500	5.6	8:22 a.m.	01/25/2005	NOx reading suspect due to NOx drift.	x
84452	1995 Ford Taurus	139316	3500	6.5	9:44 a.m.	01/25/2005		
84453	1995 Nissan Maxima	181395	3500	6.5	10:57 a.m.	01/25/2005		
84454	0.00	0	0	0.0	11:30 a.m.	01/25/2005		
84455	1995 Ford Mustang	146289	3500	7.5	1:15 p.m.	01/25/2005	Possible drive trace violations (braking).	
84456	1993 Pontiac Grand Prix	177931	3500	5.0	2:35 p.m.	01/25/2005		
84457	1995 Ford Crown Vic	179731	4000	8.5	8:20 a.m.	01/26/2005	Possible drive trace violations (braking).	
84458	1993 Ford Aerostar	147319	3500	11.1	9:32 a.m.	01/26/2005	Possible drive trace violations (braking).	
84459	1992 Ford Aerostar	164560	3500	11.4	10:50 a.m.	01/26/2005	Possible drive trace violations (braking).	
84460	0.00	0	0	0.0	11:45 a.m.	01/26/2005		
84461	1988 Ford Taurus	13748	3500	4.0	1:11 p.m.	01/26/2005		
84462	1989 Plymouth Voyager	145307	3500	7.6	2:25 p.m.	01/26/2005		
84463	1995 Ford Contour	104083	3000	5.0	8:15 a.m.	01/27/2005		
84464	1994 Dodge Intrepid	145950	3500	5.1	9:30 a.m.	01/27/2005	No NOx data for Phase 3.	x
84465	1994 Chevrolet Lumina APV	124172	4000	8.9	10:50 a.m.	01/27/2005		
84466	0.00	0	0	0.0	11:50 a.m.	01/27/2005		
84467	1988 Ford Ranger PU	77528	3500	10.2	1:30 p.m.	01/27/2005	Possible drive trace violations.	
84468	1994 Chevrolet Lumina APV	124200	4000	8.9	8:18 a.m.	01/28/2005		
84469	1989 Dodge Caravan	162878	3500	7.6	10:00 a.m.	01/28/2005	Possible high background concentration due to oil burning on exhaust system.	x
84470	1973 Mercedes 280 SE	86134	4000	11.4	11:10 a.m.	01/28/2005	Real-time instruments saturated. Background HC readings suspect due to cell saturation., Phase 2 dilution temp over 50C.	x
84471	0.00	0	0	0.0	12:00 p.m.	01/28/2005		
84472	1977 Chevrolet Monte Carlo	36999	4000	11.6	2:00 p.m.	01/28/2005	Possible drive trace violations (braking).	
84473	1996 Ford Explorer	109593	4500	11.8	8:15 a.m.	01/29/2005	Possible drive trace violations (braking).	
84474	1988 Honda Civic	207265	2250	6.4	9:30 a.m.	01/29/2005		
84475	1986 Ford Tempo	70396	2500	6.9	10:40 a.m.	01/29/2005	Vehicle stalled during Phase 2.	
84476	0.00	0	0	0.0	12:00 p.m.	01/29/2005		
84477	1989 Dodge Ram 50	133981	3500	15.0	1:45 p.m.	01/29/2005	Possible drive trace violations.	
84478	1996 Dodge Neon	79839	2500	7.2	8:20a.m.	01/31/2005	Realtime computer failed during test.	x
84479	1996 Dodge Caravan	118369	4000	7.2	9:22 a.m.	01/31/2005		
84480	1988 Ford Taurus	13768	3500	4.0	10:42 a.m.	01/31/2005	Possible high background concentrations due to building evacuation fan being turned off.	x
84481	0.00	0	0	0.0	12:00 a.m.	01/31/2005		
84482	1979 Buick Lasabre	40364	3500	10.5	1:30 p.m.	01/31/2005		
84483	1996 Dodge Neon	79848	2500	7.2	8:10 a.m.	02/01/2005		
84484	1979 Buick Lesabre	40385	3500	10.5	9:24 a.m.	02/01/2005		
84485	1991 Cadillac Fleetwood	97124	4000	6.9	11:00 a.m.	02/01/2005	Possible drive trace violations during Phase 3.	
84486	0.00	0	0	0.0	11:50 a.m.	02/01/2005		
84487	1992 Mazda B2200 PU	101090	3000	10.7	1:40 p.m.	02/01/2005		
84488	1995 Buick Lesabre	126036	3500	7.1	8:10 a.m.	02/02/2005	Tedlar bags not evacuated prior to test.	

Run #	Veh Yr, Make, Model	Odometer	Inertia	Hp@50mph	Time	Date	Dyne Test Issues	Suspect Data
84489	1987 Toyota PU	232098	2750	9.6	9:33 a.m.	02/02/2005	Possible dilution due to exhaust leaks.	
84490	1991 Cadillac Fleetwood	97144	4000	6.9	10:50 a.m.	02/02/2005		
84491	0.00	0	0	0.0	12:00 p.m.	02/02/2005		
84492	1984 Chevy C-10 Silverado	82259	4000	15.2	1:25 p.m.	02/02/2005		
84493	2004 Ford Freestar Minivan	14714	4500	10.0	8:36 a.m.	02/03/2005		
84494	1997 Ford Ranger PU	118470	3500	10.9	10:00 a.m.	02/03/2005	2.	
84495	1996 GMC Sonoma PU	51863	3000	9.2	11:00 a.m.	02/03/2005	Possible drive trace violations (braking).	
84496	0.00	0	0	0.0	12:00 p.m.	02/03/2005		
84497	1995 Toyota 4 Runner	85898	4000	12.9	1:44 p.m.	02/03/2005	Vehicle stalled during Phase 2.	
84498	2001 Toyota Sienna	59734	4000	10.0	8:23 a.m.	02/04/2005		
84499	1995 Acura Integra	80579	2750	7.2	9:30 a.m.	02/04/2005		
84500	1998 Nissan Frontier PU	112521	3500	11.0	10:57 a.m.	02/04/2005	Possible drive trace violations (braking).	
84501	0.00	0	0	0.0	12:10 p.m.	02/04/2005		
84502	1996 Chrysler Concorde	111502	3500	7.7	1:40 p.m.	02/04/2005		
84503	2002 Ford Taurus	26406	4000	8.0	8:20 a.m.	02/05/2005		
84504	2000 Chrysler Concorde	65330	3000	11.3	9:30 a.m.	02/05/2005		
84505	1993 Dodge Intrepid	210298	3500	6.8	10:52 a.m.	02/05/2005		
84506	0.00	0	0	0.0	12:00 p.m.	02/05/2005		
84507	1988 Ford Taurus	13788	3500	4.0	1:30 p.m.	02/05/2005		
84508	1992 Honda Civic	124705	2250	4.6	8:19 a.m.	02/07/2005		
84509	1992 Chevrolet Astrovan	217165	4000	12.5	9:40 a.m.	02/07/2005		
84510	1994 Chevrolet Suburban	187410	5500	10.8	10:50 a.m.	02/07/2005		
84511	0.00	0	0	0.0	11:25 a.m.	02/07/2005		
84512	1982 Chevrolet Caprice	88587	4000	4.6	1:24 p.m.	02/07/2005	Possible high background concentrations due to smoke, HC and CO instruments pegged.	x
84513	0.00	VOID	0	0.0	8:00 a.m.	02/08/2005	Voided run	
84514	2002 Chrysler Concorde	34231	3500	7.8	8:49 a.m.	02/08/2005	Possible high background concentrations due to diesel truck running outside.	x
84515	1999 Dodge Stratus	108838	3000	5.5	10:06 a.m.	02/08/2005		
84516	0.00	0	0	0.0	12:38 p.m.	02/08/2005		
84517	1998 Dodge Caravan	80989	4000	7.9	12:38 p.m.	02/08/2005		
84518	1994 Buick Skylark	200811	3000	5.4	1:52 p.m.	02/08/2005		
84519	1992 Dodge Caravan	213493	3500	8.0	3:07 p.m.	02/08/2005		
84520	2001 Ford Taurus	47479	3500	6.8	8:30 a.m.	02/09/2005		
84521	1997 Honda Accord	101888	3000	4.9	9:44 a.m.	02/09/2005		
84522	1996 Chevrolet 1500 PU	46711	4000	12.2	10:58 a.m.	02/09/2005		
84523	0.00	0	0	0.0	11:30 a.m.	02/09/2005		
84524	1995 Isuzu PU	87225	3000	12.0	1:30 p.m.	02/09/2005		
84525	1993 CHEVROLET ASTRO, VUE539	0	0	0.0		02/09/2005	Voided run	x
84526	1991 Lincoln Towncar	188033	4000	7.1	3:10 p.m.	02/09/2005		
84527	1995 Dodge Ram 1500 PU	93425	4000	15.0	8:21 a.m.	02/10/2005		
84528	1994 Mercury Grand Marquis	130521	4000	10.7	9:38 a.m.	02/10/2005		
84529	1993 Plymouth Sundance	84652	2750	6.3	10:53 a.m.	02/10/2005		
84530	0.00	0	0	0.0	12:00 p.m.	02/10/2005		
84531	1992 Geo Tracker	48704	2750	14.5	1:28 p.m.	02/10/2005		
84532	2003 Pontiac Montana	49337	4500	10.1	8:09 a.m.	02/11/2005	Invalid RH value (battery in hygrometer dead), used airport data	x
84533	1999 Chevrolet Suburban	88900	5000	12.5	9:26 a.m.	02/11/2005	Invalid RH value (battery in hygrometer dead), used airport data	x
84534	1993 Subaru Legacy	114227	3500	9.0	10:44 a.m.	02/11/2005	Possible dilution due to tailpipe disconnect at 1000 seconds into test. Invalid RH value (battery in hygrometer dead)., used airport data	x
84535	0.00	0	0	0.0	11:55 a.m.	02/11/2005		

Run #	Veh Yr, Make, Model	Odometer	Inertia	Hp@50mph	Time	Date	Dyne Test Issues	Suspect Data
84536	1988 Ford Taurus	13809	3500	4.0	1:10 p.m.	02/11/2005	Bags inadvertently evacuated during Phases 1 and 2. Invalid RH value (battery in hygrometer dead), used airport data.	x
84537	2000 Jeep Cherokee	88513	3500	12.5	8:10 a.m.	02/12/2005	HC2 malfunction during Phase III.	x
84538	1998 Ford Ranger PU	48208	3500	11.7	9:23 a.m.	02/12/2005		
84539	1996 Chevrolet Tahoe	69010	4500	12.5	10:37 a.m.	02/12/2005		
84540	0.00	0	0	0.0	11:30 a.m.	02/12/2005		
84541	1996 Dodge Caravan	161280	4000	7.2	1:19 p.m.	02/12/2005		
84542	1996 Dodge Caravan	161308	4000	7.2	8:25 a.m.	02/14/2005		
84543	2000 Jeep Cherokee	88541	3500	12.5	9:43 a.m.	02/14/2005		
84544	1988 Ford Taurus	13828	3500	4.0	11:40 a.m.	02/14/2005		
84545	0.00	0	0	0.0	12:40 p.m.	02/14/2005		
84546	1999 Dodge Dakota PU	64155	3500	9.6	8:04 a.m.	02/15/2005		
84547	1995 Toyota Corolla	103068	2750	6.0	9:18 a.m.	02/15/2005		
84548	1995 Dodge Intrepid	138989	3500	5.9	10:41 a.m.	02/15/2005		
84549	0.00	0	0	0.0	12:15 p.m.	02/15/2005		
84550	1988 Lincoln Continental	31667	4000	8.3	1:08 p.m.	02/15/2005		
84551	2002 Isuzu Axiom	46363	4000	13.4	8:06 a.m.	02/16/2005		
84552	2002 Oldsmobile Silouette	61168	4000	9.2	9:20 a.m.	02/16/2005		
84553	2002 Dodge Durango	VOID	0	0.0	10:30 a.m.	02/16/2005	Voided run	x
84554	1992 Ford F50 PU	134791	4500	14.6	10:48 a.m.	02/16/2005		
84555	0.00	0	0	0.0	11:55 a.m.	02/16/2005		
84556	2001 Chrysler Town & Country	75545	4500	8.4	8:09 a.m.	02/17/2005		
84557	2000 Buick Park Avenue	67099	4000	6.6	9:20 a.m.	02/17/2005		
84558	2001 Chevrolet S-10 PU	106236	4000	9.8	10:28 a.m.	02/17/2005	Numerous restarts during test.	x
84559	0.00	0	0	0.0	11:32 a.m.	02/17/2005		
84560	1998 Dodge Dakota Sport	49775	3500	11.2	12:46 p.m.	02/17/2005	No Phase 3 data.	x
84561	86 Ford Crown Victoria SW	54310	3500	9.0	1:59 p.m.	02/17/2005	Voided run	x
84562	2004 Dodge Dakota PU	8627	4000	12.6	8:02 a.m.	02/18/2005		
84563	2003 Ford Ranger 4X4 PU	18757	3500	11.5	9:16a.m.	02/18/2005		
84564	1998 Dodge Caravan	127230	4000	7.9	10:27 a.m.	02/18/2005		
84565	0.00	0	0	0.0	11:32 a.m.	02/18/2005		
84566	1995 Honda Odyssey	109044	3500	9.8	12:43 p.m.	02/18/2005		
84567	1992 Cadillac Sedan De-Ville	155895	4000	6.9	1:54 p.m.	02/18/2005		
84568	1999 Ford Ranger PU	126851	3500	9.0	8:08 a.m.	02/19/2005		
84569	1995 Ford Taurus	203067	3500	5.4	9:20 a.m.	02/19/2005		
84570	1994 Chevrolet S10 PU	63902	3000	9.8	10:30 a.m.	02/19/2005		
84571	0.00	0	0	0.0	10:35 a.m.	02/19/2005		
84572	1994 Mercury Topaz	41482	2750	7.0	1:14 p.m.	02/19/2005		
84573	1993 Buick Park Avenue	74444	4000	6.1	8:20 a.m.	02/21/2005		
84574	1993 Ford Taurus	39476	3500	5.5	9:39 a.m.	02/21/2005		
84575	1994 Chevrolet Lumina	126825	3500	5.4	10:48 a.m.	02/21/2005		
84576	0.00	0	0	0.0	10:30 a.m.	02/21/2005		
84577	1998 Ford Aerostar	0	4000	7.9	8:15 a.m.	02/22/2005		
84578	1988 Ford Taurus	13871	3500	4.0	9:15 a.m.	02/22/2005		
84579	0.00	0	0	0.0	12:00 a.m.	02/22/2005		
84580	2002 Chrysler Town & Country	84580	4500	11.1	8:19 a.m.	02/23/2005	Traction control problem at 180 seconds into test.	
84581	1995 Chevrolet Corsica	78767	3000	5.9	9:45 a.m.	02/23/2005		
84582	1988 BMW 528e	287806	3500	10.7	11:12 a.m.	02/23/2005		
84583	0.00	0	0	0.0	12:00 a.m.	02/23/2005		
84584	1995 Nissan PU	86705	3500	12.0	8:16 a.m.	02/24/2005		
84585	1993 Ford Escort SW	99988	2750	6.6	9:20 a.m.	02/24/2005		

Run #	Veh Yr, Make, Model	Odometer	Inertia	Hp@50mph	Time	Date	Dyne Test Issues	Suspect Data
84586	0.00	0	0	0.0	12:00 p.m.	02/24/2005		
84587	1996 Mercury Villager	166799	4000	7.9	8:54 a.m.	02/25/2005		
84588	1978 Buick Regal	81379	4000	9.9	10:12 a.m.	02/25/2005		
84589	2001 Saturn	56662	2750	6.1	11:25 a.m.	02/25/2005		
84590	0.00	0	0	0.0	12:30 p.m.	02/25/2005		
84591	1993 Toyota 4Runner	178462	4000	12.9	8:12 a.m.	02/26/2005		
84592	1979 Ford LTD	65850	4000	10.7	9:26 a.m.	02/26/2005	Possible drive trace violations due to bad brakes.	
84593	1998 Honda Accord	75067	3000	4.0	10:45 a.m.	02/26/2005		
84594	0.00	0	0	0.0	11:50 a.m.	02/26/2005		
84595	1988 Ford Escort	133085	2750	6.0	8:33 a.m.	02/28/2005	NOx reading suspect due to short NOx warmup prior to test. O3 generator not working.	x
84596	1997 Ford Taurus	97601	3500	6.7	9:50 a.m.	02/28/2005		
84597	1994 Pontiac Sunbird	145869	2750	5.2	11:08 a.m.	02/28/2005		
84598	0.00	0	0	0.0	12:15 p.m.	02/28/2005		
84599	1998 Toyota Avalon	29575	3500	5.8	8:15 a.m.	03/01/2005		
84600	1993 Ford Explorer	47980	4000	10.2	9:30 a.m.	03/01/2005		
84601	1979 Buick Regal	5864	3500	11.8	10:40 a.m.	03/01/2005		
84602	0.00	0	0	0.0	12:00 p.m.	03/01/2005		
84603	1979 Nissan Datsun 210 Wagon	47114	2500	9.8	8:30 a.m.	03/02/2005	Vehicle stalled 30 seconds into test.	
84604	0.00	0	0	0.0	10:00 a.m.	03/02/2005		
84605	1977 Nissan 280Z	94782	3000	9.9	10:14 a.m.	03/03/2005	Phase 2 dilution temp over 50C.	
84606	1988 Ford Taurus	13936	3500	4.0	11:36 a.m.	03/03/2005		
84607	0.00	0	0	0.0	12:30 p.m.	03/03/2005		
84608	1996 Nissan Quest	125651	4000	10.0	8:09 a.m.	03/04/2005		
84609	1978 Buick Regal	64571	3500	10.8	9:30 a.m.	03/04/2005	Vehicle stalled several times during Phase 1. Possible dilution due to exhaust leaks.	
84610	0.00	0	0	0.0	11:00 a.m.	03/04/2005		
84611	1989 Toyota Camry	168091	3500	8.4	11:49 a.m.	03/04/2005		
84612	2000 Ford Ranger PU	33680	3500	12.0	8:06 a.m.	03/05/2005		
84613	1990 Oldsmobile Delta 88	185694	3500	6.8	9:28 a.m.	03/05/2005		
84614	1978 Oldsmobile Delta 88	73729	4000	8.7	10:30 a.m.	03/05/2005	Torque board dislodged during Phase 2. Reinserted for Phase 3.	x
84615	0.00	0	0	0.0	11:30 a.m.	03/05/2005		
84616	1999 Plymouth Voyager	113389	4000	7.2	8:07 a.m.	03/07/2005		
84617	1997 Chevrolet Suburban	145147	5500	11.2	9:30 a.m.	03/07/2005		
84618	1992 Plymouth Voyager	154297	4000	7.5	10:30 a.m.	03/07/2005		
84619	0.00	0	0	0.0	11:45 a.m.	03/07/2005		
84620	1992 Ford Ranger PU	19758	3500	11.3	1:00 p.m.	03/07/2005	Possible dilution due to exhaust leaks. Vehicle stalled several times during Phase 1.	
84621	1992 Ford Ranger PU	13586	3500	11.1	2:15 p.m.	03/07/2005		
84622	1999 Toyota Camry	64134	3500	6.4	8:00 a.m.	03/08/2005		
84623	1989 Plymouth Acclaim	164203	3000	6.9	9:30 a.m.	03/08/2005		
84624	1988 Ford Taurus	14013	3500	4.0	10:41 a.m.	03/08/2005	No bag CO2 value for Phase 3.	
84625	0.00	0	0	0.0	11:50 a.m.	03/08/2005		
84626	!987 Dodge D100 PU	23200	3500	13.2	1:05 p.m.	03/08/2005	Possible drive trace violations (braking).	
84627	1987 Ford F150 PU	410	4000	10.4	2:25 p.m.	03/08/2005	Possible drive trace violations (braking). Phase 2 dilution temp over 50C.	
84628	2002 Chevrolet Trailblazer	77758	4500	10.0	8:06 a.m.	03/09/2005		
84629	1996 Acura TL2.5	117642	3500	8.1	9:25 a.m.	03/09/2005		
84630	1989 Honda Accord	139963	2750	6.0	10:40 a.m.	03/09/2005		
84631	0.00	0	0	0.0	12:00 PM	03/09/2005		
84632	1987 Ford F150 PU	428	4000	13.9	1:30 p.m.	03/09/2005	Possible drive trace violations (braking). Phase 2 dilution temp over 50C.	
84633	1987 Volvo 740 Turbo	248178	3000	9.9	8:10 a.m.	03/10/2005		
84634	1988 Plymouth Voyager	162874	4000	7.8	9:30 a.m.	03/10/2005		

Run #	Veh Yr, Make, Model	Odometer	Inertia	Hp@50mph	Time	Date	Dyne Test Issues	Suspect Data
84635	1989 Ford Crown Vic	62847	3500	11.0	10:38 a.m.	03/10/2005	Possible drive trace violations (braking).	
84636	0.00	0	0	0.0	11:50 a.m.	03/10/2005		
84637	1980 Oldsmobile Cutlass Supreme	79420	3500	10.5	1:10 p.m.	03/10/2005	Possible drive trace violations (braking).	
84638	1996 Chrysler Town & Country	213656	4000	8.5	8:09 a.m.	03/11/2005		
84639	1995 Cheverolet Cavalier	140500	2750	4.8	9:20 a.m.	03/11/2005		
84640	1994 Ford Explorer	98974	4000	10.6	10:30 a.m.	03/11/2005		
84641	0.00	0	0	0.0	11:40 a.m.	03/11/2005		
84642	1989 Dodge Spirit	139488	3000	8.4	1:01 p.m.	03/11/2005		
84643	1987 Ford Escort	12845	2500	7.4	2:10 p.m.	03/11/2005		
84644	2001 Nissan Pathfinder	66284	4000	15.3	8:02 a.m.	03/12/2005		
84645	1993 Volvo 960	197094	3500	10.3	9:14 a.m.	03/12/2005	Possible dilution due to exhaust leak.	
84646	1988 Honda Accord	209194	2750	6.4	10:30 a.m.	03/12/2005	Background HC reading suspect due to instrument drift.	x
84647	0.00	0	0	0.0	11:40 a.m.	03/12/2005	Background HC reading suspect due to instrument drift.	x
84648	1987 Dodge Dakota PU	112838	3500	10.6	1:00 p.m.	03/12/2005	Vehicle stalled several times during Phase 1. Phase 2 dilution temp over 50C.	
84649	1995 GMC Sonoma PU	56578	3500	9.8	8:17 a.m.	03/14/2005		
84650	1990 Chevrolet Lumina APV	136313	3500	8.1	9:35 a.m.	03/14/2005		
84651	1988 Ford Taurus	14033	3500	4.0	10:40 a.m.	03/14/2005		
84652	0.00	0	0	0.0	11:30 a.m.	03/14/2005		
84653	1977 Chevrolet C-20 PU	37697	4000	13.9	1:07 p.m.	03/14/2005	Phase 2 dilution temp over 50C.	
84654	1990 Oldsmobile Cutlass Cierra	97522	3000	5.4	8:05 a.m.	03/15/2005	Real-time computer had internal error during soak.	
84655	1990 Buick Electra Park Avenue	169860	3500	6.3	9:12 a.m.	03/15/2005		
84656	1990 Chevrolet Lumina APV	123632	3500	8.1	10:21 a.m.	03/15/2005		
84657	0.00	0	0	0.0	11:30 a.m.	03/15/2005		
84658	1989 Chevrolet Astrovan	215908	3500	12.0	1:12 p.m.	03/15/2005	Possible dilution due to exhaust leak, possible high background concentrations.	x
84659	1988 Chrysler Le Baron	117003	3000	8.3	1:52 p.m.	03/15/2005		
84660	1988 Dodge Caravan	61439	3500	8.0	3:07 p.m.	03/15/2005		
84661	1990 Buick Century	148959	3000	6.8	8:10 a.m.	03/16/2005		
84662	1990 Cadillac Eldorado	185384	3500	6.2	9:17 a.m.	03/16/2005	Possible dilution due to exhaust leak, possible high background concentrations.	x
84663	1989 Chevrolet Corsica	98999	3000	5.3	10:31 a.m.	03/16/2005	Possible high background concentrations due to oil burning on exhaust.	x
84664	0.00	0	0	0.0	11:40 a.m.	03/16/2005		
84665	1989 Toyota 4X4 PU	262316	3500	10.9	1:17 p.m.	03/16/2005		
84666	1988 Ford F150 PU	14075	4000	14.6	2:08 p.m.	03/16/2005		
84667	1982 Ford F250 PU	85513	3500	11.9	3:19 p.m.	03/16/2005	Vehicle stalled several times during test. Possible high background concentrations and dilution due to exhaust leaks.	x
84668	1991 Oldsmobile Delta 88	139412	3500	7.0	8:00 a.m.	03/17/2005		
84669	1990 Dodge Spirit	109931	3000	8.7	9:09 a.m.	03/17/2005	Possible high background concentrations due to another vehicle being operated in building during test.	x
84670	1989 Mercury Topaz	6137	2750	6.6	10:24 a.m.	03/17/2005		
84671	0.00	0	0	0.0	11:22 a.m.	03/17/2005		
84672	1983 Toyota Tercel	87900	2250	6.7	12:30 p.m.	03/17/2005	Possible dilution due to exhaust leaks.	
84673	1983 GMC Vandura	52728	4500	16.2	10:30 a.m.	03/17/2005	Possible drive trace violations (max speed of vehicle is 50 mph). Phase 2 dilution temp over 50C.	x
84674	1979 Pontiac Firebird	45370	4000	10.8	3:04 p.m.	03/17/2005		
84675	1993 Ford Tempo	25053	2750	6.1	8:00 a.m.	03/18/2005		
84676	1990 Ford Bronco	25202	4500	13.3	9:44 a.m.	03/18/2005	Possible drive trace violations (braking).	
84677	1988 Buick Park Avenue	146833	3500	6.3	10:23 a.m.	03/18/2005		
84678	0.00	0	0	0.0	11:30 a.m.	03/18/2005		
84679	1983 Toyota PU	97635	3000	9.9	12:39 p.m.	03/18/2005		
84680	1973 Chevrolet PU	57484	4000	12.6	1:50 p.m.	03/18/2005	Possible dilution due to exhaust leaks. Phase 2 dilution temp over 50C.	

Run #	Veh Yr, Make, Model	Odometer	Inertia	Hp@50mph	Time	Date	Dyne Test Issues	Suspect Data
84681	1993 Ford Tempo	25073	2750	6.1	8:12 a.m.	03/19/2005	Invalid RH values, corrected using airport values	x
84682	1990 Toyota Camry	138235	3500	9.0	9:25 a.m.	03/19/2005	Invalid RH values, corrected using airport values	x
84683	1990 Ford Ranger PU	72976	3500	11.1	10:35 a.m.	03/19/2005	Possible dilution due to exhaust leaks. Invalid RH values, corrected using airport values	x
84684	0.00	0	0	0.0	11:40 a.m.	03/19/2005	Invalid RH values, corrected using airport values	x
84685	1988 Ford F150 PU	62947	4000	13.5	1:14 p.m.	03/19/2005	Invalid RH values. Phase 2 dilution temp over 50C.	x
84686	1986 Ford F150 PU	94737	3500	12.5	2:22 p.m.	03/19/2005	Possible dilution due to exhaust leaks. Possible drive trace violations (braking). Invalid RH values, corrected using airport values	x
84687	1976 Chevrolet El Camino	61809	4000	12.1	3:14 p.m.	03/19/2005	Invalid RH values, corrected using airport values	x
84688	1993 Ford Taurus	92978	3500	9.5	8:05 a.m.	03/21/2005		
84689	1992 GMC Jimmy	90871	3500	9.5	9:21 a.m.	03/21/2005	Possible dilution due to exhaust leaks.	
84690	1989 Oldsmobile Cutlass Cierra	220970	3000	5.4	10:31 a.m.	03/21/2005		
84691	0.00	0	0	0.0	11:30 a.m.	03/21/2005		
84692	1988 Buick Century	94555	3000	6.4	12:48 p.m.	03/21/2005	Possible dilution due to exhaust leaks.	
84693	1988 Ford F150 PU	97172	4000	14.6	1:59 p.m.	03/21/2005	Possible dilution due to exhaust leaks. Engine stalled at 1300 seconds into test.	
84694	1983 Chevrolet C10 PU	98799	3500	14.0	3:09 p.m.	03/21/2005		
84695	1989 Oldsmobile Cutlass Ciera	220989	3000	5.4	8:00 a.m.	03/22/2005		
84696	1987 Toyota PU	169293	2750	9.6	9:16 a.m.	03/22/2005	Possible dilution due to exhaust leaks.	
84697	1988 Ford Taurus	14052	3500	4.0	10:25 a.m.	03/22/2005		
84698	0.00	0	0	0.0	11:30 a.m.	03/22/2005		
84699	1985 Chevrolet Caprice	58223	3500	8.7	12:46 p.m.	03/22/2005	Vehicle stalled several times during test. No bag data available. Possible drive trace violations (braking).	
84700	1978 Ford PU	73447	4000	11.7	2:08 p.m.	03/22/2005	Possible dilution due to exhaust leaks.	
84701	1990 Ford F150 PU	38803	4000	13.5	8:00 a.m.	03/23/2005	Possible drive trace violations (braking).	
84702	1989 Chevrolet G20 Van	27435	4000	16.2	9:14 a.m.	03/23/2005		
84703	1987 Chevrolet Blazer	153398	3500	9.8	10:26 a.m.	03/23/2005	Possible drive trace violations (braking). Possible dilution due to exhaust leaks.	
84704	0.00	0	0	0.0	11:30 a.m.	03/23/2005		
84705	1980 Chevrolet Malibu	31253	3500	9.5	12:39 p.m.	03/23/2005		
84706	1776 Chevrolet Nova/ 144MGX	86094	3500	9.6	1:51 p.m.	03/23/2005	Voided run	x
84707	1973 Chevrolet Impala	94178	4000	11.4	2:31 p.m.	03/23/2005	Vehicle stalled several times during test. Phase 2 dilution temp over 50C.	
84708	2003 Dodge Caravan	10200	4000	7.2	8:27 a.m.	03/24/2005		
84709	1989 Ford Ranger PU	28864	3000	11.1	10:02 a.m.	03/24/2005		
84710	1984 Chevrolet Monte Carlo	68810	3500	10.6	11:17 a.m.	03/24/2005	Possible dilution and high background concentrations due to exhaust leaks.	x
84711	0.00	0	0	0.0	12:30 p.m.	03/24/2005		
84712	1979 Chevrolet Nova	86117	3500	9.6	1:49 p.m.	03/24/2005	Possible dilution due to exhaust leaks.	
84713	1996 Chevrolet Blazer	94350	4000	10.7	8:07 a.m.	03/25/2005		
84714	1994 Saturn SW	132333	2500	6.1	9:16 a.m.	03/25/2005		
84715	1988 Mazda B2200 PU	220307	3000	10.6	10:15 a.m.	03/25/2005	Possible dilution due to exhaust leaks.	
84716	0.00	0	0	0.0	11:40 a.m.	03/25/2005		
84717	1979 Ford Mustang	45551	3000	9.7	1:58 p.m.	03/25/2005	Possible real-time data values erroneous due to real-time computer failure.	x
84718	QBI692	0	0	0.0	8:07 a.m.	03/26/2005	Voided run	x
84719	1990 Oldsmobile Cutlass Supreme	85449	3500	4.5	9:14 a.m.	03/26/2005		
84720	1989 Chevrolet 1500 PU	140678	4000	12.8	10:21 a.m.	03/26/2005	Possible drive trace violations due to bad brakes.	
84721	0.00	0	0	0.0	11:50 a.m.	03/26/2005		
84722	1998 Ford Windstar	99476	4000	7.9	8:07 a.m.	03/28/2005		
84723	1991 Chevrolet Cavalier	182349	2750	5.8	9:19 a.m.	03/28/2005		
84724	1990 Oldsmobile Cutlass Ciera	171475	3000	5.4	10:30 a.m.	03/28/2005		
84725	0.00	0	0	0.0	11:50 a.m.	03/28/2005		
84726	1990 Ford Aerostar	19648	3500	10.3	12:45 p.m.	03/28/2005	Possible drive trace violations due to bad brakes.	

Run #	Veh Yr, Make, Model	Odometer	Inertia	Hp@50mph	Time	Date	Dyne Test Issues	Suspect Data
84727	1982 Ford Grenada	64654	3500	10.6	1:45 p.m.	03/28/2005	Possible drive trace violations due to bad brakes Phase 2 dilution temp over 50C.	
84728	2002 Ford Escape 2wd	36209	3500	7.5	8:06 a.m.	03/29/2005		
84729	2001 Toyota Camry	46869	3500	6.7	9:16 a.m.	03/29/2005		
84730	1995 Chevrolet S10 PU	75640	3500	9.8	10:26 a.m.	03/29/2005		
84731	0.00	0	0	0.0	11:40 a.m.	03/29/2005		
84732	1979 Jeep CJ76	8518	3000	10.6	12:50 p.m.	03/29/2005		
84733	1998 Buick Skylark	65464	3500	5.9	8:21 a.m.	03/30/2005	HC values suspect, dyne bench HC wouldn't span properly.	x
84734	1993 Plymouth Voyager	166916	4000	7.3	9:32 a.m.	03/30/2005		
84735	1988 Honda Accord	209393	2750	6.4	10:41 a.m.	03/30/2005		
84736	0.00	0	0	0.0	11:50 a.m.	03/30/2005		
84737	1984 Chevrolet Celebrity	64091	3000	6.7	1:08 p.m.	03/30/2005		
84738	1976 Pontiac Gran Prix	60909	4500	10.7	2:20 p.m.	03/30/2005	Possible drive trace violations due to bad brakes.	
84739	1998 Mazda Protoge	88569	2750	6.8	7:54 a.m.	03/31/2005		
84740	1990 Buick Lesabre	107876	3500	6.8	9:13 a.m.	03/31/2005		
84741	1988 Ford Taurus	14072	3500	4.0	10:25 a.m.	03/31/2005		
84742	0.00	0	0	0.0	11:40 a.m.	03/31/2005		
84743	1999 Mazda Protoge	122968	2750	6.9	8:02 a.m.	04/01/2005		
84744	0.00	0	0	0.0	9:00 a.m.	04/01/2005		
84745	1990 Honda Civic	133966	2250	4.6	8:05 a.m.	04/02/2005		
84746	0.00	0	0	0.0	9:13 a.m.	04/02/2005		
84747	2003 Dodge Caravan	0	0	0.0	8:18 a.m.	04/04/2005	Wrong drive trace used.	x
84748	2002 Dodge Caravan	60790	4500	9.3	9:23 a.m.	04/04/2005		
84749	2001 Toyota Sienna	80227	4000	9.4	10:34 a.m.	04/04/2005		
84750	0.00	0	0	0.0	11:59 a.m.	04/04/2005		
84751	1998 Ford Escort	55309	2750	6.0	12:47 p.m.	04/04/2005		
84752	1978 Ford F100 PU	58917	3500	12.2	2:00 p.m.	04/04/2005		
84753	2003 Dodge Caravan	47649	4500	7.9	8:15 a.m.	04/05/2005		
84754	2003 Chrysler Town & Country	20787	4500	8.9	9:25 a.m.	04/05/2005		
84755	2002 Honda Odyssey	60753	4500	12.7	10:42 a.m.	04/05/2005		
84756	0.00	0	0	0.0	11:30 a.m.	04/05/2005		
84757	2001 Jeep Grand Cherokee	90011	4000	11.7	12:56 a.m.	04/05/2005		

Run #	Veh Yr, Make, Model	Odometer	Inertia	Hp@50mph	Time	Date	Dyne Test Issues	Suspect Data
84758	1979 Chevrolet C10 Beauville	84025	4000	14.6	2:30 a.m.	04/05/2005		
84759	2005 Ford Focus	6701	3000	11.7	8:19 a.m.	04/06/2005	Realtime filter heater off.	
84760	2004 Ford Escape	10519	3500	10.4	9:28 a.m.	04/06/2005	Realtime filter heater off.	
84761	2004 Kia Sedona	16609	5000	10.7	10:45 a.m.	04/06/2005	Realtime filter heater off.	
84762	0.00	0	0	0.0	11:36 a.m.	04/06/2005		
84763	2003 Honda Odyssey	44752	4500	12.4	12:50 p.m.	04/06/2005		
84764	202GMB	0	0	0.0	1:30 p.m.	04/06/2005		
84765	1985 Chevrolet Impala	75914	4000	11.1	2:15 a.m.	04/06/2005	Possible dilution due to exhaust leaks. Possible drive trace violations (braking).	
84766	2000 Dodge Caravan	93162	4000	10.0	8:14 a.m.	04/07/2005		
84767	1998 Nissan Frontier PU	107615	3500	11.0	9:26 a.m.	04/07/2005		
84768	1995 Ford F150 PU	147342	4500	11.6	10:40 a.m.	04/07/2005		
84769	0.00	0	0	0.0	11:56 a.m.	04/07/2005		
84770	1995 Ford F250 PU	52586	4500	11.6	12:45 p.m.	04/07/2005	Possible drive trace violations (braking).	
84771	1994 Chevrolet Astrovan	133318	4000	12.3	2:06 p.m.	04/07/2005		
84772	1992 Dodge Caravan	143971	4000	7.0	3:23 p.m.	04/07/2005		
84773	1998 Toyota 4Runner	115768	4000	11.7	8:30 a.m.	04/08/2005		
84774	1995 Dodge Caravan	136837	4000	7.6	9:45 a.m.	04/08/2005		
84775	1997 Chevrolet Suburban	137630	5000	10.8	11:00 a.m.	04/08/2005		
84776	0.00	0	0	0.0	11:59 a.m.	04/08/2005		
84777	1987 Oldsmobile Cutlass	87020	3500	9.6	1:15 p.m.	04/08/2005	Possible dilution due to exhaust leaks. CVS bags not fully evacuated prior to start of test.	

Kansas City PM Characterization Study

Final Report

Appendix W
Remote Sensing Data Second-by-Second
Round 1 Model Year
Vehicle Specific Power

Assessment and Standards Division
Office of Transportation and Air Quality
U.S. Environmental Protection Agency

Sponsors:

National Renewable Energy Laboratory, U.S. Department of Energy
Federal Highway Administration, U.S. Department of Transportation
STAPPA-ALAPCO Emission Inventory Improvement Program
Coordinating Research Council Inc. (Project No. E-69)

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United States
Environmental Protection
Agency

EPA420-R-08-009
April 2008

mygrp	vsp_bin	r_n	s_n	tm_n_mea	rvsp_mean	rvsp_var	svsp_mea	svsp_var	rspeed_me	rspeed_va	sspeed_me	sspeed_va	rhc_ppm_n
81	0	1	4	180	-0.11203	.	-0.025633	0.00045	27.36343	28.29181	7.033759	135.0792	164.9515
81	3	25	3	1194	1.728781	0.610613	0.082654	0.004892	22.0604	42.08593	1.678024	2.023111	341.5352
1994	0	4	9	256	-0.097424	0.006643	-1.616845	6.93846	25.95218	27.15642	4.901422	57.85284	62.58809
1994	3	138	8	978.875	1.669362	0.80198	0.209957	0.067601	21.1492	35.4539	3.580007	18.24158	84.30688
1994	306	258	3	127.3333	4.742632	0.646474	4.412237	0.036849	22.86062	26.10955	25.90554	31.95191	81.20585
1994	609	604	3	106	7.635469	0.65839	7.408025	0.001748	24.43561	18.81325	28.81263	85.81596	76.96396
1994	912	831	3	92.33333	10.59467	0.713862	10.44574	0.011596	25.87995	12.77765	33.33489	114.0356	58.55913
1994	1218	1358	3	96	14.54893	2.650966	14.51158	0.000132	28.72598	12.97037	35.7561	195.1463	58.16862
1994	1824	415	2	26	20.25986	2.683251	20.34191	0.031503	31.61014	11.70486	50.74511	0.156596	65.88253
1994	2430	63	2	10	26.08284	2.106726	26.78191	0.65812	33.84857	12.79533	49.29927	8.290236	91.08333
1995	0	5	11	171.0909	-0.116717	0.007247	-3.052619	7.951346	26.48289	32.55045	13.91429	97.69157	50.27819
1995	3	167	7	835.8571	1.58943	0.654339	0.367873	0.06041	21.87557	32.13256	6.397085	18.71649	59.99587
1995	306	326	4	164	4.70428	0.74691	4.476331	0.00429	23.105	26.46938	28.95595	1.162676	96.33641
1995	609	664	4	135	7.649005	0.711584	7.436483	0.006264	24.33863	19.21262	33.62834	3.278511	61.54895
1995	912	1069	4	107	10.48889	0.708727	10.48314	0.015648	25.82921	14.76602	36.40744	5.67678	49.55198
1995	1218	1768	4	127.75	14.67386	2.87271	14.16172	0.027833	28.4532	12.06798	43.97956	4.665775	47.49991
1995	1824	512	4	29.25	20.20378	2.540019	20.17704	0.184939	31.98648	11.91941	46.8469	49.23417	51.70986
1995	2430	80	4	8	26.17593	2.696712	26.37253	0.227128	33.51475	13.84685	43.79008	8.569452	54.316
1995	3099	27	2	10.5	32.92428	4.254191	40.35732	159.5869	35.4237	22.42191	43.43972	17.88999	106.8307
1996	0	3	10	242.6	-0.070754	0.007346	-2.636404	7.645868	25.87	18.5173	7.99536	81.08432	72.13774
1996	3	148	10	933.2	1.62165	0.679673	0.319532	0.10745	22.79297	35.1499	5.206102	25.77032	80.30061
1996	306	330	5	141.4	4.73942	0.678033	4.487225	0.0095	22.63073	27.09623	26.09776	43.18342	35.83639
1996	609	653	5	125	7.685369	0.744562	7.454708	0.001577	24.38778	20.60105	30.89126	48.15528	40.20897
1996	912	1057	4	133	10.53087	0.73803	10.54713	0.001854	25.88616	13.05804	39.06196	2.882844	32.17074
1996	1218	1799	4	138.25	14.66119	2.858663	14.48415	0.060298	28.60568	12.919	44.91233	1.713916	35.31525
1996	1824	527	4	29.75	20.12617	2.5289	20.51843	0.203363	31.53241	11.02665	46.95155	13.42855	39.67829
1996	2430	97	4	9.75	26.16772	2.436288	26.10013	0.623694	35.01041	20.2733	48.68039	21.42383	41.7533
1996	3099	37	2	3.5	1093.037	2138899	33.31693	1.395959	33.71757	49.54354	42.1248	5.873335	82.32189
1997	0	2	17	237.9412	-0.096956	0.009476	-1.781286	6.551711	25.939	20.22273	8.08514	85.38599	49.16333
1997	3	163	15	952.8	1.602874	0.755781	0.298829	0.078421	23.34515	31.03311	4.843527	17.86888	50.24939
1997	306	419	5	177.6	4.680104	0.686999	4.495692	0.002744	22.532	27.22243	29.53097	0.187715	25.19473
1997	609	821	5	147	7.722207	0.682127	7.456428	0.005236	24.04553	20.37028	33.64949	2.708508	55.8628
1997	912	1280	5	135.6	10.5395	0.682751	10.50659	0.010552	25.74709	14.39764	39.08318	1.303432	25.17728
1997	1218	2457	5	142.6	14.63801	2.678529	14.38144	0.045665	28.50435	13.13721	44.59043	0.760327	25.68873
1997	1824	750	5	23.2	20.19417	2.558786	20.77685	0.110194	32.01539	11.83219	49.33446	10.29935	25.35963
1997	2430	124	5	8.2	25.89407	2.301443	26.45177	0.450748	35.37161	14.38529	45.17693	25.59733	30.80548
1997	3099	27	1	2	33.6635	7.395346	30.72778	.	35.73593	33.41135	44.3622	.	80.94444
1998	0	5	11	173.3636	-0.08334	0.001038	-3.074975	8.056117	26.04895	28.88571	11.81762	110.3816	13.55942
1998	3	173	8	878.5	1.555442	0.759277	0.378195	0.087647	22.46069	29.05693	6.378349	23.79745	28.75931

mygrp	vsp_bin	r_n	s_n	tm_n_mear	rvsp_mean	rvsp_var	svsp_mear	svsp_var	rspeed_me	rspeed_var	sspeed_me	sspeed_va	rhc_ppm_n
1998	306	423	4	178.5	4.777674	0.725941	4.489399	0.004606	22.56017	30.60901	29.44843	3.905977	13.57593
1998	609	900	4	149.75	7.684995	0.686275	7.453907	0.001003	23.9235	17.66416	33.74279	2.701432	16.32913
1998	912	1426	4	131.75	10.57262	0.71867	10.46844	0.001118	25.71358	14.30051	38.83988	1.20378	18.58168
1998	1218	2653	4	143	14.75901	2.895214	14.30318	0.012551	28.49958	12.94845	44.92861	0.752526	17.97184
1998	1824	916	4	20.75	20.23659	2.468931	19.98204	0.172346	31.83857	12.91585	50.10412	6.726139	21.472
1998	2430	158	4	8.75	26.33372	2.962359	26.74487	1.937421	34.42658	13.63412	42.18104	30.93661	29.34171
1998	3099	23	2	3.5	34.10896	9.285426	34.38098	27.06864	37.27304	19.08617	44.20792	5.930706	81.87652
1999	0	2	15	274.7333	-0.178693	0.000631	-3.513319	6.656568	25.98595	19.92278	15.36006	81.67144	34.15163
1999	3	179	12	666.8333	1.513247	0.739528	0.480583	0.078463	22.52413	32.76026	7.988808	20.63957	9.244134
1999	306	393	8	179.5	4.756571	0.700961	4.491011	0.005192	22.66234	27.231	29.36186	1.955068	14.59702
1999	609	971	8	146.875	7.652011	0.710395	7.494057	0.004905	23.80622	19.05435	33.17935	5.670709	13.88288
1999	912	1462	8	119.25	10.55677	0.69694	10.5158	0.004575	25.83995	15.02039	39.10786	2.526565	25.68741
1999	1218	2991	8	146	14.71654	2.803368	14.42827	0.034101	28.59317	12.1575	44.4557	1.905048	19.75938
1999	1824	946	8	31.625	20.28642	2.849927	20.27703	0.069763	31.90365	12.06122	50.57366	17.30145	17.00248
1999	2430	201	8	10.125	25.98365	2.437513	26.65553	0.426828	34.05438	17.34668	45.77262	17.07711	28.68697
1999	3099	34	6	2.833333	645.567	1675685	32.50422	2.51793	35.11294	54.77961	40.80252	5.11479	45.39706
2000	0	1	12	354.5	-0.057851	.	-2.64427	7.547296	26.37516	25.42075	9.67044	84.8245	10.55486
2000	3	185	12	737.1667	1.600609	0.801201	0.363814	0.10313	22.29249	22.94594	6.077856	29.21583	10.3413
2000	306	461	6	179.8333	4.76483	0.720785	4.513621	0.006188	22.1959	26.77018	30.37481	1.170625	11.04876
2000	609	1000	6	151	7.675579	0.738889	7.441475	0.001995	24.14939	18.56132	33.2363	0.932476	9.64043
2000	912	1606	6	126.6667	10.60558	0.724202	10.51703	0.00115	25.79355	15.02846	39.60403	3.372884	11.51511
2000	1218	3266	6	143.5	14.72917	2.808849	14.43795	0.04045	28.48113	11.7774	44.52786	1.439977	10.17599
2000	1824	1026	6	24.5	20.22176	2.580508	20.54958	0.16435	31.68432	12.79908	49.7203	10.35217	14.96744
2000	2430	195	6	7.333333	26.08903	2.474472	26.58309	0.551399	34.752	12.66732	42.25945	9.396152	15.10569
2000	3099	96	4	2.75	1182.012	1968126	32.68697	4.084047	33.56844	51.53958	43.3424	85.92947	20.59667
2001	0	3	13	190.6923	-0.124034	0.008036	-2.331291	7.422348	26.11944	23.99842	10.23021	106.5219	13.26024
2001	3	188	9	873.8889	1.673219	0.548654	0.344443	0.089225	22.3417	31.99685	5.768939	24.38135	0.417553
2001	306	436	5	146.8	4.750237	0.679849	4.415174	0.026404	22.22686	23.17954	26.74492	34.63992	5.931078
2001	609	905	5	121.8	7.648664	0.702548	7.267467	0.135133	23.72702	19.98483	30.04559	73.12563	4.821702
2001	912	1506	4	126.5	10.57362	0.762505	10.51837	0.005077	25.81475	14.96464	39.9857	3.621262	10.47501
2001	1218	2849	4	144.5	14.72824	2.826091	14.30138	0.044477	28.56062	12.87536	44.05477	2.613103	7.567466
2001	1824	962	4	22.75	20.23497	2.582318	20.41841	0.022654	31.79412	12.27862	50.28702	13.12125	10.75015
2001	2430	205	4	10.5	26.10809	2.74176	26.15522	0.026997	34.54454	17.32844	46.13675	16.99424	16.06941
2001	3099	107	2	1	1100.893	2265559	30.77626	0.008039	32.77355	46.88569	49.8937	13.88856	8.678972
2002	0	2	6	279.1667	-0.063335	0.000399	-4.190591	5.435688	27.65732	23.79248	16.84972	59.04609	6.118969
2002	3	129	5	592	1.649165	0.688339	0.555598	0.046009	21.99953	26.12504	9.294374	15.59669	2.27093
2002	306	369	4	171.25	4.721596	0.683571	4.546037	0.001501	22.22076	21.55857	29.37632	1.471222	7.702602
2002	609	721	4	153.75	7.529089	0.766307	7.412975	0.005402	23.95397	18.03872	34.27219	8.044454	4.309903
2002	912	1136	4	128.25	10.63117	0.708823	10.44978	0.035306	25.84776	13.9154	38.98662	1.986957	4.933741

mygrp	vsp_bin	r_n	s_n	tm_n_mear	rvsp_mean	rvsp_var	svsp_mear	svsp_var	rspeed_me	rspeed_var	sspeed_me	sspeed_va	rhc_ppm_n
2002	1218	2231	4	142.75	14.72189	2.847101	14.38399	0.058895	28.47765	12.62336	43.92324	1.4859	4.617324
2002	1824	839	4	27.75	20.27745	2.605376	20.3117	0.114691	31.7331	11.78279	50.28896	9.322214	6.636818
2002	2430	162	4	8.5	26.19885	2.500145	26.25742	0.182843	35.14784	13.50694	45.01388	15.98119	8.259506
2002	3099	89	2	3	1936.199	3223567	33.05438	12.51522	31.6273	47.59227	39.62142	0.00575	10.61112
2003	0	0	3	274.3333	.	.	-3.652591	9.819539	27.64518	25.36476	13.11022	94.71074	5.98904
2004	0	0	1	380	.	.	-5.510371	.	28.07877	22.36193	17.8579	.	3.618883
8385	0	0	8	238.625	.	.	-0.917676	4.791137	28.62737	27.06599	3.34386	41.26257	46.77
8385	3	28	6	1010.333	1.747848	0.806976	0.171321	0.056597	22.57214	27.44922	3.053585	15.30485	428.3168
8385	306	60	1	199	4.473999	0.683986	4.351329	.	22.4135	23.63828	29.33072	.	238.0142
8385	609	153	1	128	7.541561	0.704646	7.627801	.	24.34961	15.27631	36.07098	.	270.8605
8385	912	176	1	114	10.58862	0.701305	10.47808	.	26.1879	15.44117	37.36859	.	174.7711
8385	1218	257	1	151	14.33287	2.770873	14.38687	.	28.62366	12.1953	42.59035	.	192.4407
8385	1824	65	1	27	20.52322	2.393346	20.33262	.	32.72615	12.34259	50.88894	.	151.1977
8385	2430	7	1	12	25.63042	1.04073	25.1204	.	34.94143	24.33428	47.38028	.	205.9829
8385	3099	1	1	1	31.2182	.	33.59496	.	33.84	.	49.4233	.	38.69
8689	0	3	27	185.6667	-0.136735	0.003999	-2.1353	7.005587	25.96868	40.7392	6.45929	63.16538	225.3503
8689	3	119	23	994.8696	1.577779	0.78329	0.307047	0.08777	20.93462	31.94836	5.198298	22.98318	189.1339
8689	306	315	8	175	4.785614	0.666392	4.504839	0.004886	22.47492	25.86161	29.19812	1.144156	177.3892
8689	609	605	8	152.25	7.588028	0.730146	7.459296	0.001585	23.91471	16.3401	33.61268	3.659462	152.2228
8689	912	728	8	124.25	10.52287	0.719724	10.48177	0.00244	25.91956	14.44827	39.37469	2.980678	156.5203
8689	1218	1100	8	147.625	14.57361	2.734622	14.42437	0.015459	28.58355	11.32684	44.27813	1.734531	124.5358
8689	1824	318	8	25	20.28267	2.682074	20.51264	0.16848	31.34786	14.59608	50.3557	6.495875	102.8878
8689	2430	57	8	10.75	26.11659	2.364535	25.95398	0.410574	32.7686	14.32795	47.80293	13.86272	155.4851
8689	3099	21	4	2	33.28166	4.093481	32.28561	1.325625	34.99952	27.31468	41.20556	25.6345	250.3305
9093	0	6	20	204.2	-0.097482	0.004032	-2.398126	6.57868	26.37934	25.46441	11.41351	94.22827	65.8924
9093	3	317	14	832.7857	1.685102	0.811699	0.404973	0.093767	21.58028	32.26638	6.599783	23.76767	150.1142
9093	306	728	8	144.375	4.697634	0.714593	4.463751	0.016157	22.89177	25.19667	31.33356	79.19755	144.4307
9093	609	1411	8	112.5	7.604664	0.748959	7.436873	0.020895	24.22259	19.52074	35.1028	49.26539	107.4315
9093	912	1936	8	98.75	10.5115	0.74609	10.40146	0.065691	25.98216	14.57021	39.55564	60.21342	97.37079
9093	1218	3339	8	107.75	14.63183	2.718404	14.40563	0.031288	28.71911	12.50471	42.68338	31.54019	83.36582
9093	1824	953	8	21.375	20.262	2.51557	20.10125	0.58666	31.73616	11.88846	46.85895	56.71521	81.34977
9093	2430	174	7	6.857143	26.13712	2.493969	26.12491	0.464383	33.78029	20.83763	45.67776	22.46786	85.53638
9093	3099	45	5	21.4	89.40596	71161.33	52.08212	1983.474	35.69756	42.51981	42.10531	110.9769	98.66756

rhc_ppm_v	shc_ppm_r	shc_ppm_\	rco_perc_n	rco_perc_v	sco_perc_r	sco_perc_\	rco2_perc_	rco2_perc_	sco2_perc_	sco2_perc_	rnx_ppm_n	rnx_ppm_v	snx_ppm_r	snx_ppm_var
111740.4	4321.323	8771814	1.139804	3.831796	3.516583	7.936394	14.20128	2.010332	10.71471	4.235413	704.5849	679844.7	269.5798	45635.08
131405.2	3750.892	9166448	2.7724	10.03166	3.120964	9.553001	13.042	5.1699	11.53925	0.767887	258.7056	42389.89	687.4196	510385.1
5896.233	294.9323	46606.38	0.433689	0.517152	0.175883	0.0183	14.69536	0.270974	13.5942	4.257731	1196.97	683909.4	154.152	3404.575
31028.02	301.6888	26982.2	0.576243	0.862359	0.23065	0.029043	14.62442	0.458234	14.14982	1.57491	273.4533	140541.4	295.9402	27880.3
50081.01	301.7353	82409.27	0.493226	1.662864	0.256671	0.046909	14.67213	0.870546	15.05819	0.000543	576.9099	457696	287.6634	28282.94
67458.56	345.96	120106.2	0.460006	1.058501	0.217745	0.026794	14.6924	0.552139	15.1077	0.000392	728.8241	537532.3	398.2244	54572.33
8806.838	762.7625	1178622	0.436664	1.102027	0.219241	0.028528	14.7078	0.57185	15.14355	0.002506	781.2031	609874.2	431.1098	7210.325
17253.5	884.1383	1687518	0.435103	0.761957	0.231529	0.047913	14.70412	0.393472	15.14356	0.010985	920.9017	771627.7	525.9786	3623.37
14762.89	322.3201	57333.7	0.875122	3.325128	1.095337	1.322124	14.38506	1.702553	14.62217	0.282472	1020.315	966277.7	587.8922	208.6682
25307.61	1090.361	3036.715	1.402063	3.153765	3.223973	0.167604	14.0081	1.61449	13.1729	0.000509	932.7916	1011832	592.1251	1813.619
15426.46	287.972	18831.38	0.396995	0.799705	0.236885	0.013075	14.74325	0.414303	13.88651	1.425999	615.508	365489.3	150.8412	5678.594
74867.59	498.6189	128959.6	0.412939	0.42052	0.534953	0.373099	14.74329	0.227344	14.09351	0.996044	267.6384	312365.9	264.3573	30182.05
235563.8	220.2868	13340.31	0.389575	0.53517	0.399962	0.006666	14.7504	0.289482	14.86673	0.019039	479.0935	373939.3	292.9655	10600.95
56063.08	190.7712	8310.381	0.322096	0.496719	0.438274	0.001033	14.79687	0.261187	14.86952	0.005656	588.5786	425799.5	338.4375	22126.21
14947.42	173.9902	7106.613	0.309757	0.517512	0.337051	0.001523	14.80119	0.271266	14.9774	0.002452	738.8092	659202.9	382.627	22849.07
17533.1	172.8556	6434.247	0.424881	1.003991	0.354673	0.002606	14.71735	0.519551	14.92553	0.016197	772.8208	615601.8	476.3079	87676.39
5935.024	344.8302	30272.7	0.603146	1.525246	1.098655	0.946524	14.58396	0.784113	14.52569	0.39412	926.0588	701423.8	556.439	49420.89
6782.785	475.1719	123126.9	1.18875	3.82813	1.343314	1.066586	14.16413	1.960235	14.39946	0.359015	930.8488	534149.2	983.1391	261435.8
7169.83	395.2787	1455.169	3.051111	8.359503	0.547601	0.005735	12.82444	4.216756	14.88812	0.000437	1010.443	1276160	753.0235	124089
16554.57	210.391	14865.11	0.449772	0.761378	0.174818	0.024788	14.69755	0.399542	12.25085	14.96333	775.856	476637.6	70.54985	3787.541
192883.4	257.3201	43045.9	0.463196	0.864576	0.228941	0.019967	14.70547	0.465215	14.10029	2.460742	301.4243	325756.7	154.2168	5466.5
10480.96	234.7509	56476.91	0.217448	0.108493	0.228801	0.015763	14.88058	0.060667	15.01344	0.039972	398.6351	330509.1	225.4361	13037.72
19126.86	207.0866	37719.33	0.284681	0.488857	0.221775	0.020423	14.82781	0.257779	15.0788	0.028051	509.6674	492232.4	226.4513	7452.643
6352.353	123.1883	7839.131	0.257514	0.537014	0.206339	0.027864	14.84774	0.28106	15.15807	0.019561	515.9703	358245.3	236.0747	8353.237
31686.74	129.6702	11530.44	0.31631	0.651696	0.193146	0.028627	14.80345	0.339903	15.17839	0.018744	558.8602	408642.3	281.0163	10730.33
5054.948	179.8785	35932.59	0.507065	1.210468	0.203922	0.031483	14.66319	0.62503	15.18269	0.024056	659.8026	470354.1	416.3684	8521.363
5197.575	205.3109	32717.43	0.765524	2.731136	0.528222	0.280516	14.4734	1.398202	14.97761	0.091665	792.9766	714215.8	625.6699	9669.289
3837.844	558.134	380807.4	2.476141	6.54343	0.957104	0.45416	13.24703	3.321727	14.61701	0.345634	759.6719	679474.9	539.114	10875.49
14326.15	124.5531	8877.666	0.218397	0.50105	0.115434	0.007553	14.86633	0.255874	13.69263	1.981911	747.8547	336415.8	117.7197	2663.99
75278.14	158.5567	5131.909	0.321387	0.338853	0.183467	0.011669	14.81215	0.185848	14.36687	0.488975	193.8447	229267.9	187.3353	13140.13
3548.726	90.64956	1162.94	0.242292	0.21846	0.181627	0.033023	14.86685	0.115207	15.04804	0.017704	302.4326	233572	172.8987	12987.81
313591.9	91.92582	2225.05	0.252723	0.396745	0.20214	0.050466	14.85218	0.221391	15.12321	0.014778	447.1004	397132.4	196.1575	13902.74
5857.03	96.68639	2860.981	0.203818	0.225925	0.185359	0.052614	14.88841	0.118684	15.18471	0.016451	461.1316	327430.4	209.7555	10695.86
3077.359	112.5253	7005.965	0.276445	0.566855	0.168004	0.033583	14.83484	0.294155	15.22501	0.012871	502.5733	385312.3	227.7313	14121.26
2927.793	218.5687	75600.54	0.45427	1.081218	0.411334	0.207172	14.70684	0.557569	15.04662	0.122632	516.1365	353568.3	418.6234	67543.62
3969.39	510.0765	676266.9	0.498831	1.704238	1.556266	5.299071	14.67274	0.882305	14.41806	2.07606	579.7052	482619.3	455.8475	12696.62
20828.16	974.143	.	1.722078	3.630617	4.491	.	13.79593	1.896648	12.1123	.	490.4356	297541.5	572.1038	.
1554.363	197.9679	91100.5	0.242292	0.567755	0.120671	0.019135	14.85767	0.292437	13.80376	4.88027	535.6238	383987	142.5683	38402.93
21066.54	144.1604	12304.87	0.298131	0.732862	0.167788	0.013235	14.83156	0.388738	14.77166	0.025126	146.2149	81072.72	83.70197	2737.603

rhc_ppm_v	shc_ppm_r	shc_ppm_v	rco_perc_n	rco_perc_v	sco_perc_r	sco_perc_v	rco2_perc_	rco2_perc_	sco2_perc_	sco2_perc_	rnx_ppm_n	rnx_ppm_v	snx_ppm_r	snx_ppm_var
4173.062	60.49668	568.6382	0.200353	0.402814	0.049196	0.002221	14.89856	0.209696	15.16998	0.009503	258.251	230593.3	139.5515	2301.225
4618.184	52.34982	441.6834	0.171295	0.308106	0.033445	0.00073	14.91823	0.162058	15.21633	0.010529	293.3237	230765.1	176.7593	9576.165
4109.785	41.71928	448.7488	0.17392	0.223775	0.023734	0.000415	14.91381	0.118623	15.24885	0.010167	353.9766	273758.2	176.4673	8023.714
3883.231	43.21579	420.6201	0.218132	0.478221	0.028415	0.000479	14.88139	0.248512	15.26299	0.009371	381.1257	268364.5	255.1878	16526.29
3325.12	50.77116	808.8483	0.402997	0.986723	0.045413	0.002657	14.74571	0.509316	15.26822	0.012256	460.3167	411675.6	391.326	54234.88
4036.924	47.7475	699.263	0.612765	1.269449	0.035222	0.002851	14.59481	0.656583	15.2634	0.012238	464.5727	287944	726.9506	113341.6
9416.72	84.7078	966.9619	2.60913	8.020436	0.259025	0.002391	13.15043	4.091159	15.12059	0.000671	704.0887	544115	779.1878	68113.91
7388.584	115.9911	40739.67	0.22157	0.466489	0.100048	0.016348	14.86432	0.241074	13.19687	8.319946	757.2779	480179.9	72.65087	5089.71
3054.815	90.60049	2995.051	0.254358	0.255417	0.109843	0.005889	14.86609	0.132828	13.35255	7.135807	115.0791	99179.81	91.3078	2387.528
3598.478	54.65822	2916.838	0.200549	0.224528	0.097064	0.025523	14.90087	0.117259	14.10746	2.598708	186.6427	146897.3	130.7517	13113.97
3962.314	50.05768	1723.672	0.139019	0.229288	0.083871	0.016145	14.94465	0.120197	14.42964	1.445427	204.1013	141533.9	142.2801	19971
50978.04	61.40337	2381.821	0.13295	0.109764	0.102356	0.023216	14.94637	0.060983	14.65559	0.75707	254.6351	169795	150.0234	21761.3
23748.37	70.49745	3400.546	0.183935	0.344879	0.100377	0.014273	14.90919	0.18078	14.81492	0.372577	294.2658	201200	166.5331	26485.09
2789.761	130.8945	16979.87	0.319346	0.762436	0.287601	0.147379	14.81087	0.393662	14.85923	0.245403	323.4655	182573.5	238.2248	54897.49
4699.67	243.974	114873.6	0.970284	3.531866	0.557174	0.933192	14.34597	1.82289	14.83392	0.333117	262.5263	84447.92	355.0655	70969.72
4316.567	441.8697	408646.1	1.366435	4.621857	0.788581	1.716718	14.05765	2.377182	14.67811	0.976827	385.02	224554.7	459.7285	55624.46
2082.204	66.29535	4774.104	0.081783	0.067534	0.093308	0.008921	14.97694	0.036922	13.44252	14.97564	453.6935	384063.4	42.62221	658.5662
2882.917	69.4844	4051.156	0.225258	0.318889	0.092843	0.007926	14.888	0.16703	13.78408	16.73602	81.50508	65199.76	52.6593	836.6545
5179.392	60.72604	1547.174	0.142369	0.167933	0.081091	0.003272	14.9436	0.089867	15.18116	0.023718	165.6902	162517.3	97.34508	3960.611
5075.101	61.95688	2136.027	0.108955	0.152861	0.063346	0.001368	14.96786	0.081859	15.21359	0.025065	171.6117	174593.6	90.2239	2637.915
5016.873	63.88151	2756.519	0.119464	0.168998	0.065028	0.00065	14.95876	0.08817	15.21862	0.02193	208.7425	160435.4	108.8741	2527.73
3436.123	66.57606	3108.01	0.12087	0.175808	0.061777	0.001592	14.95723	0.091804	15.23012	0.022462	230.832	137274.9	104.4359	6130.338
2805.781	84.5141	5196.138	0.320128	1.050046	0.150305	0.017099	14.81261	0.541637	15.17361	0.016861	275.3884	192880	236.8443	37961.46
2048.082	228.0991	37991.75	0.686112	2.336353	1.126889	1.655494	14.54867	1.199965	14.59393	0.419868	324.0874	233411.3	351.8485	80461.04
1904.099	629.111	177173.4	0.946049	3.220969	2.280458	2.535636	14.36927	1.660306	13.66105	0.962385	122.891	50594.87	346.0986	42395.76
2087.322	99.00545	53762.75	0.119731	0.152813	0.125836	0.10464	14.95184	0.080012	14.49592	1.091228	391.2271	331100.1	29.70424	1110.648
3133.368	182.6427	122080.5	0.145827	0.137959	0.242812	0.250395	14.94723	0.071345	14.63613	0.379449	62.31021	28221.16	32.65119	529.9859
2139.706	305.4149	318057.5	0.099219	0.07944	0.495541	1.037559	14.97798	0.04195	14.86517	0.561216	86.04791	52044.8	42.2755	3191.134
1681.012	209.584	121218.7	0.055285	0.021088	0.32742	0.427807	15.00893	0.011746	15.04312	0.251396	115.3491	108523.2	20.29946	76.93676
3407.543	234.3895	129237	0.083868	0.080429	0.388596	0.48759	14.98749	0.043117	15.003	0.266064	132.1313	107171.2	20.974	106.5921
1391.415	121.6055	14036.05	0.10941	0.212704	0.143294	0.042151	14.96877	0.110536	15.16875	0.047744	143.6086	96875.89	32.60086	384.7093
2315.408	145.551	30001.17	0.202097	0.52242	0.147483	0.044073	14.90086	0.269629	15.18127	0.042891	179.1826	135251.4	64.99139	1240.369
4629.189	160.6663	31771.02	0.286656	0.940482	0.163767	0.053307	14.83834	0.485278	15.19426	0.029176	227.1904	187112.1	82.03202	1936.879
2055.191	82.5465	3233.286	0.845135	3.382509	0.0711	0.000238	14.43935	1.741548	15.3107	0.005141	189.2039	188536.4	108.3613	9240.032
1600.172	18.08869	290.0915	0.091221	0.148285	0.035277	0.001525	14.98159	0.077589	14.43972	0.225253	146.2905	139549.7	19.89324	145.401
1434.836	24.15215	205.0445	0.109309	0.060639	0.048184	0.003579	14.9731	0.032053	14.75675	0.051362	53.91419	20560.72	29.59254	281.806
2384.168	30.22454	457.3945	0.092433	0.067064	0.085968	0.00704	14.98257	0.035447	15.22919	0.005858	94.11247	80012.36	15.40225	93.72726
4915.206	33.38583	498.628	0.057354	0.047097	0.075613	0.003715	15.0084	0.02579	15.26426	0.006861	86.92412	68287.32	23.27652	220.8159
2033.522	40.10859	676.0195	0.058368	0.03703	0.104136	0.006201	15.0077	0.019717	15.26349	0.008071	86.2724	48641.69	28.59104	910.5159

rhc_ppm_v	shc_ppm_r	shc_ppm_\	rco_perc_n	rco_perc_v	sco_perc_r	sco_perc_\	rco2_perc_	rco2_perc_	sco2_perc_	sco2_perc_	rnx_ppm_n	rnx_ppm_v	snx_ppm_r	snx_ppm_var
2477.98	43.93557	840.7964	0.075067	0.101901	0.111811	0.012881	14.99435	0.053168	15.26108	0.009471	125.3624	87951.99	32.06734	1256.979
1012.285	58.7964	848.452	0.156	0.411308	0.15193	0.009589	14.93626	0.212103	15.25953	0.010334	127.8002	66603.45	63.46978	3526
730.1006	62.72525	738.5114	0.433139	1.498778	0.141558	0.007646	14.73531	0.773285	15.2462	0.009951	190.7457	64435.96	139.0159	16364.62
680.4774	147.459	15154.01	0.408822	1.249391	0.34565	0.155849	14.75247	0.644757	15.20004	0.001575	158.3507	207740.4	175.348	3312.44
1762.607	24.80634	238.8612	0.077435	0.178068	0.019572	0.000346	14.99406	0.09255	15.00641	0.093774	84.01058	58773.97	11.48259	17.47418
1339.736	16.45659	.	0.048526	0.051923	0.080318	.	15.01548	0.027248	14.2777	.	58.01029	34466	15.1799	.
6372.405	2428.229	10601495	0.17705	0.60593	2.208353	7.284976	14.89789	0.319839	11.67713	7.342191	739.395	785992.2	231.8667	13723.55
242436	2414.259	7495258	3.44	9.604104	2.424657	7.547319	12.5475	4.965479	12.00686	8.645916	455.7729	217754.4	539.6581	71029.55
89635.96	265.6904	.	2.152833	9.507478	0.346382	.	13.464	4.921913	14.28014	.	874.2912	581608.1	167.4666	.
327513.4	262.2626	.	1.667699	5.587622	0.556837	.	13.80144	2.88531	14.32071	.	1145.535	922550	177.1028	.
125828.2	272.9303	.	1.383971	4.690187	0.787881	.	14.00824	2.404531	14.39734	.	1190.769	1272299	241.7674	.
213347.5	286.9952	.	1.588803	5.285275	1.051183	.	13.85922	2.714605	14.34033	.	1200.675	1064347	305.3139	.
79046.67	492.949	.	1.539658	6.207756	2.988893	.	13.90354	3.190267	13.23418	.	1041.349	928370.9	307.1817	.
8777.458	887.3234	.	4.894286	18.30756	5.458742	.	11.51714	9.398924	11.78963	.	514.4829	503412.3	420.957	.
.	1185.85	.	4.8	.	5.9813	.	11.59	.	11.0779	.	522.27	.	413.1654	.
334167.3	1081.414	2050965	0.770526	1.529919	0.74352	1.683086	14.45184	0.789291	11.69817	10.23305	1048.088	723188.3	223.7683	50168.7
73744.07	911.9493	823479.9	1.217199	4.164211	0.795558	0.588789	14.15084	2.160965	12.91472	5.059985	522.6233	376819.4	404.966	47027.85
282181.1	666.7651	161868.2	0.743167	1.942706	0.729792	0.570895	14.47483	1.006517	14.09495	0.863381	961.636	1043963	612.4696	164180.6
101477.6	694.0735	222939.8	0.827963	2.984392	0.720848	0.508691	14.40957	1.539116	14.28204	0.568847	1122.828	1213539	722.0859	258357.6
114544.4	615.3492	166742.1	1.05108	3.751077	0.708081	0.67024	14.24633	1.923632	14.44725	0.552552	1218.462	1134239	799.2841	292999.5
93795.9	672.0111	227751	0.926039	2.991459	0.752861	0.88134	14.33525	1.536165	14.50951	0.535995	1292.231	1184877	954.2478	430337.5
15140.02	791.108	262028.1	1.268853	3.197293	1.253154	1.571816	14.09679	1.634949	14.2917	0.820258	1148.101	1086600	1097.308	353711.7
68964.73	1243.021	1122647	2.304561	5.077254	2.021266	4.623197	13.35018	2.582848	13.83216	1.917921	1145.935	980223.7	1189.123	368442.8
166209.4	1877.343	209020.6	3.383152	4.56245	2.997958	7.675415	12.59143	2.373623	12.66242	1.269066	690.9267	351573.5	1041.601	478064.7
8144.929	871.7503	2499229	0.661943	2.067138	0.403615	0.092164	14.53918	1.066583	13.03091	4.413242	970.069	626765.3	277.8996	55464.57
194672.3	917.4005	2551811	0.648263	1.099554	0.489882	0.081128	14.56397	0.586156	13.95115	1.24609	441.8329	382031.6	404.0627	67068.3
179599.2	983.0085	2292867	0.756895	2.410405	0.509094	0.099013	14.47492	1.249695	14.65438	0.157459	750.8731	621230.5	739.617	306069.6
116555.2	961.5166	2253008	0.642166	2.457412	0.510815	0.124476	14.55272	1.275073	14.66694	0.1693	930.6097	793129.9	848.3271	404090.3
141643	903.24	1863122	0.54021	1.383359	0.499487	0.10549	14.62236	0.724163	14.71151	0.119386	1043.492	905007.9	866.1591	470304.4
50945.41	877.7029	1936141	0.657517	1.934577	0.444852	0.080369	14.53879	0.998979	14.77227	0.125395	1051.095	921015.1	1019.029	496095.8
34636.17	995.653	1970662	1.036566	3.215788	0.48179	0.102387	14.26591	1.650781	14.75054	0.120766	1078.71	920001.2	1129.662	454499.1
24149.48	1347.008	2683388	1.518286	4.419165	1.027858	0.933884	13.92534	2.26501	14.41234	0.376673	928.06	595247.6	1320.969	421410.1
6844.646	3048.81	10398860	1.990222	4.829693	2.431541	3.679421	13.578	2.451407	13.259	2.635074	1174.581	974643.7	929.7697	391721.2

Kansas City PM Characterization Study

Final Report

Appendix X
Remote Sensing Data Second-by-Second
Round 2 Model Year
Vehicle Specific Power

Assessment and Standards Division
Office of Transportation and Air Quality
U.S. Environmental Protection Agency

Sponsors:

National Renewable Energy Laboratory, U.S. Department of Energy
Federal Highway Administration, U.S. Department of Transportation
STAPPA-ALAPCO Emission Inventory Improvement Program
Coordinating Research Council Inc. (Project No. E-69)

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United States
Environmental Protection
Agency

EPA420-R-08-009
April 2008

Part A: Overall RSD Results

mygrp	vsp_bin	r_n	s_n	tm_n_mea	rvsp_mean	rvsp_var	svsp_mea	svsp_var	rspeed_me	rspeed_var	sspeed_me	sspeed_va	rhc_ppm_n
81	0	1	21	373.1905	-1.527332	.	-4.715548	0.660976	23.13056	25.95821	20.11067	11.0935	1045.768
81	3	3	18	390.5556	1.283851	1.150296	0.699619	0.018132	22.13333	71.72143	12.27779	11.24258	1276.443
81	306	6	18	155.9444	4.899546	1.191585	4.503636	0.006318	20.68333	5.897227	30.07207	3.122031	1617.3
81	609	17	18	140.8333	7.710454	0.670514	7.429501	0.007346	21.87824	22.66485	33.98836	2.947428	1109.719
81	912	13	18	117.8333	10.47864	0.784022	10.49398	0.012538	23.54385	14.72211	39.0872	6.438454	828.04
81	1218	12	18	132.9444	14.46185	4.471173	14.36139	0.068194	25.96417	16.84839	44.62183	4.030871	368.1933
81	1824	7	18	33.16667	19.2379	2.026268	20.58043	0.076383	29.43143	9.923581	49.44821	6.82985	437.6286
1994	0	16	15	296.4667	-3.419584	13.37687	-5.407024	0.129418	23.89904	22.51983	20.88384	7.949563	310.9973
1994	3	15	11	389.7273	2.099845	0.983407	0.676438	0.002184	21.69933	12.81595	11.28779	0.741155	154.7573
1994	306	64	11	168.8182	4.633369	0.855014	4.491464	0.002372	21.34875	21.71075	29.76748	1.62445	279.3092
1994	609	135	11	157	7.514248	0.718354	7.445187	0.008587	21.52689	14.05484	34.21896	1.581776	242.5829
1994	912	237	11	128	10.53814	0.772852	10.49757	0.006588	24.05616	12.28016	38.63022	1.478115	346.3289
1994	1218	411	11	148.1818	14.62979	2.876267	14.35249	0.021721	26.1427	12.74685	44.90782	0.83921	165.8645
1994	1824	126	11	26.54545	20.18699	1.994978	20.26868	0.088637	29.305	10.36652	50.96035	13.65781	115.789
1994	2430	21	11	8.636364	25.51932	0.961244	26.48944	0.811991	31.62857	17.00513	47.75294	23.67096	95.15
1994	3099	3	9	3.444444	49.08816	816.1179	32.42509	2.577063	27.28667	12.20263	47.10354	60.90887	100.49
1995	0	20	26	324.0769	-2.547153	5.85995	-5.332924	0.069627	23.77744	30.12979	19.49411	21.09975	186.5995
1995	3	26	22	438.2727	1.766588	0.976773	0.646454	0.022126	21.67615	18.7866	10.44999	6.088345	215.9342
1995	306	59	21	169.9048	4.953424	0.740333	4.518793	0.004872	21.27915	20.8739	29.12104	4.07241	146.9708
1995	609	157	21	152.7143	7.62683	0.666336	7.448626	0.006387	22.37561	13.75159	34.20242	2.966303	135.5749
1995	912	284	21	124.2381	10.48709	0.806382	10.45986	0.00974	24.1044	13.73215	39.50619	3.793909	261.248
1995	1218	555	21	153.3333	14.58593	2.830265	14.45296	0.019272	26.32686	12.2346	44.78545	1.712168	142.8504
1995	1824	157	21	29.71429	20.27553	2.929895	20.24257	0.148717	28.72962	12.40991	50.27474	10.26915	153.5579
1995	2430	27	21	9	26.80193	4.87458	26.66891	0.303156	30.69296	10.46423	46.45029	11.11452	241.5426
1995	3099	9	20	3.15	37.7157	101.2295	32.28926	1.302869	31.95111	19.36556	43.41522	16.84519	189.5778
1996	0	24	10	361.9	-2.125355	2.690569	-5.313372	0.03161	23.63643	19.65725	19.70311	3.694019	299.3293
1996	3	28	9	390.2222	1.624016	0.711194	0.679262	0.001867	22.39893	31.27495	10.793	0.362754	115.0239
1996	306	68	9	161.1111	4.780002	0.631777	4.499233	0.005535	19.55368	26.37189	29.15559	2.685358	78.35647
1996	609	170	9	155.4444	7.671953	0.654507	7.460514	0.008851	22.23653	13.72843	33.58876	2.197348	110.1704
1996	912	266	9	124.2222	10.51947	0.772864	10.40491	0.005478	23.73342	12.62334	38.79568	1.571931	131.7648
1996	1218	543	9	153.8889	14.72521	2.642666	14.39302	0.031069	26.39908	11.39159	45.00997	1.261427	111.7719
1996	1824	181	9	32.66667	20.30365	2.806935	20.18747	0.192965	29.12757	13.28625	47.96061	7.55146	106.369
1996	2430	22	9	9.444444	26.68324	3.42488	26.77122	0.220743	30.26182	5.865073	51.8602	11.18925	465.4818
1996	3099	10	9	4.888889	1286.182	1218499	35.21851	14.78608	27.521	27.89959	47.29289	34.21006	140.869
1997	0	17	8	206.5	-1.812319	0.949416	-5.145516	0.059501	24.15343	33.48144	22.01514	10.25069	127.9529
1997	3	35	4	385.5	1.917083	0.756655	0.702444	0.000782	20.034	37.38364	11.69275	0.132246	140.31
1997	306	73	4	169.75	4.652673	0.732289	4.544449	0.007639	20.76973	29.29749	28.65658	0.231947	152.9792
1997	609	203	4	155.25	7.797892	0.697851	7.468226	0.014194	21.75537	18.52433	33.89918	1.863682	111.9017

Part A: Overall RSD Results

mygrp	vsp_bin	r_n	s_n	tm_n_mear	rvsp_mean	rvsp_var	svsp_mear	svsp_var	rspeed_me	rspeed_var	sspeed_me	sspeed_va	rhc_ppm_n
1997	912	358	4	125.75	10.56331	0.78569	10.43648	0.009809	23.60159	12.71235	38.69845	3.033839	81.92844
1997	1218	793	4	148	14.81011	2.849774	14.52298	0.065728	26.376	12.02259	45.04538	5.177349	109.443
1997	1824	237	4	25.75	20.04879	2.513527	19.91976	0.103859	29.13236	11.46656	50.56903	7.284962	87.03291
1997	2430	42	4	8.75	25.61566	1.853203	26.52751	0.400642	30.50548	7.408523	47.47034	16.10399	102.4652
1997	3099	14	4	2.25	52.71465	1352.228	34.30023	12.87631	31.28429	75.08056	47.88974	0.491881	606.3043
1998	0	31	18	351.7778	-2.260419	3.000616	-5.356153	0.057537	23.21739	30.19838	19.89821	4.255627	80.27087
1998	3	29	16	392.375	1.775817	0.581131	0.642912	0.001991	20.2769	30.09287	10.89413	0.704071	175.0852
1998	306	67	16	164.5625	4.863981	0.526962	4.501219	0.000985	21.15791	17.09529	28.74032	1.525988	178.5246
1998	609	255	16	151.875	7.752419	0.599443	7.476148	0.00419	21.82349	15.31893	32.78953	2.361738	68.11439
1998	912	406	16	127.5	10.57003	0.705345	10.45042	0.006588	24.03182	13.44989	38.08647	4.469098	116.0467
1998	1218	807	16	156.3125	14.7872	2.90652	14.42682	0.036852	26.27103	11.56921	45.47622	0.839512	73.06612
1998	1824	281	16	33.125	20.25872	2.800803	20.1584	0.157745	28.86206	10.75675	51.36148	8.867716	43.63441
1998	2430	39	16	9	26.11519	3.483072	26.73363	0.38495	31.49564	13.13146	48.78514	14.69765	41.27923
1998	3099	14	13	4.307692	47.27867	445.5303	33.1178	2.579933	32.72429	30.44575	43.1269	27.96766	243.5536
1999	0	24	10	233.3	-1.891631	3.737335	-5.328732	0.049855	23.30253	20.7993	20.47558	99.08977	81.99671
1999	3	33	8	482.75	1.703628	1.02576	0.582224	0.055688	19.85576	24.96446	11.426	45.40822	179.0461
1999	306	90	7	147.1429	4.755283	0.749588	4.416588	0.006643	21.52589	23.20012	30.20013	38.54234	88.38271
1999	609	230	7	131.7143	7.752986	0.716575	7.485516	0.016001	21.79652	18.64104	36.89394	65.27608	84.04697
1999	912	402	7	111.5714	10.64313	0.739819	10.51337	0.002486	23.59851	14.07349	39.86362	24.48344	60.22292
1999	1218	937	7	138.8571	14.81499	2.937359	14.43354	0.011561	26.34867	11.9313	45.60877	11.96125	71.06322
1999	1824	377	7	34.14286	20.15602	2.612208	20.23934	0.106741	28.95668	11.18992	52.45985	7.255908	67.48414
1999	2430	52	7	9.142857	26.20765	2.793701	26.61478	0.613034	31.04712	8.89975	41.91124	98.2762	71.85481
1999	3099	19	5	5.8	561.6014	1610489	33.81523	13.05847	33.23632	21.53028	45.05491	29.65827	62.87053
2000	0	30	10	311	-2.712952	13.77028	-5.419784	0.026004	24.48453	21.4286	17.60702	42.39711	47.76039
2000	3	37	9	505	1.848292	0.82859	0.588091	0.051143	20.51297	34.37732	9.543084	13.26232	109.2914
2000	306	103	8	171.625	4.84171	0.748017	4.518812	0.003589	19.95854	24.65797	29.21102	2.973004	104.4829
2000	609	277	8	148.125	7.681441	0.702038	7.427445	0.006735	22.18816	18.84901	33.75136	4.79109	59.39949
2000	912	435	8	129.875	10.58435	0.762198	10.49483	0.011169	23.8986	13.78597	39.15606	1.54017	78.2517
2000	1218	959	8	154.25	14.83074	2.781434	14.48695	0.020477	26.40575	12.24377	44.57966	0.4344	47.34372
2000	1824	385	8	34.5	20.13719	2.305939	20.47918	0.109316	28.91766	10.45947	51.42863	12.05087	35.45894
2000	2430	65	8	13.25	26.26594	2.704573	26.40138	0.388733	31.78862	13.86948	47.81146	19.11294	16.918
2000	3099	24	7	2	954.1808	1646756	31.63868	1.94287	30.5525	25.17289	46.6652	86.40442	137.2838
2001	0	28	13	338	-2.436174	6.77346	-5.419617	0.038261	24.73165	19.81184	20.2517	4.752798	25.17079
2001	3	38	11	391.2727	1.61845	0.663068	0.640255	0.001459	20.92079	45.70315	10.76145	1.502639	13.65658
2001	306	99	11	167.3636	4.794409	0.668832	4.513796	0.003816	21.20798	31.67237	29.53146	3.531637	46.22273
2001	609	227	11	157.8182	7.60776	0.828967	7.452596	0.003549	22.10286	15.52323	33.97293	0.916792	61.12573
2001	912	415	11	127.0909	10.59528	0.731955	10.48232	0.005803	23.68728	11.90746	38.74205	3.814095	38.21995
2001	1218	1042	11	150.9091	14.79126	2.865727	14.4325	0.012111	26.32647	11.14898	44.93513	1.916402	49.94402

Part A: Overall RSD Results

mygrp	vsp_bin	r_n	s_n	tm_n_mea	rvsp_mean	rvsp_var	svsp_mear	svsp_var	rspeed_me	rspeed_var	sspeed_me	sspeed_va	rhc_ppm_n
2001	1824	291	11	29.45455	20.0853	2.585912	20.48825	0.164577	29.14124	10.36936	50.44098	3.329231	10.89351
2001	2430	56	11	7.636364	25.92548	2.625161	26.4932	0.395208	31.09929	10.13732	46.42572	20.82969	38.68089
2001	3099	26	10	3.3	784.9174	1176164	33.7569	26.44271	28.73462	28.15391	46.66263	34.23824	158.0081
2002	0	13	9	316.5556	-2.626634	10.84118	-5.219978	0.196965	25.21479	24.55668	20.22195	8.26773	44.26581
2002	3	28	7	385	1.578083	0.620644	0.656805	0.003758	21.915	42.26519	11.30398	1.260919	76.57464
2002	306	72	7	162.7143	4.905316	0.754108	4.490593	0.007637	20.46889	21.76837	29.1411	2.225425	24.96722
2002	609	193	7	151.8571	7.694551	0.634803	7.479114	0.004332	22.3887	16.39439	34.08164	1.914648	75.59803
2002	912	277	7	134.1429	10.6143	0.73823	10.48978	0.014568	23.73437	12.50662	39.63049	2.017474	22.47996
2002	1218	764	7	151.7143	14.90854	2.806993	14.2434	0.031618	26.46576	11.54218	44.16501	2.090391	39.12393
2002	1824	304	7	29.28571	20.23838	2.660581	20.64523	0.102338	29.42911	10.20261	51.25837	2.503852	27.41658
2002	2430	50	7	10.14286	25.99596	2.808825	26.80453	0.596586	31.7374	9.233122	48.67632	30.74107	-5.401
2002	3099	30	5	3	1701.659	2225127	33.49085	10.50324	27.17267	35.97349	44.97213	119.1211	102.4957
2003	0	0	8	291.75	.	.	-5.256376	0.069251	25.51722	21.97342	20.38243	10.13288	20.7915
2004	0	0	3	390	.	.	-5.38275	0.060372	27.19895	19.64483	19.25844	0.098732	15.77444
2005	0	0	2	0	.	.	.	.	30.86	.	24.37063	0.017965	11.02
8182	3	3	3	347	1.175898	0.194991	0.740508	7.46E-05	18.63667	90.26243	11.06044	1.293153	1692.033
8182	306	4	3	165.6667	4.837035	1.319814	4.49925	0.008715	24.7225	9.170825	29.1763	0.882263	2356.99
8182	609	5	3	165.6667	7.053107	0.168899	7.486248	0.00209	22.132	8.60992	33.52201	0.279365	314.57
8182	912	9	3	133	10.36275	1.135696	10.55684	0.004379	24.36667	13.11985	41.6606	1.834926	289.64
8182	1218	11	3	147	14.89558	1.595557	14.16627	0.021637	25.76091	16.30871	44.14546	1.442148	538.0145
8182	1824	4	3	23.66667	20.75396	4.620804	20.52694	0.047427	26.3575	15.80243	48.28404	6.40737	106.45
8385	0	3	8	260.625	-1.092865	0.616366	-4.996263	0.147357	23.56077	130.5632	21.19037	9.831897	295.3815
8385	3	7	5	370	1.460336	0.975619	0.650162	0.00176	22.63857	6.931848	10.75431	1.11318	1695.93
8385	306	12	5	160.4	4.988299	0.646878	4.50672	0.014793	20.705	17.67134	28.16893	1.846787	452.605
8385	609	31	5	152	7.81559	0.705057	7.431364	0.003695	22.72935	13.96438	32.85448	1.088816	448.7171
8385	912	38	5	131.6	10.36533	0.802358	10.54358	0.014982	23.88947	8.869113	39.78868	0.809183	590.9213
8385	1218	48	5	161.4	14.26282	2.457395	14.2882	0.090449	26.78479	9.279532	45.60009	0.450753	264.1223
8385	1824	19	5	29.4	20.3445	2.920947	20.2838	0.182634	29.30579	18.60455	49.12155	6.819293	662.4168
8385	2430	6	5	9.2	26.41782	2.498523	25.80189	0.868555	31.08333	16.33295	50.55332	28.97926	324.0883
8385	3099	1	3	5	58.6695	.	33.29075	0.833669	37.77	.	43.91038	15.85633	648.93
8689	0	19	32	366.125	-2.235589	1.493885	-6.435223	52.04111	23.165	20.0505	19.92609	5.239747	952.0079
8689	3	20	28	373.9286	1.93278	0.72902	0.685933	0.013942	23.395	53.32522	10.84989	4.490038	849.655
8689	306	57	28	154.4643	4.625112	0.742747	4.526111	0.004382	20.14912	29.56994	29.2978	10.39931	490.4361
8689	609	126	28	142	7.633157	0.726063	7.437132	0.008397	22.76651	15.41485	33.43054	13.52535	400.089
8689	912	193	28	123.0714	10.58286	0.743651	10.50968	0.007158	24.40114	13.0383	38.48415	9.7987	466.6713
8689	1218	271	28	146	14.40888	2.775097	14.40847	0.043537	26.76779	10.0498	44.56068	9.55397	402.5314
8689	1824	67	28	32.75	20.18809	3.160933	20.37922	0.171605	28.59239	12.39212	49.65544	36.21896	365.2396
8689	2430	16	28	9.142857	26.25841	2.777365	26.48719	0.606237	31.19563	12.41951	46.35397	41.01401	324.8138

Part A: Overall RSD Results

mygrp	vsp_bin	r_n	s_n	tm_n_mea	rvsp_mean	rvsp_var	svsp_mea	svsp_var	rspeed_me	rspeed_va	sspeed_me	sspeed_va	rhc_ppm_n
8689	3099	5	21	29.2381	90.09284	9872.392	40.41934	1276.473	41.45	110.5418	47.8767	45.45667	468.122
9093	0	40	44	347.5	-2.166914	4.078052	-5.822161	15.10297	24.49405	22.67033	20.38648	6.251563	917.8663
9093	3	57	36	376.5	1.820344	0.811863	0.693149	0.002652	19.3107	47.83088	11.12019	1.141603	698.6342
9093	306	134	36	163.3056	4.779215	0.720214	4.484145	0.006919	21.31739	24.731	28.93587	3.470606	432.6163
9093	609	294	36	141.2222	7.744669	0.766223	7.454408	0.005683	22.3169	15.42174	33.95444	4.297017	253.5351
9093	912	485	36	125.8611	10.57465	0.736783	10.47829	0.007358	24.06452	12.74142	38.71065	2.219594	304.8019
9093	1218	915	36	148.3333	14.72651	2.801895	14.41274	0.041059	26.56356	11.56228	43.94968	5.919125	198.1138
9093	1824	243	36	28.27778	20.17843	2.522177	20.19045	0.1619	29.09346	11.30463	50.40444	24.83395	228.1288
9093	2430	42	35	10.62857	26.15999	2.171236	26.41523	0.440536	30.66667	12.33786	47.84308	22.24537	322.3993
9093	3099	20	26	20.15385	47.14563	551.5787	37.50195	626.028	29.656	25.60204	44.48812	26.95427	795.548

Part B: RSD vs. PEMS results for site 21

date	RSD Spee	Veh ID #	RSD HC (p	RSD CO (%	RSD CO2 (	RSD NOx (	RSD Accel	PEMS HC	PEMS CO	PEMS CO2	PEMS NOx	PEMS VI S	PEMS GPS
2/22/2005	25.2	729	14.94	0.26	14.85	230.16	1.71	262.66	0.04	13.01	903.74	24.6	23.1
								274.84	0.04	13.05	745.56	26.1	23.6
								286.07	0.04	13.07	1063.07	27.8	25.4
								295.76	0.03	13.08	1580.85	29.6	26.1
Avg	25.2		14.94	0.26	14.85	230.16		279.83	0.03	13.05	1073.3	27.03	24.55
Median	25.2		14.94	0.26	14.85	230.16		280.46	0.04	13.06	983.4	26.95	24.5
StdDev	N/A		N/A	N/A	N/A	N/A		14.29	0	0.03	362.34	2.16	1.43
N	1		1	1	1	1		4	4	4	4	4	4
2/22/2005	25.2	728	-32.31	0.07	14.96	1065.43	2.27	80.33	0.02	12.99	404.26		29.1
2/22/2005	29.6		-102.39	0.05	15.01	95.12		68.58	0.01	13.14	309.13		29.2
								65.81	0.01	13.17	306.62		29.2
								68.61	0.03	13.16	310.49		30
								136.71	0.02	12.72	850.42		21.5
								142.82	0.09	12.78	459.91		23.5
								157.23	0.11	12.86	592.01		25.7
								128.14	0.08	12.89	837.78		28
Avg			-67.35	0.06	14.99	580.28		106.03	0.05	12.96	508.83		27.03
Median			-67.35	0.06	14.99	580.28		104.23	0.03	12.94	432.09		28.55
StdDev			49.55	0.01	0.04	686.11		38.7	0.04	0.18	228.43		3.12
N			2	2	2	2		8	8	8	8		8

Part A: Overall RSD Results

mygrp	vsp_bin	r_n	s_n	tm_n_mear	rvsp_mean	rvsp_var	svsp_mear	svsp_var	rspeed_me	rspeed_var	sspeed_me	sspeed_va	rhc_ppm_n
2/23/2005	29.7	731	-25.32	0.16	14.9	894.32	1.09	112.37	0.23	12.98	856.19		26.6
2/23/2005	29.2		-60.06	0.49	14.68	506.28	-0.27	107.55	0.18	13.01	808.93		27.2
2/23/2005	29.2		-18.73	0.16	14.91	685.49	1.12	103.35	0.19	13.03	759.53		28.6
								100.39	0.22	13.03	853.8		29.7
Avg			-34.7	0.27	14.83	695.36		105.92	0.21	13.01	819.61		28.03
Median			-25.32	0.16	14.9	685.49		105.45	0.21	13.02	831.36		27.9
StdDev			22.21	0.19	0.13	194.21		5.21	0.02	0.02	45.57		1.4
N			3	3	3	3		4	4	4	4		4
2/24/2005	31.1	737	123.1	1.02	14.29	496.48	0.81	863.66	1.24	12.2	270.49		30.2
								1120.88	3.33	11.14	246.13		30
								1427.21	6.09	9.48	128.84		29.9
								1662.31	7.41	8.39	136.4		30.2
Avg			123.1	1.02	14.29	496.48		1268.51	4.52	10.3	195.46		30.08
Median			123.1	1.02	14.29	496.48		1274.04	4.71	10.31	191.26		30.1
StdDev			N/A	N/A	N/A	N/A		349.27	2.77	1.7	73.31		0.15
N			1	1	1	1		4	4	4	4		4
2/25/2005	33.2	747	-16.25	0.3	14.8	1083.18	1.4	187.93	0.12	13.07	600.58	N/A	30.6
2/25/2005	30		5.54	0.13	14.91	1109.65	0.66	179.87	0.17	13.07	1198.47	N/A	31.2
2/25/2005	20.1		-45.95	0.12	14.96	109.56	3.09	172.03	0.13	13.09	1116.21	N/A	32.1
2/25/2005	29.9		-61	0.13	14.95	141.28	1.28	164.96	0.1	13.11	955.87	N/A	33.7
Avg			-29.42	0.17	14.91	610.92		176.2	0.13	13.09	967.78		31.9
Median			-31.1	0.13	14.93	612.23		175.95	0.12	13.08	1036.04		31.65
StdDev			29.81	0.09	0.07	560.86		9.91	0.03	0.02	264.72		1.35
N			4	4	4	4		4	4	4	4		4
2/25/2005	31.5	744	15.84	0.19	14.91	5.26	0.74	32.73	0.12	9.37	50.23	29.9	28.6
2/25/2005	36.4		-61.53	0.18	14.91	264.73	1.17	32.77	0.09	9.37	73.71	30.6	29.6
2/25/2005	36.9		-28.48	1.96	13.64	9.92	3.49	30.03	0.08	9.37	81.64	31.3	30.6
2/25/2005	33.8		-48.1	0.1	14.97	94.76	1.38	34.95	0.12	9.36	104.42	32.4	31.4
Avg			-30.57	0.61	14.61	93.67		32.62	0.1	9.37	77.5	31.05	30.05
Median			-38.29	0.19	14.91	52.34		32.75	0.11	9.37	77.68	30.95	30.1
StdDev			33.78	0.9	0.65	121.23		2.02	0.02	0.01	22.36	1.07	1.22

Part A: Overall RSD Results

mygrp	vsp_bin	r_n	s_n	tm_n_mear	rvsp_mean	rvsp_var	svsp_mear	svsp_var	rspeed_me	rspeed_var	sspeed_me	sspeed_va	rhc_ppm_n
N			4	4	4	4		4	4	4	4	4	4

rhc_ppm_v	shc_ppm_r	shc_ppm_\	rco_perc_n	rco_perc_v	sco_perc_r	sco_perc_\	rco2_perc_	rco2_perc_	sco2_perc_	sco2_perc_	rnx_ppm_n	rnx_ppm_v	snx_ppm_r	snx_ppm_var
7283726	5555.87	49946258	1.839058	7.891367	2.391323	4.536237	13.655	4.219466	10.74709	9.103693	1140.118	1261749	191.4523	27193.52
2197741	5171.675	54303523	3.463333	17.53083	2.243822	3.441938	12.49333	8.728133	10.6279	8.750008	868.9267	683249	250.1131	39708.74
4204069	5234.507	82938615	0.898333	3.248137	1.742685	2.359434	14.31333	1.829867	12.32137	3.978808	1247.363	466891.2	524.3462	220325.6
6984190	5119.979	82071230	1.460847	11.82009	1.63853	2.422388	13.90647	6.368699	12.54408	3.107217	1658.53	2155935	649.0622	290019.3
1347002	4853.419	65268995	0.726923	0.726673	1.713821	2.535983	14.42231	0.366019	12.66957	2.256094	2173.779	821669.6	754.0951	414939.2
304106.9	4560.337	58670336	1.482725	2.622561	1.803886	2.515354	13.93333	1.37977	12.78451	1.809119	1101.057	551247.1	857.549	469391.1
655116.2	5002.08	61204979	2.165714	9.109395	2.867449	2.376683	13.44857	4.736714	12.43072	1.244675	845.8471	1139817	808.2133	281535.4
787936.8	826.2264	1869473	0.554517	1.257845	0.446094	0.228682	14.61058	0.686296	13.79199	0.845235	769.9731	649498.1	141.554	19129.16
52237.23	668.2447	895659.4	0.646	0.534569	0.348928	0.111291	14.56267	0.271935	13.79795	0.685766	401.8673	198323.9	133.3387	8314.517
894086.5	462.4377	523347.6	0.546286	1.000659	0.289519	0.086395	14.62359	0.541963	14.54799	0.187508	608.6134	338529.1	223.1831	38935.17
343402.8	451.3313	506736.6	0.507051	0.804449	0.284844	0.079281	14.64289	0.429734	14.66273	0.16334	893.7001	764600.1	230.9459	39001.88
2058244	428.9406	488630.6	0.56634	1.91304	0.262551	0.088898	14.59211	1.026401	14.73567	0.161378	1022.265	822872.7	248.3221	36470.5
234434.8	407.3392	424990.5	0.469779	0.678375	0.209256	0.050761	14.66908	0.358921	14.79985	0.143407	963.8967	888372.3	299.6578	48690.51
41569.47	369.6176	354466.1	0.640162	1.378643	0.203086	0.046641	14.54254	0.70995	14.82974	0.135244	1130.705	1245631	443.1574	78357.21
25013.54	419.8439	399147.2	1.558095	4.357056	0.518343	0.743075	13.89381	2.245655	14.66055	0.428045	863.9271	383100	586.3059	107252.6
6970.867	591.6584	570231.4	0.236667	0.046433	1.131225	3.750141	14.81667	0.010233	14.20146	1.903673	1676.337	2320328	645.3544	125200.2
144321.6	290.3509	164854.7	0.377593	0.530753	0.193897	0.027009	14.73302	0.280964	13.70809	2.853634	1007.448	1294197	125.5153	33537.47
123408.4	396.3049	260331.2	0.690331	0.735208	0.301365	0.097912	14.52462	0.389298	13.99968	1.140714	572.6708	389718.6	117.8901	4149.065
45808.47	240.1711	58832.46	0.508417	1.110101	0.218564	0.014335	14.65085	0.570732	14.50393	0.78816	702.8297	410186.3	187.2954	7995.069
82224.6	222.9722	33727.2	0.478925	1.017079	0.196305	0.011839	14.6658	0.529348	14.58035	0.605957	890.3486	730591	198.8145	10885.71
3601233	219.4416	39747.8	0.385563	0.778806	0.171564	0.007541	14.73268	0.430553	14.64686	0.490386	802.9688	801432.3	232.5092	18568.22
135708.7	211.6507	9445.674	0.475979	0.83644	0.170481	0.008211	14.66503	0.438943	14.69259	0.380611	991.8504	798637.2	275.2778	28340.58
100642.4	272.8842	14857.75	0.798143	2.145648	0.280188	0.052454	14.43121	1.105086	14.65685	0.294837	1064.389	1003371	389.3107	30891.44
215084.5	482.7672	183089.1	1.167722	2.75887	0.68246	0.684351	14.16889	1.424687	14.45074	0.319348	943.3833	666857.4	600.5211	73263.17
21436.57	526.3867	197342.8	2.191111	4.539236	0.869549	1.12099	13.42	2.33385	14.33677	0.448283	1393.021	751229.4	619.9098	110031.8
451357.4	147.485	21546.47	0.847857	1.172768	0.10428	0.007495	14.39881	0.613591	11.67943	19.20763	810.3279	899254.1	62.31416	1527.825
43473.31	244.0849	50366.89	0.598243	1.284719	0.167155	0.021475	14.6025	0.671242	11.76706	17.28828	289.8704	219996.1	73.77175	2027.756
41429.69	194.5792	41355.37	0.225478	0.120889	0.192808	0.041126	14.86397	0.069194	12.42749	19.17712	487.2022	454907.5	116.0459	5184.93
116108.1	200.1409	37328.69	0.301597	0.232091	0.186318	0.04299	14.80524	0.126167	12.52805	18.89392	587.2423	507601.5	146.8399	12096.99
135709.3	213.0161	38754.38	0.291659	0.602834	0.198582	0.047321	14.80883	0.319178	12.79588	15.16621	664.17	646248.6	170.1779	20150.6
127011.8	243.3745	40582.32	0.349678	0.436316	0.224331	0.056817	14.76464	0.232059	12.90544	13.77469	751.3129	596377.9	218.5758	36079.34
66828.89	297.4688	59961.93	0.398509	0.685999	0.339659	0.123589	14.72685	0.357146	12.3413	20.38556	828.2862	657949.2	302.4322	81470.66
1460951	458.5838	218403.7	1.549032	4.274762	0.67917	0.579375	13.89409	2.182082	11.75724	28.70347	790.7623	706097.6	369.8777	124426.8
82260.77	922.7967	2112884	1.11503	2.889019	1.410372	2.969568	14.216	1.478071	10.92299	30.84107	699.798	523416.5	383.3766	166982.8
193058.4	208.2874	69223.16	0.428571	0.314113	0.167393	0.014064	14.70771	0.156165	13.91386	0.7891	732.828	1021962	124.6595	15451.45
116876.8	149.6348	3896.443	0.839389	4.625579	0.169807	0.0001	14.42657	2.4048	13.94759	0.559005	387.07	238004.1	92.36469	2947.275
226732.9	86.04334	263.6942	0.315216	0.272532	0.176065	0.001706	14.79822	0.144248	14.67647	0.04188	481.3256	426768	166.8733	16566.06
70237.59	81.58495	174.2338	0.282069	0.456142	0.18259	0.003507	14.82069	0.239325	14.74892	0.024431	538.0645	377679.3	188.5726	24478.2

rhc_ppm_v	shc_ppm_r	shc_ppm_v	rco_perc_n	rco_perc_v	sco_perc_r	sco_perc_v	rco2_perc_	rco2_perc_	sco2_perc_	sco2_perc_	rnx_ppm_n	rnx_ppm_v	snx_ppm_r	snx_ppm_var
73428.31	87.12024	314.3343	0.199959	0.091279	0.179323	0.007386	14.87793	0.051013	14.79508	0.013953	612.309	532481.5	236.1516	28092.57
184229.9	93.94795	324.8639	0.244499	0.264672	0.163746	0.006653	14.8432	0.143747	14.85118	0.005231	669.2073	550633.5	277.9089	38298.07
67780.55	108.791	501.0012	0.333161	0.544301	0.246473	0.010578	14.77688	0.285713	14.80451	0.006283	763.5222	754332.3	317.2115	33384.28
25771.56	250.6537	19255.67	1.279574	3.428117	1.00191	0.315923	14.10286	1.771367	14.40794	0.103466	609.8498	289084.7	497.9748	57426.11
705193.4	425.6928	64840.21	1.070371	2.658599	2.051258	1.017874	14.22357	1.333425	13.70846	0.484405	1004.983	517795.2	535.325	45990.86
25405.48	118.0453	10254.66	0.321328	0.15316	0.114285	0.009816	14.79804	0.085727	13.94021	0.573419	439.0033	464855.9	88.28426	3808.351
426290.2	169.5279	14563.21	0.196507	0.117471	0.16654	0.009751	14.89517	0.063369	14.19853	0.232794	108.7807	22458.05	127.6472	10800.1
641758.9	128.5417	17574.47	0.218615	0.161025	0.171965	0.020548	14.87239	0.09007	14.72349	0.038929	325.4504	331509.4	204.0269	31370.8
90553.72	131.6319	16110.42	0.168034	0.048375	0.175817	0.023275	14.91055	0.028683	14.78318	0.037354	358.3296	270485.5	237.3147	38322.64
488231.8	141.734	14406.71	0.242731	0.698487	0.19367	0.031648	14.85283	0.37062	14.827	0.024404	444.6568	419721.5	293.5784	48695.69
71742	165.3147	17198.39	0.237594	0.311327	0.226931	0.044443	14.85439	0.163855	14.83844	0.024898	527.3235	513398.4	379.5934	70372.79
42467.71	237.429	52091.21	0.302558	0.459342	0.426392	0.220837	14.80712	0.240882	14.73496	0.083176	573.7037	511400.8	500.2965	92758.17
24533.82	353.2132	189293.7	0.588518	0.854435	0.967706	1.596786	14.60641	0.449003	14.44198	0.517935	449.279	245014.1	715.5789	239911.4
125410.6	655.6165	561214.1	1.939936	4.341237	1.436866	3.081112	13.62929	2.245038	14.06164	1.198172	530.7736	390139.7	655.4761	261434.2
36588.31	150.5849	7868.115	0.255491	0.437808	0.121305	0.010868	14.8362	0.225703	13.74673	4.342399	686.5977	436228.3	86.48599	8327.473
201526.9	175.8503	2819.135	0.228409	0.319145	0.183469	0.013057	14.87242	0.165025	14.19223	0.398353	140.9642	72915.62	77.056	4059.516
127774.4	123.5481	4021.411	0.189524	0.149491	0.157802	0.024286	14.896	0.08557	14.8175	0.008173	328.7012	359498.7	182.6936	18456.61
111240.7	115.0092	2462.771	0.186301	0.23927	0.157094	0.025132	14.89957	0.12872	14.86401	0.008521	294.6772	226886.9	187.1124	13054.84
55872.78	125.4581	3562.235	0.16151	0.201312	0.157956	0.025773	14.9149	0.106762	14.88148	0.00948	370.7655	295323.5	216.0469	24637.51
94167.15	141.8165	3631.735	0.191512	0.232538	0.155149	0.024937	14.89239	0.123917	14.91046	0.009916	393.3002	299217.6	211.7683	16644.84
122270.3	149.4797	5394.053	0.245732	0.34495	0.199313	0.043609	14.85042	0.181642	14.90363	0.012172	487.7666	421592.2	295.9898	47500.79
34538.16	237.5779	44058.75	0.472512	0.65111	0.356459	0.168367	14.68308	0.34123	14.79815	0.05123	623.1927	251241.9	425.465	101609.2
26277.16	144.3597	8445.658	0.831579	1.55827	0.204717	0.045588	14.42526	0.807915	14.84507	0.015687	642.4989	367866.9	374.3075	60793.41
52060.89	108.4899	7592.782	0.140315	0.090842	0.058793	0.006708	14.92617	0.048676	13.65077	6.16222	500.9305	509473.2	45.52812	969.08
154866.7	150.198	23286.12	0.133954	0.041884	0.093711	0.005625	14.94216	0.022217	14.26491	0.046888	140.6024	119057.8	62.40468	1317.78
162334.1	131.2766	14278.41	0.112549	0.034532	0.08258	0.008294	14.95932	0.019244	14.85297	0.012902	93.32029	72076.77	97.99902	3542.252
72814.99	138.3667	14558.08	0.13466	0.05882	0.075603	0.003615	14.94159	0.031737	14.90966	0.010547	182.4235	126950.5	100.6018	3890.445
105655.7	162.716	23285.31	0.159855	0.252711	0.079796	0.003092	14.91894	0.132326	14.92308	0.009953	283.4733	380809.8	127.6448	4288.503
46957.94	182.3124	30770.42	0.141153	0.197674	0.084533	0.003385	14.93325	0.103698	14.94391	0.01141	284.0552	243695.1	139.3059	4190.589
34074.96	173.3086	23991.83	0.220298	0.574327	0.114952	0.005405	14.8761	0.298792	14.94101	0.009895	301.1733	132219.3	200.2187	4787.765
6322.379	170.4296	17702.2	0.562951	1.311755	0.128329	0.008151	14.62354	0.675954	14.92097	0.012607	518.728	487661.6	265.7017	14582.82
63623.75	190.3797	20372.97	0.745596	1.055574	0.170707	0.048537	14.48792	0.548287	14.89019	0.024676	510.7971	487377.5	349.2255	43701.95
13652.9	44.68462	827.9054	0.115654	0.04469	0.04304	0.001151	14.945	0.02434	13.81393	5.913064	478.8556	388136.3	31.15883	380.6652
9405.71	69.69483	4427.797	0.134884	0.109999	0.053747	0.003799	14.94605	0.056938	13.79898	5.672813	105.6821	60356.31	43.1192	657.6221
111328.4	54.42042	1558.242	0.117725	0.093191	0.05495	0.003266	14.95758	0.048984	14.16564	5.889203	111.0395	89640.95	65.77934	2017.7
162137.7	58.09659	1803.449	0.071922	0.016402	0.053917	0.00169	14.98885	0.010849	14.13301	7.047381	117.1325	119802.6	65.22565	2580.187
43359.53	72.97186	3155.541	0.085679	0.022933	0.055079	0.001276	14.97793	0.013273	14.33755	4.079129	168.6588	118505.6	62.82561	2070.9
110271.3	94.42055	5803.281	0.110062	0.088185	0.082005	0.004435	14.95968	0.046803	14.33568	4.062811	178.6627	112340.8	75.13318	3456.944

rhc_ppm_v	shc_ppm_r	shc_ppm_v	rco_perc_n	rco_perc_v	sco_perc_r	sco_perc_v	rco2_perc_	rco2_perc_	sco2_perc_	sco2_perc_	rnx_ppm_n	rnx_ppm_v	snx_ppm_r	snx_ppm_var
15742.9	92.91373	4869.528	0.157401	0.187146	0.168502	0.03674	14.92526	0.096762	14.25296	4.555373	212.5176	100889.9	128.7165	13641.73
26408.42	105.0475	8589.376	0.351059	0.81178	0.2497	0.091345	14.78643	0.419318	14.18538	4.635861	203.245	141918.7	255.7597	35970.19
194780.8	137.2847	39442.22	0.89795	3.584806	0.542482	1.169433	14.38846	1.857918	13.93345	5.333494	251.7342	287797.9	270.1137	100374.5
74413.86	530.2909	2196807	0.102246	0.159886	0.31957	0.667659	14.96389	0.084197	13.8535	3.329044	218.8782	264855.7	27.02559	148.9192
102727.6	531.2707	1463934	0.098379	0.025536	0.378064	0.62144	14.9725	0.013797	13.71798	3.458203	47.25357	71408.97	44.71364	1161.286
37521.99	609.7768	2253843	0.186676	0.61683	0.578868	1.777998	14.90778	0.325781	14.34591	1.922052	127.6456	99091.59	66.7723	2757.22
130215.5	617.5695	2339887	0.067918	0.023844	0.580986	2.012838	14.99181	0.012884	14.45147	1.640774	111.6163	141526.7	90.29875	8793.382
25525.47	555.85	1814706	0.06506	0.019847	0.712178	3.116372	14.99466	0.011096	14.48456	1.577566	127.7314	75039.5	94.54752	6499.88
51182.25	473.5649	1256927	0.097606	0.126229	0.632653	2.493142	14.96987	0.066023	14.58926	1.129797	144.602	78321.53	107.4667	21413.74
46841.88	374.9978	691609.9	0.153966	0.204233	0.462823	1.196481	14.92766	0.105312	14.71027	0.615716	187.3581	117147.2	218.6738	129741.9
1262.507	343.4598	572201.8	0.403736	0.909139	0.472787	1.241093	14.7504	0.465392	14.7129	0.588048	176.6376	82236.95	256.623	104462.5
89396.43	408.4758	662691.7	0.20243	0.283283	0.620865	1.447578	14.89	0.146359	14.56109	0.751263	205.7547	438496.4	368.309	189008.1
28305.81	19.76221	139.2798	0.083428	0.087179	0.015565	0.000404	14.98246	0.045718	14.22241	0.190524	109.426	103371.7	42.2583	173.9754
23959.92	9.086707	62.15024	0.078328	0.031042	0.008156	1.35E-06	14.98611	0.016625	14.82191	0.032735	111.4195	129250	4.132698	21.78658
.	35.197	55.72351	0.03	.	0.045457	0.000841	15.02	.	14.7203	0.011172	37.18	.	7.687626	4.608685
1328437	14865.24	3.77E+08	1.443333	5.258533	3.150022	8.298869	13.90333	2.747233	9.255489	2.943238	1545.45	1194628	159.3922	14376.51
11490853	14808.42	4.78E+08	1.498875	3.033572	2.777558	9.802837	13.8325	1.502825	9.881828	3.347081	1948.775	4154453	208.8383	20886.16
63556.15	14617.16	4.68E+08	0.644	0.31573	2.685632	6.97857	14.5	0.1555	10.50917	3.633986	2071.498	3846027	297.0593	76464.08
39192.43	14780.25	5.1E+08	2.363333	5.19525	2.478305	8.850819	13.29667	2.59565	11.01839	6.014845	1239.251	1294362	389.4155	150531.5
211757	14749.7	5.01E+08	2.376364	5.097605	2.713272	9.280945	13.27455	2.590947	11.17651	7.563043	1452.465	1102614	461.5929	227702.1
46676.3	14919.71	4.96E+08	1.213125	5.019139	3.563859	10.84797	14.1375	2.675825	10.96455	10.67424	1061.858	1596600	541.5522	324824.3
71303.83	1121.489	2357228	1.312308	10.63657	0.92421	2.141343	14.07308	5.459523	11.9259	4.104156	634.5015	269273.9	181.8608	8601.243
6255235	421.9223	62687.43	1.608571	1.422914	0.183255	0.01884	13.82714	0.830224	12.3587	3.976824	411.6443	341416.8	254.1945	13698.54
289015	438.2132	132000.7	1.595	13.73665	0.226957	0.027034	13.8525	7.103657	13.12036	1.695042	981.0367	671048.6	459.8259	111729.6
167320.9	429.1634	91485.94	1.747742	5.801785	0.279106	0.044643	13.72677	2.959969	13.39749	1.075932	1445.791	1724610	582.0027	239547.3
1029775	529.9631	163662.4	2.222105	8.858044	0.373746	0.085544	13.37579	4.477425	13.63396	0.723915	1654.693	2565435	660.4044	301432.8
99982.89	701.147	260422	1.108306	3.307203	0.536742	0.128759	14.18271	1.69182	13.87639	0.430689	1659.85	2102648	752.1598	337076.2
2018296	1249.35	805055.9	2.323684	7.513791	1.658012	0.93953	13.30684	3.830678	13.53969	0.070231	1483.968	1694915	714.4257	158059.8
83190.43	1773.386	969652.7	1.461667	2.758777	3.280271	4.868963	13.915	1.31527	12.7941	0.96516	2103.553	3533945	602.318	90530.53
.	5699.745	31689893	7.41	.	3.250847	6.821629	9.7	.	12.0674	3.882956	459.99	.	830.3023	22973.02
2150039	1620.269	4667752	1.716779	5.323246	0.818773	2.131669	13.74625	2.749633	12.27881	3.036387	1135.46	1179049	202.5505	25853.06
6813215	1555.593	3003756	1.352	2.389501	0.853356	2.115738	14.027	1.233643	12.08629	5.105096	681.181	325771.4	270.3795	18942.58
888879.4	1376.729	2557044	0.698691	1.55904	0.983861	2.475973	14.4907	0.825892	13.12812	2.283175	1098.877	1144675	556.2049	65521.03
1326736	1360.272	2329778	0.914733	3.8949	1.031896	2.921856	14.32754	2.030369	13.26413	2.443474	1406.145	1555205	650.59	85313.12
1208488	1325.488	1873602	1.113285	3.285219	1.134075	3.129881	14.18466	1.683675	13.40986	2.132798	1359.107	1332345	752.2322	123218
1971809	1355.442	1666708	1.246483	4.057381	1.255008	3.30073	14.08723	2.117847	13.50529	1.944375	1467.105	1490086	869.407	184102.4
644385.7	1544.129	1911584	1.27483	3.559086	1.851903	4.841897	14.06	1.836442	13.1655	2.610531	1685.258	1413768	949.7464	328329.4
256376.3	1731.207	2452264	1.635813	4.870009	2.546586	5.64658	13.82375	2.521185	12.74327	3.450002	1067.599	746942.2	900.3043	371103.3

rhc_ppm_v	shc_ppm_r	shc_ppm_\	rco_perc_n	rco_perc_v	sco_perc_r	sco_perc_\	rco2_perc_	rco2_perc_	sco2_perc_	sco2_perc_	rnx_ppm_n	rnx_ppm_v	snx_ppm_r	snx_ppm_var
59738.4	2904.947	10330125	3.872	11.39777	3.441082	7.246123	12.198	5.69747	12.06341	3.814633	1582.424	1819894	850.4385	392746.1
18617446	977.0111	2444207	0.979899	1.846837	0.730035	1.799902	14.28139	1.041053	13.27044	2.782544	947.1775	1217901	206.0274	41113.11
2215789	772.4141	494655.6	1.305425	6.325433	0.535912	0.258867	14.07158	3.377417	13.46458	1.913943	477.2744	292096.1	236.4489	25188.38
680893.8	517.0442	281543.1	0.91734	3.217151	0.423394	0.182023	14.33903	1.65888	14.18016	0.886518	996.7759	1024647	486.1789	99459.62
332798.1	503.0699	296612.4	0.649967	1.780939	0.404537	0.209578	14.53167	0.925383	14.31817	0.677458	1127.28	1056013	573.2175	127309.3
776720.6	491.1243	301267.6	0.662644	2.01674	0.414958	0.233337	14.51769	1.058388	14.40214	0.549094	1221.722	1204777	613.67	122007.3
222725.1	507.6322	281721.8	0.658977	1.319309	0.437986	0.310669	14.52049	0.684553	14.46468	0.449606	1301.963	1180028	677.5437	133061.9
128499.6	577.634	301538.2	1.148498	3.029501	0.716966	1.320981	14.16786	1.560006	14.36821	0.667808	1319.55	1084413	785.5241	138859.7
266047.2	624.2346	308128.4	2.317381	6.041805	1.056221	1.888012	13.33524	3.093987	14.19321	0.851521	1078.538	770544.6	915.7403	210989.3
2222407	839.9128	379593.6	3.719	11.87191	1.661682	2.920355	12.301	6.064294	13.76658	1.041569	1532.178	931347.8	907.9068	211137.6

PEMS Latit	PEMS Longitude (deg)
39.10017	-94.73025
39.10011	-94.73034
39.10005	-94.73044
39.09999	-94.73057

39.10018	-94.73024
39.1001	-94.73034
39.10003	-94.73047
39.09997	-94.73061
39.10016	-94.73021
39.1001	-94.7303
39.10004	-94.7304
39.09998	-94.73053

rhc_ppm_v	shc_ppm_r	shc_ppm_\	rco_perc_n	rco_perc_v	sco_perc_r	sco_perc_\	rco2_perc_	rco2_perc_	sco2_perc_	sco2_perc_	rnx_ppm_n	rnx_ppm_v	snx_ppm_r	snx_ppm_var
39.10018	-94.73022													
39.1001	-94.73033													
39.10003	-94.73045													
39.09997	-94.73059													
39.10017	-94.73026													
39.10009	-94.73037													
39.10002	-94.7305													
39.09997	-94.73064													
39.10022	-94.73022													
39.10012	-94.73032													
39.10004	-94.73046													
39.09997	-94.73062													
39.10022	-94.73023													
39.10013	-94.73034													
39.10005	-94.73047													
39.09999	-94.73062													

rhc_ppm_v	shc_ppm_r	shc_ppm_\	rco_perc_n	rco_perc_v	sco_perc_r	sco_perc_\	rco2_perc_	rco2_perc_	sco2_perc_	sco2_perc_	rnx_ppm_n	rnx_ppm_v	snx_ppm_r	snx_ppm_var

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Appendix Y
Kansas City Remote Sensing Data Sites

Assessment and Standards Division
Office of Transportation and Air Quality
U.S. Environmental Protection Agency

Sponsors:

National Renewable Energy Laboratory, U.S. Department of Energy
Federal Highway Administration, U.S. Department of Transportation
STAPPA-ALAPCO Emission Inventory Improvement Program
Coordinating Research Council Inc. (Project No. E-69)

Prepared for EPA by
Eastern Research Group, Incorporated
Austin, TX

Bevilacqua-Knight Incorporated
Oakland, CA

NuStats LLC
Austin, TX

Desert Research Institute
Reno, NV

EPA Contract No. GS 10F-0036K

October 27,2006
Revised April 2008 by EPA staff

United States
Environmental Protection
Agency

EPA420-R-08-009
April 2008

Site ID	Site Code	State	Description	County	Slope	Zip Code	Latitude	Longitude
001	KSJAC001	KS	Hwy 69 (South 18th Street expressway) onto I-35 S	JACKSON	-1.5	66103	39.04775	-94.64824
002	KSJOH002	KS	Johnson Drive onto I-35 S	JOHNSON	2.5	66203	39.02178	-94.69228
003	KSJOH003	KS	Roe Avenue onto I-435 W (near 77A &B)	JOHNSON	0.9	66211	38.93275	-94.64227
004	MOJAC004	MO	Front St. onto I-435 S	JACKSON	1.5	64120	39.129	-94.49937
005	MOJAC005	MO	Front St. onto I-435 N	JACKSON	0.5	64120	39.13092	-94.4984
006	MOJAC006	MO	Holmes onto I-435 W	JACKSON	0.7	64131	38.94102	-94.58374
007	MOJAC007	MO	Rte. W (Bannister Rd.) onto 71 N	JACKSON	-1.2	64137	38.95425	-94.53973
008	MOJAC008	MO	Rte. W (Bannister Rd.) onto 71 S	JACKSON	2.1	64137	38.95302	-94.54038
009	KSJOH009	KS	95th onto I-69 S	JOHNSON	-4.2	66214	38.95605	-94.70849
010	KSWYA010	KS	Steele Rd. onto 69 S	WYANDOTTE		66106	39.0615	-94.6474
011		MO	Eastwood onto I-435 N		2.1	64129	39.03206	-94.49979
012		MO	Eastwood onto I-435 S		2.1	64129	39.03016	-94.50106
013		MO	Rte. 24 onto I-435 N		0.2			
014		MO	Rte. 24 onto I-435 S		2.5			
015		MO	Wornall onto I-435 W		1.6			
016		KS	67th Street onto I-35 N		2.6	66203	39.00836	-94.69346
017	MOJAC017	MO	87th St. onto I-435 S	JACKSON	1.4	64138	38.96683	-94.52071
018		MO	12th/Truman Road onto I-435 N		0.7	64126	39.09351	-94.48721
019		MO	12th/Truman Road onto I-435 S		0.1	64126	39.09203	-94.48799
020		MO	Metcalf onto I-435 W		3.3			
021		KS	Northbound 65th onto Westbound Turner Diagonal (132) W				39.099966 to 39.100382	-94.731105 to -94.730204

Kansas City PM Characterization Study
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Appendix Z
Data Map

Assessment and Standards Division
Office of Transportation and Air Quality
U.S. Environmental Protection Agency

Sponsors:

National Renewable Energy Laboratory, U.S. Department of Energy
Federal Highway Administration, U.S. Department of Transportation
STAPPA-ALAPCO Emission Inventory Improvement Program
Coordinating Research Council Inc. (Project No. E-69)

Prepared for EPA by
Eastern Research Group, Incorporated
Austin, TX

Bevilacqua-Knight Incorporated
Oakland, CA

NuStats LLC
Austin, TX

Desert Research Institute
Reno, NV

EPA Contract No. GS 10F-0036K

October 27,2006
Revised April 2008 by EPA staff

United States
Environmental Protection
Agency

EPA420-R-08-009
April 2008

The programs below generally read in raw data and output SAS datasets

Input	*SAS Program*	*Output*	*Notes*
/Analysis/Round2/Final/BKI_Corrected_Rnd2/**KC_Regdata_Winter_SWF.csv**, /Analysis/Round2/Final/BKI_Corrected_Rnd2/***.prn**	/Analysis/Round2/Final/BKI_Corrected_Rnd2/rdBKI_Aligned.sas	/Analysis/Round2/Final/BKI_Corrected_Rnd2/**bki_bag_aligned**.sas7bdat, /Analysis/Round2/Final/BKI_Corrected_Rnd2/**bki_sbs_aligned**.sas7bdat	Reads in summary and SbS bag data and writes to SAS datasets
/Analysis/Round2/Final/BKI_Corrected_Rnd2/**bki_sbs_aligned.sas7bdat**, /SEMTECH/Round2/Dynetests/***.csv**	/Analysis/Round2/rdSEMTECH_r2.sas	/Analysis/Round2/**semtech_sbs_dyno**.sas7bdat, /SEMTECH/Round2/Dynetests/**semtech_bag_dyno**.sas7bdat, /SEMTECH/Round2/Dynetests/**semtech_veh_short**.sas7bdat	Reads in PEMS data and writes out SBS, bag, and vehicle info datasets
/SEMTECH/Round2/PrecondRuns/***.csv**	/Analysis/Round2/rdSEM_Pre_r2.sas	/Analysis/Round2/**semtech_sbs_precond**.sas7bdat, /SEMTECH/Round2/PrecondRuns/**semtech_bag_precond**.sas7bdat, /SEMTECH/Round2/PrecondRuns/**semtech_veh_short_precond**.sas7bdat	Reads in PEMS data and writes out SBS, bag, and vehicle info datasets
/SEMTECH/Round2/Driveaways/***.csv**	/Analysis/Round2/rdSEM_Drive_r2.sas	/Analysis/Round2/**semtech_sbs_driveaway**.sas7bdat, /SEMTECH/Round2/Driveaways/**semtech_bag_driveaway**.sas7bdat, /SEMTECH/Round2/Driveaways/**semtech_veh_short_driveaway**.sas7bdat	Reads in PEMS data and writes out SBS, bag, and vehicle info datasets
/Data/Emission/Round2/DRI/**Summary_Data_File_Round_2_SWF.csv**, /Data/Emission/Round2/DRI/**composite_speciation1_Rnd2.csv**, /Data/Emission/Round2/DRI/**composite_speciation2_Rnd2.csv**, /Data/Emission/Round2/DRI/**filter_data.csv**	/Analysis/Round2/rdDRI.sas	/Analysis/Round2/**dri_all_baglevel**.sas7bdat	Reads in composite PM emissions from various instruments, speciated PM from DRI's summary, and elemental PM from the filter measurements, and writes out a SAS dataset
/Data/Emission/Round2/**vehnew_rnd2.csv**, /Analysis/Round2/Final/BKI_Corrected_Rnd2/**bki_bag_aligned.sas7bdat**, /Analysis/Round2/**dri_all_baglevel.sas7bdat**, /SEMTECH/Round2/Dynetests/**semtech_veh_short.sas7bdat**, /SEMTECH/Round2/PrecondRuns/**semtech_veh_short_precond.sas7bdat**, /SEMTECH/Round2/Driveaways/**semtech_veh_short_driveaway.sas7bdat**	/Analysis/Round2/rdveh.sas	/Analysis/Round2/**vehID_dyn_pre_drw**.sas7bdat, /Analysis/Round2/**vehround2_2**.sas7bdat, /Analysis/Round2/**vehround2**.sas7bdat	Reads in Mike's QC'ed vehicle info and writes out SAS dataset
/Data/Emission/Round2/DRI/SBS/**KC-Test-***	/Analysis/Round2/rdDRI_SbS.sas	/Data/Emission/Round2/DRI/SBS/**top_file**.sas7bdat, /Data/Emission/Round2/DRI/SBS/**sbs_fil**.sas7bdat	Reads in Cantrell's QC'ed PM data and writes out summary and Sbs datasets
/Analysis/Round2/**NVFEL_update.csv**	/Analysis/Round2/rdfuel.sas	/Analysis/Round2/**fuel**.sas7bdat	Reads in summary spreadsheet SWF adapted from raw lab measurements, filters out non-Round2 data, and writes out SAS dataset

The programs below generally read in the SAS datasets created above and write out .txt files for input to Visual Foxpro .dbf files (and subsequently MSOD)

Input	*SAS Program*	*Output*	*Notes*
/Analysis/Round2/vehround2_2.sas7bdat	/Analysis/Round2/MSOD/ksequip.sas	/Analysis/Round2/MSOD/MSOD_in/**equip_in**.txt	Equip_in dump
/Analysis/Round2/fuel.sas7bdat	/Analysis/Round2/MSOD/ksfuel.sas	/Analysis/Round2/MSOD/**fbat_in**.txt	Fuel batch info dump
/Analysis/Round2/vehID_dyn_pre_drw.sas7bdat, /Analysis/Round2/Final/BKI_Corrected_Rnd2/bki_bag_aligned.sas7bdat, /Analysis/Round2/Final/BKI_Corrected_Rnd2/bki_sbs_aligned.sas7bdat, /Analysis/Round2/dri_all_baglevel.sas7bdat	/Analysis/Round2/MSOD/ksdyno.sas	/Analysis/Round2/MSOD/MSOD_in/**dynob_in**.txt, /Analysis/Round2/MSOD/MSOD_in/**tmeas_in**.txt, /Analysis/Round2/MSOD/MSOD_in/**bag_in**.txt, /Analysis/Round2/MSOD/MSOD_in/**bmeas_in**.txt, /Analysis/Round2/MSOD/MSOD_in/**time_in**.txt	Dump of all bag-related data
/Analysis/Round2/vehID_dyn_pre_drw.sas7bdat, /Analysis/Round2/Final/BKI_Corrected_Rnd2/bki_bag_aligned.sas7bdat, /Analysis/Round2/Final/BKI_Corrected_Rnd2/bki_sbs_aligned.sas7bdat, /Analysis/Round2/dri_all_baglevel.sas7bdat, /Analysis/Round2/semtech_sbs_dyno.sas7bdat, /SEMTECH/Round2/Dynetests/semtech_veh_short.sas7bdat	/Analysis/Round2/MSOD/ksactty_dyno.sas	/Analysis/Round2/MSOD/MSOD_in/**actty_in_dynob**.txt, /Analysis/Round2/MSOD/MSOD_in/**trip_in_dynob**.txt, /Analysis/Round2/MSOD/MSOD_in/**ttime_in_dynob**.txt, /Analysis/Round2/MSOD/MSOD_in/**omeas_in_dyno**.txt,	Dump of dyne PEMS data
/Analysis/Round2/vehID_dyn_pre_drw.sas7bdat, /Analysis/Round2/semtech_sbs_precond.sas7bdat, /SEMTECH/Round2/PrecondRuns/semtech_veh_short_precond.sas7bdat	/Analysis/Round2/MSOD/ksactty_predcond.sas	/Analysis/Round2/MSOD/MSOD_in/**actty_in_precond**.txt, /Analysis/Round2/MSOD/MSOD_in/**trip_in_precond**.txt, /Analysis/Round2/MSOD/MSOD_in/**ttime_in_precond**.txt, /Analysis/Round2/MSOD/MSOD_in/**omeas_in_cond**.txt,	Dump of Precond PEMS data
/Analysis/Round2/vehID_dyn_pre_drw.sas7bdat, /Analysis/Round2/semtech_sbs_driveaway.sas7bdat, /SEMTECH/Round2/Driveaways/semtech_veh_short_driveaway.sas7bdat	/Analysis/Round2/MSOD/ksactty_driveaway.sas	/Analysis/Round2/MSOD/MSOD_in/**actty_in_driveaway**.txt, /Analysis/Round2/MSOD/MSOD_in/**trip_in_driveaway**.txt, /Analysis/Round2/MSOD/MSOD_in/**ttime_in_driveaway**.txt, /Analysis/Round2/MSOD/MSOD_in/**omeas_in_driveaway**.txt,	Dump of Driveaway PEMS data
/Data/Emission/Round2/DRI/SBS/sbs_fil.sas7bdat	/Analysis/Round2/MSOD/ks_rmeas.sas	/Analysis/Round2/MSOD/MSOD_in/**rmeas_in**.txt	Dump of SBS PM data

Notes:
All paths preceded with /proj1/KansasCity
Some filenames have an "_update" or "_update2" suffix (e.g. "rdDRI_update.sas"); these were the files actually run
FindSEMTECH_format_r2.sas isn't mentioned above, but it's a meta-program that generates input for use in rdSEMTECH.sas to help determine which routines should be used to parse the data

The nine files created under the ksactty_*.sas program series are later combined into three accty_, trip_in, and ttime_in .dbf files using a Foxpro script

Kansas City PM Characterization Study

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Appendix AA
Quality Assurance Project Plan
(including revised Appendix A)

Assessment and Standards Division
Office of Transportation and Air Quality
U.S. Environmental Protection Agency

Sponsors:

National Renewable Energy Laboratory, U.S. Department of Energy
Federal Highway Administration, U.S. Department of Transportation
STAPPA-ALAPCO Emission Inventory Improvement Program
Coordinating Research Council Inc. (Project No. E-69)

Prepared for EPA by
Eastern Research Group, Incorporated
Austin, TX

Bevilacqua-Knight Incorporated
Oakland, CA

NuStats LLC
Austin, TX

Desert Research Institute
Reno, NV

EPA Contract No. GS 10F-0036K

October 27,2006
Revised April 2008 by EPA staff

United States
Environmental Protection
Agency

EPA420-R-08-009
April 2008

Quality Assurance Project Plan

Characterizing Exhaust Emissions from Light-Duty Gasoline Vehicles in the Kansas City Metropolitan Area

Prepared for:

U.S. Environmental Protection Agency
4411 Montgomery Road, Suite 300
Norwood, OH 45212

Prepared by:

Eastern Research Group

August 1. 2006

QAPP REVISION HISTORY

Revision 1: April 15, 2004
Revision 2: June 30, 2004
Revision 3: July 2, 2004
Revision 4 (current): August 1, 2006

QUALITY ASSURANCE PROJECT PLAN

SIGNATURES OF APPROVAL

Name: William S. Crews
Title: Project Manager
Org.: Bevilacqua Knight Inc.
Date. 8-1-06

Name: Rob Santos
Title: Quality Assurance Manager
Org.: NuStats
Date: 9 / 28 /06

Name: Eric Fujita
Title: Project Manager
Org.: Desert Research Institute
Date. 9/28/06

Name: Sandeep Kishan
Title: Vice President
Org.: Eastern Research Group
Date. 9/28/06

APPROVAL FOR THE AGENCY

Name: Greg Janssen
Title: Project Officer, US EPA
Org.: U.S. Environmental Protection Agency
Date:

Name: Carl Fulper
Title: Work Assignment Manager
Org.: U.S. Environmental Protection Agency
Date:

Name: Ruth Schnek
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Org.: U.S. Environmental Protection Agency
Date:

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SECTION 1: PROJECT MANAGEMENT

1.1 Project/Task Organization - ERG

ERG is responsible for operation of the portable emission measurement systems (PEMS) devices. The PEMS devices are SEMTECH-G systems, manufactured by Sensors, Inc. of Saline, Michigan, and owned by EPA. EPA is responsible for providing the equipment and some of the consumable gases. ERG is responsible for installing, operating, and maintaining the equipment and providing most of the consumable gases.

As indicated in the bulleted list below, overall QA responsibility for the PEMS systems is in the hands of Sandeep Kishan. The task leader for PEMS installation is Andrew Burnette and Michael Sabisch will head most of PEMS operations in the field. Both Andrew Burnette and Michael Sabisch will report directly to Sandeep Kishan. QC/QA responsibilities to be implemented by ERG staff are described in detail in the QMP.

- Sandeep Kishan, Project Manager, ERG Project Manager
- Andrew Burnette, Engineer, PEMS Task Management
- Michael Sabisch, Engineer, PEMS Field Operations

During field testing ERG personnel are responsible for the installation, operation, and maintenance of the PEMS units. The WAM is EPA's principal contact. The EPA WAM determines the quality criteria on the basis of intended use of the results to be generated and communicates those criteria.

1.1.1 Problem Definition/Background

PEMS will be used in three ways:

- To record driving and emissions data during vehicle pre-conditioning of vehicles to be tested on the dynamometer (including on-road driving);
- To record driving and emissions during testing on the dynamometer; and,
- To collect on-road emissions and driving data on a randomly selected group of vehicles that have been tested on the chassis dynamometer. The purpose of collecting these data is simply to improve EPA's understanding of "real world" vehicle operations and emissions. Also the data will be added to the MSOD database, which EPA will use in the creation of the MOVES model.

ERG personnel will perform the first and third activities listed above and BKI personnel will perform the second activity. Both ERG and BKI personnel will assist each other, as necessary, during all PEMS activities.

1.1.2 Project Task Description

ERG personnel will install a PEMS device on each vehicle as it is prepared for pre-conditioning the day before testing on the dynamometer.

Owners of the selected vehicles will be instructed on their agreed duties while their vehicles have a PEMS unit installed. In summary, these owners will agree to drive their vehicles in the manner they normally would (as if the PEMS unit were not present on their vehicle). They will also be required to keep a log of significant events during the testing period (e.g., changes in vehicle load, such as passengers entering and leaving the vehicle).

After the device has been present on their vehicle for the prescribed time period, the owner will return to the project data collection location to have the PEMS/PAMS unit de-installed. The owner will receive an interview at that time to determine various data about their experience and events that occurred during their participation.

Quality Objectives and Criteria for PEMS Data

Quality assurance objectives for accuracy and precision have been developed specific to this project. These objectives are listed in the standard operating procedures and check lists developed by ERG for this project. Those documents are contained in Appendix A of this QAPP. If at any time it is noted that deviations in measured values exceed the objectives, testing will be stopped, equipment examined, and testing resumed after the problem has been corrected.

Special Training

ERG personnel (Andrew Burnette and Michael Sabisch) were trained in the proper use of SEMTECH equipment by the manufacturer. These personnel will train others on the proper use of the SEMTECH equipment during the course of the project, as needed. The manufacturer (Sensors, Inc.) has been retained as a subcontractor for technical help on an “as needed” basis.

Documents and Records

All maintenance, calibrations and data will be reported as specified in our standard operating procedures (Appendix A). Data input comes manually and automatically. Manual data include items such as vehicle description, calibration gas values, and testing notes. Automatic data are logged by the SEMTECH system. These data are combined in the SEMTECH electronic records during testing. Raw test records are downloaded after each test when possible, and will be archived at the end of each test day. The raw data are processed and plotted on site and given a visual quality check. The processed data are also archived for post processing and reporting offsite. Standard operating procedures (refer to Appendix A) detail how each of these documentation and recording processes is to take place.

1.2 Project/Task Organization - NuStats

Employees and managers at all levels in NuStats share a concern for, and pride in, quality. Acceptable quality is not achieved by managerial actions, edicts and checks. It is achieved through understanding client needs and the sound application of knowledge and expertise at many levels. It requires motivated and competent human resources, and the effective development and management of these resources and their activities. To this end, NuStats has in place a series of human resource programs, together with the policies and procedures to promote, facilitate, and fortify activities and behavior consistent with the firm's central concern for quality.

- Mia Zmud, Project Manager, NuStats Project Manager
- Stacey Bricka, Project Scientist, Survey Instrument Development

1.3 Project/Task Organization - BKI

The QC/QA organization for the operation of the Transportable Dynamometer assigns overall QA responsibility to Mr. W.S. Crews, Project Manager of Bevilacqua Knight Inc. (BKI). Directly reporting to Mr. W.S. Crews in support of project quality assurance is Mr. Richard Snow, Project Scientist, for regulated emissions determinations, vehicle testing and data reporting.

- W.S. Crews, Project Manager, BKI Project Manager
- R.F. Snow, Project Scientist, Laboratory Simulations QC/QA

The key QC/QA responsibilities to be implemented by BKI staff are as follows:

QC Responsibilities

- Maintain up-to-date project records;
- Maintain sample chain-of-custody documentation;
- Follow and document deviations from established procedures/methods;
- Make data quality determinations based on QC data collected; and
- Reporting all problems and corrective actions.

QA Responsibilities

- Participate in the preparation of the Quality Assurance Project Plan;
- Ensure that all project participants read and follow the Quality Assurance Project Plan;
- Establish quality requirements with the EPA Work Assignment Manager (WAM);
- Train analysts to perform and evaluate QC measurements; and
- Verify that QC activities are performed and data quality is determined as required in the QA project plan, and document QC outputs.

As subcontractor to ERG the BKI Project Manager is ultimately responsible for the performance and coordination of the transportable dynamometer operation and vehicle testing during the project. The WAM is EPA's principal contact with ERG and ERG will relay to BKI information regarding the analysis requirements. The EPA WAM determines the quality criteria on the basis of intended use of the results to be generated and communicates those criteria. These criteria include the following:

QC Requirements

- Review data notebooks;
- Arrange for performance evaluation or audit samples (when applicable);
- Assist in scheduling audits; and
- Report data quality problems to Contracting Officer.

QA Requirements

- Ensure the development and approval of the Quality Assurance Project Plan;
- Ensure that SOPs are developed, reviewed and approved;
- Establish quality requirements with contractor staff;
- Ensure that required corrective actions are implemented; and
- Review project QC outputs.

The BKI Project Manager is responsible for all projects under this subcontract and for ensuring that all technical outputs meet the quality requirements of the contract.

1.3.1 Problem Definition/Background

BKI, as a subcontractor will support ERG and the United States Environmental Protection Agency (USEPA). BKI 's support will be directed towards the maintenance, calibration, testing and reporting automotive data from mobile source emissions measurements for "Characterizing Exhaust Emissions from Light-Duty Gasoline Vehicles in the Kansas City Metropolitan Area". A transportable chassis dynamometer will be used to simulate engine load while the vehicle is operated over a representative highway transient driving cycle. Regulated emissions will be determined using prescribed driving cycles. All maintenance and QA performed with the transportable dynamometer will be done in accordance with the Transportable Dynamometer Standard Operating Procedure (SOP), (November 2002).

1.3.2 Project/Task Description

BKI, as a subcontractor, will support ERG and the USEPA, and will provide technical support for the calibration, operation, and maintenance of a transportable chassis dynamometer, associated driver's aid, constant volume sampler (CVS), analytical bench, and data acquisition/reduction system. This system is used to obtain exhaust emission samples in the field. BKI will support the calibration, operation, and maintenance of other sampling and measuring equipment, as specified in the task descriptions. In addition, BKI shall implement the capability to collect particle matter and gaseous organic samples during field studies involving the transportable dynamometer. All tests will be performed as designated in the Standard Operating Procedure (SOP) or by technical direction through ERG as directed by the WAM.

1.3.3 Quality Objectives and Criteria for Measurement Data

Quality assurance objectives for accuracy and precision have been developed specific to this project, as described below. If at any time it is noted that deviations in measured values exceed the objectives, testing will be stopped, equipment examined, and testing resumed after the problem has been corrected (see Section C1). Performance objectives for vehicle emissions test systems and regulated emissions are based on procedures found in the Code of Federal Regulations (CFR 40 Part 86, Subpart B, 86.114 through 86.126). Accuracy determination of the regulated emissions analyzers is based on response to NIST gaseous standards. Accuracy determination of the vehicle test systems is based on comparisons of rigid initial calibrations to performance checks.

It is the responsibility of the EPA personnel to define the intended use of the data and to develop, in cooperation with the data users and BKI, the Data Quality Objectives (DQOs) appropriate to the project within the time and resources of the effort. These DQOs need to be conveyed to BKI as specifically as possible. DQOs are traditionally described in terms of precision, accuracy, completeness, representativeness, and comparability for all variables to be measured in this project. Development of DQOs must include the following steps.

- Define with specificity the objectives to be addressed.
- Establish guidelines for the types and quality of data needed to meet the objectives.
- Explain in quantitative terms the possible errors that may arise during the monitoring and measurement process.

DQOs will be established for each major measurement parameter. The measurements will be made so that results are representative of the media (i.e., air) and conditions being measured. An example of possible DQOs is summarized in Table 1-1. All data will be calculated and reported in units consistent with those used by other organizations reporting similar data to allow for comparability of data among organizations. The data quality objectives for accuracy and precision will be based on prior knowledge of the measurement system employed and methods validation studies using replicates, spikes, standards, calibrations, recovery studies, etc. Definitions of data quality parameters are discussed below.

Table 1-1. Example Data Quality Objectives

Parameter	Accuracy (%)	Precision (%)
THC Analysis	10	2
CO Analysis	10	2
NO_X Analysis	10	2
CO_2 Analysis	10	2
Dyno Speed	5	5
Dyno Torque	5	5
PDP Counter	10	5
CVS Temperature	5	5
CVS Pressure	10	5

A. Precision: Precision is a measure of mutual agreement among individual measurements of the same property, usually under prescribed similar conditions. Precision is best expressed in terms of the standard deviation. Various measures of precision exist depending upon the “prescribed similar condition”. Precision will be assessed by the collection of matrix spike and spike duplicate samples.

B. Accuracy: Accuracy is the degree of agreement of a measurement (or an average of measurements of the same thing), X, with an accepted reference or true value. This term is a measure of the bias in a system. Accuracy will be assessed by the use of traceable reference standards and EPA-approved SOPs for all instrumentation.

C. Representativeness: Representativeness is the degree to which data accurately and precisely represents the characteristics of a population, process, or environmental condition, or parameter variations at a sampling point. Representativeness will be assessed by the collection of appropriate sample numbers and the use of a statistically valid sampling design.

D. Data Comparability: Comparability expresses the confidence with which one data set can be compared to another. Comparability of field sampling, monitoring, and analytical data will be ensured by using the standard sampling, analysis, and reporting methods. All data will be presented in specified and documented units and methods.

E. Data Completeness: Completeness is a measure of the amount of valid data obtained from a measurement system compared to the amount that was expected to be obtained under normal conditions. Completeness will be assessed by reviewing field and laboratory data logs, sample custody forms, and field and laboratory logbooks to ensure that all data is certified and validated within established DQOs.

1.3.4 Special Training/Certification

No specialized training or certifications are required by personnel in order to successfully complete the project or task. However, instructions in sampling fuels and other safety courses may be held as required.

1.3.5 Documents and Records

Mr. William S. Crews, Project Manager of BKI's North Carolina operations, has 30 years of direct experience in conducting and monitoring QA activities for all aspects of performing research on investigating, characterizing, and reporting emissions from light-duty vehicles. Mr. Crews is responsible for the preparation of this Quality Assurance Project Plan for the Transportable Dynamometer and for ensuring the appropriate project personnel have the most current approved version of the QAPP, including version control, updates, distribution, and disposition.

Mr. Richard F. Snow, Project Scientist, has over 24 years of experience in conducting complex mobile source emissions projects and performing and directing all aspects of laboratory simulations, analytical methodology and emissions sampling for the determination of regulated and unregulated emissions. Mr. Snow is also thoroughly experienced in collecting and reporting batch and real-time data. Mr. Snow is accomplished in the QA requirements of the test facilities and equipment utilized in emissions testing. Mr. Snow is responsible for ensuring the appropriate operational personnel have the most current approved version of the QAPP, including version control, updates, distribution, and disposition

All maintenance, calibrations and data will be reported as specified by the US EPA. Data input comes in two forms, the data from the Vehicle Inspection team for initial vehicle data and the Operations team for regulated emissions and maintenance. Data from these two areas can be combined and final reports generated. The input includes a unique run number assigned by the systems analyst that identifies the research project, the testing cycle, and other parameters as required. As testing objectives change, the emissions database will be adapted to reflect those changes. BKI shall provide raw dynamometer vehicle emissions, fuels, and analytical data in electronic format for incorporation into spreadsheet models. The reports shall be structured so as to be easily imported into a database.

1.4 Project/Task Organization - DRI

- Eric Fujita, Project Manager, Principal Investigator
- William (Pat) Arnott, Project Manager, Co-Principal Investigator, Continuous PM, Photoacoustic, QCM, nephelometer
- David Campbell, Research Scientist, QA Support

1.4.1 Project and Task Organization

The QC/QA organization at Desert Research Institute assigns overall QA responsibility for this program to Dr. Eric M. Fujita, Principal Investigator. Dr. Fujita will be the primary contact at DRI and will coordinate project activities between field personnel and DRI’s Organic Analytic Laboratory and Environmental Analysis Facility. He will be responsible for collection of integrated samples, validation of the integrated chemical data and analysis of the project results in relation to similar studies conducted in recent years. Dr. William P. Arnott will serve as co-Principal Investigator and will be responsible for operation of continuous PM instruments and compilation and validation of the PA, QCM, and nephelometer measurements. Mr. David E. Campbell, Research Scientist, will support project quality assurance by conducting flow audits, coordinating sample shipping and receiving, coordinating identification of samples to be analyzed by the two DRI laboratories, and validating and preparing the database. The accompanying Quality Management Plan (QMP) delineates specific QC/QA responsibilities to be implemented by DRI field and laboratory personnel.

As a subcontractor to Eastern Research Group Inc. (ERG), the DRI principal investigator is ultimately responsible for sample collection and analysis during the project. The work assignment Manager (WAM) is EPA's principal contact with ERG and ERG will relay to DRI information regarding the analysis requirements. The EPA WAM determines the quality criteria on the basis of the intended use of the results to be generated and communicates those criteria.

1.4.2 Problem Definition/Background

The U.S. Environmental Protection Agency (EPA), U.S. Department of Transportation (DOT), Federal Highway Administration (FHWA), National Renewable Energy Laboratory, Coordinating Research Council (CRC), and the State and Territorial Air Pollution Program Administrators/ Association of Local Air Pollution Control Officials (STAPPA/ ALAPCO) are conducting a program to evaluate exhaust emissions from light-duty gasoline vehicles. The proposed program consists of measuring particulate matter (PM) and other toxic components in exhaust emissions of 480 randomly selected, light-duty vehicles in the Kansas City Metropolitan Area. A sampling plan has been developed that will allow for the determination of the distribution of particulate matter (PM) and other emissions in the sampled fleet as well as the identification of the percent of high emitters. Data obtained from this program will be used to evaluate and update existing and future mobile source emission models (MOBILE6 and MOVES), evaluate existing emission inventories and assess the representativeness of previous PM emissions studies. The project team consists of the prime contractor, Eastern Research Group (ERG), and the following subcontractors: Bevilacqua Knight Inc (BKI), Desert Research Institute (DRI) and NuStats Partners L.P.

1.4.3 Project Task Description

The work to be performed by the Desert Research Institute (DRI) provides the sampling and chemical analysis support for the EPA-sponsored study to characterize exhaust emissions from light-duty gasoline vehicles in the Kansas City Metropolitan Area. The sampling and analytical laboratory services include those in Task 3.2 (specialized sampling and analytical needs for vehicle testing) and Task 4 (chemical speciation) of the Statement of Work for U.S. EPA Solicitation No. PR-Cl-03-10697. These services include the following.

1. Provide and prepare sampling equipment and sampling substrates required for the collection of the samples listed in Table 7 of the Solicitation.
2. Provide and operate real-time monitors for the measurement of fine particulate mass and fine particle elemental carbon as shown in Table 11 of the Solicitation.

3. Collect sample on each vehicle tested and conduct laboratory analyses of samples as shown in Table 7 of the Solicitation.
4. Perform sample analysis for integrated PM mass, EC/OC, elements, ions, semi-volatile organic compounds, and gaseous air toxics base on a percent of samples estimates shown in Table 7 of the Solicitation.

1.4.4 Quality Objectives and Criteria

DRI is fully committed to an effective quality assurance/quality control (QA/QC) program for this project. DRI will ensure that measurement data shall meet specific data quality objectives (DQOs). These DQOs are summarized in Tables 1-2 through 1-6. The data quality indicators that are typically used to characterize these measurements are listed below.

Precision: Precision is the degree of mutual agreement among individual measurements under prescribed conditions. Measurements, where possible, will be made of analytical precision and overall precision. The project goal for overall precision will be ±10% expressed as the coefficient of variation (CV) as determined from collocated instruments. The goal for analytical precision is ±10-30% for analytes that are present in concentrations greater than 10 times their detection limit. The goal for analytical precision of gravimetric mass is ±5% CV as determined from replicate weighings.

Bias: Bias is the systematic or persistent distortion of a measurement process that causes error in one direction. Bias may be determined through performance audits and or by inter-comparisons of the performance of similar instruments.

Accuracy: Accuracy is the correctness of data and refers to the degree of difference between a measured value and a known or "true" value. For particulate measurements, there are no known true values. Relative accuracy may be determined by comparing a measured value with a presumed reference or standard. Sampler accuracy will be measured by performance (flow rate) checks and audits between the sampler and a certified flow meter. The goal is ± 5% relative percent difference (RPD) or better. Since no true reference samples exist for the chemistry of airborne particulate matter, the accuracy of other speciated atmospheric components cannot be inherently determined. Analytical accuracy of the analytes will be determined by analyzing known reference materials in the laboratory.

Table 1-2. Analysis List of Inorganic Species for the Kansas City LDGV Emission Characterization Study

Species	Analysis Method[a]	MDL[b] (µg/filter)	Species	Analysis Method[a]	MDL[b] (µg/filter)
Chloride (Cl^-)	IC	1.5005	Zinc (Zn)	XRF	0.0144
Nitrate (NO_3^-)	IC	1.5005	Gallium (Ga)	XRF	0.0259
Sulfate ($SO_4^=$)	IC	1.5005	Arsenic (As)	XRF	0.0230
			Selenium (Se)	XRF	0.0173
Organic Carbon (OC)	TOR	2.7590	Bromine (Br)	XRF	0.0144
Elemental Carbon (EC)	TOR	2.7590	Rubidium (Rb)	XRF	0.0144
			Strontium (Sr)	XRF	0.0144
Sodium (Na)	XRF	0.9533	Yttrium (Y)	XRF	0.0173
Magnesium (Mg)	XRF	0.3456	Zerconium (Zr)	XRF	0.0230
Aluminum (Al)	XRF	0.1382	Molybdenum (Mo)	XRF	0.0374
Silicon (Si)	XRF	0.0864	Palladium (Pd)	XRF	0.1526
Phosphorus (P)	XRF	0.0778	Silver (Ag)	XRF	0.1670
Sulfur (S)	XRF	0.0691	Cadmium (Cd)	XRF	0.1670
Chlorine (Cl)	XRF	0.1382	Indium (In)	XRF	0.1786
Patassium (K)	XRF	0.0835	Tin (Sn)	XRF	0.2333
Calcium (Ca)	XRF	0.0634	Antimony (Sb)	XRF	0.2477
Titanium (Ti)	XRF	0.0403	Barium (Ba)	XRF	0.7171
Vanadium (V)	XRF	0.0346	Lanthanum (La)	XRF	0.8554
Chromium (Cr)	XRF	0.0259	Gold (Au)	XRF	0.0432
Manganese (Mn)	XRF	0.0230	Mercury (Hg)	XRF	0.0346
Iron (Fe)	XRF	0.0202	Thallium (Tl)	XRF	0.0346
Cobalt (Co)	XRF	0.0115	Lead (Pb)	XRF	0.0403
Nickel (Ni)	XRF	0.0115	Uranium (U)	XRF	0.0317
Copper (Cu)	XRF	0.0144			

[a] IC=ion chromatography. AC=automated colorimetry. AAS=atomic absorption spectrophotometry. TOR=thermal/optical reflectance. XRF=x-ray fluorescence.

[b] Minimum detectable limit (MDL) is the concentration at which instrument response equals three times the standard deviation of the response to a known concentration of zero.

Additional Notes

1. Boron (specified in Section 3.3.2.2 of RFP) cannot be done by XRF.
2. XRF can be replaced with ICP-MS with greater sensitivity. However, cannot measure Sulfur and Chlorine and cost twice as much as XRF. Three Teflon filters can be extracted together with ICP-MS to reduce cost.

Table 1-3. Analysis List of Hydrocarbons and Carbonyl Compounds for the Kansas City LDGV Emission Characterization Study

Hydrocarbons			Carbonyl Compounds
Sum C2s	2,4-DiMePentane	m/p-xylene	Formaldehyde
propene	223TriMeButane	2MeOctane	Acetaldehyde
propane	1MeCypentene	3MeOctane	Acetone
isoButane	Benzene	Styrene+heptanal	Acrolein
1Butene+iButylene	CycloHexane	o-xylene	Propionaldehyde
1,3-Butadiene	4MeHexene	Nonene-1	Crotonaldehyde
n-Butane	2MeHexane	n-Nonane	Methyl Ethyl Ketone
t-2-Butene	23DiMePentane	iPropBenzene	Methacrolein
c-2-Butene	Cyclohexene	iPropCyHexane	Butyraldehyde/Acrolein RP
3-Me-1-Butene	3MeHexane	26DiMeOctane	Benzaldehyde
isopentane	3EtPentane	alpha-pinene	Glyoxal
1-Pentene	1-Heptene	36DiMeOctane	Valeraldehyde
2-Me-1-Butene	224TrMePentane	nPropBenzene	m-Tolualdehyde
n-Pentane	t-3-Heptene	mEtToluene	Hexanaldehyde
Isoprene	n-Heptane	pEtToluene	
t-2-Pentene	244TMe-1-Pentene	135TriMeBenzene	
c-2-Pentene	MeCyHexane	oEtToluene	
2-Me-2-Butene	25DiMeHexane	beta-pinene	
22DiMeButane	24DiMeHexane	124TriMeBenzene	
CycloPentene	234TrMePentane	n-Decane	
CycloPentane	Toluene	iButBenzene	
23DiMeButane	23DiMeHexane	sButBenzene	
MTBE	2MeHeptane	123TriMeBenzene	
2-MePentane	4MeHeptane	Limonene	
22-DiMePentane	3MeHeptane	Indan	
3-MePentane	225TMHexane	13diethylbenzene	
2-Me-1-Pentene	Octene-1	14diethylbenzene	
1-Hexene	11DMeCyHexane	12diethylbenzene	
n-Hexane	n-Octane	2-propylToluene	
t-2-Hexene	235TriMeHexane+Bgr.	iPrToluene	
2-Me-2-Pentene	24DiMeHeptane	n-Undecane	
c-3-Me-2-Pentene	44DiMeHeptane	1245tetraMeBenzene	
c-3-Hexene	26DiMeHeptane	1235tetraMeBenzene	
c-2-Hexene	25DiMeHeptane	1234tetraMeBenzene	
t-3-Me-2-Pentene	33DiMeHeptane	Naphthalene+Decanal	
MeCyPentane	EtBenzene	n-Dodecane	

a. Canister/GC-FID or MS with MLD = 0.1 ppbC.

b. DNPH cartrideges/HPLC-UV with MDL = 0.1 ppbv.

Acrolein RP - rearrangement product of acrolein coelutes with butyraldelhyde.

Table 1-4. Analysis List of Polycyclic Aromatic Hydrocarbons for the Kansas City LDGV Emission Characterization Study

Polycyclic Aromatic Hydrocarbons (PAH) [a]		Nitro-PAH [b]
Naphthalene	Anthrone	1-Nitronaphthalene
2-methylnaphthalene	9-methylanthracene	2-Nitronaphthalene
1-methylnaphthalene	Anthraquinone	2-Nitrobiphenyl
Biphenyl	3,6-dimethylphenanthrene	3-Nitrobiphenyl
2-Methylbiphenyl	A-dimethylphenanthrene	4-Nitrobiphenyl
3-Methylbiphenyl	B-dimethylphenanthrene	1,3-Dinitronaphthalene
4-Methylbiphenyl	C-dimethylphenanthrene	1,5-Dinitronaphthalene
1+2ethylnaphthalene	D-dimethylphenanthrene	5-Nitroacenaphthene
2,6+2,7-dimethylnaphthalene	E-dimethylphenanthrene	2-Nitrofluorene
1,3+1,6+1,7dimethylnaphth	1,7-dimethylphenanthrene	9-Nitroanthracene
1,4+1,5+2,3-dimethylnaphth	Fluoranthene	4-Nitrophenanthrene
1,2-dimethylnaphthalene	Pyrene	9-Nitrophenanthrene
Acenaphthylene	9-Anthraaldehyde	3-Nitrophenanthrene
Acenaphthene	Retene	1,8-Dinitronaphthalene
Dibenzofuran	1-MeFl+C-MeFl/Py	2-Nitrofluoranthene
A-trimethylnaphthalene	B-MePy/MeFl	3-Nitrofluoranthene
B-trimethylnaphthalene	C-MePy/MeFl	1-Nitropyrene
C-trimethylnaphthalene	D-MePy/MeFl	2,7-Dinitrofluorene
E-trimethylnaphthalene	4-methylpyrene	7-Nitrobenz(a)anthracene
F-trimethylnaphthalene	1-methylpyrene	6-Nitrochrysene
2,3,5+I-trimethylnaphthalene	Benzonaphthothiophene	1,3-Dinitropyrene
J-trimethylnaphthalene	Benzo(c)phenanthrene	1,6-Dinitropyrene
2,4,5-trimethylnaphthalene	Benz(a)anthracene	1,8-Dinitropyrene
1,4,5-trimethylnaphthalene	Chrysene/Triphenylene	6-Nitrobenz(a)pyrene
Fluorene	Benzanthrone	
A-methylfluorene	Benz(a)anthracene-7,12-dione	
1-methylfluorene	5+6-methylchrysene	
B-methylfluorene	7-methylbenz(a)anthracene	
9-fluorenone	Benzo(b+j+k)fluoranthene	
Phenanthrene	BeP	
Anthracene	BaP	
Xanthone	Perylene	
Perinaphthenone	7-methylbenzo(a)pyrene	
Acenaphthenequinone	9,10-dihydrobenzo(a)pyrene-7(8H)-one	
A-methylphenanthrene	Indeno[123-cd]pyrene	
2-methylphenanthrene	Dibenzo(ah+ac)anthracene	
B-methylphenanthrene	Benzo(ghi)perylene	
C-methylphenanthrene	Coronene	
1-methylphenanthrene		

a. TIGF/XAD and GC/MS with MDL = 0.02 ug/sample

b. TIGF/XAD and GC/MS with MDL = 0.01 ug/sample

Table 1-5 Analysis List of Hopanes, Steranes and Alkanes for the Kansas City LDGV Emission Characterization Study

Hopanes and Steranes [a]	Alkanes [b]
C27-20S5a(H),14a(H)-cholestane	norfarnesane
C27-20R5a(H),14ß(H)-cholestane	heptylcyclohexane
C27-20S5a(H),14ß(H),17ß(H)-cholestane	farnesane
C27-20R5a(H),14a(H),17a(H)-cholestane & C29-20S13ß(H),17a(H)-diasterane	octylcyclohexane
C28-20S5a(H),14a(H),17a(H)-ergostane	nonylcyclohexane
C28-20R5a(H),14ß(H),17ß(H)-ergostane	norpristane
C28-20S5a(H),14ß(H),17ß(H)-ergostane	hexadecane
C28-20R5a(H),14a(H),17a(H)-ergostane	heptadecane
C29-20S5a(H),14a(H),17a(H)-stigmastane	decylcyclohexane
C29-20R5a(H),14ß(H),17ß(H)-stigmastane	pristane
C29-20S5a(H),14ß(H),17ß(H)-stigmastane	undecylcyclohexane
18a(H),21ß(H)-22,29,30-Trisnorhopane	octadecane
17a(H),18a(H),21ß(H)-25,28,30-Trisnorhopane	nonadecane
C29-20R5a(H),14a(H),17a(H)-stigmastane	phytane
17a(H),21ß(H)-22,29,30-Trisnorhopane	dodecylcyclohexane
17a(H),21ß(H)-30-Norhopane	tridecylcyclohexane
17b(H),21a(H)-30-Norhopane	tetradecylcyclohexane
17a(H),21ß(H)-Hopane	eicosane
17ß(H),21a(H)-hopane	heneicosane
22S-17a(H),21ß(H)-30-Homohopane	pentadecylcyclohexane
22R-17a(H),21ß(H)-30-Homohopane	hexadecylcyclohexane
17ß(H),21ß(H)-Hopane	docosane
22S-17a(H),21ß(H)-30,31-Bishomohopane	triacosane
22R-17a(H),21ß(H)-30,31-Bishomohopane	heptadecylcyclohexane
22S-17a(H),21ß(H)-30,31,32-Trisomohopane	octadecylcyclohexane
22R-17a(H),21ß(H)-30,31,32-Trishomohopane	tetracosane
	pentacosane
	hexacosane
	nonadecylcyclohexane
	eicosylcyclohexane
	heptacosane
	octacosane
	nonacosane
	triacontane
	hentriacontane
	dotriacontane
	tritriacontane
	tetratriacontane
	pentatriacontane
	hexatriacontane

a. TIGF/XAD and GC/MS with MDL = 0.02 ug/sample
a. TIGF/XAD and GC/MS with MDL = 0.1 ug/sample

Table 1-6. Analysis List of Polar Organics for the Kansas City LDGV Emission Characterization Study

Analytical Standards	Classification	Potential Organic Marker Type	MDL microgram/sample
hexanoic acid	alkanoic acid		0.05
heptanoic acid	alkanoic acid		0.05
methylmalonic	alkanedioic acid	secondary aerosol	0.05
guaiacol	methoxy phenol	wood smoke	0.05
benzoic acid	aromatic acid		0.05
octanoic acid	alkanoic acid		0.05
butenedioic (maleic) acid	alkenedioic acid	secondary aerosol	0.05
butanedioic (succinic) acid	alkanedioic acid	secondary aerosol	0.05
4-me-guaiacol	methoxy phenol	wood smoke	0.05
me-succinic acid	alkanedioic acid	secondary aerosol	0.05
nonanoic acid	alkanoic acid		0.05
4-ethyl-guaiacol	methoxy phenol	wood smoke	0.05
syringol	methoxy phenol	wood smoke	0.05
glutaric acid	alkanedioic acid	secondary aerosol	0.05
2-methylglutaric	alkanedioic acid	secondary aerosol	0.05
3-methylglutaric acid	alkanedioic acid	secondary aerosol	0.05
decanoic acid	alkanoic acid		0.05
4-allyl-guaiacol (eugenol)	methoxy phenol	wood smoke	0.05
4-methyl-syringol	methoxy phenol	wood smoke	0.05
hexanedioic (adipic) acid	alkanedioic acid	secondary aerosol	0.05
cis-pinonic acid	aromatic acid		0.05
3-methyladipic acid	alkanedioic acid	secondary aerosol	0.05
4-formyl-guaiacol (vanillin)	methoxy phenol	wood smoke	0.05
undecanoic acid	alkanoic acid		0.05
isoeugenol	methoxy phenol	wood smoke	0.05
heptanedioic (pimelic) acid	alkanedioic acid	secondary aerosol	0.05
acetovanillone	methoxy phenol	wood smoke	0.05
dodecanoic (lauric) acid	alkanoic acid		0.05
phthalic acid	aromatic diacid		0.05
suberic acid	alkanedioic acid	secondary aerosol	0.05
levoglucosan	carbohydrate	wood smoke	0.05
syringaldehyde	methoxy phenol	wood smoke	0.05
tridecanoic acid	alkanoic acid		0.05
isophthalic acid	aromatic diacid		0.05
vanillic acid	methoxy acid	wood smoke	0.05
homovanillic acid	methoxy acid	wood smoke	0.05
azelaic acid	alkanedioic acid	secondary aerosol	0.05
myristoleic acid	alkenoic acid	meat cooking	0.05
myristic acid	alkanoic acid		0.05
sebacic acid	alkanedioic acid	secondary aerosol	0.05
syringic acid	methoxy acid		0.05
pentadecanoic acid	alkanoic acid		0.05
undecanedioic acid	alkanedioic acid	secondary aerosol	0.05
palmitoleic acid	alkenoic acid	meat cooking	0.05
palmitic acid	alkanoic acid		0.05
isostearic acid	alkanoic acid		0.05
dodecanedioic acid	alkanedioic acid	secondary aerosol	0.05
heptadecanoic acid	alkanoic acid		0.05
traumatic acid	alkenoic acid		0.05
1,11-undecanedicarboxylic acid	alkanedioic acid	secondary aerosol	0.05
oleic acid	alkenoic acid		0.05
elaidic acid	alkenoic acid		0.05
stearic acid	alkanoic acid		0.05
1,12-dodecanedicarboxylic acid	alkanedioic acid	secondary aerosol	0.05
8,15-pimaradien-18-oic acd	resin acid	wood smoke	0.05
pimaric acid	resin acid	wood smoke	0.05
nonadecanoic acid	alkanoic acid		0.05
isopimaric acid	resin acid	wood smoke	0.05
dehydroabietic acid	resin acid	wood smoke	0.05
abietic acid	resin acid	wood smoke	0.05
eicosanoic acid	alkanoic acid		0.05
heneicosanoic acid	alkanoic acid		0.05
docosanoic acid	alkanoic acid		0.05
tricosanoic acid	alkanoic acid		0.05
tetracosanoic acid	alkanoic acid		0.05
cholesterol	sterol	meat cooking	0.05

Detectability: Detectability is the low range critical value that a method-specific procedure can reliably discern. DRI determines the minimum detection limit as 3 times the standard deviation of field blanks or 3 times the standard deviation of the noise of an instrument when subjected to clean air

Completeness: Completeness is the percentage of valid data compared to the total expected data. For this project, the completeness objective for all species and measurements is 75%.

Representativeness: Representativeness is the degree to which data accurately and precisely represents a characteristic of a population, parameter variations at a sampling point, a process condition, or an environment condition. For this project, spatial and temporal data representativeness will be achieved by assuring that criteria are met for site selection and setup, and that air quality measurements and statistics are compiled.

Comparability: Comparability reflects how confidently one data set can be compared with another. Using similar reporting units and measurement times may enhance comparability. For a research project that will be testing state-of-the-art instruments and methods, comparability becomes more difficult to estimate. Under such circumstance inferential methods are used to assess comparability. These may include comparisons of related, but dissimilar measurements such as measurements that may represent both the gaseous and particulate phases of a constituent with measurements of only the particulate phase of that constituent. In addition, trend analyses may be used including, but not limited to, regression analyses, agreement with model results such as stochastic chemistry, or typical ratios of atmospheric parameters.

1.4.5 Special Training/Certification

The Principal Investigators and QA Manager have appropriate degrees, background, and experience appropriate for their roles in the project. Laboratory personnel have appropriate degrees in scientific fields and experience in performing the tasks required by this project such as extracting, analyzing, and reporting field data and sample analysis results. Site operators have appropriate scientific and technical degrees and experience in operating and maintaining a field monitoring and sampling site. Additional guidance about actual site operations for this project is provided to the site operators in the form of checklists, forms, SOPs, and other material forming part of this QAPP.

1.4.6 Documents and Records

This QAPP summarizes planned measurements, defines data quality indicators, and specifies data quality objectives. Field and laboratory SOPs developed for the Kansas City vehicle characterization measurements are followed, and revised as needed, for the duration of the study. Revisions made to SOPs during the study period are noted and archived for traceability. Remedial actions taken as a result of field, laboratory, or data audits are also be documented. This information will be incorporated into a summary of quality assurance as part of final project report delivery to EPA.

SECTION 2: SURVEY DATA ACQUISITION, PROCESSING, AND REPORTING

2.1 Data Acquisition Process

2.1.1 Sampling

Sampling is the selection of a set of units from a target population. This set of units is referred to as the sample. The choice of the sampling design will take into account many factors, including the desired level of precision of the information to be produced, the availability of appropriate sampling frames, the availability of appropriate stratification variables, the estimation methods that will be used, and the available budgets. Decisions about the survey frame should conform to the target population and contain minimal undercoverage and overcoverage (avoiding duplication). Frame creation, use, maintenance and monitoring will be implemented within operational and cost constraints.

When determining sample size, the required levels of precision needed for the survey estimates, the type of design and estimator to be used, as well as both sampling factors (e.g., clustering) and non-sampling factors (e.g., nonresponse) will be taken into account.

The vehicle fleet samples associated with the MARC households as well as the RDD households that participated in the incentives test have been reviewed. The vehicles represented in those random sample had a different distribution than what was originally specified in the work plan (see Table 2-1). Since differences between the "real" distribution of vehicles compared to the originally estimated distribution affects the efficiency of data collection, we will monitor status by quota type daily during phases 1 and 2 of the study to confirm that we are meeting the strata goals specified. To support this, we will be using reports similar to the "Status by Cohort Day" and "Status by Sample Type" provided in Appendix A.

Table 2-1. Sample Strata Specified in the Work Plan

Stratum	Vehicle Class	Age Class	Total Vehicles Tested	Regular Responders	Refusers
1	Truck	Pre 1980	50	42	8
2	Truck	1980 – 1990	100	84	16
3	Truck	1991 –1995	70	58	12
4	Truck	1996 and newer	40	33	7
5	Car	Pre 1980	40	33	7
6	Car	1980 – 1990	50	42	8
7	Car	1991 –1995	80	66	14
8	Car	1996 and newer	50	42	8
Total			480	400	80

In addition, the Kansas vehicle registration data has recently been obtained. Combined with the Missouri vehicle registration data, this will provide a second fleet validation source. We are analyzing these databases to determine sample size allocations based on an "optimal" allocation strategy, which effects a disproportionate allocation in order to increase statistical precision beyond that achievable through proportionate stratified sampling. During implementation of the sampling, the size and characteristics of the actual sample will be compared to what was expected. Monitoring the sampling process in this way helps in identifying and correcting errors that can occur.

Appropriate sample control procedures are in place for monitoring data collection operations. Such procedures track the status of sampled units from the beginning through the completion of data collection so that survey managers and clients can assess progress at any point in time. Sample control procedures and feedback from them are also used to ensure that every sampled unit is processed through all data collection steps, with a final status being recorded. These procedures include:

- Close monitoring of participants who meet the scheduled appointment with daily adjustments in scheduling goals. Nustats staff will initially over-book to minimize no-shows and adjust bookings daily until the right number is booked to ensure 5 vehicles are tested daily. Nustats will also work with onsite technicians daily to negotiate changes in test dates, in consultation with participants, to maximize testing.
- Establishing stratum specific sample size targets and daily monitoring both scheduling and testing status with regard to those targets.
- Daily communications with BKI and ERG using the projects online scheduling system (monitoring scheduled participants and testing status).
- Use of a "continuous improvement" operations model in which the early vehicle recruitment performance will be used to fine-tune the overbooking factor (and, if necessary, adjust incentive offerings).

As mentioned above, an online scheduling system will be developed that will facilitate transfer of information between NuStats and onsite testing staff. This system will allow for scheduling of vehicles for testing in order to ensure cohort sampling goals are met. For a given day, NuStats will be able to specify, at minimum, the following information for each vehicle:

- Vehicle License Plate
- Owner Name
- Owner Address
- Owner Phone Number
- Owner Alternate Phone Number
- Incentive Offered
- Last Contact Date
- Miscellaneous NuStats Comments

Onsite technicians will be able to access information on the system via the internet to assist with contact of participants as necessary. During the course of testing, onsite staff will be able to update the following information to reflect current testing status:

- Test Completion Status
- “Drive-away” PAMS information, if selected
- Incentive paid
- Miscellaneous Onsite Team Comments

Control systems are in place to ensure the security of data transmission and handling, with a network security system that prevents loss of information (and the resultant loss in quality) due to system failures or human errors. Information regarding quality on any given research project are used to signal that collection procedures or tools should be changed in future projects.

2.1.2 Instrument Design

Questionnaires are designed with the following in mind: the statistical requirements of the project, the administrative requirements of data collection organization, the requirements for data processing and the nature and characteristics of the respondent population (such as identifying the correct incentive level to ensure adequate participation). Good questionnaires impose low respondent burden while remaining both respondent and interviewer-friendly. Survey design will maximize the efficiency of data collection, with a minimum number of errors, while facilitating the coding and capture of data and minimizing the amount of editing and imputation that is required.

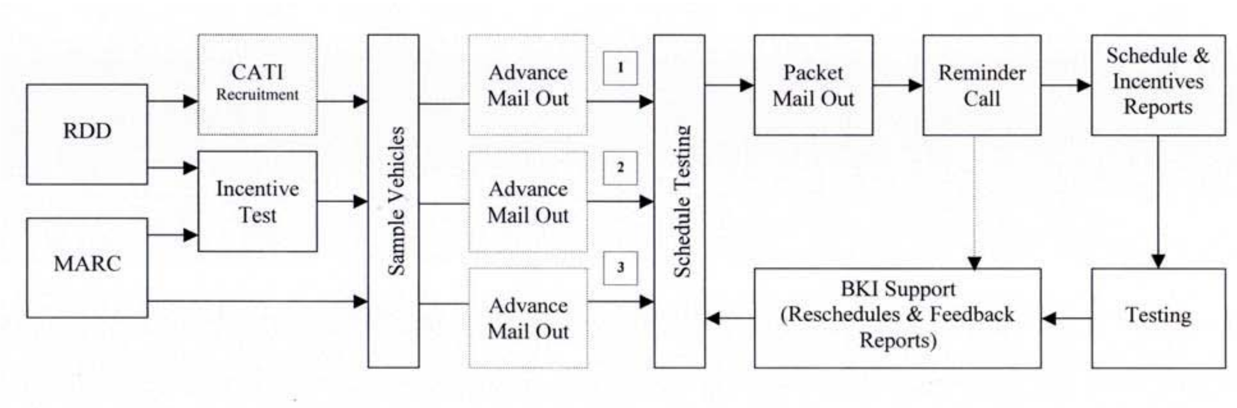
Introductions to the questionnaire will provide the subject of the research project, identify the sponsor or authority on whose behalf the project has been undertaken, explain the purpose, request the respondent’s cooperation, how the research data will be used, and what confidentiality protection will be afforded. The opening questions will be applicable to all respondents, easy and interesting to complete, and establish that the respondent is a member of the target population.

A wide range of methods will be used to test and evaluate the study instrument(s). In this case a pilot test was conducted to gain insight on the incentives that will be necessary to ensure participation in the vehicle testing. It also provided insight into how respondents react to the questionnaire (e.g., help identify poor question wording, errors in questionnaire layout or instructions, and problems caused by the respondents’ inability or unwillingness to answer the questions).

Even prior to conducting the pilot survey or the surveys in Phase I or II, a pretest was conducted for each (as part of interviewer training) that served as a “dress rehearsal” to observe how all the survey operations, including the administration of the questionnaire, worked together in practice.

A figure depicting data flow for the survey instrument is presented in Figure 2-1.

Figure 2-1. Survey Instrument Data Flowchart



2.1.3 Response and Nonresponse

Response patterns of two types are monitored under QA guidelines. Item response pertains to the number of data items answered by a respondent; unit response pertains to the number of sampled units that responded at all to the survey. Households will be considered non-responders if:

- they do not provide all vehicle information (year, make, model, and fuel type),
- they do not provide a mailable home address for delivery of the testing packet, or
- they miss more than two scheduled appointments.

Despite best efforts to maximize response, some nonresponse is virtually certain to occur. Nonresponse has two effects on the data: it contributes to an increase in the sampling variance of estimates as the effective sample size is reduced from that originally sought, and it contributes to bias of estimates when nonrespondents differ from respondents in the characteristics measured. For these reasons, response rates will be optimized to the degree that budget and time constraints allow.

To optimize response rates, research projects are designed to allow data to be provided using methods and formats that are convenient for respondents – not the survey organization. Since differences between respondents and nonrespondents can cause biases in the estimates, attempts are always made to determine if such differences exist. Although difficult to determine, this is done by linking to external data sources (for example, estimates from the U.S. Bureau of the Census), and by examining the responses of the nonrespondents who were converted with reluctance or during follow-up activities.

With client consent, one of two methods of compensating for nonresponse will be used: by means of sampling weight adjustment or through the use of imputation. For all projects, response and nonresponse rates will be reported using guidelines from established agencies (such as the Council of American Survey Research Organizations or the American Association for Public Opinion Research).

2.1.4 Data Acquisition Methods

Data acquisition is any process whose purpose is to acquire or assist in the collection of data. Collection is often the most costly part of the survey process with significant influence on data quality. The effective use of available technology promotes improvement of the efficiency and quality of the data collection process. One example of this is the Computer Assisted Telephone Interviewing (CATI) technology that will be used in this study to interview respondents and collect data.

Interviewing is always done with surveyors who have the appropriate training and tools. As was addressed previously, prior to the initiation of the pilot study or either of the two phases of data collection, a training manual will be developed specifically for this study that includes background on the project, the objectives of the study, and a question-by-question guide that describes what will be asked of the respondents. This includes definitions of the incentives and other technical terminology. Each interviewer will participate in a training session that includes 2 hours conducting mock interviews before actually beginning the survey process. If the survey will be conducted in another language than English, interviewers will also participate in mock interviews in the alternative language as well. All training will be monitored and only those staff that exhibit mastery of the task will be allowed to conduct the survey.

Each data collection shift is monitored by an experienced data collection manager assigned to this project. These individuals track productivity, listen in and observe interviewers, and provide continual support to improve interviewer productivity. The EPA Project Manager or others are welcome to “listen-in” or visit the survey operations center to observe interviewing at any time.

Automated systems have been designed for measuring the quality and productivity of interviewing during every interviewing shift. Important data collection quality measures include refusal rates, interview completion rates, frequency of editing rejects, and number and type of corrections applied to the data. For this study, data review processes that provide feedback reports will be relied upon for managers and surveyors that contain information on frequencies of and causes of errors. Examples of these reports include daily productivity reports. So that the EPA Project Manager can adequately monitor the study’s progress on a daily basis during data collection, a password protected website can be set up for client access to monitor key productivity variables such as interview completion rates, cohort or quota completion, and other data.

2.2 Data Processing and Management (Review, Validation, and Verification)

2.2.1 Editing

Data editing is the application of checks that identify missing, invalid, or inconsistent entries or that point to data records that are potentially in error. In this study, the goals of editing are three-fold: to provide the basis for future improvements in survey designs and implementation (for

Phases I and II), to provide information about the quality of the survey data, and to tidy up the data for analysis.

While fatal errors (e.g., invalid or inconsistent entries) should be removed from the data sets in order to maintain our credibility and to facilitate further automated data processing and analysis, our culture guards against over editing which is not only costly in terms of financing, timeliness, and increased response burden, but can also lead to severe biases resulting from "changing" respondent reported information to fit some implicit model of data correctness.

Data is processed in a continuous fashion under a continuous data flow (CDF) model, which enables the moving of the editing step to the early stages of the survey process so that we can look upstream to reduce errors rather than cleaning up at the end. In editing data, automated procedures (such as edit check programs) are relied upon to the degree possible because with them editing can be done more expediently. Manual procedures are responsible for the high cost of editing, and we strive to find an appropriate balance between error detection and cost.

We typically work in conjunction with the client to identify the priorities for data editing, according to types or severity of errors or according to the importance of the variable or the reporting unit. We assign a high priority to learning from the editing process so that error prevention rather than error correction is the norm.

2.2.2 Imputation

Imputation is the process used to resolve problems of missing, invalid, or inconsistent responses identified during editing. This is done by changing some of the responses or missing values on the record being edited to ensure that a plausible, internally coherent record is created. Data will only be imputed with the client's consent. Imputed values are flagged in the data set and clearly identify the methods and sources of imputation. The unimputed and imputed values of the record's fields are retained for evaluation purposes.

2.2.3 Estimation

Estimation is the process that consists of assigning values to unknown population parameters using information from the data set. The parameters that are to be estimated can mostly be expressed as functions of population totals. Examples include simple descriptive statistics as well as more complicated analytical statistics such as regression coefficients. The quality of the computed estimates is in large part dependent on the preceding steps. Proper estimation conforms to the sampling design. To that end, sampling weights are incorporated in the estimation process. We attempt to keep statistical adjustments for nonresponse to a minimum because they may introduce a bias. Estimated standard errors or coefficients of variation are provided when reporting point estimates (e.g., a mean value) as a measure of precision. If appropriate, confidence intervals are provided.

2.2.4 Data Quality Evaluation

Data quality evaluation is the process of evaluating the final product in light of the original objectives of the statistical activity, in terms of the data's accuracy and reliability. Such information allows clients to make more informed interpretations of the survey results and is used to improve the way surveys are designed and implemented.

Data quality evaluations must meet the following minimum requirements: a measure of coverage error, a response rate and / or imputation rate, and measures of item nonresponse rates and / or sampling error for key characteristics. Managerial discretion is used to determine the appropriate amount of data quality evaluation for a given study. Factors considered include the uses of the data, the potential for error and its significance to the use of the data, the cost of the evaluation relative to the cost of the study, and whether or not the survey will be repeated or not.

Internal methods to evaluate data quality include:

- Checks of consistency with external sources of data,
- Internal consistency checks, for example calculation of ratios that are know to lie within certain bounds (e.g., sex ratios, trip rate estimates),
- Unit-by-unit reviews of the largest contributions to errors in estimates (e.g., geocoding precision),
- Calculation of data quality indicators such as nonresponse rates, imputation rates, and coefficients of variation,
- Debriefings with staff involved in the collection and processing of the data.

Sources of errors that are considered for evaluation include the following:

- Coverage errors, which consist of omission, erroneous inclusions, and duplications in the frame used to conduct the survey.
- Nonresponse errors, which occur when the survey fails to get a response to one, possibly all, of the questions.
- Measurement errors, which occur when the response received differs from the "true" value and can be caused by the respondent, the interviewer, the questionnaire, the mode of collection, or the respondent's record-keeping system. Such errors can be random in nature, or can introduce a systematic bias into the results.
- Processing errors, which can occur at the subsequent steps of data editing, coding, capture, imputation, and tabulation.
- Sampling errors, which occur when the results of a survey are based on a sample of the population rather than the entire population.

2.3 Data Reporting and Presentation

2.3.1 Disclosure Control

Strict practices are observed to ensure and protect respondent data confidentiality. Team members adhere to practices advocated by the Council of American Survey Research Organizations and the American Association of Public Opinion Research. The following steps make up our confidentiality protection protocol:

- All project staff are given explicit training in the need to uphold confidentiality protocols and commitments. We train staff in reasons why this is such an important responsibility..
- All staff working on a given project (e.g., telephone supervisors and interviewers, application programmers, data processing staff, etc.) sign legally binding pledges of confidentiality as part of their employment contract.
- Only those personnel who have signed such pledges will have access to the confidential data, and then only on an as-needed basis.
- A unique number in the survey response database identifies each study participant so that names are not associated with responses to questions. Moreover, the data file containing the link between name and ID number will be stored separately from the data files containing question responses.
- Telephone numbers and all other potentially identifying information such as name, address, and SSN are purged from the data files and replaced with case identification numbers after interviewing and data processing have been completed.
- All confidential information will be stored in password-protected files by the holders of this information. Analytic files contain neither names, addresses, nor telephone numbers.
- During data collection and processing, access to all such files will be scrupulously controlled and we use a system of passwords to limit access to the files. These files are not accessible through Internet routes.
- We keep only a minimal amount of respondent-identifiable information is kept in the data files that are delivered.
- To maintain confidentiality and maximize respondent cooperation, all survey respondents will be assured that their survey answers will remain confidential and that no personal information that they give will be individually identified with them.

2.3.2 Data Analysis

Data analysis is the process of transforming raw data into useable information, often presented in the form of a published document (typically Microsoft Word) or presentation (typically

Microsoft Powerpoint), in order to add value to the statistical output. The basic steps in the analytic process consist of:

- examining the topic,
- asking meaningful questions,
- developing support for the answers, and
- communicating that story to the reader.

Quality Assurance is exercised in data analysis and reporting by:

- arranging ideas in a logical order and in order of relevance or importance;
- using headings, sub-headings, and sidebars to strengthen the organization of the report;
- keeping the language as simple as the subject permits;
- using graphs in preference to or in addition to text or tables to communicate the message; and
- helping readers understand the information in the charts by discussing it in the text.

When tables are used, special care is taken with the overall format, spacing, and the wording, placement, and appearance of the titles, row and column headings, and other labeling that contribute to the clarity of the data in the tables and prevents misinterpretation. All tables and graphs define the base used for the rates, and use only the number of significant digits that add to the utility of the data.

All reports and presentations are checked for consistency of figures used in the text, tables and charts, verification of the accuracy of external data, and simple arithmetic.

2.3.3 Documentation

Documentation constitutes a record of the statistical activity, including the underlying concepts, definitions, and methods used in the production of the data. It serves as a record for clients of what was done in order to provide a context for effective and informed use of the data. The level of detail provided in the documentation will depend on its intended audience, the type of data collection, the data sources, the analysis, range and impact of uses of the data, and the total budget of the study.

Documentation may include the following:

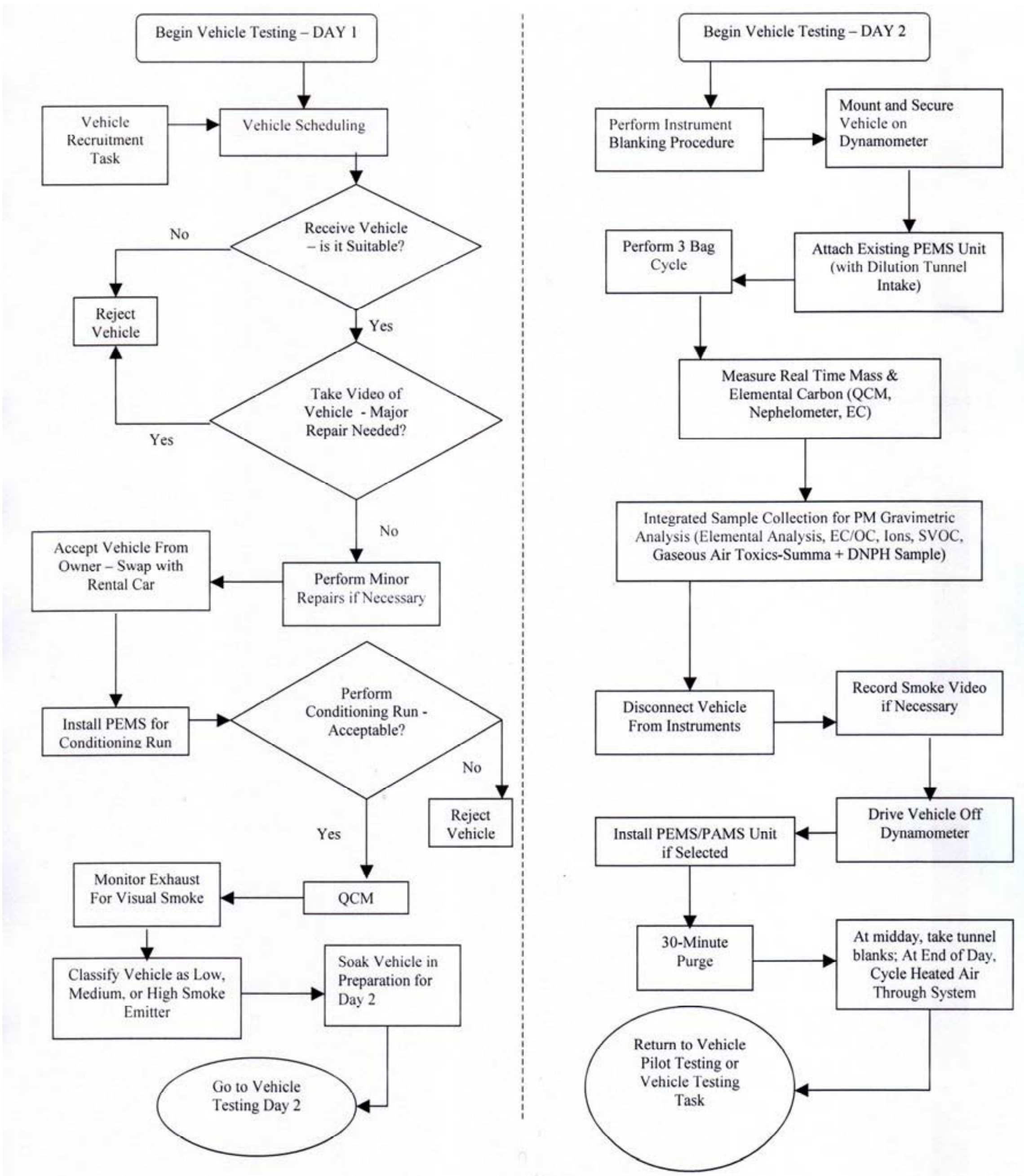
- Objectives;
- Content of the questionnaire;

- Tests of the questionnaire and the process;
- Methodological overview and discussion of technical issues;
- Data systems (data files structures, algorithms used to construct or define variables, weighting and expansion factors);
- Results of monitoring reports;
- Operations issues (training, feedback or debriefing reports;
- Implementation steps and challenges;
- Quality control indicators; and
- Data quality measures.

SECTION 3: DAY ONE VEHICLE INSPECTION AND CONDITIONING

The next two sections are organized temporally to follow an individual vehicle through the testing and analytical process. The flowchart presented in Figure 3-1 depicts the process.

Figure 3-1. Summary of Daily Activities



3.1 Vehicle Inspection

A number of vehicle inspections and vehicle data gathering activities are required to be performed during this study, in order to obtain vehicle information for the MSOD data table EQUIP_IN.dbf. Documentation for these activities may take the form of videotapes, interview questionnaires, checklists, hard copy data forms, and computer files. Each vehicle will receive a unique identification code which will be used to track documentation as it is gathered in the field.

While the vehicle is on site, all paper documentation generated will be maintained in a file folder inside the vehicle. Once the vehicle is returned to the owner, the vehicle documentation folder will be stored in a designated file cabinet located at the test site for the duration of the study, and at an offsite facility after the conclusion of the study. All vehicle data will be transferred to magnetic media to facilitate inclusion in the study database.

A staff member will be designated to co-ordinate all vehicle inspection procedures. The vehicle inspection coordinator will assign additional staff to perform many of the inspections. The coordinator will also review collected vehicle data to insure completeness and accuracy. Types of vehicle inspections to be performed are listed in Table 3-1.

Table 3-1. Vehicle Inspections

Inspection Type	Purpose
Initial Acceptance Inspection	To insure safety and test worthiness
Owner Questionnaire	Query for fuel and oil types
Video Tape	Document pre-existing damages
MSOD Compliant Vehicle Data Form	VIN, Engine family, Model, etc.
OBD Scan	OBD data
Visual	Smoke observations

Forms and checklists pertaining to the inspections listed above are provided in for reference Appendix A.

3.2 Vehicle Repair

Each test vehicle will be evaluated for repairs recently performed and for repairs which may need to be performed. The latter will serve primarily to ensure the vehicle can be safely operated on the road and dynamometer. If repairs are required, the vehicle owner will be notified and his/her permission will be obtained before repairs are performed. If the repairs cannot be performed by on-site personnel, the vehicle will be taken to a local repair shop by on-site personnel. Records of the repair will be maintained in the vehicle folder and a brief narrative of the repair will also be included. Repairs will also be documented in table sets associated with REPAR_IN.DBF in the MSOD. Following repair, the vehicle will be outfitted in the normal fashion, conditioned, and cued for testing.

Minor repairs that may be performed may include, but are not limited to, the following:

1. Replacement of unsafe, worn tires.
2. Replacement of belts or hoses.
3. Replenishment of fluids.
4. Brake service.
5. Replacement/repair of emission control components (oxygen sensor, EGR valve, etc.), so long as a short break-in period (approximately 100 miles) is feasible prior to testing.

Major repairs (either recently performed on the vehicle, or that the vehicle may require) that would cause us to exclude a vehicle from the test program may include, but are not limited to, the following:

1. Replacement of exhaust system. New exhaust systems would have to be conditioned for quite some time (> 300 miles) to remove cutting oils. These oils could bias the PM results.
2. Replacement of Catalyst. Conditioning of approximately 5000 miles would be required to age the catalyst.
3. Engine or engine component replacement or rebuild within the last 5000 miles (Including heads, valves, block, etc).

3.3 Vehicle Conditioning Run

Each test vehicle will be prepped the day before testing on a predetermined route that includes high speed accelerations, driving at freeway speeds, and driving at stop and go traffic patterns. This route is described in detail in Appendix A.

Prior to the conditioning run, a PEMS unit will be installed on the vehicle to monitor emission. The PEMS unit used for the preconditioning drive will undergo full a complete warm-up, zero and audit sequence to verify CO, CO2, NOx, and THC measurement accuracy. Calibrations will be performed as necessary to bring the PEMS into proper calibration. The concentrations and accuracy of all gasses used for auditing and calibrating will be recorded, and data files will be generated during all audits to preserve records of system accuracy and calibrations. All PEMS system flows and pressures will be verified and recorded, and ambient conditions as measured by the PEMS will be recorded and verified with independent measurements. A sample system leak check will be performed to verify sample system integrity, and a FID fuel leak check will also be performed. System temperatures (FID oven and chiller) will also be verified and recorded, and all sample rates and transport delay settings will be verified. Detailed installation guidelines, along with a checklist for the installation procedure, QC requirements are provided in Appendix A. This vehicle prep will be conducted for about 45 minutes. After the prep each vehicle will be soaked overnight for testing the next day. The dynamometer will be thoroughly warmed for at least 30 minutes and a coastdown will be performed at a specified load to check for dynamometer load and inertia problems. Alternate vehicle prep and conditioning procedures may be used to meet specific field study goals. Inertia will be set before the vehicle is chained down. Both inertia and load for a particular vehicle model and year will be taken from tables supplied by EPA. Table inertia values will be rounded to the nearest available setting on the dynamometer.

SECTION 4: DAY TWO VEHICLE TESTING

4.1 Sampling Equipment

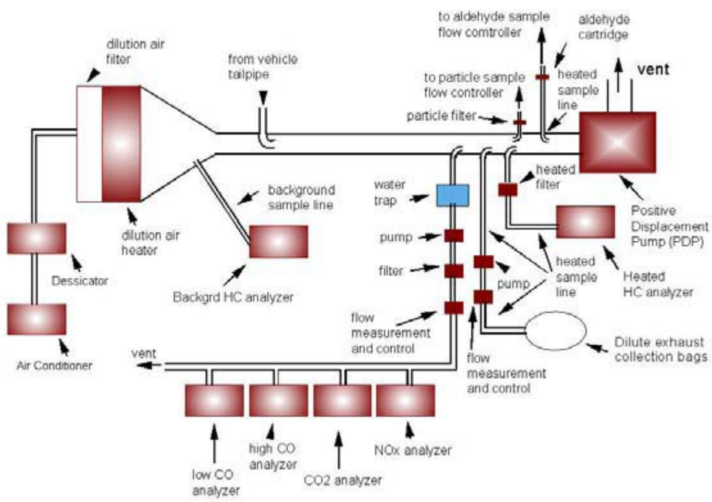
PEMS

Once the vehicle is mounted on the dynamometer, a PEMS unit will be installed on the vehicle to monitor undiluted emissions. Detailed installation guidelines, along with a checklist for the installation procedure, are provided in Appendix A.

Constant Volume Sampling (CVS)

Positive Displacement Pump-Constant Volume Sampling (PDP-CVS) system is used to dilute and transport the vehicle tailpipe exhaust to analyzers during the test. The PDP-CVS system employs an 8-inch diameter dilution tunnel with filtered dilution air. This system is graphically depicted in Figure 4-1. The CVS flow rate is sized to prevent water condensation over the range of ambient conditions and vehicle engine displacements encountered during testing. The existing test cell PDP is limited to about 540 SCFM. A spreadsheet model is available to accurately calculate second-by-second CVS water concentrations and dew points during transient speed tests. This model can be used to define the CVS system operating conditions (flow rates, temperatures) as a function of dilution air temperature and humidity, and vehicle emissions, that are necessary to avoid water condensation. A dilution air heater will also be used to avoid water condensation and loss of organic emissions in the sampling system. Condensed water will influence sampling system organic compound losses and can deteriorate sampling system flow control.

Figure 4-1. CVS Sampling System Schematic



The diluted exhaust is transported to the chemical analytical instrumentation through 1/4 inch O.D. tubing that is either heated (220° to 240°) to prevent water condensation, or when the compounds being analyzed are not water soluble (e.g., CO, NO), through a cryogenic water trap. The sample probes are located at least 10 tunnel diameters downstream from the position where the vehicle exhaust first encounters dilution air. Sample line flow rates must be adequate to achieve instrument response suitable for "real-time" measurement of the concentrations of the exhaust components of interest. Continuously integrated emission analyzers are required to have a response time of 1.5 seconds or less to 90% of a step change in concentration, where a step change is 60% of full scale or better. System response times between a step change at the sample probe position in the CVS tunnel and reading 90% of the change must be less than 10 seconds. Integrated bag samples may also be collected for each test phase permitting comparison of analytical results with those obtained by integration of the observed "real time" concentrations.

The potential for HC measurement artifacts exist resulting from absorption and subsequent release of HC from the dilution tunnel walls. As part of the dilution tunnel conditioning process, the dilution air heater and PDP are turned on at least 45 minutes prior to the days first test to purge the exhaust transfer line and dilution tunnel. Pumps at the analytical bench are also run to purge all sample lines. The PDP, dilution air heater and sample pumps run continuously (not shut down between tests) until conclusion of the days testing. Dilution tunnel HC concentrations are also monitored between tests to ensure that they return to ambient levels. Testing will not resume until dilution tunnel HC concentrations are within 15% of the ambient concentration.

CVS sample probes are designed to assure that continuous and adequate volume of sample is collected for analysis. Background and dilute exhaust sample line flows are monitored to assure no malfunction causing inadequate sample flow or analyzer response time deterioration such that time correlation for each emission constituent is no longer valid. The sample system will have an easily replaceable filter element to prevent particulate matter from reducing the reliability of the analytical system. The filter element will provide reliable sealing after filter element is changed. When the sample line is heated, the filter system is also heated.

The duct for transferring exhaust from the vehicle tailpipe to the CVS should be maintained as short as possible. The design should not cause static pressure in the tailpipe to change such that the emission levels are significantly affected. A change of ±1.0 inch of water or less, as measured at the tailpipe, is acceptable. For dual exhaust systems, the design must insure that each leg maintains equal flow. Equal flow will be assumed if each leg is approximately equal in length ± 1 foot, and the area at the end of each leg is approximately equal.

All materials in contact with exhaust gas should be unaffected by and not affect the sample (i.e., the materials should not react with the sample, and neither should they taint the sample as a result of outgassing). Acceptable materials include stainless steel, Teflon ®, silicon rubber, and Tedlar®.

Continuous Measurements

In addition to the regulated gas pollutants measured by BKI, DRI will provide continuous measurements of PM mass using an EPA-supplied Brooker Systems Model RPM-101 Quartz

Crystal Microbalance (QCM) and Thermo-MIE Inc. DataRam 4000 Nephelometer. Black carbon will be measured continuously with a DRI photoacoustic instrument and integrated samples will be collected and analyzed by DRI for PM gravimetric mass, elements, elemental and organic carbon, ions, particulate and semi-volatile organic compounds, volatile organic air toxics (benzene, toluene, xylenes, ethylbenzene, styrene, 1,3-butadiene, n-hexane, naphthalene, fo

The samples will be extracted from the BKI dilution tunnel through a low particulate loss 2.5 um cut point pre-classifier. The sample will be isokinetically partitioned among the continuous instruments and integrated air samples using a suitable sample distribution manifold. Separate Teflon and quartz filters will be collected for each of the three phases of the Unified Driving Cycle (UDC) using a sequential sampler. All other integrated samples will be collected over all three phases of the cycle, excluding the 10-minute soak period between phases 2 and 3.

The dynamometer dilution air will be dehumidified and heated to 47°C during testing. No residence chamber will be used for integrated samples and sampling streams will be maintained at 47°C. Photoacoustic instrument is an exception since it is designed to operate at below 35°C and black carbon concentrations should not be affected by temperature. The dilution tunnel will be purged between tests for a minimum of 30 minutes. PM mass will be monitored to ensure that background levels have stabilized after the prescribed purge period. A 60-minute dilution tunnel blank are collected once per day at the middle of the day.

Figure 4-2 presents a schematic of the sampling instrumentation.

4.2 Calibration of Equipment

Each piece of equipment or instrument will be calibrated and maintained to ensure accuracy within specified limits. Calibration and maintenance procedures are detailed in the Team Technical Standard Operating Procedures (SOPs) Manual. A copy of this and any other appropriate SOPs will be kept on-site. The equipment used by onsite personnel to collect samples will be calibrated according to Federal Register requirements (when applicable), manufacturer's procedures, or internal guidelines at recommended intervals. An equipment logbook will be kept on file that contains the calibration procedures and the results of each calibration, and will also serve as a permanent record of maintenance for the sampling equipment. This document will be available for review, if so requested.

4.2.1 Dynamometer, CVS, and Gas Analysis Equipment

SOPs for calibration are typically designated in the analytical methodology to be used but will be also be outlined in the laboratory's Quality Assurance Manual. Calibrations are also performed at regular intervals by onsite personnel. Calibrations to be performed for onsite equipment are presented in Table 4-1.

Figure 4-2. Kansas City Exhaust Measurement Flowchart

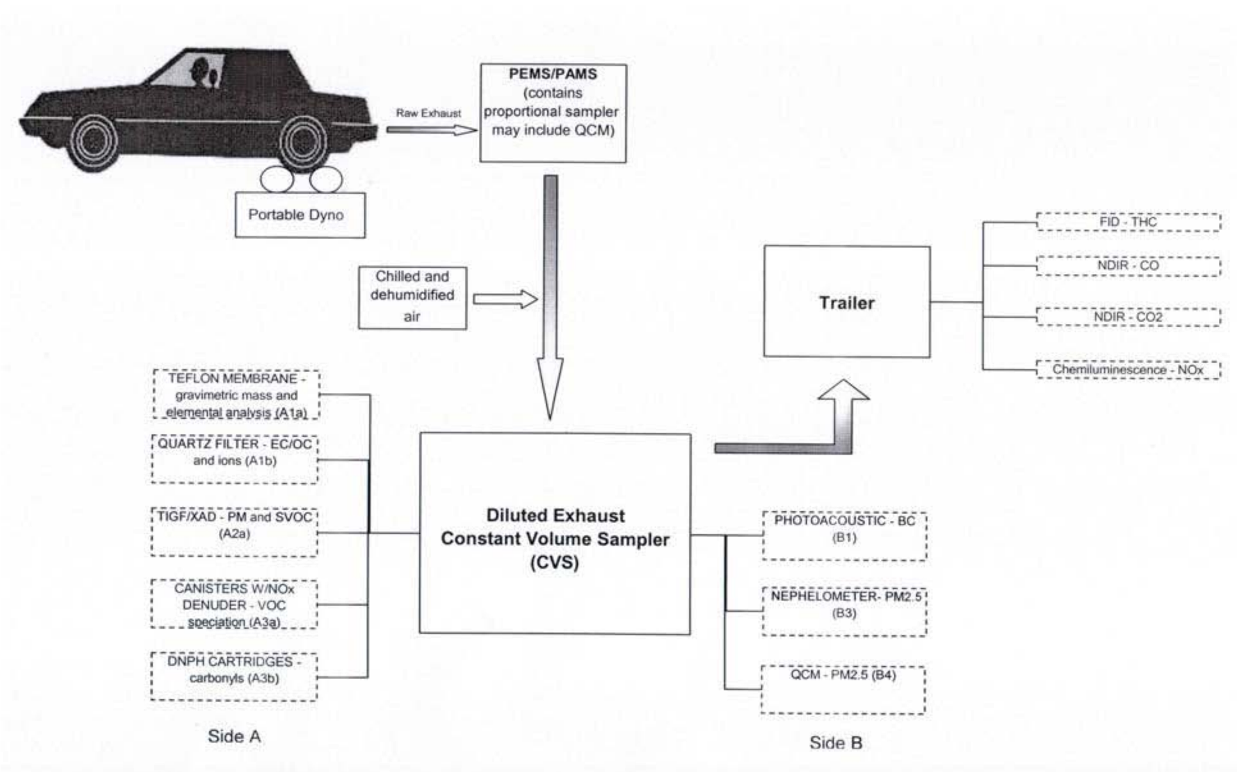


Figure 4-3. Testing Facility Layout

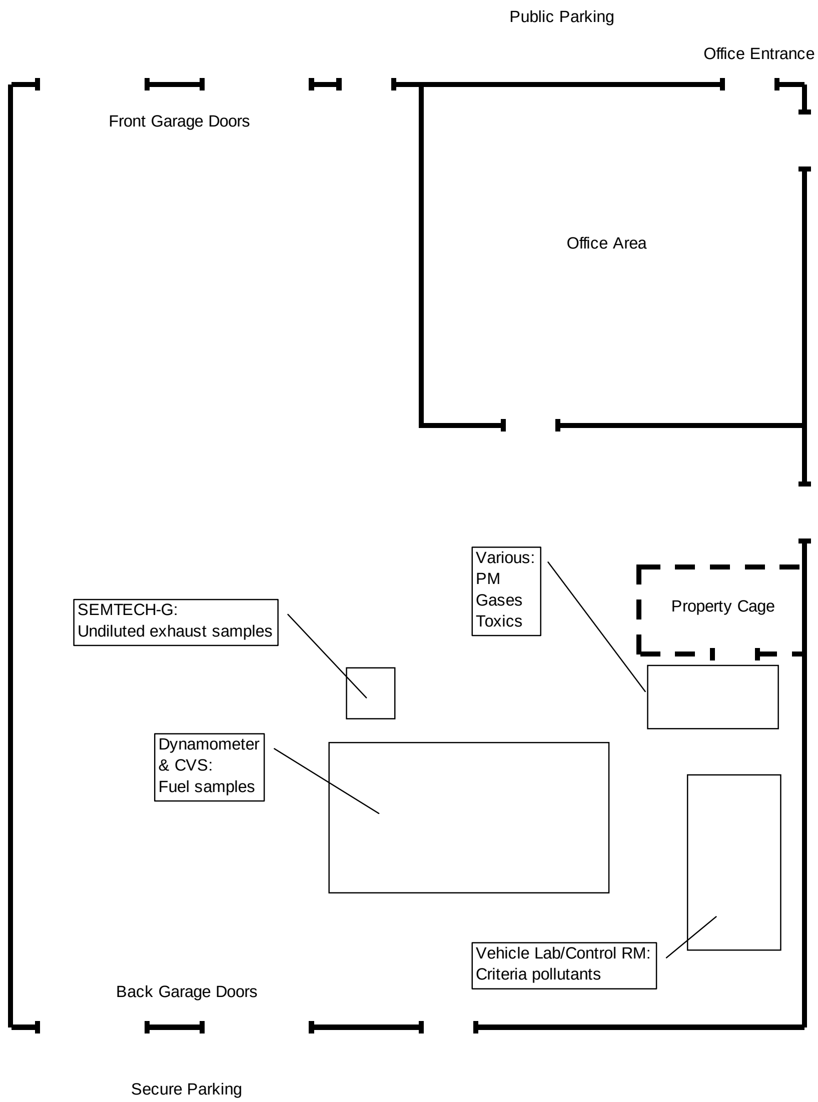


Table 4-1. Calibration and Performance Checks of Test Equipment and Analytical Instrumentation

Parameter	CFR Procedure	Time Period
DYNAMOMETER		
Calibration	86.118.78	Initial
Performance Check	86.118.78(b)	Daily
CONSTANT VOLUME SAMPLER (PDP-CVS)		
CVS system verification	86.119.90(c)	monthly
THC ANALYZER		
Response Optimization	86.121.90(a)	Initial
Multipoint calibration	86.121.90(b)	initial/monthly
Zero and Span Check	86.140-94	pre/post test
*Blind Audit Sample	-	as available
CARBON MONOXIDE ANALYZER		
H_20 and CO_2 interference check	86.122-78(a)	Initial
Multipoint calibration	86.122-78(b)	Initial/monthly
Zero and Span Check	86.140.94	pre/post test
*Blind Audit Sample	-	as available
OXIDES OF NITROGEN ANALYZER		
Multipoint calibration	86.123-78(b)	Initial/monthly
Zero and Span Check	86.140.94	pre/post test
*Blind Audit Sample	-	as available
CARBON DIOXIDE ANALYZER		
Multipoint calibration	86.124-78	Initial/monthly
Zero and Span Check	86.140-94	pre/post test
* Blind Audit Sample	-	as available

* If available

When any of the parameters, accuracy and/or precision exceeds applicable boundaries (as specified in the CFR procedures listed above), then vehicle testing will cease and an investigation will be conducted to determine the cause of the problem. Testing will resume only when the problem is corrected and the parameter values are within the stated QC objectives. Instrument drift over a period of time, such as the time between calibration and sample analysis, is considered a component of measurement accuracy and must be reported. The precision is defined by evaluating the degree of mutual agreement among individual measurements made under prescribed like conditions.

The following narrative demonstrates SOPs and research protocol methods (RPMs) for some of the more critical instrumentation and test methods to be used in this project. The calibrations are included for the dynamometer operation, as well as calibrations for each of the instruments involved in the project.

Dynamometer Calibration

To ensure proper dynamometer simulation, speed and torque measurement and readout systems will be periodically calibrated. A suggested calibration schedule would include calibration just prior to transport to the field and then again just after initial setup in the field. In addition, calibrations shall be performed when daily coastdown tests so indicate the need.

Calibration of Dynamometer Roll Speed

Dynamometer speed will be calibrated using a Phototachometer to determine roll rpm. Using a vehicle to motor the dynamometer at a constant speed, the roll rpm shall be measured and the corresponding speed in mph determined. Simultaneous readings will be taken from the dynamometer's speed meter. Initial calibrations will be made at 10, 20, 30, 40, 50, and 60 MPH. Thereafter, daily calibration checks will be made at 50 MPH. Detailed instructions on speed signal calibration and adjustments are found in section 1.4.2 of the operator's manual.

Torque Cell Calibration

The dynamometer torque cell will be calibrated using the dead weight method as described in detail in section 1.4.3 of the operator's manual. A torque arm arbor and 3 weights are provided for this purpose.

Coastdowns

Coastdown tests are conducted for two purposes: 1) To establish a reference table of actual vs. indicated horsepower @ 50 MPH, and 2) to verify dynamometer calibration on a daily basis. A new reference table of actual vs. indicated horsepower @ 50 MPH will be made any time mechanical components of the dynamometer (including PAU fluid) are changed or altered. To construct the table, a series of coastdown tests will be performed at a variety of inertia and load settings. Coastdown times obtained are used to compute actual horsepower, which are in turn compared to indicate horsepower (by polynomial regression) to generate the table. Thereafter, coastdown tests will be performed on a daily basis (beginning of each day) on a thoroughly warmed up dynamometer. Daily coastdown times will agree within 1 second of reference times. If not, corrective action will be taken. As an initial step, speed and torque cell calibrations will be checked.

The coastdown test will be performed as outlined in the Code of Federal Regulations (CFR) 40 part 86. Speed trigger points of 55 and 45 mph are used. In order to perform a coastdown test, a vehicle will be used to motor the rolls to a speed above the high trigger point. At that time, the vehicle will be raised and the rolls allowed to coast down from 55 to 45 MPH. Coastdown time will be recorded and used to calculate horsepower absorbed @ 50 MPH. Detailed instructions on conducting the coastdown tests are given in Section 1.4.4 of the operator's manual.

For special high speed cycles, trigger points of 70 and 15 mph are used. In performing these special coastdown tests, a vehicle will be used to motor the rolls to a speed above the high trigger point, usually 73 mph. At that time, the vehicle is raised and the rolls allowed to coast down from 70 to 15 mph. Coastdown time will be recorded and used to calculate speed vs. load curves for 70 to 15 mph.

Maintenance

Maintenance of the dynamometer will be carried out on a routine basis. Periodic checkups will occur at 1000-hour intervals or annually. Maintenance will be carried out in accordance with the Clayton Instruction Manual.

All laboratory equipment is on a preventative maintenance schedule. The most important preventative maintenance tool is the systematic performance check of the instruments. When an instrument is not performing to standards, the problem is investigated and corrected before it becomes significant.

All major laboratory equipment (GC/MSs, HPLC, ASE extractor) are on service contracts with the original manufacturer (Varian, Waters, Dionex, respectively). The contracts provide annual or biannual preventative maintenance by the manufacturer's service technician and immediate on-site response to any service call within 48 hours of notification of the manufacturer.

Several laboratory personnel have extensive experience working with all the major laboratory equipment, and extensive support facilities (electronics and machine shops, and QA lab with standard reference materials, etc.) are available. These personnel and facilities ensure the continued operation of all analytical laboratory instruments.

CVS Operation

The CVS system consists of an 8-inch dilution tunnel, particulate/charcoal inlet filter, and a positive displacement pump (PDP) operated to draw approximately 540 CFM of diluted exhaust gas through the system. Flow through the system during a test phase is a function of the volume swept per pump revolution, pump rpm, and the inlet pressure and temperature. Therefore, measurement of these four variables is needed to correctly calculate the flow.

Calibration of CVS

Volume per pump revolution, or Vo, is determined from propane injections that are conducted periodically in accordance with 86.119-78 paragraph (c) of 40 CFR July 1, 1983. Under normal circumstances, Vo, once determined, is not subject to change. The temperature and pressure measurements at the blower inlet will be taken using transducers which are periodically calibrated to insure accurate and precise values. PDP rpm will not be measured on a per test basis, but will be checked periodically (at least once daily) using a phototachometer.

Preventative Maintenance

The CVS dilution air filter pak will be changed whenever the pressure drop across the filter becomes excessive. This condition occurs when it is no longer possible to maintain exhaust line pressure within +/- 6 inches of water.

Driving Cycle Simulation

The test vehicle will be operated by a driver over a specified driving schedule on the dynamometer. The driver will follow a speed vs time trace on a driver's aid which establishes a speed error band within which vehicle speeds are controlled. Following the test, an indication will be given of the number of driver violations. A violation occurs when the vehicle speed is outside the error band for two or more seconds. Generally, violations resulting from inability of the vehicle to keep up with the test cycle will be disregarded.

Drivers Aid Speed Check

At the time the dynamometer speed calibration is carried out, indicated speed on the driver's aid will also be checked. Zero and span adjustments to the driver's aid will be made if the driver's aid speed signal does not agree with actual speed.

Measurement of Diluted Exhaust Gases

The four routinely measured automobile or truck exhaust emissions are HC, CO, CO2, and NOx. Concentrations of these gases will be measured in exhaust gas which has been diluted with a constant volume sampler (CVS). During the test, concentrations in diluted exhaust will be measured and logged on a real time basis (1 sample per second). At the conclusion of a test, with the vehicle's engine off, the ambient air will also be measured for background concentrations of HC, CO, CO2, and NOx. Average gaseous concentrations per test will be computed, background corrected and used per the CFR 40, for mass emission determination.

Calibration of Exhaust Gas Analyzer

All analyzers used in the measurement of HC, CO, NOx, and CO2 shall be calibrated in accordance with requirements 86.121-82, 86.122-78, 86.123-78, and 86.124-78 respectively, all of which can be found in 40 CFR July 1, 1983. These procedures include periodic multipoint calibrations using NIST gases and zero and single point span checks before each dynamometer test.

Operation and Maintenance of Exhaust Gas Analyzers

All analyzers shall be operated and maintained in accordance with their respective operating manuals. Deviations from these procedures will be documented in the Lab Notebook.

Analytical Gases

Analytical gases must meet the requirements of 86.114-94 of 40 CFR July 1, 1998. Accordingly, calibration gases in the laboratory are traceable within 1 percent of NIST gases, while span gases will be accurate to within 2 percent of true concentration (NIST gases). The reference followed for naming cylinder gases as calibration standards is EPA Protocol No. 2 which is entitled "Traceability Protocol for Establishing True Concentrations of Gases Used for Calibration and Audits of Air Pollution Analyzers", June 15, 1978.

Multipoint Calibrations

All regulated emissions instrumentation will be subjected to monthly multipoint calibrations to ensure response linearity. THC, FIDs, and NOX chemiluminescent analyzers are inherently linear over the analysis ranges normally used, while CO and CO2 NDIRs are linearized by electronic methods and therefore subject to drift. Procedures for multipoint calibration are identical for each method. The response of each analyzer will be adjusted for appropriate response to zero gas and a full-scale calibration gas. With no further adjustments, down-scale concentrations will be introduced to the instrument and responses recorded. Down-scale concentrations of 90, 80, 70, 60, 50, 40, 30, 20, and 10% of full scale will be generated by dynamically diluting the full-scale calibration gas with a 10-point gas divider. Linear regression techniques will be used to define a best-fit linear curve to the data. Actual concentrations for each down-scale point will then be compared to concentrations calculated from instrument response and curve coefficients. If the calculated concentration deviates by more than 2% from the actual concentration, corrective action is required.

Zero/Span

Immediately before analysis of the CVS bags, each instrument will be zeroed and spanned by using appropriate zero and span gas. Span gases will be accurate to ±2% of true concentration (as referenced to NIST standards). Prior to zeroing and spanning, the CVS sample will be "sniffed" to ensure analysis will be done on the proper instrument range. Range control, zero/span, and analysis of the CVS bags are automated to reduce potential for operator error.

Analytical Systems

Prior to analysis, analytical systems (i.e., GC/ECD/FID, HPLC, GC/MS, and GC/IRD/MSD) are checked for purity and are certified clean (less than 0.1 ppbv of targeted compound). Quality control in the laboratory includes instrument calibration for each batch of samples analyzed, replicates of standards, and analysis of approximately 10% of the samples for estimate of analytical precision (historically less than 6%).

Primary reference standards are traceable to a NIST Standard Reference Material (SRM). For canister hydrocarbon speciation by GC/FID, a NIST SRM 1805 is used consisting of 254 ppb of benzene in nitrogen. In addition, NIST SRM 2764 (245 ppb of propane in air) is used for calibrating the light hydrocarbon analytical system. For halogenated compound measurements, a NIST-traceable standard mixture of 39 compounds is purchased from Scott Specialty Gases and diluted for calibration. For VOC measurements by the GC/MS system, a 74 compound mixture in low ppb level (Air Environmental, Inc., Denver, CO), traceable to the NIST SRM 1805, is used for calibration. For PAH measurements, a NIST SRM 1647 with the addition of other compounds not present in the mixture is used.

Gas cylinders of helium, nitrogen, hydrogen, and ultra zero air (all UHP grade from best sources available) are used for the analytical systems. From a single analysis, the GC/IRD/MSD system gives three dimensions of data for positive compound identification: retention times, infrared spectra, and mass spectra. Unknown compounds are identified by matching corresponding data of known standards. The current inventory of reference samples consists of over 250 single- and multi-component reference samples and includes most of the compounds of interest in this project.

The analytical systems are calibrated initially by multipoint calibration (i.e., three levels plus humid zero air) and checked regularly by a one-point calibration using appropriate NIST SRM or other standard. The day-to-day reproducibility of ±10% is acceptable for either standard. Control charts are used for assessing analytical system performance.

Samples that fall outside the calibration range are diluted until bracketed by the calibration curve. Instrument responses to calibration standards for each parameter are analyzed using a least squares linear regression. The calibration must generate a correlation co-efficient (R2) of 0.99 to be acceptable.

During the course of analysis, calibration standards are routinely analyzed to ensure that the instrument response has not changed. The criterion of ±10% of the expected response is used by the analyst to determine whether the instrument must be recalibrated. Retention time windows for each analyte are established prior to analysis and re-established continuously throughout the course of the analytical period.

The QA Manager conducts a field and laboratory systems audits, a laboratory performance audit and/or interlaboratory comparisons, and four field performance audits. Systems audits examine all phases of measurement and data processing to determine that the SOPs are followed and that operational staff is properly trained. The systems audit is intended to be a cooperative assessment resulting in improved data, rather than a judgmental activity. Performance audits establish the extent to which data specifications are being achieved in practice and evaluate measurement accuracy against independent standards. The field systems audit is conducted at the beginning of the project after all equipment is installed and operating. It will be followed by the first field performance audit. These audits will identify deficiencies and implement remedial actions. Subsequent field performance audit results will be used to define accuracy of field measurements.

Laboratory audits present standards with known concentrations to each laboratory process. These standards are analyzed according to normal procedures and the results will be compared with the standard values. In some cases, however, NIST standards are not available (e.g., elemental carbon, organic carbon). In such cases, interlaboratory comparisons are an effective audit tool. Audit strategies, issues, and procedures are described in detail in respective SOPs.

In the case of a failure of a performance or technical systems audit, written notification including the details of the recommended corrective action will be sent from the audit team to the project PI and to the QA Manager. The PI - in collaboration with the QA Manager - will determine the party responsible for taking corrective action and will verify any work completed. All audits will be reported in the Quality Assurance Final Report, which will be submitted as an attachment to the Project Final Report.
Analytical procedures that may be required for the accomplishment of the Statement of Work tasks are listed in Table 4-2. All QC requirements designated in these methods will be met. For

required tasks not described in an EPA- or ASTM-approved method, SOPs will be required and archived. A summary of the SOPs currently in use for these studies is provided in Table 4-2. These SOPs are stand- alone documents and are not included with this document.

Table 4-2. Standard Operating Procedures to Characterize Emissions

Analytical Measurement	Standard Operating Procedure
Regulated Emissions	Federal Register: Standards for Emissions
CVS Water Condensation	Procedures for Determining Constant Volume Sampling System Water Condensation
Thermocouples	Procedures for Calibration of Thermocouples

Mr. Richard Snow is responsible for the analytical equipment for the Transportable Dynamometer system should a failure occur. In the case of an electronic malfunction in the analytical equipment, the usual repair method is for an onsite technician to contact the equipment or instrument manufacturer. With the assistance of the manufacture's service departments, Mr. Snow has successfully performed troubleshooting and repair of analytical equipment. The assistance of an electronic engineer(s) for troubleshooting instrument problems and diagnosing individual component problems that may need replacing, such as diodes, resistors, circuit boards and capacitors, etc is available if necessary. In extreme cases, the manufacturer's service representative will be required to travel onsite to make the required repairs. The repair of any analytical equipment will be recorded in the instrument laboratory maintenance logbook. The entry will describe the problem and remedy.

4.2.2 PEMS

A PEMS unit will be used to concurrently measure vehicle exhaust emissions during dynamometer testing. This unit will undergo a complete verification, audit, and calibration sequence (calibration only as necessary), for each vehicle tested. This sequence will be identical to that as described in Section 3.4. All audit and calibration information will be recorded on data collection sheets, as shown in Appendix A.

4.3 Sampling Media Preparation and Certification

Teflon and Quartz Filters

Teflon filters are equilibrated for weighing only after they pass acceptance testing by XRF. The filters are equilibrated for a minimum of four weeks before performing initial weights. At least two filters from each lot (typically 100 filters) received from the manufacturers are analyzed for species to verify that pre-established specifications have been met. Lots are rejected if they do not pass this acceptance test. Each filter is individually examined over a light table prior to use for discoloration, pinholes, creases, or other defects. In addition to laboratory blanks, 5 to 10% of all filters will be designated as field blanks to follow handling procedures, except for actual sampling.

Quartz fiber filters absorb organic gases from ambient air and organic artifacts from the manufacturing process. By pre-firing the quartz filters before sampling, these absorbed gases and artifacts are reduced to constant insignificant levels. The filters are pre-fired in preparation for thermal/optical reflectance carbon (TOR) analysis, which is a thermal desorption process subjecting the filters to temperatures between 25°C through 800°C. Therefore, the filters are pre-fired at 900°C to remove all possible interferences with the TOR analysis. Sets of filters with levels exceeding 1.5 mg/cm2 for organic carbon and 0.5 mg/cm2 for elemental carbon are re-fired or rejected. Pre-fired filters are sealed and stored in a freezer prior to preparation for field sampling.

PUF/XAD/PUF Cartridge and Filter

DRI will also acceptance test TIGF filters and XAD-4 resin packs. XAD-4 is placed in a Buchner funnel and rinsed with distilled water three times followed by technical grade methanol 3-4 times, and again three times with distilled water. It is then further cleaned by Soxhlet extraction for 48 hours with methanol, followed by Dionex ASE extraction for 15min/cell with ~170 mL of dichloromethane (CH2Cl2) and acetone at 1500 psi and 100 C. The XAD-4 is then dried in a vacuum oven at –15 to –20 in Hg and 50° C. Cleaned XAD-4 is transferred to clean 1L glass jars and stored in aluminum cans with activated charcoal. The TIGF filters will be cleaned by sonification in CH2Cl2 for 30 minutes, followed by another 30-minute sonification in methanol. Then they will be dried, placed in aluminum foil, and labeled. Each batch of precleaned XAD-4 resin and ~10% of precleaned TIGF filters. The XAD-4 resins are assembled into glass cartridges (50 g of XAD between two screens), wrapped in aluminum foil and stored in a clean freezer prior shipment to the field. This procedure is described in detail in the DRI Standard Operation Procedure: Analysis of Semi-Volatile Organic Compound by GC/MS.

Carbonyl DNPH Cartridges

For commercial 2,4-dinitrophenylhydrazine (DNPH) cartridges (Waters Sep-Pak XpoSure Aldehyde Sampler), DRI will analyze 5% of the purchased cartridges to ascertain the blank variability. Another 5% will be analyzed if the initial data show that the blank variability is marginally acceptable (at or slightly higher than 1/3 of the desired lower quantifiable limits (LQL)). This is necessary because unless cartridges are prepared in-house there is no other indication of the quality of the product, such as reagent and blank cartridge purity. In carbonyl measurements, the blank variability is the single most important factor in determining the lower quantifiable limit of the measurement; other factors such as flow rate, and analytical variability are secondary in importance.

Canister Cleaning and Preparation

Prior to sampling, the canisters will be cleaned by repeated evacuation and pressurization with humidified zero air, as described in the EPA document "Technical Assistance Document for Sampling and Analysis of Ozone Precursors" (October 1991, EPA/600-8-91/215). Six repeatable cycles of evacuation to ~0.5 mm Hg absolute pressure followed by pressurization with UHP humid zero air to ~15 psig is used. Our method differs from the EPA method by heating the canisters to 140°C during the vacuum cycle. At the end of the cleaning procedure, one canister out of the six per lot is filled with humidified UHP zero air and analyzed by the GC/FID method. The canisters are considered clean if total NMOC concentrations are less than 20 ppbC.

Sampling System Cleaning

Sampling systems with internal surfaces upstream of the collection media (e.g., canister sampler) must be cleaned and certified for cleanliness prior to sampling. The canister sampling systems are cleaned prior to field sampling by purging with humidified zero air for 48 hours, followed by purging with dry UHP zero air for one hour. Each canister sampling system is certified clean by the GC/FID analysis of humidified zero air collected through this sampling system. The system is considered clean if the concentration of any individual targeted compound is less than 0.2 ppbv, and total NMOC concentration is less than 10 ppbC. In addition, a QA sample consisting of a blend of organic compounds of known concentration in clean humidified zero air is collected through the sampling system and analyzed by the GC/FID method. The sampling system is considered non-biasing if recoveries of each of the QA compounds are in the range of 80-120% (EPA document EPA/600-8-91/215).

4.4 Testing, Inspection, and Maintenance of Equipment

4.4.1 Dynamometer and Associated Gas Analysis

Prior to deployment in the field, each instrument is bench-tested and inspected in the laboratory. Maintenance frequency varies depending on instrument. Instrument and equipment testing, inspection, and maintenance requirements are discussed in detail in the SOPs.

Procedures and schedules for preventive maintenance of field sampling equipment are the responsibility of onsite personnel. Maintenance procedures and calibrations will be performed periodically on each piece of analytical laboratory equipment to ensure accuracy within DQOs. These procedures and frequency of performance are designated in the individual instrument manuals or in the laboratory Quality Assurance Manual.

4.4.2 PEMS

Prior to project deployment, current firmware will be downloaded onto all PEMS units, and all host computers will be updated with current operating software. Sampling system filters will be checked and replaced as necessary. All systems will undergo a full audit and calibration sequence to ensure they are operating within allowable limits. All system operating parameters will be monitored throughout testing, as listed in Section 3.4 and detailed in Appendix A. PEMS units will be removed from service if any out “out of range” operating conditions are identified, and all “out of range” conditions will be corrected prior to placing the unit back into service. All pertinent audit, verification, and calibration information will be recorded on data collection sheets included in Appendix A.

4.5 Obtaining Background Levels for Gas Analysis Equipment

THC background levels used for emission rate calculations are measured continuously during all test phases with a dedicated FID. Carbon Monoxide, CO2, and NOx background levels used for emission rate calculations are measured during the engine-off soak period between phases 2 and 3 for multi phase cycles or after completion of the test for single phase cycles, using the same instrumentation that measures diluted exhaust during the test phases.

Background levels are also monitored prior to each test to ensure reasonable ambient conditions exist at the start of the test. Background THC, CO, NOx, and CO2 concentrations in the dilution tunnel are recorded by the regulated emissions bench operator within 2 minutes prior to the start of the day's first test. These are designated background reference concentrations. These reference levels should be at or below typical ambient levels for the area. Backgrounds are measured before each subsequent test and compared to the reference concentrations. If these measured concentrations are greater than 15% above the reference concentrations, corrective action must be taken. If the increase in background concentration is due to an increase in the ambient background level (not influenced by station exhaust or spillage) and cannot be corrected, a new set of background reference concentrations may be established and testing may resume.

4.6 Securing the Vehicle on the Dynamometer

The transportable test cell includes a Clayton model CTE 50-0 water brake chassis dynamometer mounted on a Freuhauf trailer. The dynamometer is coupled to a Clayton direct drive variable inertia flywheel system allowing vehicle testing at inertia weights of 1750, 2000, 2250, 2500, 2750, 3000, 3500, 4000, 4500, 5000, and 5500 pounds. Vehicle road load (Hp @ 50 MPH) is manually set using the driver's pendant switch.

All utilities necessary for dynamometer operation (compressed air, cooling water, and electrical power distribution) are self-contained on the trailer. A compressor provides compressed air for operation of the dynamometer's roll brake, vehicle lift, and flywheel clutches. Compressed air is also available at each corner of the trailer via quick-disconnect fittings for adjusting test vehicle tire pressure. A closed-loop water system provides the dynamometer's power absorption unit with both cooling and load water. The water system includes a SPA pump, a 12-gallon storage tank, and a liquid to air heat exchanger. The water system is normally filled with a 50/50 mixture of water and antifreeze to prevent freeze damage in colder weather. The air compressor and water system are electrically wired into the test cell's electrical power distribution box. Electrical outlets, also wired to the power distribution box, are located underneath the trailer for miscellaneous equipment with either110 VAC and 220 VAC power requirements.

The vehicle is maneuvered onto the dynamometer with the drive wheels positioned and laterally stabilized on the dynamometer rolls. The vehicle's hood is opened and an auxiliary cooling fan is positioned in front of the vehicle. Testing does not begin until this system is positioned and activated. The cooling system is positioned to direct air to the vehicle cooling system, but shall not be directed at the catalytic converter. The vehicle must be restrained to assure that it cannot leave the dynamometer rolls during acceleration and braking. The parking brake should be set for front wheel drive vehicles prior to the start of the test. The parking brake need not be set for vehicles that release the parking brake automatically when the transmission is put in gear. A detailed SOP describing the securing a vehicle on the dynamometer is presented in Appendix A.

Several equipment systems are required to fulfill the objectives of this project. The dynamometer and its constant volume sampling (CVS) system are used to simulate roadway conditions in a stationary setting. Undiluted vehicle exhaust gases are sampled by a SEMTECH before the exhaust enters the CVS. Diluted exhaust is sampled from the CVS by several types of measurement systems that continuously quantify particulate, carbon dioxide, carbon monoxide, oxides of nitrogen, hydrocarbons. Other systems remove a “batch” or an “integrated” sample throughout a given vehicle’s test for storage and later analysis (e.g., fuels and some toxic gases). The sketch in Figure 4-3 gives an overview of the facility layout and the physical relationship between the various instrument systems.

Figure 4-3. Overview of Facility and Equipment Layout

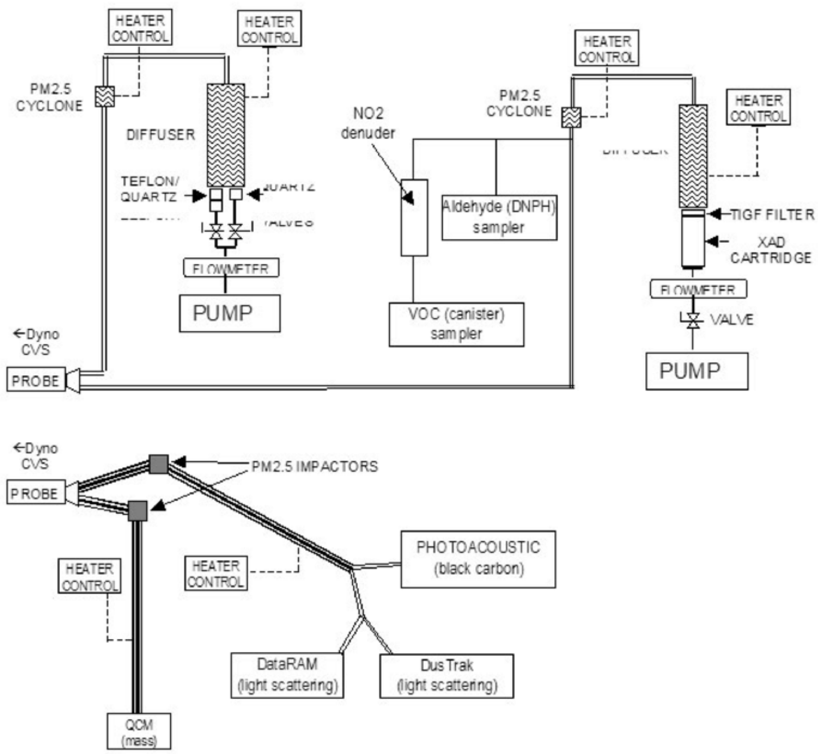
4.7 Particulate and Toxics Sampling Methods.

DRI will install and operated a suite of instruments to provide continuous PM analysis and to collect batch samples of particle and gaseous exhaust components for later analysis. These instruments collect sample air from the dynamometer dilution system via two isokinetic probes, provided by BKI, inserted prior to a 90-degree bend in the dilution tunnel. Figure 4-4 illustrates the sample train as it was installed for the pilot study. Heated conductive lines carried air from the probes to the continuous instruments. Insulated copper tubing was used to carry sample air to the time-integrated samplers.

4.7.1 Continuous PM Measurements

Continuous measurements include a Brooker Systems Model RPM-101 Quartz Crystal Microbalance (QCM) and Thermo-MIE Inc. DataRam 4000 Nephelometer for PM mass and DRI photoacoustic instrument for determination of black carbon mass concentrations. The continuous monitors will all sample from a common sampling manifold. The photoacoustic instrument is equipped with pressure, temperature, and relative humidity sensors so that the mass concentration can be adjusted to the desired ambient condition of pressure and temperature. Data from the real-time sensors can also be used to evaluate total particulate emissions by accumulating it over the sample period, and can be compared with data from the filter samplers.

Figure 4-4. Sample Train of DRI Equipment



Procedures for operation of the photoacoustic instrument, QCM, and MPS, as well as daily continuous instrument checklists, can be found in Appendix A.

4.7.2 Collection of Time Integrated PM and Toxics Samples

The vehicles will be tested on the EPA transportable dynamometer using a Unified Driving Cycle that will be composed of three phases. Teflon and quartz samples are collected for each phase and additional samples are integrated over the entire three phases of the UDC. These samples include whole air samples in stainless steel canisters, DNPH cartridges and Teflon-impregnated glass fiber (TIGF) filters with a backup cartridge consisting of XAD-4 resin.

The following substrates are proposed for this program:

- Gelman (Ann Arbor, MI) polymethylpentane ringed, 2.0 mm pore size, 47 mm diameter PTFE Teflon-membrane Teflo filters (#RPJ047) for particle gravimetric mass and elements.
- Pallflex (Putnam, CT) 47 mm diameter pre-fired quartz-fiber filters (#2500 QAT-UP) for water soluble chloride, nitrate and sulfate and for organic and elemental carbon measurements.

- Pallflex (Putnam, CT) TX40HI20-WW 102 mm diameter teflon-impregnated glass fiber filters for the DRI Sequential Fine Particulate/Semi -Volatile Organic Compounds Sampler (PSVOC sampler).
- Polystyrene-divinylbenzene resins, XAD-4 in a cartridges for collection of semi-volatile PAH. The Amberliete XAD-4 resin (20-60 mesh) is purchased from Aldrich Chemical Company, Inc.

Daily checklists pertaining to the time integrated sampler are included in Appendix A.

4.7.2.1 Teflon and Quartz Filters

Time-integrated samples for laboratory analysis are collected during each unified cycle test and a 60-minute tunnel blank each day as follows using specially adapted samplers designed and constructed at DRI. Sample air is drawn from the CVS via ½" insulated copper tubing to a small heated stainless steel chamber. The sample air exits via a PM2.5 cyclone contained in the chamber to a heated diffusing chamber approximately 1m tall, containing a thermistor temperature probe. From this chamber, the sample air exits through the two filter cartridges. Flow rates for each filter are set to 56 lpm by adjustable valves to give a combined flow of approximately 113 lpm as required by the inlet cyclone. Single oil-less pump is used to draw air through the sampler.

4.7.2.2 PUF/XAD/PUF Cartridge and Filter

A separate sampler for determination of particulate and semi-volatile organic compounds collects samples on 100 mm Teflon-impregnated glass fiber (TIGF) filters followed by glass cartridges containing XAD adsorbent at a flow rate of 112 lpm. The material collected on these media are removed by solvent extraction and analyzed at DRI by gas chromatography and mass spectrometry. A single filter and adsorbent pair were collected for each unified cycle, combining phases 1, 2 and 3. Sampling is suspended during the 10-minute soak period by turning off the pump. Sample air is drawn from the dynamometer CVS via ½" insulated copper tubing to a small heated stainless steel chamber. The sample air exited via a PM2.5 cyclone contained in the chamber to a heated diffusing chamber, containing a thermistor temperature probe, approximately 50cm tall. From this chamber, the sample air exits via the filter followed by the XAD cartridge. Flow rates are approximately 113 lpm as required by the inlet cyclone, and are monitored by an in-line TSI 4000 mass-flow meter. A single oil-less pump is used to draw air through the sampler.

4.7.2.3 Carbonyl DNPH Cartridges

Sample air is drawn from heated cyclone chamber via a ¼" diameter Teflon hose and passed through DNPH cartridges using a 6-channel sampler with integrated pump and mass flow controller. Airflow is maintained at 500 cc/min. A single cartridge is exposed for the duration of the 3 phases of the unified cycle and sampling is suspended during the 10-minute soak by switching to an unused channel.

4.7.2.4 Canister Sampling

For motor vehicle exhaust sampling, NO2 is of concern, since it may react with 1,3 butadiene. Atkinson et al. (1984) described the series of reactions involving NO2 and dialkenes and the consequence of the presence of NO. The reaction proceeds via initial NO2 addition to the double bond, followed by rapid addition of O2 to the peroxy radical. In the absence of NO these peroxy radicals react with NO2 to yield the thermally unstable peroxynitrates. Upon addition of NO, however, the peroxy radical will react rapidly with NO leading to a rapid disappearance of the peroxynitrates. The alkoxy radicals formed from the reaction of the peroxy radical with NO will then decompose, react with O2, ultimately leading to the formation of HO2 radical. The reaction of HO2 radical with NO generates HO radicals, which react with alkenes leading to rapid loss of alkenes. Modeling of this chemical system by Stockwell (2004) shows the following results for a canister samples containing 1,3-butadiene (43 ppbv), NO (10.0 ppm) and NO2 (1.0 ppm) in various combination, assuming a canister pressure of 1.5 atmospheres and NO emission rate of 2.2 mg/mile. This emission rate was the highest among 57 LDGVs tested during the Gas/Diesel PM Split Study (Fujita et al., 2001; Gabele, 2003). The decay rate of 1,3-butadiene in NO2 alone was linear with a rate of about 9% loss per 24-hour period. With NO alone, the disappearance of 1,3-butadiene is about 50% in the first 22 hours and over 90% in 65 hours.

Under separate funding by the U.S. Department of Energy's National Renewable Energy Laboratory, DRI is currently evaluating the efficiency of a denuder for removing both nitric oxide (NO) and nitrogen dioxide (NO2) from the sampling stream prior to collection in stainless steel canisters. This evaluation will consist of the following three parts.

Determine the stability of a 1,3-butadiene standard in two sets of three synthetic canister samples over a period of three weeks. Each set includes a canister containing 1,3-butadiene with purified zero air and canisters with addition of NO and NO2, respectively. Aliquots are analyzed by gas chromatography within the first hour, after 1 week and after three weeks. NO and NO2 levels correspond to the highest NOx emitter in DOE's Gas/Diesel PM Split Study. This task was completed in June, 2004 and decay rates match those predicted by Stockwell (2004).

Evaluate the removal efficiency of a denuder for removing NOx (NO and NO2). Saathoff et al. (2003) recently reported the use a denuder containing cobalt oxide coated ceramic granulate to remove NOx. Varying concentrations of NOx will be passed through the denuder and the denuded sampling stream will be monitored with a chemiluminescence NOx analyzer. Three levels of NOx will be used, which correspond to 2.0, 1.0 and 0.5 times the highest NOx emitter in DOE's Gas/Diesel PM Split Study.

Exhaust from an in-use high-mileage automobile will be collected in two sets of two canisters, one with an upstream NOx denuder and one without the denuder. Samples will be collected from a sampling manifold to ensure a well-mixed exhaust sample and NOx concentrations in the sampling manifold will be monitored with a chemiluminescence analyzer. The three sample sets will be collected over a five-minute period from cold-start, and after a two-hour soak. Aliquots will be analyzed by gas chromatography within the first hour, after 1 week and after three weeks.

The colbalt oxide will replace the triethanoloamine (TEA) denuder that was originally proposed to remove NO2. Sample air is drawn from heated cyclone chamber via a ¼" diameter Teflon hose and passed through a Teflo filter and a denuder coated with the denuder to remove NOx before being pumped into a Summa polished steel canister. Air flow was controlled by a needle valve to obtain the necessary flow rate to fill the canisters to approximately 15"Hg positive pressure over the duration of the complete unified cycle. Sampling is interrupted during the 10-minute soak by switching to a bypass channel. The sampler draws a total flow of 2 lpm, but only about 300 cc/min of that was pumped into the canisters.

4.8 Laboratory Analytical Methods

Analytical procedures that may be required for the accomplishment of the Statement of Work tasks are listed in Table 4-3. All QC requirements designated in these methods will be met. For required tasks not described in an EPA- or ASTM-approved method, SOPs will be required and archived. These SOPs are stand- alone documents and are not included with this document.

Table 4-3. Summary of Laboratory Related SOPs

DRI SOP No.	Observable/Method	Title
2-102.4	PM Gravimetry	Gravimetric Analysis Procedures
2-106.3	Quartz Fiber Filter Prep	Pre-firing of Quartz Fiber filters for Carbonaceous Material Sampling
2-108.3	Sectioning of Filters	Sectioning of Teflon and Quartz Filter Samples
2-109.4	Ionic Species Filter Extraction	Extraction of Ionic Species from Filter Samples
2-110.4	Filter Pack Processing	Filter Pack Assembling, Disassembling, and Cleaning Procedure
2-111.4	Filter Pack Shipping and Receiving	Sample Shipping, Receiving, and Chain-of-Custody
2-114.1	$PM_{2.5}$ FRM Mass	PM2.5 FRM Gravimetric Analysis
2-201.1	Filter Sectioning	Filter Sectioning
2-202.1	Filter Extraction	Filter Extraction
2-203.4	IC Analysis	Analysis of Filter Extracts and Precipitation Samples by Ion Chromatography
2-204.4	TOR Carbon Analysis	Thermal/Optical Reflectance Carbon Analysis of Aerosol Filter Samples
2-205.2	XRF Analysis	X-ray Fluorescence (XRF) Analysis of Aerosol Filter Samples
2-703.1	VOC by GC	Analysis of VOC in Ambient Air by Gas Chromatography with Cyrogenic Concentration
2-704.1	VOC by GC/MS	Analysis of VOC in Ambient Air by Gas Chromatography and Mass Spectrometry
2-710.1	Carbonyls by HPLC	Analysis of Carbonyl Compounds by High Pressure Liquid Chromatography
2-750.1	Analysis of SVOC by GC/MS	Analysis of Semi-Volatile Organic Compounds by Gas Chromatography and Mass Spectrometry

The following numbers of samples are to be collected in each of the two test rounds: 903 Teflon, 903 quartz, 349 TIGF/XAD, 337 canisters and 349 DNPH cartridges. Of the total samples collected, the following numbers of analytical measurements are budgeted: 903 gravimetric mass, 114 XRF (protocol A), 38 ICP/MS, 309 TOR carbon analysis (IMPROVE), 38 ion chromatography, 17 GC/MS analysis of combined TIGF/XAD extracts, 18 GC/MS of TIGF extract, 18 GC/MS of XAD extract, 32 canisters by GC-FID and 38 DNPH cartridges by HPLC-UV. The following specific chemical analysis protocol applies to the Kansas City LDGV emissions characterization study.

- Following gravimetric mass and XRF (protocol A) analysis of the three Teflon filters for the separate phases of the UDC, the three filters will be extracted together and the composite sample analyzed for elements by ICP-MS. We recommend Mn, As, Hg and Pb for elemental analysis by ICP-MS based upon results of the Gas/Diesel PM Split Study and the relative detection limits shown in Table A7-1b for XRF and ICP-MS.
- Each quartz filter will be sectioned into two halves. One half of each quartz filter for the three phases of the UDC will be used for thermal optical reflectance carbon analysis (TOR) using the IMPROVE protocol. Remaining halves of the three quartz filters will be extracted together and analyzed by ion chromatography for chloride, sulfate and nitrate.
- TIGF/XAD samples will be analyzed for PAHs, methylated-PAHs, oxy-PAHs, nitro-PAHs, hopanes, steranes, organic acids, cycloalkanes and alkanes by GC/MS. The TIGF filters and XAD will be extracted and analyzed separately for the 1991 to 1995 and 1996 and newer categories in order to improve the analytical sensitivity of the method by reducing contributions of background contamination. The filter and XAD will be extracted and analyzed together for the two older model year categories.

4.8.1 Protocol for Selection of Samples for Chemical Analysis

Each of the two rounds of vehicle testing will be completed over approximately two months. Because organic samples should be extracted within a month after sample collection, compositing decisions will need to be made before the end of each round of testing. Timely decisions are also required due to the limited number of canisters that will be available to the project. Due to other programmatic needs, DRI can only supply about 120 stainless steel canisters to the Kansas City Study. That number is about a third of the total number of canister samples that are planned for each round. Consequently, about a third of the available canisters must be recycled on a weekly basis. This section describes the rationale and operational procedures for selecting samples for chemical analysis.

Most vehicles newer than ten years and with mileage accumulations less than 100K that were tested in the Gasoline/Diesel PM Split Study yielded mass loadings below the optimum target loadings of 200 ug per sample for carbon analysis and 1 mg per sample for organic speciation. Table 4-4 show the numbers of trucks and cars that will be recruited for the Kansas City Study in each of the four model year groupings (pre-80, 80-90, 91-95 and 96 and newer) and the approximate numbers of vehicles that are expected to be tested within each stratum. PM loadings will be sufficient for chemical analysis for most vehicles in the two older model year categories and compositing of samples is an option for these strata. In contrast, compositing is a necessity for the two new model year categories in order to obtain adequate analytical sensitivity for organic analysis.

Because the study design calls for testing the vehicles in random order, no media composites will be collected (i.e., sampling multiple vehicles on the same media). Rather an appropriate number of samples will be extracted and analyzed together where analytical methods allow compositing prior to the chemical analysis (e.g., elements by ICP-MS, ions by IC, organic speciation by GC/MS, carbonyl compounds by HPLC-UV, and volatile organics by GC-FID). Table 4-4 shows the numbers of planned chemical analyses and approximate numbers of composite samples by test vehicle category. The total number of composite samples and average number of samples in each composite are shown, along with the corresponding percentages of vehicles in the composites relative to the total number of vehicles tested in each stratum. These percentages are larger for the two newer model year categories because no compositing is assumed for these categories. These numbers are intended to reflect the overall objectives of the project. They are tentative and subject to approval by the sponsor.

We anticipate that about 40 sample sets (including 6 dilution tunnel blanks) will be collected during a week of sampling. If vehicles are tested randomly in portion to the sampling strata, the numbers of vehicles tested in each stratum are listed in Table 4-5. The second number is the average number of samples that would be required to for a composite.

Sufficient numbers of samples would be collected weekly to create composites in all categories except for the 1996 and newer categories. A decision will be needed on a timely basis to either analyze the sample set, hold them for subsequent compositing with other samples, or remove the sample from further consideration by either archiving the sample or, in the case of canisters, to discard the sample and recycle the clean evacuated canister back to the field. We propose to make these decisions on a weekly basis beginning at the conclusion of the second week. The decisions each week will be based on the previous two weeks of sampling. The target mass loadings for each composite is a minimum of 1 mg of organic carbon, which will be estimated by the differences of the continuous mass measurements (either QCM or DataRam or DustTrak) minus the continuous black carbon measurements by PA. Composites will consist of samples with similar OC to PM ratios. Some composite containing high black carbon to PM ratios (i.e., black smokers) will be analyzed as well. The weekly decision will be made by DRI and posted at the end of the day each Monday.

Table 4-4. Number of Planned Chemical Analyses and Approximate Number of Composite Samples by Test Vehicle Category

	No. in Stratum	No. Tested	No in Comp	No. of Comp	% Tested	Teflon filter mass	Teflon filter elements	quartz filter OC/EC	quartz filter Ions	TIGF/XAD POC and SVOC	TIGF POC	XAD SVOC	canister VOC	DNPH cartridge Carbonyls
Round 1														
Daily Tunnel Blanks		60	10			60	6	60	6		6	6	6	6
Test Vehicles		250				750								
Truck - Pre 1980	50	26	1	4	15.4%		4	12	4	4			4	4
Truck - 1980 to 1990	100	52	1	4	7.7%		4	12	4	4			4	4
Truck - 1991 to 1995	70	36	3	2	16.5%		2	18	2		2	2	2	2
Truck - 1996 and newer	40	21	5	2	48.0%		2	30	2		2	2	2	2
Car - Pre 1980	40	21	1	5	24.0%		5	15	5	5			5	5
Car - 1980 to 1990	50	26	1	4	15.4%		4	12	4	4			4	4
Car - 1991 to 1995	80	42	3	3	21.6%		3	27	3		3	3	3	3
Car - 1996 and newer	50	26	5	2	38.4%		2	30	2		2	2	2	2
Replicate Vehicle Tests		15				45		45						
Weekly Calibration Vehicle		12				36		36						
Field/Transport Blanks		12				12	6	12	6		3	3		6
						903	38	309	38	17	18	18	32	38
Round 2														
Daily Tunnel Blanks		60	10			60	6	60	6		6	6	6	6
Test Vehicles		230				690								
Repeat Vehicle from Round 1		25				75								
Truck - Pre 1980	50	27	1	4	15.1%		4	12	4	4			4	4
Truck - 1980 to 1990	100	53	1	4	7.5%		4	12	4	4			4	4
Truck - 1991 to 1995	70	37	3	2	16.1%		2	18	2		2	2	2	2
Truck - 1996 and newer	40	21	5	2	47.1%		2	30	2		2	2	2	2
Car - Pre 1980	40	21	1	5	23.5%		5	15	5	5			5	5
Car - 1980 to 1990	50	27	1	4	15.1%		4	12	4	4			4	4
Car - 1991 to 1995	80	43	3	3	21.2%		3	27	3		3	3	3	3
Car - 1996 and newer	50	27	5	2	37.6%		2	30	2		2	2	2	2
Replicate Vehicle Tests		10				30		30						
Weekly Calibration Vehicle		12				36		36						
Field/Transport Blanks		12				12	6	12	6		3	3		6
						903	38	294	38	17	18	18	32	38
Total Round 1 and 2						1806	76	603	76	34	36	36	64	76

Table 4-5. Composite Breakdown

Test Vehicles	Vehicles Tested Weekly	No. in Composite
Truck - Pre 1980	3	1
Truck - 1980 to 1990	6	1
Truck - 1991 to 1995	4	3
Truck - 1996 and newer	3	5
Car - Pre 1980	3	1
Car - 1980 to 1990	3	1
Car - 1991 to 1995	5	3
Car - 1996 and newer	3	5

4.8.2 Mass Gravimetric Analysis

Unexposed and exposed Teflon-membrane filters are equilibrated at a temperature of 20 ±5°C and a relative humidity of 30±5% for a minimum of 24 hours prior to weighing. Weighing is performed on a Sartorius SE2 electro microbalance with ±0.0001 mg sensitivity. The charge on each filter is neutralized by exposure to a polonium source for 30 seconds prior to the filter being placed on the balance pan. The balance is calibrated with a 20 mg Class M weight and the tare is set prior to weighing each batch of filters. After every 10 filters are weighed, the calibration and tare are re-checked. If the results of these performance tests deviate from specifications by more than ±5 mg, the balance is re-calibrated. If the difference exceeds ±15 mg, the balance is recalibrated and the previous 10 samples are re-weighed. At least 30% of the weights are checked by an independent technician and samples are re-weighed if these check-weights do not agree with the original weights within ±0.015 mg. Pre- and post-weights, check weights, and re-weights (if required) are recorded on data sheets as well as being directly entered into a data base via an RS232 connection. All PM2.5 and PM10 Teflon filters will be analyzed for mass. All weights are entered by filter number into the DRI aerosol data base.

4.8.3 Elements by XRF

Table A7-1b compares the elements that are quantified by XRF and ICP-MS and the associated minimum detection limits. Neither method will provide data for all specified elements. We recommend a combination of XRF using DRI protocol A for three Teflon filters from each phase of the UDC and ICP-MS for selected elements (e.g., Pb and Hg As, and Mn) Total cost per test would be comparable to the budget estimate in our original proposal.

4.8.4 Elements by ICP-MS

Teflon-membrane filters will be analyzed with a Thermo Elemental X7 Inductively Coupled Plasma Mass Spectrometer with Collision Cell and Xi interface for the following elements: Mn, As, Hg and Pb. A quality control standard and a replicate from a previous batch are analyzed with each set of 14 samples. When a quality control value differs from specifications by more than ±5% or when a replicate concentration differs from the original value (when values exceed 10 times the detection limits) by more than ±10%, the samples are re-analyzed. If further tests of standards show that the system calibration has changed by more than ±2%, the instrument is re-calibrated as described above. All ICP-MS results are directly entered into the DRI databases.

4.8.5 Elemental and Organic Carbon

The thermal/optical reflectance (TOR) method measures organic (OC) and elemental (EC) carbon. The TOR method is based on the principle that different types of carbon-containing particles are converted to gases under different temperature and oxidation conditions. The different carbon fractions from TOR are useful for comparison with other methods which are specific to a single definition for organic and elemental carbon. These specific carbon fractions also help distinguish among seven carbon fractions reported by TOR:

- The carbon evolved in a helium atmosphere at temperatures between ambient and 120°C (OC1)
- The carbon evolved in a helium atmosphere at temperatures between 120°C and 250°C (OC2)
- The carbon evolved in a helium atmosphere at temperatures between 250°C and 450°C (OC3)
- The carbon evolved in a helium atmosphere between 450°C and 550°C (OC4)
- The carbon evolved in an oxidizing atmosphere at 550°C (EC1)
- The carbon evolved in an oxidizing atmosphere between 550°C and 700°C (EC2)
- The carbon evolved in an oxidizing atmosphere between 700°C and 800°C (EC3)

The thermal/optical reflectance carbon analyzer consists of a thermal system and an optical system. The thermal system consists of a quartz tube placed inside a coiled heater. Current through the heater is controlled to attain and maintain pre-set temperatures for given time periods. A portion of a quartz filter is placed in the heating zone and heated to different temperatures under non-oxidizing and oxidizing atmospheres. The optical system consists of a He-Ne laser, a fiber optic transmitter and receiver, and a photocell. The filter deposit faces a quartz light tube so that the intensity of the reflected laser beam can be monitored throughout the analysis.

As the temperature increases from ambient (~25°C) to 550°C, organic compounds are volatilized from the filter in a non-oxidizing (He) atmosphere while elemental carbon is not oxidized. When oxygen is added to the helium at temperatures greater than 550°C, the elemental carbon burns and enters the sample stream. The evolved gases pass through an oxidizing bed of heated manganese dioxide where they are oxidized to carbon dioxide, then across a heated nickel catalyst which reduces the carbon dioxide to methane (CH4). The methane is then quantified with a flame ionization detector (FID).

The reflected laser light is continuously monitored throughout the analysis cycle. The negative change in reflectance is proportional to the degree of pyrolytic conversion from organic to elemental carbon which takes place during organic carbon analysis. After oxygen is introduced, the reflectance increases rapidly as the light-absorbing carbon is burned off the filter. The carbon measured after the reflectance attains the value it had at the beginning of the analysis cycle is classified as elemental carbon. This adjustment for pyrolysis in the analysis is significant, as high as 25% of organic or elemental carbon, and it cannot be ignored.

The system is calibrated by analyzing samples of known amounts of methane, carbon dioxide, and potassium hydrogen phthalate (KHP). The FID response is ratioed to a reference level of methane injected at the end of each sample analysis. Performance tests of the instrument calibration are conducted at the beginning and end of each day's operation. Intervening samples are re-analyzed when calibration changes of more than ±10% are found.

Known amounts of American Chemical Society (ACS) certified reagent grade crystal sucrose and KHP are committed to TOR as a verification of the organic carbon fractions. Fifteen different standards are used for each calibration. Widely accepted primary standards for elemental and/or organic carbon are still lacking. Results of the TOR analysis of each filter are entered into the DRI database.

4.8.6 Ion Chromatographic Analysis for Chloride, Nitrate, and Sulfate

Water-soluble chloride, nitrate, and sulfate are obtained by extracting the quartz-fiber particle filter in 15 ml of deionized-distilled water (DDW). The extraction vials are capped and sonicated for 60 minutes, shaken for 60 minutes, then aged overnight to assure complete extraction of the deposited material in the solvent. The ultrasonic bath water is monitored to prevent temperature increases from the dissipation of ultrasonic energy in the water. After extraction, these solutions are stored under refrigeration prior to analysis.

Water-soluble chloride (Cl-), nitrate (NO3-), and sulfate (SO4=) are measured with the Dionex 2020i (Sunnyvale, CA) ion chromatograph (IC). In IC, an ion-exchange column separates the sample ions in time for individual quantification by a conductivity detector. Prior to detection, the column effluent enters a suppressor column where the chemical composition of the component is altered, resulting in a matrix of low conductivity. The ions are identified by their elution/retention times and are quantified by the conductivity peak area. Approximately 2 ml of the filter extract are injected into the ion chromatograph. The resulting peaks are integrated and the peak integrals are converted to concentrations using calibration curves derived from solution standards. The Dionex system for the analysis of Cl-, NO3-, and SO4= contains a guard column (AG4a column, Cat. No. #37042) and an anion separator column (AS4a column, Cat. No. #37041) with a strong basic anion exchange resin, and an anion micro membrane suppressor column (250´ 6 mm ID) with a strong acid ion exchange resin. The anion eluent consists of sodium carbonate (Na2CO3) and sodium bicarbonate (NaHCO3) prepared in DDW. The DDW is verified to have a conductivity of less than 1.8´ 10-5 ohm/cm prior to preparation of the eluent. For quantitative determinations, the ion chromatograph is operated at a flow rate of 2.0 ml/min.

The primary standard solution containing NaCl, NaNO3, and (Na)2SO4 are prepared with reagent grade salts which were dried in an oven at 105°C for one hour and then brought to room temperature in a desiccator. These anhydrous salts are weighed to the nearest 0.10 mg on a routinely calibrated analytical balance under controlled temperature (~20°C) and relative humidity (±30%) conditions. These salts are diluted in precise volumes of DDW. Calibration standards are prepared at least once within each month by diluting the primary standard solution to concentrations covering the range of concentrations expected in the filter extracts and stored in a refrigerator. The calibration concentrations prepared are at 0.1, 0.2, 0.5, 1.0, and 2.0 mg/ml for each of the analysis species.

Calibrations curves are performed weekly. Chemical compounds are identified by matching the retention time of each peak in the unknown sample with the retention times of peaks in the chromatograms of the standards. A DDW blank is analyzed after every 20 samples and a calibration standard is analyzed after every 10 samples. These quality control checks verify the baseline and calibration, respectively. Environmental Research Associates (ERA, Arvada, CO) standards are used daily as an independent quality assurance (QA) check. These standards (ERA Wastewater Nutrient and ERA Mineral WW) are traceable to NIST simulated rainwater standards. If the values obtained for these standards do not coincide within a pre-specified uncertainty level (typically three standard deviations of the baseline level or ±5%), the samples between that standard and the previous calibration standards are re-analyzed.

After analysis, the printout for each sample in the batch is reviewed for the following: 1) proper operational settings, 2) correct peak shapes and integration windows, 3) peak overlaps, 4) correct background subtraction, and 5) quality control sample comparisons. When values for replicates differ by more than ±10% or values for standards differ by more than ±5%, samples before and after these quality control checks are designated for re-analysis in a subsequent batch. Individual samples with unusual peak shapes, background subtractions, or deviations from standard operating parameters are also designated for re-analysis.

4.8.7 Semi-Volatile Organic Compounds

Because no media compositing will be possible, TIGF filters and XAD cartridges be extracted and analyzed separately for the 1991 to 1995 and 1996 and newer categories. TIGF filter have very low background and removing the artifacts from the XAD will improve the detection limits for particulate organic species. Several samples will be composited together based on appropriate sample composite criteria (e.g., emission rate and ratio of photoacoustic black carbon to QCM mass).

Prior to extraction, the following deuterated internal standards are added to each filter-sorbent pair: naphthalene-d8, acenaphthylene-d8, phenanthrene-d10, anthracene-d10, chrysene-d12, fluoranthene-d10, pyrene-d10, benz[a]anthracene-d12, benzo[e]pyrene-d12, benzo[a]pyrene-d12, benzo[k]fluoranthene-d-12 , coronene-d-12, and benzo[g,h,i]perylene-d12, high molecular weight aliphatic hydrocarbons ranging from dodecane-d26 to octacosane-d58, cholestane-d4; and polar organics ranging from benzoic-d3 acid to cholesterol-d6. The filter-XAD pairs will be extracted by Dionex ASE with dichloromethane followed by acetone to expand the polarity range of analytes; these extraction solvents have been reported to yield high recovery of PAH (Chuang et al., 1987) and other compounds of interest (Hawthorne et al., 1988, 1989).

The extracts are then combined and concentrated by rotary evaporation at 20°C under gentle vacuum to ~1 mL and filtered through 0.45 mm Acrodiscs (Gelman Scientific), with the sample flask rinsed twice with 1 mL CH2Cl2 each time. Approximately 100 µL of acetonitrile is added to the sample and CH2Cl2 was evaporated under a gentle stream of nitrogen. The final sample volume is adjusted to 1 mL with acetonitrile. This procedure has been tested by Atkinson et al. (1988). The detailed procedure is described in DRI standard operating procedures.

The extracts are then split into two fractions. The first fraction is analyzed without further alteration for PAH, alkanes, hopanes, and steranes by a GC/MS using an electron impact select ion storage (SIS) method. The second fraction is derivatized using a mixture of bis(trimethylsilyl)trifluoroacetamide (BSTFA), trimethylsilylcholorosilane (TMCS), and silylation grade pyridine to convert the polar compounds into their trimethylsilyl derivatives for analysis of organic acids, cholesterol, sitosterol, and levoglucosan. Samples are then analyzed by GC/MS using isobutane chemical ionization SIS method.

For hopanes and steranes, the samples are precleaned prior to GC/MS analysis using a solid phase extraction (SPE) technique described by Wang et al. (1994a,b). Clean up is conducted on a 6ml Supelco SPE cartridge packed with 0.5g of SiOH. Samples are spiked on to a SPE cartridge along with ten microliters of n_tetrocosane-d50 (internal standard) and the PAH internal standard described above. Elution and fractionation is conducted with 1ml of hexane followed by 1.25 ml of benzene/hexane (1:1). Hopanes and steranes are eluted along with n_tetrocosane-d50 in the hexane fraction, while the PAH are eluted in the hexane/benzene with the PAH internal standards.

The samples are analyzed either by the EI (electron impact) or isobutane chemical ionization (polar compounds) GC/MS technique. A Varian Star 3800CX GC equipped with an 8200CX Automatic Sampler and interfaced to a Varian Saturn 2000 Ion Trap was used for these analyses. Injections (1 µL) were made in the splitless mode onto a 30 m 5% phenylmethylsilicone fused-silica capillary column (DB-5ms, J&W Scientific). Quantification of the individual compounds is obtained by selective ion storage (SIS) technique, monitoring the molecular ion (or the characteristic ion) of each compound of interest and the corresponding deuterated internal standard, added prior to extraction. Calibration curves for the GC/MS quantification are made for the most abundant and characteristic ion peaks of the hopanes, steranes, PAH and other organic compounds of interest using the deuterated species most closely matched in volatility and retention characteristics as internal standards. Authentic PAH standards (purchased from Aldrich, Inc.) plus National Institute of Standards and Technology (NIST) Standard Reference Material (SRM) 1647 (certified PAH) with the addition of deuterated internal standards and of those compounds not present in the SRM (i.e., methoxylated phenols, hopanes, steranes, lactones, cholesterol) are used to make calibration solutions. For quantifying hopanes and steranes the following authentic standards are used: C27 20R-5a,14a,17a-cholestane (purchased from Aldrich), 17b(H),21b (H)-hopane, 17a(H),21b(H)-30-norhopane, and 17a(H),21b(H)-hopane (purchased from Chiron AS, Norway). The remaining hopane and steranes are identified based on their mass spectra and retention time comparison with data available in the literature (Wang and Fingas, 1995; Rogge et al., 1993). For quantification of the hopanes and steranes for which authentic standards are not available, the response factor of standards most closely matched in volatility and retention characteristics are used. A three-level calibration is performed for each compound of interest and the calibration check (using median calibration standards) is run every ten samples to check for accuracy of analyses. If the relative accuracy of measurement (defined as a percentage difference from the standard value) is less than 30%, the instrument is recalibrated.

Recently, the Organic Analytical Laboratory (OAL) has received Varian 1200 triple quadrupole gas chromatograph – mass spectrometer (GC/MS/MS) system. The tandem MS/MS system allows for structural elucidation of unknown compounds with precursor, product and neutral loss scan. The GC interface allows for sensitive analyses of complex mixtures in electron impact (EI) as well as positive and negative chemical ionization (CI) mode. Negative CI offers a superior sensitivity for the analysis of nitro-PAH (mutagens and/or suspected carcinogens) that could be emitted from combustion sources, including motor vehicle engines. The sensitivity of this instrument in full scan EI/MS mode is approximately 1 pg/ul with 20:1 signal-to-noise ratio (S/N). In EI/MS SIM mode it reaches 50 fg/ul with 10:1 S/N. For negative CI, 10 fg/ul of octafluoronaphthalene gives S/N of 20:1. This superior sensitivity offers the advantage of analyzing small samples collected during a short sampling time.

4.8.8 Gaseous Air Toxics

Gaseous air toxic include canister sampling for VOC (benzene, toluene, ethylbenzene, —& p-,o-xylene, ie. BTEX, styrene, n-hexane, naphthalene, 1,3-butadiene, MTBE), and DNPH-coated Sep Pak cartridges sampling for carbonyl compounds (formaldehyde, acetaldehyde, acrolein). The DRI Organic Analytical Laboratory (OAL) routinely uses these methods and DRI standard operating procedures (SOPs) for sampling and analysis are available upon request.

Canister Samples

Canister samples are analyzed for speciated VOC concentrations promptly upon receipt of samples from the field, using gas chromatography/mass spectrometry method according to guidance provided by the EPA Method TO-15. The GC/MS system includes: Entech 7100 preconcentrator, Varian 3800 gas chromatograph with FID and column switching valve, and Varian Saturn 2000 ion trap mass spectrometer. The Entech preconcentrator consisted of three traps: 50% glass beads/50% Tenax, held at –100°C during sample transfer, 100% Tenax held at –40°C and a final focusing trap (a piece of silico-steel capillary) held at –180°C. The sample is desorbed from the first trap at 10°C, from the second trap at 200°C and from the third one at approximately 70°C to a transfer line heated to 110°C and connected to the head of the first column. The sample is injected at the head of a 60 m x 0.32 mm polymethylsiloxane column (CPSil-5, Varian, Inc.) held at 30°C. This column is connected to the switching valve leading into a 30 m x 0.53 mm GS-GasPro column (J&W Scientific). After approximately 7 min the valve was switched so that the effluent from the first column eluted onto a second 15 m x 0.32 mm polymethylsiloxane column connected to the mass spectrometer. The column switch was timed so that the C2 and C3 compounds eluted on the FID and all C4 and higher compounds eluted on the mass spectrometer. The GC program is as follows: 30°C held for 2 min, then 8°C/min up to 260°C. Calibration of the system is conducted with a mixture that contained the most commonly found hydrocarbons (75 compounds from ethane to n-undecane, purchased from Air Environmental), MTBE, and halocarbons (23 compounds from F12 to the dichlorobenzenes, purchased from Scott Specialty Gases). The standards are prepared in 6 L Silco-Steel canisters (Restek, Bellefonte, PA) by mixing three different standards through a multi-valve manifold using a Baratron absolute capacitance manometer (MKS Instruments, Andover, MA) to determine the pressure each standard added to the mixture. Prior to mixing, approximately 0.2 ml of ultrapure water is added to the canister to humidify the mixture (for mixture stability). The concentrations in the mixture are in the range of 0.2 to 10 ppbv. Three point external calibrations are run prior to analysis, and one calibration check is run every 24 hours. If the response of individual compounds is more then 10% off, the system is recalibrated.

For canisters the replicate analysis is conducted at least 24 hours after the initial analysis to allow re-equilibration of the compounds within the canister. The replicate analyses are flagged in our database and the programs we have for data processing extract these replicates and determine a replicate precision. Replicate analysis is important because it provides us with a continuous check on all aspects of each analysis, and indicates problems with the analysis before they become significant.

Carbonyl Compounds

Formaldehyde, acetaldehyde and acrolein will be collected with Sep-Pak cartridges that have been impregnated with an acidified 2,4-dinitrophenylhydrazine (DNPH) reagent (Waters, Inc), according to the EPA Method TO-11A. When the exhaust is drawn through the cartridge, carbonyls in the sample are captured by reacting with DNPH to form hydrazones, which are separated and quantified using HPLC in the laboratory (Fung and Grosjean, 1981). After sampling, the cartridges will be eluted with acetonitrile. An aliquot of the eluent will be transferred into a 1-ml septum vial and injected with an autosampler into a high performance liquid chromatograph (Waters Alliance System) for separation and quantitation of the hydrazones (Fung and Grosjean 1981). Since acroleine undergoes isomerization when reacted with DNPH on the silica-gel cartridges forming two products, both peaks will be identified and quantified and the total concentration will be reported.

4.9 Quality Control

Testing Site

Internal QC checks for sampling and sample analysis activities must be determined prior to project start-up. These QC checks may include duplicate samples, matrix spikes, surrogates, and blanks for each type of sample and sample matrix.

PEMS Overview

For each integrated sample, the run number, start and stop time, elapsed time, initial and final flow rate, and any exceptional occurrences are recorded on log sheets which are kept with the media at all times. Bar coded stickers with unique media IDs are attached to all media and their corresponding log sheets for tracking. Immediately after the conclusion of each test cycle the media are repacked with the log sheets and stored in a refrigerator, except for the canisters, which are packed and shipped via 2-day express to DRI each day. All media are packed into coolers with ice packs and shipped overnight back to DRI where they were logged in and placed in cold storage until analysis.

Continuous data are backed up via the wireless network and processed at the end of each sampling day to determine phase-averaged values. Run number, date, time, and vehicle license plate number were attached to all files to identify the data.

- For those instruments whose measurement depends on accurate flow rate determinations, such as the TEOM and QCM, the indicated flow rate must be checked against the flow rate measured with a Gillibrator bubble flow rate meter.
- The continuous instruments must be checked for leaks in a manner that is appropriate for each instrument. The sample system will be under substantial negative pressure with respect to the ambient pressure.
- Inlet integrity and sample line losses need to be evaluated at the outset by the combination of models from the aerosol spread sheets, and from direct measurement. A line transfer measurement needs to be performed that determines the mass concentration upstream of an instrument inlet, as well as the downstream concentration. These measurements can be performed, for example, with two Dustrak nephelometers. The two Dustraks must first be compared in a side-by-side test with a common inlet to make sure they are responding at the same clip.
- The instruments must be checked for any zero offsets. Filtered air can be introduced to the inlet of the instrument in question, and a measurement of the indicated quantity needs to be performed to quantify, and correct, any zero offsets. This measurement can also be performed when vehicle exhaust enters the sampling chamber, in which case any unexpected sensitivity to exhaust gas can be discovered and quantified.
- Daily plots will be made of the data from the continuous instruments as time series to provide immediate feedback in a raw form for the integrity of the sampling system, and of each instrument. Time-averaged data for each phase of the test will be obtained daily, and compared against filter-sampled data if available.
- Continuous measurements can provide an assessment of the likely loadings that are occurring on filter media. The flow rate used to deliver sample to the filter media can be adjusted accordingly.

The DRI photoacoustic instrument has a built in piezo electric transducer for use in occasionally evaluating the microphone calibration. Results from this measurement must be looked to ensure that the instrument is working properly.

As described earlier in this plan, all PEMS units used in this study will a full a complete warm-up, zero and audit sequence to verify CO, CO2, NOx, and THC measurement accuracy. Calibrations will be performed as necessary to bring the PEMS into proper calibration. The concentrations and accuracy of all gasses used for auditing and calibrating will be recorded, and data files will be generated during all audits to preserve records of system accuracy and calibrations.

All PEMS system flows and pressures will be verified and recorded, and ambient conditions as measured by the PEMS will be recorded and verified with independent measurements. A sample system leak check will be performed to verify sample system integrity, and a FID fuel leak check will also be performed. System temperatures (FID oven and chiller) will also be verified and recorded, and all sample rates and transport delay settings will be verified.

PEMS units will be removed from service if any out "out of range" operating conditions are identified. All pertinent audit, verification, and calibration information will be recorded on data collection sheets, as shown in Appendix A. Also included in Appendix A are detailed usage guidelines to provide the PEMS technician item-specific instructions along with appropriate SEMTECH user manual references.

Laboratory

Prior to the start of the field work, all samplers will be checked for leaks and the in-line flow meters will be cross calibrated using reference flow measurement devices. Leak testing will be performed by capping the inlet lines leading to each sampler and turning on the pumps. If the flow meter readings decrease to less than 10% of the nominal sampling flow rate in a reasonably short time the system will be passed. If not, the source of the leak will be identified and fixed, then the test repeated. With the exception of the Teflon/Quartz filter sampler all units need to achieve near-zero flow rates during the leak test. Due to the friable nature of the pre-fired quartz filters it is not possible to obtain a perfect seal in the filter holders without damaging the media, but the <10% criteria can still be met for each filter individually and for the system as a whole. In addition to the vacuum test, the sum of flows through each of the two filter cartridges will be compared to the total flow entering the inlet and need to agree within 5%.

All flowmeters will be calibrated using either a Gillibrator electronic bubble meter or a rotameter that has been cross-calibrated with a Roots meter at DRI. Calibration flows will be measured at the inlet point of each sampler (or outlet for the canister sampler) with appropriate sampling media installed. The resulting calibrations will be used to determine the desired nominal flow rates, and will be marked on a label on each flowmeter so that the operator can observe any deviations during testing. Variations in nominal flow rate due to sampler problems will be recorded in a logbook.

4.10 Sample Handling and Custody

Testing Site

All samples will follow the chain-of-custody requirements and standard Good Laboratory Practices required for labeling, recording, and tracking all samples from collection through database archival. It will be the responsibility of the laboratory personnel to maintain internal logbooks and records that provide a custody record throughout sample collection.

Identifying labels are attached to each fuel and oil sample container. Label information will include the unique vehicle identifier, date/time of collection, and sampler initials. To protect the label from water and solvent damage, each label will be waterproof. The sample labels permanently identify each sample collected and link each sample to the vehicle from which it was collected.

In addition to the vehicle identification number, each sample container will be numbered consecutively and a sample sheet identifying each sample will be included in the shipping box, if appropriate. These sample sheets are retained by the laboratories as physical evidence of sample receipt and must therefore be signed by the sampler. The sample sheet will contain a summary of the field logbook entries for all the samples collected and will be maintained on electronic format (spreadsheets).

Onsite sampling staff will record sampling events in a formal field logbook. Logbooks will be maintained and archived as a permanent record of all sample collection activities performed.

Laboratory

A sample is considered in custody when received by the laboratory receiving department from an official package courier. At this time, it is logged into the general receiving logbook a representative of the laboratory signs for the package. The samples are bar-coded into the respective Laboratory Information Management System (LIMS), in lieu of updating the chain-of-custody form (if supplied), and the samples are stored properly. Damaged shipping containers, evidence of damage and/or tampering, etc., are brought to the attention of the Laboratory Director and QA Manager. If necessary, a review is initiated to determine whether the damage compromised the integrity and/or quality of the sample. All condensed phase samples and sample extracts are stored in freezers. The rooms are locked when not in use and the building has limited access (i.e., locked from 1730 to 0730 weekdays and 24 hours weekends to ensure access by authorized personnel only).

When a sample is analyzed, its unique identification number is recorded in a written logbook for each instrument (e.g., run list) and/or the LIMS. These unique identification numbers allow the sample to be tracked through LIMS and/or written records during sample preparation, analysis, and data validation. Condensed phase samples and sample extracts are archived for at least one year following the completion of the project.

Several types of laboratory records are routinely maintained. Written records include receiving logbooks, shipping logbooks, chain-of-custody forms, project folders, instrument logbooks, instrument service logbooks, calibration records which include a calibration standard logbook, a canister cleaning logbook, and sampler maintenance and cleaning logbooks. Computerized records include LIMS, method files, calibration files, raw data files, processed data files, and combined data files.

Written records are maintained in the appropriate location in the laboratory. Written records are always maintained in non-erasable ink so that alterations are easily noted. Project folders include sample lists and other information regarding the sample and project. Instrument logbooks record each sample analyzed and pertinent information regarding the analysis. All calibrations are also recorded. Other calibration records include the calibration logbook that includes information about the standard solutions made in the laboratory. Service logbooks and files show services and/or modifications done to the instruments. The canister cleaning LIMS record includes the unique can and ID number and the project the canister is assigned, date of last cleaning, and QA certification lot number and information. Logbooks are kept on file in the laboratory for a minimum of 5 years.

Computerized records are maintained on a central computer (the LIMS file server). The data collection system includes a history record that maintains lists of files created or modified, and the name of the person creating or modifying the file. An original report is printed after analysis and documents the method and calibration file used including the last modification date of the file. Backups of computerized records, including but not limited to removable media (floppy disks) and tapes, are stored in the LIMS manager's office for off-site storage.

4.11 Inspection/Acceptance of Supplies and Consumables

Staff are authorized to acquire property and supplies from vendors, and are authorized to make appropriate transactions. Accountable property that is acquired and charged to the Work Assignment will be authorized on an individual line item basis and will be authorized by the Project Manager or Acting Project Manager.

Receiving Process

Upon arrival, property will be examined to determine quantity received, condition, and to identify transit related discrepancies. When shortages or damages are identified at time of delivery, the carrier's signature will be obtained. Shipped items will be checked from a copy of the original invoice and the packing slips to document quantities received and condition, and will be moved to a protected area for distribution. Full accountability is established once the invoice has been compared to the purchase order, prices have been adjusted for all items ordered and shipped, and the invoice has been sent to the accounting department for payment. Gas cylinders and all returnable or reusable containers will be accounted for and immediately returned to their appropriate vendors.

Discrepancies in Shipments

If an overage, shortage, or damage upon receipt is discovered, necessary actions will be taken directly with the vendor or supplier.

SECTION 5: DATA MANAGEMENT AND VALIDATION

5.1 Data Acquisition Requirements (Non-Direct Measurements).

Testing Site

Exhaust emissions measurements must be accurately acquired, mathematically manipulated, and logged onto computer storage devices for archival. Quality assurance of each step ensures that transfer errors are eliminated and that data in the database truly represent the data collected during the experimental run.

A primary function of this work area is to provide for the generation of emissions reports with accompanying statistics according to the procedures specified in the Federal Register for determining emission rates of pollutants from mobile sources and in accordance with Federal Testing and Work Assignment requirements and guidelines. The task of this specialized section is multi-functional to accomplish assignment objectives. We will assist as requested in the design and specification of computer systems necessary to acquire, archive, process, and report the vast quantities of physical and analytical data generated during each vehicle test, project, and the overall mobile source program. The proposed staff will be responsible for the installation, operation, preventive maintenance, troubleshooting, and repair of the computer systems and peripherals utilized in this area as requested. Support will be provided in the area of software development, enhancement, and evaluation of software packages. The staff has the responsibility of software maintenance and updating.

Laboratory

The goal of data processing is to provide accurately combined data into a single database for each analysis. Depending on the analysis, the data includes calculations for replicate precision, mean blank values, blank variability, blank-corrected concentrations, and standard errors for each reported value based on combined volume, replicates and blank uncertainties. The standard error is calculated based on the combined volume for carbonyl and semi-volatile compound; replicates for hydrocarbon, SVOC, and carbonyls; and blank uncertainties for carbonyl and SVOC, the minimum detection limits is substituted for hydrocarbon data. The uncertainty analysis allows us to present our data with absolute uncertainties associated with each number in the report.

The primary function of laboratory data management is to store data in a consistent fashion that is both secure and available. To serve this need, file server systems have been established that provide a central storage area for all laboratory and field data. The databases have defined structures that are maintained in one area where all field names are consistent and permit easy merging and comparison of the various databases. Locating all data on a central file server prevents problems associated with having multiple copies of the same data set, and allows the individuals charged with data processing, security, validation, and QA access to the same databases.

5.2 Reporting

Analytical personnel will be responsible for reducing analytical data according to the method used and providing both raw and summary data with a case narrative and along with the completed sample calculations. Records of all weighings, calibrations, system performance checks, blanks, surrogate recoveries, and any other method-required QC data will be provided, along with the raw sample data and notes of problems and corrective action taken. Notes from logbooks made by onsite sampling personnel will be reduced and compiled.

Reports of analysis will be generated for all samples analyzed in support of the Statement of Work. These reports, along with the applicable chain-of-custody documentation (if required), will be provided as required in accordance with the schedule within the Work Plan. These reports of analysis will be provided in both a written and a computerized format. The computerized reports will be on CD-ROMs in either Microsoft Excel 5.0, Lotus for Windows, or ASCII format, as directed by ERG and the EPA Work Assignment Manager.

5.3 BKI Data Review, Verification, and Validation

Data will be examined for compliance with all QC requirements for the method used for analysis. Notations will be made concerning any deviations from these criteria. Outliers will be tested according to ASTM E-178-80 or other applicable standard, and appropriate notations will be made in the summary report concerning the rejection of any data as outliers.

5.4 DRI Verification and Validation Methods

Data validation will be performed by DRI personnel according to SOPs. This validation will begin with examination of the raw data, summary data, and field and laboratory validation codes. We will ensure that all the required data are included, sample calculations are complete, and that the summary data accurately represent the raw data. The validation data will be assembled with the reduced laboratory notation sand data validation notations, and a report will be prepared.

Mueller (1980), Mueller et al., (1983), and Watson et al. (1983, 1989, 1995) define a three-level data validation process for an environmental measurement study. Data records are designated as having passed these levels by entries in the column of each data file. These levels, and the validation codes that designate them, are defined as follows:

Level 0 (ZERO): These data are obtained directly from the data loggers that acquire the data in the field. Averaging times represent the minimum intervals recorded by the data logger, which do not necessarily correspond to the averaging periods specified for the database files. Level 0 data have not been edited for instrument downtime, nor have procedural adjustments for baseline and span changes been applied. Level 0 data are not contained in the database; although they are consulted on a regular basis to ascertain instrument functionality and to identify potential episodes prior to receipt of Level 1A data.

Level 1A (1A): These data have passed several validation tests applied by the measurement investigator prior to data submission. The general features of Level 1A are: 1) no removal of data values and use of flagging data when monitoring instruments did not function within procedural tolerances; 2) flagging measurements when significant deviations from measurement assumptions have occurred; 3) verifying computer file entries against data sheets; 4) replacement of data from a backup data acquisition system in the event of failure of the primary system; 5) adjustment of measurement values for quantifiable baseline and span or interference biases; and 6) identification, investigation, and flagging of data that are beyond reasonable bounds or that are unrepresentative of the variable being measured.

Level 2 (2): Level 2 data validation takes place after data from various measurement methods have been assembled in the master database. Level 2 validation is the first step in data analysis. Level 2A tests involve the testing of measurement assumptions (e.g. internal nephelometer temperatures do not significantly exceed ambient temperatures), comparisons of collocated measurements, and internal consistency tests (e.g. the sum of measured aerosol species does not exceed measured mass concentrations). Level 2 tests also involve the testing of measurement assumptions, comparisons of collocated measurements, and internal consistency tests.

Level 3 (3): Level 3 is applied during the model reconciliation process, when the results from different modeling and data analysis approaches are compared with each other and with measurements. The first assumption upon finding a measurement, which is inconsistent with physical expectations, is that the unusual value is due to a measurement error. If, upon tracing the path of the measurement, nothing unusual is found, the value can be assumed to be a valid result of an environmental cause. The Level 3 designation is applied only to those variables that have undergone this reexamination after the completion of data analysis and modeling. Level 3 validations continue for as long as the database is maintained.

A higher validation level assigned to a data record indicates that those data have gone through, and passed a greater level of scrutiny than data at a lower level. All data supplied to the Kansas City LDGV emission characterization study database will have undergone data validation through Level 1A.

5.5 Verification and Validation for the PEMS

All PEMS testing and audit data will be collected and transferred to a main repository on a daily basis. Each file name, as well as fields within each data file, will be used to indicate the associated BKI dynamometer run number (if applicable), vehicle license plate digits, and type of file (audit, preconditioning run, dyne test, or drive-away). Independent tracking logs will also be maintained for all PEMS test files.

After the PEMS files are transferred to the main repository, they will be processed and reviewed. PEMS audit records will be reviewed to ensure all testing is performed within allowable accuracy limits. PEMS emission measurements taken during dynamometer testing will be calculated and compared with those measured by the dynamometer sampling system (both overall and phase-specific emissions). In addition, application of appropriate correction factors and transport delays will be verified for each sampling system.

5.6 QC Calculations

Measurement precision will be assessed by calculating the relative standard deviation of the results of replicate measurements. The equation used is:

$$s = \sqrt{\sum \frac{(x_i - \bar{x})^2}{(n-1)}}$$

where s is the standard deviation, x_i is an individual measurement, x (bar) is the mean of the measurements, and n is the number of measurements compared.

Acceptance criteria will be based on the relative standard deviation:

$$RSD = \frac{s}{\bar{x}} * 100\%$$

where RSD is the relative standard deviation, s is the standard deviation, and x (bar) is the mean.

Accuracy will be assessed by measuring the agreement between the accepted value for a QC material versus the determined value:

$$\%R = 100\% * \frac{C_m}{C_a}$$

where R is recovery, C_m is the measured concentration of the QC material, and C_a is the accepted value for the QC material.

Completeness of data will be calculated in the following way:

$$\%C = 100\% * \frac{v}{n}$$

where C is completeness, v is the number of valid measurements, and n is the number of measurements necessary to achieve a specified statistical level of confidence.

For QA purposes, substantial comparisons among measurements will be made to determine their predictability, comparability, and equivalence. Although the different observables measured are quite diverse, it is possible that they may be highly correlated owing to their quantification of related particle properties or to large fluctuations caused by emissions and meteorology. Relationships between variables will depend on the composition of the aerosol as well as meteorological conditions. Measures of predictability, comparability, and equivalence are applied to data sets stratified by aerosol composition and season. Predictability requires a consistent and reliable relationship between measurements, even if they are of different quantities. Comparability can be established between monitors that ostensibly measure the same observable, but with different principles. PM2.5 mass acquired from the DataRam nephelometer, QCM and gravimetric mass are expected to be comparable.

5.7 MSOD Data Management

In accordance with the requirements set forth in the original Scope of Work, data procured over the course of the project will be processed and delivered in the EPA's MSOD format. Field data collection procedures have been designed with MSOD data collection requirements in mind.

After collecting the vehicle testing information, datasets to be imported into the EPA MSOD will be prepared. Data integrity and accuracy are of the utmost importance, and in order to ensure that the data prepared for the MSOD accurately represents the data that was originally received, the following four step approach for electronic data handling and manipulation has been developed, described below:

- Import raw data into SAS dataset(s);
- Clean up and Convert data to match MSOD format and export to text files;
- Import text files into the MSOD load files; and
- Verify the validity of the output database and files.

This approach separates raw import and data cleanup issues from project-specific issues of data format conversion and validation. In the first three stages, emphasis is placed on automation. Scripts and programs will be used as much as possible, to provide repeatable steps for the verification stage and documentation. In the first import stage, the raw input data will be loaded into SAS datasets. The data will be imported into datasets that mimic, to the extent possible, the design of the original files. In this way, each raw input file will map to one or more specific SAS datasets, with close agreement in table content and layout. While some data cleanup may be needed for a successful data import, no data manipulation (such as unit conversions or factor manipulation) will be performed at this stage. Minor data cleanup may be required because of conflicts between file types, such as end-of-record or end-of-data discrepancies, differences in character sets, conflicting numeric formats, or data types that do not convert directly. Once the data is imported, the raw import data will be considered "read only" and no updates will be made unless the import process is modified and repeated. After the data is loaded into the raw datasets, it will be reviewed for data integrity and completeness.

Once the data review and clean up is complete, the raw import datasets will remapped and all required conversions and data manipulation will be performed in SAS, moving and converting data from raw and intermediate datasets into final text files. These text files will then be imported directly into MSOD load tables (in DBF format) supplied by EPA. The final step in the process will involve running EPA's EPAVAL program against each of the DBF import tables. This program will quality assure each of the tables and log all errors encountered. Each of the errors will then be reviewed and addressed accordingly. Once the import tables for each dataset are complete they will be delivered to EPA for further verification and loading into the MSOD.

SECTION 6: ASSESSMENT AND OVERSIGHT

6.1 Assessment and Response Actions

Corrective action will be initiated as a result of internal QC checks that reveal instruments or systems operating outside the range required for acceptable data, or in the event of any system failure. For example, corrective action will be performed for the following conditions: analytical system shown "out of control" according to method acceptance criteria, analytical precision outside DQOs, and analytical accuracy outside acceptability range as defined by DQOs.

The system used for corrective action is the "closed loop" system, including the following elements.

- Problem definition;
- Assignment of responsibility for investigation of the problem;
- Problem investigation;
- Determination of appropriate corrective action;
- Implementation of corrective action;
- Verification of problem correction; and
- Implementation/dissemination of procedural changes, if any.

To enhance the timeliness of corrective action and minimize the generation of unacceptable data, problems identified by internal QC checks will be resolved at the lowest possible management level. Staff will correct the out-of-control conditions (indicated by their QC data) by using the corrective action information contained in the SOPs referenced in this QAAP and then will report the problem and corrective action taken to the Project Manager.

Problems involving any change in scheduling, the sample work plan, or performance of analytical tasks will be handled in a manner agreed upon by the Project Manager and the EPA WAM.

Performance audits typically include the submission of blind samples such as NIST Standard Reference Materials in an appropriate matrix to the analytical laboratory, and comparison of their results with the certified values. Systems audits typically include examination of sampling and packaging procedures, as well as examination of records from calibration and maintenance of both field and analytical equipment and evaluating the training of field and laboratory personnel.

Monthly internal audits/checks for sampling and sample analysis activities will be performed according to guidelines established by 48 CFR PART 46 - QUALITY ASSURANCE FAC 97-14, November 23, 1999 and the EPA Interim final EPA QA/R-5 November 1999, Interim guidelines and Specifications for Preparing Quality Management Plans, or as otherwise directed by the EPA Project Officer though ERG. These QC checks will include duplicate samples, matrix spikes, surrogates, and blanks for each type of sample and sample matrix independent of the quarterly audits for the regulated emissions bench.

The Project Manager will perform monthly spot checks of such project activities, evaluation of response to EPA and ERG communications, completion of QC data by laboratory personnel, and recording and archiving of data. In addition, a monthly summary will be prepared and submitted as part of the Monthly Progress Report to document the overall QA program activities and findings for project activities.

The most frequently used audit by onsite staff is the Technical System Audit (TSA), which is a qualitative on-site evaluation of an entire measurement system. These audits will be performed by a QA representative that is independent of the data collection activity. The TSA examines the entire operation: all equipment, facilities, personnel, record keeping, data validation, calibration procedures, reporting requirements, and QC procedures. TSAs will be scheduled and performed during the beginning of data collection activities and annually thereafter, or can be initiated any time by the Project Manager or QA Manager, or by the E PA Project Officer or QA Manager. TSAs can also be initiated when a new employee is hired in order to ensure that the staff is following the proper procedures described in SOPs. Most TSAs are based on project progress reports or the results of performance evaluation (PE) studies. Frequently, problems revealed in a PE audit will trigger a TSA to determine the cause. The two main purposes of a TSA are to determine that project personnel and equipment are functioning properly and that all procedures are being implemented as prescribed in the Quality Management Plan and other project planning documents. This objective evidence is gathered by interviewing personnel, examining records, and observing project activities. Checklists are used to guide the TSA. The checklists are prepared based on performance criteria, such as Data Quality Objectives (DQOs), that are listed in the project's Quality Management Plan and other planning documents.

Data Quality Audits (DQAs) will be used to evaluate documentation associated with data quality indicators to verify that the data are of known quality. Its primary purpose is to verify the existence of quantitative and qualitative indicators of data quality. The following activities will be evaluated against the QA project plan and any other relevant documentation on a quarterly basis and reported in the quarterly QA report.

- Recording, and transferring raw data;
- Calculations, including equations used;
- Documentation of data-handling methods; and
- Selection and discussion of data quality indicators.

QA representatives will implement the DQA which entails tracing data through their processing steps and duplicating intermediate calculations in the beginning of each project and quarterly thereafter. A representative set of the data will be used from raw data and instrument readouts through data manipulation and through data reduction to summary data, data calculations, and final reported data. The focus is on identifying a clear, logical connection between the steps. Particular attention is paid to the use of QC data in evaluating and reporting the data set. DQAs will be conducted throughout the project, or afterwards as required. They may be prescheduled or performed at the request of our Project Manager, QA Manager or by ERG and EPA staff if problems are discovered.

6.2 Reports to Management

To provide essential feedback to management on the progress of the QA Program, a quarterly report will be prepared for the Program Director by the Project Manager. In addition, a summary of QC activities will be made in the monthly progress report prepared for the EPA. Both of these reports will address the following.

- Status of any major QA activities;
- Corrective actions taken during the period;
- Summaries of measures of precision and accuracy for the materials prepared during the period;
- Performance and system audit results; and
- Significant changes in facilities, personnel, major analytical or support equipment, procedures, data processing, or reporting.

In addition to these quarterly outputs, QA-specific deliverable outputs will be provided for all of the compositional parameters according to the schedule given in Table 6-1.

Table 6-1. Schedule for QC Deliverable Outputs.

Output	Time Period
THC Analysis	Monthly
CO Analysis	Monthly
NO_x Analysis	Monthly
CO_2 Analysis	Monthly
CVS Verification	Monthly
HC Blind Audit Results	Quarterly
CO Blind Audit Results	Quarterly
NO_x Blind Audit Results	Quarterly
CO_2 Blind Audit Results	Quarterly
QC Notebook (PC/AT)	Quarterly

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Appendix A

Study Modifications made between Rounds 1 and 2

A1. Changes from Round 1

Round 2 test procedures, equipment, and testing conditions differed somewhat from those during Round 1. The most notable differences are discussed in an Appendix to the updated QAPP, and are presented below:

Onsite PEMS repair support

Onsite PEMS repair support was available throughout the Round 2, and greatly reduced equipment downtime and shortages. Most PEMS problems were minor issues such as stuck solenoids, loose or dirty contacts and fittings, water in the system, or blown relays, and were able to be repaired quickly. Most larger repairs, such as system module and CPU board replacements, could also be accomplished onsite (after receipt of necessary repair materials).

Temperatures and ambient conditions

Round 2 testing was conducted during the winter, as opposed to the Round 1 summer study. Since this portion of the study was to be conducted at ambient temperatures, an enclosed and heated structure was erected in which to conduct PEMS installation activities. This prevented operation of the units sub-freezing temperatures (beyond their specified operating temperature range). Operation of the PEMS units below freezing temperatures was occasionally necessary, and resulted in various operational problems, such water freezing in the FID exhaust drain lines and internal filters, and freezing in the flowmeter pressure-differential measurement tubes and exhaust sample lines. The signal transducer boxes used with the new pressure-differential flowmeters occasionally would not warm up to operating temperature (as indicated by the "warm-up" indicator LED), and some emissions measurement drift was seen during some conditioning runs (as evidenced by pre-test and post-test audits). This drift may be due to auditing the PEMS in the heated installation bay and then performing the conditioning test in a vehicle's trunk or bed at ambient temperatures.

Flowmeter changes

Hot-wire anemometer-style flowmeters were used throughout the Round 1 summer portion of the study. These were replaced with pressure-differential style flowmeters for Round 2 of the study. These new flowmeters transmitted pressure signals through flexible tubes to a signal transducer box which converted the pressure-differential signal and exhaust temperature measurement into an exhaust mass flow rate determination.

Flowmeter mounting changes

License plate brackets and suction cup clamp assemblies were primarily used to install the flowmeters used during Round 1 of the study. This posed concerns associated participants or pedestrians burning themselves (particularly on driveaway testing) or the assemblies falling off. Occasionally, flowmeters were hung underneath the rear of the vehicle, which was generally laborious and exposed the flowmeter to water and possible dragging damage. The new pressure-differential flowmeters were significantly larger and heavier, so common bicycle racks were used for flowmeter installations during Round 2. Wire meshes were secured to these racks to allow mounting of license plates and to protect against burns.

Software changes

Several PEMS software changes were implemented prior to or during Round 2. This new software allowed use of the new pressure-differential flowmeters, and it also allowed activation of auto-zero and automatic FID heater shut-down after a period of time (auto-zeros were performed only on drive-away testing). Another software update involved adding a "session manager" which "bundled" all the audits and second by second test information into one file. The following software changes were implemented throughout the study (including both Rounds 1 and 2):

- Rollout beginning July 12, 2004: Software Version 9.03
- Rollout beginning August 17, 2004: Software Version 9.03 SP1
- Rollout beginning November 23, 2004: Software Version 9.04
- Rollout beginning December 6, 2004: Software Version 9.05 SP1
- Rollout beginning December 16, 2004: Software Version 9.05 SP2

Testing was continued with Software Version 9.05 SP2 through the end of Round 2.

A.2 Procedural changes between Rounds 1 and 2

The equipment downtime experienced during Round 1 was greatly reduced during Round 2 through the addition of an on-site PEMS repair and support person. Most repairs were minor, such as stuck solenoids, loose or dirty contacts and fittings, water in the system, or blown relays, and were able to be repaired quickly. Most larger repairs, such as system module and CPU board replacements, were also accomplished onsite (after necessary repair items were received onsite). This increase in equipment up-time allowed significantly more driveaways to be conducted in Round 2 than were possible during Round 1 of the study.

As mentioned in Section 2.4.1, the hot-wire anemometer-style flowmeters used throughout the Round 1 summer portion of the study were replaced with pressure-differential style flowmeters for Round 2 of the study. Measurements from the original hot-wire anemometer flowmeters were adversely affected by heat radiation effects at low vehicle speeds and idle. Since convective cooling minimized these effects when vehicles were in motion, low-speed and idle flow measurements were biased low. This bias was eliminated with the use of pressure-differential style flowmeters provided for Round 2 of the study. These flowmeters relied on a bank of differential pressure sensors (as opposed to a hot-wire anemometer) in order to determine corrected mass exhaust flowrates. However, the orifices in the differential pressure sensors used in these new flowmeters were susceptible to particulate matter clogging and moisture freezing. This condition was minimized as much as possible by thoroughly purging all orifices with high-pressure dry compressed nitrogen prior to each use, and by maintaining the flowmeters and tubing assemblies in above-freezing conditions.

Earlier in the study, problems were encountered with preventing moisture and exhaust fumes from entering vehicles during testing. The new flowmeters required additional tubing to be routed out of the trunk (generally requiring the trunk to be propped open wider). Standard household pipe insulation purchased at a hardware store was found to fairly effectively seal trunks. Carbon monoxide detectors were used to ensure vehicle exhaust was not entering the passenger compartment.

As mentioned in Section 2.4.1, Round 2 testing was conducted during the winter, as opposed to the Round 1 summer study. Operation of the PEMS units below freezing temperatures was occasionally necessary, and proved to be problematic because of water freezing in system components and measurement drift. Battery life seemed greatly reduced during Round 2 testing, perhaps due to battery cycle fatigue (these were the original batteries used since the start of the study) and also possibly due to operation in the cold temperatures.

In order to prevent trunks from inadvertently popping open, as would occasionally happen with the original vice-grip-devised trunk latches, heavy-duty zip-ties were used (with metal rings installed in the trunk latch assembly) to secure trunks. These zip ties, which are typically used for securing building ventilation and may be found at a typical hardware store, also prevented motorists from tampering with the PEMS units installed in trunks during driveaway tests.

Experience gained during Round 1 of the study helped streamline Round 2 testing. For example, installation procedures and sequences were modified in order to minimize lost time in the event of equipment malfunctions. Certain “tricks” and procedures for equipment software helped expedite installations and minimize system resets. The incorporation of a session manager into the host software also allowed consolidation of audit and test information into one test file, thereby expediting equipment setup and reducing time needed for test processing and analysis.

Kansas City PM Characterization Study
Final Report

Appendix BB
Pilot Report

Assessment and Standards Division
Office of Transportation and Air Quality
U.S. Environmental Protection Agency

Sponsors:

National Renewable Energy Laboratory, U.S. Department of Energy
Federal Highway Administration, U.S. Department of Transportation
STAPPA-ALAPCO Emission Inventory Improvement Program
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Kansas City PM Characterization Study

Draft Pilot Testing Report

Prepared for:

U.S. Environmental Protection Agency

June 21, 2004

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KANSAS CITY PM CHARACTERIZATION STUDY
DRAFT PILOT TESTING REPORT

EPA Contract #GS 10F-0036K

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1.0 Introduction

The USEPA have established a contract with Eastern Research Group, Inc. to conduct a program in Kansas City to evaluate exhaust emissions from light-duty gasoline vehicles. The proposed program consists of measuring particulate matter (PM) and other components in exhaust emissions from 480 randomly selected light-duty gasoline vehicles in the Kansas City metropolitan area.

The study is being conducted in Kansas City in three parts:

Part 1: Pilot Study (May 2004)
Part 2: Phase I Testing (July-September 2004)
Part 3: Phase II Testing (January-March 2005)

This report summarizes the results of the Pilot Study conducted in Ann Arbor, MI and Kansas City, KS in April through May 2004.

1.1 Goals of the Pilot Testing

The primary goals of the Pilot Study were to:

1) Set up a testing facility in Kansas City that will be used for the entire study;

2) Finalize all testing methodologies, testing procedures, and data handling procedures; and

3) Test three vehicles in Ann Arbor and Kansas City to establish the relationship between the emission results from the two facilities.

2.0 Site Preparation

2.1 Site Selection for Protective Covering for the Equipment and Vehicles

Five potential test sites for the Kansas City vehicle emissions study were visited on Friday, March 26, 2004. Several additional sites were visited in April. Visits to all of the sites were arranged through Brian Staton of CBRE (Industrial site realtor) and John Dietel of ERG, both of whom visited the sites with ERG's technical staff. The listing realtors were also with ERG at their respective properties. ERG subsequently ranked the sites from most desired to least desired according to criteria important to the emissions study. The major ranking criteria are as follows:

1) Can be used to soak and test vehicles at outside, ambient temperatures.

2) Adequate ventilation to maintain suitable background levels and to insure safety of personnel.

3) Adequate size for test equipment, vehicle storage and movement.

4) Heated/Air Conditioned office space.

5) Other: Easy access to major driving arteries (interstate highways), Adequate power, restrooms, minimum sound amplification, adequate outdoor parking.

Another important factor was whether or not the property had an overhead water sprinkler system. The typical warehouses were all equipped water sprinkler systems and could not be used below ~34 F. Only two of the properties offered did not have water sprinkler systems, so these two properties became our primary choices, and are described below.

#1. 6636 Berger Avenue, Kansas City, KS

This property had about 7,000 sq ft total floor space, with about 1,000 sq ft office and 2 restrooms. With four 12' x 12' bay doors plus two wall vent fans, this site provided adequate ventilation and easy access. This was also one of two properties visited which did not have an overhead water sprinkler system, which meant it can be used at sub-freezing temperatures. Indoor space was adequate -- about 5,000 sq ft of main floor space for test area and vehicle soaking, with another 900 sq ft of area for working on and inspecting vehicles. The site also included three offices plus a common area. The front entrance and parking was ideal to greet vehicle owners. This was a stand-alone property, so we would not have to interact with other tenants. The site had ample outdoors parking and storage, and the building was ready to occupy after minor clean up.

This was the site ultimately chosen.

#2. 9601 Alden, Lenexa, KS.

This property had about 7,900 sq ft total floor space, with about 1,000 sq ft office and 2 restrooms. With seven 12' x 12' bay doors plus two ceiling vent fans, this facility was built with ventilation of exhaust fumes in mind. This was one of two properties visited, and did not have an overhead water sprinkler system, which meant it could be used at sub-freezing temperatures. Indoor space was adequate, with about 6,000 sq ft main floor space for test area and vehicle soaking, and another 900 sq ft of area for working on and inspecting vehicles. The site featured eight offices plus a common area. One office had window overlooking test area and has potential for housing auxiliary sampling equipment (PM samplers, etc). The front entrance and parking was ideal to greet vehicle owners. This was also a stand-alone property, so we would not have to interact with other tenants. The site had ample outdoors parking and storage, and was located in an industrial park with easy access to Interstates 35 and 435. The building was ready to occupy after minor clean up. The only negative feature of this property was that a sub-lease arrangement could not be worked out satisfactorily in the required time.

#3. 9870-9878 Pflumm Rd, Lenexa, KS.

This property was a huge warehouse, of which we would occupy half. A dividing wall, offices, and restrooms would have to be constructed. One drive in bay door and four dock high bay doors were located on one side of this space, with the other three sides enclosed, so ventilation was in question. A couple of roof vents could have been added to help with ventilation. The facility could not be operated below 35 F due to water sprinkler system. In addition, ERG would need to obtain permit to operate motor vehicles inside this space. This is the largest space we visited and had ample room. One office is presently in place. Additional offices, restrooms, and dividing firewall would have to be constructed. The site featured easy access to interstates.

#4. 6926 Martindale Road, Shawnee, KS

This site was a 6,000 sq ft warehouse, with unfinished construction. They were preparing (grading) the parking lot for paving when we were there. The site featured two drive in bay doors along one wall. Again, ventilation was a problem. The offices (once constructed) would split the test area into two halves. The site had a water sprinkler system, so building must be maintained above 35 F.

#5. 1530-64 E. Spruce St, Olatahe, KS

This was a warehouse space with adequate office space and a nice entrance facade for greeting vehicle owners. However, one drive in bay door and two dock high bay doors on one corner of space did not lend itself to adequate ventilation. Noise amplification was high in this space. The overhead water sprinkler system meant temperatures must be kept above 35 F.

#6. 6230-6244 Merriam Dr., Johnson Co.

This site was totally unacceptable, with one 8' high drive in bay door. ERG would not be able to get the testing equipment into the facility. Multiple dock high bay doors opposite wall could have provided ventilation, although minimal power was available. Three 3,000 sq ft spaces were separated by walls. This was a dirty warehouse space located in a very crowded, small parking area.

2.2 Transportation of Dynamometer and Analytical Trailer.

Final preparations for shipping the transportable dynamometer and analytical trailer were made the week of May 3, 2004. All necessary equipment was loaded onto either the open dynamometer trailer or the enclosed analytical trailer. Equipment was protected from the elements as appropriate and securely strapped.

Equipment was transported by Wilson Transport, SVC, and left the RTP-EPA facility on Monday, May 10, 2004, aboard two separate drop deck trucks. Delivery in Kansas City was scheduled for Wednesday, May 12.

The equipment arrived in Kansas City without incidence. BKI staff members also arrived in Kansas City on May 12 to off-load the equipment and begin set-up. The drop deck trucks arrived at the test site around 4:00 p.m. A wrecker was called and arrived shortly thereafter to off-load both the dynamometer and analytical trailer. The equipment was inspected and found to be in great shape, with no apparent mishaps in transit. Provisions were made to store the equipment in the secure, fenced yard at the test site, as the building itself had not yet been vacated by the previous tenant.

2.3 Transportation of Correlation Vehicles.

The three correlation vehicles were transported from Ann Arbor to the Kansas City site by M & R Transport. The vehicles were picked up in Ann Arbor on May 14 and arrived at the Kansas City test site on Monday, May 17. The vehicles appeared to have suffered no damage during transit. At the conclusion of the pilot study, two of the vehicles were shipped back to Ann Arbor via the same carrier. (The third vehicle is to remain at the KC test site for use during the summer and winter test phases). These two vehicles were picked up on May 28 and arrived in Ann Arbor on June 1.

2.4 Set-up of Dynamometer, Analytical Trailer, and Associated Sampling Equipment.

Set up of the dynamometer and associated equipment began on the afternoon of Saturday, May 15, immediately after the previous tenet completed moving out. The first order of business was to wash the bay floors, which were covered in mud and other debris. The dynamometer and analytical trailer were then towed into the building and positioned at the rear of the building, near electrical power sources and ventilation. The dynamometer trailer was set in place, leveled, and catwalks and ramping were installed. The following day, electrical power was connected, the dilution tunnel was assembled and set in place, and plumbing and electrical interfaces between the analytical trailer and dynamometer were established. Working gases for the analytical trailer were received and installed.

2.4.1 Setup of Associated Sampling Equipment

DRI installed and operated a suite of instruments to provide continuous PM analysis and to collect batch samples of particle and gaseous exhaust components for later analysis. These instruments collected sample air from the dynamometer dilution system via two isokinetic probes, provided by BKI, inserted prior to a 90-degree bend in the dilution tunnel. Figure 2-1 illustrates the sample train as it was installed for the pilot study. Heated conductive lines carried air from the probes to the continuous instruments. Insulated copper tubing was used to carry sample air to the time-integrated samplers. The following instruments were operated continuously during all tests.

Photoacoustic: Designed and built at DRI, this instrument continuously measures the concentration of light-absorbing carbonaceous material (black carbon) in the airstream by the photoacoustic principle, in which the absorption of modulated light by particles results in thermal-acoustic pulses that can be detected by a highly-sensitive transducer and phase-locked amplifier.

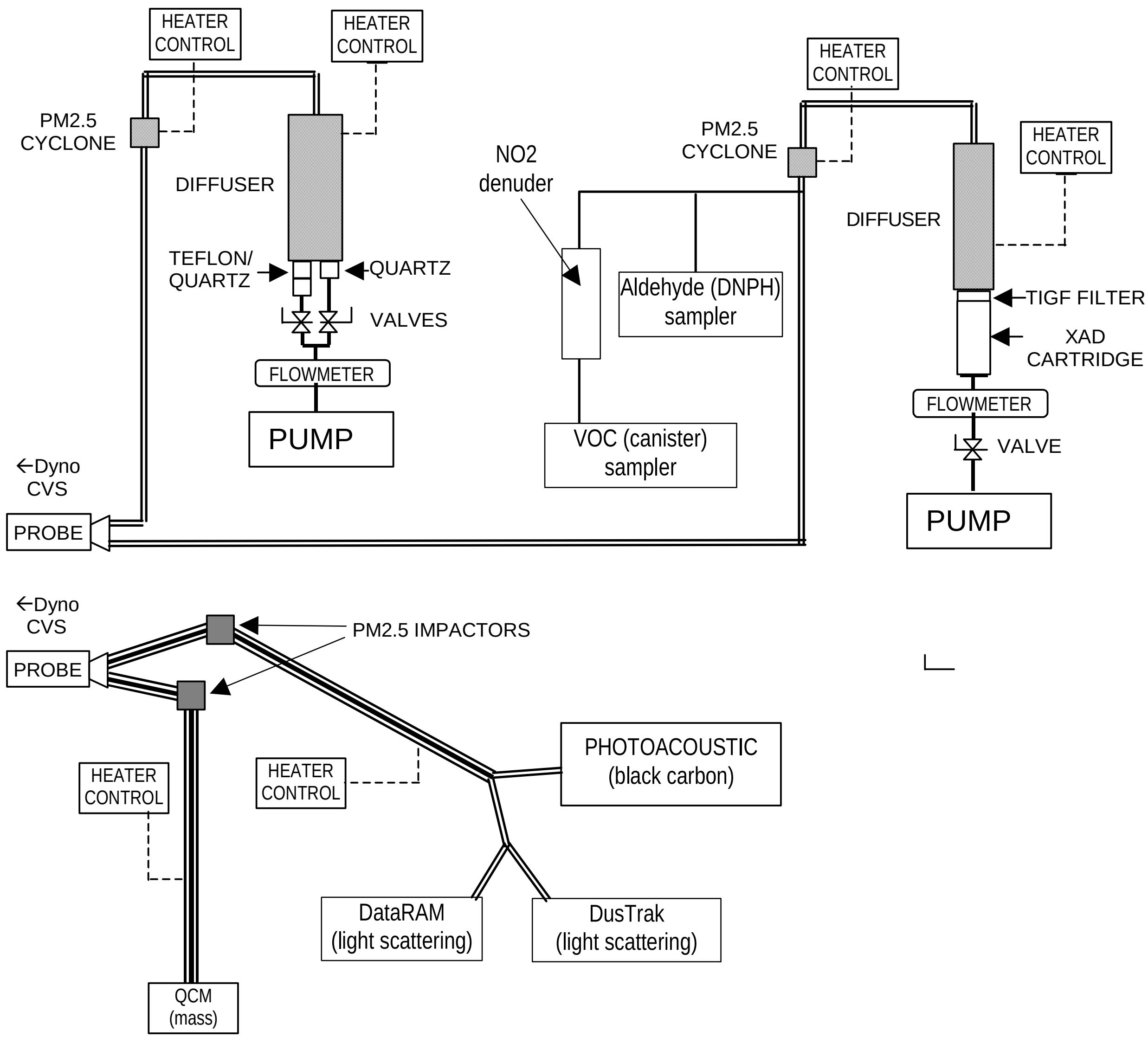


Figure 2-1. Sampling Train for the Pilot Study

QCM: Quartz crystal microbalance, manufactured by SEMTECH, monitors the accumulation of particles on a surface in real-time. A clean-air dilution system is used in conjunction with this instrument to reduce the dynamic range of the source aerosol concentration.

DustTrak: A commercially available portable monitor for particulate matter, the TSI DustTrak estimates the concentration of particulate mass by measuring the intensity of light scattered perpendicular to a laser beam directed through the airflow stream. Flow rate is 1.5 lpm.

DataRAM: Another commercially available portable monitor for particulate matter, which operates on the same principle but uses two wavelengths for more uniform response to varying particle sizes. Flow rate is 2 lpm.

Time-integrated samples for laboratory analysis were collected during each unified cycle test and a 60-minute tunnel blank each day as described below, using specially adapted samplers designed and constructed at DRI:

Filter samples: During each phase of the unified cycle tests a pair of filter cartridges collected particles to be analyzed for gravimetric mass and organic and elemental carbon concentrations. Pre-weighed 47mm Gelman Teflo filters were used for gravimetry. Pre-fired 47mm quartz fiber filters were collected for analysis of organic and elemental carbon by Thermal Optical Reflectance (TOR). Back-up quartz filters were also included behind the Teflo and will also be analyzed by TOR to investigate the effect of sampling temperature on volatilization of organic particles. For this sampler, air was drawn from the CVS via ½" insulated copper tubing to a small heated stainless steel chamber. The sample air exited via a $PM_{2.5}$ cyclone contained in the chamber to a heated diffusing chamber approximately 1m tall, containing a thermistor temperature probe. From this chamber, the sample air exited through the two filter cartridges. Flow rates for each filter were set to 56 lpm by adjustable valves to give a combined flow of approximately 113 lpm as required by the inlet cyclone. A single oil-less pump was used to draw air through the sampler.

Since the automated sequential sampler designed for this project was not completed in time for the Pilot Study, it was necessary to manually change filters between phases of each test. This was done as quickly as possible during the ~25 second idle period during the transition from phase 1 to phase 2. The operators were able to observe the vehicle on the dynamometer during this process and begin the process as soon as the vehicles wheels stopped turning to assure synchronization with the driving cycle.

Samples were collected by a separate sampler for determination of particulate and semi-volatile organic compounds on 100 mm Teflon-impregnated glass fiber (TIGF) filters followed by glass cartridges containing XAD adsorbent at a flow rate of 112 lpm. The material collected on these media will be removed by solvent extraction and analyzed at DRI by gas chromatography and mass spectrometry. A single filter and adsorbent pair were collected for each unified cycle, combining phases 1, 2 and 3. Sampling was suspended during the 10-minute soak period by turning off the pump. Sample air was drawn from the dynamometer CVS via ½" insulated copper tubing to a small heated stainless steel chamber. The sample air exited via a

$PM_{2.5}$ cyclone contained in the chamber to a heated diffusing chamber, containing a thermistor temperature probe, approximately 50cm tall. From this chamber, the sample air exited via the filter followed by the XAD cartridge. Flow rates were approximately 113 lpm as required by the inlet cyclone, and was monitored by an in-line TSI 4000 mass-flow meter. A single oil-less pump was used to draw air through the sampler.

Aldehydes: Sample air was drawn from the heated cyclone chamber via a ¼" diameter Teflon hose and passed through 2,4-dinitrophenylhydrazine (DNPH) cartridges using a 6-channel sampler with integrated pump and mass flow controller. Airflow was maintained at 500 cc/min. A single cartridge was exposed for the duration of the 3 phases of the unified cycle. Sampling was suspended during the 10-minute soak by switching to an unused channel.

VOC: Sample air was drawn from the heated cyclone chamber via a ¼" diameter Teflon hose and passed through a Teflo filter and a denuder coated with triethanolamine to remove NO_2 before being pumped into a Summa polished steel canister. Air flow was controlled by a needle valve to obtain the necessary flow rate to fill the canisters to approximately 15"Hg positive pressure over the duration of the complete unified cycle. Sampling was interrupted during the 10-minute soak by switching to a bypass channel. The sampler draws a total flow of 2 lpm, but only about 300 cc/min of that was pumped into the canisters.

[Heated tubing is shown as triple lines, insulated tubing as double lines.]

2.4.2 Equipment Provided

Table 2-1 lists equipment was either rented or purchased to support the sampling efforts.

Table 2-1: Sampling Support Equipment Rented or Purchased by ERG, On-Site.

Name	Purpose	Notes
Oil-less Air Compressor	To supply clean, dry dilution air to the micro-dilution system used with the QCM.	Purchased. Provides up to 5 SCFM at 100 psig. Has a 25 gal. tank. Water trap and filtration provided by EPA.
AC Electricity Generator	To supply power for the CVS dilution air heater.	Rented from United Rentals. Wacker model G-50. 50-kilowatt capacity. Diesel fueled. Power umbilical provided by BKI.
CVS Dilution Air Dryer	To reduce CVS dilution air humidity.	Rented from United Rentals. TempAir (Rupp Industries) model TD 400. Dries up to 400 CFM. Intentionally undersized for this application (since we don't require the usual 10% RH it is designed to deliver). Requires 230 V, 1 phase, 30 A, electric supply. Portable desiccant-type dehumidifier. Alumina silicate wheel continuously absorbs gas-phase water. Heated slip-stream of dried air re-directed back to used section of wheel to desorb water and regenerate the wheel.
Refrigerator	To store particulate filter media.	Purchased. 14 cubic feet, upright.
Freezer	To store fuel samples.	Purchased. 10 cubic feet, chest.

2.5 Maintenance and Calibration of Dynamometer, Analytical Trailer, and Associated Sampling Equipment.

Dynamometer Static Load (Dead Weight) and Speed Calibrations:

Initial, and thereafter, daily, load cell checks were made using the available calibration weights. Minor "zero" adjustments were periodically required. No span adjustments were made. Results, shown below in Table 2-2, were consistent with historic data.

Table 2-2. Static Load (Dead Weight) Checks

	Arbor + W1+W2	Arbor + W1	Arbor + W2	Arbor	Unloaded
Total Weight	50 lbs	40 lbs	15 lbs	5 lbs	0 lbs
Equivalent Hp @ 50 MPH	18.5	14.8	5.55	1.85	0.0
5/17/04 Reading	18.5	14.9	5.5	1.8	0.0
5/19/04 Reading	18.4	14.7	5.5	1.8	0.0
5/20/04 Reading	18.3	14.6	5.4	1.8	0.0
5/21/04 Reading	18.5	14.7	5.5	1.8	0.0
5/22/04 Reading	18.4	14.6	5.5	1.8	0.0
5/23/04 Reading	18.4	14.7	5.4	1.7	0.0
5/25/04 Reading	18.3	14.6	5.4	1.8	0.0
5/26/04 Reading	18.3	14.6	5.4	1.7	0.0

Initial, and thereafter, daily dynamometer roll speed checks were also made. Roll speed was checked using a phototachometer and compared to the driver's aid digital speed output. No adjustments were required. Results are shown in Table 2-3.

Table 2-3. Dynamometer Roll Speed Checks

Date	Roll RPM	*Equivalent Speed*	Driver's Aid Reading
5/17/04 Reading	1930	49.5 mph	49.7 mph
5/19/04 Reading	1938	49.9	50.0
5/20/04 Reading	1959	50.4	50.3
5/21/04 Reading	1955	50.3	50.3
5/22/04 Reading	1962	50.5	50.1
5/23/04 Reading	1944	50.0	49.8
5/24/04 Reading	1941	50.0	50.0
5/25/04 Reading	1941	50.0	49.9
5/26/04 Reading	1958	50.4	50.3

Dynamometer Coastdowns:

Daily dynamometer coastdowns were performed to verify overall dynamometer operation. Coastdowns were performed from 55 to 45 mph at an inertia setting of 3,500 lbs. and a load setting of 6.0 Hp (indicated) @ 50 MPH, after a 10-15 minute warmup at 50 mph. Coastdown times obtained are shown in Table 2-4, and indicated the dynamometer was operating within its normal specifications.

Table 2-4. Daily Coastdowns (Vehicle off Rolls) @ 3500 lbs and 6.0 Hp Indicated

Date	CD #1 time, seconds	CD #2 time, seconds	CD #3 time, seconds
5/17/04 Reading	22.84	23.17	23.35
5/20/04 Reading	24.18	24.49	-
5/21/04 Reading	23.72	23.28	-
5/22/04 Reading	23.84	24.26	-
5/23/04 Reading	23.46	23.88	23.96
5/24/04 Reading	23.31	24.07	23.54
5/25/04 Reading	22.66	22.86	22.90
5/26/04 Reading	23.31	22.77	23.05

Prior to vehicle testing, coastdowns were also performed with the three correlation vehicles on the rolls to determine appropriate load settings for each of the vehicles. Desired coastdown times for each of the vehicles was provided by EPA, Ann Arbor. Table 2-5 gives results of these initial vehicle coastdowns.

Table 2-5. Initial Correlation Vehicle Coastdowns

Vehicle	Test Inertia, pounds	Desired 55-45 mph Coastdown time, seconds	Actual 55-45 mph Coastdown time, seconds
2004 Stratus	3,500	17.86	17.90 ± 0.23
1988 Taurus	3,500	17.30	14.93 ± 0.16
1988 New Yorker	4,000	17.59	17.47 ± 0.19

Coastdown times obtained for the Stratus and New Yorker agreed very well with the desired coastdown times. Times for the Taurus could not be increased past ~ 15 seconds, as the dynamometer was fully unloaded at this point.

Vehicle coastdown times were checked on several additional days, immediately after the conclusion of the vehicle's emissions test, and again at the end of the study. For all three vehicles, the indicated load tended to be a little higher, and coastdown times a little shorter, immediately after the emissions test. This phenomena could be duplicated by motoring the vehicle above 60 mph for several seconds, but did not occur when motoring the vehicle below 60 mph. The apparent change in load is not clearly understood, but is thought to be due to mechanisms within the dynamometer's Power Absorption Unit, possibly as a result of leaks, cavitation, or aeration of the load fluid. Because this occurs apparently only after motoring at speeds above 60 mph, one would expect the LA92 driving cycle to be impacted most from the point in Phase 2 where maximum speeds are above 60 mph, and to extent into phase 3. That is, the vehicles would be operating under slightly higher loads than initially preset.

A major change in coastdown times occurred for the 1988 New Yorker during the course of testing. The initial coastdown time of 17.47 seconds had decreased to ~ 12 seconds when checked after the third day of testing. This could be due to brake “hang-up” (testing staff did exercise the breaks quite a bit on the first two days of the LA92) affecting the vehicle’s rolling resistance. After this change was detected, we readjusted the load setting (from 10.3 indicated to 5.0 indicated) to yield coastdown times within the 17 second time frame. It should be noted that warm start (phase 3) emissions exhibited no significant differences when using the two different load settings.

Additional, high speed coastdowns (65mph to 35 mph, and 65 mph to 45 mph) were also conducted on all three vehicles. It is assumed that the effect of dynamometer operation above 60 mph as described above would also affect these coastdowns.

Tables 2-6 through 2-8 below show results for the additional coastdown tests.

Table 2-6. Additional 2004 Stratus Coastdowns

Date	Speed Range, mph	Coastdown time, sec	Hp Indicated	Comment
5/22/04	55-45	12	6.0	Immediately after emission test
	55-45	12.49	6.0	Immediately after emission test
5/23/04	55-45	14.95	4.1	Immediately after emission test
	55-45	16.54	3.4	After test, reset to nominal value
	65-35	30.2	3.4	After test, reset to nominal value
5/26/04	55-45	17.05	3.4	After test, reset to nominal value
	55-45	16.99	3.4	After test, reset to nominal value
	55-45	17.09	3.4	After test, reset to nominal value
	65-35	49.4	3.4	After test, reset to nominal value
	65-35	50.7	3.4	After test, reset to nominal value
	65-35	51.62	3.4	After test, reset to nominal value

Table 2-7. Additional 1988 Taurus Coastdowns

Date	Speed Range, mph	Coastdown time, sec	Hp Indicated	Comment
5/22/04	55-45	14.6	3.5	Immediately after emission test
	65-45	26.63	3.5	Immediately after emission test
	55-45	15.58	3.0	After test, reset to nominal value
	65-45	29.25	3.0	After test, reset to nominal value
5/24/04	55-45	14.21	3.3	Immediately after emission test
	55-45	14.97	3.3	Immediately after emission test
	55-45	14.88	3.3	Immediately after emission test
	55-45	15.69	3.0	After test, reset to nominal value
	55-45	15.89	3.0	After test, reset to nominal value
	55-45	15.38	3.0	After test, reset to nominal value
5/26/04	55-45	11.74	6.3	Immediately after emission test
	55-45	11.88	6.3	Immediately after emission test
	55-45	12.02	6.3	Immediately after emission test
	65-35	37.16	6.3	Immediately after emission test
	65-35	38.86	6.3	Immediately after emission test
	65-35	38.79	6.3	Immediately after emission test
	55-45	15.27	3.0	After test, reset to nominal value
	55-45	15.63	3.0	After test, reset to nominal value
	55-45	15.52	3.0	After test, reset to nominal value
	65-35	47.2	3.0	After test, reset to nominal value
	65-35	47.16	3.0	After test, reset to nominal value
	65-35	47.3	3.0	After test, reset to nominal value

Table 2-8. Additional 1988 New Yorker Coastdowns

Date	Speed Range, mph	Coastdown time, sec	Hp Indicated	Comment
5/22/04	55-45	11.72	11.3	Immediately after emission test
	65-45	20.47	11.3	Immediately after emission test
5/23/04	55-45	12.5	10.3	After test, reset to nominal value
	55-45	17.38	5.0	Reset nominal from 10.3 to 5.0
	55-45	17.51	5.0	Nominal is now 5.0
	55-45	17.2	5.0	Nominal is now 5.0
5/24/04	55-45	15.78	5.5	Immediately after emission test
	55-45	17.7	5.5	After test, reset to nominal value
	55-45	16.56	5.0	After test, reset to nominal value
	55-45	16.65	5.0	After test, reset to nominal value
5/26/04	55-45	16.45	5.3	Immediately after emission test
	55-45	16.99	5.3	Immediately after emission test
	55-45	17.02	5.3	Immediately after emission test
	65-35	48.59	5.3	Immediately after emission test
	65-35	49.18	5.3	Immediately after emission test
	65-35	50.2	5.3	Immediately after emission test
	55-45	18.01	5.0	After test, reset to nominal value
	55-45	17.47	5.0	After test, reset to nominal value
	55-45	17.72	5.0	After test, reset to nominal value
	65-35	53.58	5.0	After test, reset to nominal value
	65-35	53.7	5.0	After test, reset to nominal value
	65-35	54.57	5.0	After test, reset to nominal value

It is not clear whether the increased load when motoring the dynamometer over 60 mph is due to a defective PAU or whether this response is an innate characteristic of the water brake system. Most other studies with this unit have involved lower speed cycles, so this issue has not been previously addressed.

CVS and Analytical System:

Propane injections were conducted on two separate occasions to verify dilution tunnel flow. During the first set of injections, the dilution tunnel was heated to 47 C. During the second set of injections, the dilution tunnel was operated at ambient temperature (~ 25 C). Results of the injections are given in Table 2-9 and indicate the dilution tunnel flow was at normal levels.

Table 2-9. CVS Propane Injections

	1	2	3	4	5	6
Date	05/19/2004	05/19/2004	05/19/2004	05/24/2004	05/24/2004	05/24/2004
START MASS (GM)	860	849	838	827.2	819	811.2
FINISH MASS (GM)	849	838	827.6	819	811.2	803.5
TIME (MIN)	10	10	10	10	10	10
TEMP PDP, F	116.6	118.8	118.8	84	84	84
BARO PRES, (mmHg)	740.00	740.00	740.00	734.00	734.00	734
Pi, INCHES H20	11.00	11.00	11.00	11.00	11.00	11.00
CONC(B),PPM C	2.10	2.20	2.20	2.60	2.70	3.4
CONC(S),PPM C	136.90	137.10	132.00	98.30	96.60	93.9
COUNTS	17,700.00	17,700.00	17,700.00	17,700.00	17,700.00	17,700
VMIX	4,681.12	4,663.32	4,663.32	4,920.27	4,920.27	4,920.27
GMS PRO. CALC	10.92	10.88	10.47	8.15	7.99	7.70
GMS PRO. INJECTED	11.00	11.00	10.40	8.20	7.80	7.70
% Difference	-0.76	-1.06	0.69	-0.66	2.47	0.04
ACFM	543.98	545.66	536.16	543.43	526.83	539.62
Vo	0.307	0.308	0.303	0.307	0.298	0.305
	AVG	STD		AVG	STD	
ACFM	539.214	6.995		536.629	7.099	
Vo	0.305	0.004		0.303	0.004	
SCFM	471.56	471.21	463.01	495.14	480.02	491.67

Working gases (Zero air and FID fuel) were obtained locally from Kirk Gases. Span gases were also ordered from Kirk, but did not arrive in time for use in the Pilot Study. Alternately, span gases brought from RTP were used to span the gas analyzers. Pre-test spans for NO were conducted with an 89.2 ppm NO in N2 mixture. Pre-test spans for CO, CO2 and THC were conducted with a multi-component mixture containing 93.2 ppm C Propane, 90.1 ppm CO, and 0.900 % CO2. Concentrations of these gases were verified in RTP, with primary calibration gases, before being sent to KC. Additional calibration gases brought to KC included a 893 ppm CO in air and a 931 ppm C (propane) in air mixture. Multipoint calibrations were performed on each analyzer to verify linearity. Full Scale and downscale concentrations were generated using a capillary type ten-point gas divider. Full scale and down scale instrument readings and slope and correlation coefficient (r2) results from linear regression analysis are given in Table 2-10 for each analyzer.

Table 2-10. Gas Analyzer Linear Regression Analysis

	NO_x	Hi CO	Lo CO	CO2	HC1(sam)	HC2 (amb)
F.S.	90.0 ppm	893 ppm	90 ppm	0.892 %	93.2 ppm C	93.2 ppm C
90 % FS	80.7	806.4	79	0.798	83.7	83.2
80 % FS	71.7	722.6	71	0.714	74.6	73.8
70 % FS	62.7	634.8	62	0.615	64.5	63.8
60 % FS	54.0	545.0	54	0.533	55.8	55.3
50 % FS	44.7	462.2	45	0.446	46.5	46.1
40 % FS	35.7	371.8	36	0.352	37.1	36.4
30 % FS	27.0	273.8	27	0.265	27.8	27.2
20 % FS	18.0	177.3	19	0.176	18.6	17.9
10 % FS	9.0	84.2	11	0.086	9.2	8.5
Zero Air	0.0	5.8	0	0.002	0.0	0.0
Slope	0.9971	1.0105	0.9916	0.9955	0.0075	0.9898
R2	1.0000	0.9995	0.9990	0.9999	1.0000	0.9997

As a cross check, audit and span gases for the SEMTECH instruments were read on the dynamometer bench. These results are given in Table 2-11.

Table 2-11. Analysis of PEMS Audit and Span Gases

	NOx, ppm	CO, ppm	CO2, %	Propane, ppm
Audit Gas				
Dyno Bench	299	189	5.89	48.3
Vendor Analysis	305	198.8	6.045	49.6
Span Gas				
Dyno Bench	-	1,240	11.20	194
Vendor Analysis	1,485	1,203	12.02	200.6

2.5.1 Calibration and QC Testing of Associated Sampling Equipment

Prior to the start of the Pilot Study, all samplers were checked for leaks and the in-line flow meters were cross calibrated using reference flow measurement devices. Leak testing was performed by capping the inlet lines leading to each sampler and turning on the pumps. If the flow meter readings decreased to less than 10% of the nominal sampling flow rate in a reasonably short time, the system was passed. If not, the source of the leak was identified and fixed, then the test was repeated. With the exception of the Teflon/Quartz filter sampler all units achieved near-zero flow rates during the leak test. Due to the friable nature of the pre-fired quartz filters it is not possible to obtain a perfect seal in the filter holders without damaging the media, but the <10% criteria was still met for each filter individually and for the system as a whole. In addition to the vacuum test, the sum of flows through each of the two filter cartridges was compared to the total flow entering the inlet and found to agree within 5%.

All flowmeters were calibrated using either a Gillibrator electronic bubble meter or a rotameter that had been cross-calibrated with a Roots meter at DRI. Calibration flows were measured at the inlet point of each sampler (or outlet for the canister sampler) with appropriate sampling media installed. The resulting calibrations were used to determine the desired nominal flow rates, and these were marked on a label on each flowmeter so that the operator could observe any deviations during testing. Variations in nominal flow rate due to sampler problems were recorded in a logbook. The only significant flow problems occurred with the canister sampler, which was unable to provide adequate flow to pressurize the canister during 2 of the tunnel blank runs due to accumulated moisture in the internal tubing. Frequent draining of the accumulate moisture prevented additional data loss*, but this may represent a future problem unless the dilution air is dehumidified.*

For each integrated sample, the run number, start and stop time, elapsed time, initial and final flow rate, and any exceptional occurrences were recorded on log sheets which were kept with the media at all times. Bar coded stickers with unique media IDs were attached to all media and their corresponding log sheets for tracking. Immediately after the conclusion of each test cycle the media were repacked with the log sheets and stored in a refrigerator, except for the canisters, which were packed and shipped via 2-day express to DRI each day. At the conclusion of the Pilot Study all media were packed into coolers with ice packs and shipped overnight back to DRI where they were logged in and placed in cold storage until analysis.

Continuous data was backed up via the wireless network and processed at the end of each sampling day to determine phase-averaged values. Run number, date, time, and vehicle license plate number were attached to all files to identify the data.

2.6 QC Tests and Preparation of the Dilution Tunnel

Two issues regarding dilution tunnel operation, operating temperature and sample hang-up, were to be examined during the Pilot Study. Concerning operating temperature, it was desired to operate the dilution tunnel at 47 ± 5 ^{o}C. For this purpose, an inlet air heater was installed to heat the dilution air entering the tunnel. The heater, requiring 480 VAC 3-phase power, was powered by a diesel-fueled generator placed outside of the building. Temperature of the diluted exhaust was monitored near the PM and regulated emissions sampling points (at the PDP entrance, some 30 feet downstream of the heater) using a type J thermocouple. This thermocouple also served as the feedback control for the heater. The dilution tunnel and sampling fittings were insulated to an R17 value using thin aluminum foiled bubble wrap insulating material. During vehicle testing, the second-by-second temperature of the diluted exhaust was recorded with the real time data acquisition system. Small adjustments were made to the temperature controller during the first two days of vehicle tests to fine-tune control. A plot of the diluted exhaust air temperatures obtained for all three vehicles on the final day of testing is given in Figure 2-2. Minimum observed temperatures were within the 47 ± 5 ^{o}C window for all three vehicles. Maximum observed temperatures exceeded the 47 ± 5 ^{o}C, most noticeably with the New Yorker. The higher than desired temperatures were due to heat being added from the vehicle's exhaust during high speed operation, and not due to heater malfunction. Figure 23- shows a plot of the distribution of diluted exhaust temperatures for the three vehicles. Temperature distributions for all three vehicles are slightly skewed toward the higher temperatures, again indicative of the heat added by the exhaust. As indicated in the distribution plots, the maximum desired temperature (52 C) was exceeded only a small percentage of the time (less than 1.5 % of the time) with the Taurus and Stratus, but almost ~ 12 % of the time with the New Yorker.

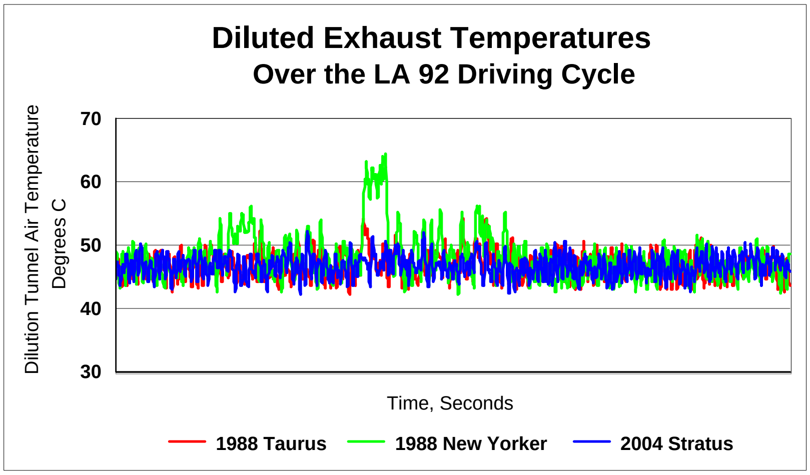


Figure 2-2. Diluted Exhaust Temperatures

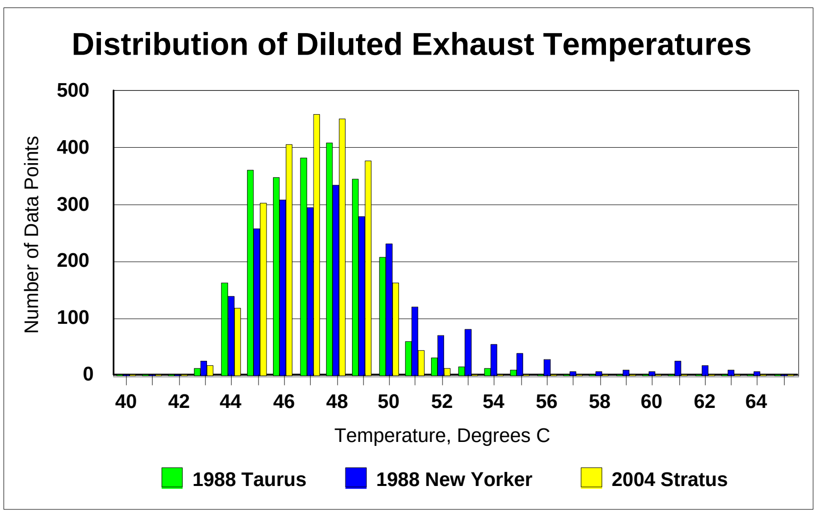


Figure 2-3. Diluted Exhaust Temperature Distribution

The second issue with regards to the dilution tunnel was to quantify any sample hang-up that may occur with THC and particulate matter, and to determine an appropriate tunnel purge time to minimize THC and particulate carry over to subsequent emissions tests. Tunnel THC emissions were measured during the 10 minute engine-off period of the LA92 cycle, and also on daily “blanks” conducted along with the Particulate Matter blanks. Very little THC sample hang-up was noted in the dilution tunnel. Figure 2-4 illustrates measured THC concentrations in the tunnel during the 10-minute engine off period during testing of the 1988 New Yorker, the highest emitter of the three correlation vehicles. Shown are concentrations measured at two locations. The Heated FID (HFID) Sample Port is located adjacent to the PDP and is the location normally used for sampling diluted exhaust. The background port is located upstream of the raw exhaust entry port and measures the treated dilution air. On three of the runs, THC was inadvertently sampled through a cold sample port and cold line. Data collected from the cold port on one of these tests is also included in the plot to contrast with the measurements collected through the normally used heated port and heated lines. As can be seen in the graph, THC levels at the HFID sample port quickly dropped from 10 ppm at the start of the soak, to background levels within 2 minutes. (The HFID trace appears to be much noisier because it was operated on the 0-1,000 ppmC range vs. the background, which was operated on the 0-100 ppmC range.). Conversely, the concentration of the THC sample collected through the cold sample line had not reached background levels at the conclusion of the 10-minute soak. This emphasizes the need to maintain heat to all sampling components when measuring THC.

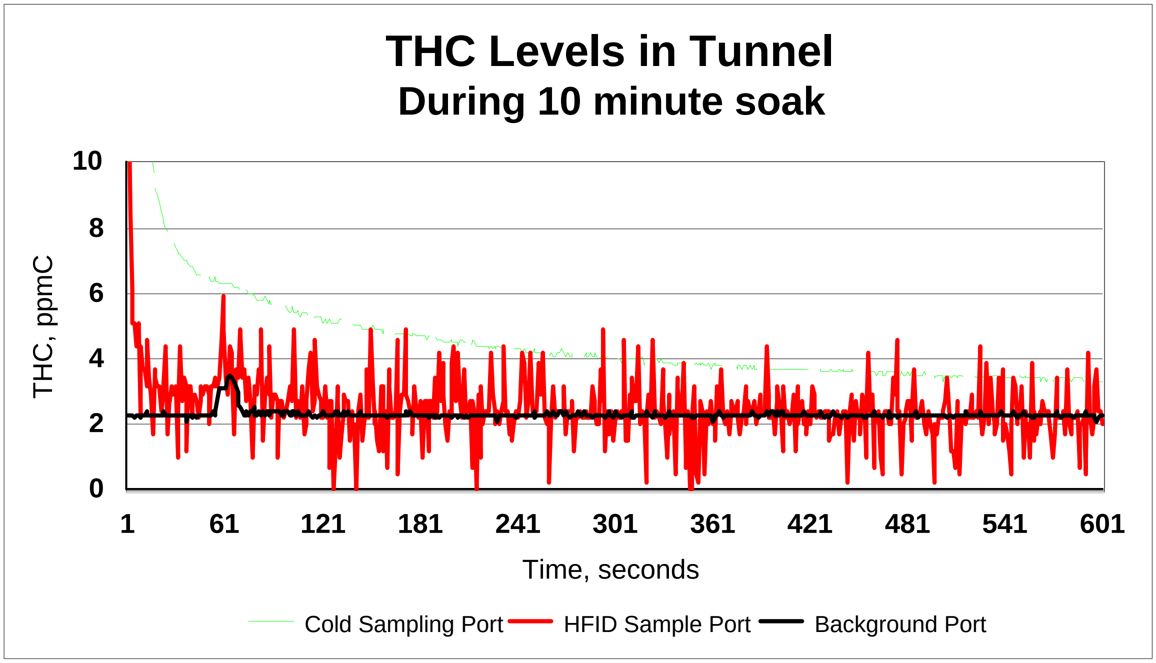


Figure 2-4. THC Levels in Dilution Tunnel.

2.7 SEMTECH Setup

2.7.1 General Pilot Study Issues

ERG and BKI staff prepared three SEMTECH units for service (units SG-01, SG-04 and SG-06). Units SG-01 and SG-04 were both used at different times for dynamometer testing, and unit SG-04 was used on all preconditioning drive testing.

In an effort to increase the accuracy of audit and calibration procedures, audits and calibrations were performed using the SEMTECH's sample port (rather than the zero and span ports). However, this change in procedure resulted in an inadvertent draining of the span and zero gasses (the sample port is not equipped with an auto shut-off solenoid as are the span and zero ports). Therefore, some testing conducted between the afternoon of Thursday, May 20, and the morning of Monday, May 24, was conducted using out of range SEMTECH equipment. To avoid this in the future, all zeros, audits, and spans will be performed using the zero and span ports on the SEMTECH, rather than drawing through the sample port. Additional information on testing conducted using out of range equipment is provided in Sections 2.8.2 and 2.8.3 below.

The flash cards used for SEMTECH memory and processing and appear to have been switched among the three SEMTECH units. Since these cards have unit-specific information, this switching appears to have created some SEMTECH initialization issues, primarily odd operation errors and communication issues between the host computers and the SEMTECH units. To prevent future problems, all SEMTECH firmware was updated (upon automatic prompting) in all three units, all out of date SEMTECH software was deleted from host computers, and current software (version 9.1) was reloaded onto all host computers. Sensors staff was helpful in diagnosing SEMTECH initialization and software problems.

Possibly due to the number of wireless networks in use at the test facility, some communication problems were identified between the SEMTECHs and their host computers. To resolve this problem, communication between the three SEMTECHs and their host computers were converted from wireless communication to a direct Ethernet cable connection (through resetting of the connection properties and reassignment of a fixed IP address). Ethernet communication is anticipated for future testing to help prevent problems associated with wireless communication.

The SEMTECH units do not record calibration or audit results (or gas concentrations used for audits/calibrations), so individual test files were created while performing all audits and calibrations during the Pilot Study. Individual test records will be used to record calibration and audit results during Phase 1 testing. This will ensure all audit and calibration results are captured and retained for future analysis. Future SEMTECH software is expected to record calibration and audit results

Despite multiple efforts, no vehicle interface (VI) communication was established with the 3 correlation vehicles or with other rental vehicles during the Pilot Study. We will be working with Sensors staff to resolve VI problems prior to the start of Phase 1 testing.

EPA comparison of vehicle exhaust flow rates as measured by the dynamometer with those measured by the SEMTECH flow meter revealed a possible bias in the SEMTECH's flow rate measurement. The EPA has been working with Sensors to correct this issue. Sensors has reportedly corrected the Pilot Study data and will revise the SEMTECH processing software to eliminate this problem.

Data collection and tracking procedures for SEMTECH test, audit and calibration files were developed to allow daily tracking of all SEMTECH data collected during the study. Since SEMTECHs don't currently record audit and span calibration results, all audits and span calibrations performed during the pilot were individually recorded as test files. Future SEMTECH software updates will apparently all the units to record audit and span calibration results.

2.7.2 SEMTECH Sampling during Preconditioning Runs

Prior to performing preconditioning runs, a preconditioning drive route believed to be equivalent to the LA92 drive trace was developed. Rental car drives along this route resulted in unacceptable speeds and delays, so this preliminary route was modified. Due to extensive on-going road construction near the test facility, future revisions of this route are possible. Speed, time, and acceleration information of the preconditioning run is presented in Section 4.

Preconditioning drives were performed on all three correlation vehicles using SEMTECH unit SG-04. The 1988 Ford Taurus (license number EPA975) and the 2004 Dodge Stratus (license number 52083) received preconditioning drives on 5/22/04. Review of the audit records performed prior to these two drives indicates possible CO bias. As shown in the dyne SEMTECH table below, (Table 2-12) this unit was also seen to have a CO bias in subsequent testing. During this time period (5/20 to 5/24), span calibration gas was not available to recalibrate the SEMTECH.

Table 2-12. Dynamometer SEMTECH Test Issues During Pilot

Date	Unit ID	Approx Start Time	Vehicle	Plate	Notes
5/20/04	SG-01	13:55	88 Taurus	EPA975	***Questionable HC readings for this test*** Test faults, and warnings indicated that the system had improper vacuum readings on drains 1 and 2 and improper sample flows. Also, test notes indicate HC calibration may not be within range (and span calibrations were not able to bring HC into range). Discussion with Sensors ruled out the possibility of the incorrect FID fuel pressure setting being the root cause.
5/20/04	N/A	N/A	N/A	N/A	Zero and span calibration gasses were inadvertently depleted in the early afternoon (after test of EPA975 but prior to 707WHY). Explanation provided in Section 2.8.1.
5/20/04	SG-01	15:10	88 New Yorker	707WHY	***Questionable HC readings for this test*** Test notes indicate pre-test audit failed for high HC. No span gas, could not recalibrate SEMTECH.
5/21/04	SG-01	N/A	All	All	Test notes do not indicate any pre-test audit issues.
5/22/04	SG-01	09:45	04 Stratus	52083	Test notes indicate SEMTECH passed all audit gasses
5/22/04	SG-01	11:05	88 Taurus	EPA975	***Questionable HC readings for this test*** SEMTECH failed HC audit, no span gas with which to recalibrate
5/22/04	SG-01	13:30	88 New Yorker	707WHY	***Questionable HC readings for this test*** SEMTECH failed HC audit, no span gas with which to recalibrate
5/23/04	SG-01	10:05	04 Stratus	52083	***Questionable HC readings for this test*** SEMTECH failed HC audit, no span gas with which to recalibrate
5/24/04	SG-04	10:50	88 Taurus	EPA975	***Questionable CO readings for this test*** SEMTECH SG-01 replaced with SG-04. SG-04 failed CO audit, no span gas with which to recalibrate.
5/24/04	N/A	N/A	N/A	N/A	Replacement span calibration gas arrived in late morning
5/24/04	SG-04	12:10	88 New Yorker	707WHY	SG-04 initially failed CO audit, recalibrated with CO span, and re-audit then passed.

2.7.3 SEMTECH Sampling during Dynamometer Testing

SEMTECH testing was performed concurrently with dynamometer testing (using Units SG-01 and SG-04). Specific differences between use of the SEMTECH for dynamometer testing vs. in-vehicle testing include:

- Rather than exhausting to the environment, the exhaust sample was drawn from the SEMTECH's sample port and flow meter tube into the transition tube feeding the dynamometer's CVS

- No GPS input was used

- An analog voltage signal proportional to dynamometer roller speed (ratio of 0.1 volt = 1 mph) was connected to external analog input 3.

- An external event marker switch was used to indicate the start of a run, and also to distinguish between test phases. However, for accuracy purposes, test-phase delineation will be based on test timing rather than manually inserted markers.

As mentioned in Section 2.7.1, some dynamometer testing was performed with "out of range" SEMTECHs. Details are presented in Table 2-12 below.

2.7.4 SEMTECH Testing during Customer Drive-Aways

No drive-away testing was performed during the Pilot Study, but some issues to consider for Round 1 testing were discussed. A primary concern for drive-away testing is motorist safety and installation integrity. In particular, the current method for installing the exhaust tube flow meter assembly requires hanging the tube off the license plate mount with extension rods and a suction-cup mounted support brace. In addition to being a potential burn hazard, this may not offer sufficient stability for long-term (i.e., one day) usage. Alternative mounting procedures are currently being considered. The objective is to develop an efficient method of mounting this assembly under the rear bumper without the need to weld or drill. As an alternative for some 1996 or newer vehicles (for which a VI is established), exhaust flow information may be gathered from the OBDII data stream collected by the SEMTECH units. With EPA approval, this OBDII information may be used in place of actual flow meter data, in installations where installation of the long flow meter tube poses a safety risk. In addition, Sensors has designed an alternative flow meter which is much shorter than the current design requirements (pressure differential vs. hot-wire anemometer). Testing is currently underway, and if this new flowmeter is found to have sufficient precision and accuracy, use of it may facilitate drive-away installations. Comparison testing between both flow meter designs is planned for Round 1 dyne/SEMTECH testing.

The SEMTECH and one or two large batteries placed in the trunk may also pose a potential safety risk (projectile, spark/flame, and acid burn hazard in the event of an accident). To minimize these risks, an attempt will be made to strap the battery (or batteries) to the SEMTECH unit, and also to tether the SEMTECH to a frame or latch section of the trunk.

Velcro will be used on the bottom of the SEMTECH units to reduce slippage and movement during everyday driving.

3.0 Testing of EPA Correlation Vehicles (Testing Schedule):

Each of the three correlation vehicles was tested over the three-phase, cold start LA92 test cycle according to the table below. All three vehicles were tested in triplicate with the dilution tunnel heater engaged (~ 47 C.). Both the Taurus and New Yorker were also tested in triplicate with the dilution tunnel at ambient temperature. One LA92 on the Stratus (Run #84011) was voided because the vehicle was tested using the wrong dynamometer settings. An additional LA92 was conducted on this vehicle to produce 3 valid tests.

Figure 3-1 describes the LA92 cycle graphically. Figure 3-2 shows the speed/acceleration contour plot for the cycle and Table 3-1 displays the speed acceleration profile in tabular form.

Collection of daily blanks were also assigned run numbers. The blanks were collected from the dilution tunnel with the raw exhaust transfer tube sealed, i.e. with only treated dilution air entering the dilution tunnel. Table 3-2 lists in numerical order the tests conducted and provides a brief description of conditions for each test. Table 3-3 groups the vehicle tests into groups by vehicle and indicated Hp.

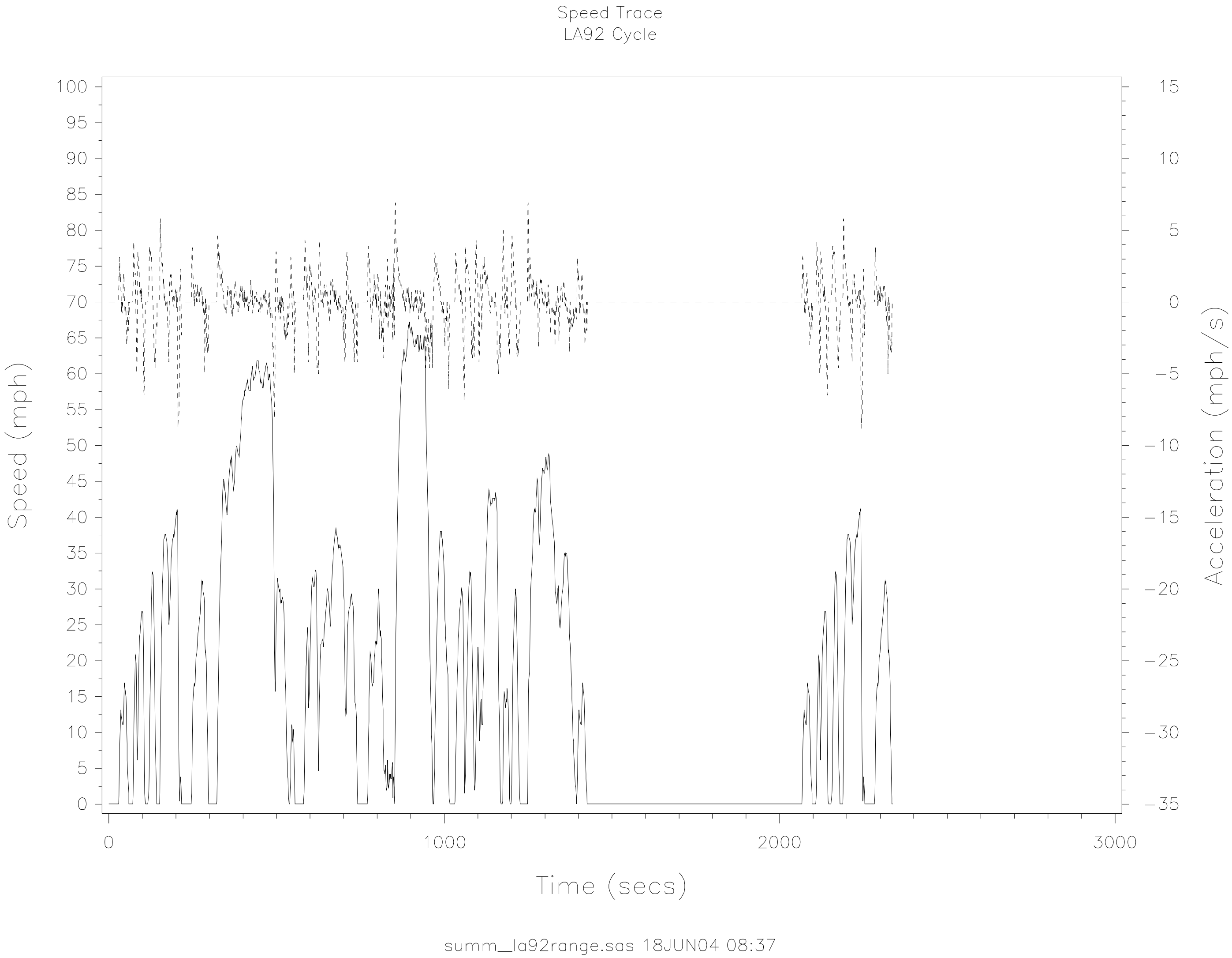


Figure 3-1. Contour Plot Showing the Speed/Acceleration Distribution of the LA92

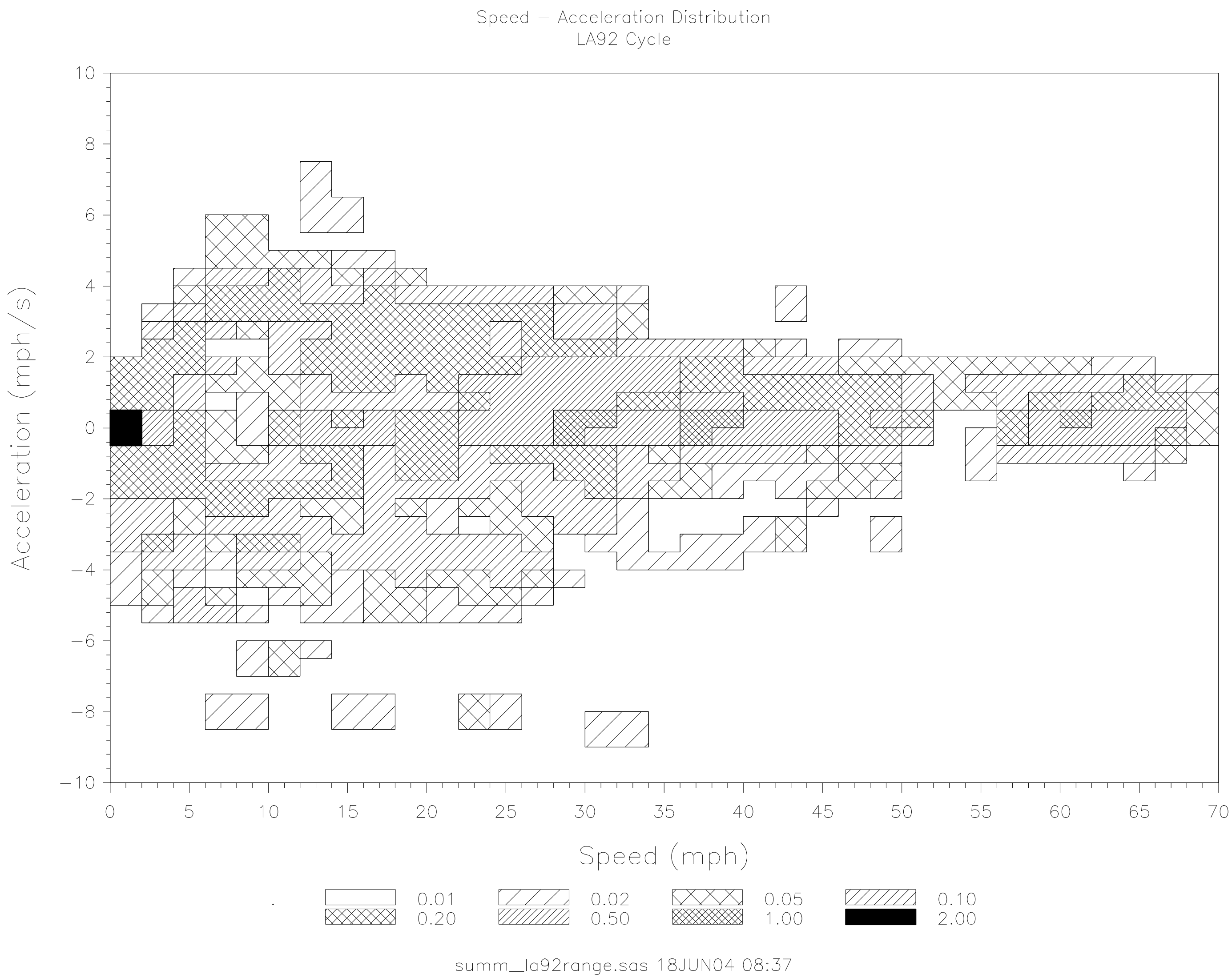


Figure 3-2. LA92 Speed Trace

Table 3-1. Speed-Acceleration for the LA92 Cycle

Speed - Acceleration Distribution 08:37 Friday, June 18, 2004 3
LA92 Cycle

Speed (mph)	Acceleration (mph/s) >-9 <=-8 (%)	>-8 <=-7 (%)	>-7 <=-6 (%)	>-6 <=-5 (%)	>-5 <=-4 (%)	>-4 <=-3 (%)	>-3 <=-2 (%)	>-2 <=-1 (%)	>-1 <0 (%)	=0 (%)	>0 <=1 (%)	>1 <=2 (%)	>2 <=3 (%)	>3 <=4 (%)	>4 <=5 (%)	>5 <=6 (%)	>6 <=7 (%)	All (%)
=0	.	.	.	.	.	.	0.06	0.63	0.52	17.61	.	.	.	.	.	.	.	18.81
>0 <=5	.	.	.	0.29	0.23	0.81	0.75	1.27	0.98	0.81	1.09	1.44	0.69	0.23	.	.	.	8.57
>5 <=10	0.12	.	0.12	0.17	0.17	0.69	0.92	0.35	0.12	.	0.12	0.35	0.23	0.98	0.29	0.17	.	4.78
>10 <=15	.	.	0.12	0.12	0.23	0.58	0.35	0.81	1.21	1.15	0.46	0.98	0.81	0.69	0.29	0.12	0.12	8.00
>15 <=20	0.12	.	.	0.29	0.35	0.52	0.35	0.86	0.86	0.69	0.52	1.21	1.27	0.63	0.12	.	.	7.77
>20 <=25	0.17	.	.	0.12	0.35	0.63	0.29	0.63	0.98	0.98	1.78	1.55	0.81	0.63	0.06	.	.	8.98
>25 <=30	.	0.06	.	.	0.12	0.12	0.46	0.81	1.96	1.61	2.36	2.01	0.75	0.17	.	.	.	10.41
>30 <=35	0.12	.	.	.	0.06	0.12	0.12	0.75	1.27	0.75	1.50	2.13	0.23	0.12	.	.	.	7.13
>35 <=40	.	.	.	0.06	.	0.12	0.06	0.12	1.55	1.38	2.07	0.86	0.06	0.06	.	.	.	6.33
>40 <=45	.	.	.	.	.	0.17	0.12	0.17	1.78	0.75	1.44	0.69	.	0.12	.	.	.	5.24
>45 <=50	.	.	.	.	.	0.12	.	0.29	0.81	0.75	1.38	0.29	0.06	.	.	.	.	3.68
>50 <=55	.	.	.	.	0.06	.	.	0.12	.	.	0.29	0.23	.	.	.	.	.	0.69
>55 <=60	.	.	.	.	0.06	0.06	.	0.06	1.15	1.32	1.09	0.35	.	.	.	.	.	4.09
>60 <=65	.	.	.	.	.	.	.	0.12	1.27	1.32	1.50	0.12	.	.	.	.	.	4.32
>65 <=70	.	.	.	.	.	.	.	.	0.40	0.35	0.40	0.06	.	.	.	.	.	1.21
All	0.52	0.06	0.23	1.04	1.61	3.91	3.45	6.96	14.84	29.46	16.00	12.26	4.89	3.62	0.75	0.29	0.12	100.0

Table 3-2. Schedule and Description of Pilot Study Emissions Tests.

Date	Time	License Number	BKI Run Number	Notes	DOW	Vehicle	Desired Dil Tun Temp	Actual Dil Tun Temp, C	Test Temp F	% Rel Hum
05/20/2004	10:30 AM	52083	84003		T	Stratus	47	48.5	81.2	76.5
05/20/2004	"Lunch"	Blank	84004	Test blank	T		47			
05/20/2004	"PM"	EPA975	84005		T	Taurus	47	47.3	86.9	68.5
05/20/2004	"PM"	707WHY	84006		T	New Yorker	47	48.1	88.2	63.9
05/21/2004	9:30 AM	52083	84007		F	Stratus	47	46.8	82.6	73.9
05/21/2004	11:00 AM	EPA975	84008		F	Taurus	47	46.8	84.8	70.3
05/21/2004	2:00 PM	707WHY	84009		F	New Yorker	47	48	87.6	58.0
05/21/2004	3:00 PM	Blank	84010	Test blank	F		47			
05/22/2004	9:00 AM	52083	84011	Test Aborted: Wrong test inertia was used	S	Stratus	47		81.1	73.5
05/22/2004	10:30 AM	EPA975	84012		S	Taurus	47	46.9	83.8	68.8
05/22/2004	1:00 PM	707WHY	84013		S	New Yorker	47	48.1	85.1	68.1
05/22/2004	2:30 PM	Blank	84014	Test blank	S		47			
05/23/2004	9:00 AM	52083	84015		Su	Stratus	47	46.8	78.6	72.9
05/24/2004	9:00 AM	EPA975	84016		M	Taurus	25	29	78.8	81.3
05/24/2004	10:30 AM	707WHY	84017		M	New Yorker	25	33	82.1	76.3
05/24/2004	11:30 AM	Blank	84018	Test blank	M		25			
05/25/2004	9:00 AM	EPA975	84019		T	Taurus	25	22.4	67.5	82.5
05/25/2004	10:30 AM	707WHY	84020		T	New Yorker	25	25	67.9	72.2
05/25/2004	12:00 PM	Blank	84021	Test blank	T		25			
05/26/2004	9:00 AM	EPA975	84022		W	Taurus	25	23.5	67.2	69.6
05/26/2004	10:30 AM	707WHY	84023		W	New Yorker	25	26.6	70.5	65.1
05/26/2004	12:00 PM	Blank	84024	Test blank	W		25			

Table 3-3. Description of Correlation Tests.

	Run #'s	Dilution Tunnel Temp.	Ambient Temp.	Inertia, lbs.	Hp Indicated
Stratus	84003	48.5 ± 2.9 C	81.2 F	3,500	3.4
	84007	46.8 ± 1.9 C	82.6 F	3,500	3.4
	84015	46.8 ± 1.7 C	82.9 F	3,500	3.4
Taurus	84005	47.3 ± 3.4 C	86.9 F	3,500	3.0
	84008	46.8 ± 2.0 C	84.8 F	3,500	3.0
	84012	46.9 ± 2.1 C	83.4 F	3,500	3.0
Taurus	84016	29.0 ± 3.3 C	78.8 F	3,500	3.0
	84019	22.4 ± 3.8 C	67.5 F	3,500	3.0
	84022	23.5 ± 3.7 C	67.2 F	3,500	3.0
New Yorker	84006	48.1 ± 4.1 C	88.2 F	4,000	10.3
	84009	48.0 ± 3.6 C	87.6 F	4,000	10.3
	84013	48.1 ± 3.6 C	85.1	4,000	10.3
New Yorker	84017	33.0 ± 5.5 C	82.1 F	4,000	5.0
	84020	25.0 ± 5.1 C	67.9 F	4,000	5.0
	84023	26.6 ± 5.4 C	70.5 F	4,000	5.0

4.0 Pilot Study Emission Results

4.1 Ann Arbor Emissions Testing

Vehicles

Three vehicles were selected for correlation testing at the EPA test facility in Ann Arbor, Michigan and at the Kansas City test site based on their particulate mater (PM) emissions. The goal was to select one vehicle that had low PM emissions, another with moderate PM emissions, and one with high PM emissions. It is believed that this approach would best describe the precision of the project's data. This approach also allows the project to utilize EPA's current correlation data between EPA test sites and those of the automotive manufacturers, thereby adding further value to the project's measurements. EPA currently has such correlation measurements for spark ignition vehicles for total hydrocarbon (THC), oxides of nitrogen (NO_x), carbon dioxide (CO_2), carbon monoxide (CO), methane (CH_4), and fuel consumption.

The low emission vehicle selected was a 2004 Dodge Stratus, the moderate emission vehicle a 1988 Ford Taurus, and the high emitter a 1988 Chrysler New Yorker. Initially, the Taurus was to be the high emitting vehicle. Its catalyst was hollowed out and made ineffective. However, the vehicle had only 12,000 miles on the odometer and the PM emissions were judged to be to relatively low. The Chrysler New Yorker proved to be a better choice, producing visible smoke from the exhaust and higher emissions than the Taurus. Except for disabling the catalyst on the Ford Taurus and a fuel exchange to the test fuel, vehicles were tested as they were received. The following table summarized the vehicles used in the test program.

Vehicle	Plate ID	Model Year	Emission Standard	Engine	Odometer
Stratus	G1252083	2004	Tier 2	2.7 L V6	8,993
Taurus	EPA975	1988	Tier 0	3.0 L V6	12,709
New Yorker	707WHY	1988	Tier 0	3.0 L V6	203,435

Test and Measurement Conditions

Ambient conditions were standard for the Federal Test Procedure (FTP), nominally 75 degrees Fahrenheit and 50 grains per pound of dry air at 60 degrees Fahrenheit. The sampling procedure and condition for all vehicles featured tail pipe emissions measured dilute with room temperature air (approximately 25 degrees Centigrade) at a bulk stream flow rate of 350 scfm. THC and NOx were measured continuously. THC, NOx, CO, CO2, PM were mechanically integrated at the phase level using Tedlar bags and filters. The PM testing used 47mm diameter

2.0-Micron Teflon filters manufactured by Pall. The flow rates for the filters were nominally 0.88 scfm. The dilution tunnel was 10-inch diameter insulated with fiberglass insulation.

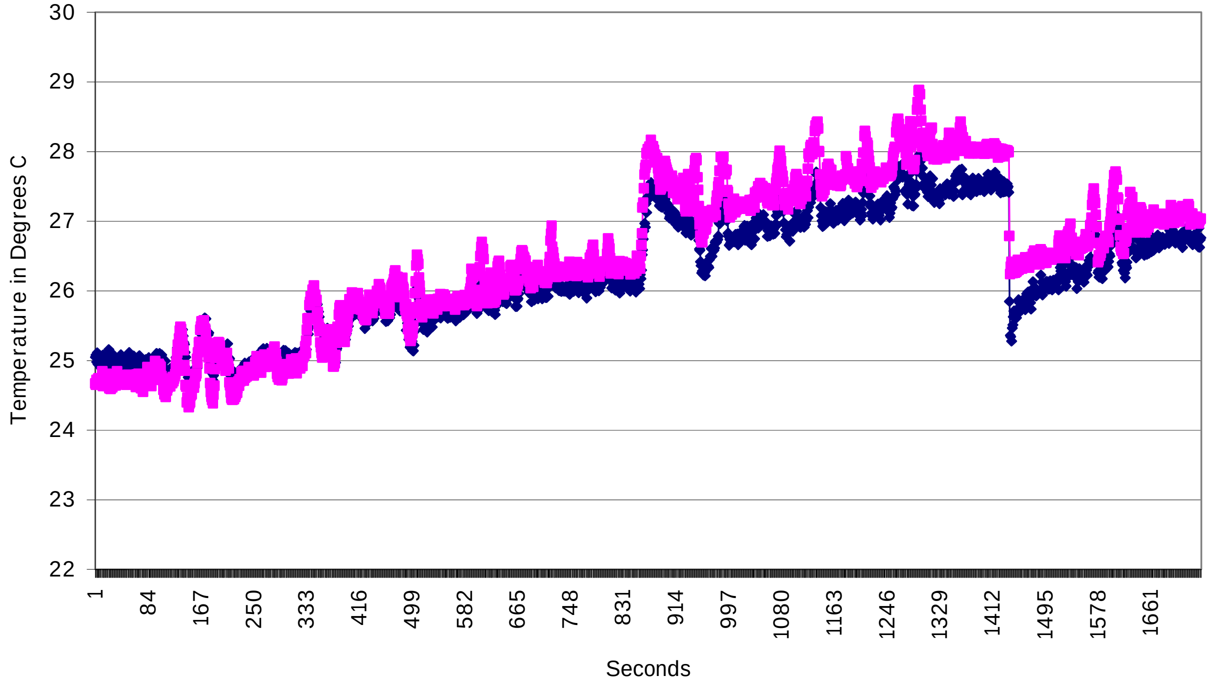
The filters were conditioned and weighted as specified under 40 CFR Part 86 for model year 2007 heavy duty engine testing. The balance has seven-place precision (10^{th} of microgram) and was mounted on a table supported by compressed air.

The vehicles were tested on a single roll 48" electric dynamometer. The dynamometer settings were similar to those used each vehicle's emission certification. However, the Taurus and the New Yorker were certified on a twin-roll water break dynamometer. Furthermore, the Taurus was tested at 150 pounds less, and the New Yorker at 450 pounds greater, than their certification test weights. The alternate weights were chosen out of necessity to match the resolution of the Kansas City dynamometer and the desire to increase emissions in the New Yorker. The following table summarizes each vehicle's dynamometer settings.

Vehicle	Test Weight (lbs.)	a Dyno coef (lbs.)	b Dyno coef (lbs./MPH)	c Dyno coef (lbs/MPH^2)	Average 55-45 mph coast (seconds)
Stratus	3500	15.47	-0.3290	0.02240	17.86
Taurus	3500	5.66	0.0355	0.02111	17.30
New Yorker	4000	4.84	0.0426	0.02498	17.59

The PM sample zone temperature for the Ann Arbor tests was uncontrolled. This was in variance to what was called for in the statement of work (47 degrees C). Though uncontrolled, all tests had sample zone temperatures between 23 and 29 degrees C. The sample zone temperature tended to rise from ambient after vehicle start to the end of the first phase, decline during the vehicle soak, and increase during the third phase. A typical temperature profile is provided in Figure 1.

Figure 1



Test Fuel

The test fuel used for all correlation testing was Federal Test Procedure Certification Fuel having the following properties.

Item		Method	Units	Target	VALUES
Vapor Pressure		Grabner	psi	8.7-9.2	8.91
Distillation		ASTM D 86			
initial boiling point			◦ F	75-95	92
10% evaporated			◦ F	120-135	124
50% evaporated			◦ F	200-230	221
90% evaporated			◦ F	300-325	311
end point			◦ F	415 MAX.	395
Sulfur		ASTM D 2622	PPM	0.003 - .0045	0.0035
Lead		ASTM D 3237	g/gal	0.01 MAX.	0.0
Phosphorous		ASTM D 3231	g/gal	0.005 MAX.	0.0001
Hydrocarbon Composition		ASTM D 1319			
olefins			Vol %	10 MAX.	2.6
aromatics			Vol %	35 MAX.	30.9
saturates			Vol %	REMAINDER	66.5
Research octane number		ASTM D 2699		96.0 MIN.	96.6
Motor octane number		ASTM D 2700		_	87.4
Antiknock index		ASTM D 439		_	92.0
Sensitivity		RON-MON		7.5 MIN.	9.2

Weight fraction carbon		ASTM D 3343		_	0.8667219
Net heat of combustion		ASTM D 3338	BTU/LB	_	18436.899
API Gravity		ASTM D 4052	◦ API	_	58.9
Specific gravity (60 F/60 F)				_	0.7431723
Fuel economy numerator (g carbon/gal)				2401-2441	2433

Preconditioning

The vehicle fuel tanks were drained of any residual gasoline and filled with the test fuel. The vehicles were then preconditioned before the first test with the dynamometer coefficient derivation procedure and a single LA92. All following tests used the previous test as preconditioning. In all instances the vehicles were tested several times before obtaining the results reported here. (The earlier tests were conducted at inertia weights that were not consistent with the Kansas City dynamometer.)

Test Data

The emission results from the Ann Arbor testing are found in Table 4-1.

Post-Test Preparation for Kansas City

An inspection of vehicle fluids was performed after testing. However, only test fuel was added to each vehicle.

Table 4-1. Summary of Ann Arbor Results

License Plate	Test Date	Bag #	Miles per gallon	CH4 (gpm)	CO (gpm)	CO2 (gpm)	THC (gpm)	NOx (gpm)	PM (micro gpm)
707WHY	04/20/2004	1	12.402	0.188	25.414	667.634	3.202	1.16	35.407
707WHY	04/21/2004	1	12.538	0.183	24.1	661.936	3.188	1.262	35.516
707WHY	04/22/2004	1	12.286	0.194	26.396	672.623	3.276	1.401	82.194
707WHY	04/27/2004	1	12.226	0.191	23.761	680.805	3.127	1.349	55.49
707WHY	04/28/2004	1	12.138	0.193	26.286	681.961	3.18	1.415	50.244
707WHY	04/20/2004	2	20.325	0.08	8.039	423.09	0.697	1.096	33.007
707WHY	04/21/2004	2	20.581	0.074	7.826	418.133	0.649	1.058	19.404
707WHY	04/22/2004	2	20.024	0.076	6.928	431.629	0.634	1.206	31.789
707WHY	04/27/2004	2	20.111	0.076	7.157	429.27	0.656	1.163	20.523
707WHY	04/28/2004	2	20.052	0.069	5.89	432.803	0.58	1.16	25.919
707WHY	04/20/2004	3	15.072	0.111	14.086	563.607	1.519	1.347	13.94
707WHY	04/21/2004	3	15.154	0.117	14.135	559.748	1.713	1.647	16.952
707WHY	04/22/2004	3	14.775	0.12	17.3	569.687	1.75	1.715	15.452
707WHY	04/27/2004	3	14.811	0.137	16.242	569.721	1.806	1.713	17.765
707WHY	04/28/2004	3	14.872	0.11	14.464	570.683	1.607	1.676	15.935
EPA975	04/20/2004	1	13.267	0.148	25.897	617.341	4.058	5.875	32.016
EPA975	04/21/2004	1	13.088	0.151	28.92	622.316	3.881	6.191	11.46
EPA975	04/22/2004	1	13.456	0.161	29.673	602.62	3.853	5.782	11.964
EPA975	04/27/2004	1	13.104	0.2	29.92	619.329	4.07	5.722	22.228
EPA975	04/28/2004	1	13.303	0.196	29.82	609.913	3.887	5.896	13.908
EPA975	04/20/2004	2	22.361	0.065	13.328	370.998	1.93	3.947	10.093
EPA975	04/21/2004	2	22.41	0.063	13.73	369.915	1.799	3.927	6.39
EPA975	04/22/2004	2	22.73	0.063	13.126	365.109	1.847	3.83	8.815
EPA975	04/27/2004	2	22.601	0.063	13.004	367.479	1.867	3.65	5.846
EPA975	04/28/2004	2	22.688	0.064	13.153	365.632	1.897	3.7	4.814

License Plate	Test Date	Bag #	Miles per gallon	CH4 (gpm)	CO (gpm)	CO2 (gpm)	THC (gpm)	NOx (gpm)	PM (micro gpm)
EPA975	04/20/2004	3	15.643	0.127	20.455	527.129	3.076	6.1	5.219
EPA975	04/21/2004	3	15.645	0.119	21.487	525.609	3.015	5.994	6.164
EPA975	04/22/2004	3	15.742	0.127	20.811	523.356	2.952	6.198	6.434
EPA975	04/27/2004	3	15.654	0.123	22.147	524.237	3.015	5.602	4.193
EPA975	04/28/2004	3	15.751	0.128	21.39	522.037	2.982	5.605	6.354
G1252083	04/21/2004	1	14.506	0.025	3.785	606.135	0.487	0.464	1.05
G1252083	04/22/2004	1	14.487	0.026	3.677	607.069	0.496	0.524	2.428
G1252083	04/27/2004	1	14.112	0.027	4.309	622.154	0.572	0.433	1.958
G1252083	04/28/2004	1	14.161	0.028	4.177	620.365	0.513	0.45	1.89
G1252083	04/21/2004	2	25.17	0.006	0.321	353.06	0.022	0.116	0.636
G1252083	04/22/2004	2	25.246	0.006	0.361	351.919	0.027	0.117	0.5
G1252083	04/27/2004	2	24.944	0.006	0.361	356.181	0.029	0.103	0.412
G1252083	04/28/2004	2	24.827	0.004	0.29	358.016	0.017	0.112	0.449
G1252083	04/21/2004	3	17.942	0.017	0.672	494.927	0.038	0.073	2.883
G1252083	04/22/2004	3	17.823	0.017	0.792	497.985	0.062	0.099	0.702
G1252083	04/27/2004	3	17.826	0.009	0.44	498.582	0.018	0.072	0.123
G1252083	04/28/2004	3	17.692	0.008	0.263	502.671	0.012	0.097	1.058

4.2 Regulated Emission Results

Regulated emission rates were calculated using modal (second-by-second) data. Table 4-2 gives individual phase emission rates for each run as well as average emission results and standard deviations. Two sets of tests were conducted on the Taurus and New Yorker, one set with the dilution tunnel temperature of ~ 47 C, the other set with an unheated tunnel temperature at about 25 C. Ambient temperatures were also a bit cooler while the second set of tests were being conducted. The effect of ambient temperature can be seen with Phase 1, and to a lesser degree, Phase 2 emissions being higher for tests conducted at the lower ambient temperature. Phase 3 emissions were not much affected by differences in ambient temperature.

Table 4-2 Regulated Emission Results

Stratus					
	Run #	**HC gm/mi**	**CO gm/mi**	**CO2 gm/mi**	**NOx gm/mi**
Phase 1	84003	0.583	3.104	645.718	0.501
	84007	0.546	3.188	655.967	0.602
	84015	0.625	3.276	637.369	0.439
	Avg	**0.585**	**3.190**	**646.352**	**0.514**
	Std Dev	**0.032**	**0.070**	**7.606**	**0.067**
Phase 2	84003	0.054	0.353	381.530	0.090
	84007	0.027	0.310	394.385	0.116
	84015	0.032	0.341	385.275	0.091
	Avg	**0.038**	**0.335**	**387.063**	**0.099**
	Std Dev	**0.012**	**0.018**	**5.398**	**0.012**
Phase 3	84003	0.056	0.181	519.757	0.163
	84007	0.013	0.339	544.240	0.181
	84015	0.042	0.421	509.885	0.142
	Avg	**0.037**	**0.313**	**524.627**	**0.162**
	Std Dev	**0.018**	**0.100**	**14.442**	**0.016**
Taurus, Set 1					
	Run #	HC gm/mi	CO gm/mi	CO2 gm/mi	NOx gm/mi
Phase 1	84005	5.331	35.355	674.961	10.419
	84008	5.038	32.677	664.854	10.300
	84012	5.525	34.414	673.240	9.987
	Avg	**5.298**	**34.149**	**671.018**	**10.236**
	Std Dev	**0.200**	**1.109**	**4.415**	**0.182**
Phase 2	84005	2.327	18.269	421.760	8.754
	84008	2.280	17.460	414.705	8.608
	84012	2.285	17.879	414.843	8.186
	Avg	**2.297**	**17.869**	**417.103**	**8.516**
	Std Dev	**0.021**	**0.330**	**3.294**	**0.241**
Phase 3	84005	3.814	25.318	575.042	10.761
	84008	3.569	22.886	569.298	10.790
	84012	3.822	22.086	569.178	10.476
	Avg	**3.735**	**23.430**	**571.173**	**10.676**
	Std Dev	**0.117**	**1.374**	**2.736**	**0.142**
Taurus, Set 2					

	Run #	HC gm/mi	CO gm/mi	CO2 gm/mi	NOx gm/mi
Phase 1	84016	5.936	39.941	685.902	10.080
	84019	6.582	45.075	683.585	8.725
	84022	6.244	43.291	674.279	8.569
	Avg	**6.254**	**42.769**	**681.255**	**9.124**
	Std Dev	**0.264**	**2.128**	**5.023**	**0.678**
Phase 2	84016	2.370	19.429	425.062	8.348
	84019	2.417	20.351	437.324	7.556
	84022	2.451	20.860	440.050	7.327
	Avg	**2.413**	**20.213**	**434.146**	**7.744**
	Std Dev	**0.033**	**0.592**	**6.519**	**0.437**
Phase 3	84016	3.926	22.678	577.758	10.601
	84019	3.770	24.220	568.340	9.199
	84022	3.871	24.729	572.297	8.646
	Avg	**3.856**	**23.876**	**572.798**	**9.482**
	Std Dev	**0.064**	**0.872**	**3.861**	**0.823**
New Yorker, Set 1					
	Run #	HC gm/mi	CO gm/mi	CO2 gm/mi	NOx gm/mi
Phase 1	84006	5.662	32.782	693.806	2.413
	84009	5.435	29.070	685.725	2.326
	84013	3.297	26.859	707.918	2.167
	Avg	**4.798**	**29.570**	**695.816**	**2.302**
	Std Dev	**1.065**	**2.444**	**9.171**	**0.102**
Phase 2	84006	1.012	10.972	496.552	2.210
	84009	1.018	12.077	479.766	2.184
	84013	0.403	14.804	481.561	2.338
	Avg	**0.811**	**12.618**	**485.960**	**2.244**
	Std Dev	**0.289**	**1.610**	**7.526**	**0.067**
Phase 3	84006	2.085	17.026	611.411	2.304
	84009	2.331	26.558	593.735	2.195
	84013	2.119	19.142	596.187	2.662
	Avg	**2.178**	**20.909**	**600.444**	**2.387**
	Std Dev	**0.109**	**4.087**	**7.819**	**0.200**
New Yorker, Set 2					
	Run #	HC gm/mi	CO gm/mi	CO2 gm/mi	NOx gm/mi
Phase 1	84017	5.947	31.166	718.395	2.350
	84020	7.355	26.316	725.995	1.965
	84023	6.866	27.266	737.880	2.189
	Avg	**6.723**	**28.250**	**727.423**	**2.168**
	Std Dev	**0.584**	**2.098**	**8.018**	**0.158**
Phase 2	84017	1.303	10.445	465.075	1.997
	84020	1.205	8.681	448.938	1.675
	84023	1.344	8.933	454.931	1.752
	Avg	**1.284**	**9.353**	**456.314**	**1.808**
	Std Dev	**0.058**	**0.779**	**6.660**	**0.137**
Phase 3	84017	2.321	20.433	609.247	2.550
	84020	2.244	18.255	591.832	2.103
	84023	1.930	17.664	598.233	2.390
	Avg	**2.165**	**18.784**	**599.771**	**2.348**
	Std Dev	**0.169**	**1.190**	**7.193**	**0.185**

Percent standard deviations for each set of triplicate tests were calculated as a measure of precision, and are presented in Table 4-3. A good level of precision was found for the regulated emissions. Percent standard deviations (%SD) were less than 2 % for CO2 for all three correlation vehicles, except Phase 3 Stratus CO2 emissions, which had a %SD of 2.8 %. In general, HC, CO, and NOx % SDs were within 5 %- 10 %. Higher %SDs were seen in the case of extremely low emissions, for instance Phase 2 and 3 HC emissions and Phase 1 and 2 NOx emissions for the Stratus. Higher %SDs were also noted for HC and CO emissions for the first set of New Yorker tests. The high HC %SD is the result of low Phase 1 and 2 HC emissions on the last test of the set. This is probably due to the HC sampling valve inadvertently being placed in the "cold" sampling position (see discussion below).

Table 4-3. Percent Standard Deviation (%SD) for the Regulated Emissions.

	HC,% SD	CO, % SD	CO2,% SD	NOx, %SD
Phase 1				
Stratus	5.48	2.20	1.18	13.08
Taurus Set 1	3.78	3.25	0.66	1.78
Taurus Set 2	4.21	4.98	0.74	7.43
New Yorker Set 1	22.21	8.26	1.32	4.42
New Yorker Set 2	8.68	7.43	1.10	7.29
Phase 2				
Stratus	31.52	5.38	1.39	11.86
Taurus Set 1	0.93	1.85	0.79	2.83
Taurus Set 2	1.39	2.93	1.50	5.65
New Yorker Set 1	35.59	12.76	1.55	2.99
New Yorker Set 2	4.55	8.33	1.46	7.58
Phase 3				
Stratus	49.09	31.77	2.75	9.82
Taurus Set 1	3.14	5.87	0.48	1.33
Taurus Set 2	1.67	3.65	0.67	8.68
New Yorker Set 1	4.99	19.55	1.30	8.37
New Yorker Set 2	7.82	6.34	1.20	7.88

During the course of the Pilot Study, several changes were made to the sampling schemes, which had a minor impact on the real-time regulated emissions data. These changes are listed below:

1) Starting with run # 84020, time and date columns were added to the real-time data files. These will become a permanent fixture of the real-time files.

2) On three runs, #84008, #84013, and #84023, both the sample and the background FIDs measured diluted exhaust through a "cold" sample train due to sampling valves inadvertently left open.

3) On runs #84016 through #84022, the HC background line was disconnected from the dilution tunnel in order to sample untreated room air during testing.

4) On run # 84015, the NOx span bottle was inadvertently sampled for the first 76 seconds of the test.

4.3 Continuous and Time-Integrated Gravimetric Mass Measurements

Chemical analysis of the time-integrated samples is currently in progress. Only data for gravimetric mass are available at this time, reported here and compared to the continuous PM mass measurements. The TOR organic and elemental carbon data will be available in mid-June and organic speciation will be available in July 2004. Table 4-4 shows the $PM_{2.5}$ gravimetric mass analysis of the Teflon filters for all tests by UDC phase along with the corresponding phase-averaged continuous mass concentrations.

Figure 4-1 shows the gravimetric mass concentrations for all tests for each of the three vehicles (Stratus, Taurus and New Yorker) in chronological order. Tests prior to May 24 were performed with the dilution air to the CVS heated to 47C and the sample train also maintained at 47±5C. Tests from May 24 –26 were performed with dilution air at ambient temperature and without temperature control of the sampling train. No substantial difference due to temperature is evident. Phase 1 consistently yields higher average mass concentrations than either Phases 2 or 3. Phase 3 shows the most variability, probably due to the smaller amounts of mass collected. Figure 4-2 shows the gravimetric filter mass loading for the daily tunnel blanks relative to the combined total mass loadings for each test. Mass data for the tunnel blanks are adjusted for the longer run time. Tunnel blanks are consistently small relative to Phase 1 and 2 concentrations. There is an apparent decrease in the tunnel blanks for the lower temperature tests, and total mass loadings are somewhat more consistent for the lower temperature tests.

Figures 4-3 through 4-5 compare the continuous mass data for the DustTrak versus the DataRam nephelometer for the Dodge Stratus, Ford Taurus and the Chrysler New Yorker, respectively. Figure 4-6 compares the average continuous mass and black carbon to the corresponding filter mass concentrations. The photoacoustic black carbon data are also shown. Nephelometer mass is much higher in the ambient temperature measurements (probably closer to

Table 4-4. Gravimetric Mass and Averaged Continuous Data for All Tests, by Phase

[Note: gravimetric mass has been corrected by media blank subtraction.]

Date	Run#	plate	vehicle	PHASE	T (C)	ug/filter	unc.	mass conc (ug/m3)	uncer. (ug/m3)	DustTrakMass _(ug/m3)	DataRamMass _(ug/m3)	BlackCarbon _(ug/m3)
5/20	84003	52083	Stratus	1	47	49	6	119	29	22	13	2
5/20	84003	52083	Stratus	2	47	102	6	88	12	15	9	0
5/20	84003	52083	Stratus	3	47	49	6	118	29	11	4	2
5/20	84004	blank		blank	47	70	5	16	3	5	2	0
5/20	84005	EPA975	Taurus	1	47	103	6	309	43	118	34	40
5/20	84005	EPA975	Taurus	2	47	73	6	53	9	38	20	9
5/20	84005	EPA975	Taurus	3	47	35	6	70	26	25	11	12
5/20	84006	707why	Yorker	1	47	305	6	1118	120	246	116	40
5/20	84006	707why	Yorker	2	47	481	6	432	45	141	238	43
5/20	84006	707why	Yorker	3	47	325	6	1067	114	56	28	5
5/21	84007	52083	Stratus	1	47	41	5	95	25	19	10	3
5/21	84007	52083	Stratus	2	47	87	5	72	10	11	7	1
5/21	84007	52083	Stratus	3	47	74	5	181	28	15	8	1
5/21	84008	epa975	Taurus	1	47	151	5	482	57	146	45	52
5/21	84008	epa975	Taurus	2	47	80	5	60	9	45	21	4
5/21	84008	epa975	Taurus	3	47	43	5	96	24	31	13	15
5/21	84009	707WHY	Yorker	1	47	157	5	508	59	208	94	43
5/21	84009	707WHY	Yorker	2	47	403	5	365	38	305	171	25
5/21	84009	707WHY	Yorker	3	47	112	5	344	44	94	45	12
5/21	84010	blank		blank	47	126	6	36	5	4	2	1
5/22	84012	EPA975	Taurus	1	47	105	5	424	56	114	204	55
5/22	84012	EPA975	Taurus	2	47	89	5	85	12	32	21	5
5/22	84012	EPA975	Taurus	3	47	139	5	573	69	42	25	21
5/22	84013	707WHY	Yorker	1	47	298	5	1003	107	456	908	60
5/22	84013	707WHY	Yorker	2	47	474	5	429	45	336	249	25
5/22	84013	707WHY	Yorker	3	47	72	5	201	32	106	91	8
5/22	84014	blank		blank	47	153	5	41	5	#N/A	#N/A	#N/A
5/23	84015	52083	Stratus	1	47	41	5	92	24	21	18	6
5/23	84015	52083	Stratus	2	47	66	5	48	8	6	4	0
5/23	84015	52083	Stratus	3	47	15	5	-2	19	5	3	1
5/24	84016	EPA975	Taurus	1	25	172	5	556	64	165	282	80
5/24	84016	EPA975	Taurus	2	25	107	5	84	11	25	20	5
5/24	84016	EPA975	Taurus	3	25	19	5	11	19	43	46	18
5/24	84017	707WHY	Yorker	1	25	229	5	758	83	360	639	59
5/24	84017	707WHY	Yorker	2	25	387	5	347	37	82	68	9
5/24	84017	707WHY	Yorker	3	25	73	5	205	32	62	73	6
5/24	84018	blank		blank	25	42	5	8	2	#N/A	#N/A	#N/A
5/25	84019	EPA975	Taurus	1	25	115	5	357	45	372	898	135
5/25	84019	EPA975	Taurus	2	25	170	5	149	17	31	100	7
5/25	84019	EPA975	Taurus	3	25	11	5	-18	19	83	78	26
5/25	84020	707WHY	Yorker	1	25	200	5	654	73	487	2178	75
5/25	84020	707WHY	Yorker	2	25	358	5	320	34	97	112	9
5/25	84020	707WHY	Yorker	3	25	95	5	283	39	86	97	9
5/25	84021	blank		blank	25	80	5	19	3	7	11	1
5/26	84022	EPA975	Taurus	1	25	155	3	490	56	390	1335	130
5/26	84022	EPA975	Taurus	2	25	237	3	207	22	37	37	8
5/26	84022	EPA975	Taurus	3	25	42	3	92	19	29	61	27
5/26	84023	707WHY	Yorker	1	25	279	3	936	100	830	3187	80
5/26	84023	707WHY	Yorker	2	25	485	3	439	45	280	258	14
5/26	84023	707WHY	Yorker	3	25	53	3	166	28	110	88	6
5/26	84024	blank		blank	25	26	3	3	1	1	0	0

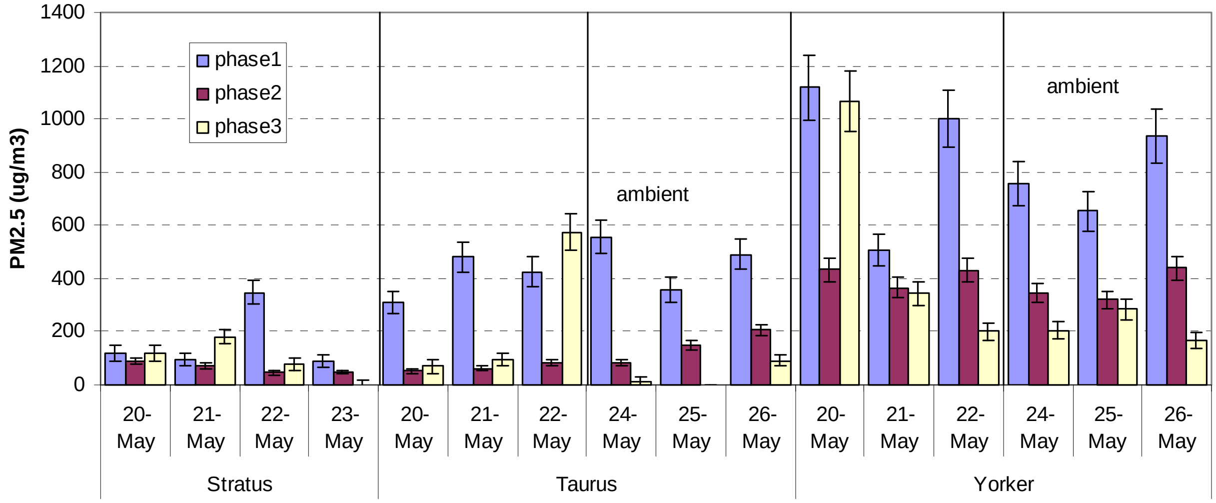


Figure 4-1. Mass Concentration as Determined by Gravimetric Analysis of Teflon Filters for All Tests by Cycle Phase.

[Uncertainties are indicated by error bars. Tests prior to May 24 were performed with the sample train maintained at 47C. Tests from May 24 –26 were performed w/out temperature control.]

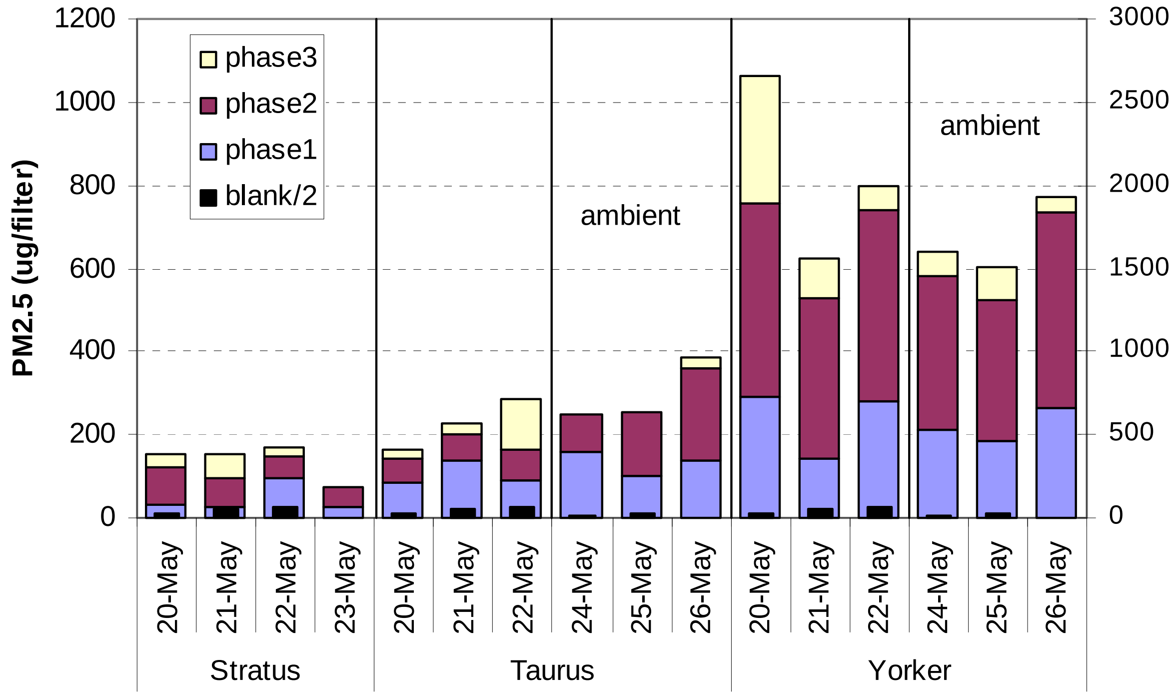


Figure 4-2. PM2.5 Gravimetric Filter Mass for All Tests

[Daily tunnel blanks are indicated also, and have been adjusted for the longer run time.]

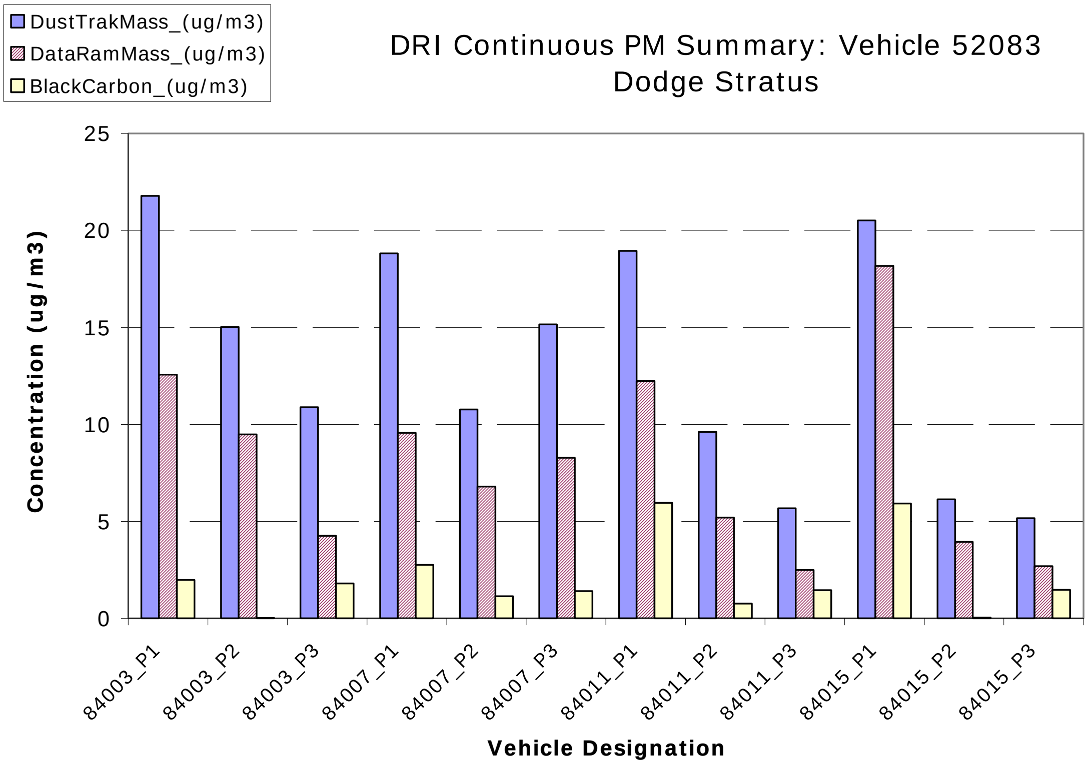


Figure 4-3. Continuous PM Mass Measurements, Dodge Stratus

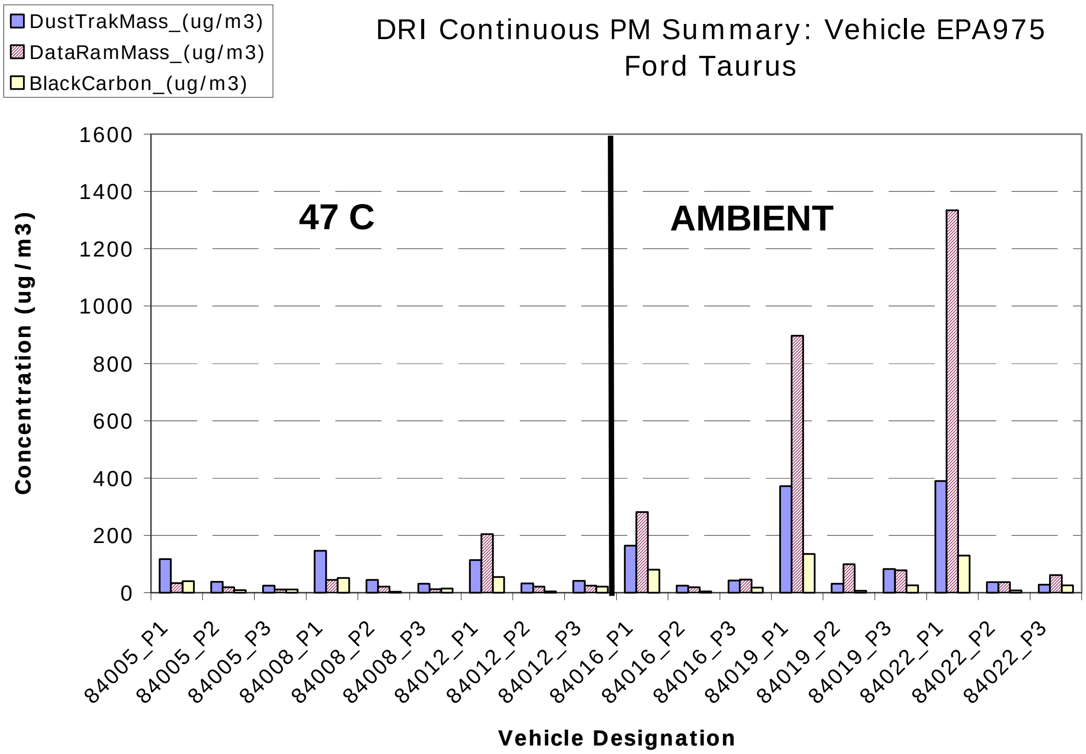


Figure 4-4. Continuous PM Mass Measurements, Ford Taurus

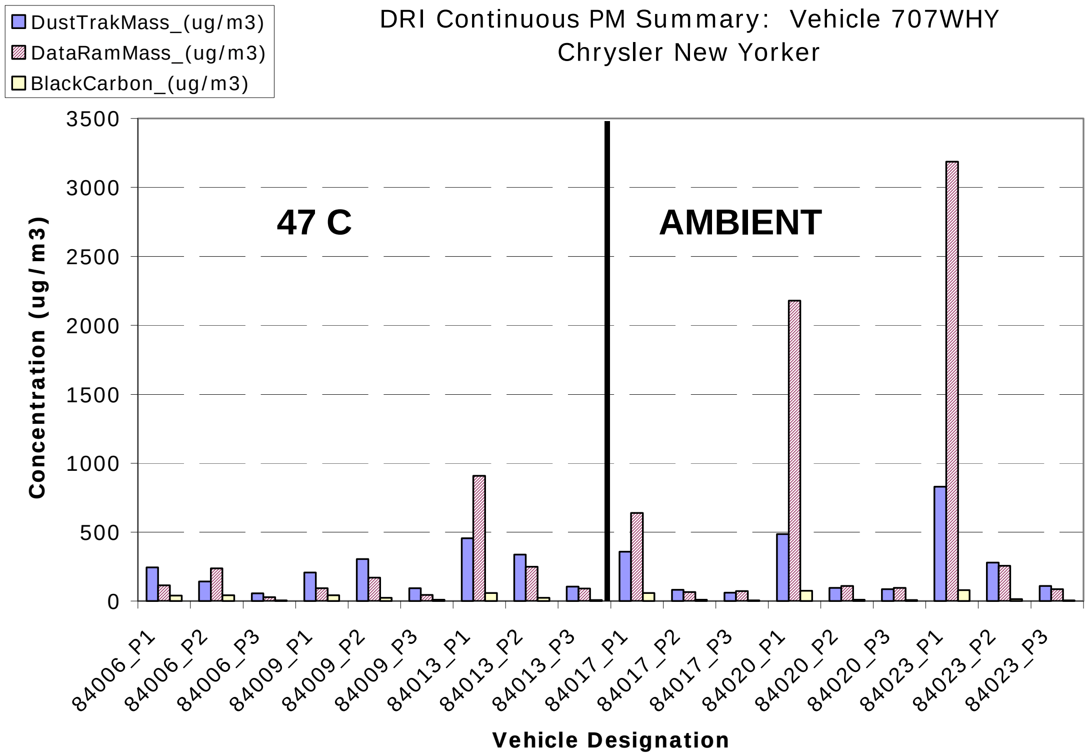


Figure 4-5. Continuous PM Mass Measurements, Chrysler New Yorker

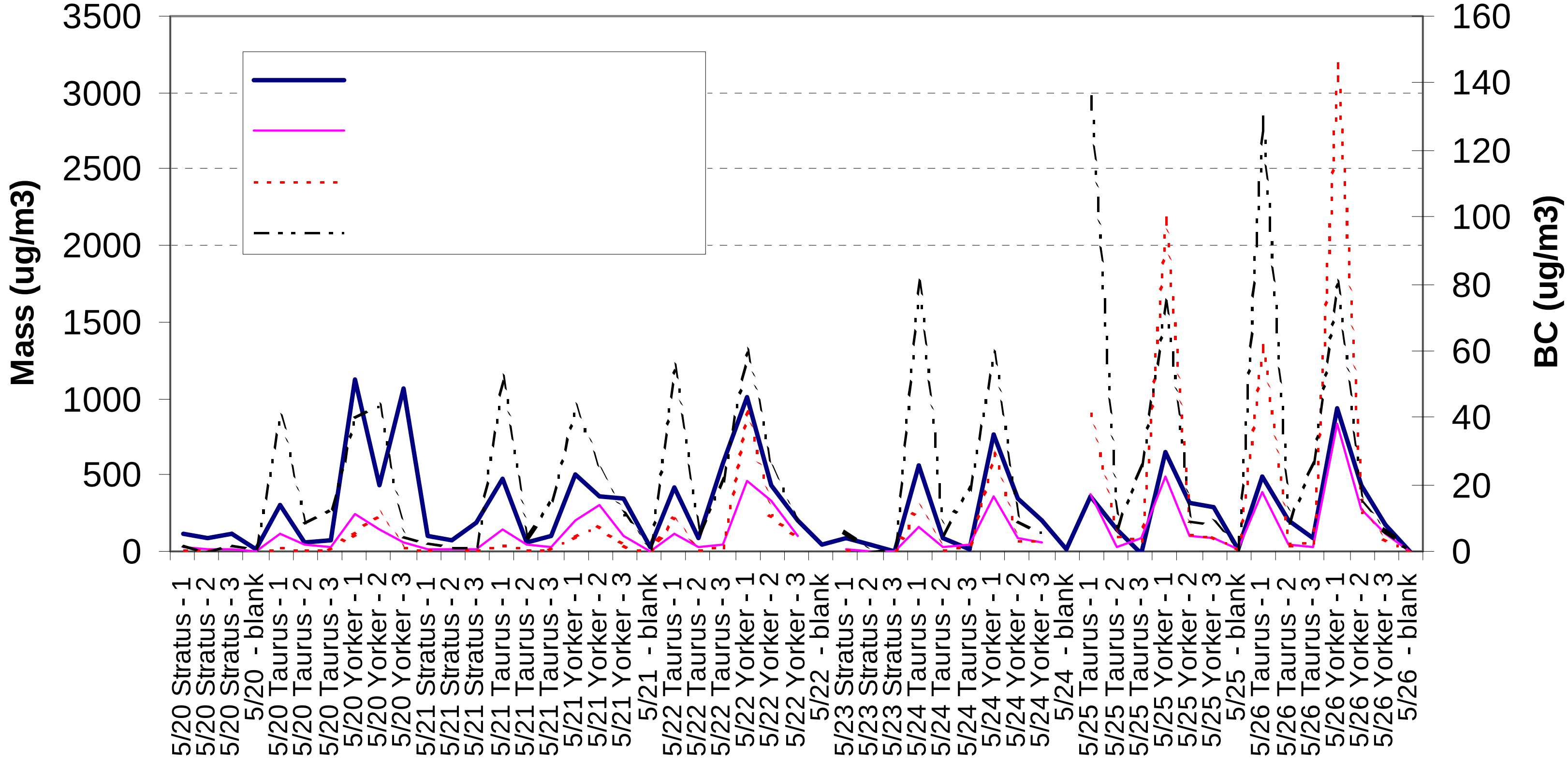


Figure 4-6. Comparison of Averaged Continuous Mass and Black Carbon to Corresponding Filter Mass Concentrations for Each

the filter values) than the 47 C data, possibly indicating reduced particle size for the 47 C data. However, black carbon mass concentration from the PA is also higher for the measurements with dilution air at ambient temperature. This finding is independent of particle size, so these differences may reflect run-to-run variations in emission rates. When the tunnel is at 47C, the nephelometer and photoacoustic instruments are at about 30C (not feasible to heat them to 47C), so particle loss along the sample lines associated with the temperature gradient are possible. One way to deal with this would be to educt a sample (with some dilution) from the dynamometer at high temperature, and use the eduction dilution to quench the sample quickly.

Figures 4-7 and 4-8 show the cumulative QCM response for the three test vehicles. The vertical axis shows accumulated mass, so the average concentration for the three cycles taken together is the final mass divided by the total sampled volume (at 1 LPM flow rate, 29 minutes sampling time, the total sample volume is about 1/34.5 cubic meters). The New Yorker concentration should also be multiplied by a factor of 20, as this was the dilution ratio for this vehicle. The QCM average mass concentrations for Phases 1-3 agree reasonably well with the DRI filter sampler results for the first run (time weight average of Phase 1-3). (For example, the New Yorker time weighted average for all phases was 655 ug/m3, while the QCM time weighted average for the first run was about 628 ug/m3.) Run #84016 (New Yorker) and #84017 (Taurus) were done with the dynamometer CVS dilution air at ambient temperature. These runs look different than the other runs done at 47 Degrees C. However, note that the Taurus run #84012 (47 C) shows more decrease of mass during the hot soak than does the other run (#84016) done at ambient conditions. This is a bit of a paradox, given that the elevated temperature would likely make for less volatile aerosol to begin with.

A summary of the OCM results is shown in Table 4-5. Figures 4-9 through 4-11 show all the OCM results in Kansas City and Ann Arbor.

It is too soon to draw any conclusions from these runs, given the variability. The QCM average mass concentrations for the Pilot Study are being processed by EPA and will be examined in greater detail relative to the other measurements in the final version of this report.

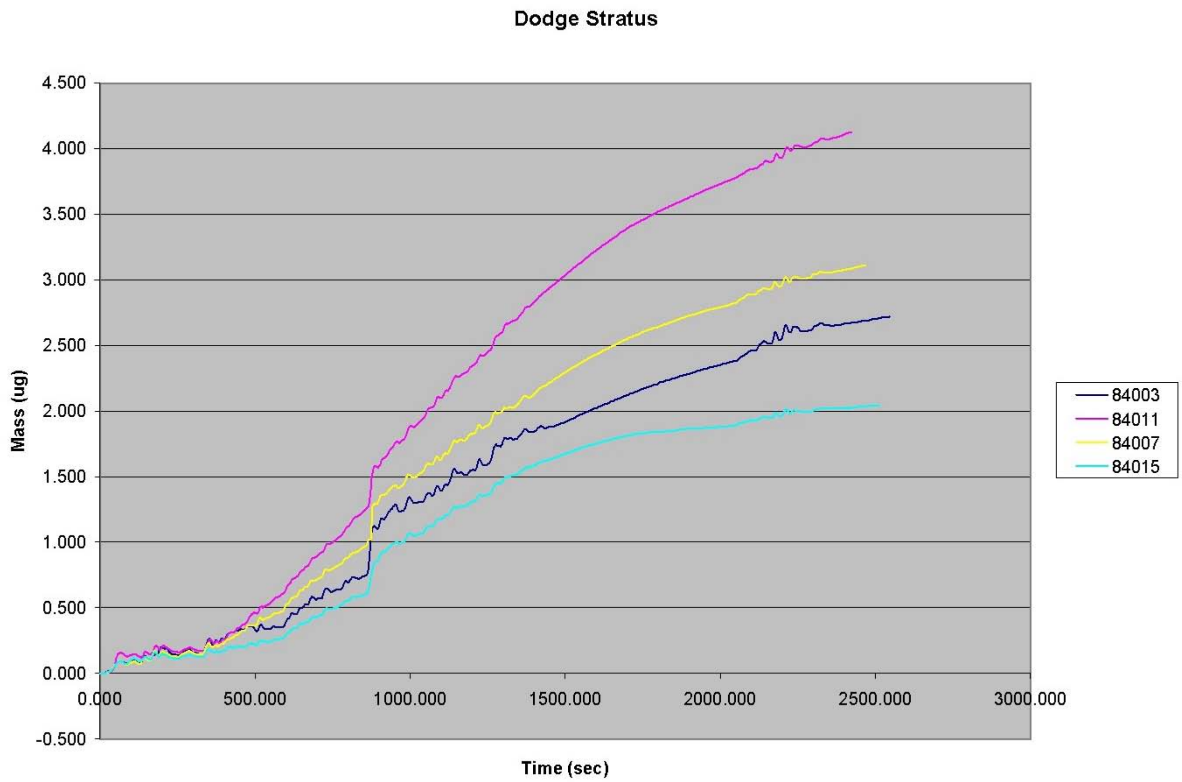


Figure 4-7. Cumulative QCM Response for the Dodge Stratus.

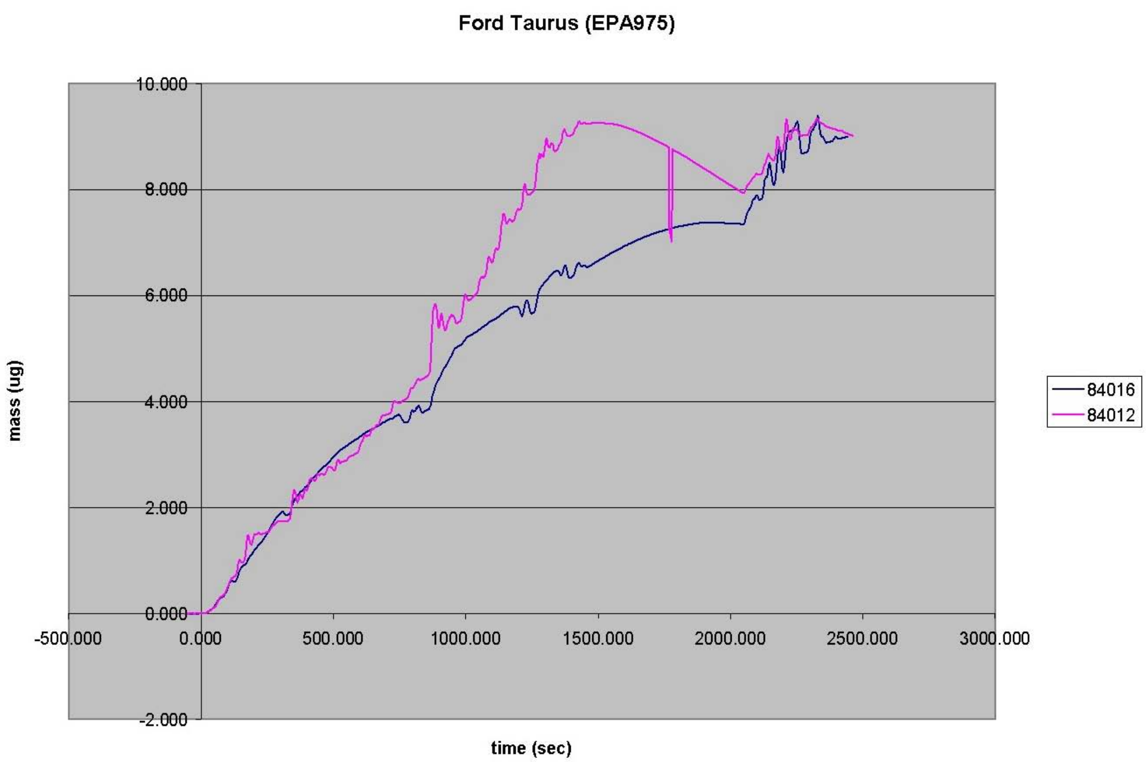


Figure 4-8. Cumulative QCM Response for the Ford Taurus.

Table 4-5. Summary of QCM Results

Date	Test No.	Vehicle	Phase	Elapsed Time (sec)	Collected Mass ug	Sample Flow (Lpm)	Dilution Ratio	QCM Conc. ug/m3	CVS Volume cu.ft.	Distance Traveled mi.	Emissions mg/mi.	Emissions Composite g/mi. (FTP)	
47DEG. C													
5/20/2004	KC Test 84003	STRATUS	1	309.5	0.164	0.986	1.0	32.24	2350.138	1.18	1.825979592		
			2	1114.6	1.691	0.987	1.0	92.22	8890.3	8.64	2.685521665		
			3	310.1	0.264	0.990	1.0	51.58	2346.3	1.20	2.856803133	0.002653192	
5/21/2004	KC Test 84007	STRATUS	1	310.8	0.180	0.969	1.0	35.86	2363.852	1.18	2.029602319		
			2	1114.0	2.021	0.969	1.0	112.39	8928.3	8.63	3.292697374		
			3	309.174	0.224	0.973	1.0	44.68	2364.2	1.19	2.514271198	0.00317347	
5/22/2004	KC Test 84011	STRATUS	1	310.0	0.210	0.973	1.0	41.79	2348.568	1.19	2.331926544		
			2	1114.7	2.720	0.968	1.0	151.20	8879.3	8.65	4.396030538		
			3	309.1	0.283	0.969	1.0	56.67	2347.7	1.19	3.172099067	0.004204292	
5/23/2004	KC Test 84015	STRATUS	1	309.3	0.146	0.958	1.0	29.55	2342.480	1.18	1.663335699		
			2	1115.7	1.461	0.970	1.0	81.00	8868.4	8.64	2.353844783		
			3	309.6	0.111	0.970	1.0	22.17	2338.0	1.19	1.230158617	0.002240496	
											Ave./Std.	0.003067863	0.000848354
47 DEG. C													
5/20/2004	KC Test 84005	FORD TAURUS	1	309.6	0.040	1.042	10.9	94.29	2360.614	1.20	5.271922657		
			2	1114.6	0.089	1.048	10.9	62.84	8926.3	8.64	1.838491768		
			3	309.7	0.044	1.055	10.8	100.60	2362.6	1.19	5.640808758	0.002280978	
5/21/2004	KC Test 84008	FORD TAURUS	1	309.7	0.083	0.960	9.9	274.08	2364.414	1.19	15.42178759		
			2	1120.0	0.032	0.960	9.9	125.62	8928.2	8.63	3.679664008		
			3	303.0	0.051	0.962	9.9	104.47	2364.4	1.20	5.84651719	0.004441776	
5/22/2004	KC Test 84012	FORD TAURUS	1	309.9	1.747	0.970	1.0	348.68	2348.312	1.19	19.52479458		
			2	1114.4	7.449	0.970	1.0	413.47	8869.4	8.65	12.00778436		
			3	308.6	1.248	0.964	1.0	251.76	2346.2	1.19	14.08979991	0.012541285	
											Ave./Std.	N/A	N/A
AMBIENT													
5/24/2004	KC Test 84016	FORD TAURUS	1	309.5	1.971	0.980	1.0	389.94	2514.441	1.17	23.66308173		
			2	1114.4	4.489	0.980	1.0	246.62	9347.8	8.62	7.573420292		

Date	Test No.	Vehicle	Phase	Elapsed	Collected	Sample	Dilution	QCM	CVS	Distance	Emissions	Emissions	
				Time	Mass	Flow	Ratio	Conc.	Volume	Traveled		Composite	
				(sec)	ug	(Lpm)		ug/m3	cu.ft.	mi.	mg/mi.	g/mi. (FTP)	
			3	308.7	1.373	0.974	1.0	274.05	2505.3	1.18	16.41106554	0.009011035	
5/25/2004	KC Test 84019	FORD TAURUS	1	310.6	1.468	0.953	1.0	297.48	2581.209	1.18	18.40019195		
			2	1115.1	8.058	0.953	1.0	454.86	9574.7	8.64	14.27982604		
			3	309.9	1.562	0.954	1.0	317.14	2571.2	1.18	19.52089079	0.014852954	
5/26/2004	KC Test 84022	FORD TAURUS	1	310.0	2.038	0.970	1.0	406.70	2568.635	1.19	24.89911739		
			2	1114.7	6.720	0.970	1.0	372.90	9524.1	8.64	11.64269135		
			3	310.1	1.212	0.970	1.0	241.74	2553.8	1.18	14.84781105	0.012551043	
											Ave./Std.	0.012138344	0.002942744
47 DEG. C													
5/20/2004	KC Test 84006	CHRYSLER NY	1	311.4	0.084	0.933	19.2	333.72	2367.296	1.22	18.34328507		
			2	1114.1	0.726	0.941	19.3	802.49	8854.0	8.59	23.41204919		
			3	311.4	0.058	1.020	19.4	212.50	2360.0	1.21	11.72843726	0.02231874	
5/21/2004	KC Test 84009	CHRYSLER NY	1	309.4	0.042	0.959	18.9	160.41	2356.807	1.21	8.864481177		
			2	1115.3	0.482	0.960	18.9	510.83	8848.0	8.69	14.73353023		
			3	309.2	0.041	0.963	19.0	157.14	2355.9	1.17	8.965567919	0.014035471	
5/22/2004	KC Test 84013	CHRYSLER NY	1	310.7	0.075	0.952	18.8	286.73	2342.702	1.22	15.61094031		
			2	1113.7	0.857	0.950	18.9	917.30	8792.1	8.68	26.29779167		
			3	309.7	0.029	0.953	19.0	111.92	2343.1	1.20	6.211601288	0.024346924	
											Ave./Std.	0.020233712	0.005462785
AMBIENT													
5/24/2004	KC Test 84017	CHRYSLER NY	1	309.6	0.095	0.960	19.7	377.84	2497.896	1.22	21.94380696		
			2	1114.3	0.839	0.952	19.7	936.67	9163.7	8.68	28.01427409		
			3	308.8	0.102	0.967	19.8	405.35	2481.4	1.20	23.68682341	0.027392712	
5/25/2004	KC Test 84020	CHRYSLER NY	1	310.6	0.106	0.970	19.3	406.90	2570.282	1.21	24.50897862		
			2	1114.0	0.722	0.970	19.3	772.98	9454.2	8.65	23.91608964		
			3	308.1	0.037	0.970	19.4	143.91	2555.1	1.20	8.711827288	0.022895525	
5/26/2004	KC Test 84023	CHRYSLER NY	1	313.3	0.128	0.970	19.5	492.44	2549.899	1.20	29.60364162		
			2	1111.1	0.617	0.970	19.3	664.58	9372.4	8.65	20.38355521		
			3	309.5	0.088	0.970	19.4	341.22	2538.3	1.19	20.60441037	0.020882019	
												0.023723419	0.003333368

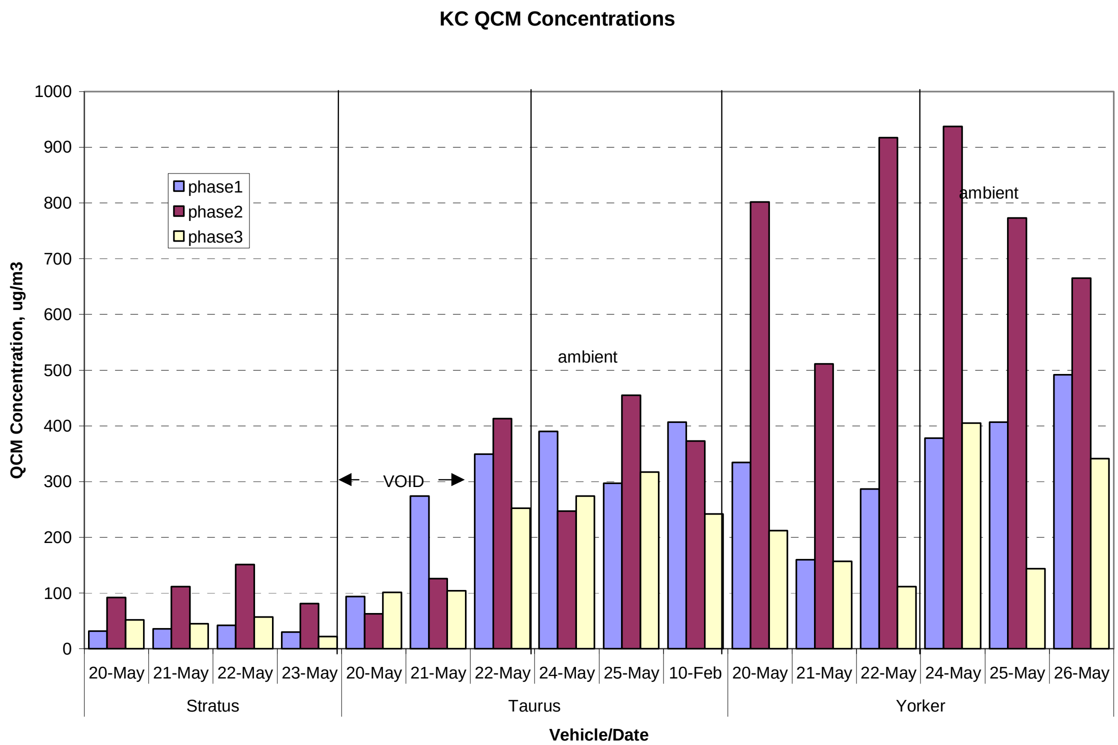


Figure 4-9. Kansas City QCM Summary

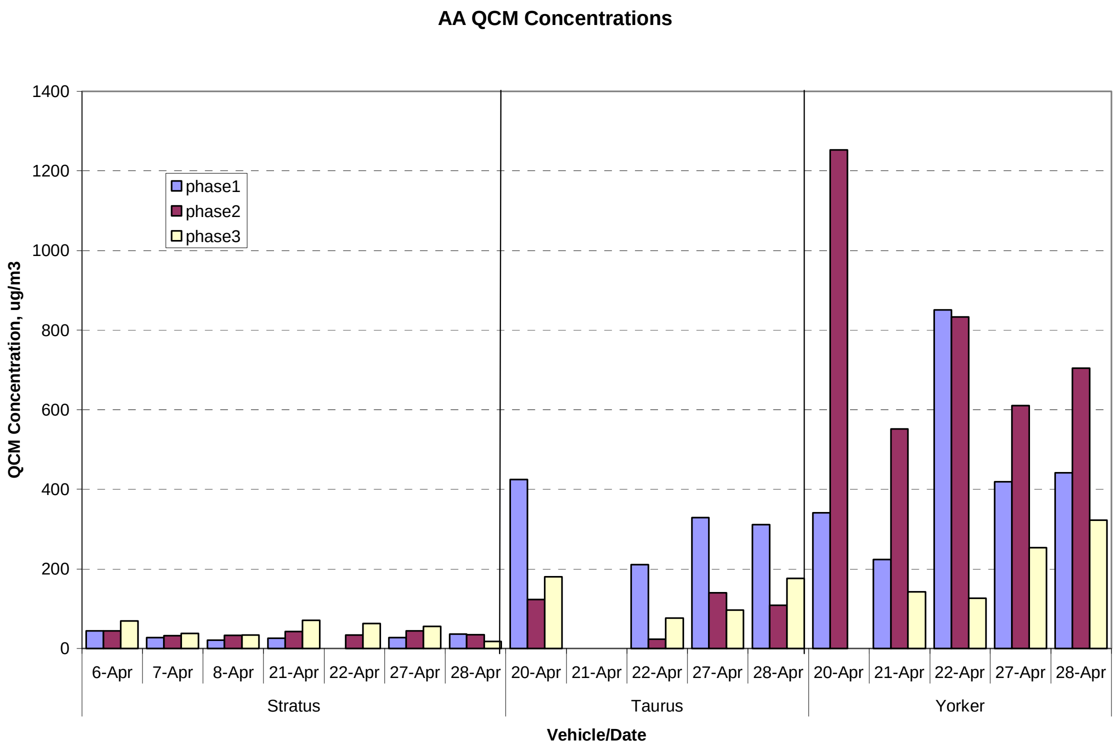


Figure 4-10. Ann Arbor QCM Summary

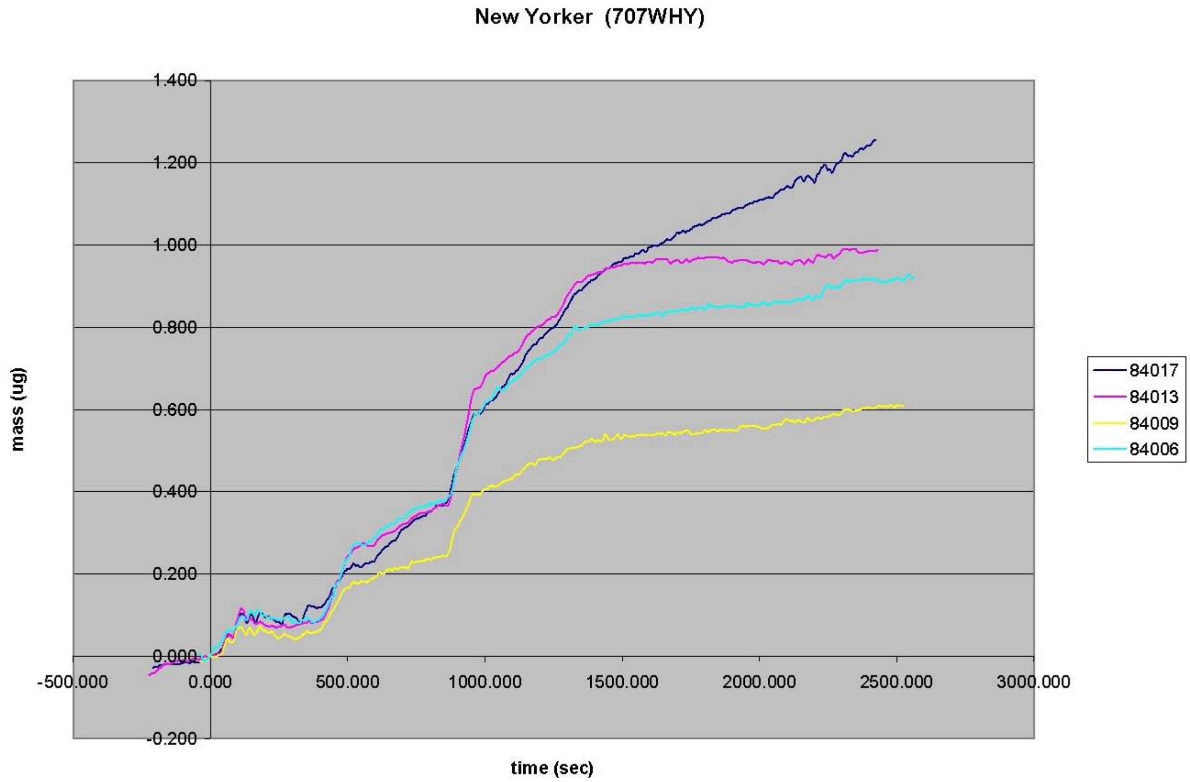


Figure 4-11. Cumulative QCM Response for the Chrysler New Yorker

4.4 SEMTECH Pre-Conditioning Runs

All three test vehicles were driven on a designated route which will be used in the full program to precondition vehicles. Figure 4-12 shows the speed and acceleration plot for the precondition and drive on the Dodge Stratus. The speed/acceleration profile for the drive is shown in Figure 4-13.

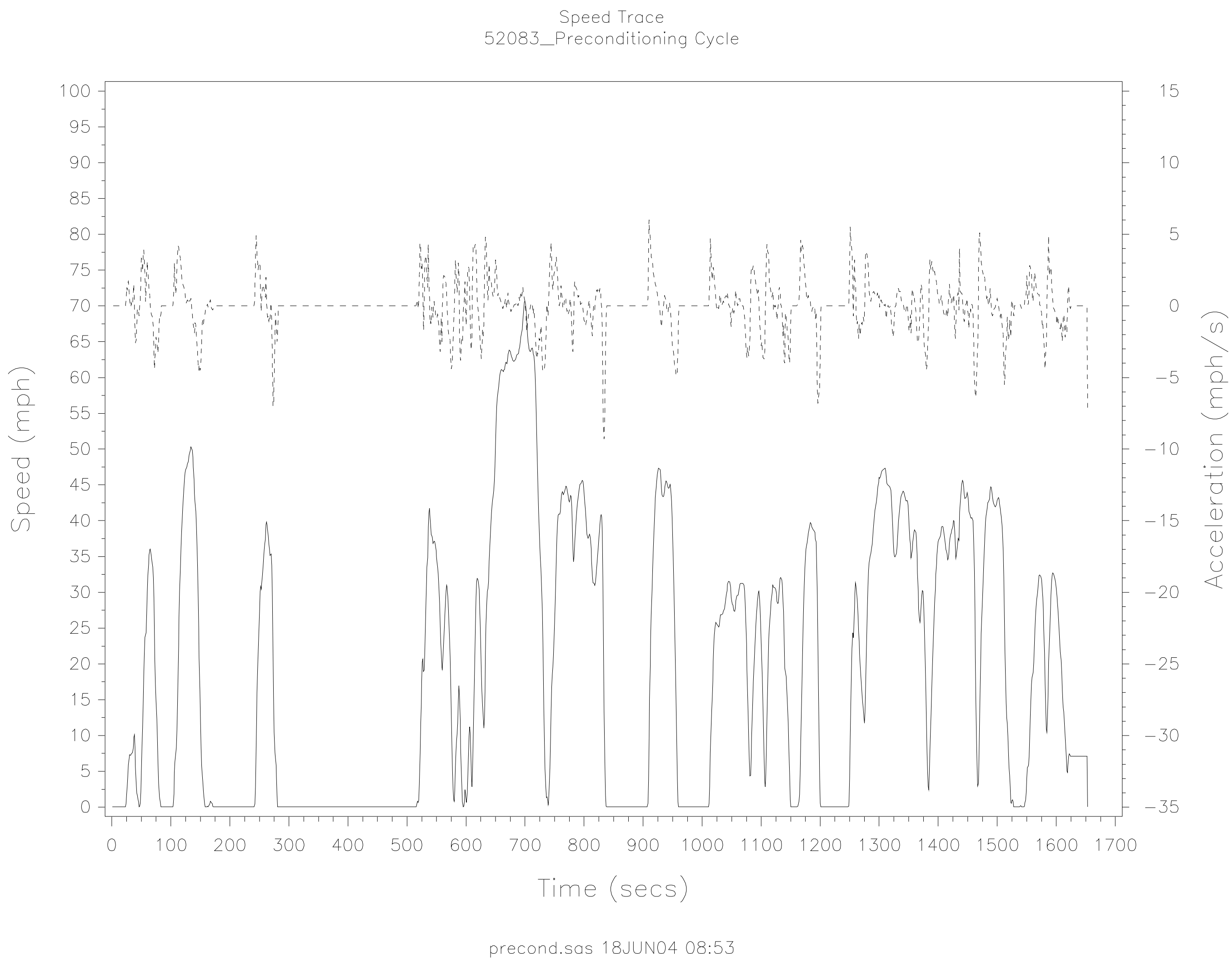


Figure 4-12. Speed Trace for Preconditioning Run for the Dodge Stratus

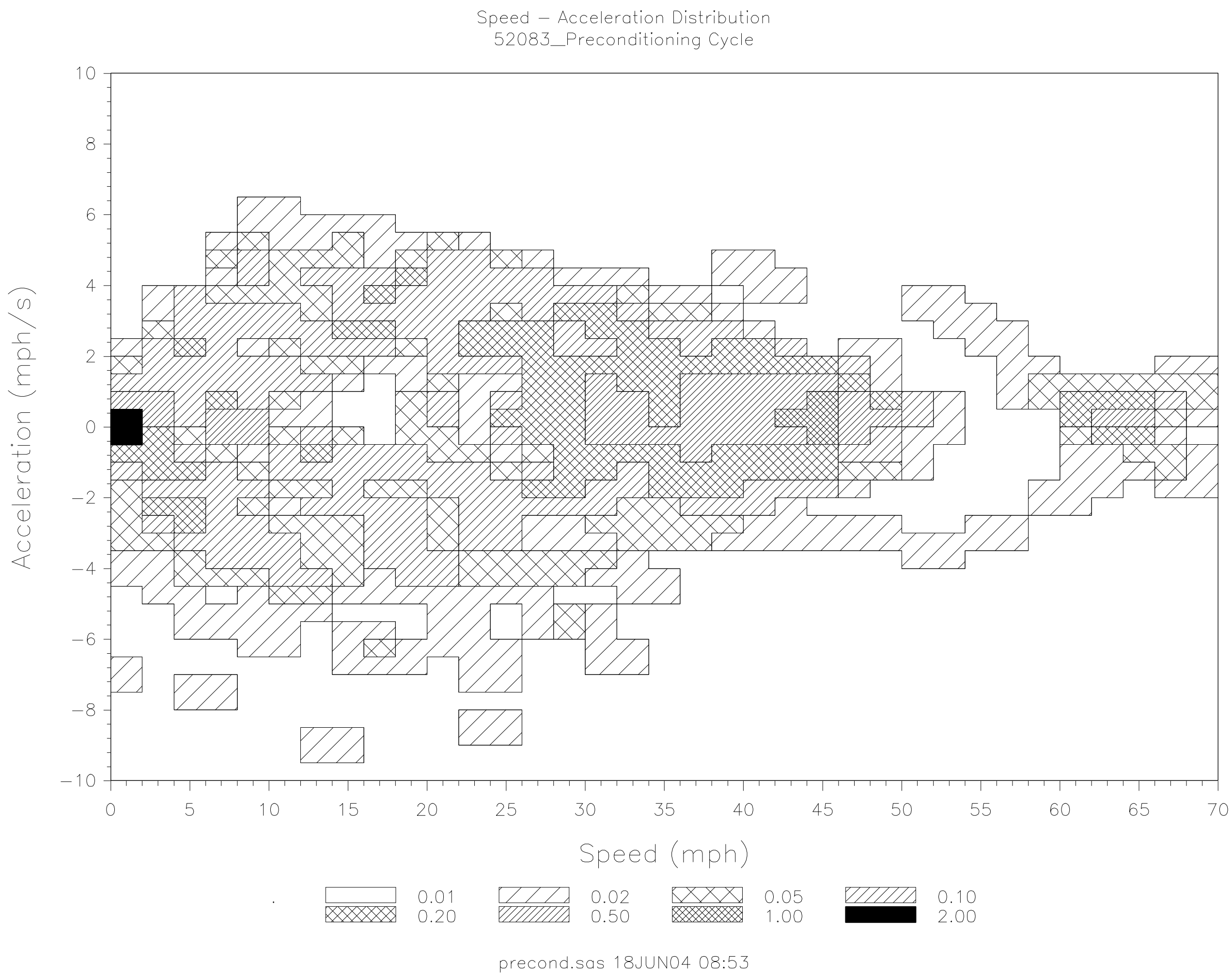


Figure 4-13. Speed-Acceleration Distribution for the Preconditioning Run for the Dodge Stratus

4.5 Emission Events as a Function of Vehicle Driving

Figure 4-14 shows the Bag 2 of a run on the Taurus from run number 84022. Figure 4-15 shows the contour plot of the region of vehicle operation where NOx emissions predominantly occur. This data was generated from the BKI second-by-second data after the emissions were time aligned with the speed. As shown in the plot, most emissions were at high speed and/or high acceleration situations. These kind of data reductions can be used to model the relationship between speed/acceleration and emissions can also be generated with time aligned PM data.

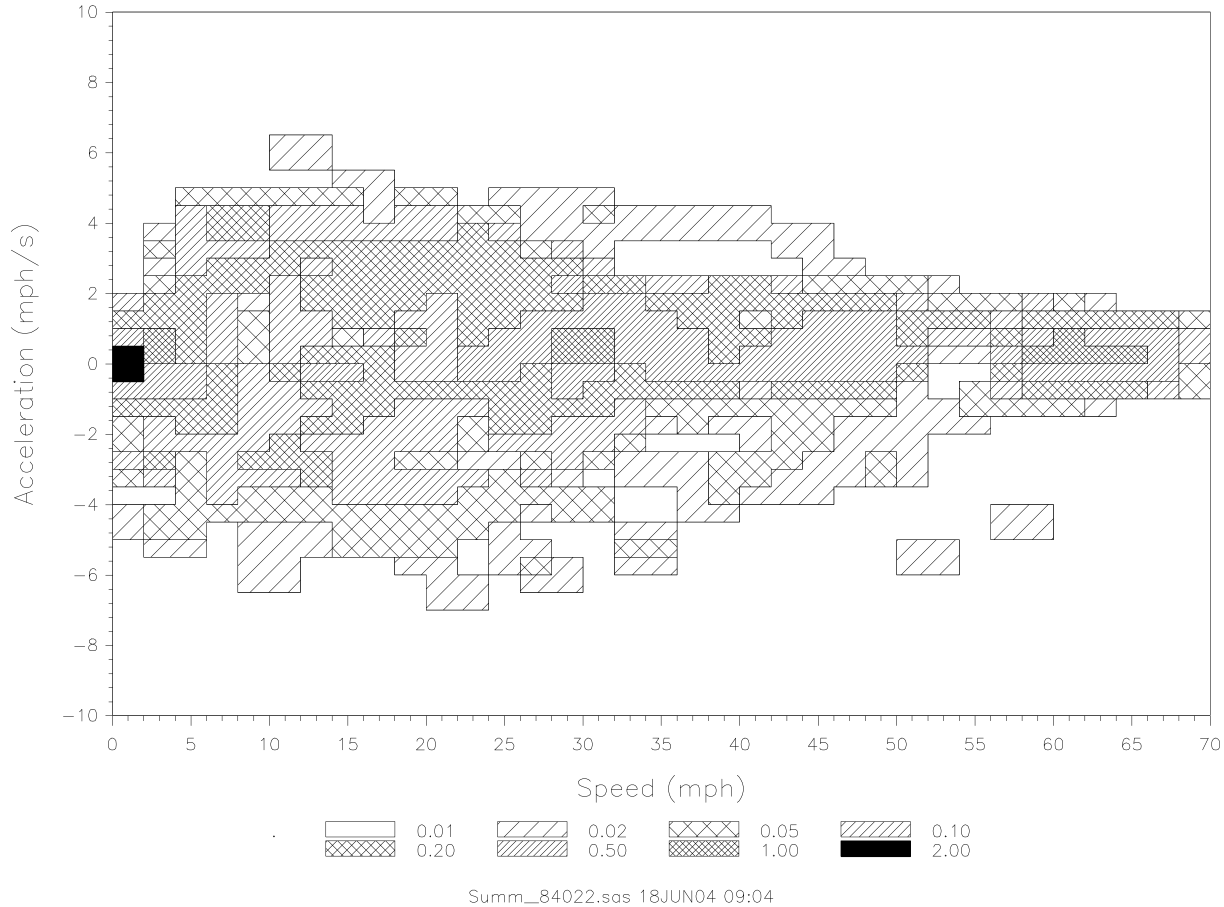


Figure 4-14. Dynamometer Speed/Acceleration Profile for Run #84022

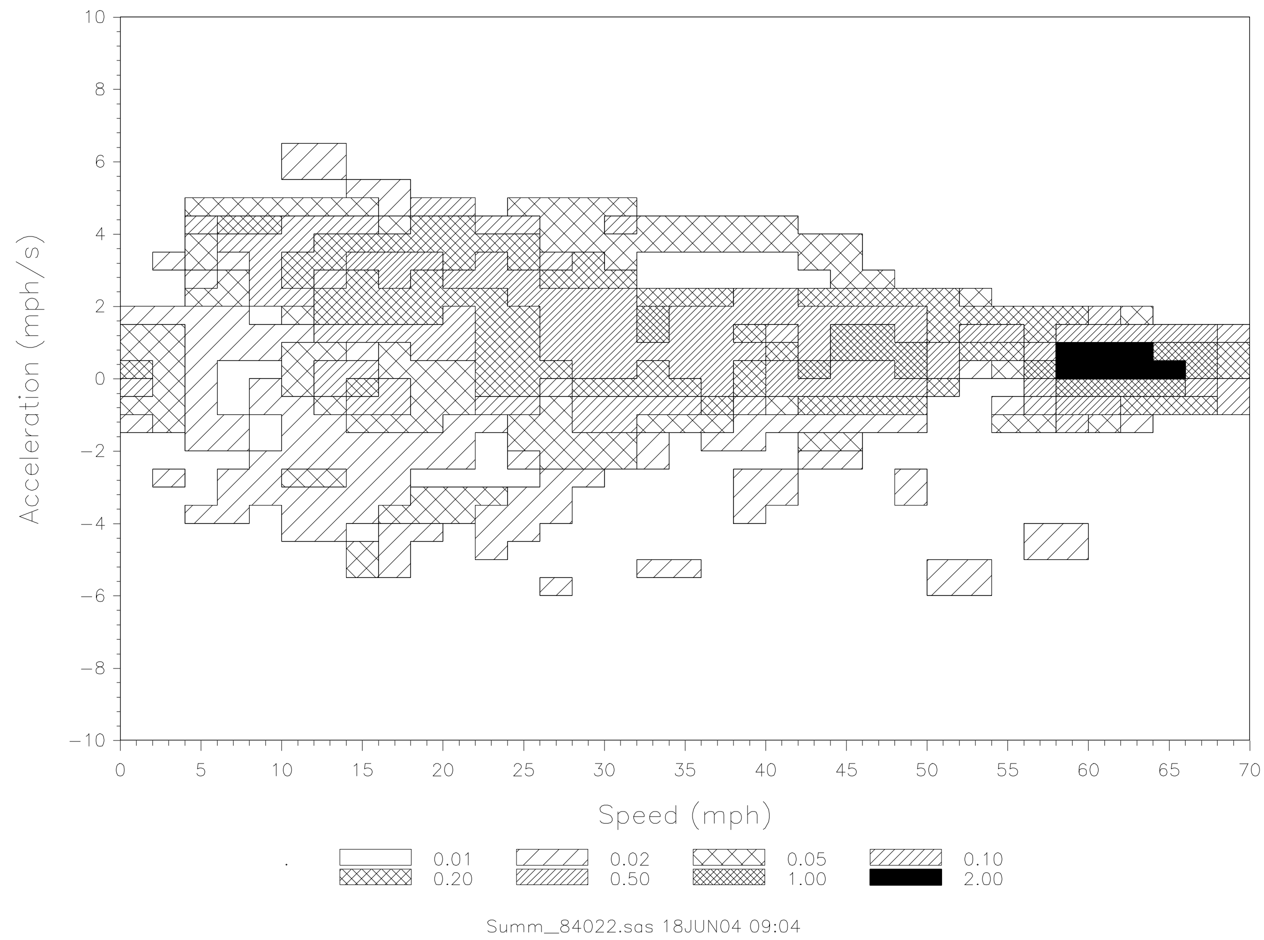


Figure 4-15. Dynamometer NOx Emission Generation Contour Plot for Run #84022

4.6 Composite LA92 Results from Dynamometer and SEMTECH

SEMTECH sampling was performed concurrently with all dynamometer testing. By-phase and total composite emission rates as measured using each system (SEMTECH vs. dynamometer) were then calculated and are presented in Table 4-6 below. Results in Table 4-6 are based on time-aligned test data to which the necessary corrections (humidity, dilution, flow) have been applied.

For each system, phase-specific grams/mile emission rates were calculated by dividing the total phase emissions by the distance the vehicle traveled during that phase. For all calculations, mileage was that as measured by the front dynamometer rollers. Composite emission rates for the entire run were calculated using the following formula:

$$C = 0.43\left[\frac{Pol1 + Pol2}{D1 + D2}\right] + 0.57\left[\frac{Pol2 + Pol3}{D2 + D3}\right]$$

Where:

C = Composite emission rate for the run (grams/mile)
Pol1 = Total pollutant (HC, CO, CO2, or NOx) emissions for phase 1 (grams)
Pol2 = Total pollutant (HC, CO, CO2, or NOx) emissions for phase 2 (grams)
Pol3 = Total pollutant (HC, CO, CO2, or NOx) emissions for phase 3 (grams)
D1 = Phase 1 distance traveled (miles)
D2 = Phase 2 distance traveled (miles)
D3 = Phase 3 distance traveled (miles)

Comparison of phase-specific and total composite emission rates Table 4-6 below shows a relatively good correlation between the two methods of measurement.

The BKI dynamometer numbers are based on speed and emissions time aligned second-by-second data. These estimates are integrated values for each phase. The SEMTECH rates have also been estimated by using speed and emissions time alignment methodology developed by Sensors. Table 4-6 shows good correlation for CO2, CO, and NOx but not for HC. Although EPA staff identified incorrect flow rate readings obtained by the SEMTECH unit, the data presented in Table 4-6 is based on emission rate estimates with corrected flow rates. The data from Table 4-6 is also graphically in Figure 4-16, which provides plots of BKI dynamometer composite results vs. SEMTECH composite results. This again shows good correlation for CO2, CO, and NOx but less of a correlation between SEMTECH and BKI dynamometer HC results.

The data in Table 4-6 and Figure 4-16 is only based on testing conducted 5/20 through 5/24. As shown in Table 2-12 (Section 2.7), several testing problems occurred during this time period that could strongly influence the accuracy of the SEMTECH readings (and consequently the correlation between the two datasets). It is anticipated that analysis of additional SEMTECH vs. dynamometer data (including analysis of data from testing conducted 5/25 and 5/26) will show a better correlation between the two systems. The 5/25 and 5/26 test data is currently undergoing SEMTECH flow meter bias corrections and will be included in future reporting.

The Phase 1 NOx reading for run ID 84015 (2004 Stratus tested 5/23/04) is unusually high relative to other NOx readings for this vehicle (both for this run as well as for other runs). Review of the second-by-second raw dynamometer data for this run shows NOx readings around 89.5 ppm for the first 60 seconds of testing. Subsequent readings then drop to under 1 ppm (which is equivalent to PPM readings for other Stratus runs). Investigation into the cause of this unusually high NOx reading should be performed to identify the root cause of this anomaly.

Table 4-7 provides a side-by-side comparison of SEMTECH vs. Dynamometer composite results for each test, categorized by vehicle. The composite results shown in bold-faced font indicate which system had higher emission measurement readings. Percentage difference between the two systems (relative to the lower of the two readings) is also shown for each run, and results with overall differences greater than 100% are highlighted in yellow. As shown in Table 2-12, the runs with overall differences greater than 100% were performed when SEMTECH HC readings were questionable due to calibration issues. For the New Yorker, all SEMTECH HC readings were fairly consistent and were consistently higher than the BKI dynamometer readings. For the Taurus, the SEMTECH HC reading for the first run (ID 84005) was much lower than the SEMTECH HC readings for the last two runs (IDs 84008 and 84012). BKI dynamometer HC readings were fairly consistent for all Taurus runs. This calls into question the SEMTECH HC reading on the first Taurus run. Additional analysis of the correlation of SEMTECH results vs. BKI dynamometer results will be performed.

Table 4-6. Comparison of SEMTECH and Dynamometer Emission Measurements

Run ID #	Phase	HC (gm/mile)		CO (gm/mile)		CO2 (gm/mile)		NOx (gm/mile)		Distance (miles)
		SMTCH	**BKI**	**SMTCH**	**BKI**	**SMTCH**	**BKI**	**SMTCH**	**BKI**	
84003	1	0.29	0.55	2.84	3.11	641.24	654.38	0.44	0.38	1.17
	2	0.03	0.04	0.45	0.35	368.84	379.46	0.09	0.07	8.63
	3	0.01	0.02	0.27	0.16	459.08	439.90	0.13	0.10	1.42
	Comp	0.04	0.06	0.56	0.48	390.13	398.48	0.11	0.09	11.22
84005	1	1.84	5.30	40.71	37.93	694.39	684.07	7.90	7.55	1.20
	2	1.09	2.29	21.16	18.27	422.06	418.80	7.03	6.24	8.62
	3	1.55	3.78	29.71	26.78	606.90	582.03	8.44	7.76	1.19
	Comp	1.16	2.55	22.78	19.89	449.12	443.99	7.18	6.41	11.01
84006	1	7.46	5.65	38.03	36.31	736.63	700.09	1.89	1.78	1.22
	2	2.59	1.00	23.07	11.53	792.01	491.26	2.59	1.60	8.58
	3	2.92	2.08	20.32	17.24	670.50	618.32	2.01	1.70	1.21
	Comp	2.87	1.32	23.67	13.26	780.48	511.39	2.51	1.62	11.01
84007	1	0.34	0.56	3.03	3.18	653.71	665.12	0.48	0.46	1.18
	2	0.04	0.04	0.40	0.31	385.06	392.18	0.10	0.09	8.61
	3	0.03	0.03	0.47	0.34	577.51	552.43	0.17	0.14	1.19
	Comp	0.06	0.06	0.54	0.46	412.31	417.43	0.13	0.11	10.99
84008	1	2.48	4.94	35.86	34.50	669.51	673.00	7.82	7.70	1.19
	2	3.02	2.20	19.77	17.62	405.60	412.24	7.03	6.37	8.62
	3	5.14	3.50	24.99	23.34	595.41	576.67	8.69	8.07	1.20
	Comp	3.14	2.44	20.97	18.90	432.56	437.27	7.19	6.55	11.00
84009	1	7.21	5.43	35.11	31.40	739.66	691.33	1.76	1.87	1.21
	2	2.38	1.01	25.27	12.40	749.42	475.33	2.58	1.73	8.67
	3	3.32	2.33	31.70	27.05	656.03	600.76	1.91	1.78	1.17
	Comp	2.70	1.33	26.23	14.40	742.58	495.18	2.49	1.74	11.05
84011	1	0.84	0.76	3.05	3.35	673.42	700.45	0.53	0.50	1.19
	2	0.05	0.04	0.50	0.40	404.68	428.10	0.12	0.09	8.63
	3	0.03	0.03	0.43	0.25	585.94	574.40	0.17	0.13	1.19
	Comp	0.09	0.08	0.63	0.54	431.19	452.39	0.14	0.11	11.01
84012	1	7.59	5.50	39.16	36.76	683.17	681.67	8.08	7.77	1.19
	2	3.01	2.25	20.44	17.98	401.73	411.96	6.93	6.28	8.63
	3	5.24	3.80	25.78	22.83	593.60	577.03	8.65	8.17	1.19
	Comp	3.40	2.53	21.78	19.29	429.58	437.36	7.11	6.49	11.01
84013	1	8.22	5.75	33.53	30.07	761.78	715.54	1.61	1.64	1.22
	2	3.20	1.27	31.85	15.55	747.03	477.02	2.64	1.74	8.67
	3	3.06	2.09	23.70	19.93	652.28	603.48	2.25	2.02	1.20
	Comp	3.46	1.56	31.38	16.62	741.27	498.39	2.56	1.75	11.08

Run ID #	Phase	HC (gm/mile)		CO (gm/mile)		CO2 (gm/mile)		NOx (gm/mile)		Distance (miles)
		SMTCH	**BKI**	**SMTCH**	**BKI**	**SMTCH**	**BKI**	**SMTCH**	**BKI**	
84015	1	0.76	0.63	3.21	3.27	632.09	647.02	0.47	2.33	1.18
	2	0.04	0.03	0.45	0.34	368.37	383.36	0.08	0.08	8.63
	3	0.04	0.05	0.53	0.42	535.27	518.41	0.12	0.12	1.19
	Comp	0.08	0.07	0.60	0.50	393.56	406.34	0.10	0.19	11.00
84016	1	5.43	5.91	46.38	43.14	679.21	693.98	7.90	7.82	1.17
	2	2.07	2.34	22.18	19.49	406.74	421.94	6.89	6.38	8.60
	3	3.54	3.89	27.16	23.13	593.17	584.57	8.54	8.22	1.18
	Comp	2.35	2.63	23.77	20.96	433.65	447.19	7.05	6.58	10.96
84017	1	4.00	5.93	36.97	34.53	739.37	725.21	1.80	1.75	1.22
	2	1.93	1.28	19.20	10.85	595.64	461.37	2.02	1.47	8.66
	3	2.18	2.31	24.16	21.17	634.82	616.86	2.21	1.90	1.20
	Comp	2.06	1.60	20.49	12.82	605.98	486.16	2.02	1.51	11.08

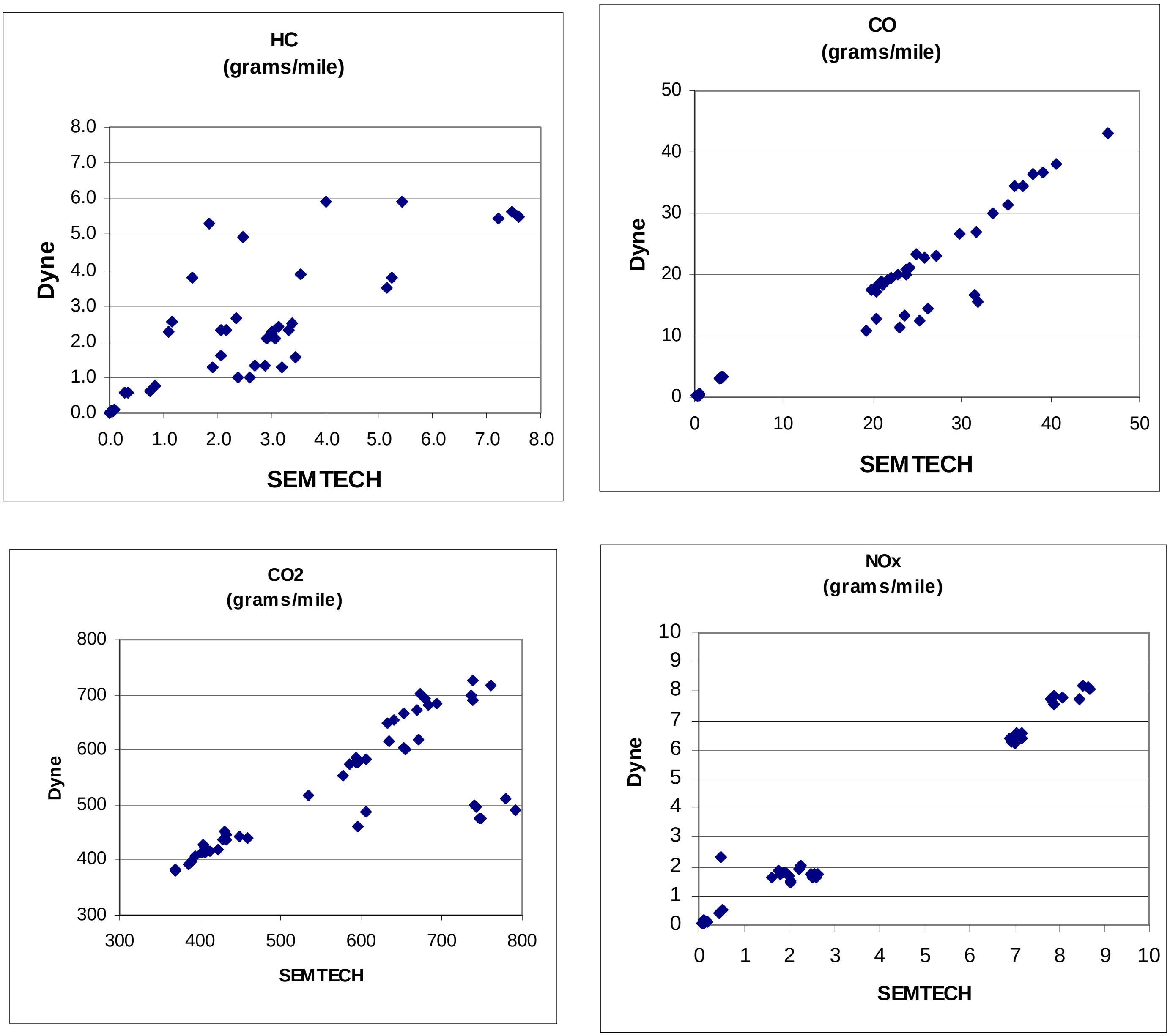


Figure 4-16. Plots of Dynamometer Measurements vs. SEMTECH Measurements

Table 4-7. By-Vehicle Comparison SEMTECH vs. Dynamometer Composite Results

Run ID #	HC (gm/mile)		% diff	CO (gm/mile)		% diff	CO2 (gm/mile)		% diff	NOx (gm/mile)		% diff
	SMTCH	BKI		SMTCH	BKI		SMTCH	BKI		SMTCH	BKI	
New Yorker												
84006	**2.873**	1.324	117	**23.67**	13.26	79	**780.5**	511.4	53	**2.513**	1.620	55
84009	**2.699**	1.331	103	**26.23**	14.40	82	**742.6**	495.2	50	**2.493**	1.745	43
84013	**3.457**	1.564	121	**31.38**	16.62	89	**741.3**	498.4	49	**2.559**	1.753	46
84017	**2.056**	1.601	28	**20.49**	12.82	60	**606.0**	486.2	25	**2.023**	1.514	34
Stratus												
84003	0.042	**0.064**	52	**0.558**	0.479	16	390.1	**398.5**	2	**0.109**	0.087	25
84007	0.058	**0.062**	6	**0.538**	0.461	17	412.3	**417.4**	1	**0.125**	0.109	14
84011	**0.092**	0.080	14	**0.627**	0.545	15	431.2	**452.4**	5	**0.145**	0.111	31
84015	**0.076**	0.066	16	**0.598**	0.496	21	393.6	**406.3**	3	0.102	**0.195**	92
Taurus												
84005	1.162	**2.551**	120	**22.78**	19.89	15	**449.1**	444.0	1	**7.176**	6.411	12
84008	**3.139**	2.435	29	**20.97**	18.90	11	432.6	**437.3**	1	**7.186**	6.555	10
84012	**3.402**	2.525	35	**21.78**	19.29	13	429.6	**437.4**	2	**7.109**	6.487	10
84016	2.347	**2.630**	12	**23.77**	20.96	13	433.7	**447.2**	3	**7.053**	6.583	7

5.0 Issues to be Resolved

CO_2 emission results were higher on all three correlation vehicles at the Kansas City test site than were found in Ann Arbor (by about 5-10 % for Phases 1 and 3, and 10-20 % for Phase 2). Discussions have focused primarily on emission differences as a result of using different dynamometer types (water brake, twin roll Clayton in Kansas City versus an electric, 48" roll Horiba in Ann Arbor). Discussions have yielded several plausible explanations for these differences, which are summarized below.

It was observed in the field that operating at speeds above 60 mph may adversely affect the Clayton dynamometer loading, resulting in subsequent higher loading until speeds were reduced to about 20-30 mph. It was also noted that under continuous operation without breaking the 60 mph barrier, the load held fairly constantly. It was also noted that the greater differences in CO_2 emissions seen in Phase 2, relative to Phase 1 and Phase 3 differences, with the Clayton dynamometer would be consistent with abnormally higher loading on the Clayton associated with speeds above 60 mph. Possible reasons for higher loads under the circumstances described include:

1) Possible foaming of 50/50 glycol/water mixture.

2) Setting of dead bands at 50 mph.

3) Innate characteristic of the Clayton PAU.

4) Leaking load/unload valves.

As the load has been observed to first go higher and then return to original values after low speed operation, leaking of the load/unload valves seems a remote possibility (if they were leaking, the PAU would either only load or only unload all the time, not back and forth).

Action items for BKI include reducing the glycol content of the cooling/loading fluid and performing dead band adjustments (preferably at ~60 mph). Coastdowns at a variety of speeds up to 65-70 mph should also be performed (with speed and torque being recorded) both before and after adjustments to determine the effect of the adjustments.

Additionally, coastdowns performed at Ann Arbor and in Kansas City should be compared. This would include the old and new coastdowns from Kansas City and the new (65-35 mph) coastdowns from Ann Arbor.

Driver differences could also be responsible for at least part of the CO_2 differences. We therefore also propose to conduct two additional LA92s on the Taurus, using two different drivers.

In later discussions, it was pointed out that the set-up of the Clayton dynamometer located in Kansas City is a bit different than the set-up of similar dynamometers in Ann Arbor. In particular, speed measurement is taken from the front (or loaded) rolls in Kansas City, but taken from the rear (free wheeling) rolls in Ann Arbor. In general, speeds measured on the loaded rolls will be less than speeds measured on the rear rolls due to tire slippage on the loaded rolls, particularly with the aggressive nature of the LA92 driving cycle. As a result, when speed is measured from the front rolls, the test vehicle will be operated at a higher speed to compensate for the tire slippage, which could very well account for the differences in observed emission rates. *This seems to be the most plausible explanation. Accordingly, the set up in Kansas City will be changed to measure rear roll speed instead of front roll speed.*

Lastly, it is unclear whether the inertia of the rear rolls (~155 lbs.) has been accounted for in the flywheel system of the Clayton dynamometer used in Kansas City. Available literature will be searched to see if this determination can be made. Emissions tests will be repeated with the Taurus both before and after the changes are made, as discussed above. The BKI team is planning to conduct some additional testing in late June in Kansas City. In addition, in Ann Arbor coast down are being conducted on a clayton dynamometer. It is also anticipated that some additional emissions tests may also be conducted in Ann Arbor on the Clayton dynamometer.

The correlation between measurements of regulated pollutants made by the SEMTECH vs. those made by the BKI dynamometer requires investigation. Since the SEMTECH testing performed between 5/20 and 5/24 is suspect due to calibration issues, it is recommended that investigation be primarily focused on testing conducted subsequent to 5/24. Investigation into the cause of the high BKI dynamometer NOx readings for phase 1 of Run ID 84015 will also be performed.

Some issues have been identified regarding the correlation between particulate mass emissions as measured by the QCM vs. estimates using gravimetric analysis. Additional investigation is required to help resolve these correlation issues.

Kansas City PM Characterization Study

Final Report

Appendix CC
Scope of Work

Assessment and Standards Division
Office of Transportation and Air Quality
U.S. Environmental Protection Agency

Sponsors:

National Renewable Energy Laboratory, U.S. Department of Energy
Federal Highway Administration, U.S. Department of Transportation
STAPPA-ALAPCO Emission Inventory Improvement Program
Coordinating Research Council Inc. (Project No. E-69)

Prepared for EPA by
Eastern Research Group, Incorporated
Austin, TX

Bevilacqua-Knight Incorporated
Oakland, CA

NuStats LLC
Austin, TX

Desert Research Institute
Reno, NV

EPA Contract No. GS 10F-0036K

October 27,2006
Revised April 2008 by EPA staff

United States
Environmental Protection
Agency

EPA420-R-08-009
April 2008

ORDER FOR SUPPLIES OR SERVICES

PAGE OF PAGES

IMPORTANT: Mark all packages and papers with contract and/or order numbers.

1.DATE OF ORDER	2. CONTRACT NO. *(If any)* GS-10F-0036K	6. SHIP TO: a. NAME OF CONSIGNEE KATHLEEN A. WALSH, TOPO
3. ORDER NO. 1104	4.REQUISITION/REFERENCE NO. PR-CI-04-10377	b. STREET ADDRESS 2565 PLYMOUTH ROAD
5. ISSUING OFFICE *(Address correspondence to)* Environmental Protection Agency		c. CITY ANN ARBOR; d. STATE MI; e. ZIP CODE 48105
7. TO:		f. SHIP VIA
a. NAME OF CONTRACTOR EASTERN RESEARCH GROUP INC		8. TYPE OF ORDER
b. COMPANY NAME		[ ] a. PURCHASE REFERENCE YOUR: ______ Please furnish the following on the terms and conditions specified on both sides of this order and on the attached sheet. If any, including delivery as indicated.
c. STREET ADDRESS 110 HARTWELL AVENUE		[X] b.TASK -- Except for billing instructions on the reverse, this task order is subject to instructions contained on this side only of this form and is issued subject to the terms and contitions of the above-numbered contract.
d. CITY Lexington	e. STATE MA; f. ZIP CODE 02421	
9. ACCOUNTING AND APPROPRIATION DATA See Attached		10. REQUISITIONING OFFICE Same as Block 6

11. BUSINESS CLASSIFICATION (Check appropriate box(es))

[] a. SMALL [X] b. OTHER THAN SMALL [] c. DISADVANTAGED [] d. WOMEN OWNED

12. F.O.B. POINT Same as Block 6	14. GOVERNMENT B/L NO.	15. DELIVER TO F.O.B. POINT ON OR BEFORE *(Date)*	16. DISCOUNT TERMS N/A
13. PLACE OF a. INSPECTION; b. ACCEPTANCE			

17. SCHEDULE *(See reverse for Rejections)*

ITEM NO. (a)	SUPPLIES OR SERVICES (b)	QUANTITY ORDERED (c)	UNIT (d)	UNIT PRICE (e)	AMOUNT (f)	QUANTITY ACCEPTED (g)
	See Attached All Base CLINs as set forth in Attachment 7 are ordered at time of award.					

SEE BILLING INSTRUCTIONS ON REVERSE	18. SHIPPING POINT	19. GROSS SHIPPING WEIGHT	20. INVOICE NO.	17(h). TOT. *(Cont. pages)*
	21. MAIL INVOICE TO: a. NAME			
	b. STREET ADDRESS (or P.O. Box)			
	c. CITY	d. STATE	e. ZIP CODE	$543,223.96 17(i). GRAND TOTAL

22. UNITED STATES OF AMERICA BY *(Signature)* See Page 2

23. NAME *(Typed)* DAVID H. PLAGGE

TITLE: CONTRACTING/ORDERING OFFICER

NSN 7540-01-152-8083
PREVIOUS EDITION NOT USABLE

OPTIONAL FORM 347 (REV. 6/95)
Prescribed by GSA/FAR 48 CFR 53.213(e)

Task Order Signature Sheet

CONTRACTOR

EASTERN RESEARCH GROUP INC

By: ________________________________ ____________________
Date Signed

Title: ________________________________

ENVIRONMENTAL PROTECTION AGENCY

By: ________________________________ ____________________
Date Signed

Title: Contracting Officer

Summary Information

Title:		Characterizing Exhaust Emissions from Light Duty Gasoline Vehicles in the Kansas City Metropolitan Area
Period of Performance:	From:	Effective of Task Order
	To:	08/15/05
Award Date:		
Total Funding:		$543,223.96

Accounting/Appropriation Data

POP	DCN	BFYS	Appr.#	Org	Program Element	Site/ Project	Cost Org	Obj Clss	Amount	P/C
Base	H30421	03	CR1	56H5X04	10102A	00000000		2505	$255,000.00	C
Base	U2C172	03	C	26U20NN	10201F	00000000		2532	$88,223.96	P
Base	H30385	03	CR	56H0X03	10101A	00000000		2505	$200,000.00	C

Funding Breakout

Acct.Info	Funding Category	Amount
FY2003 - H30385	Cost Ceiling	$200,000.00
	Total:	$200,000.00
FY2003 - H30421	Cost Ceiling	$255,000.00
	Total:	$255,000.00
FY2003 - U2C172	Cost Ceiling	$88,223.96
	Total:	$88,223.96

Procurement Management Roles

TASK ORDER PROJECT OFFICER:

U.S. E.P.A.
Attn: KATHLEEN A. WALSH
2565 PLYMOUTH ROAD
ANN ARBOR, MI 48105

Mail Code:
Phone Number:
Fax Number:
E-Mail Address:

ALTERNATE TASK ORDER PROJECT OFFICER:

U.S. E.P.A.
Attn: RICHARD W. BALDAUF
RESEARCH TRIANGLE PARK
RTP, NC 27711

Mail Code:
Phone Number:
Fax Number:
E-Mail Address:

ALTERNATE TASK ORDER PROJECT OFFICER:

U.S. E.P.A.
Attn: CARL R. FULPER
2565 PLYMOUTH ROAD
ANN ARBOR, MI 48105

Mail Code:
Phone Number:
Fax Number:
E-Mail Address:

Attachments

Attachment Name
Applicable EPA Clauses
Performance Work Statement
Appendix A
Appendix B
Appendix C
Appendix D
Task Order Line Items
Incentive Plan

Task Order Totals

Category	POP	Amount
Cost Ceiling	Base Pd.	$3,894,463.84

COMPLIANCE WITH EPA POLICIES FOR INFORMATION RESOURCES MANAGEMENT (EPAAR 1552.211-79) (OCT 2000)

(a) Definition. Information Resources Management (IRM) is defined as any planning, budgeting, organizing, directing, training, promoting, controlling, and managing activities associated with the burden, collection, creation, use and dissemination of information. IRM includes both information itself, and the management of information and related resources such as personnel, equipment, funds, and technology. Examples of these services include but are not limited to the following:

(1) The acquisition, creation, or modification of a computer program or automated data base for delivery to EPA or use by EPA or contractors operating EPA programs.

(2) The analysis of requirements for, study of the feasibility of, evaluation of alternatives for, or design and development of a computer program or automated data base for use by EPA or contractors operating EPA programs.

(3) Services that provide EPA personnel access to or use of computer or word processing equipment, software, or related services.

(4) Services that provide EPA personnel access to or use of: Data communications; electronic messaging services or capabilities; electronic bulletin boards, or other forms of electronic information dissemination; electronic record-keeping; or any other automated information services.

(b) *General*. The Contractor shall perform any IRM related work under this contract in accordance with the IRM policies, standards and procedures set forth in this clause and noted below. Upon receipt of a work request (i.e. delivery order or work assignment), the Contractor shall check this listing of directives (see paragraph (d) for electronic access). The applicable directives for performance of the work request are those in effect on the date of issuance of the work request.

(1) IRM Policies, Standards and Procedures. The 2100 Series (2100-2199) of the Agency's Directive System contains the majority of the Agency's IRM policies, standards and procedures.

(2) Groundwater Program IRM Requirement. A contractor performing any work related to collecting Groundwater data; or developing or enhancing data bases containing Groundwater quality data shall comply with *EPA Order 7500.1A - Minimum Set of Data Elements for Groundwater*.

(3) EPA Computing and Telecommunications Services. *The Enterprise Technology Services Division (ETSD) Operational Directives Manual* contains procedural information about the operation of the Agency's computing and telecommunications services. Contractors performing work for the Agency's National Computer Center or those who are developing systems which will be operating on the Agency's national platforms must comply with procedures established in the Manual. (This document may be found at: http://basin.rtpnc.epa.gov:9876/etsd/directives.nsf.)

(c) *Printed Documents*. Documents listed in (b)(1) and (b)(2) may be obtained from:

U.S. Environmental Protection Agency
Office of Administration
Facilities Management and Services Division
Distribution Section
Mail Code: 3204
Ariel Rios Building
1200 Pennsylvania Avenue, N.W.
Washington, D.C. 20460
Phone: (202) 260-5797

(d) *Electronic Access*. Electronic access. A complete listing, including full text, of documents included in the 2100 Series of the Agency's Directive System is maintained on the EPA Public Access Server on the Internet at http://epa.gov/docs/irmpoli8/.

INSPECTION AND ACCEPTANCE (EP 52.246-100) (APR 1984)

(a) The Contracting Officer or the duly authorized representative will perform inspection and acceptance of materials and services to be provided.

(b) For the purposes of this clause, the Project Officer is the authorized representative of the Contracting Officer.

(c) Inspection and acceptance will be performed at:

U.S. EPA NVFEL
2565 Plymouth Rd.
Ann Arbor, MI 48108

PERIOD OF PERFORMANCE (EP 52.212-140) (APR 1984)

The period of performance of this contract shall be from AWARD DATE through August 15, 2005 inclusive of all required reports.

CONTRACT ADMINISTRATION REPRESENTATIVES (EP 52.242-100) (AUG 1984)

Project Officer(s) for this contract:

Project Officer:
Kitty Walsh
US EPA NVFEL, Stop ASD
2565 Plymouth Road
Ann Arbor MI 48105

Telephone: (734) 214-4228
Fax: (734) 214-4816

Alternate Project Officer:
Carl Fulper
US EPA NVFEL, Stop ASD
2565 Plymouth Road
Ann Arbor MI 48105

Telephone: (734) 214-4400
Fax: (734) 214-4816

Alternate Project Officer:
Rich Baldauf - Stop MD-E205-04
109 T.W. Alexander Drive
Research Triangle Park, NC 27711

Telephone: (919) 541-4386
Fax: (919) 541-0960

Contract Specialist(s) responsible for administering this contract:

Matt Growney
26 W. Martin Luther King Drive
Cincinnati OH 45268
Telephone (513)487-2029
Fax: (513) 487-2107

Administrative Contracting Officer:

David Plagge
26 W. Martin Luther King Drive
Cincinnati OH 45268
Telephone (513)487-2022
Fax: (513) 487-2107

ORGANIZATIONAL CONFLICTS OF INTEREST (EPAAR 1552.209-71) (MAY 1994) ALTERNATE I (MAY 1994)

(a) The Contractor warrants that, to the best of the Contractor's knowledge and belief, there are no relevant facts or circumstances which could give rise to an organizational conflict of interest, as defined in FAR Subpart 9.5, or that the Contractor has disclosed all such relevant information.

(b) Prior to commencement of any work, the Contractor agrees to notify the Contracting Officer immediately that, to the best of its knowledge and belief, no actual or potential conflict of interest exists or to identify to the Contracting Officer any actual or potential conflict of interest the firm may have. In emergency situations, however, work may begin but notification shall be made within five (5) working days.

(c) The Contractor agrees that if an actual or potential organizational conflict of interest is identified during performance, the Contractor will immediately make a full disclosure in writing to the Contracting Officer. This disclosure shall include a description of actions which the Contractor has taken or proposes to take, after consultation with the Contracting Officer, to avoid, mitigate, or neutralize the actual or potential conflict of interest. The Contractor shall continue performance until notified by the Contracting Officer of any contrary action to be taken.

(d) Remedies - The EPA may terminate this contract for convenience, in whole or in part, if it deems such termination necessary to avoid an organizational conflict of interest. If the Contractor was aware of a potential organizational conflict of interest prior to award or discovered an actual or potential conflict after award and did not disclose it or misrepresented relevant information to the Contracting Officer, the Government may terminate the contract for default, debar the Contractor from Government contracting, or pursue such other remedies as may be permitted by law or this contract.

(e) The Contractor agrees to insert in each subcontract or consultant agreement placed hereunder provisions which shall conform substantially to the language of this clause, including this paragraph, unless otherwise authorized by the Contracting Officer.

NOTIFICATION OF CONFLICTS OF INTEREST REGARDING PERSONNEL (EPAAR 1552.209-73) (MAY 1994)

(a) In addition to the requirements of the contract clause entitled "Organizational Conflicts of Interest," the following provisions with regard to employee personnel performing under this contract shall apply until the earlier of the following two dates: the termination date of the affected employee(s) or the expiration date of the contract.

(b) The Contractor agrees to notify immediately the EPA Project Officer and the Contracting Officer of (1) any actual or potential personal conflict of interest with regard to any of its employees working on or having access to information regarding this contract, or (2) any such conflicts concerning subcontractor employees or consultants working on or having access to information regarding this contract, when such conflicts have been reported to the Contractor. A personal conflict of interest is defined as a relationship of an employee, subcontractor employee, or consultant with an entity that may impair the objectivity of the employee, subcontractor employee, or consultant in performing the contract work.

(c) The Contractor agrees to notify each Project Officer and Contracting Officer prior to incurring costs for that employee's work when an employee may have a personal conflict of interest. In the event that the personal conflict of interest does not become known until after performance on the contract begins, the Contractor shall immediately notify the Contracting Officer of the personal conflict of interest. The Contractor shall continue performance of this contract until notified by the Contracting Officer of the appropriate action to be taken.

(d) The Contractor agrees to insert in any subcontract or consultant agreement placed hereunder, except for subcontracts or consultant agreements for well drilling, fence erecting, plumbing, utility hookups, security guard services, or electrical services, provisions which shall conform substantially to the language of this clause, including this paragraph (d), unless otherwise authorized by the Contracting Officer.

SCREENING BUSINESS INFORMATION FOR CLAIMS OF CONFIDENTIALITY (EPAAR 1552.235-70) (APR 1984)

(a) Whenever collecting information under this contract, the Contractor agrees to comply with the following requirements:

(1) If the Contractor collects information from public sources, such as books, reports, journals, periodicals, public records, or other sources that are available to the public without restriction, the Contractor shall submit a list of these sources to the appropriate program office at the time the information is initially submitted to EPA. The Contractor shall identify the information according to source.

(2) If the Contractor collects information from a State or local Government or from a Federal agency, the Contractor shall submit a list of these sources to the appropriate program office at the time the information is initially submitted to EPA. The Contractor shall identify the information according to source.

(3) If the Contractor collects information directly from a business or from a source that represents a business or businesses, such as a trade association:

(i) Before asking for the information, the Contractor shall identify itself, explain that it is performing contractual work for the Environmental Protection Agency, identify the information that it is seeking to collect, explain what will be done with the information, and give the following notice:

(A) You may, if you desire, assert a business confidentiality claim covering part or all of the information. If you do assert a claim, the information will be disclosed by EPA only to the extent, and by means of the procedures, set forth in 40 CFR Part 2, Subpart B.

(B) If no such claim is made at the time this information is received by the Contractor, it may be made available to the public by the Environmental Protection Agency without further notice to you.

(C) The Contractor shall, in accordance with FAR Part 9, execute a written agreement regarding the limitations of the use of this information and forward a copy of the agreement to the Contracting Officer.

(ii) Upon receiving the information, the Contractor shall make a written notation that the notice set out above was given to the source, by whom, in what form, and on what date.

(iii) At the time the Contractor initially submits the information to the appropriate program office, the Contractor shall submit a list of these sources, identify the information according to source, and indicate whether the source made any confidentiality claim and the nature and extent of the claim.

(b) The Contractor shall keep all information collected from nonpublic sources confidential in accordance with the clause in this contract entitled "Treatment of Confidential Business Information" as if it had been furnished to the Contractor by EPA.

(c) The Contractor agrees to obtain the written consent of the Contracting Officer, after a written determination by the appropriate program office, prior to entering into any subcontract that will require the subcontractor to collect information. The Contractor agrees to include this clause, including this paragraph (c), and the clause entitled "Treatment of Confidential Business Information" in all subcontracts awarded pursuant to this contract that require the subcontractor to collect information.

TREATMENT OF CONFIDENTIAL BUSINESS INFORMATION (EPAAR 1552.235-71) (APR 1984)

(a) The Contracting Officer, after a written determination by the appropriate program office, may disclose confidential business information (CBI) to the Contractor necessary to carry out the work required under this contract. The Contractor agrees to use the CBI only under the following conditions:

(1) The Contractor and Contractor's employees shall: (i) use the CBI only for the purposes of carrying out the work required by the contract; (ii) not disclose the information to anyone other than properly cleared EPA employees without the prior written approval of the Assistant General Counsel for Contracts and Information Law; and (iii) return to the Contracting Officer all copies of the information, and any abstracts or excerpts therefrom, upon request by the Contracting Officer, whenever the information is no longer required by the Contractor for the performance of the work required by the contract, or upon completion of the contract.

(2) The Contractor shall obtain a written agreement to honor the above limitations from each of the Contractor's employees who will have access to the information before the employee is allowed access.

(3) The Contractor agrees that these contract conditions concerning the use and disclosure of CBI are included for the benefit of, and shall be enforceable by, both EPA and any affected businesses having a proprietary interest in the information.

(4) The Contractor shall not use any CBI supplied by EPA or obtained during performance hereunder to compete with any business to which the CBI relates.

(b) The Contractor agrees to obtain the written consent of the CO, after a written determination by the appropriate program office, prior to entering into any subcontract that will involve the disclosure of CBI by the Contractor to the subcontractor. The Contractor agrees to include this clause, including this paragraph (b), in all subcontracts awarded pursuant to this contract that require the furnishing of CBI to the subcontractor.

RELEASE OF CONTRACTOR CONFIDENTIAL BUSINESS INFORMATION (EPAAR 1552.235-79) (APR 1996)

(a) The Environmental Protection Agency (EPA) may find it necessary to release information submitted by the Contractor either in response to this solicitation or pursuant to the provisions of this contract, to individuals not employed by EPA. Business information that is ordinarily entitled to confidential treatment under existing Agency regulations (40 C.F.R. Part 2) may be included in the information released to these individuals. Accordingly, by submission of this proposal or signature on this contract or other contracts, the Contractor hereby consents to a limited release of its confidential business information (CBI).

(b) Possible circumstances where the Agency may release the Contractor's CBI include, but are not limited to the following:

(1) To other Agency contractors tasked with assisting the Agency in the recovery of Federal funds expended pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act, 42 U.S.C. Sec. 9607, as amended, (CERCLA or Superfund);

(2) To the U.S. Department of Justice (DOJ) and contractors employed by DOJ for use in advising the Agency and representing the Agency in procedures for the recovery of Superfund expenditures;

(3) To parties liable, or potentially liable, for costs under CERCLA Sec. 107 (42 U.S.C. Sec. 9607), et al, and their insurers (Potentially Responsible Parties) for purposes of facilitating settlement or litigation of claims against such parties;

(4) To other Agency contractors who, for purposes of performing the work required under the respective contracts, require access to information the Agency obtained under the Clean Air Act (42 U.S.C. 7401 et seq.); the Federal Water Pollution Control Act (33 U.S.C.1251 et seq.); the Safe Drinking Water Act (42 U.S.C. 300f et seq.); the Federal Insecticide, Fungicide and Rodenticide Act (7 U.S.C. 136 et seq.); the Resource

Conservation and Recovery Act (42 U.S.C. 6901 et seq.); the Toxic Substances Control Act (15 U.S.C. 2601 et seq.); or the Comprehensive Environmental Response, Compensation, and Liability Act (42 U.S.C. 9601 et seq.);

(5) To other Agency contractors tasked with assisting the Agency in handling and processing information and documents in the administration of Agency contracts, such as providing both preaward and post award audit support and specialized technical support to the Agency's technical evaluation panels;

(6) To employees of grantees working at EPA under the Senior Environmental Employment (SEE) Program;

(7) To Speaker of the House, President of the Senate, or Chairman of a Committee or Subcommittee;

(8) To entities such as the General Accounting Office, boards of contract appeals, and the Courts in the resolution of solicitation or contract protests and disputes;

(9) To Agency contractor employees engaged in information systems analysis, development, operation, and maintenance, including performing data processing and management functions for the Agency; and

(10) Pursuant to a court order or court-supervised agreement.

(c) The Agency recognizes an obligation to protect the contractor from competitive harm that may result from the release of such information to a competitor. (See also the clauses in this document entitled "Screening Business Information for Claims of Confidentiality" and "Treatment of Confidential Business Information.") Except where otherwise provided by law, the Agency will permit the release of CBI under subparagraphs (1), (3), (4), (5), (6), or (9) only pursuant to a confidentiality agreement.

(d) With respect to contractors, 1552.235-71 will be used as the confidentiality agreement. With respect to Potentially Responsible Parties, such confidentiality agreements may permit further disclosure to other entities where necessary to further settlement or litigation of claims under CERCLA. Such entities include, but are not limited to accounting firms and technical experts able to analyze the information, provided that they also agree to be bound by an appropriate confidentiality agreement.

(e) This clause does not authorize the Agency to release the Contractor's CBI to the public pursuant to a request filed under the Freedom of Information Act.

(f) The Contractor agrees to include this clause, including this paragraph (f), in all subcontracts at all levels awarded pursuant to this contract that require the furnishing of confidential business information by the subcontractor.

KEY PERSONNEL (EPAAR 1552.237-72) (APR 1984)

(a) The Contractor shall assign to this contract the following key personnel:

PROJECT MANAGER - Sandeep Kishan

(b) During the first ninety (90) calendar days of performance, the Contractor shall make no substitutions of key personnel unless the substitution is necessitated by illness, death, or termination of employment. The Contractor shall notify the Contracting Officer within 15 calendar days after the occurrence of any of these events and provide the information required by paragraph (c) below. After the initial ninety (90) calendar day period, the Contractor shall submit the information required by paragraph (c) to the Contracting Officer at least 15 calendar days prior to making any permanent substitutions.

(c) The Contractor shall provide a detailed explanation of the circumstances necessitating the proposed substitutions, complete resumes for the proposed substitutes, and any additional information requested by the Contracting Officer. Proposed substitutes should have comparable qualifications to those of the persons being replaced. The Contracting Officer will notify the Contractor within 15 calendar days after receipt of all required information of the decision on substitutions. This clause will be modified to reflect any approved changes of key personnel.

ORGANIZATIONAL CONFLICT OF INTEREST NOTIFICATION (EPAAR 1552.209-70) (APR 1984)

(a) The prospective Contractor certifies, to the best of its knowledge and belief, that it is not aware of any information bearing on the existence of any potential organizational conflict of interest. If the prospective Contractor cannot so certify, it shall provide a disclosure statement in its proposal which describes all relevant information concerning any past, present, or planned interests bearing on whether it (including its chief executives and directors, or any proposed consultant or subcontractor) may have a potential organizational conflict of interest.

(b) Prospective Contractors should refer to FAR Subpart 9.5 and EPAAR Part 1509 for policies and procedures for avoiding, neutralizing, or mitigating organizational conflicts of interest.

(c) If the Contracting Officer determines that a potential conflict exists, the prospective Contractor shall not receive an award unless the conflict can be avoided or otherwise resolved through the inclusion of a special contract clause or other appropriate means. The terms of any special clause are subject to negotiation.

CONSIDERATION AND PAYMENT--ITEMIZED FIXED PRICES (EP 52.216-170) (APR 1984)

The fixed price of this contract is $543,223.96 (without incentives). Payment will be made upon delivery and acceptance of required items as follows:

Base	Net 30 Days After Completion and Acceptance
Option 1	Net 30 Days After Completion and Acceptance
Option 2	Net 30 Days After Completion and Acceptance
Option 3	Net 30 Days After Completion and Acceptance
Option 4	Net 30 Days After Completion and Acceptance
Option 5	Net 30 Days After Completion and Acceptance

HIGHER-LEVEL CONTRACT QUALITY REQUIREMENT (GOVERNMENT SPECIFICATION) (FAR 52.246-11) (MAR 2001)

The Contractor shall comply with the higher-level quality standard selected below.

	Title	Numbering	Date	Tailoring
[✔]	*Specifications and Guidelines for Quality Systems for Environ mental Data Collection and Environmental Technology Programs*	ANSI/ASQC E4	1994	See below
[ ]				
[ ]				

As authorized by FAR 52.246-11, the higher-level quality standard ANSI/ASQC E4 is tailored as follows:

The solicitation and contract require the offeror/contractor to demonstrate conformance to ANSI/ASQC E4 by submitting the quality documentation described below.

In addition, after award of the contract, the Contractor shall revise, when applicable, quality documentation submitted before award to address specific comments provided by EPA and submit the revised documentation to the Contracting Officer's Representative.

After award of the contract, the Contractor shall also implement all quality documentation approved by the Government.

A. **Pre-award Documentation:** The offeror must submit the following quality system documentation as a separate and identifiable part of its technical proposal: *(CO, select one or more)*

	Documentation	Specifications
[X]	Quality Management Plan	EPA Requirements for Quality Management Plans (QA/R-2) [dated 03/20/01]
[ ]	Joint Quality Management Plan/Quality Assurance Project Plan for the contract	EPA Requirements for Quality Management Plans (QA/R-2) [dated 03/20/01] and EPA Requirements for Quality Assurance Project Plans (QA/R) [dated 03/20/01]
[X]	Programmatic Quality Assurance Project Plan for the entire program (contract)	EPA Requirements for Quality Assurance Project Plans (QA/R-5) [dated 03/20/01]
[ ]	Other Equivalent: ____________	____________

This documentation will be prepared in accordance with the specifications identified above. Work involving environmental data generation or use shall not commence until the Government has approved this documentation and incorporated it into the contract.

B. **Post-award Documentation:** The Contractor shall submit the following quality system documentation to the Contracting Officer's Representative at the time frames identified below: *(CO, select one or more)*

	Documentation	Specification	Due After
[ ]	Quality Management Plan	EPA Requirements for Quality Management Plans (QA/R-2) [dated 03/20/01]	Award of contract
[ ]	Joint Quality Management Plan/Quality Assurance Project Plan for the contract	EPA Requirements for Quality Management Plans (QA/R-2) [dated 03/20/01] and EPA Requirements for Quality Assurance Project Plans (QA/R-5) [dated 03/20/02]	Award of contract

[ ]	Quality Assurance Project Plan for the contract	EPA Requirements for Quality Assurance Project Plans (QA/R-5 [dated 03/20/01]	Award of contract
[ ]	Programmatic Quality Assurance Project Plan for the entire program (contract)	EPA Requirements for Quality Assurance Project Plans (QA/R-5 [dated 03/20/01]	Award of contract
[X]	Quality Assurance Project Plan for each applicable project	EPA Requirements for Quality Assurance Project Plans (QA/R-5 [dated 03/20/01]	Exercise of Option for each task order
[ ]	Project-specific supplement to Programmatic Quality Assurance Project Plan for each applicable project.	EPA Requirements for Quality Assurance Project Plans (QA/R-5 [dated 03/20/01]	Issuance of statement of work for the project
[ ]	Other Equivalent: ____________________	____________________	[ ] award of contract [ ] issuance of statement of work for the project

This documentation will be prepared in accordance with the specifications identified above.

The Government will review and return the quality documentation, with comments, and indicating approval or disapproval. If necessary, the contractor shall revise the documentation to address all comments and shall submit the revised documentation to the government for approval.

The Contractor shall not commence work involving environmental data generation or use until the Government has approved the quality documentation.

(Note: Statement of work includes statements of work to perform projects under work assignments, task orders, delivery orders, etc.)

SUBMISSION OF INVOICES (EPAAR 1552.232-70) (JUN 1996) ALTERNATE I (JUN 1996) DEVIATION

In order to be considered properly submitted, an invoice or request for contract financing payment must meet the following contract requirements in addition to the requirements of FAR 32.905:

(a) Unless otherwise specified in the contract, an invoice or request for contract financing payment shall be submitted as an original and five copies. The Contractor shall submit the invoice or request for contract financing payment to the following offices/individuals designated in the contract: the original to the Accounting Operations Office shown in Block 21 on the cover of the contract; two copies to the Project Officer (the Project Officer may direct one of these copies to a separate address); and one copy to the Contracting Officer.

(b) The Contractor shall prepare its invoice or request for contract financing payment on the prescribed Government forms. Standard Forms Number 1034, Public Voucher for

Purchases and Services other than Personal, shall be used by contractors to show the amount claimed for reimbursement. Standard Form 1035, Public Voucher for Purchases and Services other than Personal - Continuation Sheet, shall be used to furnish the necessary supporting detail or additional information required by the Contracting Officer. The Contractor may submit self-designed forms which contain the required information.

(c)(1) The Contractor shall prepare a contract level invoice or request for contract financing payment in accordance with the invoice preparation instructions identified as a separate attachment in Section J of the contract. If contract work is authorized by individual delivery orders, the invoice or request for contract financing payment shall also include a summary of the current and cumulative amounts claimed by cost element for each delivery order and for the contract total, as well as any supporting data for each delivery order as identified in the instructions.

(2) The invoice or request for contract financing payment that employs a fixed rate feature shall include current and cumulative charges by contract labor category and by other major cost elements such as travel, equipment, and other direct costs. For current costs, each cost element shall include the appropriate supporting schedules identified in the invoice preparation instructions.

(3) The charges for subcontracts shall be further detailed in a supporting schedule showing the major cost elements for each subcontract. The degree of detail for any subcontract exceeding $5,000 is to be the same as that set forth under (c)(2).

(4) The charges for consultants shall be further detailed in the supporting schedule showing the major cost elements of each consultant. For current costs, each major cost element of the consulting agreement shall also include the supporting schedule identified in the invoice preparation instructions.

(d) Invoices or requests for contract financing payment must clearly indicate the period of performance for which payment is requested. Separate invoices or requests for contract financing payment are required for charges applicable to the basic contract and each option period.

(e)(1) Notwithstanding the provisions of the clause of this contract at FAR 52.216-7, Allowable Cost and Payment, invoices or requests for contract financing payment shall be submitted once per month unless there has been a demonstrated need and Contracting Officer approval for more frequent billings. When submitted on a monthly basis, the period covered by invoices or requests for contractor financing payments shall be the same as the period for monthly progress reports required under this contract.

(2) If the Contracting Officer allows submissions more frequently than monthly, one submittal each month shall have the same ending period of performance as the monthly progress report.

(3) Where cumulative amounts on the monthly progress report differ from the aggregate amounts claimed in the invoice(s) or request(s) for contract financing payments covering the same period, the contractor shall provide a reconciliation of the difference as part of the payment request.

OPTION FOR INCREASED QUANTITY--FIXED-PRICE CONTRACT (EP 52.217-982) (APR 1984)

(a) The Government may increase the quantity of work called for under this contract as follows:

Option	Description	Total Price	Delivery Date
1	Phase 2 Round 1 Vehicle Testing	$1,452,282.59	See PWS
2	Phase 2 Round 1 Speciation Toxic Analysis	$50,923.54	See PWS

3	Phase 3 Round 2 Vehicle Testing	$1,600,871.64	See PWS
4	Phase 3 Round 2 Speciation Toxic Analysis	$55,161.01	See PWS
5	Final Report / Analysis	$148,139.49	See PWS

Please see the Task Order Line Item Attachment for breakout of individual line items prices. The Delivery Schedule s set forth in the Performance Work Statement for the Task Order.

(b) The Contracting Officer may exercise an option by written notice to the Contractor within the following time periods:

Option	Time Period for Exercising Option
1	Up to Twelve (12) Months After Award
2	Up to Twelve (12) Months After Award
3	Up to Twelve (12) Months After Award
4	Up to Twelve (12) Months After Award
5	Up to Twelve (12) Months After Award

Characterizing Exhaust Emissions from Light-Duty Gasoline Vehicles in the Kansas City Metropolitan Area

1.0 EXECUTIVE SUMMARY

The U.S. Environmental Protection Agency (EPA), the Coordinating Research Council (CRC), the U.S. Department of Energy's (DOE) National Renewable Energy Lab (NREL), the U.S. Department of Transportation (DOT) Federal Highway Administration (FHWA), and the State and Territorial Air Pollution Program Administrators/Association of Local Air Pollution Control Officials (STAPPA/ALAPCO) propose to conduct a program to evaluate exhaust emissions from light-duty gasoline vehicles. The proposed program consists of measuring particulate matter (PM) and other components in exhaust emissions of 480 randomly selected, light-duty vehicles in the Kansas City Metropolitan Area. A sampling plan has been developed that will allow for the determination of the distribution of particulate matter (PM) and other emissions in the sampled fleet as well as the identification of the percent of high emitters. Data obtained from this program will be used to evaluate and update existing and future mobile source emission models (MOBILE6 and MOVES), evaluate existing emission inventories and assess the representativeness of previous PM emissions studies.

2.0 BACKGROUND

Mobile sources significantly contribute to ambient concentrations of air contaminants, including particulate matter. Recent source apportionment studies for PM_{10} and $PM_{2.5}$ indicate that mobile sources can be responsible for over half of the ambient PM measured in an urban area (Motallebi, 1999; Magliano, 1998; Dzubay et al., 1988). Some of these source apportionment studies have attempted to differentiate between contributions from gasoline and diesel combustion. Studies conducted in Denver and Phoenix indicated that gasoline combustion from mobile sources contributed more to ambient PM than diesel combustion (Lawson and Smith, 1998; Ramadan, 2000). However, studies conducted in Los Angeles and the San Joaquin Valley in California indicate that diesel combustion contributed more than gasoline combustion to ambient PM (Schauer et al., 1996; Schauer and Cass, 2000). Existing emission inventories developed by the EPA also suggest diesel vehicles contribute more than gasoline vehicles to ambient PM concentrations.

Exhaust emissions of particulate matter from gasoline-powered motor vehicles have changed significantly over the past 25 years (Cadle et al., 1999). These changes have resulted from reformulation of fuels, the wide application of exhaust gas treatment, and changes in engine design and operation. Because of these evolving tailpipe emissions, along with the wide variability of emissions between vehicles of the same class (Hildemann et al., 1991; Cadle et al., 1997; Sagebiel et al., 1997; Yanowitz et al., 2000), well-defined average emissions profiles for the major classes of motor vehicles have not been established.

The majority of exhaust PM emitted by motor vehicles is in the $PM_{2.5}$ size range. Kleeman et al., (2000) have shown that gasoline and diesel fueled vehicles produce particles that are mostly less than 2.0 μm in diameter. Cadle et al., (1999) found that 91% of PM emitted by in-use gasoline vehicles in the Denver area was in the $PM_{2.5}$ size range, which increased to 97% for "smokers" (i.e., light-duty vehicles with visible smoke emitted from their tailpipes). Durbin et al.,(1999) found that 92% of the PM was smaller than 2.5 μm for smokers. The mass median diameter of the PM emitted by the gasoline vehicles sampled by Cadle et al., (1999) was about 0.12 μm, which increased to 0.18 μm for smokers. Corresponding average emissions rates of $PM_{2.5}$ were 38 mg/mi for normal emitting gasoline vehicles and 222 mg/mi for gasoline smokers.

Emissions from smokers are comparable to those from diesel vehicles. Thus, older and poorly maintained gasoline vehicles could be significant sources of $PM_{2.5}$ (Sagebiel et al., 1997; Lawson and Smith, 1998). Durbin et al. (1999) point out that although smokers constitute only 1.1 to 1.7% of the light-duty fleet in the South Coast Air Quality Management District in California, they contribute roughly 20% of the total PM emissions from the light-duty fleet. Motor vehicles that are high emitters of hydrocarbons and carbon monoxide can be high emitters of PM (Sagebiel et al., 1997; Cadle et al., 1997). National distributions of smokers and high emitting vehicles for PM have not been evaluated.

A major obstacle in previous emissions testing studies has been the recruitment of vehicles. Most studies have not incorporated random sampling in the study design due to the high non-participation rate and the high incentive costs associated with random sampling of vehicles. Therefore, few studies, and no studies evaluating light-duty PM emissions, can be used to represent the distribution of vehicle emissions in a large population.

The EPA, CRC, NREL, DOT, and the STAPPA/ALAPCO and EPA Emission Inventory Improvement Program (EIIP), hereafter referred to as the Project "Sponsors", plan to conduct a program to characterize exhaust emissions from light-duty gasoline vehicles. Data obtained from this program will be used to evaluate and update existing and future mobile source emission models (MOBILE6 and MOVES) and evaluate existing emission inventories. For the purpose of this RFP, the term "Contractor" shall include the primary contractor and any subcontractors awarded the project task order.

3.0 PROJECT DESCRIPTION

The Sponsors propose to conduct exhaust emissions testing on 480 light-duty, gasoline vehicles in the Kansas City Metropolitan Area (KCMA). The goal of the project is to determine the distribution of PM emissions in a randomly selected fleet as well as identify the percent of high emitters in the fleet. The project will also characterize gaseous and PM toxics exhaust emissions from a portion of these light-duty vehicles. Data obtained from this program will be used to evaluate and update emission models, evaluate existing emission inventories, and assess the representativeness of previous emissions studies.

EPA through its Project Officer will represent the Sponsors during this test program. The contractor will address and forward all issues and technical assistance through EPA Project Officer. The Project Officer will disseminate this information to the Sponsors to get the best advice on how to proceed. The information from the contractor can be sent to the Sponsors and the EPA Project Officer at the same time but only the Project Officer can give technical guidance to the contractor. The EPA Project Officer will assume the responsibility that all Sponsors are provided the information in a timely fashion. The Sponsors will assure that they or their representative give timely advice back to the Project Officer in order to keep delays to a minimum.

The EPA Project Officer, or any representatives of the project sponsors, will conduct audits of all facets of the project. The contractor may be notified prior to an audit; however, the sponsors reserve the right to conduct audits without notification.

The project description has been divided into three main sections: Vehicle Recruitment and Pilot Studies, Vehicle Testing, and Sample Analysis. The contractor shall ensure integration of all three work areas. Specific tasks associated with each of these work areas are listed in Section 5.

3.1 Vehicle Recruitment

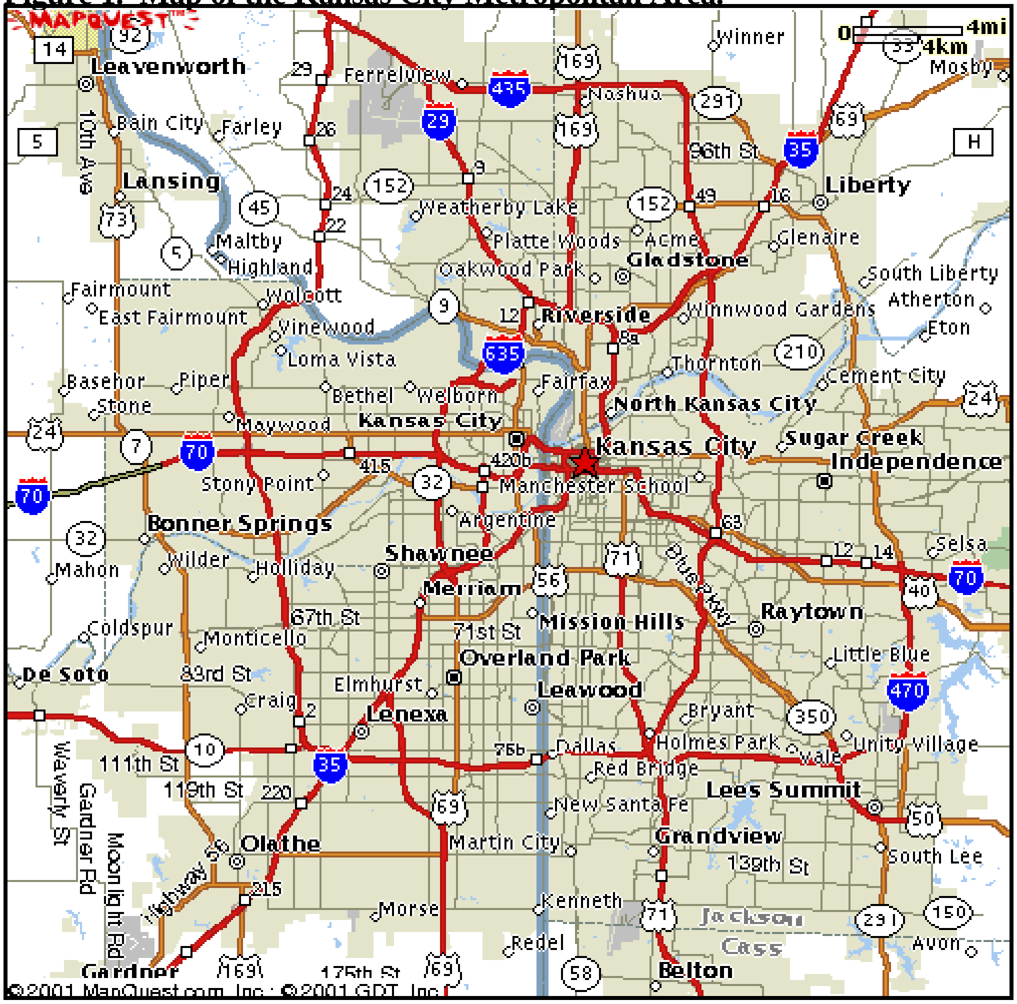
Vehicle recruitment activities will be designed to identify the distribution of PM emissions from gasoline vehicles in order to better evaluate the contribution of gasoline high emitters to ambient PM concentrations. Vehicles will be recruited from the Kansas City Metropolitan Area (KCMA) (see Figure 1). **The sample size estimation was derived from data based on a previous study (CRC E-24) in which EPA estimated the initial sample size, estimated the effective sample size, and then allocated the effective sample among strata.(see Appendix B)** For the purposes of this task order the KCMA consists, at a minimum, of the counties of Wyandotte and Johnson in Kansas; and Jackson, Cass, Clay, and Platte in Missouri. In order to increase the likelihood of obtaining a representative sample population and a high participation rate, the contractor will obtain a cohort, (existing or newly developed), from which vehicles will be randomly recruited for emissions testing. The cohort shall include a socioeconomically diverse group of citizens that represent the demographics of the KCMA. Additionally, the contractor shall compare the characteristics of the vehicles owned by the cohort to those of the Kansas City and national fleets to assess the representativeness of the cohort population. The contractor shall include an assessment of the effect of non-respondents to the cohort development program. In addition, the contractor shall document and evaluate non-respondents to the emissions testing program to ensure non-biased sample collection. The following information will be required for this assessment:

- Geo-demographic data for the cohort including vehicle ownership, approximate residence location, and socioeconomic status.
- Vehicle characteristics for the cohort group including year, make, model, and mileage of all owned

vehicles.

- Comparisons of select volunteer vehicle's oxides of nitrogen (NO_x), carbon monoxide (CO), and hydrocarbon (HC) emissions to other vehicle emissions in the Kansas City fleet.
- Detailed on-road vehicle fleet characteristics for the KCMA.
- Vehicle registration database for the KCMA which includes both vehicle characteristics listed above and vehicle ownership (name and address)**.**

Figure 1. Map of the Kansas City Metropolitan Area.



Vehicles will be recruited from the KCMA for two rounds of emissions testing: Round 1 during the summer, 2003 and Round 2 during the winter, 2003/2004. Two sources will be considered as sample frames for test vehicles.

Cohort Sample: The contractor shall draw a random sample of 400 vehicles from the socio-demographically representative cohort chosen by the contractor for the purpose of this project. The contractor shall also draw a random sample of 80 vehicles from non-respondents to the cohort (described in Section 3.1.3). The sample shall be stratified by vehicle age and class with target recruitment numbers as shown in Table 1. **EPA does not possess any cohort data for Kansas City or any other locality. However, EPA is aware of data being collected through a DOT Congestion, Mitigation Air Quality (CMAQ) grant administered through the Mid- America Regional Council (MARC) in Kansas City. The mention of this data does not constitute a recommendation to use this data set. In addition, there might be other sources of data available in the region. (Note: Specific guidelines have not been established on what constitutes a "diverse" population. In general, the contractor shall ensure that multiple ethnicities and socioeconomic classes are included in the project. The contractor shall also ensure the demographic data is obtained for all respondents.)**

Registration Sample: The Sponsors recognize that a demographically representative cohort group may not possess a sufficient mix of vehicles, or the vehicles may not be representative of the general fleet. The contractor shall provide the EPA representative with the vehicle registration database for the KCMA. The EPA representative shall randomly select 400 vehicles from this database **(vehicles from the cohort)** stratified by vehicle age and class with target recruitment numbers as shown in Table 1. The contractor shall also draw a random sample of 80 vehicles from non-respondents to the cohort (described in Section 3.1.3). The contractor shall obtain socio-demographic data on all vehicle owners chosen in this sample frame if this sample frame is used for recruitment. **(Note: EPA has not made prior arrangements with the States representing Kansas City for vehicle registration data. The contractor should contact MARC and the State's Department of Motor Vehicles to arrange for this data. EPA and Contractors shall consider all vehicle owner data acquired as confidential with proper safe guards to ensure its access is restricted. This personal data will be destroyed after the test program has ended).**

3.1.1 Sample Representativeness Assessment.

The contractor shall determine the representativeness of the cohort sample for use in vehicle recruitment. The contractor shall compare the characteristics of the cohort fleet, by make and model year, to the Kansas City area fleet and the national fleet. The contractor shall also compare vehicle exhaust emissions of NOx, HCs, and CO for select cohort vehicles and Kansas City fleet vehicles using new or previously collected remote sensing data **(RSD)**. **Existing RSD could be used for assessing sample representativeness if applicable. (Note: PM RSD measurements are not an acceptable method for comparing emissions from RSD response and non-response vehicles. RSD data for gaseous compounds does not always correlate well with PM emissions. In addition, PM RSD techniques are not well proven.)** Second-by-second chassis dynamometer emissions data from the Unified Cycle may be compared against remote sensing data collected from the Kansas City area fleet as one approach. Recommended standard remote sensing data collection protocols can be found at www.crcao.com (see E-23 Interim Report). The selected approach must be justified in detail to ensure representativeness of Kansas City area fleet remote sensing data to the general vehicle population and subsequent comparison of this data to the study test fleet including appropriate weighting of the data used in this assessment. The contractor shall also conduct a double blind comparison between the proposed sample obtained using the cohort sample frame and the proposed sample using the registration sample frame to ensure representativeness of the vehicles recruited for the program.

3.1.2 Vehicle Selection.

The contractor shall be responsible for documenting and contacting all owners of vehicles chosen for emissions testing. The contractor shall have the capability of multilingual recruitment (English and Spanish at a minimum) to ensure that a majority of the KCMA population can participate in the program.

If the cohort sample is deemed representative, this database will be used for vehicle recruitment. Otherwise, the registration sample will be used by the contractor for recruitment. All vehicles in the sample frame shall be binned into a sample stratum. Vehicles shall be randomly selected from each stratum, so that all vehicles in the stratum have an equal probability of selection. **(This means that all vehicles in the cohort sample will be assigned to a stratum based on year and type of vehicle and then vehicles within each stratum will be randomly selected.)** The total number of tests to be performed for the program is shown in Table 2.

Table 1. Estimated Sample Sizes by Stratum to Achieve Data Precision Goals (includes positive respondents and non-respondents).

Stratum (*h*)	Vehicle Class	Age Class	Sample size (n_h)[1]
1	Truck	Pre 1980	50
2	Truck	1980 – 1990	100
3	Truck	1991-1995	70

4	**Truck**	**1996 and newer**	**40**
5	**Car**	**Pre 1980**	**40**
6	**Car**	**1980 – 1990**	**50**
7	**Car**	**1991-1995**	**80**
8	**Car**	**1996 and newer**	**50**
Total			**480**

Table 2. Estimated Number of Vehicles Recruited and Test Performed

	Different Vehicles	Tests
Round 1		
Positive Respondents from Cohort	170	170
Replicate Vehicle Tests	0	15
Non-respondent from Cohort[a]	80	80
Weekly calibration vehicle test [b]	0	12
Total	**250**	**277**
Round 2		
Positive Respondents from Cohort	230	230
Non-respondent from Cohort[a]	0	0
Replicate Vehicle Tests	0	10
Repeat Vehicles from Round 1[b]	25	25
Weekly calibration vehicle test [b]	0	12
Total	**255**	**277**

[a] see Section 3.1.3 for description of this activity.
[b] see Section 3.2.3 for description of this activity.
Total vehicles includes non-response assessment.

3.1.3 Non-Response Assessment.

As part of the recruitment process, the contractor shall randomly select eighty (80) people who did not positively respond to the initial request to participate in the cohort. These owner's vehicles will be recruited to the program to assess any potential bias in results from the recruitment of volunteers to the study. A list of non-respondent criteria will be developed with approval from the EPA Project Officer after consulting with the Sponsors. As shown in Table 3, the number of vehicles to target in each stratum for the non-response analysis shall be proportional to the vehicles recruited for the total population. **The contractor shall propose criteria to determining methods that achieve a high participation rate for non-respondents which might include different incentive packages for different cohort stratum. The contractor can propose a different criteria for what constitutes a non-respondent but shall provide documentation supporting its approach.**

Table 3. Estimated Sample Sizes by Stratum for Non-Respondent Testing

Stratum (*h*)	Vehicle Class	Age Class	Sample size (n_h)[1]

1	Truck	Pre 1980	8
2	Truck	1980-1990	16
3	Truck	1991-1995	12
4	Truck	1996 and newer	7
5	Car	Pre 1980	7
6	Car	1980 – 1990	8
7	Car	1991-1995	14
8	Car	1996 and newer	8
Total			**80**

1 Number of randomly selected vehicles tested for the non-response assessment.

3.1.4 Participation Incentives

Incentives will be required for study participants. At a minimum, participants will require the use of a rental vehicle during testing of their vehicle. Other likely incentives include cash, free gasoline, free repairs, and free cleanup of participant vehicles. Since the vehicles will likely be randomly chosen from the cohort, incentive requirements may be less than for previous testing programs. However, incentives must be adequate to ensure the lowest possible rejection rate from study participants. **Incentive packages will be reviewed and refined in a pilot study program as described in section 3.1.5 in order to assure a high participation rate and reduce both contractor time and cost. If a vehicle is rejected for some reason when the vehicle is inspected (see section 3.2.1), the potential participant should be compensated for their time and trouble. The contractor shall propose a rejection participation package if this situation occurs.**

From previous studies, the Sponsors have developed an outline on the cost of incentives that might be used by the contractor to reduce rejection rates. The contractor can propose other incentives packages that they feel might improve the response rate for the program and/or reduce contractor's time in managing the incentives program.

A separate emission and activity program involving portable emission measurement system (PEMS) or portable activity measurement system (PAMS) will need additional incentives for selected participants whose vehicles would have this device. See Section 3.2.4 for details.

The contractor will propose a budget for achieving these goals outlined in this section. Monthly progress reports itemizing incentive expenditures and details on those expenditures shall be provided to the Contracting Officer and the Project Officer. The Contractor shall notify the Project Officer when 75% of the incentive funds have been expended.

Table 4. Incentives.

Type of Incentives	Incentive Cost
Cash	$200 (if using a rental vehicle) $275 (for not using a rental vehicle)
Full Tank of Gasoline	$25
Rental Vehicle	$75 (for up to three days)
Car Wash (possible)	$10
PEMS / PAMS Use	$50
Total	**$360**

3.1.5 Vehicle Recruitment Pilot Study

The contractor shall conduct a pilot study to evaluate recruitment methods and incentive packages to identify the adequacy of the proposed recruitment process in achieving a high response rate from vehicle owners (positive respondents and non-respondents) and to assure proper flow of vehicles for emission testing. **The contractor shall propose methods and evaluate methods from this pilot study. The contractor shall include in their proposal methods that will be used for contacting participants that include: mode of contact (phone calling, letter) , number and frequency of contacts, and incentives.** The pilot vehicle recruitment study should indicate cost savings in reduced contractor's time burden and savings for recruiting vehicles. **Vehicles do not have to be recruited during this pilot study but focus groups could be used as one way to evaluate recruitment methods and incentive packages for different geodemographic groups.**

3.1.6 Data Management.

The contractor shall maintain all data records, and make all databases used in the assessment accessible to the EPA Project Officer and to the Sponsors. The contractor shall document all statistical methods used in determining the representativeness of the vehicles chosen for the sample frame. The contractor shall also maintain a list of all vehicle owners contacted for recruitment to the study. The contractor shall list the person contacted, socio-demographic information associated with each person contacted, the response, and the incentives required, if the response is positive. To identify all people contacted for participation in the study, the contractor shall use a confidential, unique identification code to protect the privacy of all individuals.

3.2 Vehicle Testing

All vehicle testing will occur outdoors under ambient conditions. The contractor shall select a suitable location that provides security and accessibility for all project participants. The general testing site area needed to conduct **the** program is approximately 100 ft x 200 ft for equipment (transportable dynamometer and trailers) plus room for vehicles. The contractor shall provide cover to ensure that all equipment and vehicles are protected from the elements during participation in the study. The contractor shall be responsible for identifying and procuring a suitable location for conducting the emissions tests **and** covering the costs of shipping the portable dynamometer to **and from** the testing location in Kansas City **(dynamometer is located in Research Triangle Park Area, NC)**. The contractor shall be responsible for providing the following electrical power at the site needed to power the sampling equipment, and the dynamometer:

- 60 amp, 3 phase, 480 v.
- 200 amp., 1 phase, 240 v.

The contractor and subcontractor(s) are required to have insurance that covers vehicles procured from the public that might be damaged while in their possession. All vehicles whether they are insured or uninsured will be tested. (None, if any, uninsured vehicle should occur since State's require vehicle insurance.)

The contractor **may need to** provide vehicles for the duration of the study: a full-sized **vehicle** for moving heavy equipment and a **vehicle** for transporting people.

3.2.1 Vehicle Inspection, Maintenance, and Conditioning

All vehicles shall be inspected upon arrival to the testing facility. To lessen the chance of an owner complaining that the car was scratched or damaged, a video recording **is recommended**. The major components of the inspection are engine condition (engine noises, whether it "knocks" or other "noises"), tire condition, brake condition, and integrity of the exhaust system.

All appropriately equipped vehicles shall have their OBD system scanned. The scan results shall be reported along with the type of OBD systems found on the vehicle, such as OBDI or OBDII. Any defects or deficiencies in the vehicle condition that pose a danger **to testing personnel will be repaired by the contractor. Any defects or deficiencies in the vehicle condition that will not affect exhaust emissions**

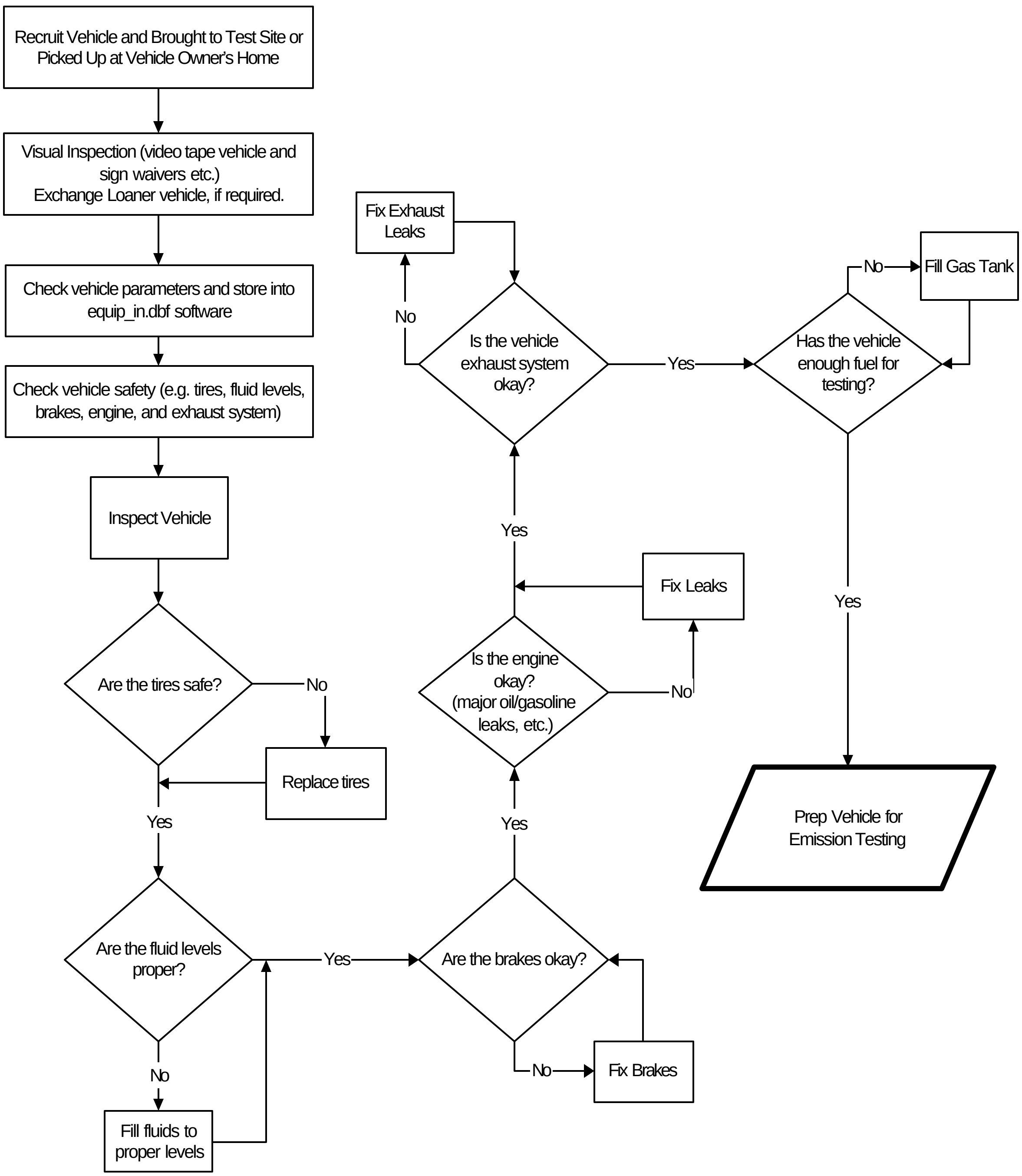
will not be repaired by the contractor since the goal of the project is not to reject any vehicle due to operating condition. All repairs shall be documented. If a vehicle cannot be repaired to a condition that does not pose a safety risk to project participants, the vehicle must be rejected. Detailed information on all vehicles must be obtained and recorded for the overall vehicle study **even if a vehicle is rejected**.
Portable Emission Measurement Systems (PEMS) or Portable Activity Measurement Systems (PAMS) devices might be used to further characterize these rejected vehicles.

Initial vehicle data will be collected and recorded on a computerized vehicle information form. Recorded information is not limited to but will include date and time of vehicle procurement, date and time of vehicle testing, test number, vehicle license plate number, make, model, model year, odometer, engine family number, vehicle identification number (VIN), evaporative emission number, engine displacement, number of cylinders, emission controls, catalyst type, vehicle registration status, and fuel and oil information. Condition of the motor oil (e.g. clean or new vs. used/dirty) will be reported. A visual and odor inspection of the exhaust will also be noted to determine in advance whether or not a vehicle might be a low or high PM emitter **or smoker**. All information will be documented for each vehicle brought to the testing facility, regardless of whether the vehicle is tested.

After the vehicle has passed inspection, it shall be conditioned for testing. Conditioning will occur by driving the vehicle on a route pre-established by the contractor in the vicinity of the testing location. The conditioning route must contain multiple high speed accelerations, a minimum of ten minutes of continuous high speed operation, and low speed operation and idling just prior to the completion of the conditioning route. After conditioning, the vehicle shall soak overnight prior to emissions testing on the dynamometer. Portable activity measurement system (PAMS) might be used to compare conditioning differences between vehicles.

Vehicles will be observed for visible smoke during vehicle processing and after the initial dynamometer test. A test will be developed by the contractor for smoke observation as part of the vehicle conditioning process. Based on observations during this test, vehicles will be characterized in the smoker category **(measured by color)**, if appropriate.

Figure 1a - Vehicle Inspection Flow Diagram



3.2.2 Vehicle Testing Procedures and Equipment

Vehicles will be brought to the testing facility randomly for testing by the contractor. No predetermined order for testing should be incorporated. However, if the vehicle pre-inspection does indicate that a vehicle might be a high emitter (due to smoke, smell, etc.), that vehicle shall be tested last in the day. A calibration (or control) vehicle will be used weekly to test the dynamometer system. The contractor shall report the control vehicle weekly results before beginning the next week of vehicle tests. **As part of the Quality Assurance Project Plan (QAPP) and Quality Management Plan (QMP), the contractor shall develop guidelines or standards for vehicle inspections and testing of vehicles.**

3.2.2.1 Dynamometer Testing

Vehicle exhaust emissions testing will occur using the EPA Office of Research and Development (ORD) transportable chassis dynamometer (refer to Section 3.2).

The contractor shall provide a cost break down for both options listed below. EPA will decide during proposal review which option to select.

Scenario A - EPA's ORD provides the dynamometer testing equipment, the contractor operates and is responsible for all costs.

Scenario B - EPA's ORD provides the dynamometer testing equipment and the dynamometer's operation occurs under a separate contract and the contractor needs to coordinate with the contractor operating the dynamometer.

The information in this section is for the contractor's information only. However, the contractor awarded this task order must ensure that data collected **through either option** is integrated into the program.

The EPA dynamometer simulates driving on a Clayton Model CTE-50-0 chassis dynamometer. The dynamometer is capable of simulating a continuous spectrum of loads from three to 50 hp @ 50 mph and inertias from 1750 to 3000 pounds in 250-pound increments and 3000 to 5500 pounds in 500 pound increments. Cooling fluid for the dynamometer's water brake power absorption unit consists of a 50/50 mixture of water and glycol. The fluid is recirculated and cooled by a self-contained pumping and cooling system. Test inertia and hp settings for the dynamometer will be determined from computerized EPA I/M lookup tables and recorded on the vehicle test form.

Vehicles will be operated over the LA92 Unified Driving Cycle (shown in Figure 2). The LA92 cycle will consist of a cold start Phase 1 (first 310 seconds), a stabilized Phase 2 (311 – 1427 seconds), a 600-second engine off soak, and a warm start Phase 3 (repeat of Phase 1 of LA92), PM filter collection will occur separately for phase 1, phase 2, and phase 3.

A positive displacement pump-constant volume sampling (PDP-CVS) system will be used to quantitatively dilute exhaust gas from the vehicle operating on the dynamometer. The PDP-CVS system is constructed of an 8-inch diameter stainless steel dilution tunnel and a SutorBilt Model GAELAPA (6-LP) PDP operating at 500 CFM. Dilution air is treated with a charcoal bed (for HC stabilization) followed by a HEPA filter (99.97% DOP filter efficiency) to remove particles prior to mixing with vehicle exhaust.

During transient testing, the dilution tunnel temperature shall be kept constant at 47±5˚C to prevent loss of volatile PM components from high temperature portions of the driving test cycle and because of the dominance of volatile PM components from low temperature portions of the driving test cycle. Maintenance of a constant temperature will also enable PM instrument sample temperature controls to operate more effectively.

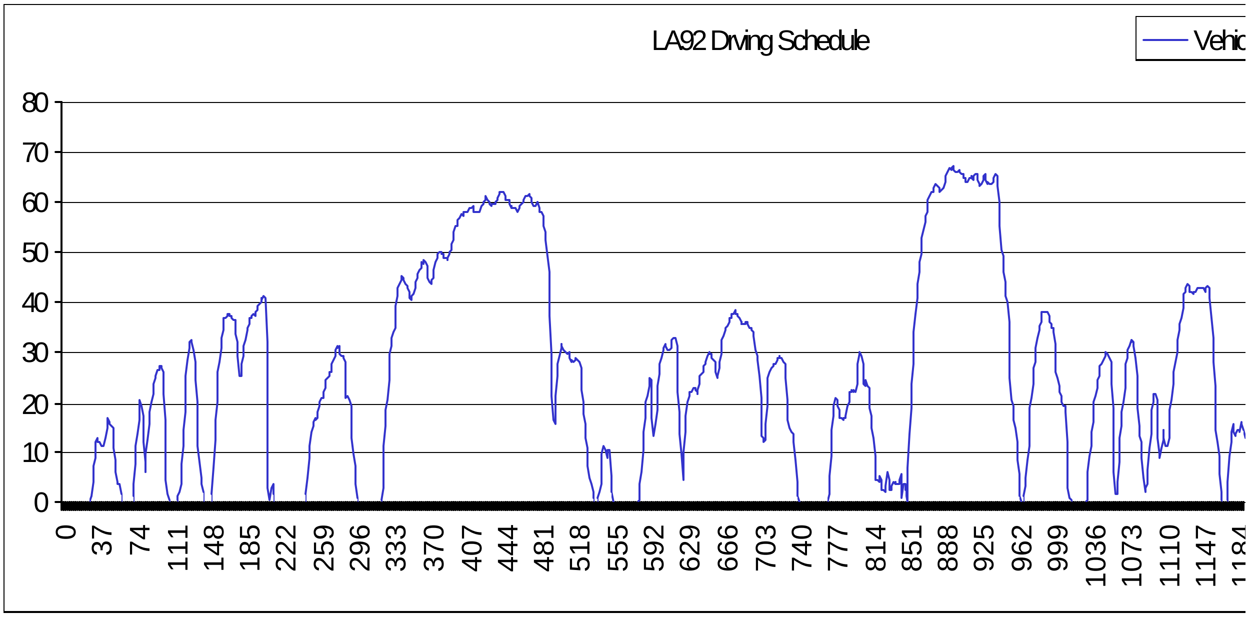


Figure 2. LA92 Driving Cycle.

As part of the tunnel conditioning process, the CVS and tunnel dilution air heater shall be turned on at least ten (10) hours prior to engine start and run to purge the exhaust transfer line and dilution tunnel. Pilot testing results may indicate that less than ten hours is sufficient. Pumps at the analytical bench shall be run at least one (1) hour prior to engine start to purge all sample lines. The CVS, tunnel heater and sample pumps shall be kept running throughout the day and will not be shut down until the conclusion of testing for that day. Testing shall not be started until the temperature in the dilution tunnel has reached a stable value (no increase in temperature over a 3 minute period).

Within two (2) minutes of the start of the initial test of the day, background THC, CO, NO_x, and CO_2 concentrations in the dilution tunnel shall be recorded by the regulated emissions bench operator. These levels shall serve as reference background levels for the tests that immediately follow that day. If prior to the start (within 2 minutes of start) of succeeding tests that day, the background levels measured for that test differ from the reference background by more than ±15%, testing shall be delayed until corrective measures are taken. If the greater than ±15% change in background is due to a change in the ambient background level (not influenced by station exhaust or spillage) and cannot be corrected, the testing may resume with a new set of reference background levels. However, after each test, the ambient background levels shall be monitored by the bench operator so that the reference background levels can be adjusted if ambient levels continue to change.

Background levels of THC from the tunnel filter shall also be monitored by the instrument bench operator for fifteen (15) minutes before the start of a test. If the background level of THC in the dilution tunnel differs by ±15% of the background level of THC after the tunnel filter, the test shall be delayed until tunnel levels are adjusted accordingly.

PDP and ambient temperatures will be monitored with Type K thermocouples coupled to Omega readout meters. Relative humidity and atmospheric pressure are also measured electronically. Vehicle speed will be measured using a digital optical encoder as part of the driver's aid system. The emission measurement system has the capability to measure both continuous and bag emission measurement for the following pollutants (THC, Nox, CO and CO_2). Emission measurements gathered in bags and processed through a GC can be used as a QC procedure to compare to emissions being measured on a continuous basis.

A pentium class computer will be provided by EPA to be used to log real time output signals from the regulated emissions instrumentation and meteorological and speed sensors. The computer is equipped with two A/D boards (Data Translation model numbers DT2801A and DT2821). Each A/D board will provide eight (8) differential analog input channels for recording data and sixteen (16) digital output channels for control of sampling solenoids. The real-time system is controlled by a commercial software package, Labtech Notebook. Labtech Notebook is a menu driven software package used to configure sampling rates, engineering conversion factors, data storage modes, etc., for each sampling and control channel.

3.2.2.2 Vehicle Fluid Sampling

Fuel and oil samples will be collected by the contractor from all feasible vehicles after completion of the dynamometer test(s). Fuel samples from different grades will also be collected from five local gasoline distributors to account for newer vehicles in which fuel samples cannot be collected. The fuel and oil samples will be analyzed for sulfur content, aromatic content, elements (see Section 3.3.2.7), and speciated HCs (see Section 3.3.2.5). Approximately 2-3 ounces of sample will be collected from each vehicle to allow excess sample to be retained by the contractor for a period of two (2) years after completion of the task order for potential future compositional analysis. If EPA requires any samples to be analyzed beyond what is specified in section 3.3.2.7, EPA will pay for shipping cost through a different contract mechanism. Two years after testing has been completed, ownership of samples revert to the contractor. Disposal of samples may be accomplished by taking them to the local recycling station.

3.2.3 Quality Assurance for Vehicle Testing

Dynamometer calibration checks will be performed on a daily basis through a combination of coast-downs and speed calibrations. PDP rpm will also be checked on a daily basis. The dynamometer's torque sensor is calibrated after field set up using dead weight techniques. PM mass and EC tunnel blanks will be collected to ensure no significant background problems for the measurement of regulated emissions.

Second by second data shall be aligned to vehicle tractive power and shall be done through the testing of a vehicle over the test cycle to be used in this test program, the LA92 (Unified Cycle). This process is only necessary during the configuration or reconfiguration of the sampling system. This configuration also includes variations in the sampling pipe from the vehicle to the dilution tunnel. Conceivably, different sampling pipes will require different alignment values. Using parameters for light duty vehicles on a flat (zero grade) roadway this equation can use the following form:

VSP (kW/metric Ton) = 1.04* v*a+ 0.132*v+00.00121*v^3;

where v is in units of m/s and a in m/s/s. This assumes a value for rolling resistance, **aerodynamic** drag, vehicle mass, engine efficiency (the 1.04 coefficient of the v*a term), etc., which will vary from vehicle to vehicle. However, this is sufficient because only timing is being considered.

The contractor shall correlate all the gases to VSP; this is done any time that there is a change in the plumbing or instrumentation. The best correlation between each gas and VSP shall be determined by shifting the emission results in relation to VSP. The time shift for individual analyses shall be the offset used between vehicle's speed and its corresponding emissions.

For the field testing, round-robin comparisons will be made between the transportable dynamometer in Kansas City (ORD's transportable dynamometer) and the EPA laboratory dynamometers in Ann Arbor, MI. Three vehicles will be tested at the Ann Arbor labs **(each vehicle tested in triplicate)** and shipped to Kansas City for testing on the transportable dynamometer. The types of vehicles might include a new, low mileage vehicle; an intermediate mileage vehicle (approximately 50,000 miles); and a high mileage, high emitting vehicle. The contractor shall be responsible for arranging for testing and conducting sample analyses in Kansas City and vehicle shipment to and from Ann Arbor, MI. The contractor will also be responsible for doing sample analyses for the Ann Arbor samples. **EPA will provide the vehicles for the contractor to use during this test program.**

As another possible QA procedure, all vehicles shall pass by a remote sensing device multiple times. The contractor can choose to conduct this testing during the preconditioning route or after emissions testing on the dynamometer. The data will be used to compare with the other continuous emission monitoring devices (PEMS units and the dilution tunnel measurements). The data may also be used to determine the representativeness of the vehicle in relation to the Kansas City regional fleet for HC, CO, and NO_x emissions.

Twenty-five vehicles tested during Round 1 of the program will be re-tested during Round 2 to determine comparability between testing Rounds. These vehicles will be randomly selected from each stratum as shown in Table 5. This data may also provide information on the effect of ambient temperature on PM emissions.

Table 5. Estimated Sample Sizes by Stratum for Round 2 Re-Testing

Stratum (*h*)	Vehicle Class	Age Class	Sample size (n_h)[1]
1	Truck	Pre 1980	3
2	Truck	1980-1990	5
3	Truck	1991-1995	3
4	Truck	1996 and newer	2
5	Car	Pre 1980	2
6	Car	1980 – 1990	3
7	Car	1991-1995	4
8	Car	1996 and newer	3
Total			**25**

[1] Number of randomly selected vehicles tested during Round 1 re-tested during Round 2.

3.2.4 PEMS and PAMS Vehicle Testing.

To advance the Sponsors' understanding of "real world" vehicle operations and emissions and to create realistic airshed models of mobile sources, the contractors shall install PEMS and PAMS units on randomly selected vehicles. EPA will provide technical information on which vehicles will receive the PEMS and PAMS units **(see Appendix C as a reference users manual of a typical PEMS type unit)**. EPA will be looking for a mixture of vehicles as specified in Table 5 and will also target vehicles based on their emission rates and mileage. These devices can record measurements on a second-by-second basis in the following areas: environmental conditions (e.g., ambient temperature, humidity, barometric pressure, etc), vehicle parameters (engine rpm, vehicle speed, air conditioning on, OBD codes, etc), date/time stamp, and emissions (HC, NOx, CO and CO_2). **PEMS has the capability to operate from battery only for 8 hours or for 16 hours with two batteries. For multiple day data gathering would require the recharging of batteries which can occur two ways: recharging by electrical outlet overnight or from the vehicle's electrical system during vehicle normal operating. Fuel to operate the FID analyzer lasts for 8 hours of continuous operation**.

The PEMS and PAMS devices will be installed into the owner's vehicle trunk either at the testing facility or at the owner's home. Installation and removal requires about one hour which includes calibration, quality assuring and quality controlling (QA/QC) the equipment. All calibrations and QA/QC procedures shall be recorded and documented for each vehicle. EPA expects that 10 – 20% of the vehicle's might require an additional hour because of either installation or calibration issues. After installing the PEMS/PAMS device, the vehicle owner operates the vehicle in a normal fashion that would be typical for that day(s). The owner will be required to record in a log a date and time that certain events occurred such as changes in the vehicle's load (e.g., number of passengers in vehicle entered and left the vehicle or other items such as groceries or packages, etc). Installation and removal of the PEMS/PAMS equipment can occur at either the vehicle emission test site **or** at the vehicle owner's home. **The contractor shall provide a strategy for testing vehicles using PEMS/PAMS devices.**

Table 6. Use of PEMS and PAMS Devices.

Type of Device	Number of Days	Number of Vehicles	
		Round 1	**Round 2**
PEMS	**1- 3**	**20** per device (**16** vehicles per week)	**20** per device (**16** vehicles per week)

PAMS	1-7	10 – 12 per device (1 vehicle per week)	10-12 per device (1 vehicle per week)

EPA plans on using **up to** eight PEMS/PAMS devices (depending on which device types are available at the time of testing) on the recruited vehicles to gather either activity or both activity and emissions data during the timeframe specified above. EPA will provide the equipment and training in Kansas City at no cost to the contractor. PEMs devices will be on the vehicle for an average of **three days with some vehicles being repeated to look at the difference between weekday and weekend driving habits.** The maximum amount of data that would be gathered is between **6 - 20** hours with a typical data set consisting of about **2 - 6** hours. PEMS devices will only be used in vehicles that will be operated for at least an hour on that day. The contractor will be responsible for the installation, removal of instrumentation from the vehicle, equipment calibration and maintenance, data storage, maintaining Quality Assurance Project Plan (QAPP) and Quality Management Plan (QMP) procedures and data format conversion (if needed). The contractor will perform a PEMS evaluation comparing second-by-second data between the dynamometer and "real-world" for each vehicle. The contractor might need to provide additional incentives to owners who are selected to have one of these devices installed. PAMS devices will be used to gather "real world" activity of a vehicle so there will be no minimum amount of vehicle use required. **The contractor shall also price the cost of operating PEMS on a per vehicle basis.**

3.2.5 Data Management.

The contractor shall maintain and provide the EPA's Project Officer and all Sponsors with all records associated with vehicle inspection, maintenance, and testing. All vehicle identifiers shall coincide with the identifiers used for vehicle recruitment. Data must be collected for all vehicles recruited to the project, even if the vehicle is not tested.

Data shall be delivered in the input formats for EPA's relational database Mobile Source Observation Data Base (MSOD). The formats are described and defined in Attachment A.1. Delivered tables shall be accurate and complete before they are forwarded to the Sponsors. Any time a significant change or changes to the test program or its software are adopted, the contractor shall again perform a complete comparison of the data from the first affected test vehicle to the .dbf data tables generated for that vehicle (See section 4.2 for further data management issues).

3.3. Sample Analysis.

Chemical and physical analyses of the samples collected during vehicle testing will be required to support the study. Results from the chemical and physical characterization of the exhaust emissions will provide information for the SPECIATE emission factor database, profiles for source apportionment studies, and air toxics emission estimates for trends assessments. Table 7 lists the number of samples that need to be collected. The contractor shall assume that no compositing of samples will be required. However, results of the pilot study may indicate that sample compositing is required. The contractor shall develop as part of the QAPP, a methodology for regularly transferring and review of all data streams within this project. **Not all samples will be analyzed, so the contractor shall propose one or more statistical approaches to choose samples to be analyzed to meet budget limitations. Compound analyses shall be conducted in a timely manner to ensure the integrity of the sample collected. The contractor shall specify the time between sample collection and analysis and the anticipated recovery rate for volatile species. EPA recognizes that results of the project may be used to develop source apportionment profiles. Contractors may compare these profiles with previous studies.**

Table 7. The number of samples to be collected for each testing Round.

Type of Sample	# of vehicles	LA92 Cycles	# of samples per cycle	# of bkgnd per cycle	Total
Integrated Samples					
PM Mass Filters	277	1	3	1	1108
Elements Filters	265	1	0	0	0
EC/OC Filters	277	1	3(*)	1	1108
Ion Filters	265	1	1	0	265
SVOC PUF or denuder & filters	265	1	1	0	265
VOC summa canisters-	265	1	1	0	265
Aldehyde DNPH cartridges	265	1	1	0	265
Continuous Sample Periods					
QCM	277	1	1	1	554
TEOM (Continuous/Integrated)	277	1	2 (LA92 phase 1 & 3 only)	2	1108
EC	277	1	1	1	554
Nephelometer	277	1	1	1	554

[a] The contractor may use the PM mass filter for the elements analysis after weighing for mass.
* EC/OC testing requires two, back-to-back quartz filters for each sample. The backup filter is accounted for as a dynamic filter blank listed in Table 8.

Measurement methods to be used in this project include continuous air monitoring, integrated air sampling, and vehicle fluid grab sampling. Continuous methods for measurement of fine particle mass provide several useful data products as well as immediate feedback about the nature of the emissions from vehicles. These methods are ideally suited to identify the portions of a driving cycle where particulate emissions are greatest and least. Rapid time response is also useful for identifying potential high emitting vehicles and determining the conditioning status of the dilution tunnel. The integrated measurements allow for detailed analysis of chemical components present in the vehicle's exhaust for which no continuous methods exist. Grab samples will be used to identify the composition of the fuel and oil used in each vehicle during testing to assess potential mass balance relationships for specific compound emissions.

PM continuous and integrated air measurements will be extracted from the dilution tunnel through a low particulate loss 2.5 um cut point pre-classifier. The sample shall be isokinetically partitioned among the sample and direct measurement instruments using a sample distribution manifold. Throughout the sample extraction and partition process, the temperature of the sample air just before the PM filter shall be maintained at 47 ± 5˚C to ensure that PM sample loss due to thermophoresis is kept to a minimum.

Sample transport from the partitioning system to the individual instruments and sample collection fixtures shall be through straight, short transport lines. These lines shall be heated to maintain sample temperature. This will ensure that PM sample loss due to diffusion and thermophoresis is kept to a minimum. Sample transport lines shall also be of comparable length.

EPA will be providing equipment for some of the testing to be performed (see Appendix D). The contractor can also submit alternative equipment that they feel is as good or better than what is provided by EPA. The contractor shall justify the use, accuracy and cost of such equipment so that a proper evaluation can be conducted.

3.3.1 Continuous Measurements.

Continuous measurements will be collected for $PM_{2.5}$ (mass and elemental carbon (EC)) and gaseous compounds (NOx, THC, CO_2, and CO). Each method provides useful information on the amount and composition of PM and gaseous emissions from motor vehicles. The contractor will be required to diligently monitor this equipment. Operating methods must be approved by the EPA's Project Officer through the Quality Assurance Project Plan (QAPP) described in Task 1.

Each of the continuous measurement instruments has its own sample environment control. These include control of sample temperature and, in the case of the TEOM, compensation for changes in sample air pressure. In addition, to ensure that sample water gain during the gravimetric analysis is compensated for in the continuous, real-time measurements, sample dew point for the continuous instruments should be controlled to maintain equivalent partial pressures for water.

3.3.1.1 $PM_{2.5}$ Mass.

For continuous $PM_{2.5}$ mass measurements, three methods will be deployed: a quartz crystal microbalance (QCM), a tapered element oscillating microbalance (TEOM), and a nephelometer. The QCM and TEOM records and reports total collected mass (μg) and average concentration (μg/m^3) measured during the specified collection period. The nephelometer reports a derived mass concentration (μg/m^3). Training for operating the QCM will be available to the contractor at no cost with the exception of travel. The training will occur in Kansas City, depending on the contractor's preference.

3.3.1.2 "Elemental" Carbon (EC).

EC concentrations (μgC/m^3) will be continuously measured using an Aethalometer™, the Desert Research Institute (DRI) Photoacoustic Sampler, or an equivalent method. The instrument chosen should have a minimum resolution of 1 second or less; although the contractor may suggest a higher setting to increase the sensitivity of the measurement. **The contractor can submit alternative equipment to be used to measure particulates, however, the equipment needs to have the ability to perform high time resolution measurements so that we can understand the relationship between activity and emission characteristics.**

3.3.1.3 Continuous Gaseous Compound Measurements (see section 3.2.2.1 scenarios)

The measurements listed in this section will be provided under separate contract **if Scenario B is chosen**. The contractor for this RFP must ensure that the data described in this section are integrated into this program.

In addition to PM collection, the EPA transportable dynamometer has a bench capability to measure total hydrocarbons, oxides of nitrogen and carbon monoxide. Total hydrocarbons (THC) will be analyzed with a Horiba model 236-Heated Flame Ionization Detector (HFID). Background THC will be monitored with a second HFID, a Horiba model FIA 34A. Oxides of nitrogen (NOx) will be analyzed with a Horiba Model CLA-220 Chemiluminescent instrument. Carbon monoxide and carbon dioxide will be analyzed with Horiba Model AIA-210/220 infrared (IR) instruments. A third IR instrument, a Horiba model AIA23-AS, will be used for analysis of low (< 1000 ppm) carbon monoxide concentrations. All six instruments are rack mounted and plumbed for introduction of zero, span, and sample gases through the use of solenoid valves and pushbutton controls.

3.3.2 Integrated PM and Gaseous Compound Analyses.

Integrated PM and gas samples will be collected to allow for detailed chemical characterization of exhaust components. Integrated samples for $PM_{2.5}$ mass, elements, EC/OC, ions, SVOCs, and gaseous air toxics will be collected. All analysis extraction and measurement methods must be approved by the EPA's Project Officer through the QAPP.

Filters will require treatment and representative chemical analyses before being used in the study. A minimum of two filters from each lot received from the manufacturers will be analyzed for species to verify that specifications established in the QAPP have been met. Lots will be rejected if they do not pass this acceptance test.

All filters will be individually examined over a light table prior to use for discoloration, pinholes, creases, or other defects. In addition to laboratory blanks, 10% of all samples will be designated as field blanks that follow all handling procedures, but do not undergo actual sampling. Duplicate laboratory analysis will be conducted for every 10 samples. Study protocols call for 10% replicate analyses. These are an important part of the QA/QC program since these are applied to determine replicate precision that allow for calculation of sample uncertainty.

Table 8 lists the anticipated number of blanks to be evaluated for the project. The numbers in Table 8 assume that tunnel blanks are collected at the end of the test day, before the start of the test day, and between each test for PM mass and EC. Ten percent of all samples will have associated field and analytical blanks, while three transportation blanks are evaluated for each shipment (numbers assume one shipment of samples occurs each week). **Not all samples will be analyzed, so the contractor shall propose one or more statistical approaches to choose samples to be analyzed to improve cost effectiveness. Compound analyses shall be conducted in a timely manner to insure the integrity of the sample collected. The contractor shall specify the time between sample collection and analysis and the anticipated recovery rate for volatile species.**

Table 8. Estimated number of blanks to be analyzed during each testing Round.

Type of Sample	Tunnel Blanks	Sample/ Field Blanks	Analytical Blanks	Transport Blanks	Total
Integrated Sample					
PM Mass Filters	332	144	144	36	656
Elements Filters *	0	27	27	36	90
EC/OC Filters †	332	1440	144	36	1952
Ion Filters	0	27	27	36	90
SVOC PUF or denuder & filters	0	27	27	36	90
VOC summa canisters	0	27	27	0	90
Aldehyde DNPH cartridges	0	27	27	36	90
Continuous Sample Periods					
QCM	332	332**	†	n/a	664
TEOM (Continuous/Integrated)	332	332**	†	n/a	664
EC	332	332**	†	n/a	664
Nephelometer	332	332**	†	n/a	664
THC	332	332**	†	n/a	664

* The contractor may use the PM mass filter for the elements analysis after weighing for Mass.
** Using humidified Zero Air.
† Field and analytical blanks are the same.

In addition to acceptance testing, some filters will require pre-treatment before sampling. Quartz-fiber filters may absorb organic vapors with time. Blank quartz-fiber filters used for the assessment of EC/OC will be heated in air for at least three hours at ~900˚C prior to acceptance testing analysis. Sets of filters with levels exceeding 1.5 ug/cm^2 for organic carbon and 0.5 ug/cm^2 for elemental carbon will be re-fired or rejected. Pre-fired filters will be sealed and stored in a freezer at -20˚C prior to preparation for field sampling.

The results of the laboratory filter treatments, chemical analyses, and visual inspections will be recorded in a database with the lot numbers as described in the data management section. A set of filter IDs will be assigned to each lot so that a record of acceptance testing can be associated with each sample.

3.3.2.1 $PM_{2.5}$ Mass.

$PM_{2.5}$ mass measurements will be determined gravimetrically by the collection of particulates on Teflon membrane filters. One filter will be used to collect LA92 Phase 1, cold start emissions, a second filter collecting emissions from LA92 Phase 2, and a third filter for Phase 3 for every vehicle tested. Phase 4 of the LA92 will not be run for this program. Unexposed and exposed Teflon-membrane filters will be used for gravimetric analysis. The filters will be equilibrated at a temperature of 20 ±5 ˚C and a relative humidity of 30±5% for a minimum of 24 hours prior to weighing. Weighing shall be performed on a microbalance with ±0.0001 mg sensitivity. The charge on each filter shall be neutralized by exposure to a polonium source for 30 seconds prior to the filter being placed on the balance pan. The balance operator shall also be grounded during filter measurement. Pre- and post-weights, check weights, and re-weights (if required) will be recorded as described in the data management section. All Teflon filters will be analyzed for mass. If practical, PM mass measurements should be conducted on-site. If on-site measurements are not feasible, shipping and handling of the filters should be minimized to the extent possible. All filters should only be handled in a clean room environment. The contractor shall minimize the amount of handling PM filters (one method for minimizing the handling by the use of cassettes). The contractor might need to use TX40 filters for some high PM emitting vehicles in order to capture these emissions. **A preferred standard for a clean room to measure PM filters is "Class 1000" standard and a balance that can record to a 0.1 microgram. The contractor can propose another system or equipment but will need to show justification for its use.**

3.3.2.2 Elements Analysis.

Chemical analyses will be performed on select Teflon-membrane filter samples that were collected for the $PM_{2.5}$ mass measurements. The contractor may also suggest collecting elements samples on separate filters. At a minimum, the following elements will be measured for these samples: S, Cl, Cr, Calcium, Silicon, Phosphorous, Boron, Na, Al, Copper, Iron, Mn, Ni, Zn, As, Hg and Pb. The contractor must demonstrate minimum detection limits using proposed analytical methods. The contractor may also recommend additional elements to be measured based on the objectives of the program and the measurement methods proposed. The additional elements listed above were important ones that came from the lube oil Comparative Toxicity Study. **Not all samples will be analyzed, so the contractor shall propose one or more statistical approaches for choosing samples to be analyzed to improve cost effectiveness.**

3.3.2.3 Elemental/Organic Carbon Analysis.

The thermal/optical reflectance (TOR) or thermal/optical transmittance (TOT) methods may be used to measure organic (OC) and elemental (EC) carbon. EC and OC will be measured using the pre-fired quartz fiber filters. The contractor shall conduct the EC/OC measurements using one of the two temperature protocols: 1) the IMPROVE temperature/oxygen cycle, or 2) the NIOSH 5040 temperature/oxygen cycle. The contractor shall also provide a cost estimate of running both temperature protocols on a single instrument. **Not all samples will be analyzed, so the contractor shall propose one or more statistical approaches for choosing samples to be analyzed to improve cost effectiveness.**

3.3.2.4 Ion Analysis.

Ion chromatography (IC) or an equivalent method will be used to measure water-soluble chloride (Cl^-), nitrate (NO_3^-), and sulfate ($SO_4^=$).

3.3.2.5 Fine Particles/Semi-Volatile Organic Compounds.

Organic compound samples will be analyzed by gas chromatography/mass spectrometry (GC/MS). XAD coated teflon-impregnated glass fiber filters and glass honeycomb denuders or polyurethane foam (PUF) cartridges are recommended to collect samples for speciated SVOC measurements. The number of filters and denuders required to prevent sample loss will be determined by the contractor, and validated during the pilot study. At a minimum, the contractor shall measure the SVOC compounds listed in Table 12. The contractor should also recommend additional compounds, including methyl- and nitro-substituted PAHs, to be measured based on the objectives of the program and the measurement methods proposed. **Compound analyses shall be conducted in a timely manner to ensure the integrity of the sample collected. The contractor shall specify the time between sample collection and analysis and the anticipated recovery rate for volatile species.**

3.3.2.6 Gaseous Air Toxics.

Gaseous air toxic compounds will be collected by Summa canisters (for VOCs) or DNPH cartridges (for aldehydes and ketones). At a minimum, the contractor shall measure benzene, formaldehyde, acetaldehyde, 1,3-butadiene, acrolein, toluene, ethylbenzene, xylenes (p-,o-,and m-), styrene, n-hexane, napthalene, and MTBE. **Compound analyses shall be conducted in a timely manner to ensure the integrity of the sample collected. The contractor shall specify the time between sample collection and analysis and the anticipated recovery rate for volatile species.**

3.3.2.7 Fuel and Oil Analysis.

Fuel and oil samples will be collected from each vehicle and will be retained by the contractor for a period of two (2) year after completion of the task order for potential future compositional analysis. If EPA requires any samples to be analyzed **beyond what is specified here**, EPA will pay for shipping cost through a different contract mechanism. Two years after testing has been completed, ownership of samples revert to the contractor. At a minimum, the following elements will be measured for these samples: S, Cl, Cr, **Ca, Si, K, B, Na, Al, Cu**, Fe, Mn, Ni, Zn, As, Hg and Pb. The contractor must demonstrate minimum detection limits using proposed analytical methods. The contractor may also recommend additional elements to be measured based on the objectives of the program and the measurement methods proposed. The additional elements listed above were important ones that came from our Comparative Toxicity Study in lube oil. One hundred (100) fuel and oil samples will be selected by the Project Officer to be analyzed. Tables 9 and 10 show analyses to be performed for fuel and oil samples, respectively. **Disposal of samples may be accomplished by taking them to the local recycling station.**

Table 9. Fuel Sample Analyses.

Test	Method
Gravity, API	ASTM D4052
Density, kg/l	ASTM D4052
Reid Vapor Pressure, psi	ASTM D323
Sulfur, Wt %	ASTM D4294
Recovery, vol %	
Benzene, vol %	
Oxygenate, vol % (identify compound(s))	
T50	
T90	
Residue, vol %	
Loss, vol %	
Oxygen, wt %	ASTM D4615
Composition, Aromatics, vol %	ASTM D1319
Composition, Oelfins, vol %	ASTM D1319
Composition, Saturates, vol %	ASTM D1319
Carbon, wt fraction	ASTM E191
Hydrogen, wt fraction	ASTM E191
Hydrogen/Carbon ratio	ASTM E191
Research Octane Number	ASTM D2699
Iron, ppm	Elemental Analysis
Copper, ppm	Elemental Analysis
Tin, ppm	Elemental Analysis
Aluminum, ppm	Elemental Analysis
Boron, ppm	Elemental Analysis
Calcium, ppm	Elemental Analysis
Chloride, ppm	Elemental Analysis
Sulfur, ppm	Elemental Analysis
As, ppm	Elemental Analysis
Cr, ppm	Elemental Analysis
Phosphorous, ppm	Elemental Analysis
Silicon, ppm	Elemental Analysis
Nickel, ppm	Elemental Analysis
Lead, ppm	Elemental Analysis
Magnesium, ppm	Elemental Analysis
Sodium, ppm	Elemental Analysis
Zinc, ppm	Elemental Analysis

Water, % (Karl Fisher)	ASTM D4926
Motor Octane Number	ASTM D2700
Fuel Economy Number/C Density	ASTM E191
C Factor	ASTM E191
Net heating Value, btu/lb	ASTM D3338 or D240

Table 10. Oil Sample Analyses

Test	**Method**
Sulfur Content	ASTM D4294-90
Viscosity, cST 40˚C, kinematic	ASTM D445
Wear Particles, Total Ferrous Particles	ISO 4405
Iron, ppm	Elemental Analysis
Copper, ppm	Elemental Analysis
Tin, ppm	Elemental Analysis
Aluminum, ppm	Elemental Analysis
Boron, ppm	Elemental Analysis
Calcium, ppm	Elemental Analysis
Chloride, ppm	Elemental Analysis
Sulfur, ppm	Elemental Analysis
As, ppm	Elemental Analysis
Cr, ppm	Elemental Analysis
Phosphorous, ppm	Elemental Analysis
Silicon, ppm	Elemental Analysis
Nickel, ppm	Elemental Analysis
Lead, ppm	Elemental Analysis
Magnesium, ppm	Elemental Analysis
Sodium, ppm	Elemental Analysis
Zinc, ppm	Elemental Analysis
Water, % (Karl Fisher)	ASTM D4926
Glycol	**Infrared Analysis FT-IR**
Total Acid Number, mg KOH/g	ASTM D664
Chromium, ppm	Elemental Analysis

3.3.3 Quality Assurance and Quality Control Procedures for Equipment.

The contractor will follow and ensure quality assurance and quality control procedures described below and throughout this statement of work are performed.

- Daily instrument blank. An appropriate blank will be run daily for each instrument. Generally this is run after the calibration check and before any samples are analyzed. This confirms that there is no carryover from the calibration check as well as confirming the blank or zero level of the instrument.
- Daily calibration. All instruments to be used in this study will have calibration checks run a minimum of once each day. These checks will confirm both response factors and retention times for both GC/MS analyses.
- Duplicate laboratory analysis for every 10 samples. Study protocols call for 10% replicate analyses. These are an important part of the QA/QC program since these are applied to determine replicate precision that allow for calculation of sample uncertainty.
- Control samples. The contractor shall analyze a variety of control samples for QA/QC purposes. These include calibration, replicate, collocated and blind QA samples.
- Recovery tests for selected analytes. Recoveries are determined within each sample by the addition of deuterated internal standards prior to extraction. For DNPH analyses internal standards will also be added.
- Determine and report minimum trapping efficiency. True measures of trapping efficiency are nearly impossible to determine due to the challenge of generating an appropriate standard stream of the analyte of interest. A more appropriate method is the use of backup traps to confirm that no quantifiable levels of compounds are getting through the first trap.
- Determine THC, CO, CO_2, NOx and PM from the control vehicle every week. This is done to determine if there is no drift in the dynamometer.

As stated, a number of filter blanks will be evaluated to ensure quality control. Three laboratory control blanks will be evaluated for each filter lot group to ensure accuracy of the laboratory measurement technique. In addition, a minimum of one transport and one field blank will be included with each shipment of filters for analysis. The transport blank will be shipped with each filter group, but not be removed from the shipping containers. The field blank will be removed from the shipping container, and loaded into filter packs, but not be subject to sampling. In addition, daily, dynamic tunnel blanks for PM mass and EC will be collected as described in the Vehicle Testing section.

(The following paragraph is required for both scenarios as specified in section 3.2.2.1) Under separate task order, regulated emission analysis instrumentation will be zeroed and spanned before each test. Calibration gases consisting of a NO in Nitrogen mixture (90.2 PPM NO) and a CO, CO_2, and Propane in air mixture (900 PPM CO, 300 PPM Propane, and 2.54 % CO_2) were obtained from National Welders. Cylinder concentrations will be verified through comparison to NIST standards. Zero air and the FID fuel (60% H2/40% He) will be obtained. CEM zero air is used with a certification of < 0.5 PPM CO, < 1 PPM CO_2, and < 0.1 PPM HC. Multipoint calibrations are performed on all of the regulated emissions analyzers after arrival in the field to confirm their linearity.

A quality control standard and a replicate from a previous batch will be analyzed by the contractor with each set of 10 samples. When a quality control value differs from specifications by more than ± 5% or when a replicate concentration differs from the original value (when values exceed 10 times the detection limits) by more than ± 10%, the samples will be re-analyzed. If further tests of standards show that the system calibration has changed by more than ± 2%, the instrument will be re-calibrated. All results will be recorded as described in the data management section.

3.3.4 Data Management.

All sample analysis data shall be provided to the EPA's Project Officer. Continuous measurements will have time stamps to determine the events occurring during sampling. The contractor shall provide documentation to associate continuous measurements with specific vehicle testing times and conditions. The contractor shall also provide filter identification codes to track and catalog all filter samples collected during the study. The filter identification codes shall allow for the identification of the vehicle(s) tested to obtain the sample. The contractor shall also prepare proper sample handling and tracking procedures (chain of custody) as required by the QAPP.

Data shall be delivered in the input formats for EPA's relational database Mobile Source Observation Data Base (MSOD). The formats are described and defined in Attachment A.1. Delivered tables shall be accurate and complete before they are forwarded to the Sponsors. Any time a significant change or changes to the test program or its software are adopted, the contractor shall again perform a complete comparison of the data from the first affected test vehicle to the .dbf data tables generated for that vehicle (See section 4.0 for further data management issues.) ID Codes shall be established for all samples (not just filters).

Table 11a. Potential instrument configuration for continuous and quasi-continuous measurement of PM.[a]

Instrument Manufacturer	Instrument Type (Measurement)	Sensor Technology	Time Resolution (sec.)	Sensor Operating Environment: Temperature Range (˚C)	Sensor Operating Environment: Sample Flow Rate (Lpm)
QCM, RPM – 101 Booker Systems, UK	Inertial Micro-Balance (PM Mass)	Quartz Crystal/ Frequency Deficit	1	35 to 50	1 to 5
DPM Monitor, 1105a R & P, Albany, NY	Inertial Micro-Balance (PM Mass)	Tapered Element/Filter Frequency Deficit	15	35 to 50	1 to 3.5
Dataram – 4 Thermo MIE, Bedford MA	Nephelometer (PM light Scattering)	Photo Diode/Two Wavelength	1	35 to 50	1 to 2
Aethalometer, AE2 McGee Scientific, Berkeley, CA	Light Absorption (Black Carbon and PAH)	Photo Diode/Light Absorption at 800nm and 370nm	300	20 to 40	5

[a] The instruments listed are an example only, based on the descriptions in Section 3.3. The contractor may propose alternative instruments.

Table 11b. Potential instruments for integral measurement of PM.

Instrument Manufacturer	Instrument Type (Measurement)	Sensor Technology	Suggested Sample Media	Sample Operating Environment: Temperature Range (˚C)	Sample Operating Environment: Sample Flow Rate (Lpm)
Filter Holder 6186 R & P, Albany, NY	Gravimetric Micro-Balance (separate filters for LA92 Phase 1 and LA92 Phases 2-4.(PM Mass)	Gravimetric Micro-Balance	Teflo Filter	35 to 50	50 to 70
Thermo-Optical Carbon Aerosol Lab Analyzer Sunset Laboratory, Forest Grove, OR	Carbon Aerosol Analysis (PM Elemental and Organic Carbon Mass)	FID Detection of Thermaly Liberated CO_2	Pre-Fired Quartz Filter	35 to 50	2 to15
Filter Holder 6186 R & P, Albany, NY	ICP-MS and/or XRF (PM Element Mass)[b]	Analysis Dependent	Teflo Filter	35 to 50	50 to 70
Filter Holder 6186 R & P, Albany, NY	IC and AC (PM Water Soluble Ions)	Analysis Dependent	Quartz Filter	35 to 50	50 to 70
Filter Holder 6186 R & P, Albany, NY	GC/MS (PM SVOC)	Analysis Dependent	XAD-4 Coated Filter	35 to 50	50 to 70
Summa Cannister Anderson Instruments, Atlanta, GA	GC/MS (VOCs)	Analysis Dependent	Summa Cannister	35 to 50	Sample Dependent
DNPH Cartridge Anderson Instruments, Atlanta, GA	GC/MS (Aldehydes and Ketones)	Analysis Dependent	DNPH Cartridges	35 to 50	Sample Dependent

1 See Statement of Work
[a] The instruments listed are an example only, based on the descriptions in Section 3.3. The contractor may propose alternative instruments.
[b] The contractor may use the PM mass filter for the elements analysis.

Table 12. SVOCs Recommended for Analysis[a]

Compound	**Compound**
PAHs	**Steranes**
Naphthalene	20R,5a(H),14b(H),17b(H)-Cholestane
Acenaphthylene	20S,5a(H),14b(H),17b(H)-Cholestane
Acenaphthene	20R,5a(H),14a(H),17a(H)-Cholestane
Fluroene	20R,5a(H),14b(H),17b(H)-Ergostane
Phenanthrene	20S,5a(H),14b(H),17b(H)-Ergostane
Anthracene	22R,5a(H),14b(H),17b(H)-Sitostane
Fluoranthene	22S,5a(H),14b(H),17b(H)-Sitostane
Acephenathrylene	**Hopanes**
Pyrene	22,29,30-Trisnorhopane
Benzo[ghi]fluoranthene	17a(H)-21b(H)-29-Norhopane
Cyclopenta[cd]pyrene	18a(H)-29-Norneohopane
Benzo[a]anthracene	17a(H)-21b(H)-Hopane
Chrysene/Triphenylene	22R&S,17a(H),21b(H)-30-Homohopane
Benzo[k]fluoranthene	22R&S,17a(H)21b(H)-30-Bishomohopane
Benzo[b]fluoranthene	**Resin Acids**
Benzo[j]fluoranthene	Pimaric Acid
Benzo[e]pyrene	Isopimaric acid
Benzo[a]pyrene	Sandaracopimaric acid
Perylene	
Indeno[cd]fluoranthene	8,15-Pimaredienoic acid
Indeno[cd]pyrene	Dehydroabietic acid
Dibenzo[ah]anthracene	7-Oxodehydroabietic acid
Benzo[ghi]perylene	Abieta-6,8,11,13,15-pentae-18-oic acid
Coronene	Abieta-8,11,13,15-tetraen-18-oic acid
Retene	Abietic acid
Saturated Cycloalkanes	**Branched Alkanes**
Dodecylcyclohexane	Norpristane
Tridecylcyclohexane	Pristane
Tetradecylcyclohexane	Phytane
Pentadecylcyclohexane	iso-Nonacosane
Hexadecylcyclohexane	anteiso-Triacontane
Heptadecylcyclohexane	iso-Hentriacontane
Octadecylcyclohexane	anteiso-Dotriacontane

Nonadecylcyclohexane	iso-Hentriacontane

[a] At a minimum, the compounds listed in this Table should be analyzed. The contractor should recommend additional compounds that they believe are important for the program related to emission inventory and source apportionment profile development including, but not limited to, methyl- and nitro-substituted PAHs.

4.0 Quality Assurance Project Plan

4.1 Preparation of Quality Assurance Project Plan and Quality Management Plan

The contractor will submit a draft Quality Assurance Project Plan (QAPP) **and Quality Management Plan (QMP)** to the EPA's Project Officer and to Sponsors for approval within thirty (30) days of task order execution. The plan will detail sample collection and analysis tasks and procedures for the proposed study and be implemented in the pilot study. A final QAPP will be submitted within thirty (30) days after completing the pilot study. Information on completing a QAPP can be found at http://www.epa.gov/quality/qsdocs/r5final.pdf. As part of the QAPP, we are proposing that ten samples collected during each vehicle round (1 & 2) will be analyzed by the contractor and an independent laboratory chosen by the EPA's Project Officer in a round-robin test. Two sample sets will be analyzed for each of the major analyses identified in this statement of work: gravimetric, elements, EC/OC, ions, SVOCs, and gaseous air toxics.

All analysis needs to be completed and reported before Project Officer can approve the start of Vehicle Testing Round 2. The contractor shall address how this will be accomplished in a timely manner to allow for quick data review and program review that includes technical direction by the Project Officer and Sponsors for vehicle testing in Round 2.

The project implementation plan will specify the details required to collect and analyze the source samples in a manner consistent with the objectives of the study. The plan will be developed in consultation with the EPA's Project Officer and Sponsors. The QAPP must be approved by the EPA's Project Officer before the contractor may proceed with sample analysis. The contractor may submit separate QAPPs to obtain approvals for specific tasks to expedite sample analysis for the project. The final QAPP will cover all aspects of this test program as outlined in this document including the following areas:

- provide contractual support in maintaining, calibrating, and operating mobile source emissions measurement equipment used in the field. The equipment may be, but is not limited to, the NERL transportable dynamometer, roadway integrated sampling systems, and remote sensing of vehicle emissions measuring systems (RSDs). The necessary support such as analyzing the collected samples, data processing, and report writing are included.
- pilot programs (including a report on all sample data analyzed)
- vehicle recruitment
- vehicle testing
- speciation
- quality assurance/quality control
- data management and integration
- data analysis
- oral and written reports
- a methodology for regularly transferring and review of all data streams within this project

4.2 Data Management

Data shall be delivered in the input formats for EPA's relational database Mobile Source Observation Data Base (MSOD) and Excel format

The formats are described and defined in Attachment A.1. Delivered tables shall be accurate and complete before they are forwarded to the Sponsors. Any time a significant change or changes to the test program or its software are adopted, the contractor shall again perform a complete comparison of the data from the first affected test vehicle to the .dbf data tables generated for that vehicle.

The level of precision for reporting the data is defined in the table specifications. However, it may be necessary to alter that specification at some time during the test program. Therefore all raw data files shall be preserved and delivered to the Sponsors in the instances that reprocessing becomes necessary.

The contractor shall inform the Project Officer when they believe the specified precision is inadequate or inappropriate. The EPA's Project Officer and the contractor shall then determine what changes in the format are necessary to accurately store the test data for future use in MSOD.

The test program may propagate new data types and coordination between the testing contractor and the EPA's Project Officer will need to occur to accommodate that data. The probable input tables for this statement of work are:

activity_in.dbf
equip_in.dbf
dynob_in.dbf
bag_in.dbf
tmeas_in.dbf
bmeas_in.dbf
time_in.dbf
ttime_in.dbf
trip_in.dbf
rmeas_in.dbf
scan1_in.dbf
scan2_in.dbf
ffbat_in.dbf
tpobd_in.dbf
repar_in.dbf
tmeas_in.dbf
obd_in.dbf

Vehicle information is reported in the table equip_in.dbf. Test level is reported in the tables dynob_in.dbf and tmeas_in.dbf. Phase (bag) level information is reported in the tables bag_in.dbf and bmeas_in.dbf. Second by second data is reported in the tables time_in.prg and rmeas_in.prg.
Any repairs to a vehicle are reported in the table repar_in.dbf.

Before delivery of any test data to the EPA's Project Officer, the Contractor shall process the completed data tables through their quality assurance program. If the contractor chooses to use EPA formats, the EPA's Project Officer shall provide quality control programs to check the data against, EPAVALDATA and SBSCHK.prg. These programs shall check the data table for inconsistencies and errors that would interfere with their loading into EPA OMS/ASD's EF database (MSOD).

If the contractor enters the data by hand into tables, the contractor shall take extra precautions to assure typographical and transcription errors have not occurred.

The testing contractor must identify all tests with a unique test identifier (ctr_tst_id) that shall be no greater than 12 characters in length and a sequential bag number; 1, 2, 3, or 4 for each test phase. All subcontractors shall identify their test results for the appropriate sample using these same identifiers. The subcontractors shall follow the same specifications for data reporting and perform all the quality control steps outlined in this statement of work.

The program EPAVALDATA shall be used to determine the suitability of field level data within the individual tables in the EPA format with some cross level checking of test and vehicle weights. Some examples of fixes to the data tables that are normally found from data submitted to the EPA's Project Officer are: 1) WA_ID names misspelled or not in CAPITAL letters or an incorrect NULL value indicator was used; or 2) the data may exceed upper or lower bounds for table data (records). If this is the case, the contractor must contact the EPA's Project Officer to put through a change in the qc_specs program to allow the results in question to pass data table review. Some data inconsistencies may simply need to be accepted early on in the test program until enough results have been accumulated that an informed decision can be made to resolve them.

The contractor and the EPA's Project Officer and Sponsors shall audit **(review a subset of records in accordance to QAAP and QMP documents)** and report the number of unique records for the total program for each input table. The expected total number final inventory of records for this statement of work given a single LA92 per vehicle + 5% replicates is as follows:

Table name	**Primary Key**	Unique Records	Records per Vehicle	Parent Table	Parent Key Field
Equip_in.dbf	ms_id	480	1	None	None
Repar_in.dbf	ms_id	1 for every repair	0 to many	Equip_in.dbf	equip_in.ms_id
Obd_in	ms_id	1 for every OBD scan	0 to 1	Equip_in.dbf	equip_in.ms_id_id
Scan1_in	Obd_in	1 to many for vehicles with OBDI	0 to many	Obd_in	obd_in.ctr_test_id
Scan2_in	Obd_in	1 to many for vehicles with OBDII	0 to many	Obd_in	obd_in.ctr_test_id
Dynob_in.dbf	Ctr_tst_id	530	Number of Tests Per Vehicle	Equip_in.dbf	Equip_in.ms_id
Bag_in.dbf	Ctr_tst_id and bag_num	1590	Number of Tests Per Vehicle*Number of Non-Core analytes	Dynob_in.dbf	dynob_in.ctr_tst_id
Tmeas_in.dbf	Meas_id and ctr_tst_id	530	Number of Tests Per Vehicle*Number of Non-Core analytes	Dynob_in.dbf	dynob_in.ctr_tst_id
Bmeas_in.dbf	Bag_num, meas_id, and ctr_tst_id	3*The Number of Records in tmeas_in.dbf	3*Number of Tests Per Vehicle*Number of Non-Core analytes	Bag_in.dbf	dynob_in.ctr_tst_id and bag_num
Time_in.dbg	ctr_tst_id and dynosecs	761,610	1437*Number of Tests Per Vehicle	Dynob_in.dbf	dynob_in.ctr_tst_id

Rmeas_in.dbf	Ctr_tst_id, dynosecs,and meastype	The Number of records in time_in*Number of Non-Core analytes	1437*Number of Tests Per Vehicle*Number of Non-Core analytes	Time_in.dbf	dynob_in.ctr_tst_id and dynosecs
Ttime_in.dbf		Depends on Number of PEMS/PAMS units	Depends on Number of seconds in vehicle activity	Trip_in.dbf	Trip_id, ctr_tst_id and tpmeas_dt
Activity_in.dbf		Depends on Number of PEMS/PAMS units	0 to many	Equip_in	Ctr_tst_id
Trip_in.dbf		Depends on Number of PEMS/PAMS units	0 to many	Activity_in.dbf	ctr_tst_id
Fbat_in.dbf	Fbatch_id Ctr_tst_id	100	100	Fbatch	Fbatch_id and ctr_tst_id
Tpodb_in.dbf		1 for every OBD scan	0 to many	Ttime_in.dbf	Trip_id, ctr_tst_id and tpmeas_dt
Ffdat_in.dbf	Fbatch_id		0 to many	Tpobd_in.dbf	Ctr_tst_id, trip_id and tpmeas_dt
Pmeas_in.dbf	Ctr_tst_id, trip_id and tpmeas_dt		Number of seconds Per Vehicle activity *Number of Non-Core analytes	Ttime_in.dbf	Ttime_in.ctr_tst_id

The parent key field of each table must have a corresponding value in the primary key field in the parent table. Records that do not have a corresponding value in the parent table are "orphans" and can be identified with the program orphanid.prg.

Data reported on a second by second basis shall be integrated and cross-checked against any data of the same kind that is mechanically integrated using phase (bag) level techniques using the program sbschk.prg. All second by second data or phase level data that is derived from its integration shall be visually inspected for alignment and inappropriate transients (spikes and drop outs).

The EPA's Project Officer and Sponsors shall audit one in ten vehicle test data records for its own assurance of test data quality. The results of each review shall be published for the contractor's review and comment. Any error found shall be addressed as an action item between the Contractor and EPA's Project Officer. The EPA's Project Officer will inform the Sponsors and ask for their technical advice before contacting the Contractor.

5.0 TASKS

5.1 Quality Assurance Project Plan (QAPP) and Quality Management Plan (QMP) Task

The contractor shall provide a Draft QAPP **and QMP** thirty (30) days after task order issuance for review by the EPA's Project Officer and Sponsors. The contractor shall incorporate all feasible comments received before the pilot testing begins.

A final QAPP **and QMP** will be submitted within thirty (30) days of completing the pilot test program for use in both Rounds 1 and 2 of the vehicle test program. The QAPP shall conform to the EPA ANSI/ASQC E-4 standard and should have an appendix containing all applicable standard operating procedures (SOPs).

The contractor shall adhere to all applicable SOPs and the QA/QC procedures recommended therein. Applicable SOPs are available for the transportable dynamometer, sampling equipment and procedures, RSDs, and analytical chemistry. The contractor shall notify the EPA's Project Officer immediately if they encounter any equipment failures that cannot be readily remedied by the contractor, or technical problems that may impact the quality or on-time receipt of deliverables, or if any required equipment or supplies are unavailable to accomplish the required work under this task order.

5.2 Vehicle Recruitment Tasks

The contractor will provide vehicle recruitment services to the project. The contractor shall submit monthly progress reports, and conduct the tasks defined as follows:

5.2.1 Vehicle Recruitment Pilot Study

The contractor shall conduct a pilot study in KCMA to evaluate recruitment methods and incentive packages to identify the adequacy of the proposed recruitment process.

5.2.2 Cohort/Vehicle Analysis

Identify a cohort of private individuals or residences for recruitment of vehicles to the dynamometer emissions testing program in the Kansas City Metropolitan Area (KCMA). The cohort should consist of a minimum of 1,000 members who possess a minimum of 2,000 total vehicles. The cohort shall consist of a sociodemographically diverse population. The total vehicle population shall include the minimum number of vehicles required for each of the six stratum identified in Table 1 of this statement of work. **(Note: Specific guidelines have not been established on what constitutes a "diverse" population. In general, the contractor shall ensure that multiple ethnicities and socioeconomic classes are included in the project. The contractor shall also ensure the demographic data is obtained for all respondents.)** The following subtasks shall be performed for the selected cohort.

5.2.2.a Cohort Frame Analysis

The contractor shall identify the listing(s) or frame(s) from which the cohort was recruited. The contractor shall provide, in report form, a description of the list(s) or frame(s), to cover the following topics: (1) list type and availability, i.e., publicly available, commercially available, etc.,(2) underlying sources from which the list(s) were compiled, e.g., phone directories, etc., (3) pricing (cost for obtaining information, lists, gathering and analyzing the information), (4) restrictions on availability, use or publication, and (5) any additional topic(s) that the contractor considers pertinent in the context of the PM emissions study.

5.2.2.b Cohort Recruitment (Respondent/Non-Respondent) Analysis

The contractor shall provide a description of the process through which the cohort was recruited, to cover the following topics: (1) design of the cohort, including stratification and sampling methods, (2) whether selection probabilities varied among individual members or subgroups within the cohort, based on the design, (3) the response rate achieved during the recruitment process, and whether non-response adjustments would be appropriate for analysis of data collected from the cohort, (4) availability of contact information and descriptive information for non-respondents to the cohort and (5) any additional topic(s) that the contractor considers pertinent in the context of the study. As part of this task, the contractor shall provide the EPA Project Officer with access to the vehicle registration database for the KCMA within fifteen (15) days of task order issuance.

5.2.3 Cohort/Vehicle Fleet Analysis

Compare the distribution of vehicles, by age and class, in the cohort fleet to the Kansas City metropolitan area fleet. The contractor shall determine the representativeness of the cohort fleet to the regional fleet. The contractor shall use parametric or non-parametric statistical tests to make comparisons, as appropriate. For any test applied, the contractor shall provide a retrospective estimate of the power of the test **(Note: Power refers to an analytical process used on all analyses using standard accepted techniques for the statistics used).** The contractor shall also compare the cohort and Kansas City fleets to the national fleet characteristics, as feasible.

5.2.4 Cohort/Vehicle Emission Analysis

Compare exhaust emissions of HC, NOx, and CO from the cohort fleet to the KCMA fleet. The contractor shall determine the comparability of the cohort fleet emissions distribution to the regional fleet by comparing exhaust emissions from cohort and non-cohort vehicles using remote sensing devices (RSDs) in Kansas City. The contractor shall use parametric or non-parametric statistical tests to make comparisons, as appropriate. For any test applied, the contractor shall provide a retrospective estimate of the power of the test. The contractor shall detail the data being collected and the methods of comparison.

5.2.5 Cohort/Vehicle Summary Analysis

Prepare a report that summarizes the chosen cohort for the emissions testing program, based on socio-demographic characteristics, and compares the cohort fleet, based on vehicle characteristics and emissions, to the regional and national fleets. The report shall also include the items listed in Section 3, as well as a discussion of potential sampling or non-sampling biases that may result from using the cohort as the recruitment population for the emissions testing program.

5.2.6 Vehicle Recruitment Sample Plan

Design a sampling plan for the random selection of 480 vehicles to be tested for exhaust emissions using the EPA dynamometer. For Round 1, 170 vehicles will be recruited from the cohort and 80 vehicles will be recruited from the cohort non-response families. Round 2 vehicle testing will consist of another 230 different vehicles from the cohort and 25 vehicles recruited from Round 1 for re-testing. The plan shall target a stratified sample as identified in Table 1 of this statement of work. This task shall not commence until the contractor has received written approval from the EPA's Project Officer. If use of the registration sample for recruitment will result in different costs, the contractor shall note these costs in their proposal.

5.2.7 Vehicle Recruitment

5.2.7a Vehicle Recruitment (Round 1)

The contractor shall recruit vehicles to the emissions testing program for Round 1 of the project using the sampling plans developed for Task 5. The contractor shall retain, at a minimum, the following information for all persons recruited to the program, whether they participate or not: (1) contact information, (2) location of residence, (3) any socio-demographic description information available for the residence or individual, emphasizing indicators listed in 5.2.2 above, (4) the date, time and mode of each attempted contact, and (5) the outcome of each attempted contact. This task shall not commence until the contractor has received written approval from the EPA's Project Officer.

5.2.7b Vehicle Recruitment (Round 2)

The contractor shall recruit vehicles to the emissions testing program for Round 2 of the project using the sampling plans developed for Task 5. The contractor shall retain, at a minimum, the following information for all persons recruited to the program, whether they participate or not: (1) contact information, (2) location of residence, (3) any socio-demographic description information available for the residence or individual, emphasizing indicators listed in 5.2.2 above, (4) the date, time and mode of each attempted contact, and (5) the outcome of each attempted contact. This task shall not commence until the contractor has received written approval from the EPA's Project Officer.

5.2.8 Non-Response Assessment

As part of the recruitment process, eighty (80) people who did not positively respond to the initial request to participate in the cohort will be randomly selected. These owner's vehicles will be recruited to the program to assess any potential bias in results from the recruitment of volunteers to the study. A list of non-respondent criteria will be developed with approval from EPA's Project Officer and Sponsors. The number of vehicles to target in each strata for the non-response analysis is shown in Table 3 (section 3.1.3).

5.2.9 Participation Incentives

Incentives will be required for study participants. Potential incentives include rental cars, cash, free gasoline, free vehicle repairs, and free cleanup of participant vehicles. The contractor shall develop recruitment package(s) that will achieve a high participation rate to the study from the randomly chosen subjects (both cohort participants and non-respondents, if applicable).

5.2.10 Post Round 1 Vehicle Analysis

After the completion of Round 1 vehicle testing, the contractor shall provide to the Project Officer and the Sponsors all the results (emission results (only the PM mass filter and regulated emission), data analysis, any issues, technical directions or concerns that occurred) for their review. Based on the results of Round 1 recruitment strata and/or testing procedures might need to be adjusted before the start of vehicle testing

(Round 2). The contractor shall not start Round 2 of vehicle testing without prior approval from the Project Officer.

5.3 Vehicle Testing Task

The contractor shall provide vehicle testing services to the project for the pilot and intensive field study. The contractor shall submit **monthly** progress reports, and conduct the tasks defined as follows:

5.3.1 Pilot Vehicle Testing Task

The contractor for this program will conduct a pilot test in the Kansas City area to determine and finalize all testing methodologies, quality assurance and quality control procedures, and data management procedures. For the pilot test program, three vehicles, a newer vehicle, intermediate aged and mileage vehicle and a high emitter, will be tested a minimum of three times each on an EPA fixed-site dynamometer in Ann Arbor, MI and on the transportable EPA dynamometer located in Kansas City. All vehicle testing and sample analysis procedures described in Section 3.2 and 3.3, respectively, will be conducted for the pilot test study. Within one month after completing the pilot study, the contractor shall complete a report that includes emission rates obtained for regulated pollutants and PM from any vehicles tested during the pilot study. This report shall be submitted to the EPA's Project Officer and Sponsors for use in evaluating results obtained in the pilot study. The fuel and oil used at Ann Arbor, MI testing facilities will be shipped with the vehicles for use in Kansas City. The contractor will provide a determination by conducting an experiment or series of experiments to determine if 10 hours of tunnel purging (tunnel fans on) is needed to achieve a stable tunnel operation (this pertains to tunnel wall loss or entrainment issues) or if other methods that could achieve goal but cost less.

5.3.2 Vehicle Testing Task (Specialized sampling and analytical needs)

The contractor shall complete development and implement the capability to collect and speciate gaseous and PM organic and PM inorganic samples during any field study involving the transportable dynamometer. Emission rates of these compounds using the equipment listed in Table 11 shall be reported in units of grams per mile (g/mile).

5.3.3 Vehicle Testing Task

The contractor shall provide a cost break down for both scenarios listed in section 3.2.2.1 including the following sub-tasks listed below.

5.3.3.1 Protective Covering for Equipment and Test Vehicles: The contractor shall provide protection of the testing equipment and the recruited vehicles from the elements during participation in the study **but is not required to be heated**.

5.3.3.2 Vehicle Testing and Data Collection: Vehicles scheduled for testing will be conditioned, cold soaked overnight, then tested using the cold start, LA-92. For the cold-start tests, regulated emissions will be measured over three phases of the test cycle by integrating the real-time data. Dilute exhaust bag samples for each of the three test phases and one background bag sample shall be collected from the CVS for comparison with the integrated THC measurement (FID) and for on- and off-site GC analysis. Programming of equipment and design of the experiment shall be such as to enable separate PM samples to be drawn from each of the four separate phases of the LA-92 driving schedule. All tests should be scheduled so that a minimum of five vehicles per day can be tested.

5.3.3.3 RSD Evaluation: The contractor shall evaluate exhaust emissions of the test vehicles for NOx, HCs, and CO using RSD during the conditioning process of the vehicle and/or immediately after dynamometer testing. An alternate approach is to use second by second data from the Unified Cycle emissions measured on the chassis dynamometer.

5.3.3.4 Vehicle Fluid Sampling: The contractor shall have selected vehicle's fuel and oil samples analyzed and report the results to the Project Officer and Sponsors. The contractor shall also have KCMA fuel samples analyzed and report the results to the Project Officer and Sponsors. The contractor will provide cost estimates for gathering, shipping (if any) and analysis for both fuel and oil on a per sample basis and for each methodology listed in section 3.3.2.7.

5.3.3.5 PEMS / PAMS Data: The contractor shall report data obtained in the study to EPA's Project Officer and Sponsors. Data shall be delivered in the input formats for EPA's relational database MSOD and in Excel Spreadsheets. A separate cost estimate for each round of vehicle testing will be provided on a per vehicle basis for each PEMS and PAMS measurement. A separate cost estimate will also be provided for the use of PAMS during the vehicle conditioning route on a per vehicle basis.

5.3.3.6 Reports: The contractor shall report data obtained in the study to the EPA's Project Officer using Excel spreadsheets that have been approved by the EPA's Project Officer for compatibility with their data system. If needed, the original Excel and Lotus data files can be converted to a dbf format. The contractor shall report to the EPA's Project Officer the status of equipment following its assembly in the field and prior to its use in the study.

Upon completion of the study (within two months following testing), The contractor shall submit a draft final report to the EPA's Project Officer and Sponsors detailing their work in the study. Tables will be included showing accepted and rejected vehicle IDs with OMB2060-0078 or ICR 0619.08 questionnaire information, visible smoke observations, and emission rates for regulated pollutants and PM. The draft report shall be submitted for approval by all study participants.

5.4 Speciation Tasks

5.4.1 Pilot Methods Testing Task

The contractor will review, document, and change if necessary, all procedures, methods, and sample analyses to ensure proper sampling handling and emission measurements for the testing program. The contractor shall update the QAPP to represent any changes in the procedures or methods resulting from the pilot study. The contractor will provide and prepare sampling equipment and sampling substrates required for the collection of the samples listed in Table 7 during the pilot study.

5.4.2 Source Testing Equipment Preparation Task

The contractor will provide and prepare sampling equipment and sampling substrates required for the collection of the samples listed in Table 7. The contractor will pre-test the continuous and integrated sampling equipment prior to installation at the pilot testing site to ensure proper operation and familiarity by field personnel. The contractor will provide personnel to operate the samplers and collect and store each sample.

5.4.3 Operating Continuous Measurements of Fine PM Task

The contractor will provide and operate real-time monitors for the measurement of fine particle mass and fine particle elemental carbon as shown in Table 11. The contractor shall also provide estimates of mass and

EC concentrations collected during dynamic tunnel blank sample collection to evaluate the condition of the dilution tunnel before conducting tests on the next vehicle. The contractor shall submit separate cost estimates for operating and analyzing data for each equipment type as follows:

5.4.3.1 QCM
5.4.3.2 TEOM
5.4.3.3 Nephelometer
5.4.3.4 EC

5.4.4 Integrated Sample Collection and Sample Analyses Task

The contractor shall collect samples on each vehicle tested, and conduct laboratory analyses on the number of samples as shown in Table 7.

5.4.5 Integrated Sample Analyses Task

The contractor shall perform sample analyses for integrated PM mass, EC/OC, elements, ions, SVOC's, and gaseous air toxics based on a percent of the sample estimates shown in Table 7. The contractor shall collect samples for all vehicles tested, as shown in Table 7. All samples not analyzed shall be stored in a freezer and be retained by the contractor for a period of two (2) year after completion of the task order for potential future compositional analysis. If EPA requires any samples to be analyzed **beyond what was required in this task order**, EPA will pay for shipping cost through a different contract mechanism. Two years after testing has been completed, ownership of samples revert to the contractor. The contractor shall provide cost estimates for these tasks on a per vehicle/sample basis **for the following: 1) the analysis of only fifty (50) vehicles between Rounds 1 and 2 combined; and 2)** total costs for testing all vehicles in Rounds 1 and 2 of the project. Costs for $PM_{2.5}$ mass gravimetric analysis shall be given for all vehicles only. **The contractor can propose to do composites and composite samples may be approved by the PO. Each composite sample shall be considered as one sample. Any analytical preparation costs should be included as a lump sum in this task. The contractor may want to review the literature since these compounds have been measured in previous vehicle emission studies and some are referenced in this document. The contractor needs to provide per sample and bulk sample costs to determine potential economies of scale in multiple sample analyses. If there are no cost differences, the proposed pricing should reflect this.**

The costs shall be provided based on the compounds analyzed as follows:

5.4.5.1 $PM_{2.5}$ Mass Gravimetric Analysis.

Three filter samples will be collected and analyzed for each vehicle tested. Costs for $PM_{2.5}$ mass gravimetric analysis shall be given for all vehicles only.

5.4.5.2 Elements.

One filter sample will be collected for each vehicle tested (three if the $PM_{2.5}$ mass filters are used for this analysis). The number of samples to be collected is shown in Table 7. The contractor may use the filters collected and analyzed for $PM_{2.5}$ mass for this task. The contractor will indicate their ability to measure these elements within both fuel, oil and PM samples and the sensitivity of the measurement technique(s) (e.g. 10 namograms per mile) that they propose to use. The contractor should indicate their knowledge of measurement techniques.

5.4.5.3 EC/OC.
One sample will be collected for each vehicle tested. The number of samples to be collected is shown in Table 7.

5.4.5.4 Ions.
One sample will be collected for each vehicle tested. The number of samples to be collected is shown in Table 7.

5.4.5.5 Semi-Volatile Organic Compounds.
One sample will be collected for each vehicle tested. The number of samples to be collected is shown in Table 7. The contractor shall analyze, at a minimum, the compounds listed in Table 8. The contractor should also recommend additional compounds that they believe are important for the program related to emission inventory and source apportionment profile development. **EPA recognizes that results of the project may be used to develop source apportionment profiles. Contractors may compare these profiles with previous studies.**

5.4.5.6 Gaseous Air Toxics.
One Summa canister and DNPH sample will be collected for each vehicle. The number of samples to be collected is shown in Table 7.

5.4.6 Data Analysis Task.
The contractor will compile analyzed data into a validated database that will be made available to the EPA's Project Officer. Data validation procedures will be included in the QAPP.

5.4.7 Analysis of Continuous PM and EC Data Task.
The continuous particulate measurements will be made available promptly for the relevant personnel attached to the project. The data will be provided in individual files pertaining to a given day of measurement in the case of ambient sampling, or to a particular vehicle in the case of source sampling. The data will be calibrated to an agreed upon standard of pressure and temperature. The data will be time averaged and accumulated over the entire sampling period and will be compared with filter-based measurements.

5.4.8 Maintenance of Emission Equipment Task
The contractor shall maintain, calibrate, and operate all emission equipment except the transportable dynamometer to make real-world vehicle emissions measurements in the field and laboratory. The other equipment may include but not be limited to RSDs and other PM equipment used in conducting roadside, tunnel air pollution studies and PEMS/PAMS. The contractor shall repair the equipment on an as needed basis. However, any modification of the equipment must be approved in writing by the EPA's Project Officer.

5.4.9 Health, Safety and Environmental Practices Task The contractor shall comply with all federal health and safety, environmental, waste handling, and other applicable work rules. The contractor shall also follow proper laboratory, field testing, and vehicle testing practices for all work required by this task order.

6.0 Reporting Requirement and Deliverables
The contractor shall address and report all data and technical issues required in Sections 2 through 5 of this task order. A draft final report shall be prepared and submitted electronically and in hard copy. Once the draft report is approved, the final report shall be submitted to the EPA project officer. Documents shall be prepared

using a version of Microsoft Word or comparable systems when feasible or unless otherwise specified in the task order. Electronic media materials delivered to the EPA's Project Officer and Sponsors shall be provided on 3 1/2" disks, CD-R, DVD-R or hard-drive. Copies of all written deliverables shall, to the extent possible, be double-spaced copies, and shall be delivered in reusable/recyclable envelopes. The contractor shall develop and maintain files supporting the requirements of each task.

6.1 Test Project Workplan

The contractor shall deliver to the EPA's Project Officer and Sponsors for approval that includes all descriptions, cost, responsibilities, schedules described in this document including:

- Pilot vehicle testing
- Quality assurance project plan
- Vehicle recruitment plan
- Participate in on-going communications to develop a work plan and coordinate action items and scheduling. Deliver monthly reports summarizing activities and costs.
- Report repairs needed as a result of any evaluation of the dynamometer.
- Prepare a project implementation plan within four weeks of task order approval.
- Prepare a draft final technical report of study results
- Complete a revised technical report

6.2 Other Deliverables

Other reports or meetings dealing with problems or special situations that may arise shall be requested through technical direction from EPA's Project Officer.

7.0 Meetings and Technical Direction

A kick-off meeting to discuss this Project with EPA's Project Officer and Sponsors will be held. Meetings to review data and analyses will be held on an as needed basis. The Project Officer is authorized to provide technical direction, which clarifies the Statement of Work as set forth in this task order. Before accepting any action under technical direction, the contractor shall ensure that the technical direction falls within the scope of work for this task order. Technical direction will be confirmed in writing, by the EPA's Project Officer, within five calendar days after verbal issuance. The EPA Project Officer will forward a copy to the respective Sponsors' representatives. Technical directions must be within the scope of the task order and the Statement of Work. Technical direction includes (1) direction to the contractor which assists it in accomplishing the Statement of Work, and (2) comments on and approval of reports and other deliverables. The Contracting Officer is the only person authorized to make changes to this task order. Any changes must be approved by the Contracting Officer in writing, as a modification to the task order. Upon issuance of written technical direction, the contractor shall submit for inspection copies of all work in progress at any time under this task order.

8.0 Schedule:

Final Project Workplan	**March 5, 2004**
Draft Quality Assurance Documents	**March 20, 2004**
Pilot Vehicle Testing	**April 20, 2004**
Final Quality Assurance Documents	**May 19, 2004**
Vehicle Recruitment Plan (including cohort evaluation)	**May 19, 2004**
Begin Vehicle Recruitment (Round 1)	**June 4, 2004**
Begin Vehicle Testing (Round 1)	**June 18, 2004**
End Vehicle Testing (Round 1)	**August 18, 2004**
Interim Report on Round 1	**September 18, 2004**
Begin Vehicle Recruitment (Round 2)	**January 3, 2005**
Begin Vehicle Testing (Round 2)	**January 18, 2005**
End Vehicle Testing (Round 2)	**March 30, 2005**
Draft Final Report	**June 15, 2005**
Final Report	**August 15, 2005**

If the contractor is not comfortable with the schedule listed, the contractor should propose an alternative schedule and describe their rationale for this change.

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Appendix A.1
Mobile Source Observation Data Entry Instructions
for Kansas City PM Vehicle Testing

<u>GENERAL REQUIREMENTS:</u> The contractor shall in general fill out the data tables completely and as best they are able using the supporting documentation and tables.. If they have questions they should contact the project officer (PO) to receive guidance. If the contractor believes the categories presented are inadequate or incorrect they shall, in consort with the PO, define new categories for the data entry. If the value is nor known or cannot be known the fields appropriate null value shall be taken from the table qc_specs.dbf.

<u>VEHICLE/EQUIPMENT INFORMATION:</u>

Vehicle/equipment information is data which is required by the equipment procurement data table, equip_in.dbf and shall be recorded as soon as a piece of equipment is in contractor's custody. The equip_in.dbf data table shall be delivered to the project officer along with the test data. Its fields shall be populated as follows:

$ The vehicle's (not the engine's) serial number or VIN shall be entered into the field equip_in.veh_ms_id. The serial number for a piece of nonroad equipment is generally imprinted on a metal plate which is attached to the unit. It is generally preceded by "S/N" or some similar designation. The field retains its "veh" , or vehicle, designation to signify mobile source versus engine-only information within our database.

$ The engine's serial number shall be entered into the field equip_in.eng_ms_id. The serial number for an engine is generally imprinted on a metal plate which is attached to the block. It is generally preceded by "S/N" or some similar designation.

$ "KC_PM" shall be entered in the field equip_in.wa_id.

$ The date and time of day the equipment was received into Contractor's custody shall be reported in the field equip_in.test_date and equip_in.test_tod, respectively.

$ The contractor's unique test engine/equipment identifier for in-house tracking purposes shall be reported in the field equip_in.ctr_tst_id.

$ An appropriate value for the site shall be selected from the table site.site and be reported in the field equip_in.site.

$ The allowable values for equipment procurement methodologies to be used in this contract are located in the field procmeth.procmeth from the procmeth.dbf table. The field procmeth.procmeth_d. in this same table describes each of the allowable values. The correct value for each piece of equipment tested shall be reported in the field equip_in.procmeth.

$ The value "YES" shall be recorded in the field equip_in.highway for a piece of equipment (a vehicle, truck or bus) which is intended for highway operation and "NO" for non-road equipment.

$ A short description of the purpose or use of a piece of test equipment or the equipment platform from which a test engine was derived shall be recorded in the field equip_in.purpose. If this information is not known or cannot be determined, i.e, a test engine not associated with an equipment platform, the value “NULL" shall be entered in this field.

$ “2201020110" shall be entered for the LDT1, and “2230070000" for the type 2B trucks shall be entered into the field equip_in.scc. In the case of a non-road piece of equipment an appropriate values shall be selected from the scc.scc.

$ If the equipment to be tested has an odometer at the time of procurement, the odometer’s value shall be entered into the field equip_in.proc_odom. If the equipment does not have an odometer, then the contractor shall enter “0 “ in this field.

$ The number of hours of engine operation as displayed on the engine hour meter shall be recorded in the field equip_in.hour_meter. If it is known that the engine hour meter on a particular test engine is malfunctioning or if the hours of operation cannot be determined from a direct reading of the engine hour meter, then the value “0” shall be recorded in the equip_in.hour_meter field. However, if a “good faith” estimate of the number of hours of engine operation can be obtained from the owner/operator of a particular piece of equipment, that estimate shall be rounded to the nearest 10 hours and entered into the equip_in.hour_meter field.

$ “DIES” shall be entered into the field equip_in.fueltype for equipment which is powered by diesel fuel and ”GAS” for equipment powered by gasoline.

$ The vehicle manufacturer’s name shall be selected from the field company.company from the table company.dbf and entered into the field equip_in.vehcompany.

$ The engine manufacturer’s name shall be selected from the field company.company from the table company.dbf and entered into the field equip_in.engcompany.

$ The vehicle’s nominal engine displacement in cubic inches shall be entered in the field equip_in.disp_cid. If the engine displacement is labeled in liters or cubic centimeters this field shall be reported as “0".

$ The vehicle’s engine displacement in liters shall be entered in the field equip_in.disp_liter. If the engine displacement is labeled in cubic centimeters that value shall be multiplied by 1000, and reported to the nearest tenth of a liter. If the engine displacement is labeled in cubic inches this field shall be reported as “0".

$ The allowable values for the method of fuel delivery for a vehicle are found in the field fuel_del.fuel_deliv and their description in the field fuel_del.fuel_del_d. The correct fuel delivery code for the vehicle shall be reported in the field equip_in.fuel_deliv. The vehicles in this contract will all probably have fuel injection, “FI” or carburated “CARB”.

$ The correct fuel injection method for the unit shall be reported in the field equip_in.fi_type. The allowable values to indicate the type of fuel injection are found in the field fi_type.fi_type in the fi_tytpe.dbf table and are described in the field fi_type.fi_type_d. All of the equipment procured under this contract is expected to be described as “DIRECT”, “PFI” (Port Fuel Injection), “TBI” (Throttle

Body Inject) though "INDIR" shall be used, as appropriate.

$ The allowable values to describe the process by which intake air enters the engine for combustion are found in the field aspirate.aspirated in the table aspirate.dbf and are described in the field aspirate.apirate_d. The correct value for the engine to be tested within the equipment shall be reported in the field equip_in.aspirated.

$ The number of cylinders in the engine to be tested is recorded in the field equip_in.cylinder.

$ The allowable values to describe the type of catalyst which is present on the vehicle are located in the field cat_type.cat_type in the table cat_type.dbf and are described in the field cat_type.cat_type_d. The correct value shall be reported in the field equip_in.cat_type.

$ A brief description as to the configuration of any emission control system equipment present in the test unit shall be entered into the equip_in.ecs_descpt field (up to 50 characters).

$ The allowable values to indicate that the catalyst control configuration is close loop are "YES" or "NO". It assumed that the target vehicles in this contract that all the SI vehicles shall be "YES" and all the CI vehicles shall be "NO". The appropriate value shall be reported in the field equip_in.closedloop.

$ An appropriate value indicating the vehicle class shall be selected from vehclass.vehclass and recorded in the field equip_in.vehclass.

$ The equipment's model year will be reported into the field equip_in.model_yr in the 4-digit century inclusive format. If this information is not known, the value "0" shall be entered in this field.

$ The vehicle make shall be recorded in the field equip_in.make.

$ The vehicle model name given to the vehicle by the vehicle manufacturer shall be entered into the field equip_in.model_name.

$ The equipment build date shall be recorded in the date field equip_in.v_bld_date. The format shall be MM/DD/YY. If the actual date is not reported on the equipment or in supporting literature about the particular unit, then the build date shall be reported as MM/15/YY. If the build date cannot be determined, the null date value shall be reported by leaving the field blank.

$ The engine build date shall be recorded in the date field equip_in.e_bld_date. The format shall be MM/DD/YY. If the actual date is not reported on the engine or in supporting literature about that particular engine, then the build date shall be reported as MM/15/YY. If the build date cannot be determined, the null date value shall be reported by leaving the field blank.

$ The number of fuel tanks on the piece of equipment shall be reported in the field equip_in.fueltanks. If this information is not known, the value "0" shall be entered in this field.

$ The equipment's total fuel capacity is recorded to the nearest gallon in the field equip_in.tank_cap. Fuel capacity is to be determined by the following hierarchy; labeling found directly on the physical tank(s), OEM service manual, replacement part manual(s), owner's manual, and as a last resort a drain and fill of all the unit's tank(s). If this information can not be determined, the value "0" shall be entered in this field.

$ The engine exhaust emission certification family designation shall be recorded in the field equip_in.eng_fam. If this information can not be determined, the value "NULL" shall be entered in this field.

$ The engine evaporative emission certification family designation shall be recorded in the field equip_in.evap_fam. If this information can not be determined, the value "NULL" shall be entered in this field.

$ The allowable values for the equipment drive train description are found in the field drv_trn.dvr_trn of the table drv_trn.dbf and are described in the associated field dvr_trn.drv_trn_d. The correct value for the unit's drive train shall be reported in the field equip_in.drv_trn.. If this information is not known, the value "NULL" shall be entered in this field.

$ The engine series or product line name shall be entered into the field engine.engseries. If this information is not known, the value "NULL" shall be entered in this field.

$ An appropriate value for engine service class shall be selected from eng_clas.eng_class and shall be recorded in the field equip_in.eng_class. If this information is unknown or cannot be determined, the value "NULL" shall be entered in this field.

$ The engine model year shall be recorded in the field equip_in.eng_mod_yr. If the actual date is not reported on the engine or in supporting literature about that particular engine, the value "0" shall be recorded in the field. In general the SI vehicle model_year shall correspond with the engine model year. That assumption may not hold however with the CI vehicles. If this information is not readily apparent leave the field blank.

$ The type of aftercooling found on the engine shall be reported in the field equip_in.cooling. If the engine is not equipped with an aftercooling device, then "NONE" shall be recorded. If it is not known whether the engine has aftercooling as normally configured, the value "NULL" shall be recorded.

$ The method of fuel injection shall be recorded in the field equip_in.fi_meth The allowable values for fuel injection method are found in the field fi_met.fi_meth in the table fi_meth.dbf and are described in the field fi_meth.fi_meth_d.. While most diesel engines are covered by the DI and IDI values, the contractror is encouraged to identify the fuel injection method as specifically as possible. If this information is unknown or cannot be determined for the test engine, the value "NULL" shall be entered in this field.

- $ The engine manufacturer-specified fuel injection pressure for the fuel injection system, if present, on the test engine shall be recorded in the field equip_in.fi_press. If this information is unknown, the value "NULL" shall be entered in this field.

- $ The value "YES" shall be recorded in the field equip_in.except if there is anything which is known to be or is obviously exceptional about an engine or piece of test equipment which would cause the test unit to be an outlier in most statistical analyses involving the equipment or engine. Otherwise, the value "NO" shall be recorded in the equip_in.except field.

- $ A brief description of the quality or qualities which would make an engine or piece of test equipment exceptional shall be entered in the field equip_in.ex_comm. This field is used in conjunction with the equip_in.except field. Otherwise, the equip_in.ex_comm field shall be left blank.

- $ If an engine or piece of test equipment is to be tested with a particulate trap or filter in place, then the value "YES" shall be recorded in the field equip_in.parttrap otherwise the value "NO" shall be recorded instead. If this information is unavailable or cannot be determined, then the value "NUL" shall be entered in the equip_in.parttrap field.

- $ The value "4" shall be recorded in the field equip_in.eng_cycl for engines with a four cycle system. The value "2" shall be recorded for engines with a two cycle system.

- $ The engine manufacturer's specified maximum power value (in units of brake-specific horsepower) at rated engine speed shall be recorded in the field equip_in.ratedpower. If this information is unknown or cannot be determined from the engine or in supporting literature about that particular engine, the value "0" shall be recorded in the field.

- $ The engine manufacturer's specified rated engine speed (in units of rpm) shall be recorded in the field equip_in.ratedspeed. If this information is unknown or cannot be determined from the engine or in the service information about that particular engine, the value "0" shall be recorded in the field.

- $ The engine's peak torque shall be reported in foot -pounds into the field equip_in.peaktorque.

- $ The engine's speed where peak torque is obtained shall be reported in rpms into the field equip_in.peakspeed.

- $ The engine's fuel rate at peak torque speed in lbs per hour shall be reported into the field equip_in.peakfrate.

- $ The engine's fuel rate at rated speed in lbs per hour shall be reported into the field equip_in.ratedfrate.

- $ The engine manufacturer's specified engine speed (in units of rpm) for engine idle operation shall be recorded in the field equip_in.idle_rpm. If this information is unknown or cannot be determined from the engine or in supporting literature about that particular engine, the value "0" shall be recorded in the field.

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$ If the number of times that the test engine has been rebuilt is known or can be determined, that number shall be recorded in the field equip_in.rebuild_ct. If this information is unknown or cannot be determined from the engine or owner/operator, then the null value "99" shall be recorded in the field.

$ The date of the last engine rebuild shall be recorded in the field equip_in.rebuild_dt. If the last rebuild date cannot be determined or no rebuild has occurred the field shall be left blank.

$ For the last rebuild of the test engine only, if the reason that the test engine was rebuilt is known or can be determined, then that reason shall be described in the field equip_in.rebuildwhy. If the reason is unknown or cannot be determined or if the engine has never been rebuilt, then the equip_in.rebuildwhy field shall be left blank.

$ A brief description of the technical configuration and capabilities, power take-off, power "bulge", etc., of the test equipment/engine and shall be recorded in the field equip_in.tech_confg. If this information cannot be determined for the test equipment/engine or if the relevant information has already been reported elsewhere in another field , then the equip_in.tech_confg field shall be left blank.

$ A brief description of any electronic interface which may connect the equipment's speed/torque controls with an engine component which commands torque directly from the engine shall be recorded in the field equip_in.elec_cont. If this information is unknown or cannot be determined for the test equipment/engine or if the equipment has no electronic controls, then the equip_in.modifs field shall be left blank.

$ Any significant post-OEM additions or modifications made to the test equipment/engine shall be described in the field equip_in.modifs. If this information is unknown or cannot be determined for the test equipment/engine, then the equip_in.modifs field shall be left blank.

$ The allowable values to categorize a vehicle's transmission are found in the field tran_typ.tran_type. The correct value for the vehicle shall be reported in the field equip_in.tran_type.

$ The number of fuel injectors per cylinder shall be reported in the field equip_in.injectors. Typical values are as follows "0" for carbureted engines, "1" for most SI and CI engines, etc.

$ This represents what method, if any, was used to introduce supplemental air into the exhaust stream. Legal values are found and defined by AIR_INJ translation table. "NO" shall be recorded in the field equip_in.air_inj when no supplemental air was introduced. Other legal values are listed below:

"YES" - Has air injected
"PUMP" - Air injected by pump
"PULSE" - Air injected by pulse

$ The allowable values to indicate the catalyst control configuration are "YES" or "NO". The correct value for the vehicle shall be reported in the field equip_in.closedloop. If this information is not known, the value "NUL" shall be entered in this field.

$ "SI" shall be reported for spark ignition engines and "CI" shall be reported for compression ignition in the field equip_in.ignition.

$ "NUL" shall be recorded in the field equip_in.overdrive.

$ "NUL" shall be recorded in the field equip_in.creeper.

! "NUL" shall be recorded in the field equip_in.lockup.

! "NULL" shall be reported in the field equip_in.gears.

! For the FTP test vehicles, Vehicle Curb weight, (as defined ' CFR86.082-2) is the weight of the vehicle with all fluids at their nominal (full) capacity, including fuel. The value is not the same as the equivalent test weight. There is, however, an exception for "incomplete" vehicles in the above CFR quote. A chassis destined to become a camper is an example of such a vehicle. In the case of an "incomplete" curb weight is specified by the manufacturer. The contractor shall follow the definition where it applies. In general vehicle curb weight shall be determined by weighing the vehicle and adding an estimated additional weight that would occur if the vehicle's fuel tanks were full. That value shall be reported in the field equip_in.curbweight. For computational purposes, the default weight for a gallon of gasoline fuel shall be 6.1 pounds. "999999" shall be entered into the field equip_in.curbweight for the I/M240 test vehicles.

! If the vehicle has air conditioning "YES" shall be entered into the field equip_in.ac. If the vehicle has no air conditioning, then "NO" is entered. If you do not known if the vehicle has air conditioning, "NUL" shall be entered into the field equip_in.ac.

! An appropriate value shall be selected from the field canister.canister and entered into the field equip_in.canister.

! If there is no exhaust gas recirculation, the value entered in the field equip_in.egr shall be "NO". If the engine has exhaust gas recirculation, the value shall be "YES". If its is unknown the value entered shall be "NULL".

! "NULL" shall be reported in the field equip_in.egr_type only if the equip_in.egr field contains either a "NO" or "NUL". If the engine hasexhaust gas recirculation then either "HOT" for hot air recirculation, "COOLED" for cool air recirculation shall be reported in the equip_in.egr_type.

! The gross vehicle weight rating (GVWR) shall be entered into the field equip_in.gvwr.

! The gross combined weight rating (GCWR) shall be entered into the field equip_in.gcwr.

! The field equip_in.comments shall be used to identify/explain anything a vehicle was rejected from the test program. Otherwise the fields shall be left blank.

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- The ownership of the vehicle shall be reported into the field equip_in.ownership. The legal values are either "PRIVATE" - privately owned vehicle; "RENTAL" - rented vehicle; or "GOVT" - owned by local, state, or federal government.

- Where the vehicle is stored shall be reported into the field equip_in.depot. The legal values shall be selected from the table site.site.

- The engine's NOx certification standard shall be reported into the field equip_in.cert_nox.

- The engine's PM certification standard shall be reported into the field equip_in.cert_pm.

TEST FUEL BATCHES:

Test fuel properties are stored in the fields of the table fbat_in.dbf. Each fuel batch shall if know shall have its own unique record and is populated as follows;

- The laboratory fuel batch identifier shall be recorded in field fbat_in.fbatch_id.

- If the fuel manufacture has provided the laboratory a unique identifier for the test fuel that shall be recorded in the field fbat_in.mfg_batch.

- If the test fuel is a fuel oil its centane number as measured by ASTM D 613 shall be recorded in the field fbat_in.cetane_num, otherwise "0" shall be entered into the field.

- If the test fuel is a fuel oil its centane index as measured by ASTM D 976 shall be recorded in the field fbat_in.cetane_idx. If it is not the value 0 shall be entered.

- If the centare number was increased by a "cetane improver" the amount of improvement is recorded in the field fbat_in.cetane_imp. If no cetane improver was use "0"shall be recorded in the field fbat_in.cetane_imp.

- The name of the "cetane improver", if used shall be recorded in the field fbat_in.cetane_typ. If no cetane improver was used the "NONE" shall be reported in the field fbat_in.cetane_typ.

- The concentration of sulfur in the test fuel in ppm shall be reported in the field fbat_in.sulfur.

- If an additive was used to increase the amount of sulfur in the test fuel the additive's chemical name shall be entered into the field fbat_in.sulf_agent.

- The concentration of nitrogen in the test fuel in ppm shall be reported in the field fbat_in.nitrogen. If it is not known the value "99999" shall be entered into the field.

- The mass percent of total aromatics as measured by ASTM D 5185 shall be reported in the field fbat_in.tarom.

- The mass percent of mono-cyclic aromatics as measured by ASTM D 5185 shall be reported in the field fbat_in.marom.

- The mass percent of poly-cyclic aromatics as measured by ASTM D 5185 shall be reported in the field fbat_in.parom.

- The test fuel's distillation properties as measured with ASTM D 86 shall be entered into the appropriate fields of fbat_in.IBP, fbat_in.t10, fabatch.t50, fbat_in.t90, fbat_in.ep, fbat_in.residue, fbat_in.loss, and fbat_in.recovery.

- The test fuel's relative density as specific gravity at 60˚F shall be entered into the field fbat_in.spec_grav.

- The test fuel's relative density as Degrees API at 60˚F shall be entered into the field fbat_in.api_grav.

- The test fuel's viscosity in centistokes as measure by ASTM D 455 at 100˚F shall be entered into the field fbat_in.viscosity. If the viscosity is unknown or the fuel is a gasoline the value "0" shall be entered into the field.

- The test fuel's flashpoint in ˚F and as measured by ASTM D 93 shall be recorded in the field fbat_in.flash. If it is unknown the value "9999" shall be entered into the field.

- The test fuel's pour point in ˚F and as measured by ASTM D 97 shall be recorded in the field fbat_in.pour. If it is unknown the value "9999" shall be entered into the field.

- The test fuel's hydrogen to carbon ratio on a mole to mole basis shall be reported in the field fbat_in.hcratio. If the ratio is unknown the value "9.999" shall be entered into the field.

- The test fuel's oxygen content on a weight percent basis shall be reported in the field fbat_in.oxygen.

- The compound contributing the oxygen on the test fuel shall be reported in the field fbat_in.oxy_type. If there is no oxygen in the test fuel that "NONE" shall be reported in the field fbat_in.oxy_type.

- The weight percent of any additive package added to the fuel, other than cetane improvers, shall be reported in the field fbat_in.adddditives. If the fuel is a gasoline the field shall be left blank.

- The test fuel's lubricity in grams and as measured by ASTM D 6078 shall be entered into the field fbat_in.lubric_g. If it is unknown the value "99999" shall be entered.

- The test fuel's lubricity in millimeters of scar wear and as measured by ASTM D 6079 shall be entered into the field fbat_in.lubric_mm. If it is unknown the value "9.99" shall be entered.
- The test fuel's net heat of combustion in BTUs/pound of fuel shall be reported in the field fbat_in.heat.
- If the fuel is a diesel fuel, the test fuel's ash expressed in weight percent and as measured by ASTM D 482 shall be reported in the field fbat_in.ash.
- "0" shall be recorded in the field fbat_in.mon and fbat_in.ron fi the fuel is a diesel fuel. If the fuel is a gasoline the motor octane will be entered in the former and the research octane shall be entered in the latter.
- If the fuel is a gasoline the its RVP shall be recorded in the field fbat_in.rvp. If it is a diesel fuel the value "99.9" shall be entered.
- The grams of carbon per pound of test fuel in dry air shall be reported in the field fbat_in.fen_c.
- The weight fraction carbon of the test fuel shall be reported in the field fbat_in.wgt_fractn.
- The aromatic content of the test fuel in volume percent and as measured by ASTM D 1319 shall be reported in the field fbat_in.comp_aroma.
- The olefin content of the test fuel in volume percent and as measured by ASTM D 1319 shall be reported in the field fbat_in.comp_olefn.
- The saturate content of the test fuel in volume percent and as measured by ASTM D 1319 shall be reported in the field fbat_in.comp_sat.
- If the test fuel is the certification gasoline "60" shall be reported in the field fbat_in.fuel_id. If the test fuel is the certification diesel fuel "96" shall be reported in the field fbat_in.fuel_id. If the fuel is tank fuel the field dyno_in.fuel_id shall be "0".
- "KC_PM" shall be entered in the field equip_in.wa_id.
- The cloud measurement of the test fuel shall be reportin the field fbat_in.cloud.

<u>FTP LABORATORY TESTING</u>: The FTP shall be run as a three phase test. The laboratory test level information shall be reported in the table structure headed by dyno_in.dbf for laboratory values and are to be populated for the tests as follows:

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- ! The laboratory test identifier shall be recorded in field dyno_in.ctr_tst_id.
- ! "FTP" shall be reported in the field dyno_in.test_proc.
- ! "KC_PM" shall be entered into the field dyno_in.wa_id.
- ! "FTP" shall be reported in the field dyno_in.sched_id.
- ! The initial FTP shall have the value .F. entered into the field dyno_in.replicate. The second FTP for the test vehicles shall have the value .T. entered into the field dyno_in.replicate.
- ! If the test fuel is the certification gasoline "60" shall be reported in the field dyno_in.fuel_id. If the test fuel is the certification diesel fuel "96" shall be reported in the field dyno_in.fuel_id. If the fuel is tank fuel the field dyno_in.fuel_id shall be "0".
- ! The value entered into equip_in.veh_ms_id for this vehicle shall be reported in the field dyno_in.ms_id.
- ! The test date and time of day shall be reported into the fields dyno_in.test_date and dyno_in.test_tod respectively following the format specified for them.
- ! "ANNARBOR" shall be reported in the field dyno_in.site if tests were performed in Michigan. If test were performed in Kansas City then "KANSASCITY " shall be reported.
- ! 75 ˚F shall be reported in the field dyno_in.nom_temp.
- ! 50 grains of water per pound of dry air at 60 ˚F shall be reported in the field dyno_in.nom_humid.
- ! "0" shall be entered into the field dyno_in.disable.
- ! FTP composite emissions (' 86.144-90) for THC, CO, NOx, and CO2 shall be reported in the fields dyno_in.thc, dyno_in.co, dyno_in.co2, and dyno_in.nox.
- ! FTP composite fuel economy in miles per gallon shall be entered into the field dyno_in.mpg.
- ! The vehicle's ETW shall be entered into the field dyno_in.testwght.
- ! The dynamometer's indicated road load horse power at 50 miles per hour shall be entered into the field dyno_in.road_hp.
- ! "NO" shall be entered into the field dyno_in.ac_hp.

- An appropriate value shall be selected from the dynotype.dynotype and shall be entered into the field dyno_in.dynotype.

- The vehicle's odometer reading at the start of the test shall be entered into the field dyno_in.odometer.

- The appropriate value to represent the tests preconditioning be selected from the field precond.precond and shall be reported in the field dyno_in.precond.

- The ambient temperature in degrees F at the start of the test shall reported in the field dyno_in.int_temp.

- The barometric pressure in inches of mercury at the start of the test shall be entered into the field dyno_in.init_baro.

- The humidity in grains of water per pound of dry air at the start of the test shall entered into the field dyno_in.init_humid.

The field dynob_in.resultgrp shall be left blank.

FTP composite emissions (' 86.144-90) for methane shall be reported in the table format tmeas_in.dbf. The fields shall be populated as follows:

- "METHANE" shall be reported as tmeas_in.meas_id if being measured.

- The laboratory test id shall be reported in the field tmeas_in.ctr_tst_id and the same as that in dyno_in.ctr_tst_id.

- The composite methane emissions in grams per mile shall be reported in the field tmeas_in.measure.

FTP dynamometer brake horse power hours shall be reported in the table format tmeas_in.dbf. The fields shall be populated as follows:

- "BHPH" shall be reported as tmeas_in.meas_id.

- The laboratory test id shall be reported in the field tmeas_in.ctr_tst_id and the same as that in dyno_in.ctr_tst_id.

- The amount of work performed by the vehicle ,as measured by the dynamometer for the entire test shall be reported in the field tmeas_in.measure in units of brake horsepower hours.

For SI vehicles the test level total particulate ('86.110-90) shall be reported in the table format tmeas_in.dbf. The fields shall be populated as follows:

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- “PMT_CFR110" shall be reported as tmeas_in.meas_id.
- The laboratory test id shall be reported in the field tmeas_in.ctr_tst_id and the same as that in dynob_in.ctr_tst_id.
- Test level emissions in milligrams per mile for the particulate emissions shall be reported in the field tmeas_in.measure.

Bag (phase) level test data shall be reported for laboratory values in the table format bag_in.dbf where the fields shall be populated as follows:

- The bag (phase) number, “1” , “2" or “3" shall be reported in the field bag_in.bag_num.
- The laboratory test id used for the test level information shall be reported in bag_in.ctr_tst_id and the same as that in dyno_in.ctr_tst_id.
- The average barometric pressure in inches of mercury shall be reported in the field bag_in.bag_baro.
- The average test cell temperature in degrees F shall be reported in the field bag_in.bag_temp.
- The average test cell humidity in grains of water per pound of dry air at 60 ˚F shall be reported in the field bag_in.bag_humid.
- The total simulated distance traveled by the vehicle per phase in miles shall be reported in the field bag_in.bag_dist.
- Total hydrocarbon shall be reported as grams per mile in the field bag_in.bag_thc.
- Carbon monoxide shall be reported as grams per mile in the field bag_in.bag_co.
- Carbon dioxide shall be reported as grams per mile in the field bag_in.bag_co2.
- Oxides of nitrogen shall be reported as grams per mile in the field bag_in.bag_nox.
- The vehicle’s fuel consumption in miles per gallon per phase shall be reported in the field bag_in.bag_mpg.

The phase (bag) level methane emissions shall be reported in the table format bmeas_in.dbf. The fields shall be populated as follows:

- The phase (bag) number shall be reported in the field bmeas_in.bag_num.

- "METHANE" shall be reported as bmeas_in.meas_id if measured.

- The laboratory test id shall be reported in the field bmeas_in.ctr_tst_id and the same as that in dyno_in.ctr_tst_id.

- The phase (bag) methane emissions in grams per mile shall be reported in the field bmeas_in.measure.

The phase (bag) level amount of work exerted by the dyno in brake horsepower hour emissions shall be reported in the table format bmeas_in.dbf. The fields shall be populated as follows:

- The phase (bag) number shall be reported in the field bmeas_in.bag_num.

- "BHPH" shall be reported as bmeas_in.meas_id.

- The laboratory test id shall be reported in the field bmeas_in.ctr_tst_id and the same as that in dyno_in.ctr_tst_id.

- The phase (bag) work performed by the dynamometer in brake horsepower hour shall be reported in the field bmeas_in.measure.

For SI vehicles the phase (bag) level total particulate ('86.110-90) shall be reported in the table format bmeas_in.dbf. The fields shall be populated as follows:

- The phase (bag) number shall be reported in the field bmeas_in.bag_num.

- "PMT_CFR110" shall be reported as bmeas_in.meas_id.

- The laboratory test id shall be reported in the field bmeas_in.ctr_tst_id and the same as that in dynob_in.ctr_tst_id.

- Test level emissions in milligrams per mile for the particulate emissions shall be reported in the field bmeas_in.measure.

Second by second emission data for the laboratory test measurement shall be reported in the table format time_in.dbf where the fields shall be populated as follows:

- The accumulated test time in seconds shall be reported in the field time_in.dynosecs.

- The laboratory test id shall be reported in the field time_in.ctr_tst_id and the same as that in dyno_in.ctr_tst_id.

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- The average speed for the measured unit of time (1 second) shall be reported in miles per hour in the field time_in.speed.

- The simulated distance traveled by the vehicle for the measured unit of time (1 second) in miles shall be reported in the field time_in.dist.

- Total hydrocarbon for the measured unit of time (1 second) shall be reported in grams per second in the field time_in.r_thc.

- Carbon monoxide for the measured unit of time (1 second) shall be reported in grams per second in the field time_in.r_co.

- Oxides of nitrogen for the measured unit of time (1 second) shall be reported in grams per second in the field time_in.r_nox.

- Carbon dioxide for the measured unit of time (1 second) shall be reported in grams per second in the field time_in.r_co2.

- Total hydrocarbon accumulated to this time in grams shall be reported in the field time_in.w_thc.

- Carbon monoxide accumulated to this time in grams shall be reported in the field time_in.w_co.

- Oxides of nitrogen accumulated to this time in grams shall be reported in the field time_in.w_nox.

- Carbon dioxide accumulated to this time in grams shall be reported in the field time_in.w_co2.

- The phase number shall be reported in the field time_in.test_phase.

The second by second level amount of work exerted by the dyno in brake horsepower hour emissions shall be reported in the table format rmeas_in.dbf. The fields shall be populated as follows:

- The accumulated test time in seconds shall be reported in the field rmeas_in.dynosecs.

- "BHPH" shall be reported as rmeas_in.meas_id.

- The laboratory test id shall be reported in the field rmeas_in.ctr_tst_id and the same as that in dyno_in.ctr_tst_id.

- The phase (bag) work performed by the dynamometer in brake horsepower hour shall be reported in the field bmeas_in.rep_meas.

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FTP PEMS TESTING:
The test level information shall be reported in the table format road_in.dbf for PEMS values and are to populated for the as follows:

- The laboratory test identifier shall be recorded in field road_in.ctr_tst_id. This must be different from that used in the laboratory delivery tables and unique overall.
- “DROVE" shall be reported in the field road_in.test_proc.
- ”KC_PM” shall be entered into the field road_in.wa_id.
- The initial FTP shall have the value .F. entered into the field road_in.replicate. The second FTP for the test vehicles shall have the value .T. entered into the field road_in.replicate.
- The same value use to populate the field dynob_in.fuel shall be used to populate the field road_in.fuel.
- The value entered into equip_in.veh_ms_id for this vehicle shall be reported in the field road_in.ms_id
- The test date and time of day shall be reported into the fields road_in.test_date and road_in.test_tod respectively.
- “0” shall be entered into the field road_in.disable.
- AFTP" shall be reported in the field road_in.route.
- A unique identifier for the specific version and model of SEMTECH shall be entered into the field road_in.instrsys.
- The vehicle’s ETW shall be entered into the field road_in.actweight.
- The average ambient temperature in degrees F shall be reported in the field road_in.avg_temp.
- The average humidity in of water per pound of dry air at 60 ˚F shall be reported in the field road_in.avg_humid.
- The average barometric pressure in inches of mercury shall be reported in the field road_in.avg_baro.
- The vehicle’s odometer reading at the start of the test shall be entered into the field road_in.odometer.
- The appropriate value, selected from precond.precond, to represent the tests preconditioning shall be reported in the table road_in.precond.

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- Total test time in minutes, including the ten minute soak shall be entered into the field road_in.timeonroad.
- The total test distance in miles for the FTP shall be entered in to the field road_in.distance.
- The total work performed by the engine. calculated by SEMTECH, and in brake horsepower hours shall be entered into the field road_in.totalwork.
- “0” shall be entered into the field road_in.gallons.
- The phase emissions in grams for THC shall be reported in the field road_in.w_thc.
- The phase emissions in grams for CO shall be reported in the field road_in.w_co.
- The phase emissions in grams for CO_2 shall be reported as in the field road_in.w_co2.
- The phase emissions in grams for O_2 shall be reported as in the field road_in.w_o2.
- The phase emissions in grams for NO_x shall be reported as in the field road_in.w_no.

Bag (phase) level test data shall be reported for SEMTECH values in the table format phase_in.dbf where the fields shall be populated as follows:

- The laboratory test identifier shall be recorded in field phase_in.ctr_tst_id and the same as that in road_in.ctr_tst_id.
- The bag (phase) number, “1” , A2" or A3" shall be entered into the field phase_in.phase_no.
- The average ambient temperature in degrees F shall be reported in the field phase_in.avg_temp.
- The average humidity in of water per pound of dry air at 60 ˚F shall be reported in the field phase_in.avg_humid.
- The average barometric pressure in inches of mercury shall be reported in the field phase_in.avg_baro.
- Total test time in minutes, including the ten minute soak shall be entered into the field phase_in.timeonroad.
- The total test distance in miles for the FTP shall be entered in to the field phase_in.distance.
- The total work performed by the engine, as calculated by SEMTECH, and in brake horsepower hour shall be entered into the field phase_in.totalwork.

- The gallons of fuels for this phase shall be entered into the field phase_in.gallons.
- The phase emissions in grams for THC shall be reported in the field phase_in.w_thc.
- The phase emissions in grams for CO shall be reported in the field phase_in.w_co.
- The phase emissions in grams for CO_2 shall be reported as in the field phase_in.w_co2.
- The phase emissions in grams for O_2 shall be reported as in the field phase_in.w_o2.
- The phase emissions in grams for NO_x shall be reported as in the field phase_in.w_no.
- The start emissions shall be reported as "YES" in the field phase_in.start_emis for phase 1 and 3. The start emissions shall be reported as "NO" in the field phase_in.start_emis for phase 2.
- AAMBT" shall be reported in the field phase_in.veh_state for phase 1, AOPERA" shall be reported in the field phase_in.veh_state for phase 2, and ATRANS" shall be reported in the field phase_in.veh_state for phase 3.

Second by second emission data for the SEMTECH shall be reported in the table format rtime_in.dbf where the fields shall be populated as follows:

- The laboratory test id shall be reported in the field rtime_in.ctr_tst_id and the same as that in road_in.ctr_tst_id.
- The accumulated test time in seconds shall be reported in the field rtime_in.roadsecs.
- The phase number shall be reported in the field rtime_in.phase_no.
- The average vehicle speed for the measured unit of time (1 second) shall be reported in miles per hour in the field rtime_in.roadspeed.
- The average engine vehicle speed for the measured unit of time (1 second) shall be reported in rpm in the field rtime_in.enginerpm.
- The average engine torque for the measured unit of time (1 second) shall be reported in foot pounds in the field rtime_in.roadtorque.
- The average ambient temperature for the measured unit of time (1 second) shall be reported in degrees F in the field rtime_in.roadtemp.

- Total hydrocarbon for the measured unit of time (1 second) shall be reported in grams per second in the field rtime_in.r_thc.

- Carbon monoxide for the measured unit of time (1 second) shall be reported in grams per second in the field rtime_in.r_co.

- Oxides of Nitrogen for the measured unit of time (1 second) shall be reported in grams per second in the field rtime_in.r_no.

- Carbon dioxide for the measured unit of time (1 second) shall be reported in grams per second in the field time_in.r_co2.

- Oxygen for the measured unit of time (1 second) shall be reported in grams per second in the field rtime_in.r_o2.

LA92 - LABORATORY TESTING: The LA92 shall be run as a three phase test. The test level information shall be reported as the same as the FTP data in the table format dyno_in.dbf for laboratory values except that;

- "LA92" shall be reported in the field dyno_in.test_proc.

- The appropriate value for the preconditioning, "505HS", "LA4" or "FTP", shall be reported in the field dyno_in.precond depending on if any preconditioning was performed to keep the vehicle "fully warmed."

- The LA92 is a three phase (bag) test with physical bags, therefore the test level emissions and the phase (bag) level emissions for THC, CO, NOx, and CO_2 are equivalent and shall be reported the same in dyno_in.dbf and bag_in.dbf respectively. "1, 2 or 3" shall be reported in the field bag_in.bag_num.

- Second-by-second data shall be reported the same as for an FTP.

LA92 - SEMTECH TESTING:
The test level information shall be reported in the table format road_in.dbf for SEMTECH values and are same as the FTP data except that;

- "LA92" shall be reported in the field road_in.route.

- The total test distance in miles for the LA92 shall be entered in to the field road_in.distance.

- The road_in.gallons value shall be the same value entered into the field phase_in.gallons.

- LA92 emissions in grams for THC in the field road_in.w_thc shall be reported the same as the emissions reported in phase_in.w_thc.

- LA92 emissions in grams for CO in the field road_in.w_co shall be reported the same as the emissions reported in phase_in.w_co.

- LA92 emissions in grams for CO_2 in the field road_in.w_co2 shall be reported the same as the emissions reported in phase_in.w_co2.

- LA92 emissions in grams for O_2 in the field road_in.w_o2 shall be reported the same as the emissions reported in phase_in.w_o2.

- LA92 emissions in grams for NOx in the field road_in.w_no shall be reported the same as the emissions reported in phase_in.w_no.

The bag(phase) level test data shall be reported in the table format phase_in.dbf for SEMTECH values and are same as the FTP data except that;

- The bag (phase) number shall be "1" shall be reported in the field phase_in.bag_num.

- The start emissions shall be reported as "NO" in the field phase_in.start_emis.

- "OPERA" shall be reported in the field phase_in.veh_state.

SEMTECH FIELD DATA

The field data for all the light duty vehicles are recorded and the same manner as in the laboratory. To capture the length of time the vehicle is sampled the table actty_in.dbf is populated in the following manner;

- The sampling period shall be identified by the contractor by a unique character string in the field actty_in.ctr_tst_id.

- "KC_PM" shall be entered into the field actty_in.wa_id.

- The value entered in equip_in.veh_ms_id for this vehicle is entered into the field actty_in.ms_id

- The date and time of the installation is entered into the field actty_in.install_dt.

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! If the vehicle has an hour meter it's value shall be entered into the field actty_in.install_hrm.

! If this vehicle has been sampled before under the same procurement the field actty_in.replicate shall be >.T.'. Otherwise the field shall be marked as >.F.'

! If the odometer reading at the time of the installation shall be entered into the field actty_in.instal_odm.

! At the end of the sample period the data and time shall be entered into the field actty_in.unstall_dt, the odometer reading inactty_in.unstal_odm, and the hour meter reader in the the fieldactty_in.unstl_hrm.

The sample shall capture the concept of trips, which are periods between engine on and engine off where the engine is running. That data shall be captured in the table trip_in.dbf and populated as follows;

! A unique identifier for each trip shall be entered into the field trip_in.ctr_tst_id.

! The value of the trips associated sample with the shall be captured by recording its actty_in.ctr_tst_id in trip_in.activityid.

! A gross fuel identifier that is appropriate from the fuel.fuel_id shall be entered into the field trip_in.fuel_id.

! If fuel analysis information is available the fuel batch identifier for the fuel analysis data captured in the table fbat_in.dbf is entered into the field trip_in.fbatch_id.

! The date and time of the beginning of the trip shall be recorded in the field trip_in.tstart_dt.

! The date and time of the end of the trip shall be recorded in the field trip_in.tend_dt.

! A unique identifier of the vehicle operator shall be entered into the field trip_in.operatortp.

! Any change in the instrument configuration done for this trip shall be done so with a unique instrument configuration character string in the field trip_in.ins_config.

! An estimate of vehicle load in passengers in the case of motor vehicle shall be recorded in the field trip_in.passengers.

! An estimate of the vehicle's payload including passengers and cargo shall be estimated to the nearest pound in the fiel trip_in.payload.

The second by second data shall be captured in the table rtime_in.dbf and shall be populated as follows;

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- The value of the trip_in.ctr_tst_id shall be entered into the field rtime_in.ctr_tst_id.
- The value of the trips associated sample shall be captured by recording its rtime_in.ctr_tst_id in trip_in.activityid.
- The running sequential time in seconds shall be recorded in the field rtime_in.trip_secs.
- The one second average vehicle speed in miles per hour for the associated rtime_in.trip_secs shall be recorded in the field rtime_in.trip_speed.
- The one second average engine speed in rpm for the associated rtime_in.trip_secs shall be recorded in the field rtime_in.trip_rpm.
- The one second average engine torque in foot pounds for the associated rtime_in.trip_secs shall be recorded in the field rtime_in.trip_torq.
- The one second average engine torque in foot pounds for the associated rtime_in.trip_secs shall be recorded in the field rtime_in.trip_torq.
- The one second average ambient air temperature in degrees F for the associated rtime_in.trip_secs shall be recorded in the field rtime_in.trip_tempf.
- The one second average ambient air temperature in degrees C for the associated rtime_in.trip_secs shall be recorded in the field rtime_in.trip_temp.
- The one second average barometer in inches of mercury for the associated rtime_in.trip_secs shall be recorded in the field rtime_in.trip_baro.
- The one second average barometer in kPa for the associated rtime_in.trip_secs shall be recorded in the field rtime_in.inst_baro.
- The one second average humidity in grains of water per pound of dry air for the associated rtime_in.trip_secs shall be recorded in the field rtime_in.trip_humid.
- The one second average latitude in degrees for the associated rtime_in.trip_secs shall be recorded in the field rtime_in.trip_lat.
- The one second average longitude in degrees for the associated rtime_in.trip_secs shall be recorded in the field rtime_in.trip_long.
- The one second average altitude in feet for the associated rtime_in.trip_secs shall be recorded in the field rtime_in.trip_alt.

- The one second average grade in percent for the associated rtime_in.trip_secs shall be recorded in the field rtime_in.trip_grade.

- The one second average mass air flow thru the vehicle's engine in standard cubic feet per second for the associated rtime_in.trip_secs shall be recorded in the field rtime_in.trip_massf.

- The one second engine fuel rate in pounds per second for the associated rtime_in.trip_secs shall be recorded in the field rtime_in.fuel_rate.

- The one second thc, co, nox, and oxygen emission in grams for the associated rtime_in.trip_secs shall be recorded in the fields rtime_in.trip_thc, rtime_in.trip_co, rtime_in.trip_co2, rtime_in.trip_nox, and rtime_in.trip_o2.

- The one second engine coolant temperature in degrees F for the associated rtime_in.trip_secs shall be recorded in the field rtime_in.eng_cool.

- The one second engine oil temperature in degrees F for the associated rtime_in.trip_secs shall be recorded in the field rtime_in.eng_oil.

Non-core measurements at the second-by second level are recorded in the table pmeas_in.dbf. They are recorded by entering into each record;

- The value of the trip_in.ctr_tst_id shall be entered into the field pmeas_in.ctr_tst_id.

- The value of the trips associated sample shall be captured by recording its pmeas_in.ctr_tst_id in trip_in.activityid.

- The running sequential time in seconds shall be recorded in the field pmeas_in.trip_secs.

The associated value for pmeas_in.meas_id for the various analytes measured on a second by second basis are found in the attached table;

Measurement	meas_id	Units
AC Compressor On or off	ac_on_off	None
AC Load	ac_load	watts
Throttle Position	throttle_p	percent
Exhaust Temperature (degrees F)	exh_temp	Degrees F

Intake Manifold Pressure	intake_mfp	Inches of Mercury
Transmission Gear	trans_gear	None

The measurements themselves shall be stored in the field pmeas_in.meas_value. The ac compressor status shall be characterizes as "0" as off and "1" as on. The transmission gear shall be characterized by -1 for reverse, 0 for neutral, 1, 2,3 etc for forward gears.

Appendix B Sample Size Estimation

As mentioned in the proposal, the sample size was derived in three steps, as described below.

1. *Estimate initial sample size* (n_{SRS}). The initial sample size was calculated under the following assumptions:

- The sample will be large enough that large sample theory applies, i.e., the sampling distribution of the mean(s) will be approximately normal.
- Vehicles would be drawn from the population using simple random sampling (SRS).
- The objective is to estimate the fleet average PM emissions rate (g/mi), to within 20% margin of error (E) at a 95% level of confidence (associated t-statistic is 1.96).
- The population variance is estimated by a coefficient of variation (CV) of 250%. This value is intended to be conservative, adopted from a study in Denver that included winter as well as summer measurements in a sample heavily weighted towards older vehicles.

The initial estimate is thus calculated as:

$$n_{SRS} = \frac{CV^2 \cdot t^2}{E^2} = \frac{2.5^2 \cdot 1.96^2}{0.20^2} = 600 \text{ vehicles}$$

1. *Estimate the effective sample size* (n_{strat}). The effective sample size reflects the expected gain in precision from use of the age-by-vehicle-class stratification. It is calculated as

$$n_{strat} = n_{SRS} \cdot \text{deff}, \text{ where}$$

$$\text{deff} = \frac{s^2_{\text{mean, strat}}}{s^2_{\text{mean, SRS}}} = \frac{0.7000}{0.9014} = 0.78$$

This result suggests that the proposed stratified sampling should allow us to achieve the stated precision objective with ~20% fewer vehicles than we would expect using SRS, i.e., with 480 as opposed to 600 vehicles. The "design effect" (deff) represents the reduction in the variance of the mean achieved through stratification. Note that variances in the equation are the estimated variances of the *sampling distribution of the mean*, not the population variance. For this analysis, the estimated variances were calculated using a set of data collected in the SCAQMD (Norbeck et al. 1998). The data used represent a subset of vehicles identified as "normal" emitters, as these vehicles were recruited randomly in the context of the NCHRP. Thus, we assume that these vehicles give a rough indication of the relative sizes of the age-class and vehicle-class strata, as defined in Tables 1 and 2 below.

Our estimated variance of the mean under SRS assumptions is simply the estimated population variance divided by the total sample size, or

$$s^2_{\text{mean, SRS}} = \frac{s^2_{\text{SRS}}}{n}$$

where the estimated population variance is calculated using the available data but disregarding the age classes under which it was collected. We estimate variance of the mean under stratification ($s^2_{\text{mean,strat}}$) by calculating a weighted variance from the variances of the mean in each stratum h ($s^2_{\text{mean},h}$), as follows (Kish, 1965)[1]:

$$s^2_{mean,strat} = \sum_{h=1}^{6} W_h^{\,2} \left(\frac{s_h^2}{n_h} \right) = \sum_{h=1}^{6} W_h^{\,2} \cdot s^2_{\text{mean},h}$$

The stratum weight W_h is intended to serve as an estimate of the relative size of the stratum, and is this case was calculated as number of observations in each stratum from the SCAQMD dataset, here denoted as m_h.

$$W_h = \frac{m_h}{\sum_{h=1}^{6} m_h}$$

2. *Allocate the Effective Sample among Strata.* To divide the proposed sample among the six strata, again using the observations from the SCAQMD data (m_h) as a guide. We have used Neyman allocation, which assigns sub-samples based on the product of the stratum size m_h and stratum standard deviation s_h. This allocation is designed to optimize the resulting precision for the given total sample size. The optimal sample within each stratum $n_{h,\text{opt}}$ is given as

$$n_{h,\text{opt}} = n_{\text{strat}} \left(\frac{s_h m_h}{\sum_{h=1}^{6} s_h m_h} \right)$$

[1] Kish, L. (1965). *Survey Sampling*. John Wiley & Sons, New York.

Finally, the raw optimal stratum samples were rounded and adjusted slightly to reduce larger differences between strata given by the optimization. Final adjusted stratum samples are denoted as $n_{h,\mathrm{adj}}$ and presented in Table 2.

Table 1. Definition of Strata by Vehicle and Age Class

Stratum (*h*)	**Vehicle Class**	**Age Class[3]**
1	Truck[1]	Pre 1981
2	Truck	1981-1990[4]
3	Truck	1991 and newer
4	Car[2]	Pre 1981
5	Car	1981-1990[4]
6	Car	1991 and newer

[1] Includes LDGT1 and LDGT2 vehicle classes.
[2] Includes LDGV vehicle classes.
[3] Following Norbeck et al. (1998) and Cadle et al. (1999).
[4] Authors designated two strata, 1981-85 and 1986-90. These were collapsed, due to a close similarity in mean PM rates.

Table 2 Estimated Sample Size and Allocation Among Age and Vehicle-Class Strata

									Allocation		
Stratum	m_h	**mean**	**Variance (s^2_h)**	**Std. Dev. (s_h)**	**CV**	Var(mean) ($s^2_{mean,h}$)	**SE ($s_{mean,h}$)**	W_h	$n_{h,opt}$	$n_{h,adj}$	$n_{h,adj}$ (%)
1	2	30.34	556.95	26.30	0.78	278.48	16.69	0.0222	40.52	50	10.4
2	15	9.30	165.66	12	1.	11	3.32	0.167	165.78	140	29

				.87	38	.04					.2
3	22	3.15	9.59	3.10	0.98	0.44	0.66	0.244	58.50	70	14.6
4	2	25.00	482.34	21.96	0.88	241.17	15.53	0.0222	37.72	40	8.3
5	15	3.22	10.56	3.25	1.01	0.70	0.84	0.167	41.86	50	10.4
6	34	1.93	21.58	4.65	2.41	0.63	0.80	0.378	135.62	130	27.1
Total	**90**									**480**	

Notation:

Std. Dev. = Standard Deviation
CV = Coefficient of variation, defined as Std. Dev./mean.
Var(mean) = Variance of the sampling distribution of the mean, = variance/*n* for each stratum.
SE = Standard Error of the mean, defined as SE/√*n*.
W = stratum weight, defined as $n/\Sigma n$, for each stratum.
$n_{h,opt}$ = raw sub-sample in each stratum as assigned by Neyman allocation.
$n_{h,adj}$ = rounded sub-sample in each stratum.

Appendice D - OTAG's Government Furnished Property List

Instrument	Manufacturer	EPA ID	S/N	Cost
Diesel Particulate Monitor (DPM), Model 1105A	Rupprecht & Pataschnick Co., Inc.	792787	1105A201479907	$39,647 with computer
DPM Computer and Monitor	?	792787-2 792787-3	032333021 H051J7000434	See DPM
Dewpoint Generator, Model DG-1, Plus auxiliary Equipment:	Sable Systems, Inc.	n/a	DG0101-03	$4,290
Hot Plate, Model 1103	Jenway	n/a	1248	$ 895
Dewpoint Monitor, Model M170	Visala	n/a	X3550014	$2,495
Real Time Particulate Mass Monitor, Model RPM-101	Booker Systems, Ltd.	n/a yet	n/a	$53,000
DataRam 4000	Thermo- MIE Inc.	793003	D055	$10,550
Portable Emission Measurement Systems (PEMS)	Sensors, Inc. Semtech - D - 2 Semtech - G - 6	n/a yet		$25,000 - $40,000 depending on model type

Three Light-Duty Vehicles for Round Robin Testing	Various Manufacturers	n/a yet		$5,000 - $20,000 depending on model
Portable Activity Measurement Systems (PAMS)	approximately 10 units	n/a yet		$300 per unit
Auxiliaries				
KT1 Plus Compressor	Kaeser	n/a	n/a	$2,500
Heated Sample Valve System	Burkert	n/a	n/a	$4,500
Valve Control System	EPA	n/a	n/a	$1,200
Heated Lines and Controllers	Unique Products	n/a	n/a	$12,000

n/a - Not Assigned

Appenidces D - ORD's Government Furnished Property (Dynamometer and Other Equipment)

Item	Manufacturer	Model #	Serial (ID) #	EPA #
Trailer	Haulmark	G816B3-102	4XSGB1629Y G022365	
Instrument rack, (42"x71"x28")				
CO2 Instrument	Horiba	AIA-210	569687041	911710
CO(H) Instrument	Horiba	AIA-210	56884301	911711
Nox Instrument	Horiba	CLA220	573834033	969210
Hydrocarbon Instrument	Horiba	FIA236	850624012	
Hydrocarbon Instrument	Horiba	FIA34A	850584012	
Hydrocarbon Instrument	Horiba	OPE435	850658077	
CO Instrument, optical	Horiba	AIA23AS	850988014	
CO Instrument, electronics	Horiba	OPE135	850658014	
Digital Meter	LFE			

Meter, temperature	Omega	DP205TC		
Meter, temperature	Omega	DP205TC	3081342	
Meter, temperature	Omega	DP205TC	3081329	
2 Meters, digital	Newport	2AP2		
Meter, digital	Cole-Parmer	7350-38	17524-17-1287	
Pressure Transducer	Data Instruments	SA	3488-0017	
Temperature Controller	Unique Products	223-1531	6336	
Temperature Controller	Unique Products	223-1531		
Computer	Mitsuba	1239933	n/a	928752
Monitor	Dell	D1028L	66746JA56K	
Computer mouse	Kentronix		10017631	
Printer	Hewitt Packard	Deskjet 932C	NX0C61SOHZ	
Keyboard	Chicony	KB5181	TCK3C08137	
Monitor	Axion	CL-1566	CB266AS0074 4	
Instrument Rack (24"x24"x74")				

Heated Line	Unique Products		S11B4240TM AA1	
Temperature Controller	Unique Products	223-1531	4878	
Temperature Controller	Unique Products			
Refrigerator	Whirlpool	EL05CCXJW	EE0218193	
Chair				
Chair				
VGA distribution amplifier	Extron	P/2 DA2 Plus	249005	
Headphones	David Clark Co.	H5030	12511G-01	
Headphones	David Clark Co.	H5040	16298G-03	
Headphones	David Clark Co.	H5030		
Readout box	Tylan	RO32	FP901021	
Mass Flow Controller	Tylan	FC280	AW801070	
Instrument Rack (74"x24"x24")				
Monitor	Mitsuba	CM43	353JR000U00 644	

Drivers Aid	Horiba SADA 2040	270188	9443501	911694
Computer	Hewlett Packard	VL2	3436A00341	
Digital Readout box	Tylan	RO28	F0604019	
Mass Flow Controller	Tylan	FC280	AW801200	
Mass Flow Controller	Tylan	FC280	AW801201	
Mass Flow Controller	Tylan	FC280	AW805124	
Mass Flow Controller	Tylan	FC280	AW507001	
Keyboard	Qtronix	QX901	903000755	
Rack Power Strip	Flexiduct	BR06010	NXX300120	
Rack Power Strip	Flexiduct	SP12410	BXX300022	
Instrument manuals in 3-ring binder				
Winch, electric	Dayton	4Z327A		
Regulator, gas	National Welders	3104C		

Regulator, gas	National Welders	HPT270C	A217254	
Regulator, gas	National Welders	HPT270-125-590-DK		
Regulator, gas	National Welders	HPT2700	E227323	
Regulator, gas	Nox 660			
Regulator, gas	National Welders	HPT272C	KY37784	
Regulator, gas	National Welders	GPT2700	GA33049	
Regulator, gas	National Welders	HPT270C	FZ13512	
Bag Rack w/ 8 Tedlar bags	Horiba			
Air Pump	Metal Bellows	MB-21	10545	
Air Pump	Thomas	1107CM75	0000187	
Air Pump	Gast	0523-V191Q-G582DX	9802803610	
Air Pump	Gast	0523-V191Q-G582DX	9812011058	
Air Pump	Gast	0523-V191Q-G588DX	1002119130	

Air Pump	Thomas	607CA22		
Air Pump	Thomas	607CA22		
Air Pump	Thomas	607CA22		
Relay and Solenoid Rack				
Temperature Controller	Unique Products	223-2219	13202	
Temperature Controller	Unique Products	223-2219J	7813	
Temperature Controller	Unique Products	223-1531	4748	
Heated Line, 20' x 1/4 “	Unique Products			
Heated Line, 20' x 1/4"	Unique Products			
Heated Line, 20' x 1/4"	Unique Products			
Heated Line, 50' x 3/8"	Unique Products			
Heated Filter	Unique Products	FLT1584BB6 AAJ-000	13203	
Heated Filter (on order)				

Cyclone, ss (on order)	URG			
Cyclone, ss (on order)	URG			
(2) Power Cables, 50'		240V, 50 amp		
Condenser	Tecumsek	AE3Y14AA	9A1768096	
(2) Winches	Dayton	4Z327A		
Miscellaneous tools				
Miscellaneous office supplies				
Miscellaneous electrical supplies				
Miscellaneous tubing				
Miscellaneous swaglock fittings				
Miscellaneous hardware				
Space heater				
Miscellaneous padlocks				

Appendix D

Item	Manufacturer	Model #	Serial (ID) #	EPA #
Trailer	Fruehauf	C6HE-Y2	DLR503307	807534
Air Cooler		C810B	12936	
Air Compressor		2800061DUA0 01	45929NSO423 02	
Air Compressor Motor	Dayton	6K827L	C63GKE- 4555J977	
Positive Displacement Pump (PDP)	Suterbilt	5-LP	5085736	
PDP Motor	GE MOTORS	5KC184BB21 1	NPY300	
Dynamometer (Electronic controller, rolls, and flywheels	Clayton	CTE-50	RLC-175	807535
1- carpenter's level, 4'				
15- trailer jack stands				
Weight calibration set, 45lb.,10 lb. and arbor				
5 pieces of 18" chain				

2 Ramps, aluminum (8'x12')				
Fan	Hartzell			
Fan motor	Reliance	CS	C56E1768M-DZ	
Muffler	Burgess Manning	BEO-3.5	52-170-0	
4 Aluminum ramps (7.5' x 18")	Metro Trailer Manuf.			
Aluminum ramp (2'x12')				
8" OD Tunnel, stainless steel, 10' and 12' sections				
Flexible tube, 3"x14' braided, stainless steel				
4" OD Tunnel, stainless steel sections, total ~ 8'				
Flexible tube (4"x4')				
Filter housing (2'x2' aluminum)				

Tube elbow, stainless steel (8"x24")				
Winch	Dayton	6X190B	X1059057	
Winch post, 6' aluminum				
Water pump		FP6121-00	1E95B	
Floor Jack				
(6) Dilution tunnel support stands				
(2) Jack stands for ramps				
Dilution air heater	Unique Products	507574	8014	
Steel Toolbox, 36"x18"x18"	Payload			
(4) Metal Leg stands				
(26) silicon boots, 11"				
(5) Nylon, rachet style tie-down straps				
Wire cable with hooks, 8'				

Appendix D

Contract: GS-10F-0036K, Task Order: 1104

(5) 2000 lb chain binders				
(1) 5400 lb chain binder				
Nustar Power Pusher		44518		933311
(6) Straps, load binder				

CLIN	SCENARIO A: DESCRIPTION	TOTAL PRICE
BASE	***QUALITY ASSURANCE AND PHASE 1 PILOT STUDIES***	
0001 A	Produce Quality Documentation (SOW Section 5.1)	$64,144.46
0001 B	Pre-Testing Analysis, Non-Response Analysis, Vehicle Pilot Study (Cohort Analysis) (SOW Sections 5.2.1 through 5.2.6, and 5.2.8)	$192,293.00
0001 C	Pilot Testing Task (SOW Section 5.3.1, 5.4.1, 5.4.2)	$286,786.50
0001 D	Contract Incentive Plan	$43,861.63
OPTION 1	***PHASE 2: ROUND 1 VEHICLE TESTING***	
0002 A	Vehicle Recruitment (SOW Section 5.2.7a)	$45,552.89
0002 B	Participation Incentives (SOW Section 5.2.9) ***NOT TO EXCEED***	$105,043.43
0002 C	Vehicle Testing (SOW Section 5.3.3)	$301,982.98
0002 D	Post Round 1 Vehicle Analysis (SOW Section 5.2.10)	$21,975.49
0002 E	Vehicle Emission Analysis (SOW Sections 5.3.2, 5.3.3, 5.4.3, 5.4.4, 5.4.5(Only continuous and integrated PM mass samples), 5.4.7	$583,111.60
0002 F	Speciation Analysis (SOW Section 5.4.5 Only gaseous cmpds, 5.4.5.5)	$255,006.12
0002 G	Data Analysis (SOW Section 5.4.6)	$64,862.43
0002 H	Maintenance of Emission Equipment (SOW Section 5.4.8)	$30,886.10
0002 I	Contract Incentive Plan	$43,861.63
OPTION 2	***PHASE 2: ROUND 1 SPECIATION TOXIC ANALYSIS***	
0003	Speciation Toxic Analysis - all other analyses (SOW Section 5.4.5.2, 5.4.5.3, 5.4.5.4, 5.4.5.6)	$50,923.54
OPTION 3	***PHASE 3: ROUND 2 VEHICLE TESTING***	
0004 A	Vehicle Recruitment (SOW Section 5.2.7b)	$44,077.35
0004 B	Participation Incentives (SOW Section 5.2.9) ***NOT TO EXCEED***	$105,043.43
0004 C	Vehicle Testing (SOW Section 5.3.3)	$289,914.32
0004 D	Vehicle Emission Analysis (SOW Sections 5.3.2, 5.3.3, 5.4.3, 5.4.4, 5.4.5((Only continuous and integrated PM mass samples)), 5.4.7)	$753,625.58
0004 E	Speciation Analysis (SOW Section 5.4.5 Only gaseous cmpds, 5.4.5.5)	$255,006.12
0004 F	Data Analysis (SOW Section 5.4.6)	$37,406.70
0004 G	Maintenance of Emission Equipment (SOW Section 5.4.8)	$28,074.88
0004 H	Contract Incentive Plan	$87,723.26

OPTION 4	***PHASE 3: ROUND 2 SPECIATION TOXIC ANALYSIS***	
0005	Speciation Toxic Analysis - all other analyses (SOW Section 5.4.5.2, 5.4.5.3, 5.4.5.4, 5.4.5.6)	$55,161.01
OPTION 5	***FINAL REPORT / ANALYSIS***	
0006	Final Report / Analysis	$148,139.49

Maximum Total Price $3,894,463.84

TASK ORDER INCENTIVE PLAN

In accomplishment of this task order the U.S. EPA expects the contractor to provide accurate, effective, and timely performance. As such, an incentive shall be established regarding contractor performance. The contractor has the opportunity to be awarded up to 5% of the total task order value as described below:

Deliverable	Incentive	Surveillance Method
PHASE 1 (Line Items 0001A, 0001B, and 0001C) completed in accordance with the attached Performance Work Statement.	For accurate, effective, and timely completion of Phase 1 in accordance with the attached Performance Work Statement, the Contractor may be awarded up to 1.25% of the total value of the established task order price, exclusive of participation incentives.	The contractor will be evaluated based on the accuracy, effectiveness, and timeliness of data received as a result of contractor performance on this task order, as set forth in the Performance Work Statement.
PHASE 2 (Line Items 0002A, 0002C, 0002D, 0002E, 0002F, 0002G, 0002H, and 0003) completed in accordance with the attached Performance Work Statement.	For accurate, effective, and timely completion of Phase 2 in accordance with the attached Performance Work Statement, the Contractor may be awarded up to 1.25% of the total value of the established task order price, exclusive of participation incentives.	The contractor will be evaluated based on the accuracy, effectiveness, and timeliness of data received as a result of contractor performance on this task order, as set forth in the Performance Work Statement.
PHASE 3 (Line Items 0004A, 0004C, 0004D, 0004E, 0004F, 0004G, and 0005) completed in accordance with the attached Performance Work Statement.	For accurate, effective, and timely completion of Phase 3 in accordance with the attached Performance Work Statement, the Contractor may be awarded up to 2.5% of the total value of the established task order price, exclusive of participation incentives.	The contractor will be evaluated based on the accuracy, effectiveness, and timeliness of data received as a result of contractor performance on this task order, as set forth in the Performance Work Statement.

Kansas City PM Characterization Study
Final Report

Appendix DD
Work Plan

Assessment and Standards Division
Office of Transportation and Air Quality
U.S. Environmental Protection Agency

Sponsors:

National Renewable Energy Laboratory, U.S. Department of Energy
Federal Highway Administration, U.S. Department of Transportation
STAPPA-ALAPCO Emission Inventory Improvement Program
Coordinating Research Council Inc. (Project No. E-69)

Prepared for EPA by
Eastern Research Group, Incorporated
Austin, TX

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Oakland, CA

NuStats LLC
Austin, TX

Desert Research Institute
Reno, NV

EPA Contract No. GS 10F-0036K

October 27,2006
Revised April 2008 by EPA staff

EPA United States
Environmental Protection
Agency

EPA420-R-08-009
April 2008

Characterizing Exhaust Emissions from Light-Duty Gasoline Vehicles in the Kansas City Metropolitan Area

Work Plan

Prepared for:

U.S. Environmental Protection Agency

April 14, 2004

ERG No.: 0133.18.000.001

CHARACTERIZING EXHAUST EMISSIONS FROM LIGHT-DUTY GASOLINE VEHICLES IN THE KANSAS CITY METROPOLITAN AREA

WORK PLAN

EPA Contract No. GS-10F-0036K

Prepared for:

Kitty Walsh
Project Officer
U.S. Environmental Protection Agency
2000 Traverwood Drive
Ann Arbor, MI 48105

Prepared by:

Eastern Research Group
5608 Parkcrest Drive, Suite 100
Austin, TX 78731-4947

April 14, 2004

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CONFLICT OF INTEREST CERTIFICATION

Eastern Research Group, Inc.
EPA Contract No. 68-C-00-112
Work Assignment/Task Order No.: 3-07

In accordance with EPAAR 1552.209-71 (Organizational Conflicts of Interest), EPAAR 1552.209-73 (Notification of Conflicts of Interest Regarding Personnel), and Prime Contract clause (Work Assignment Conflicts of Interest Certification), Eastern Research Group, Inc. makes the following certifications:

ORGANIZATIONAL AND PERSONAL CONFLICTS OF INTEREST:

☒ To the best of our knowledge and belief, no actual or potential organizational conflicts of interest exist. In addition, none of the individuals proposed for work under this Work Assignment/Task Order has any personal conflicts of interest.

OR:

☐ To the best of our knowledge and belief, all actual or potential organizational and personal conflicts of interest have been reported to the EPA Contracting Officer. If applicable, attached is a letter disclosing the conflict of interest.

This is to certify that our personnel, who perform work under this Work Assignment/Task Order, or relating to this Work Assignment/Task Order, have been informed of their obligation to report personal and organizational conflicts of interest to our designated COI official.

Eastern Research Group, Inc. recognizes its continuing obligation to search for, identify, and report any actual or potential organizational or personnel conflicts of interests that may arise during the performance of this Work Assignment/Task Order or work relating to this Work Assignment/Task Order.

Authorized Signature

Sandeep Kishan, P.E.
Printed Name

Vice President, Mobile Sources
Title

May 14, 2004
Date

1.0 Introduction

The KCMSA PM characterization study requires a contractor team with technical expertise in a number of diverse specialty areas, including QA/QC, vehicle sample selection and stratification, motorist recruitment, emissions/fuel testing and lab analysis, data evaluation, and fleet characterization. In addition, the team must have the managerial expertise to coordinate all of these efforts and integrate the findings for the final product.

The ERG Team has proven capabilities in all of these areas. In addition, many of our team members are also leading experts in the fields of combustion PM formation and PM emissions modeling. Some of our key team members have been actively involved in the peer review and framework development for the MOVES model. We have also been intimately involved with the collection and use of second-by-second emissions and vehicle parameter data for many years. As such, our team members also understand the broader context of the study, regarding the ultimate uses and potential limitations of the study results.

1.1 Background

Recent studies have indicated that gasoline vehicles contribute significantly to ambient PM. PM emissions from gasoline sources have been shown to be predominantly in the PM2.5 size range especially for so called "smoker" vehicles.

Review of research led by Steve Cadle (1998), Joe Norbeck (1998), and Kevin Whitney (1998) indicates that gasoline powered vehicles with visible smoke in their exhaust plume emit about 9-times more particulate than non-smoking vehicles. This factor probably varies with model-year, with new smoking vehicles emitting more, and older smoking vehicles emitting less than this amount.

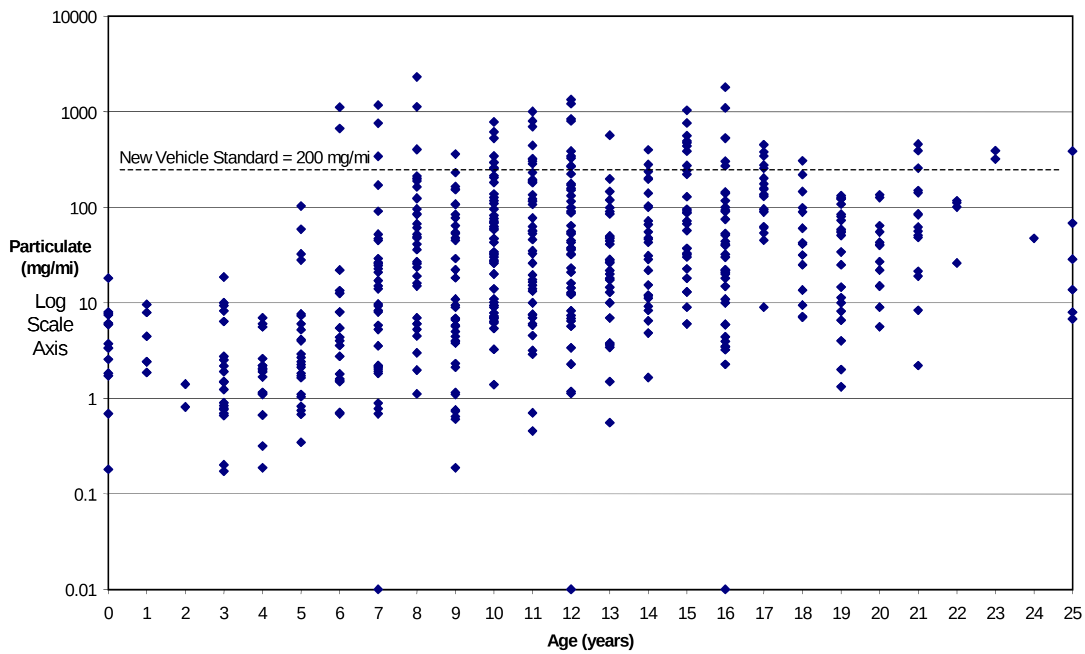
The research by Cadle and Norbeck estimated the incidence of vehicles with visible smoke plumes using roadside surveys. Cadle used both remote sensing and visual surveys in Denver, Colorado and Norbeck used the visual method in Southern California. Their results were somewhat different, but the fleet average incidence was found to be about 1%. Also, ERG has estimated the incidence of smoking vehicles in the Phoenix fleet by analyzing data from the Maricopa County Smoking Vehicle Hotline. Data from the Maricopa County Smoking Vehicle Hotline indicates that the incidence of smoking vehicles that are new is up to 100-times lower than the fleet average, and the incidence of older smoking vehicles is up to 4-times higher than the average, indicating a strong age dependence for smokers.

Many studies have tried to characterize the distribution of PM for a vehicle fleet. One such example is shown in Figure 1-1. We see that this is an age dependence in the data but also that there is a large variance among vehicles. As an example, 10-year-old vehicles can have PM emissions from 1-2 mg/mi to 1,000 mg/mi.

However, study designs have been lacking in their focus to develop random sampling techniques with careful attention to non-responsive behavior. For this research, the Project Sponsors have developed the following goals:

- Characterize gaseous and PM toxics exhaust emissions.
- Characterize the particle size distribution from these vehicles.
- Characterize the fraction of high emitters in the fleet.

Figure 1-1. Example Plot of PM Data from Light-Duty Gasoline Cars and Trucks, Model Year 1994 and Older



Source: Burnette, A.D.; Kishan, S., "PART5-TX1: Update of the PART5 Model For Use In Texas." Final report by ERG for the Texas Natural Resource Conservation Commission (now named Texas Commission on Environmental Quality). Austin, Texas, July 14, 2000.

Note: The data are from in-use vehicles recruited from private owners. The database was compiled from various research sources.

Data obtained from this program will be used to evaluate and update existing and future mobile source emission models. This project will also provide a benchmark to establish various vehicle recruitment, testing, data collection, and vehicle exhaust emissions analysis protocols which EPA may use in future data collection efforts.

2.0 Technical Approach

Section 2.1 presents an overview of the entire project. Starting in Section 2.2 we present a detailed description of all technical tasks required. Parenthetical references to Section 5 of EPA's SOW are included in the section titles.

2.1 Project Overview

The ERG team will conduct a well-organized and efficient research program to identify, recruit, test, and analyze the exhaust PM emissions from 480 vehicles in the Kansas City area. We have broken the project down into the following major components:

- Vehicle pilot testing;
- Recruitment;
- Testing and Analysis; and
- Reporting

The management and reporting tasks will be ongoing activities throughout the project. Our team will communicate with the Project Officer and the Project Sponsors through:

- Written reports;
- Face-to-face meetings;
- Regular conference calls; and
- Project website.

A kick-off meeting was held in Ann Arbor to initiate the project, and the ERG team is in the process of developing of the quality documents. We has also developed a schedule of bi-weekly conference calls with the project team, and has implemented a password-protected project website, through which the project team can gauge the progress of the project. We will also develop monthly progress reports and all the reports listed in Section 6.0 of the RFP. The final deliverable of the project will be a complete MSOD compatible database with an accompanying final report.

A detailed flowchart covering the first three components is shown in Figures 2-1 through 2-5.

Figure 2-1. Vehicle Pilot Testing

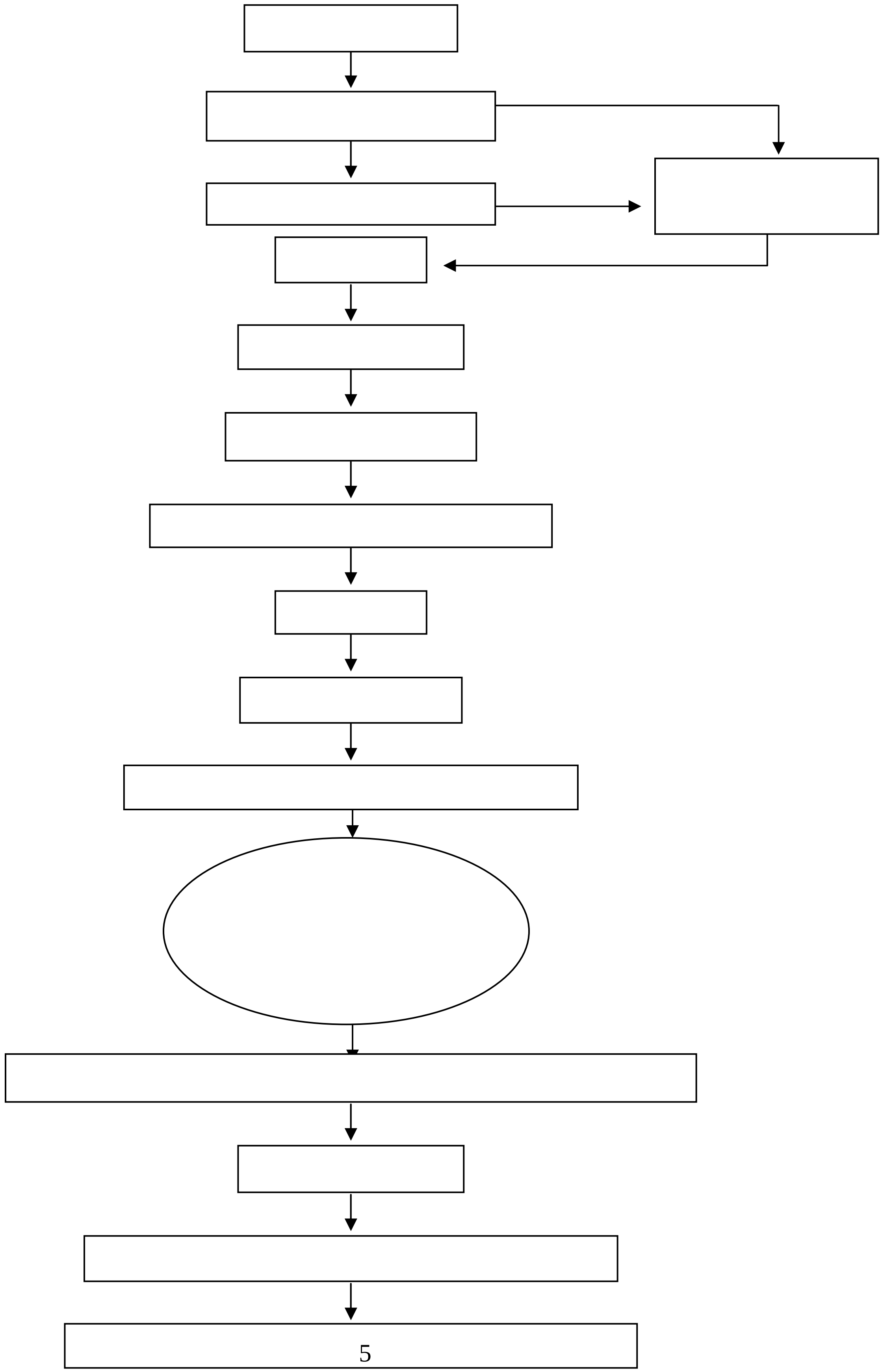


Figure 2-2. Vehicle Recruitment Task (Part 1)

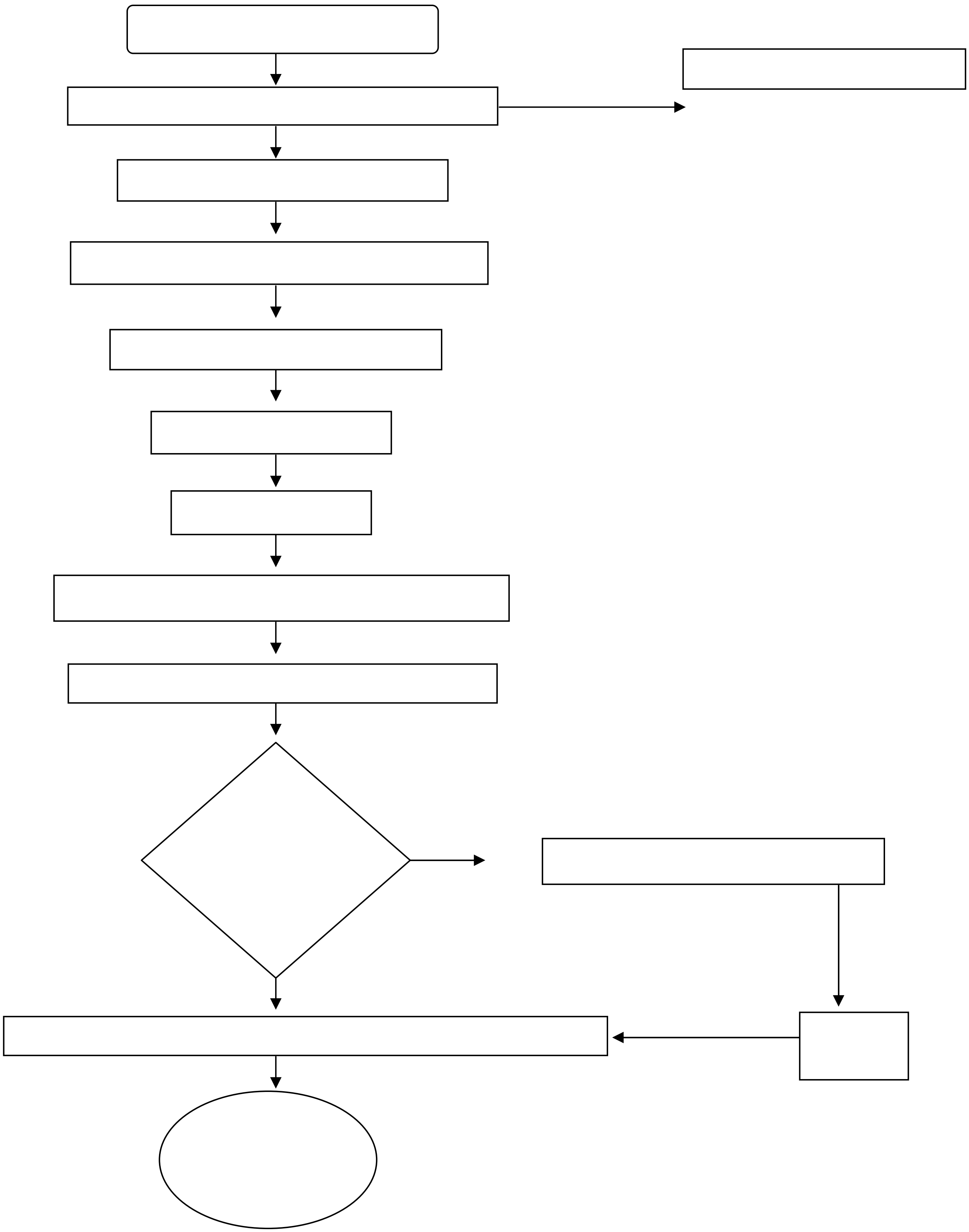


Figure 2-3. Vehicle Recruitment Task (Part 2)

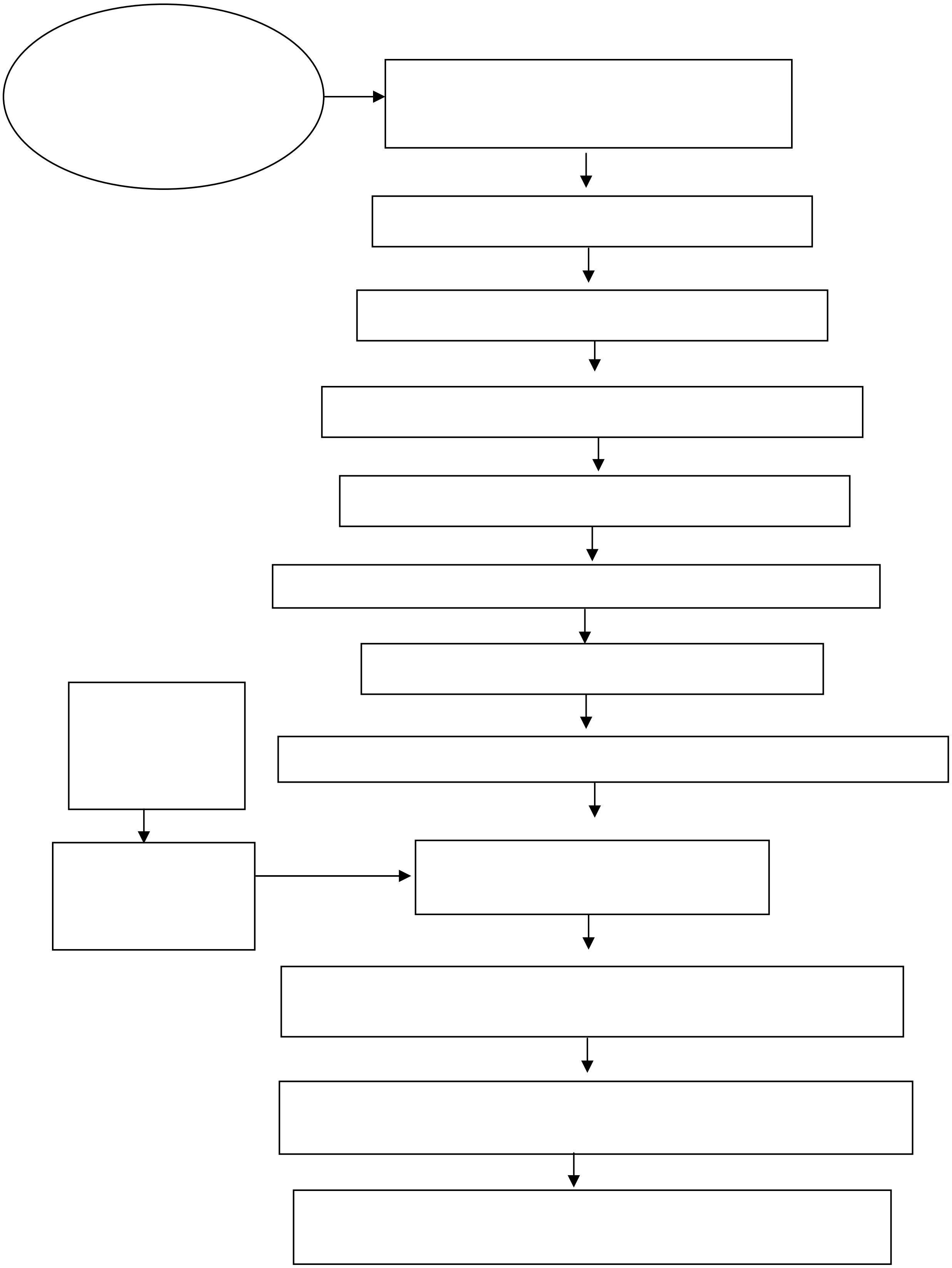


Figure 2-4. Vehicle Testing Task (Rounds 1 and 2)

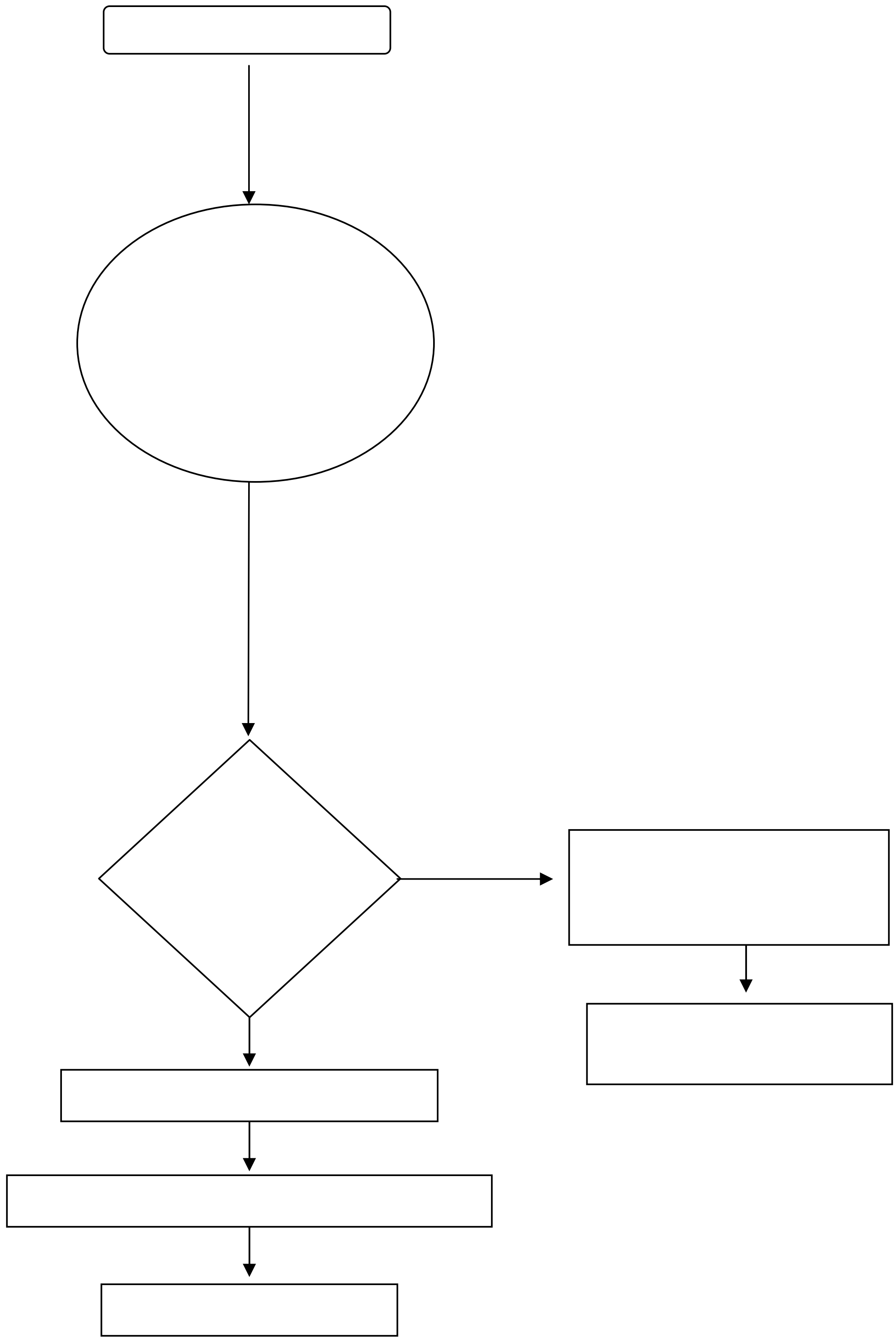
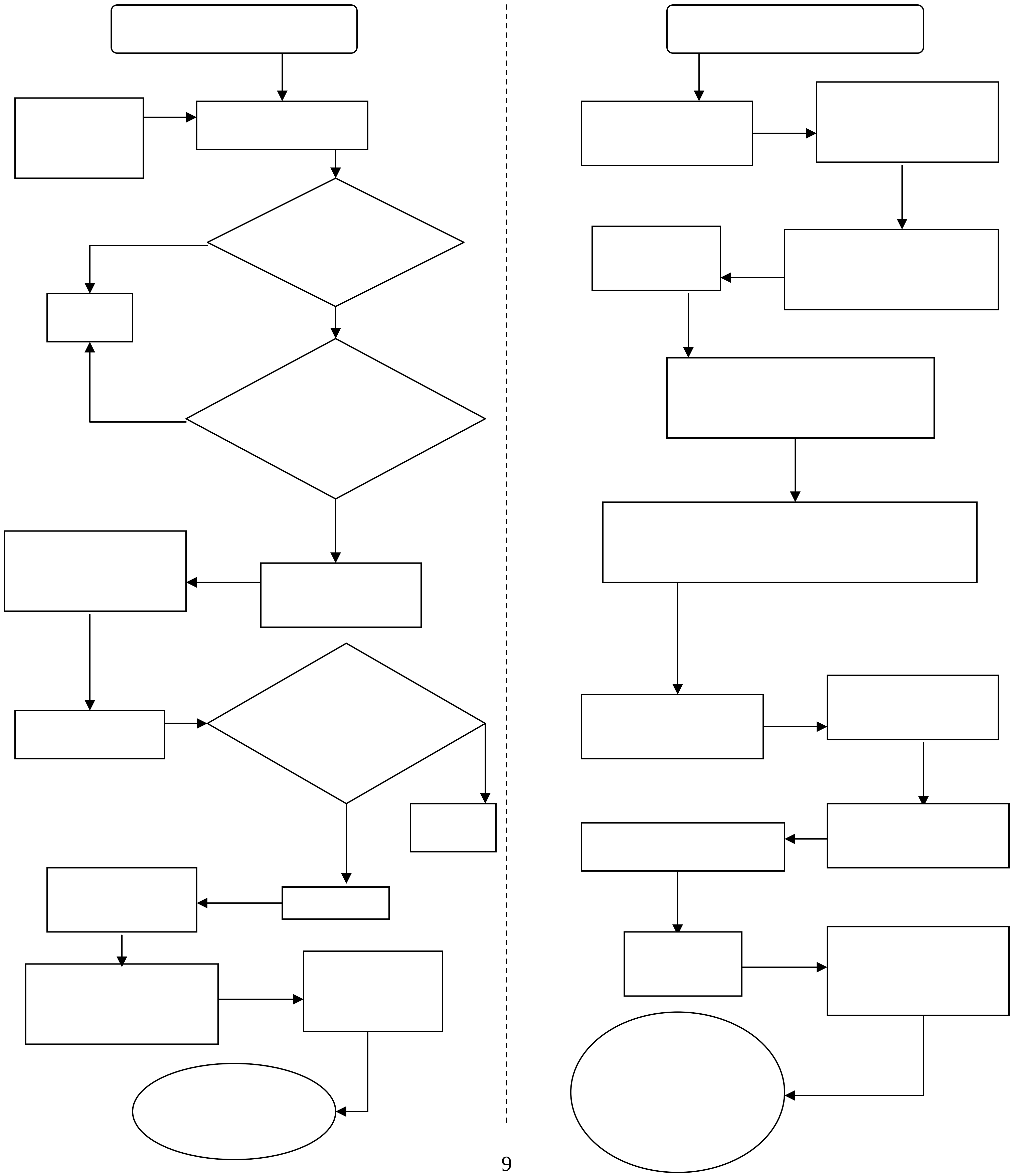


Figure 2-5. Summary of Daily Activities



Draft QAPP and QMP documents will be developed and presented to the Project Officer for approval before beginning the work on site in Kansas City. ERG has an office in Kansas City, which will be used for on-site coordination. We have also identified several options for a suitable warehouse, which could be used for vehicle testing. We have received a market survey from a broker and the location of the testing site will be finalized after a site visit by our vehicle testing contractor, BKI. The pilot phase will then be started by transporting and setting up the equipment in Kansas City. The three vehicles supplied by EPA will be used. The dynamometer and measurement equipment will be made operational and several practice tests will be conducted prior to testing the pilot vehicles. Real time PM evaluation, integrated sample collection system, and the gaseous toxics evaluation will all be made operational. Any derivations and changes from the QAPP will be noted. A pilot vehicle test report will be prepared at the conclusion of the pilot testing.

The ERG Team will conduct the vehicle recruitment task assuring statistically representative sample selection, and effective use of incentives. We believe that a Random Digit Dial (RDD) approach to cohort development offers the most robust approach to sample development, and is preferred over the strategy used to stratify the existing cohort. Therefore a new cohort of at least 2,000 households/4,000 vehicles will be developed using this methodology. Once established, the cohort will be evaluated for non-response bias and compared to the entire registered KC MSA fleet in terms of model year and other discrete variables, as well as RSD emissions data to the extent possible. A geodemographic comparison will also be performed. Based on these comparisons a determination will be made regarding which data set to use for vehicle recruitment.

Preferred vehicle incentive packages to be used for recruitment will be developed under the Vehicle Recruitment Pilot subtask. In this subtask different incentive packages will be evaluated for effectiveness, for both respondents and non-respondents. The preferred incentive package will consider both acceptance rates, as well as recruitment and incentive costs. The selected package will be used in the Round 1 Vehicle Recruitment task, and may be modified if needed for Round 2.

Our subcontractor, BKI, will lead the vehicle testing task. Upon a vehicle's arrival at the testing site an initial inspection and paperwork session will be performed before soaking the vehicle overnight. The vehicle will be scheduled for testing on the dynamometer the next day. DRI will assist the on-site ERG team in collecting the continuous PM measurements and the integrated sample collection for the filter samples. The gaseous samples will also be collected and analyzed by DRI. Fuel and oil samples will also be collected and stored for all vehicles, with a subset of these oil samples provided to a lab for analysis (fuel samples will be collected, but not analyzed). The PEMS/PAMS deployment will be conducted on selected vehicles after the vehicle testing. RSD measurements will also be conducted on all vehicles tested as well as a portion of the Kansas City fleet. DRI will perform the analysis of the speciation data. The dynamometer emissions data and the continuous PM measurements will be collected in a common database on-site. PEMS/PAMS, PM gravimetric, elements, EC/OC, ions, and gaseous analysis will be added to the dataset later.

2.1.1 Summary of Daily Activities

The Summary of Daily Activities section of the flow chart illustrates how a test vehicle will be processed and tested over a two day period. Vehicles will be over-recruited to ensure that 5 suitable vehicles will be available each day. On day one, vehicles previously scheduled will be received and inspected at the test facility. An initial inspection will determine if the vehicle is suitable for testing (no major repairs required, not too large for the dynamometer, etc.). Repairs that would result in exclusion of a vehicle from the test program include (but are not limited to):

- Replacement of vehicle exhaust system. New exhaust systems would have to be conditioned for quite some time (200- 300 miles) to remove cutting oils. These oils could bias the PM results.
- Replacement of catalyst. Conditioning would be required to age the catalyst (approximately 5000 miles).
- Engine or engine component replacement or rebuild within the last 5000 miles, including heads, valves, block, etc.

Replacement and/or repair of other systems (A/C, steering, brakes, body, tires, transmission, etc.) will generally be considered acceptable. Replacement and/or repair of emission control components (oxygen sensor, EGR valve, etc.) can be considered maintenance actions and are acceptable, but a short break-in period of approximately 100 miles would be necessary before testing.

Upon successful initial inspection of the vehicle, it will be accepted for emissions testing and the vehicle owner will be given a loaner car. The vehicle will next be video taped (to document overall condition), OBD data will be taken, and pertinent vehicle data will be recorded. In the event that minor repairs are needed (exhaust leaks, faulty tires, etc.), the vehicle will be driven to a local repair facility for repairs to ensure valid test results and safety. If the exhaust system requires major repair/replacement the vehicle will not be tested because of the lengthy preconditioning required for exhaust systems. If only the tailpipe section has a problem, it will be removed, and the exhaust transfer tube will be connected directly to the exhaust system underneath the vehicle. Processing will continue with installation of PEMS and driving of the vehicle over a prescribed conditioning route. If the vehicle performance is satisfactory, a qualitative determination of PM emissions will be made via PM sniffer, as well as visually, in order to rank the vehicle as a low, medium, or high emitter. Low and medium PM emitters will be cued for testing first on the following day. At the conclusion of Day 1, the conditioned vehicles will be soaked overnight at ambient temperatures.

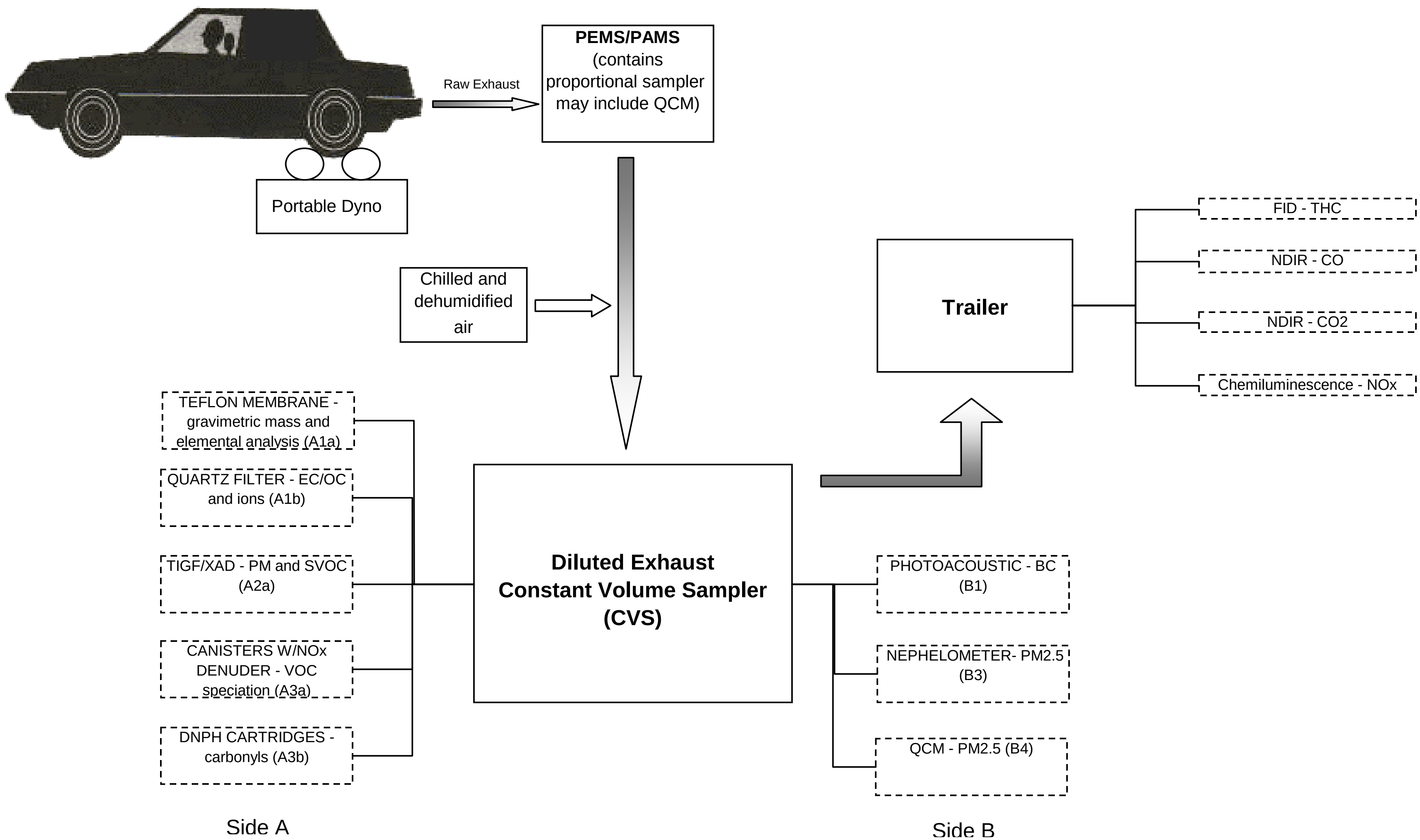
On day two, emissions tests will be performed on the vehicle. The day will start with the dilution tunnel warmup being performed, followed by dynamometer warmup and calibrations. The first test vehicle will then be placed and secured onto the dynamometer for the cold start LA92 driving cycle. All samplers and real time instruments will be readied for testing. A PEMS unit dedicated for use with the dynamometer testing will also be interfaced to the test vehicle. Real time and integrated samples to be collected over the 3 phase test cycle include regulated emissions, PEMS data, real time PM mass and elemental carbon, and integrated PM mass, EC/OC, Ions, SVOC, and gaseous air toxics. At the conclusion of the test cycle, the vehicle exhaust will be disconnected from the dilution tunnel and the dilution tunnel will be purged for at least 30 minutes. During this time, the test vehicle will again undergo a qualitative smoke evaluation, with the exhaust being video taped (if required) against a light background. Following this, the vehicle will be removed from the dynamometer and a PEMS/PAMS unit will be installed on selected vehicles. Tunnel blanks will be collected in the middle of the day during lunch instead of at the beginning of each test day. At the end of each test day the CVS tunnel will be reconditioned by setting the dilution tunnel heater to its highest level and the dilution tunnel will be thoroughly purged.

2.1.2 Summary of Exhaust Measurements

Details of the types of samples and analyses to be performed are shown in Figure 2-6. The PEMS/PAMS system will sample a small portion of the raw exhaust for bag regulated emissions (THC, CO, CO2, NOx). The remaining raw exhaust will be directed to the CVS, where it will be diluted with temperature and humidity conditioned air. The remaining samples will then be taken from this diluted mixture. Real time and bag regulated emissions will be determined using instrumentation housed in EPA’s transportable dynamometer analytical trailer. Aldehydes and Carbonyls will be collected on DNPH cartridges and subsequently transported to the laboratory for HPLC analysis. VOCs will be collected in canisters and also transported to the laboratory for GC speciation. Real time instrumentation for PM analyses include photoacoustic

(BC), Nephelometer (PM2.5) and QCM (PM2.5) instruments. These instruments will be interfaced to the CVS dilution tunnel via appropriately sized iso-kinetic probes and temperature controlled lines. Additional PM samples will be collected on filter media and transported to the laboratory for analysis. These samples will be collected from an iso-kinetic probe equipped with a 2.5 um cutpoint cyclone. Teflon membrane filters will be used to collect samples for gravimetric mass and elemental analysis. Pre-fired quartz filters will be used to collect samples for EC/OC and ion analysis. TIGF/XAD will be used to collect samples for PM and SVOC analysis.

Figure 2-6. Kansas City Exhaust Measurement Flowchart



2.1.3 Differences Between Proposal and Scope of Work

Several changes to the sampling and analysis protocol were incorporated into this version of the study plan resulting from discussions among the project sponsors and contractors. The changes are summarized below.

Vehicle Sample Selection

- At the kick-off meeting it was clear that this study does not require an overrepresentation of smoking vehicles. They will come into the study according to their prevalence in the area. As such, special protocols will not be required for smoking vehicles. Our recruitment protocols will elicit information about whether or not the subject believes that he/she has a "smoking" vehicle, but we will not be invoking sampling procedures to guarantee s prespecificed nominal representation of this vehicle attribute.
- At the kick-off meeting, NuStats provided background on the Kansas City Regional Household Travel Survey. The Travel Survey sample was drawn using list-assisted random digit dialing sampling methodology and in conducting the survey, collected demographic and vehicle information for each participating household. Because of tentative interest by the Mid-American Regional Council (MARC) in this study, NuStats sought and received approval to use the Travel Survey database to draw the sample for the recruitment pilot study. The Study is a rich source of vehicle movement by vehicle type, and NuStats felt it would enhance the analysis and estimate of emissions data in the region. Under this scenario, households that participated in the Kansas City Regional Household Travel Survey would be reviewed and categorized (demographic and fleet characteristics). Using this existing data will enable the Team to conduct the pilot study sooner and focus resources on designing the incentive study questionnaire using, a stated preference (SP) survey technique. Note that the Travel Survey data will supplement the sample purchased from Marketing Systems Group.

Vehicle Recruitment

- A stated preference (SP) survey technique will be used in the incentive study. The SP approach relies on an experimental design of various incentive combinations in order to identify the most important attributes of the incentives as well as the best combination to ensure participation for various demographic groups.
- An advance letter will be sent to households prior to recruitment. This letter will focus on study objectives and purpose, provide a contact to verify legitimacy, and be written such that the importance of participating is paramount. Doing so will lend legitimacy to the project and serve to increase participation rates.

Vehicle Sample Analysis

- The Scope of Work and proposal call for comparative analyses and the use of statistical tests (e.g., Chi-square tests, difference of means, etc.) to determine the extent to which differences occur and to measure significance of those differences. Given the straightforwardness of the analysis, these types of tests are unnecessary for phase I sampling, although analysis to answer research questions is still needed.

Protective Covering for Equipment

Locations have been identified in the Kansas City Metropolitan area for protection of the analytical testing equipment and the recruited vehicles. To better protect the analytical equipment and the consumer's vehicles from the elements during a study of this magnitude, an industrial warehouse has been secured. This warehouse exceeds the requirements set forth in the Scope of Work for protective coverings for the testing equipment.

Testing Protocol and Continuous PM Measurements

- PEMS units will be used more extensively in the emissions testing process than was previously proposed. PEMS units will now be installed during the vehicle conditioning run, prior to vehicle placement upon the dynamometer, to gather additional data. A PEMS unit will also be attached *during* dynamometer testing as well. Also note that originally, PEMS units were intended to take measurements of HC, CO, NOx, and CO2 using the Semtech-G instrument. PEMS units will now include an additional QCM for PM measurement.
- The dynamometer dilution air will be dehumidified and heated to 47^{o}C +/- 5^{o}C during testing. No residence chamber will be used for integrated samples and sampling streams will be maintained at 47^{o}C +/- 5^{o}C. The photoacoustic instrument is an exception since it is designed to operate at below 35 ^{o}C and black carbon concentrations should not be affected by temperature.
- Tunnel blanks will be collected in the middle of the day during lunch instead of at the beginning of each test day. The duration of the tunnel blank sample should be equivalent to the length of the UDC cycle minus the 10-minute soak or some multiple of this duration.
- The dilution tunnel will be purged between tests for at least 30 minutes. Continuous PM measurements will be monitored to ensure that background levels have stabilized after the prescribed purge period. The adequacy of purge time will be evaluated during the pilot study.
- The EPA-supplied TEOM is eliminated. DRI will operate its own TEOM and DustTrak at no cost to the project. However, these measurements will be made as time and resources permit and have lower priority than the QCM, nephelometer and photoacoustic measurements.

- BKI will provide DRI with a time-speed data signal that can be incorporated with the continuous PM database.

Integrated Samples and Compositing

- Vehicles will be brought in for testing randomly. No media composites will be used.
- The back-up quartz filter from the dual quartz filter pack is eliminated. The RFP proposed collecting a second, backup quartz filter behind the primary quartz filter and using the backup as a blank. This backup filter is not an appropriate blank. This approach might be applicable for ambient sampling where relative amounts of SVOC on the aerosol are considerably less than under source sampling conditions. We recommended appropriate numbers of dilution tunnel and field blanks for establishing blank levels and their variability. In addition to collecting quartz blanks during the tunnel blank samples, we are also recommending placing a second quartz filter behind the Teflon (rather than the quartz filter) to characterize the relative importance of SVOC on gravimetric mass. This issue will be evaluated during the pilot study where sampling will be conducted at two temperatures.
- The second quartz filter for ion analysis is eliminated. Each half of the three quartz filters for OC/EC analysis will be extracted together and analyzed for ions.

Chemical Analysis

- After gravimetric analysis of the three Teflon filters for the separate phases of the UDC, the three Teflon filters will be extracted together and the composite sample analyzed for elements by ICP-MS. Table 2-12 compares the elements that are quantified by XRF and ICP-MS and the associated minimum detection limits. Neither method will provide data for all specified elements. We recommend a combination of XRF using DRI protocol A ($21/sample or $63/test for three Teflon filters from each phase of the UDC) and ICP-MS for selected elements (e.g., Pb and Hg definitely and possibly As, Zn, Ni, Mn and Cr) at a cost of ($36 per sample for the first element and $2 for each additional element assuming combining the extracts from the three Teflon filters). Total cost per test would be comparable to the budget estimate in our original proposal of $128 per test.
- Because no media compositing will be possible, TIGF filters and XAD cartridges be extracted and analyzed separately for the 1991 to 1995 and 1996 and newer categories. The TIGF filter has a very low background and removing the artifacts from the XAD will improve the detection limits for particulate organic species. Several samples will be composited together based on appropriate sample composite criteria (e.g., emission rate and ratio of photoacoustic black carbon to QCM mass).

- All of the PM/SVOC organic analysis will be shifted from field blanks and some from transportation blanks to dilution tunnel blanks. Analytical blanks will remain unchanged.
- DRI will upgrade the existing gravimetric analysis to a 0.0001 mg balance.

Sampling and Analysis During Pilot Study

- Integrated measurements of gravimetric mass, OC and EC, and volatile and particulate organic compounds speciation will be included during the pilot study.

RSD Testing

- The Scope of Work originally contained methodology to test certain recruited vehicles (in the recruited sample) using RSD. It is ERG's opinion that the most important use of RSD in this project will be to compare the cohort to the Kansas City fleet as a whole. Any available RSD information is a few years old, and our intention is to obtain current RSD information. Thus, in addition to testing selected vehicles in the cohort, RSD systems will be deployed at several sites around Kansas City to allow for collection of this data.

The following describes ERG's technical approach to EPA's scope of work, as per Section 5 of the RFP.

2.2 Quality Assurance Project Plan (QAPP) and Quality Management Plan (QMP) Task (Section 5.1)

As specified in the RFP, the ERG team will provide draft QMP and QAPP documents according to the following schedule.

- A draft QMP and QAPP for each measurement system to the client within 30 days of task order execution.
- A final QAPP within 30 days of the end of the Pilot Study

2.3 Vehicle Recruitment Tasks (Section 5.2)

The vehicle recruitment effort is comprised of 5 tasks that begin with a study to identify the appropriate incentives and conclude with initial recruitment of households to participate in Round 1 activities. The activities involved in performing these tasks are discussed below, along with a summary of the proposed schedule, key dates, and deliverables.

2.3.1 Vehicle Recruitment Pilot Study (Section 5.2.1)

The purpose of this task is to identify the incentives that will be necessary to ensure participation by regional households. The result will be the creation of an effective motorist recruitment incentive package for vehicle testing and instrumentation, as well as providing the best assurance for a high response rate. The task activities cover sampling, survey design and administration, and analysis of results.

Subtask A. Pretest Household Sample Design

The demographic and fleet characteristics of the households that participated in the Kansas City Regional Household Travel Survey will be reviewed and categorized in order to draw a random sample of households for contact in the incentives test. This will be supplemented by a random general population sample, as both are anticipated for inclusion in the full study. The goal for the incentives test is to include a geodemographic representation of Kansas City residents, not necessarily a sample that is representative of the regional vehicle fleet. (The fleet characteristics will be considered for the full study testing. Here, the pilot is concerned with identifying incentives necessary to offer to the vehicle owners for participating in the study.)

Subtask B. Develop Incentive Options

As identified in the proposal, specific incentives (or combinations thereof) that will be investigated include cash (different levels), rental cars (different qualities), gas tank refills, car washes, and guaranteed rides. A matrix of options with varying levels as well as combinations of options will be developed to ensure a thorough testing during the survey.

The issue of whether respondents with smoking vehicles would require different incentives and whether using a different incentive structure would result in a over-representation of these types of vehicles in the data set was raised in the proposal.

Subtask C. Develop Draft Survey Instrument

Once the incentive option matrix has been finalized, a survey will be designed to test respondent reaction to the incentive options for both vehicle testing as well as vehicle instrumentation. The survey will begin with a brief explanation of the project and what is being requested of the respondent in terms of vehicle testing and instrumentation. Then the respondent will be presented with varying levels and combinations of incentives to identify the optimal mix for ensuring high participation rates and minimizing non-response. This survey will be conducted in English and Spanish, based on the language preference of the respondent. We anticipate about 5% of the interviewers to be in Spanish, based on language prevalence in a current transportation study of the Kansas City region.

The questionnaire will be designed for administration using computer-aided telephone interviewing (CATI) technology. The power of the CATI software will allow for a thorough and random testing of the incentive options. The survey will be designed for an interview that might last up to 20 minutes.

Two approaches will be used in the survey instrument. The first uses a method similar to the contingent evaluation technique, in order to identify the minimum levels for each incentive necessary to induce participation. For those combinations of incentives, a stated preference (SP) survey technique will be utilized. The SP approach relies on an experimental design of various incentive combinations in order to identify the most important attributes of the incentives as well as the best combination to ensure participation for various demographic groups.

Subtask D. Develop Data Collection Protocols

Although the survey will be administered using CATI technology (which implicitly contains the criteria for when particular questions will be asked and how the incentive levels and combinations will be offered), the sample management protocol, interviewer training, and survey administration details will be summarized prior to the start of the pilot. This also includes the timing of the advance mailing as well as identification of the debrief questions regarding the explanation of the vehicle testing concept and the advance mailing.

Subtask E. Develop Survey Materials

Survey research literature contains several citations regarding the positive correlation between the use of advance notification materials and the study response rate. For this study, an advance letter will be designed to inform the randomly selected households of the forthcoming interview and provide contact information to legitimize the study. The letter should be signed by an EPA staff person, preferably someone at the Kansas City office. It should also provide contact information for the EPA project manager and the NuStats manager, in case of questions.

Subtask F. CATI Program and Logic Test

May 4th is the target date for final approval of the pilot survey and materials. This date allows time for the CATI programming and logic check software to be developed and fully tested. Because the survey will incorporate experimental design elements to support the SP survey, a full week is necessary for testing to ensure the skips and rotations work as specified.

Subtask G. Develop/Test Sample Management System

Supporting the data collection effort is a sample management system. This program provides the status for each piece of sample selected for inclusion in the study throughout the course of the study. It is structured such that the key activities take place in a time-sensitive manner – for example, that the mailing addresses are provided to the staff preparing the advance letters such that the letters are mailed 4 days prior to the survey call. In addition, the status of the sample in terms of call outcomes is tracked carefully as well. Although not an issue for the pilot, this system will be critical for ensuring that respondents recruited for Round 1 testing are reminded in a timely manner.

Subtask H. Recruit and Train Interviewers

A team of experienced interviewers will be assembled to staff the project. Because of the nature of the survey and the importance of the incentives test in laying the foundation for the full study, the study will use more experienced interviewers.

A training manual will be developed that includes the background on the project, the objectives of the study, and a question-by-question guide to what is being asked of the respondents. This includes definitions of the various incentives and the levels being tested. All interviewers will receive a briefing as well as spend 2 hours conducting mock interviews before actually beginning the survey process. All training will be monitored and only those staff that exhibit mastery of the task will be allowed to conduct the survey.

Subtask I. Commence Pretest Recruitment

Approximately 100 households will be interviewed for this study, over the course of a week. During the course of interviewing, the outcomes for all calls will be carefully tracked. Interviewing will take place in two stages:

1. Regular Completes. These are households that are contacted and agree to participate in the incentives test survey. We anticipate 90 out of the 100 households to fall into this category.

2. Soft Refusals**.** Some households that are contacted may not be interested in participating due to concerns about legitimacy, other time commitments, or a general lack of interest in the study. Those that are adamant about not participating will be coded as “hard refusals”, while others will express

reluctance, but not in a rude manner. These are termed "soft refusals." Approximately 3 days after the contact that was designated as a soft refusal, an interviewer will make a follow-up call to the household and immediately offer a cash incentive of $20 to participate in the survey. Upon agreement, the same survey would be administered. The home address would be confirmed to ensure the $20 incentive reaches the participant, then the incentive would be mailed out the day following the interview, with a short note of thanks.

Subtask J. Process pretest data for analysis

The data from the survey incentives test will be processed into a master file, with flags to identify the regular vs. soft refusal completes, the various geodemographic groups, and any other identifying characteristics of the household that will support the analysis.

Subtask K. Recommendations based on pilot

The results will be analyzed and a document prepared that summarizes the preferred incentives, how those preferences vary across the respondent groups, and the anticipated cost associated with the preferred incentives. The result will be the identification of several recruitment packages with a sensible incentive costs to be offered during the vehicle recruitment phase.

2.3.2 Cohort/Vehicle Analysis (Section 5.2.2)

2.3.2.1 Cohort Frame Analysis (Section 5.2.2.a)

Our proposed approach stipulates that 2,000 households in the Kansas City Metropolitan Statistical Area (KCMSA) will be randomly selected to participate in the study using random digit dialing methodology. The RDD sample will be obtained from a nationally recognized vendor, Marketing System Group. They will provide random numbers to those exchanges that are known to have working residential telephone numbers. This approach presumes that the sampling frame of households with telephones can provide a representative sample of vehicles from the KC area, as well as from individuals who operate these vehicles, since owners often affect the performance of their vehicles (with respect to emissions) through maintenance patterns, driving styles, and driving patterns .

The frame analysis will also take into consideration the desired stratification (socio-demographic and vehicular segments) required for the sample to reflect the KC MSA. This will be assessed using MARC survey data from the ongoing KC travel survey. The data set from that survey can be used to assess the representation of the RDD sample according to population demographics as well as fleet characteristics. Note that the MARC data is being used as a supplement to the purchased sample from Marketing Systems Group. NuStats believes that relying solely on the MARC sample might introduce bias, because it would likely recruit participants who are already predisposed to participating in surveys. In addition, the MARC sample is limited in terms of number of households available to call. For these reasons, our sampling plan for recruitment of our Cohort Frame combines both MARC data and the purchased sample.

The methodology will be documented in a memorandum that documents the sample design, stratification used, associated costs, and restrictions in use, if any.

2.3.2.2 Cohort Recruitment (Respondent/Non-respondent) Analysis (Section 5.2.2.b)

Participants will be recruited via RDD sampling of the Kansas City (KC) metropolitan area. Such samples are geographically and demographically representative of the KC population. Recruitment will screen respondents on vehicle information (e.g., make, model, year, user) and household demographic information (e.g., age, gender, and other socio-demographic variables). Demographic data is available for the MARC sample, but not the purchased sample. In cases where demographic information is unknown, NuStats will use US Census-based zip code data to impute these key variables for the analysis, rather than directly inquiring of participants. Recruitment will be monitored to watch for stratification quotas, nonresponse, and other issues. Assessments for nonresponse or quota adjustments (to the interview tool) will be made as necessary. The process for recruitment and any necessary adjustments will be documented in a vehicle/cohort recruitment memorandum.

Because we will be recruiting vehicles from participating households of an RDD sample survey, our underlying assumption is that the distribution of recruited vehicles from these households will be highly representative of the KC vehicle fleet. This assumption will be assessed empirically by comparing the pool of cohort sample vehicles with the known distributions of the KC vehicle fleet obtained from extant data.

2.3.3 Cohort/Vehicle Fleet Analysis (Section 5.2.3)

The final cohort sample resulting from the cohort recruitment will be compared to the KCMSA fleet with respect to vehicle distribution patterns by year, model, and make. (Cohort recruitment comparison to the national fleet may be necessary if obtaining registration information proves problematic). The analysis will assess the degree in which the three populations differ to confirm that the cohort sample is representative of the KCMSA fleet as a whole. This analysis will be documented in a cohort/fleet analysis memorandum including methodology, databases used for KCSMA and national fleets, and analysis approach.

2.3.4 Cohort/Vehicle Emission Analysis (Section 5.2.4)

Upon completion of the vehicle emissions testing, a comparative analysis of the cohort data and the regional Kansas City fleet will be conducted. The methodology, data, and statistical analysis will be described in a memorandum.

2.3.5 Cohort/Vehicle Summary Analysis (Section 5.2.5)

A report summarizing tasks 2.3.1 – 2.3.4 will be prepared that compares the chosen cohort for the testing program with the cohort fleet. Sampling biases and other issues related to using the sampling cohort as the recruitment population will be addressed. The report will provide conclusive judgment on the value of the cohort sample for vehicle recruitment.

2.3.6 Vehicle Recruitment Sample Plan (Section 5.2.6)

Using the cohort sample, the core sample of 480 vehicles to participate in the study will be drawn. For round 1, 170 vehicles will be recruited from the cohort and 80 vehicles from the non-response households. For Round 2 vehicle recruitment, 230 different vehicles from the cohort will be recruited along with 25 vehicles from Round 1 for retesting.

2.3.7 Vehicle Recruitment (Section 5.2.7)

Subtask A. Revise Survey Instrument

Based on the incentives packets and the respondent reactions to the study descriptions provided during the pilot test, the recruitment instrument will be finalized and translated into Spanish. The recruitment interview is anticipated to average 10 minutes in length. It will begin with a description of the program, obtain household address and vehicle information, and secure agreement for testing (in a hypothetical manner). The outcome of each call attempt will be tracked and the sample thoroughly dialed according to industry standards. A “completed” recruitment interview is one in which the household agrees to be scheduled (if selected), provides all key fleet characteristics, and provides/confirms a valid home address. NuStats will use census data for given zip code to impute key demographic variables for the analysis. Sufficient households will be recruited to ensure that 480 vehicles are tested. We estimate that 2,000 households will have to be recruited to ensure that 480 vehicles conforming to the data collection goals are tested in Rounds 1 and 2.

For those households contacted who decide not to participate, the survey will include a few questions about that decision, to be attempted for all refusers. This information will most likely include home address, gender (observed), and household vehicle information.

Subtask B. Finalize Data Collection Protocols

Data collection protocols will be adjusted to accommodate the refocus from incentives testing to household recruitment. Again, the surveys will be administered using CATI technology (which implicitly contains the criteria for when particular questions will be asked and how the recruitment process will be managed). The corresponding sample management protocol, interviewer training, and survey administration details will be summarized prior to the start of recruitment. This also includes the timing of the advance mailing.

Given the requirement that a portion of the vehicles tested must come from households that initially refuse to participate, the treatment of soft refusals will be documented and pre-programmed. This includes details regarding when a callback is made, how the sample will be identified for treatment by specially trained interviewers, and how the refusal-conversion respondents "availability" designation differs from a regular recruit so that progress towards the different testing goals can be monitored.

Subtask C. Finalize Survey Materials

The advance notification mailing will be revised to focus on the key points that the pilot respondents found important. This letter will be signed by an EPA official, preferably one from the Kansas City region, and contain contact information for the EPA project manager as well as the NuStats Project Manager.

Following the recruitment call, households that agree to be scheduled will be mailed a packet containing more details about the vehicle testing program. This might include statistics about the levels of pollutants in the Kansas City region and what that means for the regional residents (we would like to discuss with EPA the possibility of obtaining and using one of their existing brochures for this purpose), what the testing will achieve, how households will be selected and what will be required of participating households. We will also consider other small "tokens of appreciation," as survey literature indicates that pre-payment of a small incentive has a positive effect on response rates. This follow-up package will only be sent to those households sampled for testing in Round 1 and Round 2, and will be mailed approximately 4 days prior to the scheduling call.

Subtask D. Finalize CATI Program and Test Logic

The CATI recruitment program will be finalized and tested to ensure it conforms to the skip logic.

Subtask E. Finalize Sample Management System

The sample management system will be critical for timely interaction with the recruited households. On any given day, the program will identify households to be mailed the advance notification, those that should be contacted for recruitment, those eligible for scheduling, and those that require reminder calls for upcoming appointments. A portion of the program will be set to receive schedule outcome updates from BKI (so that real time tracking of actual tested vehicles by goals is maintained, as well as the rates of attrition between those that agreed to testing vs. those that actually completed the testing process).

Subtask F. Recruit and Train Interviewers

A team of experienced interviewers will be assembled to staff the project. Because of the nature of the survey and the importance of securing valid agreements for the testing process, the interviewers will focus on obtaining solid commitments and their training will reflect that need to discern respondent reactions.

A training manual will be developed that includes the background on the project, the objectives of the study, and a question-by-question guide on what is being asked of the respondents. It will show the detailed data collection process, from advance mailing to recruitment, scheduling, and reminder calls, as well as how the recruitment feeds into the two rounds of recruitment. This document will also include definitions of the various incentives and the levels being offered, as well as explicit detail regarding how the incentives will be administered and under what circumstances. All interviewers will receive a briefing as well as spend two hours conducting mock interviews before actually beginning the survey process. All training will be monitored and only those staff exhibiting mastery of the task will be allowed to conduct the survey.

Subtask G. Issue Advance Letters to Households

Four days prior to the dialing of specific sample, advance letters will be mailed to households identified as being ready for the recruitment call. As discussed in an earlier task, this letter will focus on study objectives and purpose, provide a contact to verify legitimacy, and be written such that the importance of participating is paramount. It will be signed by an EPA staff person, preferably one from the Kansas City region and provide contact information for the EPA project manager and the NuStats project manager.

Subtask H. Recruitment Operations/Calling

Recruitment will take place on a daily basis, with households being identified based on the fleet characteristics that will guide the selection of households for scheduling. The best timing of the recruitment call will be adjusted based on respondent reaction and the exact number of days between recruitment, scheduling, and the actual appointments in order to maximize participation levels. Real time progress towards the vehicle testing goals will be monitored using the CATI reporting functions.

Subtask I. Process Recruitment Data

At the conclusion of each shift, the data will be extracted and appended to the master sample management system.

2.3.7.1 Vehicle Recruitment (Round 1) (Section 5.2.7a)

Subtask J. Sample Vehicles for Round 1 Recruiting

The cohort analysis conducted in the previous task will be used to select vehicles for testing from among the fleet represented by the recruited households. Sufficient vehicles will be identified to ensure that the correct distribution of 480 vehicles is obtained. This distribution is shown in Table 2-1, which is derived from Table 1 in the SOW.

Table 2-1. Estimated Sample Sizes by Stratum

Stratum	Vehicle Class	Age Class	Total Vehicles Tested	Regular Responders	Refusers
1	Truck	Pre 1980	50	42	8
2	Truck	1980 – 1990	100	84	16
3	Truck	1991 –1995	70	58	12
4	Truck	1996 and newer	40	33	7
5	Car	Pre 1980	40	33	7
6	Car	1980 – 1990	50	42	8
7	Car	1991 –1995	80	66	14
8	Car	1996 and newer	50	42	8
Total			480	400	80

It is anticipated that 300 households will need to be sampled to result in 80 vehicles tested. For the regular respondents, we anticipate sampling 1,000 to 1,500 households to complete the 400 tests.

For Round 1, the testing will include all 80 refuser vehicles and 170 of the 400 regular responder vehicles, for a total of 250 vehicles tested. In Round 2, the goal will be to retest 25 of the 250 vehicles plus 230 vehicles from the regular responder households. Table 2-2 presents a summary of vehicles recruited and tests performed for each round.

Table 2-2. Estimated Number of Vehicles Recruited and Test Performed

	Different Vehicles	Tests
Round 1		
Positive Respondents from Cohort	170	170
Replicate Vehicle Tests	0	15
Non-respondent from Cohort[a]	80	80
Weekly calibration vehicle test [b]	0	12
Total	**250**	**277**
Round 2		
Positive Respondents from Cohort	230	230
Non-respondent from Cohort[a]	0	0
Replicate Vehicle Tests	0	10
Repeat Vehicles from Round 1[b]	25	25
Weekly calibration vehicle test [b]	0	12
Total	**255**	**277**

[a] see Section 3.1.3 for description of this activity.
[b] see Section 3.2.3 for description of this activity.
Total vehicles includes non-response assessment.

Subtask K. Contact Households and Schedule Appointments

Selected households for the first round will be re-contacted and scheduled for vehicle testing. Prior to the start of scheduling operations, a detailed schedule would be developed that includes all valid testing dates, the appointment "slots" for each date, and a unique identification number for each slot on each day. This production plan is critical for ensuring successful recruitment and scheduling, as it would trigger when the advance letters are mailed as well as ensure the reminder calls be made on a timely basis. Each time slot will have a maximum cap on how many households can be scheduled, to ensure a steady flow of appointments. Once a particular time slot has been filled, households will be directed to the next available time slot (the CATI program will automatically track households in each time slot and "close" each once the maximum is reached). Ultimately, households will be scheduled for the most convenient time slot among those available.

Scheduling will take place at sufficient levels in order to ensure that 250 vehicles are tested in this round. Of the 250 vehicles, 170 will come from households that respond positively to the survey effort and 80 will come from those that initially refused but were "converted" after a follow-up call and using a different incentive (see 2.3.6 above). It will be critical for BKI to report daily on actual testings completed to ensure that scheduling is at the right level (not too many and not too few households) and stratum goals are being fulfilled as planned. Recruitment estimates will be adjusted daily based on feedback from BKI.

Scheduling calls will take place about a week prior to the appointments, and followed-up with reminder calls the day/evening prior to the appointment. Reminder calls will be critical to ensuring the proper flow of vehicles at the testing facility. They will be short (2 minutes) and exclusively for the purpose of reminding the household about their testing appointment and the promised incentive. Reminder calls will be attempted for all scheduled households.

Subtask L. Provide Appointment Schedule to Test Facility

Appointment summaries will be prepared and sent to BKI, along with summary reports tracking participation by key variables. The home address information will be used for delivery of the incentive to the household (some incentives may be provided to BKI for delivery at the time the household keeps the appointment, others may be provided directly to the household through the mail).

In addition, an appointment reminder postcard will be drafted if the pilot respondents indicated it would be useful.

Subtask M. Comparative Analysis of Tested Vehicles

Statistical tests will be used to confirm that there were no differences in the vehicles that were tested vs. those that were sampled for testing.

Subtask N. Develop Analytic Weights

Weights will be developed to compensate for non-response analysis, as well as to adjust the results to represent the overall vehicle fleet in the Kansas City region.

Subtask O. Methodology Report on Round 1

A report documenting the efforts of Round 1 recruitment, scheduling, and impact on the incentives will be prepared and submitted.

2.3.7.2 Vehicle Recruitment (Round 2) (Section 5.2.7b)

Subtask P. Review Vehicle Data of Agreeing Households

The status of data collection at the end of Round 1 will be reviewed against the data collection goals listed in Table 2-1. This will assist in the determination of which households to sample.

Subtask Q. Sample Vehicles for Round 1 Re-testing

The goal is to retest 25 vehicles from Round 1. The purpose of this task is to randomly sample 100 households from Round 1 to recontact for purposes of achieving that goal. Table 2-3 presents the estimated sample sizes for the Round 2 re-testing .

Table 2-3. Estimated Sample Sizes by Stratum for Round 2 Re-Testing

Stratum	Vehicle Class	Age Class	Sample Size **(n_h)**[1]
1	Truck	Pre 1980	3
2	Truck	1980 – 1990	5
3	Truck	1991 –1995	3
4	Truck	1996 and newer	2
5	Car	Pre 1980	2
6	Car	1980 – 1990	3
7	Car	1991 –1995	4
8	Car	1996 and newer	3
Total			25

1 Number of randomly selected vehicles tested during Round 1 re-tested during Round 2.

Subtask R. Sample vehicles for Round 2 Testing

Sufficient vehicles (and their associated households) will be sampled from the recruited households to ensure that 230 vehicles will be tested during the 2nd round of the study (see 2.3.6 above).

Subtask S. Contact Households and Schedule Appointments

Selected households for the second round will be re-contacted and scheduled for vehicle testing. As with Round 1, prior to the start of scheduling operations, a detailed schedule would be developed that includes all valid testing dates, the appointment "slots" for each date, and a unique identification number for each slot on each day. This production plan is critical for ensuring successful recruitment and scheduling, as it would trigger when the advance letters are mailed as well as ensure the reminder calls be made on a timely basis. Each time slot will have a maximum cap on how many households can be scheduled, to ensure a steady flow of appointments. Once a particular time slot has been filled, households will be directed to the next available time slot (the CATI program will automatically track households in each time slot and "close" each once the maximum is reached). Ultimately, households will be scheduled for the most convenient time slot among those available.

Scheduling will take place at sufficient levels in order to ensure that 255 vehicles are tested in this round. Of the 255 vehicles, 25 will come from vehicles that underwent testing in Round 1 and the remaining 230 will come from those that were recruited earlier in the year (see 2.3.6 above). Given the passage of time since the initial recruitment, the scheduling interview will be longer, as it will be necessary to confirm the demographic and fleet information for each household.

Again, it will be critical for BKI to report daily on actual testings completed to ensure that scheduling is at the right level (not too many and not too few households) and stratum goals are being fulfilled as planned. Recruitment estimates will be adjusted daily based on feedback from BKI.

Scheduling calls will take place about a week prior to the appointments (or at whatever length was found to work best in Round 1), and followed-up with reminder calls the day/evening prior to the appointment. Reminder calls will be critical to ensuring the proper flow of vehicles at the testing facility. They will be short (2 minutes) and exclusively for the purpose of reminding the household about their testing appointment and the promised incentive. Reminder calls will be attempted for all scheduled households.

Subtask T. Provide Appointment Schedule to Test Facility

Appointment summaries will be prepared and sent to BKI, along with summary reports tracking participation by key variables. The home address information will be used for delivery of the incentive to the household (some incentives may be provided to BKI for delivery at the time the household keeps the appointment, others may be provided directly to the household through the mail).

Subtask U. Comparative Analysis of Tested Vehicles

Statistical tests will be used to confirm that there were no differences in the vehicles that were tested vs. those that were sampled for testing.

Subtask V. Develop Analytic Weights

Weights will be developed to compensate for non-response analysis, as well as to adjust the results to represent the overall vehicle fleet in the Kansas City region.

Subtask W. Methodology Report on Round 2

A report documenting the efforts of Round 2 recruitment, scheduling, and ultimate results of the recruitment effort.

2.3.8 Non-Response Assessment (Section 5.2.8)

A critical component of this study is to determine the presence and extent of bias introduced into the survey by non-response. Using the original survey of respondents, this task will draw approximately 340 non-respondents with the goal of convincing 80 of these households to respond and agree to have their vehicles tested. The number of vehicles to target in each stratum for the non-response analysis will be proportional to the vehicles recruited for the total population - as shown in Table 2-4 below.

Table 2-4. Estimated Sample Sizes by Stratum for Non-Respondent Testing

Stratum	Vehicle Class	Age Class	Sample Size (n_h)[1]
1	Truck	Pre 1980	8
2	Truck	1980 – 1990	16
3	Truck	1991 –1995	12
4	Truck	1996 and newer	7
5	Car	Pre 1980	7
6	Car	1980 – 1990	8
7	Car	1991 –1995	14
8	Car	1996 and newer	8
Total			80

1 Number of randomly selected vehicles tested for the non-response assessment.

A list of non-respondent criteria will be developed (e.g., those classified as a "hard" refusal during the original survey along with those households refusing to answer questions critical for stratification and analysis) and submitted to EPA for approval. In addition, criteria to achieve a high participate rate for non-respondents will also be submitted to EPA for approval.

Vehicles will be recruited to participate in the program, and the results from these 80 respondents will be compared with the 400 respondents to determine the presence of any non-response bias. Findings will be reported in a non-response memorandum at the conclusion of the Phase I study.

2.3.9 Participation Incentives (Section 5.2.9)

The appropriate mix of incentive packages for use in recruiting study participants (for participants and non-respondents) will be identified during the pilot test. Incentives will be disbursed upon participant completion of the necessary paperwork at the test center. On a monthly basis, a memorandum documenting of the incentive disbursements will be submitted to the EPA Project Officer. This report will document the total amounts disbursed for all incentive packages. When 75% of the allotted incentive funds have been paid out, the EPA Project Officer will be notified. Examples of possible incentives are presented in Table 2-5 below.

Table 2-5. Incentives

Type of Incentives	**Incentive Cost**
Cash	$200 (if using a rental vehicle) $275 (for not using a rental vehicle)
Full Tank of Gasoline	$25
Rental Vehicle	$75 (for up to three days)
Car Wash (possible)	$10
PEMS / PAMS Use	$50
Total	**$360**

2.3.10 Post Round 1 Vehicle Analysis (Section 5.2.10)

Following round 1 testing, regulated and PM mass emission results, as well as vehicle data, will be compiled and submitted in a report for review by the EPA Project Officer and Sponsors. This report will also include an evaluation of the data, and document any known problems and concerns that were encountered in round 1, including vehicle processing and conditioning, testing, and emissions sampling and analysis. If problems are identified, suggestions will be offered for improving the affected processes. The goal of this analysis and report are to identify and correct issues related to the quality of data being generated that were not identified before or during the course of round 1.

2.4 Vehicle Testing Task (Section 5.3)

BKI will provide vehicle-testing services to the project for the pilot study and the intensive 2-part field study. Chassis dynamometer vehicle emissions testing will be conducted according to a protocol developed for the transportable dynamometer by EPA/ORD/NERL.

2.4.1 Pilot Vehicle Testing Task (Section 5.3.1)

BKI will provide technical support for the calibration, operation and maintenance of a portable chassis dynamometer, associated driver's aid, constant volume sampler (CVS), analytical bench, and data acquisition/reduction system. This system is used to obtain exhaust emission samples in the field. In addition, BKI will support the calibration, operation, and maintenance of other sampling and measuring equipment as specified in the SOW descriptions. BKI will comply with all EPA health and safety, environmental, waste handling, and other applicable work rules. BKI will also follow proper laboratory, field testing, and vehicle testing practices for all work required by the SOW. BKI will adhere to all applicable standard operating procedures and the QA/QC procedures recommended therein. BKI will notify the ERG Project Manager, the Project Officer, and WAM immediately if it encounters any equipment failures that cannot be readily remedied by the contractor or technical problems that may impact the quality or on-time delivery of deliverables, or if any required equipment or supplies are unavailable to accomplish the required work under this SOW. Specific subtasks for the pilot vehicle testing are described in detail below.

Subtask A. Prepare Work Plan for Pilot Study

The ERG team has prepared a Work Plan (this document) for submittal, describing the tasks and subtasks to be performed. Applicable Quality Assurance Project Plans (QAPPs) and Quality Management Plans (QMPs) will also be submitted as part of this task.

Subtask B. Protective Covering for Equipment and Vehicles, Test Site Selection

BKI and ERG will identify an industrial warehouse in the Kansas City Metropolitan area for the testing of the recruited vehicles. This will also better protect the analytical equipment from the elements and provide stable electrical power. This will allow the analytical equipment to be continually powered up which eliminates warm-up times. The location identified has large drive in doors for ease of equipment setup and for ease of entry for the test vehicles as well as increased ventilation. The test area with all doors open will allow for the overnight soaking of test vehicles at ambient conditions and will allow the background levels to be maintained at ambient levels while testing.

Subtask C. Prepare and Transport Dynamometer and Analytical Trailer

BKI staff will prepare and transport the transportable dynamometer and analytical trailer to the Kansas City test site. Before transport the dynamometer system will be inspected and packed for shipment. All components and analytical equipment will be strapped down and secured for over the road transportation. The transportable test cell includes a Clayton model CTE 50-0 water brake chassis dynamometer mounted on a Freuhauf trailer. The dynamometer is coupled to a Clayton direct drive variable inertia flywheel system allowing vehicle testing at inertia weights of 1750, 2000, 2250, 2500, 2750, 3000, 3500, 4000, 4500, 5000, and 5500 pounds. Vehicle road load (Hp @ 50 MPH) is manually set using the driver's pendant switch.

All utilities necessary for dynamometer operation (compressed air, cooling water, and electrical power distribution) are self-contained on the trailer. A compressor provides compressed air for operation of the dynamometer's roll brake, vehicle lift, and flywheel clutches. Compressed air is also available at each corner of the trailer via quick-disconnect fittings for adjusting test vehicle tire pressure. A closed-loop water system provides the dynamometer's power absorption unit with both cooling and load water. The water system includes a SPA pump, a 12 gallon storage tank, and a liquid to air heat exchanger. The water system is normally filled with a 50/50 mixture of water and antifreeze to prevent freeze damage in colder weather. The air compressor and water system are electrically wired into the test cells electrical power distribution box. Electrical outlets, also wired to the power distribution box, are located underneath the trailer for miscellaneous equipment with either110 VAC and 220 VAC power requirements.

Subtask D. Transport EPA Correlation Vehicles and Fuel to Kansas City Test Site

BKI will provide for the transportation of the EPA correlation vehicles, fuel, and oil from Ann Arbor, MI. to the Kansas City test site and back to Ann Arbor, MI. after the study concludes. The vehicles will be placed on a motor carrier and delivered after the transportable dynamometer is initially setup. After testing the vehicles will be returned to the EPA Ann Arbor facility.

Subtask E. Off-Load and Setup Dynamometer, Analytical Trailer, and Associated Sampling Equipment

BKI staff will off-load, setup, and calibrate the dynamometer, analytical trailer, and associated sampling equipment on its arrival at the Kansas City test site. A wrecker will be obtained to move both the dynamometer and analytical trailer from the flat-bed trailers and into the industrial warehouse. After positioning both trailers BKI staff will begin removing and setting up the interconnecting equipment. Electrical service will be connected to both the transportable dynamometer and analytical bench and 3 phase power will be connected to the dilution tunnel heater.

Subtask F: Maintain & Calibrate Dynamometer, Analytical Trailer, and Associated Sampling Equipment

BKI will maintain the transportable dynamometer to make real-world emission measurements in the field and the laboratory. BKI staff will repair the equipment on an as-needed basis. If the system requires modifications, approval by the EPA Project Officer is required beforehand. BKI staff will calibrate the transportable dynamometer, analytical equipment and associated sampling equipment after setup has been completed and all systems prove to be operational. The Positive Displacement Pump-Constant Volume Sampling (PDP-CVS) system used to dilute and transport the vehicle tailpipe exhaust to analyzers during the test will be calibrated as described in the SOP. Coastdowns will be performed on the Clayton dynamometer that is coupled to a direct drive variable inertia flywheel system allowing vehicle testing at inertia weights of 1750, 2000, 2250, 2500, 2750, 3000, 3500, 4000, 4500, 5000, and 5500 pounds. Vehicle road load (Hp @ 50 MPH) is manually set using the driver's pendant switch. The regulated emission analyzers will be calibrated according to the SOP. The dilute THC concentrations will be determined using a heated flame ionization. The detector analyzer calibration curve should cover the range of 0 ppmC to 3,000 ppmC. Likewise, CO concentrations will be determined using non-dispersive infrared (NDIR) analyzers. CO analysis should cover a range of 0 ppm to 10,000 ppm (1.0%). In order to meet this calibration curve, two CO analyzers are typically required - one from 0 to 1000 ppm, and one from 0 to 10,000 ppm (1%) CO. CO2 concentrations are also determined using a NDIR analyzer. CO2 analysis should cover a range of 0 ppm to 50,000 ppm (5%). NOx concentrations will be determined using a chemiluminescence analyzer. The NOx measurement must include the sum of nitrogen oxide and nitrogen dioxide. This determination can be completed satisfactorily by calibrating and running the chemiluminescence analyzer in NO only mode, and multiplying the result by 1.03. This eliminates the need for the converter and flow balance. The NOx analysis should cover a range of 0 ppm to 700 ppm.

Subtask G. Interface Study Specific Analytical Equipment

BKI will supply the interface for the study specific equipment used for EPA-AA real time PM samplers and DRI gaseous and PM samplers. These heated dilution tunnel ports and probes will allow isokinetic flows for the continuous and integrated air measurements to be extracted from the dilution tunnel. BKI staff will also supply the interface for the second-by-second speed time trace for the incorporation into the real-time PM measurements.

Subtask H. Test Dynamometer and Analytical Systems with Control Vehicle

After the analytical systems are setup and flows calibrated, BKI staff will test the dynamometer and analytical equipment using a control vehicle. This will allow the onsite scientists to calculate the delay times and make the correction in their data spreadsheets. When the corrections have been performed the control vehicle will be ran until all systems are performing as required.

Subtask I. Determine and Develop Protocol for Dilution Tunnel to Minimize the Effects of HC Entrainment

BKI will conduct a series of experiments that will determine if 10 hours of tunnel purging is required to achieve a stable dilution tunnel operation. After the designated control vehicle is disconnected from the dilution tunnel transfer tube, the degradation of PM and total hydrocarbon can be monitored on a second by second basis using the real-time PM monitors and the total hydrocarbon instrument. These tests will also be performed on a high emitting vehicle to determine the length of time required to assure that background levels are obtained before testing is resumed.

When this experiment is concluded and results are reviewed, BKI will document and change if necessary, procedures to ensure proper emission measurements for the testing program. BKI will update its SOP to represent any changes in the procedure resulting from the finding.

Subtask J. Test EPA Correlation Vehicles

BKI will test the correlation vehicles provided by EPA at the Kansas City site. Because testing is being performed under ambient conditions (outdoor conditions) all tests will be conducted as close to the Federal Procedure and the previously performed EPA Ann Arbor tests as possible. Also, the same fuel and oil will be used for performing the tests on the correlation vehicles. BKI is expecting at least 3 vehicles ranging from a newer lower mileage vehicle, an intermediate aged and mileage vehicle, and/or an older high emitting vehicle. Test vehicles will be preconditioned on the first day and tested on consecutive days for at least 3 times each. This data will be compared to the results obtained from tests performed in the EPA laboratory in the EPA-AA location. Comparisons will also be performed on tests without heat or humidity control.

Subtask K. Evaluate Test Results and Report Data

Immediately after the correlation vehicles have been tested BKI will begin evaluating the emission data. Within one month after the completion of the correlation vehicle tests the data will be reported. This report will include emission rates obtained for regulated pollutants from any vehicles tested during the pilot study. All documents will be prepared using a version of Microsoft Word or Wordperfect unless otherwise specified in the task order. Electronic media materials will be delivered on 3 ½ " disks, CD-R, DVD, or hard drive. BKI will develop and maintain files supporting the requirements of each task. This data will be reported to ERG for the inclusion of PM data for the final reporting to EPA's Project Officer and sponsors for use in their evaluating the results obtained in the pilot study.

Subtask L. Document and Change Procedures and Methods in QAPP

When the Pilot Study portion of the program is concluded and results are reviewed, BKI will document and change, if necessary, procedures and methods, quality assurance and quality control procedures, and data management procedures to be used in the actual in-use vehicle testing project to ensure the proper emission measurements for the testing program.

2.4.2 Vehicle Testing Task (Specialized Sampling and Analytical Needs) (Section 5.3.2)

The project will characterize gaseous and PM exhaust emissions from the test vehicles in accordance with the testing and sample analysis procedures described in Task 5.4. PM continuous and integrated air measurements will be extracted from the BKI dilution tunnel through a low particulate loss 2.5 um cut point pre-classifier. The sample will be isokinetically partitioned among the continuous instruments and integrated air samples using a suitable sample distribution manifold. Continuous measurements include the following instruments to be supplied by the EPA: Brooker Systems Model RPM-101 Quartz Crystal Microbalance (QCM), and Thermo-MIE Inc. DataRam 4000 Nephelometer. In addition, we will supply a DRI photoacoustic instrument for determination of black carbon mass concentrations. Parameters determined from the integrated samples include PM gravimetric mass, elements, elemental and organic carbon, ions, particulate and semi-volatile organic compounds (all compounds in Table 12 of the RFP plus methylated-PAHs and oxy-PAHs, and as an option, nitro-PAHs), volatile organic air toxics (benzene, toluene, xylenes, ethylbenzene, styrene, 1,3-butadiene, n-hexane, naphthalene, formaldehyde, acetaldehyde, acrolein and MTBE. Vehicle testing and sample analysis procedures are described in Task 5.4.

We recognize that not all of the samples specified for collection in Table 7 and 8 of the RFP can be analyzed due to budget limitations. As requested in the RFP, a budget for complete chemical analysis of 50 vehicles is provided. This budget provides for collection of all samples specified in Tables 7 and 8 of the RFP and determination of gravimetric mass for all Teflon filters and analysis of a corresponding proportion (i.e., 50/554) of the blank samples specified in Table 8 of the RFP. In similar sampling programs in the past, various compositing approaches were used to reduced analysis cost without adversing affecting project goals and objectives. These approaches are described in this section.

Recent study such as the U.S. Department of Energy's Gasoline/Diesel PM Split Study and the Northern Front Range Air Quality Study have shown that newer, low mileage gasoline vehicles are low PM emitters. Figure 2-7 shows the distribution of light-duty gasoline vehicle $PM_{2.5}$ mass emission rates by ten model year and mileage categories (Gabele et al, 2003). Figure 2-8 shows the distribution of the same data by ascending mileage accumulation and vehicle age. Of the 57 vehicles tested, all of the 16 vehicles with less than 98K miles and all of the 31 vehicles newer than 11 years had emission rates less than 20 mg/mi. Several vehicles were sampled on the same sampling media for the four cleanest categories in order to improve the signal to blank ratios. We refer to this sampling approach as "media composites" as opposed to a "sample composite", which involves combining several samples by extracting several samples together or by other means prior to chemical analysis. Figure 2-7 also shows that fewer samples were composited for chemical analysis for older, high mileage vehicles. The rationale for compositing approach used in these prior studies reflected budget limitations and limits of analytical sensitivities for various sampling media and analytical methods.

Table 2-6 gives estimate mass loadings for a range of PM mass emission rates by applying suitable parameters for the BKI portable dynamometer, driving cycle, and our various sampling systems. Based upon these estimates, most vehicles newer than ten years and with mileage accumulations less than 100K would yield mass loading well below the optimum target loadings of 200 μg per sample for carbon analysis and 1 mg per sample for all other analyses. Accordingly, we recommend a combination of media and sample composites. Test vehicles were recruited during the Gasoline/Diesel PM Split Study by vehicle category starting with the newest vehicles with low mileage. This was especially important during the first four categories that involved media composites. In these cases, about four vehicles were composited. However, for the present study, vehicles will be brought to the testing facility randomly among the eight vehicle categories and collection of media composites will not be possible. In order to reduce the effect of media blanks, we propose to extract and analyze the filters and XAD samples (or composites) separately for the two latest model year categories.

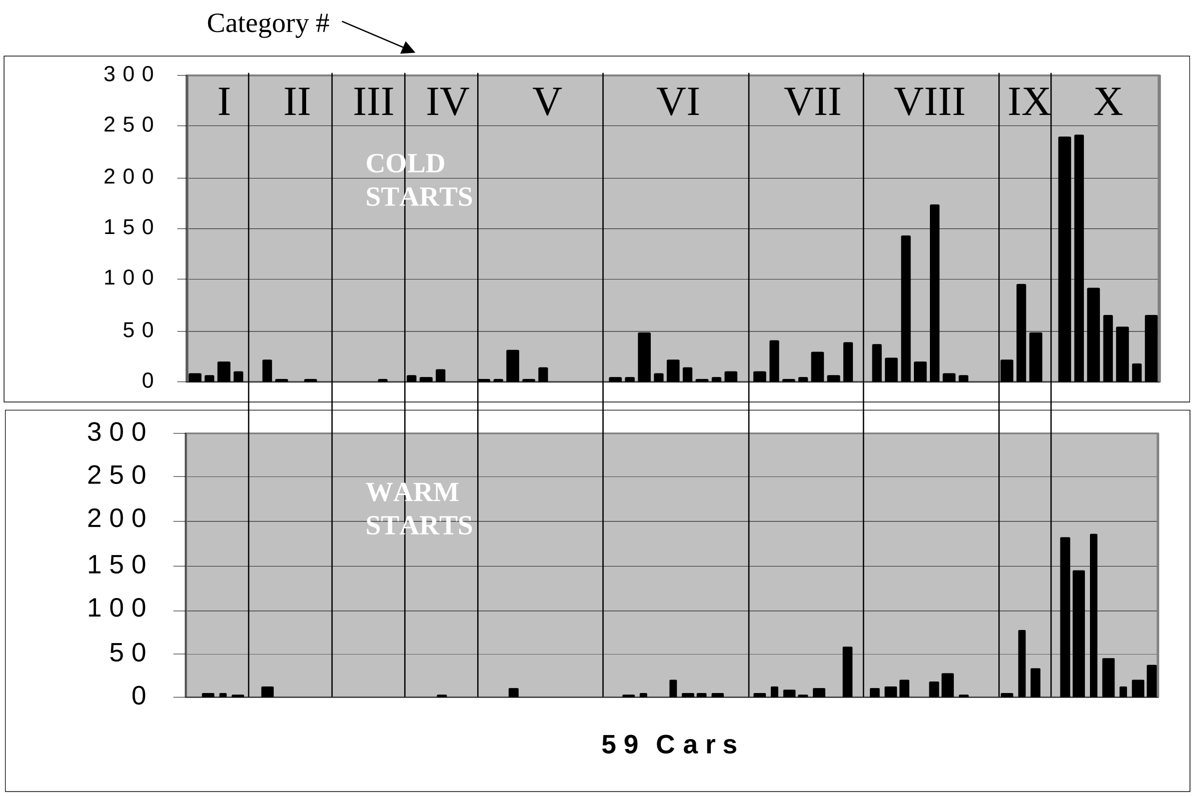
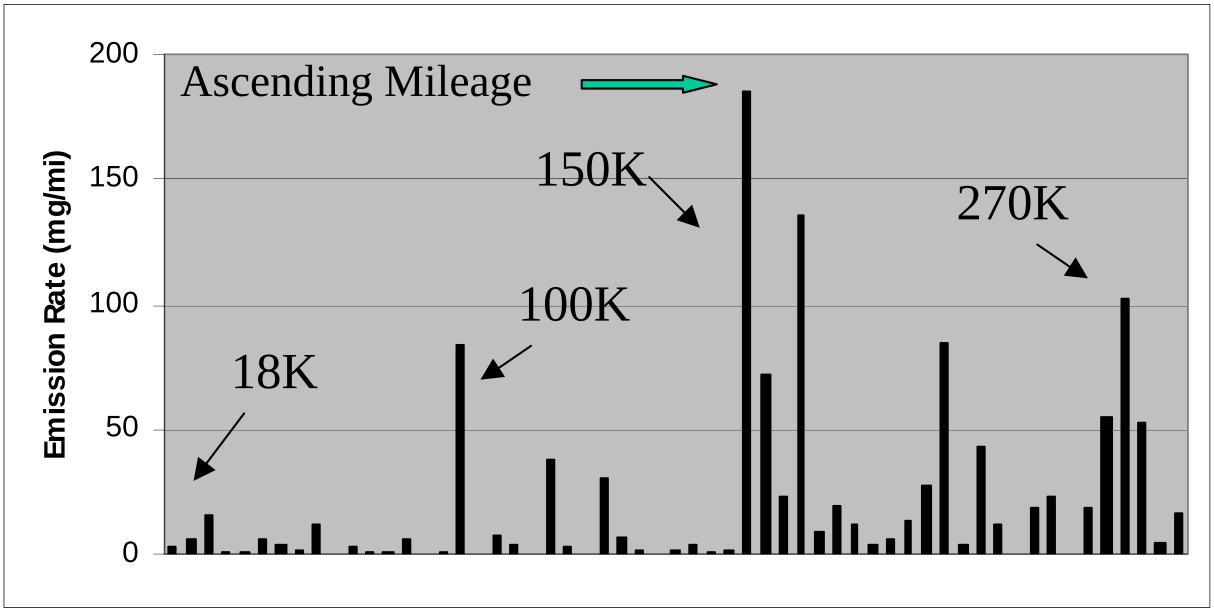


Figure 2-7. Distribution of light-duty gasoline vehicle PM2.5 mass emission rates by model year and mileage categories. Preliminary results from the DOE Gasoline/Diesel PM Split Study (Source: Gabele, 2003)

Category	Model Year	Odometer (miles)	Number of Vehicles	Number of Composites
1	1996 and newer	low mileage (< 50,000)	4	1
2	1993-95	low mileage (< 75,000)	4	1
3	1996 and newer	high mileage (> 100,000)	4	1
4	1990-92	lower mileage (< 100,000)	4	1
5	1993-95	higher mileage (> 125,000)	8	2
6	1990-92	> 125,000	9	3
7	1986-89	> 125,000	6	3
8	1981-85	> 125,000	6	3
9	1980 and earlier	> 125,000	6	3
10	Smoker	no model year or odometer criteria	6	6
11	LD Diesel	no model year or odometer criteria	2	2
		Total	59	26



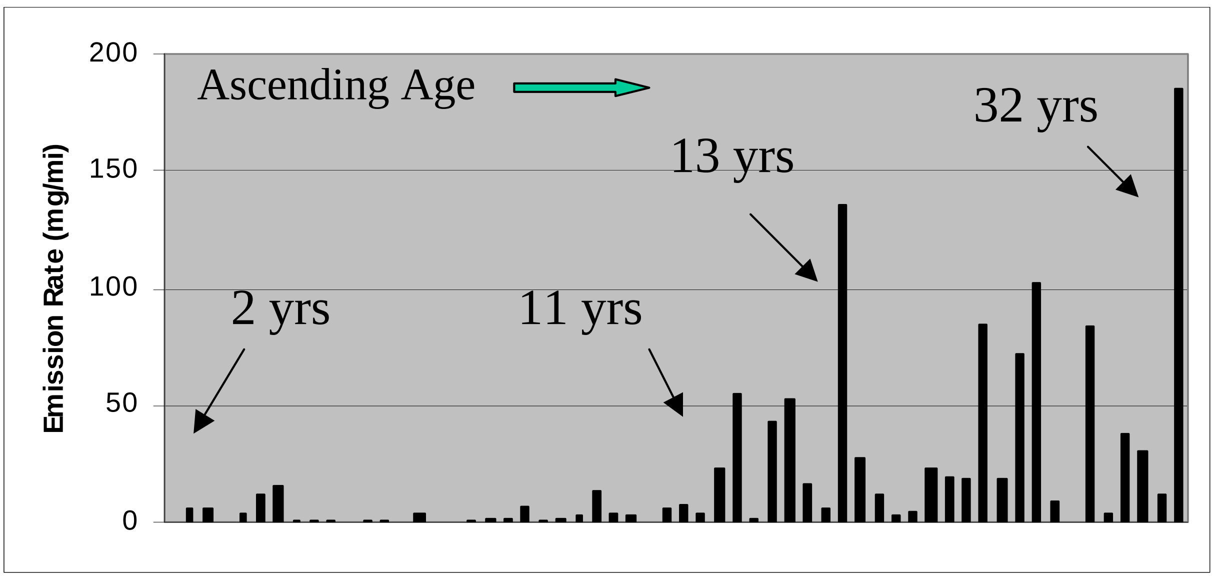


Figure 2-8. Distribution of $PM_{2.5}$ emission rates by ascending mileage accumulation and vehicle age. Preliminary results from the DOE Gasoline/Diesel PM Split Study (Source: Gabele, 2003)

Note that the 16 vehicles with less than 98K miles and 31 vehicles newer than 11 years had emission rates less than 20 mg/mi. (weighted emission rates).

Table 2-6. Expected PM Mass Loadings for Light-Duty Vehicles (micrograms per sample)

Sample	Emission Rate mg/mile	Flow Rate (l/min)	No. of Composites	UC Phase 1 or 3	UC Phase 2	UC Phases 1 plus 2
Teflon and Quartz	5	50	1	20	141	160
	5	50	4	78	562	641
	50	50	1	196	1405	1602
	50	50	2	392	2811	3203
	300	50	1	1177	8433	9609
TIGF/XAD	5	100	1	39	281	320
	5	100	4	157	1124	1281
	50	100	1	392	2811	3203
	50	100	2	784	5622	6406
	300	100	1	2353	16866	19219

[a] Target of 1 mg/sample of PM for laboratory analysis except carbon measurements by TOT (200 ug/sample)
DRI will sample at 10 to 50 lpm depending on expected mass loading

Basis for Mass Loading Calculations

Parameters	Symbol	Units	UC Phase 1/3	UC Phase 2	UC Phase 1+ 2
distance UC P1+P2	d	miles	1.2	8.6	9.8
sample duration UC P1+P2	t	min	5.0	18.9	23.9
total diluted volume UC P1+P2	V_d	m^3	76.5	289.4	365.9
PM emission rate	R	mg/mi		1 to 500	
sample volume	V_s	m^3		$V_s = Q * t * 10^{-3}$	
mass loading	m	ug/sample		$m = R * d * 1000 * V_s/V_d$	
sample volume	V_s	m^3		$V_s = Q * t * 10^{-3}$	
sample flow rate	Q	l/min		10 to 50 for Tef or Qtz, 100 for Organic	
average concentration	C	ug/m^3		m/V_s	

2.4.3 Vehicle Testing Task (Section 5.3.3)

This task includes vehicle check-in and inspections, vehicle conditioning, overnight soak and cold start dynamometer emissions testing over three phases of the LA92 driving cycle with determination of regulated emissions.

2.4.3.1 Protective Covering for Equipment and Test Vehicles (Section 5.3.3.1)

Locations have been identified in the Kansas City Metropolitan area for protection of the analytical testing equipment and the recruited vehicles. To better protect the analytical equipment and the consumer's vehicles from the elements during a study of this magnitude, an industrial warehouse is considered a better choice for testing. The locations identified have drive-in doors for ease of the equipment setup and large loading dock doors that will remain open for continuous ventilation of the area. Large overhead exhaust fans for additional ventilation are also located in the roof of the vehicle test area. The identified areas will maintain the test vehicles at ambient condition during its soak period and allow the background to be maintained at the ambient levels while testing. The testing areas consist of about 10,000 square feet plus additional office space for special analytical equipment setup. Since there could be up to 15 participants' vehicles in the area at any given time, an area of this dimension would allow orderly processing. A big advantage of using a well-ventilated industrial warehouse is the stable source of electrical power available, including 3 phase 480 volt for the dilution tunnel heater. This will allow analytical equipment to be powered up continually, eliminating instrument warm-up time; therefore reducing the time the staff is required to be onsite before vehicle testing can begin.

2.4.3.2 Vehicle Testing and Data Collection (Section 5.3.3.2)

The following subtasks describe procedures that will be undertaken during vehicle testing and data collection.

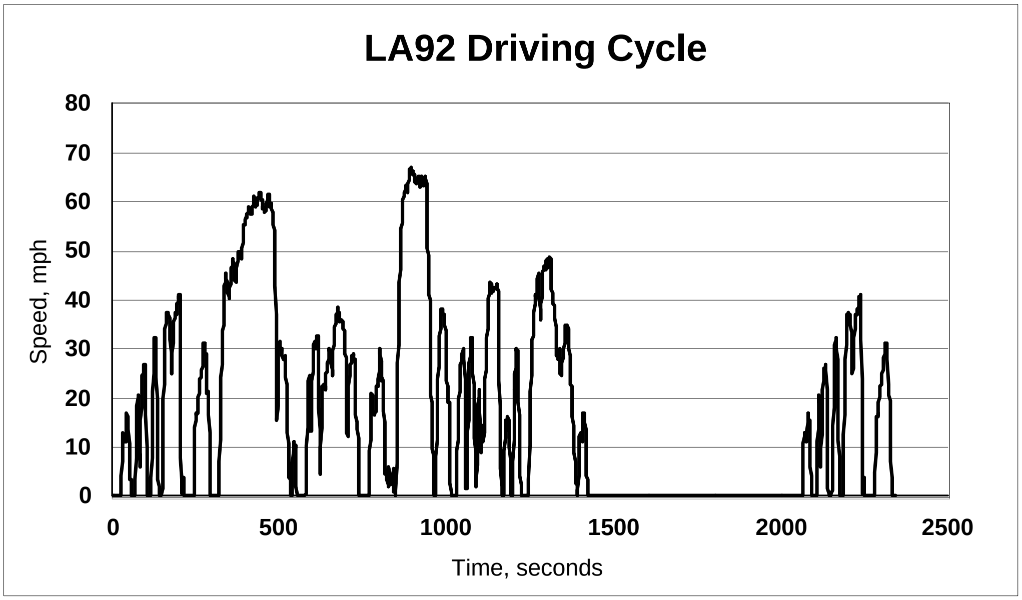
Subtask A. Vehicle Inspections

All vehicles will undergo body and mechanical inspections upon arrival at the test site. These inspections will be performed to reduce to possibility of the owner complaining that the car had been damaged during its testing. After inspections and answering the questionnaire, the agreement and waiver will be signed by the participant and they will receive their incentive and a rental vehicle. After these initial inspections and video, all vehicles with OBD1 and OBD2 systems will be scanned and the results reported along with the type of OBD system on the vehicle. Detailed information on all vehicles will be obtained and recorded on a computerized vehicle information form. Recorded information is not limited to but will include the following:

- Date and time of vehicle procurement
- Date and time of vehicle testing

- Test number
- License plate number
- Make
- Model
- Model year
- Odometer reading
- Vehicle identification number (VIN)
- Engine displacement
- Number of cylinders
- Emission control and catalyst information
- Vehicle registration status
- Fuel and oil information

Subtask B. Vehicle Conditioning



After the vehicle has passed inspections, it will undergo conditioning on a predetermined route. The conditioning route will contain multiple high speed accelerations, a minimum of ten minutes of continuous high speed operation, and low speed operation and idling just prior to the completion of the route. After conditioning, the vehicle will be staged for testing the next day and soaked overnight at ambient conditions. If any abnormalities are found while vehicle conditioning (smoker, smell) it will be noted in the vehicle folder an entered in to the database and staged for testing last vehicle of the test day.

Subtask C. Vehicle Testing

Vehicle exhaust testing will occur using the EPA Office of Research and Development dynamometer under ambient conditions. Vehicles will be operated over the LA92 Unified Driving Cycle consisting of a cold start Phase 1, (first 310 seconds) a stabilized Phase 2 (311-1427 seconds) a 600 second engine off soak, and a warm start Phase 3 (repeat of Phase 1). A positive displacement pump (PDP-CVS) operating at 540 scfm, will be used to quantitatively dilute exhaust gas from the vehicle operating on the dynamometer through an eight-inch stainless steel dilution tunnel. Dilution air will be dehumidified before it is treated with a charcoal bed followed be a HEPA filter to remove particles prior to being heated 47^{o}C +/- 5^{o}C and mixed with vehicle exhaust. Throughout the sample extraction and partition process, the temperature of the sample air at the filter face will be maintained at 47^{o}C +/- 5^{o}C, and the sample air will held within the specified humidity range.

As part of the tunnel conditioning process, the CVS and tunnel dilution air heater shall be turned on for a number of hours prior to engine start (as determined during pilot testing) and run to purge the exhaust transfer line and dilution tunnel. Pumps at the analytical bench shall be run at least one hour prior to engine start to purge all sample lines. The CVS, tunnel heater and sample pumps shall be kept running throughout the day and will not be shut down until the conclusion of testing for that day. Testing shall not be started until the temperature in the dilution tunnel has reached a stable value (no increase in temperature over a 3 minute period).

Within two (2) minutes of the start of the initial test of the day, background THC, CO, NO_x, and CO_2 concentrations in the dilution tunnel shall be recorded by the regulated emissions bench operator. These levels shall serve as reference background levels for the tests that immediately follow that day. If prior to the start (within 2 minutes of start) of succeeding tests that day, the background levels measured for that test differ from the reference background by +/-15%, testing shall be delayed until corrective measures are taken. If the +/- 15% change in background is due to a change in the ambient background level (not influenced by station exhaust or spillage) and cannot be corrected, the testing may resume with a new set of reference background levels. However, after each test, the ambient background levels shall be monitored by the bench operator so that the reference background levels can be adjusted if ambient levels continue to change.

Background levels of THC from the tunnel filter shall also be monitored by the instrument bench operator for fifteen (15) minutes before the start of a test. If the background level of THC in the dilution tunnel differs by +/- 15% of the background level of THC after the tunnel filter, the test shall be delayed until tunnel levels are adjusted accordingly.

Prior to placing the vehicle on the dynamometer, the proper load and inertia will be set by motoring the dynamometer at 50mph. Vehicle inertia and horsepower loading for each vehicle will be determined by a lookup table developed from the EPA Certified Vehicle Test Reports. After these settings have been applied, the test vehicle will then be winched onto the dynamometer, stabilized, and secured by the restraint system. During this time the CVS will remain on to purge any residual PM and hydrocarbon from the system. The emissions tests will be started when the background levels stabilize. The emission analysis system will sample and record dilute exhaust THC, CO, CO2, and NOx concentrations in 1-second intervals during the entire transit driving cycle. Temperature and pressure in the CVS, dynamometer speed, ambient temperature, relative humidity, and barometric pressure will also be recorded in 1-second intervals.

Two hundred and forty vehicles will be tested for each round of this study. Twenty-five vehicles tested during the 1st round will be retested during the 2nd round of testing. These 25 vehicles will be randomly selected from each stratum as required. There will be 15 replicate vehicle tests performed in the Round 1 test phase and 10 replicate tests performed during the Round 2 test phase. Also, there will be a weekly calibration/correlation vehicle tested each week during both Round 1 & 2.

Subtask D. Vehicle Fluid Sampling

BKI will collect fuel and oil samples from all feasible vehicles after the dynamometer tests for analysis. These fuel and oil samples will be transferred to ERG staff onsite and will be maintained for 2 years after the study is complete for possible future analysis.

Subtask E. Maintenance of Emission Equipment

BKI staff will provide for the maintenance, calibration, and operation of the transportable dynamometer and its associated sampling and analytical equipment. Manufacturer's recommendations and SOPs will dictate the types and frequency of routing maintenance performed. Additional maintenance and repairs will also be performed as the need may be indicated through calibrations and other equipment checks. Any malfunctions will be corrected before vehicle testing will continue. Prior to use, all necessary calibrations will be performed.

2.4.3.3 RSD Evaluation (Section 5.3.3.3)

New RSD data can play an important role in verifying that cohort vehicles are tested on the chassis dynamometer in a fully conditioned state and to verify that the vehicle Cohort is indeed representative of the Kansas City fleet at large. It is ERG's opinion that the most important use of RSD in this project will be to compare the Cohort to the Kansas City fleet, especially since many Cohort vehicles will have their emissions tested using a PEMS/PAMS system. (The data from the PEMS/PAMS system can be more readily compared to the chassis dynamometer data than RSD data can. From our research in Arizona we know that knowledge of the last few seconds of how the vehicle was driven is extremely influential on the emissions during a given second of operation. Since RSD systems do not record operating history, RSD data is very difficult to compare to second-by-second dynamometer data.)

It is important that the proper equipment be used to collect RSD data for this project. Environmental Systems Products (ESP) in Tucson, Arizona has developed an opacity measurement process that uses a range of ultraviolet (UV) light to detect exhaust opacity. Because UV radiation has a shorter wavelength than either visible or infrared (IR) light, it is "blocked" and "scattered" by smoke particles that are too small to effect either visible or infrared light. This allows the ESP system to detect opacity that cannot be detected by older RSD equipment (which use only IR light for opacity detection). Therefore, this new system is appropriate for finding smoking vehicles in the fleet. ERG has a contract in place with ESP to provide RSD equipment for this study. This capability may also improve our ability to recruit smoking vehicles for Round 2 testing if we find them to be under-represented during Round 1 testing.

The RSD system will be deployed at several sites near where chassis dynamometer testing is occurring, to allow easy access for Cohort vehicles soon after they are tested. RSD data will also be collected at other sites around Kansas City to ensure that the fleet in general is well represented in the data. From our previous experience with RSD data collection in the Kansas City area, we are familiar with many promising sites for RSD data collection. We are also familiar with the processes required for obtaining encroachment permits for RSD data collection sites. This will allow us to effectively oversee our RSD data provider and to ensure a representative RSD sample. RSD data will be collected during the last month of both Round 1 and Round 2 testing. This will allow us to request participating Cohort vehicles being tested at this time to drive past the RSD equipment (note that only participants whose cars are tested during the last month of each round will have RSD data collected).

2.4.3.4 Vehicle Fluid Sampling (Section 5.3.3.4)

Oil and gasoline samples will be collected from test vehicles when collection does not produce an undue burden on program time and costs. It is anticipated that oil samples will be collected from nearly all, if not all, test vehicles. Approximately 10 ml of oil will be collected and stored for later analysis. Oil sample analyses to be perfomed are listed in Table 2-7.

Due to gasoline anti-siphoning and evaporative control devices found on most vehicles, only limited collection of gasoline samples from test vehicles is anticipated.

Unused oil and gasoline samples will be stored for a period of 2 years to allow for possible further analysis. At the end of the two-year period, oil and gasoline samples will be recycled.

Table 2-7. Oil Sample Analyses

Test	**Method**
Sulfur Content	ASTM D4294-90
Viscosity, cST 40˚C, kinematic	ASTM D445
Wear Particles, Total Ferrous Particles	ISO 4405
Iron, ppm	Elemental Analysis
Copper, ppm	Elemental Analysis
Tin, ppm	Elemental Analysis
Aluminum, ppm	Elemental Analysis
Boron, ppm	Elemental Analysis
Calcium, ppm	Elemental Analysis
Chloride, ppm	Elemental Analysis
Sulfur, ppm	Elemental Analysis
As, ppm	Elemental Analysis
Cr, ppm	Elemental Analysis
Phosphorous, ppm	Elemental Analysis
Silicon, ppm	Elemental Analysis
Nickel, ppm	Elemental Analysis
Lead, ppm	Elemental Analysis
Magnesium, ppm	Elemental Analysis
Sodium, ppm	Elemental Analysis
Zinc, ppm	Elemental Analysis
Water, % (Karl Fisher)	ASTM D4926
Glycol	**Infrared Analysis FT-IR**
Total Acid Number, mg KOH/g	ASTM D664
Chromium, ppm	Elemental Analysis

2.4.3.5 PEMS/PAMS Data (Section 5.3.3.5)

Portable emission measurement systems (PEMS) and portable activity measurement systems (PAMS) will be used to collect on-road emissions and driving data on a randomly selected group of vehicles that have been tested on the chassis dynamometer.   The purpose of collecting these data is to improve EPA’s understanding of “real world” vehicle operations and emissions. The data will also be added to the MSOD database, which EPA will use in the creation of the MOVES model. The data will be ideal for MOVES since it will be collected on a carefully selected set of vehicles from a metropolitan area which does not yet require an I/M program.

EPA will supply at least eight PEMS/PAMS devices and train ERG team personnel on their use. ERG team personnel will install and de-install the equipment on vehicles selected using a method suggested by our team and approved by EPA. Procedures specified in the PEMS/PAMS QAPP will be strictly followed during installation, de-installation, data download, and equipment maintenance. These procedures are described in detail in Appendix A of this document. Whenever possible the installation and de-installation will occur at the dynamometer test site.

ERG proposes to further investigate vehicle selection methods in collaboration with EPA. The strata to be used selecting PEMS/PAMS vehicles do not necessarily need to be the same as those used to select vehicles for dynamometer tests. Since the PEMS/PAMS equipment collects driving information, it may be advantageous to consider vehicle characteristics that help dictate how a vehicle is driven in selecting the strata. For example, vehicles with a low "power-to-weight ratio" are likely to be driven quite differently than vehicles with a high "power-to-weight ratio." Yet, that ratio will not likely play a prominent role in selecting vehicles for dynamometer testing. If, after consultation with EPA it is decided to capture this or other vehicle characteristics in the sample strata, our team will design a special set of strata for the PEMS/PAMS vehicles.

Owners of the selected vehicles will be instructed on their agreed duties before their vehicles have a PEMS/PAMS unit installed. These owners will agree to drive their vehicles in the manner they normally would (as if the PEMS/PAMS unit were not present on their vehicle). They will also be required to keep a log of significant events during the testing period (e.g., changes in vehicle load, such as passengers entering and leaving the vehicle). PEMS devices will be typically be installed for a period of 1 to 3 days, with each PEMS device installed on about 20 individual vehicles. Similarly, the PAMS devices will be installed for a period of 1 to 7 days, with each PAMS device installed on about 10 to 12 vehicles.

After the device has been present on their vehicle for the prescribed time period, the owner will return to the project data collection location to have the PEMS/PAMS unit removed. The owner will be interviewed at that time to determine various information about their experience and events that occurred during their participation (no demographic information will be solicited during the interview). The questions we propose to ask the drivers are:

- Did you drive any differently than you normally drive while the PEMS/PAMS device was installed on your vehicle?

- Do you feel that having the device on your vehicle caused you to drive any differently than you normally drive?
- Did the device cause your vehicle to behave any differently than it normally does?

In the occasional instance where a vehicle owner is unable to meet at the testing location, ERG will arrange to meet the owner at a more convenient location for de-installation.

After de-installation the collected data will be downloaded and quality assured in accordance with the applicable QAPP. Any necessary equipment maintenance and preparation for the next installation will also occur at that time.

2.4.3.6 Vehicle Testing Reports (Section 5.3.3.6)

Vehicle data, regulated emission results and visible smoke observation results will be provided to ERG. This data will be compiled and provided in Lotus123 format for final reporting to the EPA Project Officer. This data will be provided in a draft report within two months following vehicle testing. The draft report will also include a description of data gathering and testing methods used in the study.

At the conclusion of the project, BKI staff will prepare and transport the transportable dynamometer and analytical trailer back to EPA in RTP NC. Before transport the dynamometer system will be inspected and packed for shipment. All components and analytical equipment will be strapped down and secured for over the road transportation.

2.5 Speciation Tasks (Section 5.4)

In addition to the regulated gas pollutants measured by BKI, DRI will provide continuous measurements of PM mass using an EPA-supplied Brooker Systems Model RPM-101 Quartz Crystal Microbalance (QCM) and Thermo-MIE Inc. DataRam 4000 Nephelometer. Black carbon will be measured continuously with a DRI photoacoustic instrument and integrated samples will be collected and analyzed by DRI for PM gravimetric mass, elements, elemental and organic carbon, ions, particulate and semi-volatile organic compounds (all compounds in Table 12 of the RFP plus methylated-PAHs and oxy-PAHs, and as an option, nitro-PAHs), volatile organic air toxics (benzene, toluene, xylenes, ethylbenzene, styrene, 1,3-butadiene, n-hexane, naphthalene, formaldehyde, acetaldehyde, acrolein and MTBE. Continuous PM and integrated air measurements that will be made during the study are summarized in Table 2-8.

The samples will be extracted from the BKI dilution tunnel through a low particulate loss 2.5 um cut point pre-classifier. The sample will be isokinetically partitioned among the continuous instruments and integrated air samples using a suitable sample distribution manifold. The proposed sampling configuration is summarized in Table 2-9. Separate Teflon and quartz filters will be collected for each of the three phases of the Unified Driving Cycle (UDC) using a sequential sampler. All other integrated samples will be collected over all three phases of the cycle, excluding the 10-minute soak period between phases 2 and 3. The number of samples collected and analyzed during the pilot study and rounds 1 and 2 of the main study are summarized in Tables 2-6 and 2-7, respectively. The chemical species that will be identified and quantified are listed in Tables 2-8 through 2-12.

The planned oil sample analysis does not include detailed organic speciation. Recent studies have shown that emission rates of high-molecular weight PAHs, which are surrogates for POM (on EPA's HAP list), are correlated with the concentration of these PAHs in lubrication oil. If additional funding is available, a few oil samples from high emitters and smokers should be speciated and compared to their relative abundances in exhaust and compared to the relative abundance of these high-moecular weight PAHs in new unused motor oil.

2.5.1 Pilot Methods Testing Task (Section 5.4.1)

A pilot test will be conducted in the Kansas City area to determine and finalize testing methodologies, quality assurance and quality control procedures and data management procedures. Three vehicles will be tested in triplicate at the Kansas City site. The vehicles will also be tested at the EPA laboratory in Ann Arbor. DRI will measure continuous PM and black carbon during the pilot study in Kansas City. Collection and analysis of the integrated samples are provided as shown on Table 2-10. BKI and DRI will review, document, and change if necessary, all procedures, methods, and sample analyses to ensure proper handling and emission measurements for the testing program. BKI and DRI will update the QAPP to represent any changes in the procedures or methods, resulting from the pilot study.

Because semi-volatile organic compounds are a significant component of emissions from LDGVs relative to emissions of PM, both continuous and integrated PM measurements will vary depending upon the partitioning of organic material between the gaseous and particulate phases. The affect of phase distribution on particulate mass measurements is generally more significant for gasoline-powered vehicles than for diesel-powered vehicles because the fraction of organic aerosol to elemental carbon is typically higher for LDGVs, especially for the high emitters.

2.5.2 Source Testing Equipment Preparation Task (Section 5.4.2)

DRI will provide and prepare sampling equipment and sampling substrates required to the collection of samples listed in Table 2-8. Table 2-9 summarizes the proposed sampling configurations for source characterization measurements. We will pre-test the continuous and integrated sampling equipment prior to installation at the pilot testing site to ensure proper operation and familiarity by field personnel. DRI will provide personnel to operate the samplers and collect and store each sample.

2.5.3 Operating Continuous Measurements of Fine PM Task (Section 5.4.3)

Continuous measurements include the following instruments to be supplied by the EPA: Brooker Systems Model RPM-101 Quartz Crystal Microbalance (QCM) and Thermo-MIE Inc. DataRam 4000 Nephelometer. In addition, we will supply a DRI photoacoustic instrument for determination of black carbon mass concentrations. Additional information on these instruments is provided in Table 2-18. We will also provide measurements of mass and BC concentrations collected during dynamic tunnel blank samples collection to evaluate the condition of the dilution tunnel before conducing tests on the next vehicle. These continuous methods for measurement of fine particulate mass provide several useful data products as well as immediate feedback about the nature of the emissions from vehicles or ambient concentrations. With a time resolution between 0.5 and 5 seconds per update, these methods are ideally suited to identify the portions of a driving cycle where particulate emissions are greatest and least. Rapid time response is also useful for the successful deployment of dilution tunnels to provide knowledge of the state of the tunnel. For example, they are useful in determining if a tunnel has been adequately flushed between measurements. The elemental carbon mass versus total particulate mass can be determined from the use of the photoacoustic instrument to measure elemental carbon and QCM instrument or nephelometer for total particulate emissions. The continuous data may also be time-averaged and accumulated (in real-time) to provide total elemental carbon emission and total particulate emission for use in comparison of the data with that obtained from Thermal Optical Reflectance (TOR) analysis and gravimetric analysis of aerosol accumulation on Teflon or quartz filters. The accumulated particulate mass as a function of time may also be useful in determining the length of a run necessary for accumulating adequate particulate mass for other run-averaged samplers such as those used to differentiate between particle and gas phase polycyclic aromatic hydrocarbons (PAH). DRI will provide estimates of cumulative particulate mass loading for each of the samples collected for subsequent chemical analysis at the conclusion of each run.

The continuous monitors will all sample from a common sampling manifold. They will provide real time graphical output as an aid for judging the best likely sampling strategy for filter samplers. The photoacoustic instrument will be equipped with pressure, temperature, and relative humidity sensors so that the mass concentration can be adjusted to the desired ambient condition of pressure and temperature. Data from the real-time sensors can also be used to evaluate total particulate emissions by accumulating it over the sample period, and can be compared with data from the filter samplers. It is recommended that all personnel agree on a single set of standard conditions, such as 1 atmosphere of pressure and 273 K temperature, and adjust all data so that applies to these conditions.

2.5.3.1 Quartz Crystal Microbalance (QCM) (Section 5.4.3.1)

A Quartz Crystal Microbalance is a thin, usually round, slice of crystalline quartz with an electrode on each side. If the two electrodes are put at different potentials an electric field results across the QCM, i.e. in the "Y direction". Because of the piezoelectric properties of quartz, such an electric field in the "y direction" couples to shear motion "around" the z-axis, and vice versa. The end result is that shear waves in the quartz, in which the mechanical displacement is in the "x" direction, also called the electric axis, are coupled to voltage between the electrodes. QCMs are used as sensitive detectors of mass deposited on them. This added mass decreases the resonant frequency of the QCM. The added mass per unit area on the QCM can be calculated by measuring the decrease in the resonant frequency of the QCM. Because frequency changes can be measured to very high precision, QCMs are very sensitive. They can measure amounts of deposited material with an average thickness of less than a single atomic layer. Hence the "microbalance" part of their name.

QCMs have been used to make "sniffers" for monitoring air pollution. This is done by having an array of QCMs, each topped with a different thin film which absorbs a particular set of chemicals. When these chemicals are present in the environment they are absorbed, increasing the mass of the QCM and decreasing its resonant frequency. The pattern of which sensor's frequency decrease gives information about what chemicals are present in the environment.

2.5.3.2 Tapered Element Oscillating Microbalance (Section 5.4.3.2)

No TEOM instrument will be used during the emissions testing procedures.

2.5.3.3 Nephelometer (Section 5.4.3.3)

Nephelometers measure light scattered by aerosol introduced into their sample chamber. Nephelometers can be fairly simple and compact instruments with excellent sensitivity and time resolution. However, scattering per unit mass is a strong function of particle size and refractive index. If particle size distributions and refractive indices in exhaust strongly depend on the particular engine and operating condition, this may not be an effective way to measure exhaust particle mass. However, it has been shown that mass scattering efficiencies for both on-road diesel exhaust and ambient fine particles have values around 3 square meters per gram. Mass scattering efficiencies for exhaust sampled from a dilution tunnel may be significantly lower. For this project, Thermo-MIE Data Ram 4000 nephelometer will be used. The MIE data Ram nephelometer measures simultaneously at two wavelengths for the purpose of reducing the uncertainty in the mass scattering coefficient.

2.5.3.4 Photoacoustic Instrument (Section 5.4.3.4)

The photoacoustic instrument has been developed at DRI and has been described in several publications (Arnott, Moosmüller et al. 1999; Arnott, Moosmüller et al. 2000). Briefly, light from a 1047 nm laser is power-modulated at the operating frequency of an acoustical resonator. Sample air is continuously drawn through the resonator at a flow rate of 1 – 3 lpm. Light absorbing aerosol (black carbon) will absorb some of the laser power, slightly heating the aerosol (typically much less than 1 C). The heat transfers very rapidly from the aerosol to the surrounding air, and the local pressure increases, contributing to the standing acoustic wave in the resonator. The acoustic wave is measured with a microphone as a measure of the light absorption. For the operating conditions of the resonator, and the laser wavelength used, the light absorption measurement is linearly proportional to the mass concentration of the black carbon aerosol in the sample air. The constant of proportionality has been inferred from correlations of black carbon measurements with elemental carbon as determined by the TOR method, and an efficiency factor of 5 square meters per gram is used to go from aerosol light absorption to estimated black carbon mass concentration. No filters are needed for the photoacoustic measurement, and the flow rate is not used in the calculation of aerosol mass concentration.   The flow rate must only be sufficient to adequately sample the air with minimal particle loss in the instrument and sample lines. The resolution of the instrument for a 3 second averaging time is usually 2.5 inverse Mm for light absorption, corresponding to 0.5 microgram per cubic meter for black carbon mass concentration. The resolution scales as the square root of sampling time, so for example, a resolution of 0.25 micrograms per cubic meter can be obtained for a 9 second averaging time. The photoacoustic measurement does not receive interference from exhaust gases, in our experience so far, and it is a zero-based measurement when no light absorbing aerosols are present.

2.5.4 Integrated Sample Collection and Sample Analyses Task (Section 5.4.4)

DRI will provide and prepare sampling equipment and sampling substrates required for the collection of the samples listed in Table 2-10. The vehicles will be tested on the EPA transportable dynamometer using a Unified Driving Cycle that will be composed of three phases. Separate samples will be collected for each phase of each vehicle for gravimetric mass and OC/EC. DRI will provide a sequential filter sampler with a $PM_{2.5}$ inlet in which two filters (Telfon and quartz) sample concurrently at up to 55 lpm each. The sequential filter sampler has sufficient number of ports to allow for collection of at least three pairs of filter samples without the need for filter changes during the three phases of the Unified Driving Cycle. DRI will also provide a parallel sequential sampler for collection of samples on Teflon-impregnated glass fiber (TIGF) filters with a backup cartridge consisting of XAD-4 resin. DRI will provide personnel to operate the samplers.

DRI will acceptance test the Teflon and quartz filters and pre-weigh Teflon filters. Pre-labeled filter packs will be prepare and shipped to the test site. DRI will also acceptance test TIGF filters and XAD-4 resin packs and prepare and ship TIGF filters and XAD plug-in cartridges to the test site. DRI will post-weigh all Teflon filters for $PM_{2.5}$ mass. DRI will perform chemical analysis as follows: Teflon filters by Inductively Coupled Plasma Mass Spectrometry for elements Na to U; quartz filters by ion chromatography for chloride, nitrate and sulfate ion, quartz filters for elemental and organic carbon by thermal optical reflectance carbon analysis (TOR) using the IMPROVE protocol; TIGF/XAD samples for PAHs, methylated-PAHs, oxy-PAHs, nitro-PAHs (optional), hopanes, steranes, organic acids, cycloalkanes and alkanes (as listed in Table 2-12, 2-14, 2-15 and 2-16) by GC/MS. Each sample collected for mass and EC/OC will be analyzed separately. Whether samples are composited for analysis of other analytes will be decided in consultation with ERG and the EPA project manager after reviewing the continuous mass and black carbon data.

The following substrates are proposed for this program:

- Gelman (Ann Arbor, MI) polymethylpentane ringed, 2.0 mm pore size, 47 mm diameter PTFE Teflon-membrane filters (#RPJ047) for particle mass, elements, and particulate organic acids
- Pallflex (Putnam, CT) 47 mm diameter pre-fired quartz-fiber filters (#2500 QAT-UP) for water soluble chloride, nitrate, sulfate, ammonium, and potassium measurements, and for organic and elemental carbon measurements

- Pallflex (Putnam, CT) TX40HI20-WW 102 mm diameter teflon-impregnated glass fiber filters for the DRI Sequential Fine Particulate/Semi -Volatile Organic Compounds Sampler (PSVOC sampler)
- Polystyrene-divinylbenzene resins, XAD-4 in a cartridges for collection of semi-volatile PAH. The Amberliete XAD-4 resin (20-60 mesh) is purchased from Aldrich Chemical Company, Inc.

Filters require treatment and representative chemical analyses before they can be used. Excessive blank levels and filter interferences discovered during or after several important air quality studies have compromised their results. At least two filters from each lot (typically 100 filters) received from the manufacturers will be analyzed for species to verify that pre-established specifications have been met. Lots will be rejected if they do not pass this acceptance test. Each filter will be individually examined over a light table prior to use for discoloration, pinholes, creases, or other defects. In addition to laboratory blanks, 5 to 10% of all filters will be designated as field blanks to follow handling procedures, except for actual sampling.

In addition to acceptance testing, some filters will require pre-treatment before sampling. Quartz-fiber filters may absorb organic vapors with time. Blank quartz-fiber filters will be heated in air for at least three hours at ~900 °C prior to acceptance testing analysis. Sets of filters with levels exceeding 1.5 mg/cm2 for organic carbon and 0.5 mg/cm2 for elemental carbon will be re-fired or rejected. Pre-fired filters will be sealed and stored in a freezer prior to preparation for field sampling. XAD-4 is placed in a Buchner funnel and rinsed with distilled water three times followed by technical grade methanol 3-4 times, and again three times with distilled water. It is then further cleaned by Soxhlet extraction for 48 hours with methanol, followed by Dionex accelerated solvent extraction (ASE) for 15min/cell with ~170 mL of dichloromethane (CH2Cl2) and acetone at 1500 psi and 100°C. (The Dionex ASE unit provides automated sequential solvent extractions with temperature and pressure controls. ASE will be used in place of sequential Soxhlet extraction, which requires more solvent and more time.) The XAD-4 is then dried in a vacuum oven at –15 to –20 in Hg and 50 °C. Cleaned XAD-4 is transferred to clean 1L glass jars and stored in aluminum cans with activated charcoal. The TIGF filters will be cleaned by sonification in CH2Cl2 for 30 minutes, followed by another 30-minute sonification in methanol. Then they will be dried, placed in aluminum foil, and labeled. Each batch of precleaned XAD-4 resin and ~10% of precleaned TIGF filters are checked for blank levels. Batches with more than 10 μg of naphthalene are recleaned and rechecked. The XAD-4 resins will be assembled into glass cartridges (50 g of XAD between two screens), wrapped in aluminum foil and stored in a clean freezer prior shipment to the field.

At times, batches of Gelman ringed Teflon-membrane filters have yielded variable (by up to 100 μg per 47 mm filter over a few days) blank masses. As the time between manufacture and use increases, this variability decreases. Since Gelman has minimized its long-term inventory of these filters, and is manufacturing them on an as-ordered basis, this variability has been observed with greater frequency, though it is not widely reported. A one-month storage period in a controlled environment, followed by one week of equilibration in the weighing environment, appear to have reduced the variability to acceptable (within ±15 μg per filter for re-weights of 47 mm and 37 mm diameter filters) levels. DRI has enough stock of these preconditioned filters to easily accommodate this study. The results of the laboratory filter treatments, chemical analyses, and visual inspections are recorded in a database with the lot numbers. A set of filter IDs is assigned to each lot so that a record of acceptance testing can be associated with each sample.

2.5.5 Integrated Sample Analyses Task (Section 5.4.5)

A summary of information on the PM instruments described below is provided in Table 2-19.

2.5.5.1 $PM_{2.5}$ Mass Gravimetric Analysis (Section 5.4.5.1)

Unexposed and exposed Teflon-membrane filters are equilibrated at a temperature of 20 ±5 °C and a relative humidity of 30±5% for a minimum of 24 hours prior to weighing. Weighing is performed on a Cahn 31 electro microbalance with ±0.0001 mg sensitivity. The charge on each filter is neutralized by exposure to a polonium source for 30 seconds prior to the filter being placed on the balance pan. The balance is calibrated with a 20 mg Class M weight and the tare is set prior to weighing each batch of filters. After every 10 filters are weighed, the calibration and tare are re-checked. If the results of these performance tests deviate from specifications by more than ±5 μg, the balance is re-calibrated. If the difference exceeds ±15 μg, the balance is recalibrated and the previous 10 samples are re-weighed. Per DRI's Standard Operating Procedure, at least 30% of the weights are checked by a second technician and samples are re-weighed if these check-weights do not agree with the original weights within ±0.015 mg. Pre- and post-weights, check weights, and re-weights (if required) are recorded on data sheets as well as being directly entered into a data base via an RS232 connection. All PM2.5 and PM10 Teflon filters will be analyzed for mass. All weights are entered by filter number into the DRI aerosol data base.

2.5.5.2 Elements (Section 5.4.5.2)

Teflon-membrane filters will be analyzed with a Thermo Elemental X7 Inductively Coupled Plasma Mass Spectrometer with Collision Cell and Xi interface for the following elements: Al, Si, P, S, Cl, K, Ca, Ti, V, Cr, Mn, Fe, Co, Ni, Cu, Zn, Ga, As, Se, Br, Rb, Sr, Y, Zr, Mo, Pd, Ag, Cd, In, Sn, Sb, Ba, La, Au, Hg, Tl, Pb, and U.

Table 2-13 compares the elements that are quantified by XRF and ICP-MS and the associated minimum detection limits. Neither method will provide data for all specified elements. We recommend a combination of XRF using DRI protocol A and ICP-MS for selected elements (definitely Pb and Hg and possibly As, Zn, Ni, Mn and Cr). Note that Boron will not be analyzed, as it cannot investigated using XRF or ICP-MS.

A quality control standard and a replicate from a previous batch are analyzed with each set of 14 samples. When a quality control value differs from specifications by more than ±5% or when a replicate concentration differs from the original value (when values exceed 10 times the detection limits) by more than ±10%, the samples are re-analyzed. If further tests of standards show that the system calibration has changed by more than ±2%, the instrument is re-calibrated as described above. All ICP-MS results are directly entered into the DRI data bases.

2.5.5.3 EC/OC (Section 5.4.5.3)

The thermal/optical reflectance (TOR) method measures organic (OC) and elemental (EC) carbon. The TOR method is based on the principle that different types of carbon-containing particles are converted to gases under different temperature and oxidation conditions. The different carbon fractions from TOR are useful for comparison with other methods which are specific to a single definition for organic and elemental carbon. These specific carbon fractions also help distinguish among seven carbon fractions reported by TOR:

- The carbon evolved in a helium atmosphere at temperatures between ambient and 120 °C (OC1)
- The carbon evolved in a helium atmosphere at temperatures between 120 °C and 250 °C (OC2)
- The carbon evolved in a helium atmosphere at temperatures between 250 °C and 450 °C (OC3)
- The carbon evolved in a helium atmosphere between 450 °C and 550 °C (OC4)
- The carbon evolved in an oxidizing atmosphere at 550 °C (EC1)

- The carbon evolved in an oxidizing atmosphere between 550 °C and 700 °C (EC2)
- The carbon evolved in an oxidizing atmosphere between 700 °C and 800 °C (EC3)

The thermal/optical reflectance carbon analyzer consists of a thermal system and an optical system. The thermal system consists of a quartz tube placed inside a coiled heater. Current through the heater is controlled to attain and maintain pre-set temperatures for given time periods. A portion of a quartz filter is placed in the heating zone and heated to different temperatures under non-oxidizing and oxidizing atmospheres. The optical system consists of a He-Ne laser, a fiber optic transmitter and receiver, and a photocell. The filter deposit faces a quartz light tube so that the intensity of the reflected laser beam can be monitored throughout the analysis.

As the temperature increases from ambient (~25 °C) to 550 °C, organic compounds are volatilized from the filter in a non-oxidizing (He) atmosphere while elemental carbon is not oxidized. When oxygen is added to the helium at temperatures greater than 550 °C, the elemental carbon burns and enters the sample stream. The evolved gases pass through an oxidizing bed of heated manganese dioxide where they are oxidized to carbon dioxide, then across a heated nickel catalyst which reduces the carbon dioxide to methane (CH4). The methane is then quantified with a flame ionization detector (FID).

The reflected laser light is continuously monitored throughout the analysis cycle. The negative change in reflectance is proportional to the degree of pyrolytic conversion from organic to elemental carbon which takes place during organic carbon analysis. After oxygen is introduced, the reflectance increases rapidly as the light-absorbing carbon is burned off the filter. The carbon measured after the reflectance attains the value it had at the beginning of the analysis cycle is classified as elemental carbon. This adjustment for pyrolysis in the analysis is significant, as high as 25% of organic or elemental carbon, and it cannot be ignored.

The system is calibrated by analyzing samples of known amounts of methane, carbon dioxide, and potassium hydrogen phthalate (KHP). The FID response is ratioed to a reference level of methane injected at the end of each sample analysis. Performance tests of the instrument calibration are conducted at the beginning and end of each day's operation. Intervening samples are re-analyzed when calibration changes of more than ±10% are found.

Known amounts of American Chemical Society (ACS) certified reagent grade crystal sucrose and KHP are committed to TOR as a verification of the organic carbon fractions. Fifteen different standards are used for each calibration. Widely accepted primary standards for elemental and/or organic carbon are still lacking. Results of the TOR analysis of each filter are entered into the DRI data base.

2.5.5.4 Ion Chromatographic Analysis for Chloride, Nitrate, and Sulfate (Section 5.4.5.4)

Water-soluble chloride, nitrate, sulfate, ammonium, sodium, and potassium are obtained by extracting the quartz-fiber particle filter in 15 ml of deionized-distilled water (DDW). The extraction vials are capped and sonicated for 60 minutes, shaken for 60 minutes, then aged overnight to assure complete extraction of the deposited material in the solvent. The ultrasonic bath water is monitored to prevent temperature increases from the dissipation of ultrasonic energy in the water. After extraction, these solutions are stored under refrigeration prior to analysis.

Water-soluble chloride (Cl^-), nitrate (NO_3^-), and sulfate ($SO_4^=$) are measured with the Dionex 2020i (Sunnyvale, CA) ion chromatograph (IC). In IC, an ion-exchange column separates the sample ions in time for individual quantification by a conductivity detector. Prior to detection, the column effluent enters a suppressor column where the chemical composition of the component is altered, resulting in a matrix of low conductivity. The ions are identified by their elution/retention times and are quantified by the conductivity peak area. Approximately 2 ml of the filter extract are injected into the ion chromatograph. The resulting peaks are integrated and the peak integrals are converted to concentrations using calibration curves derived from solution standards. The Dionex system for the analysis of Cl^-, NO_3^-, and $SO_4^=$ contains a guard column (AG4a column, Cat. No. #37042) and an anion separator column (AS4a column, Cat. No. #37041) with a strong basic anion exchange resin, and an anion micro membrane suppressor column (250 ´ 6 mm ID) with a strong acid ion exchange resin. The anion eluent consists of sodium carbonate (Na_2CO_3) and sodium bicarbonate ($NaHCO_3$) prepared in DDW. The DDW is verified to have a conductivity of less than 1.8 ´ 10-5 ohm/cm prior to preparation of the eluent. For quantitative determinations, the ion chromatograph is operated at a flow rate of 2.0 ml/min.

The primary standard solution containing NaCl, $NaNO_3$, and $(Na)_2SO_4$ are prepared with reagent grade salts which were dried in an oven at 105 °C for one hour and then brought to room temperature in a desiccator. These anhydrous salts are weighed to the nearest 0.10 mg on a routinely calibrated analytical balance under controlled temperature (~20 °C) and relative humidity (±30%) conditions. These salts are diluted in precise volumes of DDW. Calibration standards are prepared at least once within each month by diluting the primary standard solution to concentrations covering the range of concentrations expected in the filter extracts and stored in a refrigerator. The calibration concentrations prepared are at 0.1, 0.2, 0.5, 1.0, and 2.0 mg/ml for each of the analysis species.

Calibrations curves are performed weekly. Chemical compounds are identified by matching the retention time of each peak in the unknown sample with the retention times of peaks in the chromatograms of the standards.

A DDW blank is analyzed after every 20 samples and a calibration standard is analyzed after every 10 samples. These quality control checks verify the baseline and calibration, respectively. Environmental Research Associates (ERA, Arvada, CO) standards are used daily as an independent quality assurance (QA) check. These standards (ERA Wastewater Nutrient and ERA Mineral WW) are traceable to NIST simulated rainwater standards. If the values obtained for these standards do not coincide within a pre-specified uncertainty level (typically three standard deviations of the baseline level or ±5%), the samples between that standard and the previous calibration standards are re-analyzed.

After analysis, the printout for each sample in the batch is reviewed for the following: 1) proper operational settings, 2) correct peak shapes and integration windows, 3) peak overlaps, 4) correct background subtraction, and 5) quality control sample comparisons. When values for replicates differ by more than ±10% or values for standards differ by more than ±5%, samples before and after these quality control checks are designated for re-analysis in a subsequent batch. Individual samples with unusual peak shapes, background subtractions, or deviations from standard operating parameters are also designated for re-analysis.

2.5.5.5 Semi-Volatile Organic Compounds (Section 5.4.5.5)

Prior to extraction, the following deuterated internal standards are added to each filter-sorbent pair: naphthalene-d8, acenaphthylene-d8, phenanthrene-d10, anthracene-d10, chrysene-d12, fluoranthene-d10, pyrene-d10, benz[a]anthracene-d12, benzo[e]pyrene-d12, benzo[a]pyrene-d12, benzo[k]fluoranthene-d-12 , coronene-d-12, and benzo[g,h,i]perylene-d12, high molecular weight aliphatic hydrocarbons ranging from dodecane-d26 to octacosane-d58, cholestane-d4; and polar organics ranging from benzoic-d3 acid to cholesterol-d6. The filter-XAD pairs will be extracted by Dionex ASE with dichloromethane followed by acetone to expand the polarity range of analytes; these extraction solvents have been reported to yield high recovery of PAH (Chuang et al., 1987) and other compounds of interest (Hawthorne et al., 1988, 1989).

The extracts are then combined and concentrated by rotary evaporation at 20 °C under gentle vacuum to ~1 mL and filtered through 0.45 mm Acrodiscs (Gelman Scientific), with the sample flask rinsed twice with 1 mL CH2Cl2 each time. Approximately 100 µL of acetonitrile is added to the sample and CH2Cl2 was evaporated under a gentle stream of nitrogen. The final sample volume is adjusted to 1 mL with acetonitrile. This procedure has been tested by Atkinson et al. (1988). The detailed procedure is described in DRI standard operating procedures.

The extracts are then split into two fractions. The first fraction is analyzed without further alteration for PAH, alkanes, hopanes, and steranes by a GC/MS using an electron impact select ion storage (SIS) method. The second fraction is derivatized using a mixture of bis(trimethylsilyl)trifluoroacetamide (BSTFA), trimethylsilylcholorosilane (TMCS), and silylation grade pyridine to convert the polar compounds into their trimethylsilyl derivatives for analysis of organic acids, cholesterol, sitosterol, and levoglucosan. Samples are then analyzed by GC/MS using isobutane chemical ionization SIS method.

For hopanes and steranes, the samples are precleaned prior to GC/MS analysis using a solid phase extraction (SPE) technique described by Wang et al. (1994a,b). Clean up is conducted on a 6ml Supelco SPE cartridge packed with 0.5g of SiOH. Samples are spiked on to a SPE cartridge along with ten microliters of n_tetrocosane-d50 (internal standard) and the PAH internal standard described above. Elution and fractionation is conducted with 1ml of hexane followed by 1.25 ml of benzene/hexane (1:1). Hopanes and steranes are eluted along with n_tetrocosane-d50 in the hexane fraction, while the PAH are eluted in the hexane/benzene with the PAH internal standards.

The samples are analyzed either by the EI (electron impact) or isobutane chemical ionization (polar compounds) GC/MS technique. A Varian Star 3800CX GC equipped with an 8200CX Automatic Sampler and interfaced to a Varian Saturn 2000 Ion Trap was used for these analyses. Injections (1 µL) were made in the splitless mode onto a 30 m 5% phenylmethylsilicone fused-silica capillary column (DB-5ms, J&W Scientific). Quantification of the individual compounds is obtained by selective ion storage (SIS) technique, monitoring the molecular ion (or the characteristic ion) of each compound of interest and the corresponding deuterated internal standard, added prior to extraction. Calibration curves for the GC/MS quantification are made for the most abundant and characteristic ion peaks of the hopanes, steranes, PAH and other organic compounds of interest using the deuterated species most closely matched in volatility and retention characteristics as internal standards. Authentic PAH standards (purchased from Aldrich, Inc.) plus National Institute of Standards and Technology

(NIST) Standard Reference Material (SRM) 1647 (certified PAH) with the addition of deuterated internal standards and of those compounds not present in the SRM (i.e., methoxylated phenols, hopanes, steranes, lactones, cholesterol) are used to make calibration solutions. For quantifying hopanes and steranes the following authentic standards are used: C27 20R-5a,14a,17a-cholestane (purchased from Aldrich), 17b(H),21b (H)-hopane, 17a(H),21b(H)-30-norhopane, and 17a(H),21b(H)-hopane (purchased from Chiron AS, Norway). The remaining hopane and steranes are identified based on their mass spectra and retention time comparison with data available in the literature (Wang and Fingas, 1995; Rogge et al., 1993). For quantification of the hopanes and steranes for which authentic standards are not available, the response factor of standards most closely matched in volatility and retention characteristics are used. A three-level calibration is performed for each compound of interest and the calibration check (using median calibration standards) is run every ten samples to check for accuracy of analyses. If the relative accuracy of measurement (defined as a percentage difference from the standard value) is less than 30%, the instrument is recalibrated.

Recently, the Organic Analytical Laboratory (OAL) has received Varian 1200 triple quadrupole gas chromatograph – mass spectrometer (GC/MS/MS) system. The tandem MS/MS system allows for structural elucidation of unknown compounds with precursor, product and neutral loss scan. The GC interface allows for sensitive analyses of complex mixtures in electron impact (EI) as well as positive and negative chemical ionization (CI) mode. Negative CI offers a superior sensitivity for the analysis of nitro-PAH (mutagens and/or suspected carcinogens) that could be emitted from combustion sources, including motor vehicle engines. The sensitivity of this instrument in full scan EI/MS mode is approximately 1 pg/ul with 20:1 signal-to-noise ratio (S/N). In EI/MS SIM mode it reaches 50 fg/ul with 10:1 S/N. For negative CI, 10 fg/ul of octafluoronaphthalene gives S/N of 20:1. This superior sensitivity offers the advantage of analyzing small samples collected during a short sampling time.

Table 2-14 presents the list of hydrocarbons and carbonyls to be analyzed for the study. Table 2-15 shows the list of PAH, including methylated PAH and oxy-PAH and nitro-PAH analyzed by the DRI OAL. Table 2-16 shows the list of hopanes, steranes, alkanes, and cycloalkenes that are usually analyzed by the OAL and Table 2-17 list organic acids and other polar organic compounds.

2.5.5.6 Gaseous Air Toxics (Section 5.4.5.6)

Gaseous air toxic include canister sampling for VOC (benzene, toluene, ethylbenzene, m-, p-,o-xylene, ie.BTEX, styrene, n-hexane, naphthalene,1,3-butadiene, MTBE), and DNPH-coated Sep Pak cartridges sampling for carbonyl compounds (formaldehyde, acetaldehyde, acroleine). The DRI Organic Analytical Laboratory (OAL) routinely uses these methods and DRI standard operating procedures (SOPs) for sampling and analysis are available upon request.

Canister samples

The canister sampling procedure will essentially follow the pressurized sampling method described by EPA Methods TO-12 and TO-14 and the EPA document "Technical Assistance Document for Sampling and Analysis of Ozone Precursors" (October 1991, EPA/600-8-91/215). A stainless steel Viton pump draws in ambient air from the sampling manifold to fill and pressurize the sample canisters. A flow control device maintains a constant flow into the canisters over the desired sample period. This flow rate is preset to fill the canisters to about 1 atm above ambient pressure at the end of the sampling period (as described by EPA Method TO-14). For automatic operation, the timer starts and stops the pump at the appropriate time. The timer also opens the solenoid valve when the pump starts and closes it when the pump stops. The use of the solenoid manifold valves permits the automatic selection of preloaded canisters.

The canister sampling systems were custom-built at the DRI. They are multiple-event sampling systems, allowing unattended collection of three or six (plus one collocated) canister samples. The detailed Standard Operating Procedure (SOP) for canister samplers will be included in QA/QC plan.

For motor vehicle exhaust sampling, NO_2 is of concern, since it may react with 1,3 butadiene. NREL has indicated that they will consider funding a laboratory evaluation of a cobalt oxide denuder that removes both NO and NO2. This evaluation will be done prior to Round 1 and will also include an evaluation of long-term stability of 1-3 butadiene in canisters. For the pilot study, we will use a denuder to remove NO and NO2 and examine correlations of 1,3-butadiene with ethylene and propylene from the Gas/Diesel Split Study. Figure 2-9 shows that 1,3-butadiene is well correlated with ethene and propene, which are more stable combustion product. These samples were analyzed on-site with a GC-MS within a few minutes of sample collection. The loss of 1,3-butadiene in the Kansas City samples could be corrected using the correlations established in the Gas/Diesel PM Split Study. Whether these correlations are fuel specific is not known. However, we believe that these correlations may be more widely applicable since they involve compounds that are combustion products rather than from unburned fuel. As an option, we propose to deploy the same GC/MS that was used in the previous study for the first month of this study to establish both the stability of 1,3-butadiene and correlations with ethene and propene.

After sampling, an identification tag will be attached to each canister and the canister serial number, sample number, and sampling location, date, and time will be recorded on this tag. In addition a field sampling form and chain-of-custody form will be filled out giving all pertinent information on the collection of the sample.

Prior to sampling, the canisters are cleaned by repeated evacuation and pressurization with humidified zero air, as described in the EPA document "Technical Assistance Document for Sampling and Analysis of Ozone Precursors" (October 1991, EPA/600-8-91/215). Six repeatable cycles of evacuation to ~0.5 mm Hg absolute pressure, followed by pressurization with ultra-high-purity (UHP) humid zero air to ~20 psig are used. The differences between the DRI procedure and the EPA recommended method are that, in the DRI method, canisters are heated to 140°C during the vacuum cycle and more cycles of pressure and vacuum are used. According to our experience and that of others (Rasmussen, 1992), heating is essential to achieve the desired canister cleanliness. Also, the canisters are kept longer under vacuum cycles, about one hour in the DRI method, as opposed to half an hour in the EPA method. At the end of the cleaning procedure, one canister out of 12 in a lot is filled with humidified UHP zero air and analyzed by the gas chromatograph/flame ionization detection (GC/FID) method. The canisters are considered clean if the total non-methane organic compound (NMOC) concentration is less than 20 ppbC. The actual concentrations of blank-check canisters are typically below 10 ppbC.

Canister samples are analyzed for speciated VOC concentrations promptly upon receipt of samples from the field, using gas chromatography/mass spectrometry method according to guidance provided by the EPA Method TO-15. The GC/MS system includes: Entech 7100 preconcentrator, Varian 3800 gas chromatograph with FID and column switching valve, and Varian Saturn 2000 ion trap mass spectrometer. The Entech preconcentrator consisted of three traps: 50% glass beads/50% Tenax, held at –100°C during sample transfer, 100% Tenax held at –40°C and a final focusing trap (a piece of silico-steel capillary) held at –180°C. The sample is desorbed from the first trap at 10°C, from the second trap at 200°C and from the third one at approximately 70 °C to a transfer line heated to 110°C and connected to the head of the first column. The sample is injected at the head of a 60 m x 0.32 mm polymethylsiloxane column (CPSil-5, Varian, Inc.) held at 30°C. This column is connected to the switching valve leading into a 30 m x 0.53 mm GS-GasPro column (J&W Scientific). After approximately 7 min the valve was switched so that the effluent from the first column eluted onto a second 15 m x 0.32 mm polymethylsiloxane column connected to the mass spectrometer. The column switch was timed so that the C2 and C3 compounds eluted on the FID and all C4 and higher compounds eluted on the mass spectrometer. The GC program is as follows: 30°C held for 2 min, then

8°C/min up to 260°C. Calibration of the system is conducted with a mixture that contained the most commonly found hydrocarbons (75 compounds from ethane to n-undecane, purchased from Air Environmental), MTBE, and halocarbons (23 compounds from F12 to the dichlorobenzenes, purchased from Scott Specialty Gases). The standards are prepared in 6 L Silco-Steel canisters (Restek, Bellefonte, PA) by mixing three different standards through a multi-valve manifold using a Baratron absolute capacitance manometer (MKS Instruments, Andover, MA) to determine the pressure each standard added to the mixture. Prior to mixing, approximately 0.2 ml of ultrapure water is added to the canister to humidify the mixture (for mixture stability). The concentrations in the mixture are in the range of 0.2 to 10 ppbv. Three point external calibrations are run prior to analysis, and one calibration check is run every 24 hours. If the response of individual compounds are more then 10% off, the system is recalibrated.

For canisters the replicate analysis is conducted at least 24 hours after the initial analysis to allow re-equilibration of the compounds within the canister. The replicate analyses are flagged in our database and the programs we have for data processing extract these replicates and determine a replicate precision. Replicate analysis is important because it provides us with a continuous check on all aspects of each analysis, and indicates problems with the analysis before they become significant.

Carbonyl compounds

Formaldehyde, acetaldehyde and acroleine will be collected with Sep-Pak cartridges that have been impregnated with an acidified 2,4-dinitrophenylhydrazine (DNPH) reagent (Waters, Inc), according to the EPA Method TO-11A. When the exhaust is drawn through the cartridge, carbonyls in the sample are captured by reacting with DNPH to form hydrazones, which are separated and quantified using HPLC in the laboratory (Fung and Grosjean, 1981). After sampling, the cartridges will be eluted with acetonitrile. An aliquot of the eluent will be transferred into a 1-ml septum vial and injected with an autosampler into a high performance liquid chromatograph (Waters Alliance System) for separation and quantitation of the hydrazones (Fung and Grosjean 1981). Since acroleine undergos isomerization when reacted with DNPH on the silica-gel cartridges forming two products, both peaks will be identified and quantified and the total concentration will be reported. Table 2-14 presents a list of hydrocarbons and carbonyls that will be analyzed.

2.5.6 Data Analysis Task

2.5.6.1 Data Validation

Data from the field, laboratory, and various quality control activities must be unified prior to reporting in a measurement database. Values must be accepted, corrected, flagged as suspect, or removed from this database after they are evaluated against validation criteria. Precision estimates associated with each value must be calculated from performance test data. Sample validation consists of procedures which identify deviations from measurement assumptions and procedures. Three levels of validation are applied which will result in the assignment to each measurement of one of the following ratings: 1) valid; 2) valid but suspect; or 3) invalid.

Level I sample validation takes place in the field or in the laboratory and consists of: 1) flagging samples when significant deviations from measurement assumptions have occurred; 2) verifying computer file entries against data sheets; 3) eliminating values for measurements which are known to be valid because of instrument malfunctions; and 4) adjustment of measurement values for quantifiable calibration or interference biases. The Level I validated data are appended to the master database. Each sample appears as a record within the database and is identified by a unique sample identification, site, date, and time and as a primary, collocated, blank, spiked, or replicate sample.

Level II validation applies a consistency test based on known physical relationships between variables to the assembled data. Examples include range checks (both single species and ratios of species) and examination of scatterplots and time-series plots for outliers. They also include comparisons of redundant measurements made by the same group by different methods or by different groups using the same method. Validation approaches will be described fully in the project QAPP. Examples include the following checks.

- Gravimetric Mass (DRI) versus 1) integration of the continuous QCM and nephelometer measurements, 2) total and carbon fractions, sum of species (ion, elements, carbon).
- EC from TOR versus OC minus integrated continuous PM measurements
- OC versus organic species by type (PAH, hopanes, steranes, alkanes, polars) and phase (VOC, SVOC and PM)
- Comparisons of BKI and DRI gravimetric mass

A data validation summary is maintained in the character field associated with each record to provide a traceability trail for all data adjustments, replacements, or deletions. The data validation flags and summaries accompany this final database. This database will be submitted in dBase format (or other format requested by ERG and EPA) on CD. The database will be accompanied by a quality assurance reports which document results of all quality assurance activities.

Level III sample validation is part of the subsequent data interpretation process. The examination of the variability of the exhaust composition profiles with emission rates and phase (e.g., cold start) will provide further validation and determination of consistency with prior studies. The first assumption upon finding a measurement which is inconsistent with physical expectations is that the unusual value is due to a measurement error.

2.5.6.2 Variability of Emission Rates of Volatile Air Toxics

Gasoline-powered vehicles emit a substantial portion of ozone-forming volatile organic compounds in the urban areas of the country and contribute to exposures to volatile air toxics such as BTEX, 1,2-butadiene and aldehydes. In this task, we will derive emission rates for individual toxic compounds and characterize the variability in the emission rates for each run with corresponding speciation data.

2.5.6.3 Development and Evaluation of Composition Profiles

Organic carbon and elemental carbon are the most abundant species in motor vehicle exhaust, accounting for over 95% of the total mass. The abundances of organic and total carbon can be quite variable in motor vehicle exhaust profiles. Elemental carbon is relatively more abundant in diesel exhaust than in gasoline exhaust, but is less from newer technology diesel engines. The relative abundance EC is less at lower engine load. We have found that gasoline vehicles emit relatively higher amounts of elemental carbon during cold starts and during high accelerations. Gasoline exhaust measured during the NRFAS (Watson et al, 1998) had an average split of 75% organic carbon and 25% elemental carbon with higher relative EC during cold starts (based on TOR/IMPROVE carbon measurements). Because of the variability of OC/EC splits, gasoline and diesel vehicles cannot be apportioned by carbon analysis alone, and EC is not a unique tracer for diesel exhaust.

Polycyclic aromatic hydrocarbons (PAH) are present in emissions from all combustion sources and the relative proportions of different PAH compounds in emissions from a given source may vary over several orders of magnitude. PAH exhibit a wide range of volatility with naphthalene existing almost entirely in the gas phase, while BaP, other five-ring PAH, and higher ring PAH are predominantly adsorbed on particles. The intermediate three- and four-ring PAH (semi-volatile PAH) are distributed between the two phases.

Data from NFRAQS and the NREL Comparative Toxicity Study (Zielinska et al. 2001) show that gasoline vehicles emit certain PAHs in greater relative abundance to other PAHs than do diesel vehicles. Gasoline vehicle, whether low or high emitter, emit greater amounts of high molecular-weight particulate PAHs (e.g., benzo(k)fluoranthene, benzo(ghi)perylene, ideno(1,2,3-cd)pyrene, and coronene). These PAHs are found in used gasoline motor oil (but not in fresh oil and not in diesel engine oil). The oil acting as a scrubber to remove combustion-produced PAH may explain this. Diesel vehicles also emit particulate PAHs, but in lower relative proportions to other PAHs, especially the semi-volatile methylated PAHs. Diesel emissions contained higher proportions of dimethylnaphthalenes, methyl- and dimethylphenanthrenes, and methylfluorenes. These compounds are distributed between the gas and particle phase and thus require back-up traps to be quantitatively collected. Particulate methylated PAH are also more abundant in diesel than spark-ignition engine emissions. Emission rates of hopanes and steranes are the highest for both gasoline and diesel “high emitting” vehicles. Hopanes and steranes are present in lubricating oil with similar composition for both gasoline and diesel vehicles and are not present in gasoline or diesel fuels. While hopanes and steranes are useful markers for motor vehicle emission, they cannot be used to distinguish gasoline and diesel exhaust.

The source profiles will be weight fraction of gravimetric mass with one sigma analytical errors for individual measurements. The uncertainties in the composite profiles are the larger of either the one-sigma variations in fractional species abundance among members of the composite or the root mean square of the individual analytical uncertainties. Because dynamometer samples are typically collected at higher temperatures and shorter time periods than ambient samples, they tend to contain higher fractions of semi-volatile organic compounds. Most of the volatile compounds are contained in the OC1 fraction in the TOR measurements. To minimize the impact of the differences in phase distributions between source and ambient samples on the source apportionment calculations, we will also examine alternative parameters for normalization of species to weight fraction such as TC minus OC1.

2.5.7 Analysis of Continuous PM and EC Data Task

Analysis of continuous PM and EC data. The continuous particulate measurements from both the ambient and source measurements will be made available promptly for the relevant personnel attached to the project. The data will be provided in individual files pertaining to a given day of measurement in the case of ambient sampling, or to a particular vehicle in the case of source sampling. The data will be calibrated to an agreed upon standard of pressure and temperature. In the case of source sampling, the data will be processed and interpolated as appropriate to provide a real time assessment of the elemental carbon and total carbon content. The data will also be time averaged and accumulated over the entire sampling period and will be compared with filter-based measurements.

1. Instrument comparison for particulate emissions. From dynamometer tests; PM mass versus elemental carbon (EC) / total carbon (TC) by photoacoustic versus EC/TC by Thermal Optical Reflectance (TOR) and Thermal Optical Transmittance (TOT). Compare ambient EC by photoacoustic with EC by TOR and TOT.

2. Analysis of PM mass, organic carbon (OC) / TC, and EC/TC by mode (phase, speed, and acceleration) and vehicle emitter type.

2.5.8 Maintenance of Emission Equipment Task (Section 5.4.8)

An important part of our QA and QC program is equipment maintenance. Maintenance improves reliability and precision of the equipment. Also, maintenance recommended by the manufacturer is usually a mandatory part of warranty coverage.

The ERG team has a history of providing high quality data. This could not be achieved without a robust equipment maintenance program that is designed in the context of a QMP. For this project we will continue our practice of integrating all required maintenance into the QAPP for each measurement equipment system. This will include at least; the remote sensing equipment, the PEMS/PAMS equipment, the portable dynamometer system and its analytical systems, and the data collection and laboratory equipment owned and operated by DRI.

ERG, BKI and DRI will provide for the maintenance, calibration, and operation of all project testing equipment, including the transportable dynamometer, regulated emissions analytical system, PM sampling equipment, PEMS/PAMS, RSDs, and other project equipment. Manufacturer’s recommendations and good engineering practice will dictate types and frequency of routine maintenance performed. Additional maintenance and repairs will also be performed as the need may be indicated through calibrations and other equipment checks. Any equipment malfunctions will be corrected before vehicle testing is allowed to continue. Prior to use in the study, all necessary calibrations will be performed, including flow rates, temperatures, linearity, etc.

Any modifications to equipment will be approved in advance in writing from the Project Officer.

2.5.9 Health, Safety, and Environmental Practices Task (Section 5.4.9)

BKI understands the Government's concern that contractors, subcontractors, and other personnel who support EPA's research efforts have a history of concern for the welfare and safety of its employees and for the safety of government personnel in the work area. Our proposed program will ensure that our field operations are in full compliance with all applicable policies, rules, and regulations. To ensure our compliance with federal, state, and local regulations, policies, and procedures, the BKI Program Manager will assist by establishing, interpreting, and enforcing safety policies, rules, and regulations; conducting inspections, investigating accidents, and making recommendations; recommending and providing safety training; and reviewing safety protocols for hazardous operations.

The minimum personal protective equipment required in the field and laboratory where chemicals are handles are safety glasses, laboratory coats, and gloves. Depending upon the chemicals in use and the testing and procedures being performed, additional protective equipment may be required. These include goggles or a face shield when there is a chance for chemical splash, rotating machinery, or flying particles; hearing protection in high noise areas; safety shoes or for handling heavy equipment or gas cylinders; or respirators where hazard control equipment may not lower exposure levels to an acceptable limit or failure of this equipment during chemical handling would pose a threat that was immediately dangerous to life and health.

BKI provides all personal protective equipment and the necessary training for its use for employees. Employees have the responsibility to use the equipment as appropriate and to be sure it is in good working condition or is replaced.

ERG, BKI and DRI are committed to a safe working environment and will adhere to applicable health and safety practices and requirements.

Table 2-8. Summary of measurements and sample collection for the Kansas City LDGV Characterization Study

Train ID	Sample	Intended Analysis	Number of Samples/cycle	Time Resolution	Equipment Supplier [a]	Equipment Operator [a]
1	HC	Total volatile hydrocarbons	continuous	1 sec.	BKI	BKI
2	CO/CO2	CO, CO2	continuous	1 sec.	BKI	BKI
3	NOx	NO, NOx	continuous	1sec.	BKI	BKI
4	QCM	$PM_{2.5}$ mass	continuous	1-5 sec.	EPA/SWRi	DRI
5	Nephelometer	$PM_{2.5}$ mass	continuous	1-5 sec.	EPA	DRI
6	Photoacoustic	Black Carbon	continuous	1-5 sec.	DRI	DRI
7a	Teflon Membrane	gravimetric mass (each UDC phase), elements by ICP-MS (UDC composite)	3	310, 1116, 310 sec.	DRI	DRI
7a [b]	Quartz Filter backup behind Teflon filter	EC/OC by TOR (each UCD phase)	3	310, 1116, 310 sec.	DRI	DRI
8	Quartz Filter	EC/OC by TOR (each UCD phase), ions by IC (UDC composite)	3	310, 1116, 310 sec.	DRI	DRI
9	TIGF/XAD	PM and semi-volatile organic compounds by GC-MS (UCD composite)	1	1736 sec.	DRI	DRI
10	canisters with NO_2 denuder	VOC speciation by GC-FID (UDC composite)	1	1736 sec.	DRI	DRI
11	DNPH cartridges	carbonyl compounds by HPLC-UV (UDC composite)	1	1736 sec.	DRI	DRI

a. Bevilacqua-Knight, Inc. (BKI), Desert Research Institute (DRI), Southwest Research Institute (SWRi)

b. Proposed (optional cost provided in latest budget)

Table 2-9. Base sampling configuration for the Kansas City LDGV Characterization Study

Source	Primary Inlet/connection	Size Cut	Primary inlet flow (lpm)	Channel ID	Secondary Inlet Flow (lpm)	Filter media/ instrument	UCD Phase
BKI Dynamometer CVS Sampling System (450 lpm)	Side A	$PM_{2.5}$ cyclone	113	7a	50	Teflon 1 (47mm) [a]	Phase 1
						Teflon 2 (47mm) [a]	Phase 2
						Teflon 3 (47mm) [a]	Phase 3
						Teflon 4 (47mm) [a]	blank
				8	50	Quartz 1 (47 mm)	Phase 1
						Quartz 2 (47 mm)	Phase 2
						Quartz 3 (47 mm)	Phase 3
						Quartz 4 (47 mm)	blank
					10	none	
		$PM_{2.5}$ cyclone	113	9	113	TIGF/XAD	Phases 1,2,3
						none	
		None	1.3	10	0.3	VOC canisters	Phases 1,2,3
				11	1	DNPH	Phases 1,2,3
				total	*224.3*		
	Side B	$PM_{2.5}$ cyclone	113	4	5	QCM	cont.
				5	1	Nephelometer	cont.
				6	1	Photoacoustic	cont.
				B4	3	TEOM [b]	cont.
				B5	1	Dustrak [b]	cont.
				B6			
				B7			
				B8			
					102	make-up air	
		None	113		113	make-up air	
				total	*226*		
				Grand total	*450.3*		

a. Proposed optional backup quartz filter behind Teflon.

b. Will be operated by DRI at no cost to EPA.

Table 2-10. Numbers of samples collected during the Kansas City LDGV Characterization Study

Run ID Channel #	Number of Tests	Teflon filter 7	quartz filter 8	TIGF/XAD 9	canister 10	DNPH cartridge 11
Pilot Study						
Tunnel Blank	3	3	3	3	3	3
Test Vehicles	3	9	9	3	3	3
Replicate Vehicle Tests	6	18	18	6	6	6
Field Transport Blanks	3	3	3	3		3
		33	33	15	12	15
Round 1						
Daily Tunnel Blanks	60	60	60	60	60	60
Test Vehicles	250	750	750	250	250	250
Replicate Vehicle Tests	15	45	45	15	15	15
Weekly Calibration Vehicle Tests	12	36	36	12	12	12
Field/Transport Blanks	12	12	12	12	0	12
		903	903	349	337	349
Round 2						
Daily Tunnel Blanks	60	60	60	60	60	60
Test Vehicles	230	690	690	230	230	230
Replicate Vehicle Tests	10	30	30	10	10	10
Repeat Vehicle from Round 1	25	75	75	25	25	25
Weekly Calibration Vehicle Tests	12	36	36	12	12	12
Field/Transport Blanks	12	12	12	12	0	12
		903	903	349	337	349
Total Round 1 and 2		1806	1806	698	674	698

Optional Task During Pilot for NREL

Run ID Channel #	Number of Tests	Teflon filter 7a	Quartz filter [a] 7b	quartz filter 8	TIGF/XAD 9	canister 10	DNPH cartridge 11
Tunnel Blank	2	2	5	2	2	2	2
Test Vehicles	2	6	15	6	2	2	2
Replicate Vehicle Tests	4	12	30	12	4	4	4
Field Transport Blanks	0	0	0	0	0		0
		20	50	20	8	8	8

a. Includes backup quartz filters for base tests at 47 C.

Notes: One dilution tunnel blanks will be collected daily during rounds 1 and 2 at the beginning of each day of testing. Twelve sets of sampling media will be returned to the laboratory as field/transport blanks per round.

Table 2-11. Numbers of samples analyzed during the Kansas City LDGV Characterization Study

			Teflon filter		quartz filter		TIGF/XAD	TIGF	XAD	canister	DNPH cartridge
	Tests	Composite	mass	elements	OC/EC	Ions	POC and SVOC	POC	SVOC	VOC	Carbonyls
Pilot Study											
Tunnel Blank	3		3		3		3			3	3
Test Vehicles	3		9		9		2	1	1	3	3
Replicate Vehicle Tests	6		18		18		4	2	2	6	6
Field Transport Blanks	3		3		3		3				3
			33		33		12	3	3	12	15
Round 1											
Daily Tunnel Blanks	60	10	60	6	60	6		6	6	6	6
Test Vehicles	250		750								
Truck - Pre 1980		1		4	12	4	4			4	4
Truck - 1980 to 1990		1		3	9	3	3			3	3
Truck - 1991 to 1995		3		2	18	2		2	2	2	2
Truck - 1996 and newer		5		2	30	2		2	2	2	2
Car - Pre 1980		1		6	18	6	6			6	6
Car - 1980 to 1990		1		4	12	4	4			4	4
Car - 1991 to 1995		3		3	27	3		3	3	3	3
Car - 1996 and newer		5		2	30	2		2	2	2	2
Replicate Vehicle Tests	15		45		45						
Weekly Calibration Vehicle Tests	12		36		36						
Field/Transport Blanks	12		12	6	12	6		3	3		6
			903	38	309	38	17	18	18	32	38
Round 2											
Daily Tunnel Blanks	60	10	60	6	60	6		6	6	6	6
Test Vehicles	230		690								
Repeat Vehicle from Round 1	25		75								
Truck - Pre 1980		1		4	12	4	4			4	4
Truck - 1980 to 1990		1		3	9	3	3			3	3
Truck - 1991 to 1995		3		2	18	2		2	2	2	2
Truck - 1996 and newer		5		2	30	2		2	2	2	2
Car - Pre 1980		1		6	18	6	6			6	6
Car - 1980 to 1990		1		4	12	4	4			4	4
Car - 1991 to 1995		3		3	27	3		3	3	3	3
Car - 1996 and newer		5		2	30	2		2	2	2	2
Replicate Vehicle Tests	10		30		30						
Weekly Calibration Vehicle Tests	12		36		36						
Field/Transport Blanks	12		12	6	12	6		3	3		6
			903	38	294	38	17	18	18	32	38
Total Round 1 and 2			1806	76	603	76	34	36	36	64	76

Optional Task During Pilot for NREL

		Teflon filter		quartz filter	quartz filter		TIGF/XAD	TIGF	XAD	canister	DNPH cartridge
	Tests	mass	elements	OC/EC	OC/EC	Ions	POC and SVOC	POC	SVOC	VOC	Carbonyls
Pilot Study (Optional)											
Tunnel Blank	2	2		5	2			2	2	2	2
Test Vehicles	2	6		15	6			2	2	2	2
Replicate Vehicle Tests	4	12		30	12			4	4	4	4
Field Transport Blanks											
		20		50	20			8	8	8	8

a. Includes backup quartz filters for base tests at 47 C.

Notes: This table does not include analyses for certification blanks from each lot of sampling media and replicate analyses for determination of analytical precision. The costs for these samples are included in per unit cost for each analysis.

Table 2-12. Analysis list of inorganic species for the Kansas City LDGV Emission Characterization Study

Species	Analysis Method[a]	MDL[b] (µg/filter)	Species	Analysis Method[a]	MDL[b] (µg/filter)
Chloride (Cl^-)	IC	1.5005	Cobalt (Co)	XRF	0.0115
Nitrite ($NO2^-$)	IC	1.5005	Nickel (Ni)	XRF	0.0115
Nonvolatilized Nitrate (NO_3^-)	IC	1.5005	Copper (Cu)	XRF	0.0144
Phosphate ($PO4^{3-}$)	IC	1.5005	Zinc (Zn)	XRF	0.0144
Sulfate ($SO_4^=$)	IC	1.5005	Gallium (Ga)	XRF	0.0259
Ammonium ($NH4^+$)	AC	1.5005	Arsenic (As)	XRF	0.0230
Soluble Sodium (Na^+)	AAS	0.2362	Selenium (Se)	XRF	0.0173
Soluble Magnesium (Mg^{++})	AAS	0.0547	Bromine (Br)	XRF	0.0144
Soluble Potassium (K^+)	AAS	0.1498	Rubidium (Rb)	XRF	0.0144
Soluble Calcium (Ca^{++})	AAS	0.0979	Strontium (Sr)	XRF	0.0144
Organic Carbon (OC)	TOR	2.7590	Yttrium (Y)	XRF	0.0173
Elemental Carbon (EC)	TOR	2.7590	Zerconium (Zr)	XRF	0.0230
Sodium (Na)	XRF	0.9533	Molybdenum (Mo)	XRF	0.0374
Magnesium (Mg)	XRF	0.3456	Palladium (Pd)	XRF	0.1526
Aluminum (Al)	XRF	0.1382	Silver (Ag)	XRF	0.1670
Silicon (Si)	XRF	0.0864	Cadmium (Cd)	XRF	0.1670
Phosphorus (P)	XRF	0.0778	Indium (In)	XRF	0.1786
Sulfur (S)	XRF	0.0691	Tin (Sn)	XRF	0.2333
Chlorine (Cl)	XRF	0.1382	Antimony (Sb)	XRF	0.2477
Patassium (K)	XRF	0.0835	Barium (Ba)	XRF	0.7171
Calcium (Ca)	XRF	0.0634	Lanthanum (La)	XRF	0.8554
Titanium (Ti)	XRF	0.0403	Gold (Au)	XRF	0.0432
Vanadium (V)	XRF	0.0346	Mercury (Hg)	XRF	0.0346
Chromium (Cr)	XRF	0.0259	Thallium (Tl)	XRF	0.0346
Manganese (Mn)	XRF	0.0230	Lead (Pb)	XRF	0.0403
Iron (Fe)	XRF	0.0202	Uranium (U)	XRF	0.0317

[a] IC=ion chromatography. AC=automated colorimetry. AAS=atomic absorption spectrophotometry.

TOR=thermal/optical reflectance. XRF=x-ray fluorescence.

[b] Minimum detectable limit (MDL) is the concentration at which instrument response equals three times the standard deviation of the response to a known concentration of zero.

Additional Notes

1. Boron (specified in Section 3.3.2.2 of RFP) cannot be done by XRF.
2. XRF can be replaced with ICP-MS with greater sensitivity. However, cannot measure Sulfur and Chlorine and cost twice as much as XRF. Three Teflon filters can be extracted together with ICP-MS to reduce cost.

Table 2-13. Relative detection limits for XRF and ICP-MS elemental analysis.

		XRF			ICP-MS
		Protocol A	Protocol B	Protocol C	
Species	ICP/XRF sensitivity	MDL[b] (µg/filter)	MDL[b] (µg/filter)	MDL[b] (µg/filter)	mdl ug/sample
Boron (B)		na	na	na	na
Sodium (Na)		na	na	na	0.1000
Aluminum (Al)	1.1920	0.1192	0.0858	0.0429	0.1000
Phosphorus (P)		0.0668	0.0477	0.0238	na
Sulfur (S)		0.0596	0.0417	0.0215	na
Chlorine (Cl)		0.1192	0.0882	0.0441	na
Silicon (Si)		0.0751	0.0524	0.0262	na
Calcium (Ca)	0.5364	0.0536	0.0381	0.0191	0.1000
Chromium (Cr)	2.2648	0.0226	0.0167	0.0080	0.0100
Manganese (Mn)	9.5360	0.0191	0.0131	0.0067	0.0020
Iron (Fe)	0.0894	0.0179	0.0131	0.0064	0.2000
Nickel (Ni)	0.5304	0.0106	0.0075	0.0037	0.0200
Copper (Cu)	3.2780	0.0131	0.0091	0.0045	0.0040
Zinc (Zn)	6.5560	0.0131	0.0091	0.0045	0.0020
Arsenic (As)	9.5360	0.0191	0.0131	0.0067	0.0020
Mercury (Hg)	30.9920	0.0310	0.0215	0.0108	0.0010
Lead (Pb)	89.4000	0.0358	0.0262	0.0131	0.0004
K		0.0727	0.0513	0.0262	
Ti		0.0346	0.0250	0.0119	
V		0.0298	0.0203	0.0104	
Co		0.0105	0.0074	0.0037	
Ga		0.0226	0.0167	0.0081	
Se		0.0143	0.0103	0.0051	
Br		0.0119	0.0086	0.0043	
Rb		0.0119	0.0081	0.0041	
Sr		0.0131	0.0093	0.0046	
Y		0.0155	0.0110	0.0055	
Zr		0.0203	0.0143	0.0070	
Mo		0.0322	0.0226	0.0113	
Pd		0.1311	0.0906	0.0453	
Ag		0.1430	0.1025	0.0513	
Cd		0.1430	0.1025	0.0513	
In		0.1550	0.1132	0.0572	
Sn		0.2026	0.1430	0.0739	
Sb		0.2146	0.1550	0.0763	
Ba		0.6198	0.4410	0.2146	
La		0.7390	0.5245	0.2622	
Au		0.0370	0.0262	0.0131	
Tl		0.0298	0.0215	0.0105	
U		0.0274	0.0203	0.0099	

[b] Minimum detectable limit (MDL) is the concentration at which instrument response equals three times the standard deviation of the response to a known concentration of zero.

na - not available

Cost: XRF Protocol A ($21/sample), XRFb ($35/sample) XRFc ($128/sample) for 15 elements and 23 additional at no cost.

Cost for ICP-MS ($17/sample for digestion plus $19 for first element plus $2 for each additional element); $58 per sample for 12 elements

Table 2-14. Analysis list of hydrocarbons and carbonyl compounds for the Kansas City LDGV Emission Characterization Study

Hydrocarbons			Carbonyl Compounds
Ethane	MeCyPentane	m/p-xylene	Formaldehyde
Ethene	2,4-DiMePentane	2MeOctane	Acetaldehyde
Acetylene	223TriMeButane	3MeOctane	Acetone
propene	1MeCypentene	Styrene+heptanal	Acrolein
propane	Benzene	o-xylene	Propionaldehyde
isoButane	33DiMePentane	Nonene-1	Crotonaldehyde
1Butene+iButylene	CycloHexane	n-Nonane	Methyl Ethyl Ketone
1,3-Butadiene	4MeHexene	iPropBenzene	Methacrolein
n-Butane	2MeHexane	iPropCyHexane	Butyraldehyde
t-2-Butene	23DiMePentane	26DiMeOctane	Benzaldehyde
c-2-Butene	Cyclohexene	alpha-pinene	Glyoxal
3-Me-1-Butene	3MeHexane	36DiMeOctane	Valeraldehyde
isopentane	13DiMeCyPentane	nPropBenzene	m-Tolualdehyde
1-Pentene	3EtPentane	mEtToluene	Hexanaldehyde
2-Me-1-Butene	1-Heptene	pEtToluene	
n-Pentane	224TrMePentane	135TriMeBenzene	
Isoprene	t-3-Heptene	oEtToluene	
t-2-Pentene	n-Heptane	beta-pinene	
c-2-Pentene	244TMe-1-Pentene	1-Decene+bkgd	
2-Me-2-Butene	MeCyHexane	124TriMeBenzene	
22DiMeButane	25DiMeHexane	n-Decane	
CycloPentene	24DiMeHexane	iButBenzene	
4-Me-1-Pentene	234TrMePentane	sButBenzene	
3-Me-1-Pentene	Toluene	123TriMeBenzene	
CycloPentane	23DiMeHexane	Limonene	
23DiMeButane	2MeHeptane	Indan	
MTBE	4MeHeptane	Indene	
2-MePentane	3MeHeptane	13diethylbenzene	
22-DiMePentane	Hexanal	14diethylbenzene	
3-MePentane	225TMHexane	12diethylbenzene	
2-Me-1-Pentene	Octene-1	2-propylToluene	
1-Hexene	11DMeCyHexane	iPrToluene	
n-Hexane	n-Octane	n-Undecane	
t-3-Hexene	235TriMeHexane+Bgr.	1245tetraMeBenzene	
t-2-Hexene	24DiMeHeptane	1235tetraMeBenzene	
2-Me-2-Pentene	44DiMeHeptane	1234tetraMeBenzene	
c-3-Me-2-Pentene	26DiMeHeptane	1MeIndan	
c-3-Hexene	25DiMeHeptane	1-Dodecene	
c-2-Hexene	33DiMeHeptane	Naphthalene+Decanal	
t-3-Me-2-Pentene	EtBenzene	n-Dodecane	

a. Canister/GC-FID or MS with MLD = 0.1 ppbC.

b. DNPH cartrideges/HPLC-UV with MDL = 0.1 ppbv.

Table 2-15. Analysis list of polycyclic aromatic hydrocarbons for the Kansas City LDGV Emission Characterization Study

Polycyclic Aromatic Hydrocarbons (PAH) [a]		Nitro-PAH [b]
Naphthalene	Anthrone	1-Nitronaphthalene
2-methylnaphthalene	9-methylanthracene	2-Nitronaphthalene
1-methylnaphthalene	Anthraquinone	2-Nitrobiphenyl
Biphenyl	3,6-dimethylphenanthrene	3-Nitrobiphenyl
2-Methylbiphenyl	A-dimethylphenanthrene	4-Nitrobiphenyl
1+2ethylnaphthalene	B-dimethylphenanthrene	1,3-Dinitronaphthalene
2,6+2,7-dimethylnaphthalene	C-dimethylphenanthrene	1,5-Dinitronaphthalene
1,3+1,6+1,7dimethylnaphth	D-dimethylphenanthrene	5-Nitroacenaphthene
1,4+1,5+2,3-dimethylnaphth	E-dimethylphenanthrene	2-Nitrofluorene
Acenaphthylene	1,7-dimethylphenanthrene	9-Nitroanthracene
1,2-dimethylnaphthalene	Fluoranthene	4-Nitrophenanthrene
3-Methylbiphenyl	1-MeFl+C-MeFl/Py	9-Nitrophenanthrene
Acenaphthene	Pyrene	3-Nitrophenanthrene
4-Methylbiphenyl	9-Anthraaldehyde	1,8-Dinitronaphthalene
Bibenzyl	Retene	2-Nitrofluoranthene
Dibenzofuran	B-MePy/MeFl	3-Nitrofluoranthene
A-trimethylnaphthalene	C-MePy/MeFl	1-Nitropyrene
B-trimethylnaphthalene	D-MePy/MeFl	2,7-Dinitrofluorene
C-trimethylnaphthalene	4-methylpyrene	7-Nitrobenz(a)anthracene
E-trimethylnaphthalene	1-methylpyrene	6-Nitrochrysene
F-trimethylnaphthalene	2,3-Benzofluorene	1,3-Dinitropyrene
2,3,5+I-trimethylnaphthalene	Benzonaphthothiophene	1,6-Dinitropyrene
J-trimethylnaphthalene	Benzo(c)phenanthrene	1,8-Dinitropyrene
2,4,5-trimethylnaphthalene	Benz(a)anthracene	9,10-Dinitroanthracene
Fluorene	Chrysene	6-Nitrobenz(a)pyrene
1,4,5-trimethylnaphthalene	Benzanthrone	
A-methylfluorene	Benz(a)anthracene-7,12-dione	
1-methylfluorene	5+6-methylchrysene	
B-methylfluorene	7-methylbenz(a)anthracene	
9-fluorenone	1,4-chrysenequinone	
Phenanthrene	Benzo(b+j+k)fluoranthene	
Anthracene	BeP	
Xanthone	BaP	
Acenaphthenequinone	Perylene	
A-methylphenanthrene	7-methylbenzo(a)pyrene	
2-methylphenanthrene	9,10-dihydrobenzo(a)pyrene-7(8H)-one	
Perinaphthenone	Indeno[123-cd]pyrene	
B-methylphenanthrene	Dibenzo(ah+ac)anthracene	
C-methylphenanthrene	Benzo(ghi)perylene	
1-methylphenanthrene	Coronene	

a. TIGF/XAD and GC/MS with MDL = 0.02 ug/sample
b. TIGF/XAD and GC/MS with MDL = 0.01 ug/sample

Table 2-16. Analysis list of hopanes, steranes and alkanes for the Kansas City LDGV Emission Characterization Study

Hopanes and Steranes [a]	Alkanes [b]
C27-20S5a(H),14a(H)-cholestane	norfarnesane
C27-20R5a(H),14ß(H)-cholestane	heptylcyclohexane
C27-20S5a(H),14ß(H),17ß(H)-cholestane	farnesane
C27-20R5a(H),14a(H),17a(H)-cholestane & C29-20S13ß(H),17a(H)-diasterane	octylcyclohexane
C28-20S5a(H),14a(H),17a(H)-ergostane	nonylcyclohexane
C28-20R5a(H),14ß(H),17ß(H)-ergostane	norpristane
C28-20S5a(H),14ß(H),17ß(H)-ergostane	hexadecane
C28-20R5a(H),14a(H),17a(H)-ergostane	heptadecane
C29-20S5a(H),14a(H),17a(H)-stigmastane	decylcyclohexane
C29-20R5a(H),14ß(H),17ß(H)-stigmastane	pristane
C29-20S5a(H),14ß(H),17ß(H)-stigmastane	undecylcyclohexane
18a(H),21ß(H)-22,29,30-Trisnorhopane	octadecane
17a(H),18a(H),21ß(H)-25,28,30-Trisnorhopane	nonadecane
C29-20R5a(H),14a(H),17a(H)-stigmastane	phytane
17a(H),21ß(H)-22,29,30-Trisnorhopane	dodecylcyclohexane
17a(H),21ß(H)-30-Norhopane	tridecylcyclohexane
17b(H),21a(H)-30-Norhopane	tetradecylcyclohexane
17a(H),21ß(H)-Hopane	eicosane
17ß(H),21a(H)-hopane	heneicosane
22S-17a(H),21ß(H)-30-Homohopane	pentadecylcyclohexane
22R-17a(H),21ß(H)-30-Homohopane	hexadecylcyclohexane
17ß(H),21ß(H)-Hopane	docosane
22S-17a(H),21ß(H)-30,31-Bishomohopane	triacosane
22R-17a(H),21ß(H)-30,31-Bishomohopane	heptadecylcyclohexane
22S-17a(H),21ß(H)-30,31,32-Trisomohopane	octadecylcyclohexane
22R-17a(H),21ß(H)-30,31,32-Trishomohopane	tetracosane
	pentacosane
	hexacosane
	nonadecylcyclohexane
	eicosylcyclohexane
	heptacosane
	octacosane
	nonacosane
	triacontane
	hentriacontane
	dotriacontane
	tritriacontane
	tetratriacontane
	pentatriacontane
	hexatriacontane

a. TIGF/XAD and GC/MS with MDL = 0.02 ug/sample
a. TIGF/XAD and GC/MS with MDL = 0.1 ug/sample

Table 2-17. Analysis list of polar organics for the Kansas City LDGV Emission Characterization Study

Analytical Standards	Classification	Potential Organic Marker Type	MDL microgram/sample
hexanoic acid	alkanoic acid		0.05
heptanoic acid	alkanoic acid		0.05
methylmalonic	alkanedioic acid	secondary aerosol	0.05
guaiacol	methoxy phenol	wood smoke	0.05
benzoic acid	aromatic acid		0.05
octanoic acid	alkanoic acid		0.05
butenedioic (maleic) acid	alkenedioic acid	secondary aerosol	0.05
butanedioic (succinic) acid	alkanedioic acid	secondary aerosol	0.05
4-me-guaiacol	methoxy phenol	wood smoke	0.05
me-succinic acid	alkanedioic acid	secondary aerosol	0.05
nonanoic acid	alkanoic acid		0.05
4-ethyl-guaiacol	methoxy phenol	wood smoke	0.05
syringol	methoxy phenol	wood smoke	0.05
glutaric acid	alkanedioic acid	secondary aerosol	0.05
2-methylglutaric	alkanedioic acid	secondary aerosol	0.05
3-methylglutaric acid	alkanedioic acid	secondary aerosol	0.05
decanoic acid	alkanoic acid		0.05
4-allyl-guaiacol (eugenol)	methoxy phenol	wood smoke	0.05
4-methyl-syringol	methoxy phenol	wood smoke	0.05
hexanedioic (adipic) acid	alkanedioic acid	secondary aerosol	0.05
cis-pinonic acid	aromatic acid		0.05
3-methyladipic acid	alkanedioic acid	secondary aerosol	0.05
4-formyl-guaiacol (vanillin)	methoxy phenol	wood smoke	0.05
undecanoic acid	alkanoic acid		0.05
isoeugenol	methoxy phenol	wood smoke	0.05
heptanedioic (pimelic) acid	alkanedioic acid	secondary aerosol	0.05
acetovanillone	methoxy phenol	wood smoke	0.05
dodecanoic (lauric) acid	alkanoic acid		0.05
phthalic acid	aromatic diacid		0.05
suberic acid	alkanedioic acid	secondary aerosol	0.05
levoglucosan	carbohydrate	wood smoke	0.05
syringaldehyde	methoxy phenol	wood smoke	0.05
tridecanoic acid	alkanoic acid		0.05
isophthalic acid	aromatic diacid		0.05
vanillic acid	methoxy acid	wood smoke	0.05
homovanillic acid	methoxy acid	wood smoke	0.05
azelaic acid	alkanedioic acid	secondary aerosol	0.05
myristoleic acid	alkenoic acid	meat cooking	0.05
myristic acid	alkanoic acid		0.05
sebacic acid	alkanedioic acid	secondary aerosol	0.05
syringic acid	methoxy acid		0.05
pentadecanoic acid	alkanoic acid		0.05
undecanedioic acid	alkanedioic acid	secondary aerosol	0.05
palmitoleic acid	alkenoic acid	meat cooking	0.05
palmitic acid	alkanoic acid		0.05
isostearic acid	alkanoic acid		0.05
dodecanedioic acid	alkanedioic acid	secondary aerosol	0.05
heptadecanoic acid	alkanoic acid		0.05
traumatic acid	alkenoic acid		0.05
1,11-undecanedicarboxylic acid	alkanedioic acid	secondary aerosol	0.05
oleic acid	alkenoic acid		0.05
elaidic acid	alkenoic acid		0.05
stearic acid	alkanoic acid		0.05
1,12-dodecanedicarboxylic acid	alkanedioic acid	secondary aerosol	0.05
8,15-pimaradien-18-oic acd	resin acid	wood smoke	0.05
pimaric acid	resin acid	wood smoke	0.05
nonadecanoic acid	alkanoic acid		0.05
isopimaric acid	resin acid	wood smoke	0.05
dehydroabietic acid	resin acid	wood smoke	0.05
abietic acid	resin acid	wood smoke	0.05
eicosanoic acid	alkanoic acid		0.05
heneicosanoic acid	alkanoic acid		0.05
docosanoic acid	alkanoic acid		0.05
tricosanoic acid	alkanoic acid		0.05
tetracosanoic acid	alkanoic acid		0.05
cholesterol	sterol	meat cooking	0.05

Table 2-18. Potential instrument configuration for continuous and quasi-continuous measurement of PM

				Sensor Operating Environment	
Instrument Manufacturer	**Instrument Type (Measurement)**	**Sensor Technology**	**Time Resolution (sec.)**	**Temperature Range (°C)**	**Sample Flow Rate (Lpm)**
QCM, RPM – 101 Booker Systems, UK	Inertial Micro-Balance (PM Mass)	Quartz Crystal/ Frequency Deficit	1	35 to 50	1 to 5
DPM Monitor, 1105a R & P, Albany, NY	Inertial Micro-Balance (PM Mass)	Tapered Element/Filter Frequency Deficit	15	35 to 50	1 to 3.5
Dataram – 4 Thermo MIE, Bedford MA	Nephelometer (PM light Scattering)	Photo Diode/Two Wavelength	1	35 to 50	1 to 2
Aethalometer, AE2 McGee Scientific, Berkeley, CA	Light Absorption (Black Carbon and PAH)	Photo Diode/Light Absorption at 800nm and 370nm	300	20 to 40	5

[a] The instruments listed are an example only, based on the descriptions in Section 3.3. The contractor may propose alternative instruments.

Table 2-19. Potential instruments for integral measurement of PM

				Sample Operating Environment	
Instrument Manufacturer	**Instrument Type (Measurement)**	**Sensor Technology**	**Suggested Sample Media**	**Temperature Range (°C)**	**Sample Flow Rate (Lpm)**
Filter Holder 6186 R & P, Albany, NY	Gravimetric Micro-Balance (separate filters for LA92 Phase 1 and LA92 Phases 2-4.(PM Mass)	Gravimetric Micro-Balance	Teflo Filter	35 to 50	50 to 70
Thermo-Optical Carbon Aerosol Lab Analyzer Sunset Laboratory, Forest Grove, OR	Carbon Aerosol Analysis (PM Elemental and Organic Carbon Mass)	FID Detection of Thermaly Liberated CO2	Pre-Fired Quartz Filter	35 to 50	2 to15
Filter Holder 6186 R & P, Albany, NY	ICP-MS and/or XRF (PM Element Mass)[b]	Analysis Dependent	Teflo Filter	35 to 50	50 to 70
Filter Holder 6186 R & P, Albany, NY	IC and AC (PM Water Soluble Ions)	Analysis Dependent	Quartz Filter	35 to 50	50 to 70
Filter Holder 6186 R & P, Albany, NY	GC/MS (PM SVOC)	Analysis Dependent	XAD-4 Coated Filter	35 to 50	50 to 70
Summa Cannister Anderson Instruments, Atlanta, GA	GC/MS (VOCs)	Analysis Dependent	Summa Cannister	35 to 50	Sample Dependent
DNPH Cartridge Anderson Instruments, Atlanta, GA	GC/MS (Aldehydes and Ketones)	Analysis Dependent	DNPH Cartridges	35 to 50	Sample Dependent

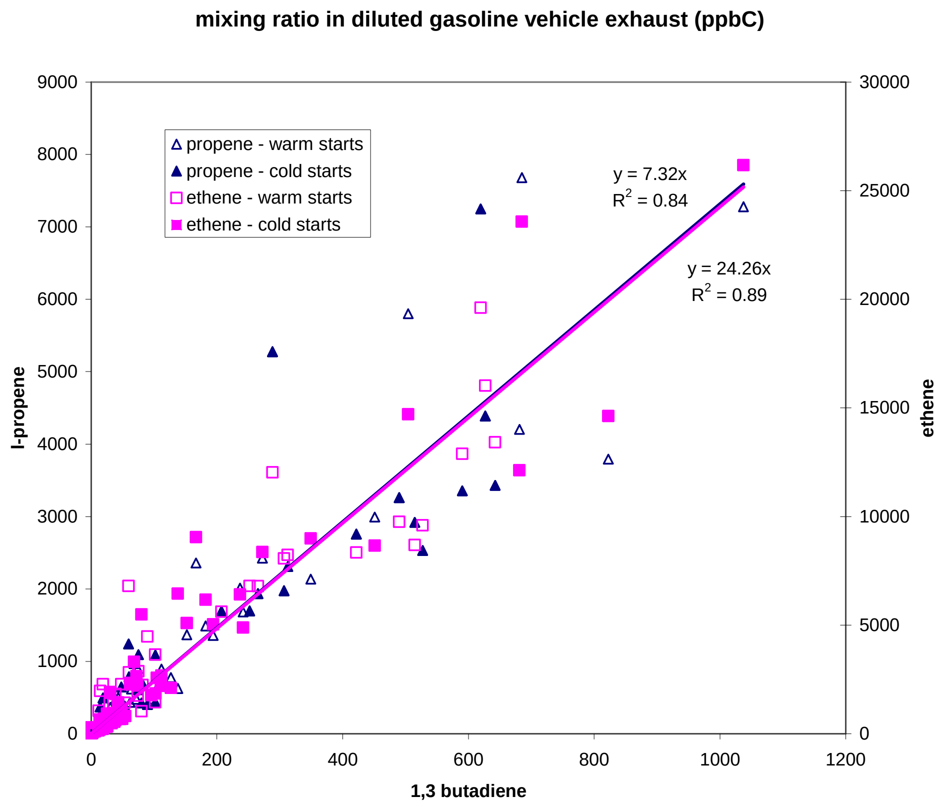


Figure 2-9. Correlation of 1,3-butadiene with ethene and propene for 57 LDGVs tested during the Gas/Diesel PM Split Study (Preliminary, unpublished data)

3.0 Organization

3.1 ERG Team Members

ERG's team brings to the PM characterization study a group of researchers and analysts with broad and complementary skills. Our key team members are recognized by their peers as leaders in their respective fields of study. Table 3-1 lists our key team members along with their anticipated role in the project, highlighting their relevant expertise and experience.

Table 3-1. Key ERG Team Members

Key Personnel / Role	Relevant Expertise and Experience
Sandeep Kishan (ERG) *Project Manager / Task Leader for Analysis and Reporting*	Project Manager for EPA's previous Driving Modes Study, a large scale effort involving vehicle recruitment, instrumentation, data collection and analysis, and extensive QA/QC. Managed recent effort to collect on-board activity data for off-road vehicles for TxDOT. Contributed to the development and testing of EPA's mobile source model MOBILE6, and an active participant in the FACA committee for the development of the MOVES model. Led the effort to develop an enhanced version of PART5 for Texas (PART5-TX) to incorporate I/M effects on PM emissions.
Andrew Burnette (ERG) *Task Leader for QAPP / Technical Lead for RSD and PEMS/PAMS Deployment*	Specialty areas include emissions evaluations using loaded mode tests, remote sensing devices and their applications, and PM emissions assessments. Recruited vehicles for emissions testing and/or PAMS instrumentation in Texas, Mexico, and Bangkok. Collected on-road emissions data for buses in Bangkok, combining second-by-second data for hydrocarbons, carbon monoxide, carbon dioxide, nitrogen oxides, oxygen, and smoke opacity with driving pattern information such as speed, acceleration, throttle position, and engine rpm to compare buses under similar driving conditions. Technical lead for data collection and analysis for PART5-TX model development, as well as RSD data collection and emissions characterization studies in Kansas City, Phoenix, Dallas, and California.
Dr. Tim DeFries (ERG) *Peer Review of Statistical Analysis and QAPP*	Expertise in mobile source emissions modeling, plume opacity, experimental design, and data analysis using statistical and neural network techniques. Daily familiarity with ordinary least squares regression, multiple linear regression, non-linear regression, analysis of variance, logistic regression, variance stabilizing transformations, and measurement-error modeling. Has used statistics to develop the QAPP/sampling plans for EPA's Driving Modes Study, representative driving cycles for on and off-road vehicles, exhaust and evaporative emissions of "off-FTP" driving, and to design a test program to collect data to improve evaporative emissions modeling.
Robert Slott (Consultant) *Peer Review for RSD*	Distinguished lecturer at Massachusetts Institute of Technology on issues dealing with mobile source pollution. Member of numerous national panels reviewing the effectiveness of remote sensing and related technologies and methods. Widely respected as an innovative thinker and student of human nature in the mobile source control industry.
William "Butch" Crews (BKI)	Supported EPA's Environmental Characterization Apportionment Branch (ECAB) emissions characterization projects for 31 years. Managed on site

Key Personnel / Role	Relevant Expertise and Experience
Task Leader for Vehicle Testing	operations, analytical, data processing, and machine shop support. Experience covers all aspects of the testing process from 2 and 4 stroke small light duty off-road and marine engines, through light-duty, alternative-fuel vehicles, to heavy-duty diesel engines. Has prepared Standard Operating Procedures and QC/QA plans and reports on all facets of emissions measurement. Led the design and evaluation of an injection system for formaldehyde, oxygenated compounds, and hydrocarbons into exhaust dilution tunnels to determine compound recoveries during modal operation.
Richard Snow (BKI) *On-Site Technical Lead for Vehicle Testing*	Helped plan, implement, and supervise projects to determine emissions from vehicles operated under a variety of conditions. Developed procedures to improve testing capabilities, and developed instrumentation and equipment for simulation of vehicle operating conditions. Leads a team providing on site operations support for the Environmental Characterization Apportionment Branch (ECAB). Played a key role in developing the operational and analytical capabilities of a transportable dynamometer system for performing independent, remote field studies to characterize emissions. Leads efforts to modify and fine tune mobile source operational and sampling equipment to meet specific project goals and objectives.
Dr. Eric Fujita (DRI) *Technical Lead for PM Sampling and Analysis*	Over 20 years of experience in managing and conducting air quality studies. Principal author of the field study plans for the 2000 Central California Ozone Study, 1997 Southern California Ozone Study (SCOS97-NARSTO), and the 1996/97 Northern Front Range Air Quality Study. Primary research interests is in the application of data from ambient monitoring programs, on-road tunnel measurements, in-use motor vehicle surveillance and inspection and maintenance programs, and from remote sensing to evaluate the effectiveness of vehicle emission control programs. Coordinated the laboratory comparisons of hydrocarbon measurements during the SCOS97-NARTSO, COAST and NARSTO-Northeast ozone studies.
Dr. Pat Arnott (DRI) *Technical Assistance for PM Sampling and Analysis*	Develops and deploys photoacoustic instruments for measurement of black carbon emission from vehicles in source sampling, and in ambient air quality studies. Measurements are often combined with other real time particulate emission measurements to establish detailed knowledge of the conditions giving rise to most of the black carbon and particulate emission to the atmosphere, and their environmental impacts. He teaches in the Atmospheric Sciences Program at the University of Nevada, Reno.
NuStats Team (Robert Santos, Mia Zmud, Stacey Bricka) *Task Leaders for Vehicle Recruitment*	Over the past 18 years, NuStats has become known for innovative survey planning, data collection, and methodological research. Since inception, NuStats has conducted more than 300 large-scale studies in more than 40 states and virtually every major metropolitan area of the United States. The firm provides a full array of research services: study management, study design, statistical sampling, data collection, database management, data analysis, geographic analysis and interpretation of results. NuStats draws upon the expertise of its research staff and utilizes such tools as computer-assisted telephone interviewing (CATI), behavioral diaries, face-to-face interviews, self-administered mail out questionnaires, computer-assisted personal interviewing (CAPI) using hand held computers, Web-based surveys, and personalized (very small) GPS units.
Dr. Imad Khalek (SwRI)	Has extensive experience in particulate emissions from internal combustion engines. An expert in dilution system design and particle measurements from

Key Personnel / Role	Relevant Expertise and Experience
Peer Review and QC for Continuous PM Monitoring and Analysis	combustion sources. Research efforts on ultra-fine particulate emissions have gained worldwide attention. Has investigated the influence of engine stabilization, exhaust catalysts and filters (traps), dilution systems, and dilution variables, on particle size distribution and number emission measurements. Also worked on modeling of binary homogenous nucleation of sulfuric acid and water droplet, and growth by hetero-molecular condensation and coagulation during exhaust dilution. Work has contributed to future particulate emission measurements and regulations.

As indicated in the table above, our key staff are fully qualified to conduct their respective technical and managerial tasks. Our overall management structure is organized functionally according to the requirements of the RFP. The following chart describes the organization of our team, showing specific responsibilities for the major project activities.

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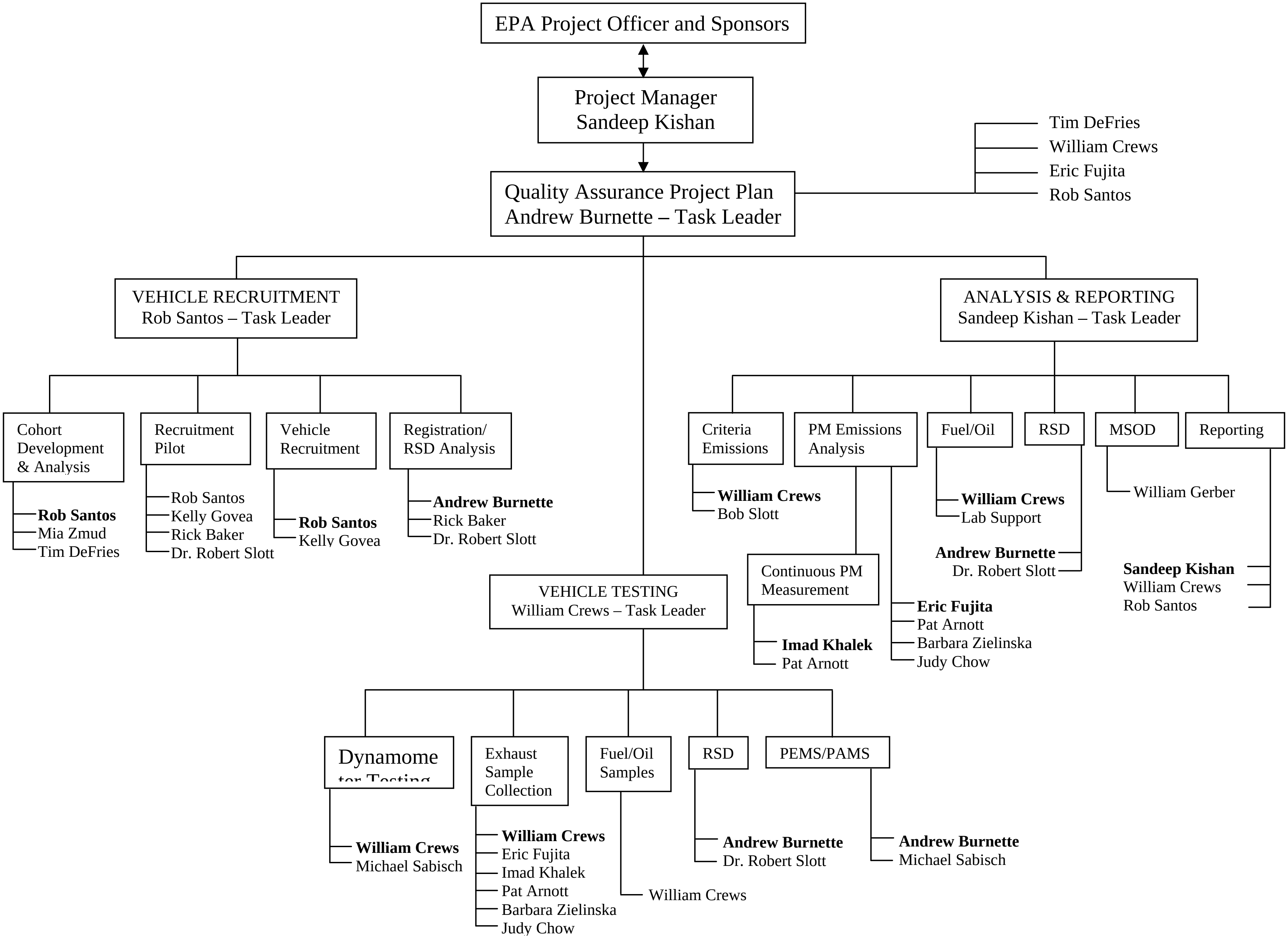

Figure 3-1. Project Management Organization

3.2 Communication with EPA Project Officer and Sponsors

The ERG Project Manger will coordinate all communications between the project team and EPA. Specifically, our Project Manager will communicate directly with the Project Officer regarding all technical matters. (Matters regarding contract issues will be directed to the EPA Contracting Officer, with the Project Officer included in all correspondence.) Questions or issues directed toward any of the Project Sponsors will be routed through the EPA Project Officer as well.

The ERG Project Manager will not authorize any substantive or significant change in operation procedures without first receiving written authorization of specific technical direction from the Project Officer. Similarly, comments and/or requested changes to deliverables will not be acted upon without written technical direction from the Project Officer.

All deliverables and required data files will be provided to the Project Officer in electronic form via a password protected Project Website. (Additional hard copies of deliverables will also be provided to the Project Officer as needed.) The Project Officer may also make this information available to the Project Sponsors at his discretion by providing them with password access as well. The Project Website is organized to provide easy access to the following:

- Project Status Reports
- Bi-Weekly Meeting Minutes
- Draft Reports
- Final Reports
- FTP-link for data transfer of large files (e.g., archived raw vehicle emissions data, vehicle registration data)

The website will also contain user instructions for downloading files, and a description of the process for providing comments or asking questions of the ERG Project Manager and/or Technical Staff. (The website will also serve as an effective communication tool for the ERG Team – see below.)

Bi-weekly calls will be held with the EPA Project Officer, arranged in advance. The ERG Project Officer will participate, as well as relevant Task Leaders and Technical Staff, as appropriate. Progress reports regarding schedule and budget will be generated by ERG in advance of these calls using MS Project, and the reports distributed to all participants for review.

Calls will cover schedule and budget status, technical progress as well as any deviations from the schedule, budget, or QAPP, and remedial actions taken/planned. Call minutes will be taken and distributed by email to all participants, and posted on the Project Website.

ERG will also provide the Project Officer with Monthly Progress Reports, as specified in the RFP. In addition to technical progress, ERG will include itemized reports of incentive expenditures once vehicle testing has begun. Any vehicle repair costs or other non-labor related expenditures (e.g., support vehicle rental costs) will also be itemized.

The ERG Project Manager will assist EPA and the Sponsors with all audit activities, and assure full cooperation of all team members with any such effort. The Project Manager will also review all questions and comments resulting from vehicle emission test data audits. Any errors or reporting discrepancies will be addressed jointly between the Project Manager and the EPA Project Officer.

4.0 Project Schedule

The recruitment task and the pilot testing task will be started as soon as our work plan is approved (anticipated on April 15, 2004). The pilot testing task is scheduled to be completed by May 30, 2004. A draft pilot study report will be delivered by June. The project schedule and a list of project deliverables is presented in the following tables.

Table 4-1. Proposed Project Schedule

Project Start	March 1, 2004
Kick-off Meeting	March 10-11, 2004
Project Workplan	April 12, 2004
Draft Quality Assurance Documents	April 19, 2004
Pilot Vehicle Testing	May 10, 2004
Final Quality Assurance Documents	June 20, 2004
Vehicle Recruitment Plan (including cohort evaluation)	June 15, 2004
Begin Vehicle Recruitment (Round 1)	June 25, 2004
Begin Vehicle Testing (Round 1)	July 7, 2004
End Vehicle Testing (Round 1)	September 20, 2004
Interim Report on Round 1	November 15, 2004
Begin Vehicle Recruitment (Round 2)	December 15, 2004
Begin Vehicle Testing (Round 2)	January 10, 2005
End Vehicle Testing (Round 2)	March 30, 2005
Draft Final Report	June 30, 2005
Final Report	August 30, 2005

Table 4-2. List of Deliverables

Task 1 – QAPP	
Project Work Plan	April 12, 2004
QAPP	April 20, 2004
QMP	April 20, 2004
Task 2 – Recruitment	
Cohort Frame Analysis	June 15, 2004
List of Non-respondent Criteria for EPA approval	May 30, 2004
Monthly Status Reports	Beginning May 15, 2004
Cohort Recruitment and Non-Respondent Analysis	June 10, 2004
Vehicle Registration Database (to Project Officer)	April 25, 2004[1]
Cohort/Vehicle Summary Analysis Report	June 5, 2004
Pilot Study Report	June 20, 2004
Vehicle Recruitment Sample Plan	June 10, 2004
Recruitment Log, Round 1 (e.g., record of contact attempts, outcomes, demographics of informant, etc.)	October 15, 2004
Post-Round 1 Vehicle Analysis	November 15, 2004
Recruitment Log, Round 2	April 30, 2005
Task 3 – Vehicle Testing	
Monthly Project Report	Monthly
Pilot Study Report	June 20, 2004
Weekly Excel Spreadsheet Reports: Round 1	1 week after testing for Round 1
Weekly Excel Spreadsheet Reports: Round 2	1 week after testing for Round 2
Task 4 – Speciation Tasks	
Round 1	
Provide Validated Speciation Database	January 15, 2005
Provide Time-Matched Continuous PM/EC Data	November 15, 2004
Round 2	
Provide Validated Speciation Database	June 15, 2005
Provide Time-Matched Continuous PM/EC Data	April 30, 2005
Other Reports	
Final MSOD/Excel Database	July 10, 2005
Draft Final Report	June 30, 2005
Final Report	August 30, 2005
Meetings/Other	
Kickoff Meeting	March 10, 2004
Bi-weekly Conference Calls (notes via email)	Beginning second week in March 2004
Project Website Deployment	March 25, 2004

[1] Pending cooperation of respective state DMVs.

Kansas City PM Characterization Study

Final Report

Appendix EE
Retest Vehicle Information

Assessment and Standards Division
Office of Transportation and Air Quality
U.S. Environmental Protection Agency

Sponsors:

National Renewable Energy Laboratory, U.S. Department of Energy
Federal Highway Administration, U.S. Department of Transportation
STAPPA-ALAPCO Emission Inventory Improvement Program
Coordinating Research Council Inc. (Project No. E-69)

Prepared for EPA by
Eastern Research Group, Incorporated
Austin, TX

Bevilacqua-Knight Incorporated
Oakland, CA

NuStats LLC
Austin, TX

Desert Research Institute
Reno, NV

EPA Contract No. GS 10F-0036K

October 27,2006
Revised April 2008 by EPA staff

United States
Environmental Protection
Agency

EPA420-R-08-009
April 2008

Round 1 Run #	Round 2 Run #	Year, Make, Model
84058	84393	1999 Chrysler 300M
84150	84394	2000 Honda Odyssey
84036	84396	1995 Ford Escort
84078	84399	1997 Honda Accord
84104	84401	1998 Plymouth Voyager
84108	84402	1991 Honda Civic
84069	84404	1997 Dodge Caravan
84347	84406	1995 Toyota Corolla
84071	84407	1989 Pontiac GrandAm
84097	84408	2002 Mercury Sable
84305	84409	1999 Chevrolet Malibu
84063	84411	1996 Saturn SC
84042	84412	1996 Honda Civic
84037	84413	1979 Ford F250 PU
84298	84415	1999 Dodge Durango
84296	84416	1998 Honda Civic
84332	84418	1997 Pontiac Grand Am
84341	84418	1997 Pontiac Grand Am
84088	84419	1998 Chevrolet Lumina
84151	84420	2000 Honda Accord
84055	84422	1998 Jeep Cherokee
84125	84424	1995 Ford Explorer
84119	84425	1995 Jeep Grand Cherokee Laredo
84084	84428	1998 Chevrolet Malibu
84040	84430	1990 Dodge Spirit
84329	84433	1997 Jeep Wrangler
84342	84437	1994 Toyota Camry
84342	84442	1994 Toyota Camry
84349	84444	2003 Chevrolet Tracker
84338	84445	2001 Saturn Sedan
84344	84446	2000 Toyota Sienna
84339	84448	1999 Plymouth Voyager
84113	84456	1993 Pontiac Grand Prix
84110	84463	1995 Ford Contour
84115	84463	1995 Ford Contour
84146	84467	1988 Ford Ranger PU
84048	84469	1989 Dodge Caravan
84309	84470	1973 Mercedes 280 SE
84188	84472	1977 Chevrolet Monte Carlo
84171	84474	1988 Honda Civic
84211	84475	1986 Ford Tempo
84263	84477	1989 Dodge Ram 50
84271	84482	1979 Buick Lasabre
84271	84484	1979 Buick Lesabre
84336	84489	1987 Toyota PU
84381	84528	1994 Mercury Grand Marquis

Kansas City PM Characterization Study

Final Report

Appendix FF
Kansas City Fuels Analysis Complete

Assessment and Standards Division
Office of Transportation and Air Quality
U.S. Environmental Protection Agency

Sponsors:

National Renewable Energy Laboratory, U.S. Department of Energy
Federal Highway Administration, U.S. Department of Transportation
STAPPA-ALAPCO Emission Inventory Improvement Program
Coordinating Research Council Inc. (Project No. E-69)

Prepared for EPA by
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Reno, NV

EPA Contract No. GS 10F-0036K

October 27,2006
Revised April 2008 by EPA staff

United States
Environmental Protection
Agency

EPA420-R-08-009
April 2008

NVFEL Fuel Analysis Report

13619

Kansas City Samples

Batch#

Facility Name: ERG Facility Type: In House
Owner: EPA Phone: (913) 299-9480
6636 Berger Avenue

U.S.

Samples Type: Correlation

VOC

Inspection information logged in by MM on 1/19/05.

Season: Winter

Kansas City Samples-567ELT(Mo) **FTAG: 13619** **Comments:** **02 of 35; 181; 08-19-04**

Test Code	Test Method	Results	Units	Fuel_Code: 41	Analys	Analysis Date
552	MTBE by D5599	0.00	Oxy Percent		TS	2/14/05
562	ETBE by D5599	0.00	Oxy Percent		TS	2/14/05
534	Ethanol by D5599	0.00	Oxy Percent		TS	2/14/05
572	TAME by D5599	0.00	Oxy Percent		TS	2/14/05
421	Sulfur In Gasoline D2622	175	Parts Per Million		NST	2/23/05
62	Vapor Pressure by D5191 (Modified)	6.32	PS I		NST	1/24/05
65	Percent Evaporated at 200 Degrees F D86	36.4	Volume Percent		MM	1/26/05
66	Percent Evaporated at 300 Degrees F D86	80.7	Volume Percent		MM	1/26/05
48	Aromatics in Gasoline MSD D5769	35.09	Volume Percent		TW	2/1/05
49	Olefins in by FIA D1319	7.6	Volume Percent		NST	2/2/05
64	Benzene in Gasoline D3606	1.85	Volume Percent		TW	2/17/05
55	MTBE by D5599	0.00	Volume Percent		TS	2/14/05
59	Weight Percent Oxygen by D5599	0.00	Weight Percent		TS	2/14/05
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent		TS	2/14/05
532	Ethanol by D5599	0.00	Volume Percent		TS	2/14/05
57	TAME by D5599	0.00	Volume Percent		TS	2/14/05
56	ETBE by D5599	0.00	Volume Percent		TS	2/14/05
630	Toluene in gasoline by MSD D5769	7.95	Volumn Percent		TW	2/1/05
46	Aromatics by FIA D1319	35.5	Volume Percent		NST	2/2/05
63	Benzene in Gasoline by GC/MSD D5769	1.8	Volume Percent		TW	2/1/05
69	Specific Gravity @ 60 deg F D4052	0.75878	60/60F		MM	1/25/05
692	Degrees API D4052	54.98	Degrees API		MM	1/25/05
691	Density @ 60 deg F D4052	0.75803	g/cm-03 @ 60 deg F		MM	1/25/05
101	Initial Boiling Point D86	101.7	Degrees F		MM	1/26/05
110	10 Percent D86	146.8	Degrees F		MM	1/26/05
150	50 Percent D86	227.5	Degrees F		MM	1/26/05
190	90 Percent D86	328.8	Degrees F		MM	1/26/05
200	End Point D86	419.2	Degrees F		MM	1/26/05
201	Residue D86	0.8	mL		MM	1/26/05
202	Total Recovery D86	97.8	mL		MM	1/26/05
203	Loss D86	1.4	mL		MM	1/26/05
543	Methanol by D5599	0.00	Volume Percent		TS	2/14/05
584	Isopropanol by D5599	0.00	Volume Percent		TS	2/14/05

585	t-Butanol	by D5599	0.00 Volume Percent	TS	2/14/05
586	n-Propanol	by D5599	0.00 Volume Percent	TS	2/14/05
587	sec-Butanol	by D5599	0.00 Volume Percent	TS	2/14/05
588	DIPE	by D5599	0.00 Volume Percent	TS	2/14/05
589	Isobutanol	by D5599	0.00 Volume Percent	TS	2/14/05
5801	t-Amyl Alcohol	by D5599	0.00 Volume Percent	TS	2/14/05
5802	n-Butanol	by D5599	0.00 Volume Percent	TS	2/14/05

NVFEL Fuel Analysis Report

13620

Kansas City Samples

Batch#

Facility Name: ERG   Facility Type: In House

Owner: EPA   Phone: (913) 299-9480

6636 Berger Avenue

U.S.

Samples Type: Correlation

VOC

Inspection information logged in by MM on 1/19/05.

Season: Winter

Kansas City Samples-624MHA(Mo)   **FTAG: 13620**   **Comments:** **03 of 35; 68; 7-28-04**

Fuel_Code: 41

Test Code	Test Method	Results	Units	Analys	Analysis Date
552	MTBE by D5599	0.00	Oxy Percent	TS	2/14/05
562	ETBE by D5599	0.00	Oxy Percent	TS	2/14/05
534	Ethanol by D5599	0.00	Oxy Percent	TS	2/14/05
572	TAME by D5599	0.00	Oxy Percent	TS	2/14/05
421	Sulfur in Gasoline D2622	73	Parts Per Million	NST	2/23/05
62	Vapor Pressure by D5191 (Modified)	6.8	PS I	NST	1/24/05
65	Percent Evaporated at 200 Degrees F D86	41.8	Volume Percent	MM	1/26/05
66	Percent Evaporated at 300 Degrees F D86	81.2	Volume Percent	MM	1/26/05
48	Aromatics in Gasoline MSD D5769	28.84	Volume Percent	TW	2/1/05
49	Olefins in by FIA D1319	12.7	Volume Percent	NST	2/2/05
64	Benzene in Gasoline D3606	0.98	Volume Percent	TW	2/17/05
55	MTBE by D5599	0.00	Volume Percent	TS	2/14/05
59	Weight Percent Oxygen by D5599	0.00	Weight Percent	TS	2/14/05
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent	TS	2/14/05
532	Ethanol by D5599	0.00	Volume Percent	TS	2/14/05
57	TAME by D5599	0.00	Volume Percent	TS	2/14/05
56	ETBE by D5599	0.00	Volume Percent	TS	2/14/05
630	Toluene in gasoline by MSD D5769	7.9	Volumn Percent	TW	2/1/05
46	Aromatics by FIA D1319	30.1	Volume Percent	NST	2/2/05
63	Benzene in Gasoline by GC/MSD D5769	0.95	Volume Percent	TW	2/1/05
69	Specific Gravity @ 60 deg F D4052	0.75036	60/60F	MM	1/25/05
692	Degrees API D4052	57.08	Degrees API	MM	1/25/05
691	Density @ 60 deg F D4052	0.74962	g/cm-03 @ 60 deg F	MM	1/25/05
101	Initial Boiling Point D86	100	Degrees F	MM	1/26/05
110	10 Percent D86	137.7	Degrees F	MM	1/26/05
150	50 Percent D86	217.9	Degrees F	MM	1/26/05
190	90 Percent D86	341.4	Degrees F	MM	1/26/05
200	End Point D86	431.4	Degrees F	MM	1/26/05
201	Residue D86	0.7	mL	MM	1/26/05
202	Total Recovery D86	98.2	mL	MM	1/26/05
203	Loss D86	1.1	mL	MM	1/26/05
543	Methanol by D5599	0.00	Volume Percent	TS	2/14/05
584	Isopropanol by D5599	0.00	Volume Percent	TS	2/14/05

585	t-Butanol	by D5599	0.00 Volume Percent	TS	2/14/05
586	n-Propanol	by D5599	0.00 Volume Percent	TS	2/14/05
587	sec-Butanol	by D5599	0.00 Volume Percent	TS	2/14/05
588	DIPE	by D5599	0.00 Volume Percent	TS	2/14/05
589	Isobutanol	by D5599	0.00 Volume Percent	TS	2/14/05
5801	t-Amyl Alcohol	by D5599	0.00 Volume Percent	TS	2/14/05
5802	n-Butanol	by D5599	0.00 Volume Percent	TS	2/14/05

NVFEL Fuel Analysis Report

13621

Kansas City Samples

Batch#

Facility Name: ERG Facility Type: In House

Owner: EPA Phone: (913) 299-9480

6636 Berger Avenue

U.S.

Samples Type: Correlation

VOC

Inspection information logged in by MM on 1/19/05.

Season: Winter

Kansas City Samples-QQA FTAG: 13621 042 **Comments:** **4 of 35; (3) License #; 7/13/04**

Test Code	Test Method	Results	Units	Fuel_ Code: 41	Analys	Analysis Date
552	MTBE by D5599	0.00	Oxy Percent		TS	2/14/05
562	ETBE by D5599	0.00	Oxy Percent		TS	2/14/05
534	Ethanol by D5599	0.00	Oxy Percent		TS	2/14/05
572	TAME by D5599	0.00	Oxy Percent		TS	2/14/05
421	Sulfur in Gasoline D2622	210	Parts Per Million		NST	2/23/05
62	Vapor Pressure by D5191 (Modified)	8.12	PS I		NST	1/24/05
65	Percent Evaporated at 200 Degrees F D86	47.8	Volume Percent		MM	1/26/05
66	Percent Evaporated at 300 Degrees F D86	83.1	Volume Percent		MM	1/26/05
48	Aromatics in Gasoline MSD D5769	26.17	Volume Percent		TW	2/1/05
49	Olefins in by FIA D1319	8.3	Volume Percent		NST	2/2/05
64	Benzene in Gasoline D3606	1.02	Volume Percent		TW	2/17/05
64	Benzene in Gasoline D3606	1.02	Volume Percent		TW	2/17/05
59	Weight Percent Oxygen by D5599	0.00	Weight Percent		TS	2/14/05
532	Ethanol by D5599	0.00	Volume Percent		TS	2/14/05
55	MTBE by D5599	0.00	Volume Percent		TS	2/14/05
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent		TS	2/14/05
57	TAME by D5599	0.00	Volume Percent		TS	2/14/05
56	ETBE by D5599	0.00	Volume Percent		TS	2/14/05
46	Aromatics by FIA D1319	26.7	Volume Percent		NST	2/2/05
63	Benzene in Gasoline by GC/MSD D5769	1	Volume Percent		TW	2/1/05
630	Toluene in gasoline by MSD D5769	5.34	Volumn Percent		TW	2/1/05
69	Specific Gravity @ 60 deg F D4052	0.73811	60/60F		MM	1/25/05
692	Degrees API D4052	60.21	Degrees API		MM	1/25/05
691	Density @ 60 deg F D4052	0.73738	g/cm-03 @ 60 deg F		MM	1/25/05
101	Initial Boiling Point D86	93.9	Degrees F		MM	1/26/05
110	10 Percent D86	127.4	Degrees F		MM	1/26/05
150	50 Percent D86	206.1	Degrees F		MM	1/26/05
190	90 Percent D86	332.8	Degrees F		MM	1/26/05
200	End Point D86	431.1	Degrees F		MM	1/26/05
201	Residue D86	0.8	mL		MM	1/26/05
202	Total Recovery D86	97.7	mL		MM	1/26/05
203	Loss D86	1.5	mL		MM	1/26/05
543	Methanol by D5599	0.00	Volume Percent		TS	2/14/05

584	Isopropanol	by D5599	0.00	Volume Percent	TS	2/14/05
585	t-Butanol	by D5599	0.00	Volume Percent	TS	2/14/05
586	n-Propanol	by D5599	0.00	Volume Percent	TS	2/14/05
587	sec-Butanol	by D5599	0.00	Volume Percent	TS	2/14/05
588	DIPE	by D5599	0.00	Volume Percent	TS	2/14/05
589	Isobutanol	by D5599	0.00	Volume Percent	TS	2/14/05
5801	t-Amyl Alcohol	by D5599	0.00	Volume Percent	TS	2/14/05
5802	n-Butanol	by D5599	0.00	Volume Percent	TS	2/14/05

NVFEL Fuel Analysis Report

13622

Kansas City Samples

Batch#

Facility Name: ERG   Facility Type: In House

Owner: EPA   Phone: (913) 299-9480

6636 Berger Avenue

U.S.

Samples Type: Correlation

VOC

Inspection information logged in by MM on 1/19/05.

Season: Winter

Kansas City Samples-UTI326   **FTAG: 13622**   **Comments:** **5 of 35; 330; (Ks.); 9-16-04**

Test Code	Test Method	Results	Units	Fuel_ Code: 41	Analys	Analysis Date
552	MTBE by D5599	0.00	Oxy Percent		TS	2/14/05
562	ETBE by D5599	0.00	Oxy Percent		TS	2/14/05
534	Ethanol by D5599	0.00	Oxy Percent		TS	2/14/05
572	TAME by D5599	0.00	Oxy Percent		TS	2/14/05
421	Sulfur in Gasoline D2622	75	Parts Per Million		NST	2/23/05
62	Vapor Pressure by D5191 (Modified)	6.11	PS I		NST	1/24/05
65	Percent Evaporated at 200 Degrees F D86	37.2	Volume Percent		MM	1/26/05
66	Percent Evaporated at 300 Degrees F D86	78.4	Volume Percent		MM	1/26/05
48	Aromatics in Gasoline MSD D5769	31.19	Volume Percent		TW	2/1/05
49	Olefins in by FIA D1319	10	Volume Percent		NST	2/2/05
64	Benzene in Gasoline D3606	1.44	Volume Percent		TW	2/17/05
55	MTBE by D5599	0.00	Volume Percent		TS	2/14/05
59	Weight Percent Oxygen by D5599	0.00	Weight Percent		TS	2/14/05
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent		TS	2/14/05
532	Ethanol by D5599	0.00	Volume Percent		TS	2/14/05
57	TAME by D5599	0.00	Volume Percent		TS	2/14/05
56	ETBE by D5599	0.00	Volume Percent		TS	2/14/05
630	Toluene in gasoline by MSD D5769	7.42	Volumn Percent		TW	2/1/05
46	Aromatics by FIA D1319	32.4	Volume Percent		NST	2/2/05
63	Benzene in Gasoline by GC/MSD D5769	1.4	Volume Percent		TW	2/1/05
69	Specific Gravity @ 60 deg F D4052	0.75655	60/60F		MM	1/25/05
692	Degrees API D4052	55.53	Degrees API		MM	1/25/05
691	Density @ 60 deg F D4052	0.7558	g/cm-03 @ 60 deg F		MM	1/25/05
101	Initial Boiling Point D86	100.8	Degrees F		MM	1/26/05
110	10 Percent D86	147.7	Degrees F		MM	1/26/05
150	50 Percent D86	225.1	Degrees F		MM	1/26/05
190	90 Percent D86	345.9	Degrees F		MM	1/26/05
200	End Point D86	434.5	Degrees F		MM	1/26/05
201	Residue D86	0.8	mL		MM	1/26/05
202	Total Recovery D86	97.9	mL		MM	1/26/05
203	Loss D86	1.3	mL		MM	1/26/05
543	Methanol by D5599	0.00	Volume Percent		TS	2/14/05
584	Isopropanol by D5599	0.00	Volume Percent		TS	2/14/05

585	t-Butanol	by D5599	0.00	Volume Percent	TS	2/14/05
586	n-Propanol	by D5599	0.00	Volume Percent	TS	2/14/05
587	sec-Butanol	by D5599	0.00	Volume Percent	TS	2/14/05
588	DIPE	by D5599	0.00	Volume Percent	TS	2/14/05
589	Isobutanol	by D5599	0.00	Volume Percent	TS	2/14/05
5801	t-Amyl Alcohol	by D5599	0.00	Volume Percent	TS	2/14/05
5802	n-Butanol	by D5599	0.00	Volume Percent	TS	2/14/05

NVFEL Fuel Analysis Report

13623

Kansas City Samples

Batch#

Facility Name: ERG Facility Type: In House
Owner: EPA Phone: (913) 299-9480
6636 Berger Avenue

U.S.

Samples Type: Correlation

VOC

Inspection information logged in by MM on 1/19/05.

Season: Winter

Kansas City Samples-553CLW(Mo) **FTAG: 13623** **Comments:** **6 of 35; #148; Missouri; 8/12/04**

Test Code	Test Method	Results	Units	Fuel_ Code: 41	Analys	Analysis Date
552	MTBE by D5599	0.00	Oxy Percent		TS	2/14/05
562	ETBE by D5599	0.00	Oxy Percent		TS	2/14/05
534	Ethanol by D5599	0.00	Oxy Percent		TS	2/14/05
572	TAME by D5599	0.00	Oxy Percent		TS	2/14/05
421	Sulfur in Gasoline D2622	150	Parts Per Million		NST	2/23/05
62	Vapor Pressure by D5191 (Modified)	6.56	PS I		NST	1/24/05
65	Percent Evaporated at 200 Degrees F D86	39	Volume Percent		MM	1/26/05
66	Percent Evaporated at 300 Degrees F D86	80.7	Volume Percent		MM	1/26/05
48	Aromatics in Gasoline MSD D5769	33.34	Volume Percent		TW	2/1/05
49	Olefins in by FIA D1319	9.5	Volume Percent		NST	2/2/05
64	Benzene in Gasoline D3606	1.53	Volume Percent		TW	2/17/05
55	MTBE by D5599	0.00	Volume Percent		TS	2/14/05
59	Weight Percent Oxygen by D5599	0.00	Weight Percent		TS	2/14/05
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent		TS	2/14/05
532	Ethanol by D5599	0.00	Volume Percent		TS	2/14/05
57	TAME by D5599	0.00	Volume Percent		TS	2/14/05
56	ETBE by D5599	0.00	Volume Percent		TS	2/14/05
630	Toluene in gasoline by MSD D5769	7.96	Volumn Percent		TW	2/1/05
46	Aromatics by FIA D1319	34.9	Volume Percent		NST	2/2/05
63	Benzene in Gasoline by GC/MSD D5769	1.5	Volume Percent		TW	2/1/05
69	Specific Gravity @ 60 deg F D4052	0.75781	60/60F		MM	1/25/05
692	Degrees API D4052	55.22	Degrees API		MM	1/25/05
691	Density @ 60 deg F D4052	0.75706	g/cm-03 @ 60 deg F		MM	1/25/05
101	Initial Boiling Point D86	102.4	Degrees F		MM	1/26/05
110	10 Percent D86	143.1	Degrees F		MM	1/26/05
150	50 Percent D86	223.2	Degrees F		MM	1/26/05
190	90 Percent D86	334.4	Degrees F		MM	1/26/05
200	End Point D86	424.4	Degrees F		MM	1/26/05
201	Residue D86	0.8	mL		MM	1/26/05
202	Total Recovery D86	98.1	mL		MM	1/26/05
203	Loss D86	1.1	mL		MM	1/26/05
543	Methanol by D5599	0.00	Volume Percent		TS	2/14/05
584	Isopropanol by D5599	0.00	Volume Percent		TS	2/14/05

585	t-Butanol	by D5599	0.00	Volume Percent	TS	2/14/05
586	n-Propanol	by D5599	0.00	Volume Percent	TS	2/14/05
587	sec-Butanol	by D5599	0.00	Volume Percent	TS	2/14/05
588	DIPE	by D5599	0.00	Volume Percent	TS	2/14/05
589	Isobutanol	by D5599	0.00	Volume Percent	TS	2/14/05
5801	t-Amyl Alcohol	by D5599	0.00	Volume Percent	TS	2/14/05
5802	n-Butanol	by D5599	0.00	Volume Percent	TS	2/14/05

NVFEL Fuel Analysis Report

13624

Kansas City Samples

Batch#

Facility Name: ERG   Facility Type: In House

Owner: EPA   Phone: (913) 299-9480

6636 Berger Avenue

U.S.

Samples Type: Correlation

VOC

Inspection information logged in by MM on 1/19/05.

Season: Winter

Kansas City Samples-545MC3(Mo)   **FTAG: 13624**   **Comments:** **7 of 35; 44; 7-23-04**

Fuel_ Code: 41

Test Code	Test Method	Results	Units	Analys	Analysis Date
552	MTBE by D5599	0.00	Oxy Percent	TS	2/14/05
562	ETBE by D5599	0.00	Oxy Percent	TS	2/14/05
534	Ethanol by D5599	0.47	Oxy Percent	TS	2/14/05
572	TAME by D5599	0.00	Oxy Percent	TS	2/14/05
421	Sulfur in Gasoline D2622	199	Parts Per Million	NST	2/23/05
62	Vapor Pressure by D5191 (Modified)	7.75	PS I	NST	1/24/05
65	Percent Evaporated at 200 Degrees F D86	39.9	Volume Percent	MM	1/26/05
66	Percent Evaporated at 300 Degrees F D86	81.5	Volume Percent	MM	1/26/05
48	Aromatics in Gasoline MSD D5769	32.22	Volume Percent	TW	2/1/05
49	Olefins in by FIA D1319	8	Volume Percent	NST	2/2/05
64	Benzene in Gasoline D3606	1.77	Volume Percent	TW	2/17/05
55	MTBE by D5599	0.00	Volume Percent	TS	2/14/05
59	Weight Percent Oxygen by D5599	0.47	Weight Percent	TS	2/14/05
593	Volume Percent Oxygenates by D5599	1.29	Volume Percent	TS	2/14/05
532	Ethanol by D5599	1.29	Volume Percent	TS	2/14/05
57	TAME by D5599	0.00	Volume Percent	TS	2/14/05
56	ETBE by D5599	0.00	Volume Percent	TS	2/14/05
630	Toluene in gasoline by MSD D5769	7.4	Volumn Percent	TW	2/1/05
46	Aromatics by FIA D1319	33.4	Volume Percent	NST	2/2/05
63	Benzene in Gasoline by GC/MSD D5769	1.74	Volume Percent	TW	2/1/05
69	Specific Gravity @ 60 deg F D4052	0.75407	60/60F	MM	1/25/05
692	Degrees API D4052	56.15	Degrees API	MM	1/25/05
691	Density @ 60 deg F D4052	0.75333	g/cm-03 @ 60 deg F	MM	1/25/05
101	Initial Boiling Point D86	99.7	Degrees F	MM	1/26/05
110	10 Percent D86	132.6	Degrees F	MM	1/26/05
150	50 Percent D86	221.7	Degrees F	MM	1/26/05
190	90 Percent D86	332.1	Degrees F	MM	1/26/05
200	End Point D86	416.3	Degrees F	MM	1/26/05
201	Residue D86	0.8	mL	MM	1/26/05
202	Total Recovery D86	97.7	mL	MM	1/26/05
203	Loss D86	1.5	mL	MM	1/26/05
543	Methanol by D5599	0.00	Volume Percent	TS	2/14/05
584	Isopropanol by D5599	0.00	Volume Percent	TS	2/14/05

585	t-Butanol	by D5599	0.00	Volume Percent	TS	2/14/05
586	n-Propanol	by D5599	0.00	Volume Percent	TS	2/14/05
587	sec-Butanol	by D5599	0.00	Volume Percent	TS	2/14/05
588	DIPE	by D5599	0.00	Volume Percent	TS	2/14/05
589	Isobutanol	by D5599	0.00	Volume Percent	TS	2/14/05
5801	t-Amyl Alcohol	by D5599	0.00	Volume Percent	TS	2/14/05
5802	n-Butanol	by D5599	0.00	Volume Percent	TS	2/14/05

NVFEL Fuel Analysis Report

13625

Batch#

Kansas City Samples

Facility Name: ERG Facility Type: In House

Owner: EPA Phone: (913) 299-9480

6636 Berger Avenue

U.S.

Samples Type: Correlation

VOC

Inspection information logged in by MM on 1/19/05.

Season: Winter

Kansas City Samples-995STJ(Mo) **FTAG: 13625** **Comments:** **10 od 35; #151; 8/13/04**

Test Code	Test Method	Results	Units	Fuel_ Code: 41	Analys	Analysis Date
552	MTBE by D5599	0.00	Oxy Percent		TS	2/14/05
562	ETBE by D5599	0.00	Oxy Percent		TS	2/14/05
534	Ethanol by D5599	0.00	Oxy Percent		TS	2/14/05
572	TAME by D5599	0.00	Oxy Percent		TS	2/14/05
421	Sulfur in Gasoline D2622	166	Parts Per Million		NST	2/23/05
62	Vapor Pressure by D5191 (Modified)	6.53	PS I		NST	1/24/05
65	Percent Evaporated at 200 Degrees F D86	39.1	Volume Percent		MM	2/2/05
66	Percent Evaporated at 300 Degrees F D86	80.2	Volume Percent		MM	2/2/05
48	Aromatics in Gasoline MSD D5769	29.37	Volume Percent		TW	2/1/05
49	Olefins in by FIA D1319	9.7	Volume Percent		NST	2/2/05
64	Benzene in Gasoline D3606	1.30	Volume Percent		TW	2/17/05
55	MTBE by D5599	0.00	Volume Percent		TS	2/14/05
59	Weight Percent Oxygen by D5599	0.00	Weight Percent		TS	2/14/05
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent		TS	2/14/05
532	Ethanol by D5599	0.00	Volume Percent		TS	2/14/05
57	TAME by D5599	0.00	Volume Percent		TS	2/14/05
56	ETBE by D5599	0.00	Volume Percent		TS	2/14/05
630	Toluene in gasoline by MSD D5769	6.11	Volumn Percent		TW	2/1/05
46	Aromatics by FIA D1319	29.5	Volume Percent		NST	2/2/05
63	Benzene in Gasoline by GC/MSD D5769	1.26	Volume Percent		TW	2/1/05
69	Specific Gravity @ 60 deg F D4052	0.7506	60/60F		MM	1/25/05
692	Degrees API D4052	57.02	Degrees API		MM	1/25/05
691	Density @ 60 deg F D4052	0.74986	g/cm-03 @ 60 deg F		MM	1/25/05
101	Initial Boiling Point D86	99.1	Degrees F		MM	2/2/05
110	10 Percent D86	142.7	Degrees F		MM	2/2/05
150	50 Percent D86	221.7	Degrees F		MM	2/2/05
190	90 Percent D86	340.2	Degrees F		MM	2/2/05
200	End Point D86	444.9	Degrees F		MM	2/2/05
201	Residue D86	1	mL		MM	2/2/05
202	Total Recovery D86	97.8	mL		MM	2/2/05
203	Loss D86	1.2	mL		MM	2/2/05
543	Methanol by D5599	0.00	Volume Percent		TS	2/14/05
584	Isopropanol by D5599	0.00	Volume Percent		TS	2/14/05

585	t-Butanol	by D5599	0.00	Volume Percent	TS	2/14/05
586	n-Propanol	by D5599	0.00	Volume Percent	TS	2/14/05
587	sec-Butanol	by D5599	0.00	Volume Percent	TS	2/14/05
588	DIPE	by D5599	0.00	Volume Percent	TS	2/14/05
589	Isobutanol	by D5599	0.00	Volume Percent	TS	2/14/05
5801	t-Amyl Alcohol	by D5599	0.00	Volume Percent	TS	2/14/05
5802	n-Butanol	by D5599	0.00	Volume Percent	TS	2/14/05

NVFEL Fuel Analysis Report

13626

Kansas City Samples

Batch#

Facility Name: ERG   Facility Type: In House

Owner: EPA   Phone: (913) 299-9480

6636 Berger Avenue

U.S.

Samples Type: Correlation

VOC

Inspection information logged in by MM on 1/19/05.

Season: Winter

Kansas City Samples-SKH303(Ks)   **FTAG: 13626**   **Comments:** **11 of 35; 82; 7-30-04**

Test Code	Test Method	Results	Units	Fuel_ Code: 41	Analys	Analysis Date
552	MTBE by D5599	0.00	Oxy Percent		TS	2/14/05
562	ETBE by D5599	0.00	Oxy Percent		TS	2/14/05
534	Ethanol by D5599	0.20	Oxy Percent		TS	2/14/05
572	TAME by D5599	0.00	Oxy Percent		TS	2/14/05
421	Sulfur in Gasoline D2622	107	Parts Per Million		NST	2/23/05
62	Vapor Pressure by D5191 (Modified)	6.89	PS I		NST	1/24/05
65	Percent Evaporated at 200 Degrees F D86	39	Volume Percent		MM	2/2/05
66	Percent Evaporated at 300 Degrees F D86	79.3	Volume Percent		MM	2/2/05
48	Aromatics in Gasoline MSD D5769	36.45	Volume Percent		TW	2/1/05
49	Olefins in by FIA D1319	8	Volume Percent		NST	2/2/05
64	Benzene in Gasoline D3606	2.17	Volume Percent		TW	2/17/05
55	MTBE by D5599	0.00	Volume Percent		TS	2/14/05
59	Weight Percent Oxygen by D5599	0.20	Weight Percent		TS	2/14/05
593	Volume Percent Oxygenates by D5599	0.54	Volume Percent		TS	2/14/05
532	Ethanol by D5599	0.54	Volume Percent		TS	2/14/05
57	TAME by D5599	0.00	Volume Percent		TS	2/14/05
56	ETBE by D5599	0.00	Volume Percent		TS	2/14/05
630	Toluene in gasoline by MSD D5769	8.84	Volumn Percent		TW	2/1/05
46	Aromatics by FIA D1319	36	Volume Percent		NST	2/2/05
63	Benzene in Gasoline by GC/MSD D5769	2.13	Volume Percent		TW	2/1/05
69	Specific Gravity @ 60 deg F D4052	0.76213	60/60F		MM	1/25/05
692	Degrees API D4052	54.16	Degrees API		MM	1/25/05
691	Density @ 60 deg F D4052	0.76138	g/cm-03 @ 60 deg F		MM	1/25/05
101	Initial Boiling Point D86	99.9	Degrees F		MM	2/2/05
110	10 Percent D86	141.3	Degrees F		MM	2/2/05
150	50 Percent D86	223.3	Degrees F		MM	2/2/05
190	90 Percent D86	339.1	Degrees F		MM	2/2/05
200	End Point D86	421.9	Degrees F		MM	2/2/05
201	Residue D86	0.9	mL		MM	2/2/05
202	Total Recovery D86	97.7	mL		MM	2/2/05
203	Loss D86	1.4	mL		MM	2/2/05
543	Methanol by D5599	0.00	Volume Percent		TS	2/14/05
584	Isopropanol by D5599	0.00	Volume Percent		TS	2/14/05

585	t-Butanol	by D5599	0.00	Volume Percent	TS	2/14/05
586	n-Propanol	by D5599	0.00	Volume Percent	TS	2/14/05
587	sec-Butanol	by D5599	0.00	Volume Percent	TS	2/14/05
588	DIPE	by D5599	0.00	Volume Percent	TS	2/14/05
589	Isobutanol	by D5599	0.00	Volume Percent	TS	2/14/05
5801	t-Amyl Alcohol	by D5599	0.00	Volume Percent	TS	2/14/05
5802	n-Butanol	by D5599	0.00	Volume Percent	TS	2/14/05

NVFEL Fuel Analysis Report

13627

Kansas City Samples

Batch#

Facility Name: ERG   Facility Type: In House

Owner: EPA   Phone: (913) 299-9480

6636 Berger Avenue

U.S.

Samples Type: Correlation

VOC

Inspection information logged in by MM on 1/19/05.

Season: Winter

Kansas City Samples-SJU224(Ks)   **FTAG: 13627**   **Comments:** **12 of 35; 189; 8-20-04**

Fuel_ Code: 41

Test Code	Test Method	Results	Units	Analys	Analysis Date
552	MTBE by D5599	0.00	Oxy Percent	TS	2/14/05
562	ETBE by D5599	0.00	Oxy Percent	TS	2/14/05
534	Ethanol by D5599	0.00	Oxy Percent	TS	2/14/05
572	TAME by D5599	0.00	Oxy Percent	TS	2/14/05
421	Sulfur in Gasoline D2622	97	Parts Per Million	NST	2/23/05
421	Sulfur in Gasoline D2622	90	Parts Per Million	NST	2/23/05
62	Vapor Pressure by D5191 (Modified)	6.7	PS I	NST	1/24/05
65	Percent Evaporated at 200 Degrees F D86	39.4	Volume Percent	MM	2/4/05
66	Percent Evaporated at 300 Degrees F D86	79.9	Volume Percent	MM	2/4/05
48	Aromatics in Gasoline MSD D5769	33.18	Volume Percent	TW	2/1/05
49	Olefins in by FIA D1319	8.7	Volume Percent	NST	2/3/05
64	Benzene in Gasoline D3606	1.58	Volume Percent	TW	2/17/05
59	Weight Percent Oxygen by D5599	0.00	Weight Percent	TS	2/14/05
55	MTBE by D5599	0.00	Volume Percent	TS	2/14/05
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent	TS	2/14/05
532	Ethanol by D5599	0.00	Volume Percent	TS	2/14/05
57	TAME by D5599	0.00	Volume Percent	TS	2/14/05
56	ETBE by D5599	0.00	Volume Percent	TS	2/14/05
46	Aromatics by FIA D1319	33.9	Volume Percent	NST	2/3/05
63	Benzene in Gasoline by GC/MSD D5769	1.55	Volume Percent	TW	2/1/05
630	Toluene in gasoline by MSD D5769	7.39	Volumn Percent	TW	2/1/05
69	Specific Gravity @ 60 deg F D4052	0.7576	60/60F	MM	1/25/05
69	Specific Gravity @ 60 deg F D4052	0.75761	60/60F	MM	1/25/05
692	Degrees API D4052	55.27	Degrees API	MM	1/25/05
692	Degrees API D4052	55.27	Degrees API	MM	1/25/05
691	Density @ 60 deg F D4052	0.75685	g/cm-03 @ 60 deg F	MM	1/25/05
691	Density @ 60 deg F D4052	0.75686	g/cm-03 @ 60 deg F	MM	1/25/05
101	Initial Boiling Point D86	101.5	Degrees F	MM	2/4/05
110	10 Percent D86	142.2	Degrees F	MM	2/4/05
150	50 Percent D86	223	Degrees F	MM	2/4/05
190	90 Percent D86	337.6	Degrees F	MM	2/4/05
200	End Point D86	425.5	Degrees F	MM	2/4/05
201	Residue D86	0.9	mL	MM	2/4/05

NVFEL Fuel Analysis Report

13627

202	Total Recovery	D86	97.5 mL	MM	2/4/05
203	Loss	D86	1.6 mL	MM	2/4/05
543	Methanol	by D5599	0.00 Volume Percent	TS	2/14/05
584	Isopropanol	by D5599	0.00 Volume Percent	TS	2/14/05
585	t-Butanol	by D5599	0.00 Volume Percent	TS	2/14/05
586	n-Propanol	by D5599	0.00 Volume Percent	TS	2/14/05
587	sec-Butanol	by D5599	0.00 Volume Percent	TS	2/14/05
588	DIPE	by D5599	0.00 Volume Percent	TS	2/14/05
589	Isobutanol	by D5599	0.00 Volume Percent	TS	2/14/05
5801	t-Amyl Alcohol	by D5599	0.00 Volume Percent	TS	2/14/05
5802	n-Butanol	by D5599	0.00 Volume Percent	TS	2/14/05

NVFEL Fuel Analysis Report

13628

Batch#

Kansas City Samples

Facility Name: ERG Facility Type: In House
Owner: EPA Phone: (913) 299-9480
6636 Berger Avenue

U.S.

Samples Type: Correlation
Inspection information logged in by MM on 1/19/05.

VOC
Season: Winter

Kansas City Samples-355FEM(Mo) **FTAG: 13628** **Comments:** **16 of 35; (494); 12/14/04**

Fuel_ Code: 41

Test Code	Test Method	Results	Units	Analys	Analysis Date
552	MTBE by D5599	0.00	Oxy Percent	TS	2/14/05
552	MTBE by D5599	0.00	Oxy Percent	TS	2/14/05
562	ETBE by D5599	0.00	Oxy Percent	TS	2/14/05
562	ETBE by D5599	0.00	Oxy Percent	TS	2/14/05
534	Ethanol by D5599	0.00	Oxy Percent	TS	2/14/05
534	Ethanol by D5599	0.00	Oxy Percent	TS	2/14/05
572	TAME by D5599	0.00	Oxy Percent	TS	2/14/05
572	TAME by D5599	0.00	Oxy Percent	TS	2/14/05
421	Sulfur in Gasoline D2622	120	Parts Per Million	NST	2/23/05
62	Vapor Pressure by D5191 (Modified)	12.92	PS I	NST	1/24/05
65	Percent Evaporated at 200 Degrees F D86	48.9	Volume Percent	MM	2/4/05
66	Percent Evaporated at 300 Degrees F D86	84.7	Volume Percent	MM	2/4/05
48	Aromatics in Gasoline MSD D5769	21.98	Volume Percent	TW	2/1/05
49	Olefins in by FIA D1319	10.2	Volume Percent	NST	2/3/05
64	Benzene in Gasoline D3606	0.96	Volume Percent	TW	2/17/05
532	Ethanol by D5599	0.00	Volume Percent	TS	2/14/05
59	Weight Percent Oxygen by D5599	0.00	Weight Percent	TS	2/14/05
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent	TS	2/14/05
55	MTBE by D5599	0.00	Volume Percent	TS	2/14/05
55	MTBE by D5599	0.00	Volume Percent	TS	2/14/05
532	Ethanol by D5599	0.00	Volume Percent	TS	2/14/05
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent	TS	2/14/05
57	TAME by D5599	0.00	Volume Percent	TS	2/14/05
57	TAME by D5599	0.00	Volume Percent	TS	2/14/05
59	Weight Percent Oxygen by D5599	0.00	Weight Percent	TS	2/14/05
56	ETBE by D5599	0.00	Volume Percent	TS	2/14/05
56	ETBE by D5599	0.00	Volume Percent	TS	2/14/05
63	Benzene in Gasoline by GC/MSD D5769	0.94	Volume Percent	TW	2/1/05
630	Toluene in gasoline by MSD D5769	5.56	Volumn Percent	TW	2/1/05
46	Aromatics by FIA D1319	22.4	Volume Percent	NST	2/3/05
69	Specific Gravity @ 60 deg F D4052	0.7286	60/60F	MM	1/25/05
692	Degrees API D4052	62.71	Degrees API	MM	1/25/05
691	Density @ 60 deg F D4052	0.72788	g/cm-03 @ 60 deg F	MM	1/25/05

101	Initial Boiling Point	D86	82	Degrees F	MM	2/4/05
110	10 Percent	D86	106	Degrees F	MM	2/4/05
150	50 Percent	D86	202.6	Degrees F	MM	2/4/05
190	90 Percent	D86	326.1	Degrees F	MM	2/4/05
200	End Point	D86	420.3	Degrees F	MM	2/4/05
201	Residue	D86	0.8	mL	MM	2/4/05
202	Total Recovery	D86	96.6	mL	MM	2/4/05
203	Loss	D86	2.6	mL	MM	2/4/05
543	Methanol	by D5599	0.00	Volume Percent	TS	2/14/05
543	Methanol	by D5599	0.00	Volume Percent	TS	2/14/05
584	Isopropanol	by D5599	0.00	Volume Percent	TS	2/14/05
584	Isopropanol	by D5599	0.00	Volume Percent	TS	2/14/05
585	t-Butanol	by D5599	0.00	Volume Percent	TS	2/14/05
585	t-Butanol	by D5599	0.00	Volume Percent	TS	2/14/05
586	n-Propanol	by D5599	0.00	Volume Percent	TS	2/14/05
586	n-Propanol	by D5599	0.00	Volume Percent	TS	2/14/05
587	sec-Butanol	by D5599	0.00	Volume Percent	TS	2/14/05
587	sec-Butanol	by D5599	0.00	Volume Percent	TS	2/14/05
588	DIPE	by D5599	0.00	Volume Percent	TS	2/14/05
588	DIPE	by D5599	0.00	Volume Percent	TS	2/14/05
589	Isobutanol	by D5599	0.00	Volume Percent	TS	2/14/05
589	Isobutanol	by D5599	0.00	Volume Percent	TS	2/14/05
5801	t-Amyl Alcohol	by D5599	0.00	Volume Percent	TS	2/14/05
5801	t-Amyl Alcohol	by D5599	0.00	Volume Percent	TS	2/14/05
5802	n-Butanol	by D5599	0.00	Volume Percent	TS	2/14/05
5802	n-Butanol	by D5599	0.00	Volume Percent	TS	2/14/05

NVFEL Fuel Analysis Report

13629

Kansas City Samples

Batch#

Facility Name: ERG Facility Type: In House
Owner: EPA Phone: (913) 299-9480
6636 Berger Avenue

U.S.

Samples Type: Correlation
Inspection information logged in by MM on 1/19/05.

VOC
Season: Winter

Kansas City Samples-533 FTAG: 13629 Comments: 17 of 35; 1-11-05

Fuel_ Code: 41

Test Code	Test Method	Results	Units	Analys	Analysis Date
552	MTBE by D5599	0.00	Oxy Percent	TS	2/14/05
562	ETBE by D5599	0.00	Oxy Percent	TS	2/14/05
534	Ethanol by D5599	0.00	Oxy Percent	TS	2/14/05
572	TAME by D5599	0.00	Oxy Percent	TS	2/14/05
421	Sulfur in Gasoline D2622	134	Parts Per Million	NST	2/23/05
62	Vapor Pressure by D5191 (Modified)	13.97	PS I	NST	1/24/05
65	Percent Evaporated at 200 Degrees F D86	52.9	Volume Percent	MM	2/4/05
66	Percent Evaporated at 300 Degrees F D86	84.8	Volume Percent	MM	2/4/05
48	Aromatics in Gasoline MSD D5769	22.05	Volume Percent	TW	2/1/05
49	Olefins in by FIA D1319	9.9	Volume Percent	NST	2/3/05
64	Benzene in Gasoline D3606	1.04	Volume Percent	TW	2/17/05
55	MTBE by D5599	0.00	Volume Percent	TS	2/14/05
57	TAME by D5599	0.00	Volume Percent	TS	2/14/05
532	Ethanol by D5599	0.00	Volume Percent	TS	2/14/05
59	Weight Percent Oxygen by D5599	0.00	Weight Percent	TS	2/14/05
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent	TS	2/14/05
56	ETBE by D5599	0.00	Volume Percent	TS	2/14/05
63	Benzene in Gasoline by GC/MSD D5769	1.01	Volume Percent	TW	2/1/05
630	Toluene in gasoline by MSD D5769	4.88	Volumn Percent	TW	2/1/05
46	Aromatics by FIA D1319	21.4	Volume Percent	NST	2/3/05
69	Specific Gravity @ 60 deg F D4052	0.72512	60/60F	MM	1/25/05
692	Degrees API D4052	63.64	Degrees API	MM	1/25/05
691	Density @ 60 deg F D4052	0.7244	g/cm-03 @ 60 deg F	MM	1/25/05
101	Initial Boiling Point D86	78.4	Degrees F	MM	2/4/05
110	10 Percent D86	95	Degrees F	MM	2/4/05
150	50 Percent D86	192.7	Degrees F	MM	2/4/05
190	90 Percent D86	326.5	Degrees F	MM	2/4/05
200	End Point D86	421.2	Degrees F	MM	2/4/05
201	Residue D86	0.4	mL	MM	2/4/05
202	Total Recovery D86	96.3	mL	MM	2/4/05
203	Loss D86	3.3	mL	MM	2/4/05
543	Methanol by D5599	0.00	Volume Percent	TS	2/14/05
584	Isopropanol by D5599	0.00	Volume Percent	TS	2/14/05

585	t-Butanol	by D5599	0.00	Volume Percent	TS	2/14/05
586	n-Propanol	by D5599	0.00	Volume Percent	TS	2/14/05
587	sec-Butanol	by D5599	0.00	Volume Percent	TS	2/14/05
588	DIPE	by D5599	0.00	Volume Percent	TS	2/14/05
589	Isobutanol	by D5599	0.00	Volume Percent	TS	2/14/05
5801	t-Amyl Alcohol	by D5599	0.00	Volume Percent	TS	2/14/05
5802	n-Butanol	by D5599	0.00	Volume Percent	TS	2/14/05

NVFEL Fuel Analysis Report

13630

Kansas City Samples

Batch#

Facility Name: ERG   Facility Type: In House

Owner: EPA   Phone: (913) 299-9480

6636 Berger Avenue

U.S.

Samples Type: Correlation

VOC

Inspection information logged in by MM on 1/19/05.

Season: Winter

Kansas City Samples-GR8WSH(Mo)   **FTAG: 13630**   **Comments:** **18 of 35; #452; 12/1/04**

Fuel_ Code: 41

Test Code	Test Method	Results	Units	Analys	Analysis Date
552	MTBE by D5599	0.00	Oxy Percent	TS	2/14/05
562	ETBE by D5599	0.00	Oxy Percent	TS	2/14/05
534	Ethanol by D5599	0.00	Oxy Percent	TS	2/14/05
572	TAME by D5599	0.00	Oxy Percent	TS	2/14/05
421	Sulfur in Gasoline D2622	93	Parts Per Million	NST	3/10/05
62	Vapor Pressure by D5191 (Modified)	12.36	PS I	NST	1/24/05
65	Percent Evaporated at 200 Degrees F D86	49.7	Volume Percent	MM	2/4/05
66	Percent Evaporated at 300 Degrees F D86	85.2	Volume Percent	MM	2/4/05
48	Aromatics in Gasoline MSD D5769	24.07	Volume Percent	TW	2/1/05
49	Olefins in by FIA D1319	10.1	Volume Percent	NST	2/3/05
64	Benzene in Gasoline D3606	1.20	Volume Percent	TW	2/17/05
59	Weight Percent Oxygen by D5599	0.00	Weight Percent	TS	2/14/05
532	Ethanol by D5599	0.00	Volume Percent	TS	2/14/05
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent	TS	2/14/05
57	TAME by D5599	0.00	Volume Percent	TS	2/14/05
55	MTBE by D5599	0.00	Volume Percent	TS	2/14/05
56	ETBE by D5599	0.00	Volume Percent	TS	2/14/05
63	Benzene in Gasoline by GC/MSD D5769	1.17	Volume Percent	TW	2/1/05
630	Toluene in gasoline by MSD D5769	5.8	Volumn Percent	TW	2/1/05
46	Aromatics by FIA D1319	23.3	Volume Percent	NST	2/3/05
69	Specific Gravity @ 60 deg F D4052	0.72967	60/60F	MM	1/25/05
692	Degrees API D4052	62.42	Degrees API	MM	1/25/05
691	Density @ 60 deg F D4052	0.72895	g/cm-03 @ 60 deg F	MM	1/25/05
101	Initial Boiling Point D86	82.6	Degrees F	MM	2/4/05
110	10 Percent D86	107.1	Degrees F	MM	2/4/05
150	50 Percent D86	200.7	Degrees F	MM	2/4/05
190	90 Percent D86	320.5	Degrees F	MM	2/4/05
200	End Point D86	404.8	Degrees F	MM	2/4/05
201	Residue D86	0.8	mL	MM	2/4/05
202	Total Recovery D86	96.7	mL	MM	2/4/05
203	Loss D86	2.5	mL	MM	2/4/05
543	Methanol by D5599	0.00	Volume Percent	TS	2/14/05
584	Isopropanol by D5599	0.00	Volume Percent	TS	2/14/05

585	t-Butanol	by D5599	0.00 Volume Percent	TS	2/14/05
586	n-Propanol	by D5599	0.00 Volume Percent	TS	2/14/05
587	sec-Butanol	by D5599	0.00 Volume Percent	TS	2/14/05
588	DIPE	by D5599	0.00 Volume Percent	TS	2/14/05
589	Isobutanol	by D5599	0.00 Volume Percent	TS	2/14/05
5801	t-Amyl Alcohol	by D5599	0.00 Volume Percent	TS	2/14/05
5802	n-Butanol	by D5599	0.00 Volume Percent	TS	2/14/05

Kansas City Samples Batch#

Facility Name: ERG Facility Type: In House
Owner: EPA Phone: (913) 299-9480
6636 Berger Avenue

U.S.

Samples Type: Correlation VOC
Inspection information logged in by MM on 1/19/05. **Season:** Winter

Kansas City Samples-QMH801(Ks) **FTAG: 13631** **Comments:** **19 of 35; (471); 12/8/04**

Test Code	Test Method	Results	Units	Fuel_ Code: **41**	Analys	Analysis Date
552	MTBE by D5599	0.00	Oxy Percent		TS	2/14/05
562	ETBE by D5599	0.00	Oxy Percent		TS	2/14/05
534	Ethanol by D5599	0.00	Oxy Percent		TS	2/14/05
572	TAME by D5599	0.00	Oxy Percent		TS	2/14/05
421	Sulfur in Gasoline D2622	116	Parts Per Million		NST	3/10/05
62	Vapor Pressure by D5191 (Modified)	11.98	PSI		NST	1/24/05
65	Percent Evaporated at 200 Degrees F D86	48.6	Volume Percent		MM	2/4/05
66	Percent Evaporated at 300 Degrees F D86	85.3	Volume Percent		MM	2/4/05
48	Aromatics in Gasoline MSD D5769	25.24	Volume Percent		TW	2/1/05
49	Olefins in by FIA D1319	9.7	Volume Percent		NST	2/3/05
64	Benzene in Gasoline D3606	1.29	Volume Percent		TW	2/17/05
59	Weight Percent Oxygen by D5599	0.00	Weight Percent		TS	2/14/05
532	Ethanol by D5599	0.00	Volume Percent		TS	2/14/05
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent		TS	2/14/05
57	TAME by D5599	0.00	Volume Percent		TS	2/14/05
55	MTBE by D5599	0.00	Volume Percent		TS	2/14/05
56	ETBE by D5599	0.00	Volume Percent		TS	2/14/05
63	Benzene in Gasoline by GC/MSD D5769	1.26	Volume Percent		TW	2/1/05
630	Toluene in gasoline by MSD D5769	6.17	Volumn Percent		TW	2/1/05
46	Aromatics by FIA D1319	24.8	Volume Percent		NST	2/3/05
69	Specific Gravity @ 60 deg F D4052	0.73324	60/60F		MM	1/25/05
692	Degrees API D4052	61.48	Degrees API		MM	1/25/05
691	Density @ 60 deg F D4052	0.73251	g/cm-03 @ 60 deg F		MM	1/25/05
101	Initial Boiling Point D86	84	Degrees F		MM	2/4/05
110	10 Percent D86	110.8	Degrees F		MM	2/4/05
150	50 Percent D86	203.4	Degrees F		MM	2/4/05
190	90 Percent D86	318.7	Degrees F		MM	2/4/05
200	End Point D86	404.2	Degrees F		MM	2/4/05
201	Residue D86	0.8	mL		MM	2/4/05
202	Total Recovery D86	97.1	mL		MM	2/4/05
203	Loss D86	2.1	mL		MM	2/4/05
543	Methanol by D5599	0.00	Volume Percent		TS	2/14/05
584	Isopropanol by D5599	0.00	Volume Percent		TS	2/14/05

585	t-Butanol	by D5599	0.00 Volume Percent	TS	2/14/05
586	n-Propanol	by D5599	0.00 Volume Percent	TS	2/14/05
587	sec-Butanol	by D5599	0.00 Volume Percent	TS	2/14/05
588	DIPE	by D5599	0.00 Volume Percent	TS	2/14/05
589	Isobutanol	by D5599	0.00 Volume Percent	TS	2/14/05
5801	t-Amyl Alcohol	by D5599	0.00 Volume Percent	TS	2/14/05
5802	n-Butanol	by D5599	0.00 Volume Percent	TS	2/14/05

NVFEL Fuel Analysis Report

13632

Kansas City Samples

Batch#

Facility Name: ERG Facility Type: In House
Owner: EPA Phone: (913) 299-9480
6636 Berger Avenue

U.S.

Samples Type: Correlation
Inspection information logged in by MM on 1/19/05.

VOC
Season: Winter

Kansas City Samples-QBL236(Ks) **FTAG: 13632** **Comments:** **23 of 35; #132; 8/7/04**

Fuel_ Code: 41

Test Code	Test Method	Results	Units	Analys	Analysis Date
552	MTBE by D5599	0.00	Oxy Percent	TS	2/14/05
562	ETBE by D5599	0.00	Oxy Percent	TS	2/14/05
534	Ethanol by D5599	11.47	Oxy Percent	TS	2/14/05
572	TAME by D5599	0.00	Oxy Percent	TS	2/14/05
421	Sulfur in Gasoline D2622	79	Parts Per Million	NST	3/10/05
62	Vapor Pressure by D5191 (Modified)	8.17	PS I	NST	1/24/05
48	Aromatics in Gasoline MSD D5769	19.77	Volume Percent	TW	2/1/05
49	Olefins in by FIA D1319	6.9	Volume Percent	NST	2/3/05
64	Benzene in Gasoline D3606	0.80	Volume Percent	TW	2/17/05
64	Benzene in Gasoline D3606	0.80	Volume Percent	TW	2/17/05
532	Ethanol by D5599	31.49	Volume Percent	TS	2/14/05
55	MTBE by D5599	0.00	Volume Percent	TS	2/14/05
57	TAME by D5599	0.00	Volume Percent	TS	2/14/05
593	Volume Percent Oxygenates by D5599	31.49	Volume Percent	TS	2/14/05
59	Weight Percent Oxygen by D5599	11.47	Weight Percent	TS	2/14/05
56	ETBE by D5599	0.00	Volume Percent	TS	2/14/05
46	Aromatics by FIA D1319	19.1	Volume Percent	NST	2/3/05
63	Benzene in Gasoline by GC/MSD D5769	0.82	Volume Percent	TW	2/1/05
630	Toluene in gasoline by MSD D5769	4.7	Volumn Percent	TW	2/1/05
69	Specific Gravity @ 60 deg F D4052	0.75739	60/60F	MM	1/25/05
692	Degrees API D4052	55.33	Degrees API	MM	1/25/05
691	Density @ 60 deg F D4052	0.75664	g/cm-03 @ 60 deg F	MM	1/25/05
543	Methanol by D5599	0.00	Volume Percent	TS	2/14/05
584	Isopropanol by D5599	0.00	Volume Percent	TS	2/14/05
585	t-Butanol by D5599	0.00	Volume Percent	TS	2/14/05
586	n-Propanol by D5599	0.00	Volume Percent	TS	2/14/05
587	sec-Butanol by D5599	0.00	Volume Percent	TS	2/14/05
588	DIPE by D5599	0.00	Volume Percent	TS	2/14/05
589	Isobutanol by D5599	0.00	Volume Percent	TS	2/14/05
5801	t-Amyl Alcohol by D5599	0.00	Volume Percent	TS	2/14/05
5802	n-Butanol by D5599	0.00	Volume Percent	TS	2/14/05

NVFEL Fuel Analysis Report

13633

Kansas City Samples

Batch#

Facility Name: ERG   Facility Type: In House

Owner: EPA   Phone: (913) 299-9480

6636 Berger Avenue

U.S.

Samples Type: Correlation

VOC

Inspection information logged in by MM on 1/19/05.

Season: Winter

Kansas City Samples-941F4W   **FTAG: 13633**   **Comments:** **24 of 35; 432; 9-29-04**

Fuel_ Code: 41

Test Code	Test Method	Results	Units	Analys	Analysis Date
552	MTBE by D5599	0.00	Oxy Percent	TS	2/14/05
562	ETBE by D5599	0.00	Oxy Percent	TS	2/14/05
534	Ethanol by D5599	0.00	Oxy Percent	TS	2/14/05
572	TAME by D5599	0.00	Oxy Percent	TS	2/14/05
421	Sulfur in Gasoline D2622	83	Parts Per Million	NST	3/10/05
62	Vapor Pressure by D5191 (Modified)	8.21	PS I	NST	1/24/05
65	Percent Evaporated at 200 Degrees F D86	43.9	Volume Percent	MM	2/4/05
66	Percent Evaporated at 300 Degrees F D86	79.2	Volume Percent	MM	2/4/05
48	Aromatics in Gasoline MSD D5769	29.97	Volume Percent	TW	2/1/05
49	Olefins in by FIA D1319	9.3	Volume Percent	NST	2/8/05
64	Benzene in Gasoline D3606	0.97	Volume Percent	TW	2/17/05
532	Ethanol by D5599	0.00	Volume Percent	TS	2/14/05
59	Weight Percent Oxygen by D5599	0.00	Weight Percent	TS	2/14/05
57	TAME by D5599	0.00	Volume Percent	TS	2/14/05
55	MTBE by D5599	0.00	Volume Percent	TS	2/14/05
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent	TS	2/14/05
56	ETBE by D5599	0.00	Volume Percent	TS	2/14/05
630	Toluene in gasoline by MSD D5769	6.45	Volumn Percent	TW	2/1/05
63	Benzene in Gasoline by GC/MSD D5769	0.94	Volume Percent	TW	2/1/05
46	Aromatics by FIA D1319	30.4	Volume Percent	NST	2/8/05
69	Specific Gravity @ 60 deg F D4052	0.74905	60/60F	MM	1/25/05
69	Specific Gravity @ 60 deg F D4052	0.7491	60/60F	MM	1/25/05
692	Degrees API D4052	57.41	Degrees API	MM	1/25/05
692	Degrees API D4052	57.39	Degrees API	MM	1/25/05
691	Density @ 60 deg F D4052	0.74836	g/cm-03 @ 60 deg F	MM	1/25/05
691	Density @ 60 deg F D4052	0.74831	g/cm-03 @ 60 deg F	MM	1/25/05
101	Initial Boiling Point D86	95.2	Degrees F	MM	2/4/05
110	10 Percent D86	129	Degrees F	MM	2/4/05
150	50 Percent D86	216.9	Degrees F	MM	2/4/05
190	90 Percent D86	342.9	Degrees F	MM	2/4/05
200	End Point D86	425.8	Degrees F	MM	2/4/05
201	Residue D86	0.8	mL	MM	2/4/05
202	Total Recovery D86	97.3	mL	MM	2/4/05

203	Loss	D86	1.9 mL	MM	2/4/05
543	Methanol	by D5599	0.00 Volume Percent	TS	2/14/05
584	Isopropanol	by D5599	0.00 Volume Percent	TS	2/14/05
585	t-Butanol	by D5599	0.00 Volume Percent	TS	2/14/05
586	n-Propanol	by D5599	0.00 Volume Percent	TS	2/14/05
587	sec-Butanol	by D5599	0.00 Volume Percent	TS	2/14/05
588	DIPE	by D5599	0.00 Volume Percent	TS	2/14/05
589	Isobutanol	by D5599	0.00 Volume Percent	TS	2/14/05
5801	t-Amyl Alcohol	by D5599	0.00 Volume Percent	TS	2/14/05
5802	n-Butanol	by D5599	0.00 Volume Percent	TS	2/14/05

NVFEL Fuel Analysis Report

13634

Kansas City Samples

Batch#

Facility Name: ERG Facility Type: In House
Owner: EPA Phone: (913) 299-9480
6636 Berger Avenue

U.S.

Samples Type: Correlation
Inspection information logged in by MM on 1/19/05.

VOC
Season: Winter

Kansas City Samples-QPJ860Ks **FTAG: 13634** **Comments:** **25 of 35; 439; 9-30-?**

Fuel_ Code: 41

Test Code	Test Method	Results	Units	Analys	Analysis Date
552	MTBE by D5599	0.00	Oxy Percent	TS	2/14/05
562	ETBE by D5599	0.00	Oxy Percent	TS	2/14/05
534	Ethanol by D5599	0.00	Oxy Percent	TS	2/14/05
572	TAME by D5599	0.00	Oxy Percent	TS	2/14/05
421	Sulfur in Gasoline D2622	130	Parts Per Million	NST	.3/10/05
62	Vapor Pressure by D5191 (Modified)	8.43	PS I	NST	1/26/05
65	Percent Evaporated at 200 Degrees F D86	44.1	Volume Percent	MM	2/14/05
66	Percent Evaporated at 300 Degrees F D86	78.4	Volume Percent	MM	2/14/05
48	Aromatics in Gasoline MSD D5769	32.3	Volume Percent	TW	2/1/05
49	Olefins in by FIA D1319	9.1	Volume Percent	NST	2/8/05
64	Benzene in Gasoline D3606	0.92	Volume Percent	TW	2/17/05
532	Ethanol by D5599	0.00	Volume Percent	TS	2/14/05
55	MTBE by D5599	0.00	Volume Percent	TS	2/14/05
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent	TS	2/14/05
59	Weight Percent Oxygen by D5599	0.00	Weight Percent	TS	2/14/05
57	TAME by D5599	0.00	Volume Percent	TS	2/14/05
56	ETBE by D5599	0.00	Volume Percent	TS	2/14/05
630	Toluene in gasoline by MSD D5769	6.87	Volumn Percent	TW	2/1/05
46	Aromatics by FIA D1319	32.3	Volume Percent	NST	2/8/05
63	Benzene in Gasoline by GC/MSD D5769	0.89	Volume Percent	TW	2/1/05
69	Specific Gravity @ 60 deg F D4052	0.75067	60/60F	MM	1/27/05
692	Degrees API D4052	57	Degrees API	MM	1/27/05
691	Density @ 60 deg F D4052	0.74992	g/cm-03 @ 60 deg F	MM	1/27/05
101	Initial Boiling Point D86	92.2	Degrees F	MM	2/14/05
110	10 Percent D86	122.8	Degrees F	MM	2/14/05
150	50 Percent D86	220.7	Degrees F	MM	2/14/05
190	90 Percent D86	341.3	Degrees F	MM	2/14/05
200	End Point D86	428.7	Degrees F	MM	2/14/05
201	Residue D86	0.7	mL	MM	2/14/05
202	Total Recovery D86	97.3	mL	MM	2/14/05
203	Loss D86	2	mL	MM	2/14/05
543	Methanol by D5599	0.00	Volume Percent	TS	2/14/05
584	Isopropanol by D5599	0.00	Volume Percent	TS	2/14/05

585	t-Butanol	by D5599	0.00	Volume Percent	TS	2/14/05
586	n-Propanol	by D5599	0.00	Volume Percent	TS	2/14/05
587	sec-Butanol	by D5599	0.00	Volume Percent	TS	2/14/05
588	DIPE	by D5599	0.00	Volume Percent	TS	2/14/05
589	Isobutanol	by D5599	0.00	Volume Percent	TS	2/14/05
5801	t-Amyl Alcohol	by D5599	0.00	Volume Percent	TS	2/14/05
5802	n-Butanol	by D5599	0.00	Volume Percent	TS	2/14/05

NVFEL Fuel Analysis Report

13635

Kansas City Samples

Batch#

Facility Name: ERG Facility Type: In House

Owner: EPA Phone: (913) 299-9480

6636 Berger Avenue

U.S.

Samples Type: Correlation

VOC

Inspection information logged in by MM on 1/19/05.

Season: Winter

Kansas City Samples-008HJ4(Mo) **FTAG: 13635** **Comments:** **26 of 35; (469); 12/7/04**

Test Code	Test Method	Results	Units	Fuel_ Code: 41	Analys	Analysis Date
552	MTBE by D5599	0.00	Oxy Percent		TS	2/14/05
562	ETBE by D5599	0.00	Oxy Percent		TS	2/14/05
534	Ethanol by D5599	0.00	Oxy Percent		TS	2/14/05
572	TAME by D5599	0.00	Oxy Percent		TS	2/14/05
421	Sulfur in Gasoline D2622	106	Parts Per Million		NST	3/10/05
62	Vapor Pressure by D5191 (Modified)	10.89	PS I		NST	1/26/05
65	Percent Evaporated at 200 Degrees F D86	48.2	Volume Percent		MM	2/2/05
66	Percent Evaporated at 300 Degrees F D86	83.7	Volume Percent		MM	2/2/05
48	Aromatics in Gasoline MSD D5769	25.99	Volume Percent		TW	2/2/05
49	Olefins in by FIA D1319	10	Volume Percent		NST	2/8/05
64	Benzene in Gasoline D3606	1.27	Volume Percent		TW	2/17/05
532	Ethanol by D5599	0.00	Volume Percent		TS	2/14/05
55	MTBE by D5599	0.00	Volume Percent		TS	2/14/05
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent		TS	2/14/05
59	Weight Percent Oxygen by D5599	0.00	Weight Percent		TS	2/14/05
57	TAME by D5599	0.00	Volume Percent		TS	2/14/05
56	ETBE by D5599	0.00	Volume Percent		TS	2/14/05
46	Aromatics by FIA D1319	26.6	Volume Percent		NST	2/8/05
63	Benzene in Gasoline by GC/MSD D5769	1.25	Volume Percent		TW	2/2/05
630	Toluene in gasoline by MSD D5769	6.01	Volumn Percent		TW	2/2/05
69	Specific Gravity @ 60 deg F D4052	0.73638	60/60F		MM	1/27/05
692	Degrees API D4052	60.66	Degrees API		MM	1/27/05
691	Density @ 60 deg F D4052	0.73565	g/cm-03 @ 60 deg F		MM	1/27/05
101	Initial Boiling Point D86	85.8	Degrees F		MM	2/2/05
110	10 Percent D86	112.6	Degrees F		MM	2/2/05
150	50 Percent D86	204.1	Degrees F		MM	2/2/05
190	90 Percent D86	325.9	Degrees F		MM	2/2/05
200	End Point D86	408.9	Degrees F		MM	2/2/05
201	Residue D86	0.8	mL		MM	2/2/05
202	Total Recovery D86	97.4	mL		MM	2/2/05
203	Loss D86	1.8	mL		MM	2/2/05
543	Methanol by D5599	0.00	Volume Percent		TS	2/14/05
584	Isopropanol by D5599	0.00	Volume Percent		TS	2/14/05

585	t-Butanol	by D5599	0.00	Volume Percent	TS	2/14/05
586	n-Propanol	by D5599	0.00	Volume Percent	TS	2/14/05
587	sec-Butanol	by D5599	0.00	Volume Percent	TS	2/14/05
588	DIPE	by D5599	0.00	Volume Percent	TS	2/14/05
589	Isobutanol	by D5599	0.00	Volume Percent	TS	2/14/05
5801	t-Amyl Alcohol	by D5599	0.00	Volume Percent	TS	2/14/05
5802	n-Butanol	by D5599	0.00	Volume Percent	TS	2/14/05

NVFEL Fuel Analysis Report

13636

Kansas City Samples

Batch#

Facility Name: ERG Facility Type: In House

Owner: EPA Phone: (913) 299-9480

6636 Berger Avenue

U.S.

Samples Type: Correlation

VOC

Inspection information logged in by MM on 1/19/05.

Season: Winter

Kansas City Samples-064MRF(Mo) **FTAG: 13636** **Comments:** **34 of 35; 51; 7-24-04**

Fuel_ Code: 41

Test Code	Test Method	Results	Units	Analys	Analysis Date
552	MTBE by D5599	0.00	Oxy Percent	TS	2/14/05
562	ETBE by D5599	0.00	Oxy Percent	TS	2/14/05
534	Ethanol by D5599	0.00	Oxy Percent	TS	2/14/05
572	TAME by D5599	0.00	Oxy Percent	TS	2/14/05
421	Sulfur in Gasoline D2622	215	Parts Per Million	NST	3/10/05
62	Vapor Pressure by D5191 (Modified)	6.5	PS I	NST	1/26/05
65	Percent Evaporated at 200 Degrees F D86	37.3	Volume Percent	MM	2/2/05
66	Percent Evaporated at 300 Degrees F D86	81.4	Volume Percent	MM	2/2/05
48	Aromatics in Gasoline MSD D5769	34.72	Volume Percent	TW	2/2/05
49	Olefins in by FIA D1319	8.3	Volume Percent	NST	2/8/05
64	Benzene in Gasoline D3606	1.88	Volume Percent	TW	2/18/05
532	Ethanol by D5599	0.00	Volume Percent	TS	2/14/05
55	MTBE by D5599	0.00	Volume Percent	TS	2/14/05
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent	TS	2/14/05
59	Weight Percent Oxygen by D5599	0.00	Weight Percent	TS	2/14/05
57	TAME by D5599	0.00	Volume Percent	TS	2/14/05
56	ETBE by D5599	0.00	Volume Percent	TS	2/14/05
46	Aromatics by FIA D1319	34	Volume Percent	NST	2/8/05
63	Benzene in Gasoline by GC/MSD D5769	1.83	Volume Percent	TW	2/2/05
630	Toluene in gasoline by MSD D5769	8.08	Volumn Percent	TW	2/2/05
69	Specific Gravity @ 60 deg F D4052	0.75809	60/60F	MM	1/27/05
692	Degrees API D4052	55.15	Degrees API	MM	1/27/05
691	Density @ 60 deg F D4052	0.75734	g/cm-03 @ 60 deg F	MM	1/27/05
101	Initial Boiling Point D86	102.2	Degrees F	MM	2/2/05
110	10 Percent D86	145	Degrees F	MM	2/2/05
150	50 Percent D86	225.9	Degrees F	MM	2/2/05
190	90 Percent D86	328.5	Degrees F	MM	2/2/05
200	End Point D86	413.4	Degrees F	MM	2/2/05
201	Residue D86	0.8	mL	MM	2/2/05
202	Total Recovery D86	97.7	mL	MM	2/2/05
203	Loss D86	1.5	mL	MM	2/2/05
543	Methanol by D5599	0.00	Volume Percent	TS	2/14/05
584	Isopropanol by D5599	0.00	Volume Percent	TS	2/14/05

585	t-Butanol	by D5599	0.00	Volume Percent	TS	2/14/05
586	n-Propanol	by D5599	0.00	Volume Percent	TS	2/14/05
587	sec-Butanol	by D5599	0.00	Volume Percent	TS	2/14/05
588	DIPE	by D5599	0.00	Volume Percent	TS	2/14/05
589	Isobutanol	by D5599	0.00	Volume Percent	TS	2/14/05
5801	t-Amyl Alcohol	by D5599	0.00	Volume Percent	TS	2/14/05
5802	n-Butanol	by D5599	0.00	Volume Percent	TS	2/14/05

NVFEL Fuel Analysis Report

13649 Batch#

Kansas City Samples

Facility Name: ERG Facility Type: In House
Owner: EPA Phone: (913) 299-9480
6636 Berger Avenue

U.S.

Samples Type: Correlation
Inspection information logged in by MM on 1/26/05.

VOC
Season: Winter

Kansas City Samples-QLX676(KS) **FTAG: 13649** **Comments:** **Label ink is partially dissolved**

Fuel_Code: 41

Test Code	Test Method	Results	Units	Analys	Analysis Date
552	MTBE by D5599	0.00	Oxy Percent	TS	2/15/05
562	ETBE by D5599	0.00	Oxy Percent	TS	2/15/05
534	Ethanol by D5599	0.00	Oxy Percent	TS	2/15/05
572	TAME by D5599	0.00	Oxy Percent	TS	2/15/05
421	Sulfur in Gasoline D2622	159	Parts Per Million	NST	3/10/05
62	Vapor Pressure by D5191 (Modified)	7.35	PS I	NST	1/26/05
65	Percent Evaporated at 200 Degrees F D86	39.3	Volume Percent	MM	2/1/05
66	Percent Evaporated at 300 Degrees F D86	80.9	Volume Percent	MM	2/1/05
48	Aromatics in Gasoline MSD D5769	32.59	Volume Percent	TW	2/2/05
49	Olefins in by FIA D1319	8.4	Volume Percent	NST	2/9/05
64	Benzene in Gasoline D3606	1.65	Volume Percent	TW	2/18/05
532	Ethanol by D5599	0.00	Volume Percent	TS	2/15/05
55	MTBE by D5599	0.00	Volume Percent	TS	2/15/05
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent	TS	2/15/05
59	Weight Percent Oxygen by D5599	0.00	Weight Percent	TS	2/15/05
57	TAME by D5599	0.00	Volume Percent	TS	2/15/05
56	ETBE by D5599	0.00	Volume Percent	TS	2/15/05
46	Aromatics by FIA D1319	32	Volume Percent	NST	2/9/05
63	Benzene in Gasoline by GC/MSD D5769	1.6	Volume Percent	TW	2/2/05
630	Toluene in gasoline by MSD D5769	7.29	Volumn Percent	TW	2/2/05
69	Specific Gravity @ 60 deg F D4052	0.75409	60/60F	MM	1/27/05
692	Degrees API D4052	56.14	Degrees API	MM	1/27/05
691	Density @ 60 deg F D4052	0.75334	g/cm-03 @ 60 deg F	MM	1/27/05
101	Initial Boiling Point D86	98.6	Degrees F	MM	2/1/05
110	10 Percent D86	138.4	Degrees F	MM	2/1/05
150	50 Percent D86	223.2	Degrees F	MM	2/1/05
190	90 Percent D86	330.8	Degrees F	MM	2/1/05
200	End Point D86	414.1	Degrees F	MM	2/1/05
201	Residue D86	0.8	mL	MM	2/1/05
202	Total Recovery D86	97.6	mL	MM	2/1/05
203	Loss D86	1.6	mL	MM	2/1/05
543	Methanol by D5599	0.00	Volume Percent	TS	2/15/05
584	Isopropanol by D5599	0.00	Volume Percent	TS	2/15/05

585	t-Butanol	by D5599	0.00	Volume Percent	TS	2/15/05
586	n-Propanol	by D5599	0.00	Volume Percent	TS	2/15/05
587	sec-Butanol	by D5599	0.00	Volume Percent	TS	2/15/05
588	DIPE	by D5599	0.00	Volume Percent	TS	2/15/05
589	Isobutanol	by D5599	0.00	Volume Percent	TS	2/15/05
5801	t-Amyl Alcohol	by D5599	0.00	Volume Percent	TS	2/15/05
5802	n-Butanol	by D5599	0.00	Volume Percent	TS	2/15/05

NVFEL Fuel Analysis Report

13650

Kansas City Samples

Batch#

Facility Name: ERG Facility Type: In House
Owner: EPA Phone: (913) 299-9480
6636 Berger Avenue

U.S.

Samples Type: Correlation

VOC

Inspection information logged in by MM on 1/26/05.

Season: Winter

Kansas City Samples-USX537(Mo) **FTAG: 13650** **Comments:** **Overpack damp; Label damp but readable; gasoline smell**

Fuel_Code: 41

Test Code	Test Method	Results	Units	Analys	Analysis Date
552	MTBE by D5599	0.00	Oxy Percent	TS	2/15/05
562	ETBE by D5599	0.00	Oxy Percent	TS	2/15/05
534	Ethanol by D5599	0.00	Oxy Percent	TS	2/15/05
572	TAME by D5599	0.00	Oxy Percent	TS	2/15/05
421	Sulfur in Gasoline D2622	284	Parts Per Million	NST	3/10/05
62	Vapor Pressure by D5191 (Modified)	13.69	PS I	NST	1/26/05
65	Percent Evaporated at 200 Degrees F D86	51.4	Volume Percent	MM	2/1/05
66	Percent Evaporated at 300 Degrees F D86	85.3	Volume Percent	MM	2/1/05
48	Aromatics in Gasoline MSD D5769	22.65	Volume Percent	TW	2/2/05
49	Olefins In by FIA D1319	9.9	Volume Percent	NST	2/9/05
64	Benzene in Gasoline D3606	1.08	Volume Percent	TW	2/18/05
532	Ethanol by D5599	0.00	Volume Percent	TS	2/15/05
55	MTBE by D5599	0.00	Volume Percent	TS	2/15/05
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent	TS	2/15/05
59	Weight Percent Oxygen by D5599	0.00	Weight Percent	TS	2/15/05
57	TAME by D5599	0.00	Volume Percent	TS	2/15/05
56	ETBE by D5599	0.00	Volume Percent	TS	2/15/05
46	Aromatics by FIA D1319	22.1	Volume Percent	NST	2/9/05
63	Benzene in Gasoline by GC/MSD D5769	1.04	Volume Percent	TW	2/2/05
630	Toluene in gasoline by MSD D5769	5.02	Volumn Percent	TW	2/2/05
69	Specific Gravity @ 60 deg F D4052	0.72684	60/60F	MM	1/27/05
692	Degrees API D4052	63.18	Degrees API	MM	1/27/05
691	Density @ 60 deg F D4052	0.72612	g/cm-03 @ 60 deg F	MM	1/27/05
101	Initial Boiling Point D86	79.2	Degrees F	MM	2/1/05
110	10 Percent D86	100	Degrees F	MM	2/1/05
150	50 Percent D86	196.7	Degrees F	MM	2/1/05
190	90 Percent D86	320.7	Degrees F	MM	2/1/05
200	End Point D86	410.5	Degrees F	MM	2/1/05
201	Residue D86	0.4	mL	MM	2/1/05
202	Total Recovery D86	96.4	mL	MM	2/1/05
203	Loss D86	3.2	mL	MM	2/1/05
543	Methanol by D5599	0.00	Volume Percent	TS	2/15/05
584	Isopropanol by D5599	0.00	Volume Percent	TS	2/15/05

585	t-Butanol	by D5599	0.00 Volume Percent	TS	2/15/05
586	n-Propanol	by D5599	0.00 Volume Percent	TS	2/15/05
587	sec-Butanol	by D5599	0.00 Volume Percent	TS	2/15/05
588	DIPE	by D5599	0.00 Volume Percent	TS	2/15/05
589	Isobutanol	by D5599	0.00 Volume Percent	TS	2/15/05
5801	t-Amyl Alcohol	by D5599	0.00 Volume Percent	TS	2/15/05
5802	n-Butanol	by D5599	0.00 Volume Percent	TS	2/15/05

NVFEL Fuel Analysis Report

13651

Kansas City Samples

Batch#

Facility Name: ERG Facility Type: In House
Owner: EPA Phone: (913) 299-9480
6636 Berger Avenue

U.S.

Samples Type: Correlation

VOC

Inspection information logged in by MM on 1/26/05.

Season: Winter

Kansas City Samples-QHK162(Ks) **FTAG: 13651** **Comments:**

Fuel_Code: 41

Test Code	Test Method	Results	Units	Analys	Analysis Date
552	MTBE by D5599	0.00	Oxy Percent	TS	2/15/05
562	ETBE by D5599	0.00	Oxy Percent	TS	2/15/05
534	Ethanol by D5599	0.21	Oxy Percent	TS	2/15/05
572	TAME by D5599	0.00	Oxy Percent	TS	2/15/05
421	Sulfur in Gasoline D2622	316	Parts Per Million	NST	3/10/05
421	Sulfur in Gasoline D2622	314	Parts Per Million	NST	3/10/05
62	Vapor Pressure by D5191 (Modified)	13.98	PS I	NST	1/26/05
65	Percent Evaporated at 200 Degrees F D86	49.9	Volume Percent	MM	2/2/05
66	Percent Evaporated at 300 Degrees F D86	85.5	Volume Percent	MM	2/2/05
48	Aromatics in Gasoline MSD D5769	23.5	Volume Percent	TW	2/2/05
49	Olefins in by FIA D1319	9.5	Volume Percent	NST	2/10/05
64	Benzene in Gasoline D3606	1.24	Volume Percent	TW	2/18/05
59	Weight Percent Oxygen by D5599	0.21	Weight Percent	TS	2/15/05
593	Volume Percent Oxygenates by D5599	0.55	Volume Percent	TS	2/15/05
532	Ethanol by D5599	0.55	Volume Percent	TS	2/15/05
55	MTBE by D5599	0.00	Volume Percent	TS	2/15/05
57	TAME by D5599	0.00	Volume Percent	TS	2/15/05
56	ETBE by D5599	0.00	Volume Percent	TS	2/15/05
630	Toluene in gasoline by MSD D5769	5.52	Volumn Percent	TW	2/2/05
63	Benzene in Gasoline by GC/MSD D5769	1.21	Volume Percent	TW	2/2/05
46	Aromatics by FIA D1319	23.9	Volume Percent	NST	2/10/05
69	Specific Gravity @ 60 deg F D4052	0.72997	60/60F	MM	1/27/05
692	Degrees API D4052	62.34	Degrees API	MM	1/27/05
691	Density @ 60 deg F D4052	0.72925	g/cm-03 @ 60 deg F	MM	1/27/05
101	Initial Boiling Point D86	80.1	Degrees F	MM	2/2/05
110	10 Percent D86	99.3	Degrees F	MM	2/2/05
150	50 Percent D86	200.3	Degrees F	MM	2/2/05
190	90 Percent D86	319.1	Degrees F	MM	2/2/05
200	End Point D86	395.8	Degrees F	MM	2/2/05
201	Residue D86	0.8	mL	MM	2/2/05
202	Total Recovery D86	96.1	mL	MM	2/2/05
203	Loss D86	3.1	mL	MM	2/2/05
543	Methanol by D5599	0.00	Volume Percent	TS	2/15/05

584	Isopropanol	by D5599	0.00	Volume Percent	TS	2/15/05
585	t-Butanol	by D5599	0.00	Volume Percent	TS	2/15/05
586	n-Propanol	by D5599	0.00	Volume Percent	TS	2/15/05
587	sec-Butanol	by D5599	0.00	Volume Percent	TS	2/15/05
588	DIPE	by D5599	0.00	Volume Percent	TS	2/15/05
589	Isobutanol	by D5599	0.00	Volume Percent	TS	2/15/05
5801	t-Amyl Alcohol	by D5599	0.00	Volume Percent	TS	2/15/05
5802	n-Butanol	by D5599	0.00	Volume Percent	TS	2/15/05

NVFEL Fuel Analysis Report

13652

Batch#

Kansas City Samples

Facility Name: ERG   Facility Type: In House

Owner: EPA   Phone: (913) 299-9480

6636 Berger Avenue

U.S.

Samples Type: Correlation

VOC

Inspection information logged in by MM on 1/26/05.

Season: Winter

Kansas City Samples-VQH119(Ks)   **FTAG: 13652**   **Comments:** **Sample leaked to the extent that label was obliterated**

Test Code	Test Method	Results	Units	Fuel_ Code: 41	Analys	Analysis Date
552	MTBE by D5599	0.00	Oxy Percent		TS	2/15/05
562	ETBE by D5599	0.00	Oxy Percent		TS	2/15/05
534	Ethanol by D5599	0.00	Oxy Percent		TS	2/15/05
572	TAME by D5599	0.00	Oxy Percent		TS	2/15/05
421	Sulfur in Gasoline D2622	73	Parts Per Million		NST	3/10/05
62	Vapor Pressure by D5191 (Modified)	6.09	PS I		NST	1/26/05
65	Percent Evaporated at 200 Degrees F D86	37.1	Volume Percent		MM	2/2/05
66	Percent Evaporated at 300 Degrees F D86	73.7	Volume Percent		MM	2/2/05
48	Aromatics in Gasoline MSD D5769	36.44	Volume Percent		TW	2/2/05
49	Olefins in by FIA D1319	10.4	Volume Percent		NST	2/10/05
64	Benzene in Gasoline D3606	1.64	Volume Percent		TW	2/18/05
532	Ethanol by D5599	0.00	Volume Percent		TS	2/15/05
55	MTBE by D5599	0.00	Volume Percent		TS	2/15/05
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent		TS	2/15/05
59	Weight Percent Oxygen by D5599	0.00	Weight Percent		TS	2/15/05
57	TAME by D5599	0.00	Volume Percent		TS	2/15/05
56	ETBE by D5599	0.00	Volume Percent		TS	2/15/05
46	Aromatics by FIA D1319	36.7	Volume Percent		NST	2/10/05
63	Benzene in Gasoline by GC/MSD D5769	1.6	Volume Percent		TW	2/2/05
630	Toluene in gasoline by MSD D5769	8.33	Volumn Percent		TW	2/2/05
69	Specific Gravity @ 60 deg F D4052	0.76526	60/60F		MM	1/27/05
692	Degrees API D4052	53.41	Degrees API		MM	1/27/05
691	Density @ 60 deg F D4052	0.7645	g/cm-03 @ 60 deg F		MM	1/27/05
101	Initial Boiling Point D86	101.8	Degrees F		MM	2/2/05
110	10 Percent D86	144.7	Degrees F		MM	2/2/05
150	50 Percent D86	230.9	Degrees F		MM	2/2/05
190	90 Percent D86	355.1	Degrees F		MM	2/2/05
200	End Point D86	427.1	Degrees F		MM	2/2/05
201	Residue D86	0.7	mL		MM	2/2/05
202	Total Recovery D86	97.9	mL		MM	2/2/05
203	Loss D86	1.4	mL		MM	2/2/05
543	Methanol by D5599	0.00	Volume Percent		TS	2/15/05
584	Isopropanol by D5599	0.00	Volume Percent		TS	2/15/05

585	t-Butanol	by D5599	0.00	Volume Percent	TS	2/15/05
586	n-Propanol	by D5599	0.00	Volume Percent	TS	2/15/05
587	sec-Butanol	by D5599	0.00	Volume Percent	TS	2/15/05
588	DIPE	by D5599	0.00	Volume Percent	TS	2/15/05
589	Isobutanol	by D5599	0.00	Volume Percent	TS	2/15/05
5801	t-Amyl Alcohol	by D5599	0.00	Volume Percent	TS	2/15/05
5802	n-Butanol	by D5599	0.00	Volume Percent	TS	2/15/05

NVFEL Fuel Analysis Report

13653

Kansas City Samples

Batch#

Facility Name: ERG   Facility Type: In House

Owner: EPA   Phone: (913) 299-9480

6636 Berger Avenue

U.S.

Samples Type: Correlation

VOC

Inspection information logged in by MM on 1/26/05.

Season: Winter

Kansas City Samples-QBX511(Ks)   **FTAG: 13653**   **Comments:** **Sample leaked to the extent that label was partially obliterated**

Test Code	Test Method	Results	Units	Fuel_ Code: 41	Analys	Analysis Date
552	MTBE by D5599	0.00	Oxy Percent		TS	2/15/05
552	MTBE by D5599	0.00	Oxy Percent		TS	2/15/05
562	ETBE by D5599	0.00	Oxy Percent		TS	2/15/05
562	ETBE by D5599	0.00	Oxy Percent		TS	2/15/05
534	Ethanol by D5599	0.00	Oxy Percent		TS	2/15/05
534	Ethanol by D5599	0.00	Oxy Percent		TS	2/15/05
572	TAME by D5599	0.00	Oxy Percent		TS	2/15/05
572	TAME by D5599	0.00	Oxy Percent		TS	2/15/05
421	Sulfur in Gasoline D2622	138	Parts Per Million		NST	3/10/05
62	Vapor Pressure by D5191 (Modified)	6.12	PS I		NST	1/26/05
65	Percent Evaporated at 200 Degrees F D86	37.2	Volume Percent		MM	2/2/05
66	Percent Evaporated at 300 Degrees F D86	80.9	Volume Percent		MM	2/2/05
48	Aromatics in Gasoline MSD D5769	35.45	Volume Percent		TW	2/2/05
49	Olefins in by FIA D1319	7.9	Volume Percent		NST	2/10/05
49	Olefins in by FIA D1319	8.3	Volume Percent		NST	2/14/05
64	Benzene in Gasoline D3606	1.75	Volume Percent		TW	2/18/05
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent		TS	2/15/05
59	Weight Percent Oxygen by D5599	0.00	Weight Percent		TS	2/15/05
55	MTBE by D5599	0.00	Volume Percent		TS	2/15/05
55	MTBE by D5599	0.00	Volume Percent		TS	2/15/05
532	Ethanol by D5599	0.00	Volume Percent		TS	2/15/05
532	Ethanol by D5599	0.00	Volume Percent		TS	2/15/05
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent		TS	2/15/05
57	TAME by D5599	0.00	Volume Percent		TS	2/15/05
59	Weight Percent Oxygen by D5599	0.00	Weight Percent		TS	2/15/05
57	TAME by D5599	0.00	Volume Percent		TS	2/15/05
56	ETBE by D5599	0.00	Volume Percent		TS	2/15/05
56	ETBE by D5599	0.00	Volume Percent		TS	2/15/05
630	Toluene in gasoline by MSD D5769	7.93	Volumn Percent		TW	2/2/05
46	Aromatics by FIA D1319	35.8	Volume Percent		NST	2/10/05
46	Aromatics by FIA D1319	36	Volume Percent		NST	2/14/05
63	Benzene in Gasoline by GC/MSD D5769	1.71	Volume Percent		TW	2/2/05
69	Specific Gravity @ 60 deg F D4052	0.75994	60/60F		MM	1/27/05

NVFEL Fuel Analysis Report

13653

692	Degrees API	D4052	54.7 Degrees API	MM	1/27/05
691	Density @ 60 deg F	D4052	0.75919 g/cm-03 @ 60 deg F	MM	1/27/05
101	Initial Boiling Point	D86	104.2 Degrees F	MM	2/2/05
110	10 Percent	D86	145.2 Degrees F	MM	2/2/05
150	50 Percent	D86	227.1 Degrees F	MM	2/2/05
190	90 Percent	D86	331.7 Degrees F	MM	2/2/05
200	End Point	D86	419.4 Degrees F	MM	2/2/05
201	Residue	D86	0.8 mL	MM	2/2/05
202	Total Recovery	D86	97.8 mL	MM	2/2/05
203	Loss	D86	1.4 mL	MM	2/2/05
543	Methanol	by D5599	0.00 Volume Percent	TS	2/15/05
543	Methanol	by D5599	0.00 Volume Percent	TS	2/15/05
584	Isopropanol	by D5599	0.00 Volume Percent	TS	2/15/05
584	Isopropanol	by D5599	0.00 Volume Percent	TS	2/15/05
585	t-Butanol	by D5599	0.00 Volume Percent	TS	2/15/05
585	t-Butanol	by D5599	0.00 Volume Percent	TS	2/15/05
586	n-Propanol	by D5599	0.00 Volume Percent	TS	2/15/05
586	n-Propanol	by D5599	0.00 Volume Percent	TS	2/15/05
587	sec-Butanol	by D5599	0.00 Volume Percent	TS	2/15/05
587	sec-Butanol	by D5599	0.00 Volume Percent	TS	2/15/05
588	DIPE	by D5599	0.00 Volume Percent	TS	2/15/05
588	DIPE	by D5599	0.00 Volume Percent	TS	2/15/05
589	Isobutanol	by D5599	0.00 Volume Percent	TS	2/15/05
589	Isobutanol	by D5599	0.00 Volume Percent	TS	2/15/05
5801	t-Amyl Alcohol	by D5599	0.00 Volume Percent	TS	2/15/05
5801	t-Amyl Alcohol	by D5599	0.00 Volume Percent	TS	2/15/05
5802	n-Butanol	by D5599	0.00 Volume Percent	TS	2/15/05
5802	n-Butanol	by D5599	0.00 Volume Percent	TS	2/15/05

NVFEL Fuel Analysis Report

13654

Kansas City Samples

Batch#

Facility Name: ERG Facility Type: In House
Owner: EPA Phone: (913) 299-9480
6636 Berger Avenue

U.S.

Samples Type: Correlation

VOC

Inspection information logged in by MM on 1/26/05.

Season: Winter

Kansas City Samples-STJIM2(Mo) **FTAG: 13654** **Comments:** **Sample leaked to the extent that label was obliterated**

Fuel_Code: 41

Test Code	Test Method	Results	Units	Analys	Analysis Date
552	MTBE by D5599	0.00	Oxy Percent	TS	2/15/05
562	ETBE by D5599	0.00	Oxy Percent	TS	2/15/05
534	Ethanol by D5599	0.00	Oxy Percent	TS	2/15/05
572	TAME by D5599	0.00	Oxy Percent	TS	2/15/05
421	Sulfur in Gasoline D2622	23	Parts Per Million	NST	3/10/05
62	Vapor Pressure by D5191 (Modified)	5.89	PS I	NST	1/26/05
65	Percent Evaporated at 200 Degrees F D86	27.7	Volume Percent	MM	2/4/05
66	Percent Evaporated at 300 Degrees F D86	85.7	Volume Percent	MM	2/4/05
48	Aromatics in Gasoline MSD D5769	29.55	Volume Percent	TW	2/2/05
49	Olefins in by FIA D1319	2.4	Volume Percent	NST	2/10/05
64	Benzene in Gasoline D3606	1.77	Volume Percent	TW	2/18/05
532	Ethanol by D5599	0.00	Volume Percent	TS	2/15/05
55	MTBE by D5599	0.00	Volume Percent	TS	2/15/05
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent	TS	2/15/05
59	Weight Percent Oxygen by D5599	0.00	Weight Percent	TS	2/15/05
57	TAME by D5599	0.00	Volume Percent	TS	2/15/05
56	ETBE by D5599	0.00	Volume Percent	TS	2/15/05
46	Aromatics by FIA D1319	28	Volume Percent	NST	2/10/05
630	Toluene in gasoline by MSD D5769	9.31	Volumn Percent	TW	2/2/05
63	Benzene in Gasoline by GC/MSD D5769	1.74	Volume Percent	TW	2/2/05
69	Specific Gravity @ 60 deg F D4052	0.74957	60/60F	MM	1/27/05
692	Degrees API D4052	57.28	Degrees API	MM	1/27/05
691	Density @ 60 deg F D4052	0.74883	g/cm-03 @ 60 deg F	MM	1/27/05
101	Initial Boiling Point D86	103.1	Degrees F	MM	2/4/05
110	10 Percent D86	160.5	Degrees F	MM	2/4/05
150	50 Percent D86	228.2	Degrees F	MM	2/4/05
190	90 Percent D86	318.4	Degrees F	MM	2/4/05
200	End Point D86	399.2	Degrees F	MM	2/4/05
201	Residue D86	0.9	mL	MM	2/4/05
202	Total Recovery D86	97.5	mL	MM	2/4/05
203	Loss D86	1.6	mL	MM	2/4/05
543	Methanol by D5599	0.00	Volume Percent	TS	2/15/05
584	Isopropanol by D5599	0.00	Volume Percent	TS	2/15/05

585	t-Butanol	by D5599	0.00	Volume Percent	TS	2/15/05
586	n-Propanol	by D5599	0.00	Volume Percent	TS	2/15/05
587	sec-Butanol	by D5599	0.00	Volume Percent	TS	2/15/05
588	DIPE	by D5599	0.00	Volume Percent	TS	2/15/05
589	Isobutanol	by D5599	0.00	Volume Percent	TS	2/15/05
5801	t-Amyl Alcohol	by D5599	0.00	Volume Percent	TS	2/15/05
5802	n-Butanol	by D5599	0.00	Volume Percent	TS	2/15/05

NVFEL Fuel Analysis Report

13655

Kansas City Samples

Batch#

Facility Name: ERG   Facility Type: In House

Owner: EPA   Phone: (913) 299-9480

6636 Berger Avenue

U.S.

Samples Type: Correlation

VOC

Inspection information logged in by MM on 1/26/05.

Season: Winter

Kansas City Samples-105TRX(Mo)   **FTAG: 13655**   **Comments:** **Overpack and label tag damp; Gasoline smell**

Fuel_ Code: 41

Test Code	Test Method	Results	Units	Analys	Analysis Date
552	MTBE by D5599	0.00	Oxy Percent	TS	2/15/05
562	ETBE by D5599	0.00	Oxy Percent	TS	2/15/05
534	Ethanol by D5599	0.00	Oxy Percent	TS	2/15/05
572	TAME by D5599	0.00	Oxy Percent	TS	2/15/05
421	Sulfur in Gasoline D2622	112	Parts Per Million	NST	3/10/05
62	Vapor Pressure by D5191 (Modified)	6.31	PS I	NST	1/26/05
65	Percent Evaporated at 200 Degrees F D86	38.1	Volume Percent	MM	2/4/05
66	Percent Evaporated at 300 Degrees F D86	81.2	Volume Percent	MM	2/4/05
48	Aromatics in Gasoline MSD D5769	30.86	Volume Percent	TW	2/2/05
49	Olefins in by FIA D1319	9.8	Volume Percent	NST	2/14/05
49	Olefins in by FIA D1319	10.4	Volume Percent	NST	2/10/05
64	Benzene in Gasoline D3606	1.13	Volume Percent	TW	2/18/05
532	Ethanol by D5599	0.00	Volume Percent	TS	2/15/05
59	Weight Percent Oxygen by D5599	0.00	Weight Percent	TS	2/15/05
57	TAME by D5599	0.00	Volume Percent	TS	2/15/05
55	MTBE by D5599	0.00	Volume Percent	TS	2/15/05
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent	TS	2/15/05
56	ETBE by D5599	0.00	Volume Percent	TS	2/15/05
46	Aromatics by FIA D1319	31.9	Volume Percent	NST	2/14/05
63	Benzene in Gasoline by GC/MSD D5769	1.09	Volume Percent	TW	2/2/05
46	Aromatics by FIA D1319	30.9	Volume Percent	NST	2/10/05
630	Toluene in gasoline by MSD D5769	8.38	Volumn Percent	TW	2/2/05
69	Specific Gravity @ 60 deg F D4052	0.7542	60/60F	MM	1/27/05
692	Degrees API D4052	56.12	Degrees API	MM	1/27/05
691	Density @ 60 deg F D4052	0.75345	g/cm-03 @ 60 deg F	MM	1/27/05
101	Initial Boiling Point D86	100	Degrees F	MM	2/4/05
110	10 Percent D86	142.2	Degrees F	MM	2/4/05
150	50 Percent D86	223.7	Degrees F	MM	2/4/05
190	90 Percent D86	338	Degrees F	MM	2/4/05
200	End Point D86	424.4	Degrees F	MM	2/4/05
201	Residue D86	0.8	mL	MM	2/4/05
202	Total Recovery D86	97.7	mL	MM	2/4/05
203	Loss D86	1.5	mL	MM	2/4/05

543	Methanol	by D5599	0.00	Volume Percent	TS	2/15/05
584	Isopropanol	by D5599	0.00	Volume Percent	TS	2/15/05
585	t-Butanol	by D5599	0.00	Volume Percent	TS	2/15/05
586	n-Propanol	by D5599	0.00	Volume Percent	TS	2/15/05
587	sec-Butanol	by D5599	0.00	Volume Percent	TS	2/15/05
588	DIPE	by D5599	0.00	Volume Percent	TS	2/15/05
589	Isobutanol	by D5599	0.00	Volume Percent	TS	2/15/05
5801	t-Amyl Alcohol	by D5599	0.00	Volume Percent	TS	2/15/05
5802	n-Butanol	by D5599	0.00	Volume Percent	TS	2/15/05

NVFEL Fuel Analysis Report

13656

Kansas City Samples

Batch#

Facility Name: ERG Facility Type: In House
Owner: EPA Phone: (913) 299-9480
6636 Berger Avenue

U.S.

Samples Type: Correlation

VOC

Inspection information logged in by MM on 1/26/05.

Season: Winter

Kansas City Samples- STJIM3(Mo) **FTAG: 13656** **Comments:** **Overpack damp with gasoline; gas smell; tape glue dissolved**

Test Code	Test Method	Results	Units	Fuel_ Code: 41	Analys	Analysis Date
552	MTBE by D5599	0.00	Oxy Percent		TS	2/15/05
562	ETBE by D5599	0.00	Oxy Percent		TS	2/15/05
534	Ethanol by D5599	0.00	Oxy Percent		TS	2/15/05
572	TAME by D5599	0.00	Oxy Percent		TS	2/15/05
421	Sulfur in Gasoline D2622	38	Parts Per Million		NST	3/10/05
62	Vapor Pressure by D5191 (Modified)	10.72	PS I		NST	1/26/05
62	Vapor Pressure by D5191 (Modified)	10.7	PS I		NST	1/26/05
48	Aromatics in Gasoline MSD D5769	32.2	Volume Percent		TW	2/2/05
49	Olefins in by FIA D1319	3.7	Volume Percent		NST	2/10/05
64	Benzene in Gasoline D3606	0.72	Volume Percent		TW	2/18/05
532	Ethanol by D5599	0.00	Volume Percent		TS	2/15/05
55	MTBE by D5599	0.00	Volume Percent		TS	2/15/05
57	TAME by D5599	0.00	Volume Percent		TS	2/15/05
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent		TS	2/15/05
59	Weight Percent Oxygen by D5599	0.00	Weight Percent		TS	2/15/05
56	ETBE by D5599	0.00	Volume Percent		TS	2/15/05
63	Benzene in Gasoline by GC/MSD D5769	0.69	Volume Percent		TW	2/2/05
630	Toluene in gasoline by MSD D5769	5.99	Volumn Percent		TW	2/2/05
46	Aromatics by FIA D1319	33	Volume Percent		NST	2/10/05
69	Specific Gravity @ 60 deg F D4052	0.74849	60/60F		MM	1/27/05
692	Degrees API D4052	57.55	Degrees API		MM	1/27/05
691	Density @ 60 deg F D4052	0.74775	g/cm-03 @ 60 deg F		MM	1/27/05
543	Methanol by D5599	0.00	Volume Percent		TS	2/15/05
584	Isopropanol by D5599	0.00	Volume Percent		TS	2/15/05
585	t-Butanol by D5599	0.00	Volume Percent		TS	2/15/05
586	n-Propanol by D5599	0.00	Volume Percent		TS	2/15/05
587	sec-Butanol by D5599	0.00	Volume Percent		TS	2/15/05
588	DIPE by D5599	0.00	Volume Percent		TS	2/15/05
589	Isobutanol by D5599	0.00	Volume Percent		TS	2/15/05
5801	t-Amyl Alcohol by D5599	0.00	Volume Percent		TS	2/15/05
5802	n-Butanol by D5599	0.00	Volume Percent		TS	2/15/05

NVFEL Fuel Analysis Report

13657

Kansas City Samples

Batch#

Facility Name: ERG Facility Type: In House

Owner: EPA Phone: (913) 299-9480

6636 Berger Avenue

U.S.

Samples Type: Correlation

VOC

Inspection information logged in by MM on 1/26/05.

Season: Winter

Kansas City Samples-ERGID-108 **FTAG: 13657** **Comments:** **Sample leaked to the point that label was obliteareated; Sample identity u**

Test Code	Test Method	Results	Units	Fuel_ Code: 41	Analys	Analysis Date
552	MTBE by D5599	0.00	Oxy Percent		TS	2/15/05
562	ETBE by D5599	0.00	Oxy Percent		TS	2/15/05
534	Ethanol by D5599	0.00	Oxy Percent		TS	2/15/05
572	TAME by D5599	0.00	Oxy Percent		TS	2/15/05
421	Sulfur in Gasoline D2622	159	Parts Per Million		NST	3/10/05
62	Vapor Pressure by D5191 (Modified)	6.43	PS I		NST	1/26/05
65	Percent Evaporated at 200 Degrees F D86	38.3	Volume Percent		MM	2/8/05
66	Percent Evaporated at 300 Degrees F D86	80.4	Volume Percent		MM	2/8/05
48	Aromatics in Gasoline MSD D5769	30.2	Volume Percent		TW	2/2/05
49	Olefins in by FIA D1319	10.3	Volume Percent		NST	2/14/05
64	Benzene in Gasoline D3606	1.42	Volume Percent		TW	2/18/05
64	Benzene in Gasoline D3606	1.43	Volume Percent		TW	2/18/05
59	Weight Percent Oxygen by D5599	0.00	Weight Percent		TS	2/15/05
57	TAME by D5599	0.00	Volume Percent		TS	2/15/05
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent		TS	2/15/05
532	Ethanol by D5599	0.00	Volume Percent		TS	2/15/05
55	MTBE by D5599	0.00	Volume Percent		TS	2/15/05
56	ETBE by D5599	0.00	Volume Percent		TS	2/15/05
63	Benzene in Gasoline by GC/MSD D5769	1.39	Volume Percent		TW	2/2/05
630	Toluene in gasoline by MSD D5769	6.36	Volumn Percent		TW	2/2/05
46	Aromatics by FIA D1319	30.2	Volume Percent		NST	2/14/05
69	Specific Gravity @ 60 deg F D4052	0.75243	60/60F		MM	1/27/05
692	Degrees API D4052	56.56	Degrees API		MM	1/27/05
691	Density @ 60 deg F D4052	0.75169	g/cm-03 @ 60 deg F		MM	1/27/05
101	Initial Boiling Point D86	101.1	Degrees F		MM	2/8/05
110	10 Percent D86	146.1	Degrees F		MM	2/8/05
150	50 Percent D86	222.8	Degrees F		MM	2/8/05
190	90 Percent D86	337.1	Degrees F		MM	2/8/05
200	End Point D86	441.7	Degrees F		MM	2/8/05
201	Residue D86	0.7	mL		MM	2/8/05
202	Total Recovery D86	97.8	mL		MM	2/8/05
203	Loss D86	1.5	mL		MM	2/8/05
543	Methanol by D5599	0.00	Volume Percent		TS	2/15/05

584	Isopropanol	by D5599	0.00	Volume Percent	TS	2/15/05
585	t-Butanol	by D5599	0.00	Volume Percent	TS	2/15/05
586	n-Propanol	by D5599	0.00	Volume Percent	TS	2/15/05
587	sec-Butanol	by D5599	0.00	Volume Percent	TS	2/15/05
588	DIPE	by D5599	0.00	Volume Percent	TS	2/15/05
589	Isobutanol	by D5599	0.00	Volume Percent	TS	2/15/05
5801	t-Amyl Alcohol	by D5599	0.00	Volume Percent	TS	2/15/05
5802	n-Butanol	by D5599	0.00	Volume Percent	TS	2/15/05

NVFEL Fuel Analysis Report

13658

Kansas City Samples

Batch#

Facility Name: ERG   Facility Type: In House

Owner: EPA   Phone: (913) 299-9480

6636 Berger Avenue

U.S.

Samples Type: Correlation

VOC

Inspection information logged in by MM on 1/26/05.

Season: Winter

Kansas City Samples-FB48MW   **FTAG: 13658**   **Comments:** **Gasoline smell in container**

Test Code	Test Method	Results	Units	Fuel_ Code: 41	Analys	Analysis Date
552	MTBE by D5599	0.00	Oxy Percent		TS	2/15/05
562	ETBE by D5599	0.00	Oxy Percent		TS	2/15/05
534	Ethanol by D5599	0.00	Oxy Percent		TS	2/15/05
572	TAME by D5599	0.00	Oxy Percent		TS	2/15/05
421	Sulfur in Gasoline D2622	106	Parts Per Million		NST	3/10/05
62	Vapor Pressure by D5191 (Modified)	6.19	PS I		NST	1/26/05
65	Percent Evaporated at 200 Degrees F D86	38.2	Volume Percent		MM	2/8/05
65	Percent Evaporated at 200 Degrees F D86	38.1	Volume Percent		MM	2/9/05
66	Percent Evaporated at 300 Degrees F D86	77.9	Volume Percent		MM	2/9/05
66	Percent Evaporated at 300 Degrees F D86	78	Volume Percent		MM	2/8/05
48	Aromatics in Gasoline MSD D5769	32.36	Volume Percent		TW	2/2/05
49	Olefins in by FIA D1319	10	Volume Percent		NST	2/14/05
64	Benzene in Gasoline D3606	1.40	Volume Percent		TW	2/18/05
532	Ethanol by D5599	0.00	Volume Percent		TS	2/15/05
55	MTBE by D5599	0.00	Volume Percent		TS	2/15/05
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent		TS	2/15/05
59	Weight Percent Oxygen by D5599	0.00	Weight Percent		TS	2/15/05
57	TAME by D5599	0.00	Volume Percent		TS	2/15/05
56	ETBE by D5599	0.00	Volume Percent		TS	2/15/05
46	Aromatics by FIA D1319	32.7	Volume Percent		NST	2/14/05
63	Benzene in Gasoline by GC/MSD D5769	1.37	Volume Percent		TW	2/2/05
630	Toluene in gasoline by MSD D5769	7.72	Volumn Percent		TW	2/2/05
69	Specific Gravity @ 60 deg F D4052	0.75729	60/60F		MM	1/27/05
69	Specific Gravity @ 60 deg F D4052	0.75731	60/60F		MM	1/27/05
692	Degrees API D4052	55.35	Degrees API		MM	1/27/05
692	Degrees API D4052	55.35	Degrees API		MM	1/27/05
691	Density @ 60 deg F D4052	0.75654	g/cm-03 @ 60 deg F		MM	1/27/05
691	Density @ 60 deg F D4052	0.75656	g/cm-03 @ 60 deg F		MM	1/27/05
101	Initial Boiling Point D86	104.9	Degrees F		MM	2/9/05
101	Initial Boiling Point D86	99.5	Degrees F		MM	2/8/05
110	10 Percent D86	146.3	Degrees F		MM	2/8/05
110	10 Percent D86	145.9	Degrees F		MM	2/9/05
150	50 Percent D86	225	Degrees F		MM	2/8/05

150	50 Percent	D86	224.6	Degrees F	MM	2/9/05
190	90 Percent	D86	347.4	Degrees F	MM	2/8/05
190	90 Percent	D86	347	Degrees F	MM	2/9/05
200	End Point	D86	455.4	Degrees F	MM	2/8/05
200	End Point	D86	446	Degrees F	MM	2/9/05
201	Residue	D86	0.9	mL	MM	2/9/05
201	Residue	D86	0.8	mL	MM	2/8/05
202	Total Recovery	D86	97.6	mL	MM	2/9/05
202	Total Recovery	D86	97.7	mL	MM	2/8/05
203	Loss	D86	1.5	mL	MM	2/8/05
203	Loss	D86	1.5	mL	MM	2/9/05
543	Methanol	by D5599	0.00	Volume Percent	TS	2/15/05
584	Isopropanol	by D5599	0.00	Volume Percent	TS	2/15/05
585	t-Butanol	by D5599	0.00	Volume Percent	TS	2/15/05
586	n-Propanol	by D5599	0.00	Volume Percent	TS	2/15/05
587	sec-Butanol	by D5599	0.00	Volume Percent	TS	2/15/05
588	DIPE	by D5599	0.00	Volume Percent	TS	2/15/05
589	Isobutanol	by D5599	0.00	Volume Percent	TS	2/15/05
5801	t-Amyl Alcohol	by D5599	0.00	Volume Percent	TS	2/15/05
5802	n-Butanol	by D5599	0.00	Volume Percent	TS	2/15/05

NVFEL Fuel Analysis Report

13659

Batch#

Kansas City Samples

Facility Name: ERG   Facility Type: In House

Owner: EPA   Phone: (913) 299-9480

6636 Berger Avenue

U.S.

Samples Type: Correlation

VOC

Inspection information logged in by MM on 1/26/05.

Season: Winter

Kansas City Samples-550BX2   **FTAG: 13659**   **Comments:** **Overpack damp with gasoline; label dam**

Test Code	Test Method	Results	Units	Fuel_ Code: 41	Analys	Analysis Date
552	MTBE by D5599	0.00	Oxy Percent		TS	2/15/05
562	ETBE by D5599	0.00	Oxy Percent		TS	2/15/05
534	Ethanol by D5599	0.00	Oxy Percent		TS	2/15/05
572	TAME by D5599	0.00	Oxy Percent		TS	2/15/05
421	Sulfur in Gasoline D2622	174	Parts Per Million		NST	3/10/05
62	Vapor Pressure by D5191 (Modified)	6.89	PS I		NST	1/27/05
65	Percent Evaporated at 200 Degrees F D86	38.7	Volume Percent		MM	2/8/05
66	Percent Evaporated at 300 Degrees F D86	81.1	Volume Percent		MM	2/8/05
48	Aromatics in Gasoline MSD D5769	34.47	Volume Percent		TW	2/8/05
49	Olefins in by FIA D1319	8	Volume Percent		NST	2/14/05
64	Benzene in Gasoline D3606	1.89	Volume Percent		TW	2/18/05
532	Ethanol by D5599	0.00	Volume Percent		TS	2/15/05
55	MTBE by D5599	0.00	Volume Percent		TS	2/15/05
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent		TS	2/15/05
59	Weight Percent Oxygen by D5599	0.00	Weight Percent		TS	2/15/05
57	TAME by D5599	0.00	Volume Percent		TS	2/15/05
56	ETBE by D5599	0.00	Volume Percent		TS	2/15/05
46	Aromatics by FIA D1319	33.9	Volume Percent		NST	2/14/05
630	Toluene in gasoline by MSD D5769	7.89	Volumn Percent		TW	2/8/05
63	Benzene in Gasoline by GC/MSD D5769	1.84	Volume Percent		TW	2/8/05
69	Specific Gravity @ 60 deg F D4052	0.75657	60/60F		MM	2/3/05
692	Degrees API D4052	55.53	Degrees API		MM	2/3/05
691	Density @ 60 deg F D4052	0.75582	g/cm-03 @ 60 deg F		MM	2/3/05
101	Initial Boiling Point D86	100.2	Degrees F		MM	2/8/05
110	10 Percent D86	141.8	Degrees F		MM	2/8/05
150	50 Percent D86	223.9	Degrees F		MM	2/8/05
190	90 Percent D86	329.7	Degrees F		MM	2/8/05
200	End Point D86	422.8	Degrees F		MM	2/8/05
201	Residue D86	0.7	mL		MM	2/8/05
202	Total Recovery D86	97.9	mL		MM	2/8/05
203	Loss D86	1.4	mL		MM	2/8/05
543	Methanol by D5599	0.00	Volume Percent		TS	2/15/05
584	Isopropanol by D5599	0.00	Volume Percent		TS	2/15/05

585	t-Butanol	by D5599	0.00	Volume Percent	TS	2/15/05
586	n-Propanol	by D5599	0.00	Volume Percent	TS	2/15/05
587	sec-Butanol	by D5599	0.00	Volume Percent	TS	2/15/05
588	DIPE	by D5599	0.00	Volume Percent	TS	2/15/05
589	Isobutanol	by D5599	0.00	Volume Percent	TS	2/15/05
5801	t-Amyl Alcohol	by D5599	0.00	Volume Percent	TS	2/15/05
5802	n-Butanol	by D5599	0.00	Volume Percent	TS	2/15/05

NVFEL Fuel Analysis Report

13660

Kansas City Samples

Batch#

Facility Name: ERG Facility Type: In House

Owner: EPA Phone: (913) 299-9480

6636 Berger Avenue

U.S.

Samples Type: Correlation

VOC

Inspection information logged in by MM on 1/26/05.

Season: Winter

Kansas City Samples-QEB986(Ks) **FTAG: 13660** **Comments:** **Gasoline smell in container**

Test Code	Test Method	Results	Units	Fuel_ Code: 41	Analys	Analysis Date
552	MTBE by D5599	0.00	Oxy Percent		TS	2/15/05
552	MTBE by D5599	0.00	Oxy Percent		TS	2/15/05
562	ETBE by D5599	0.00	Oxy Percent		TS	2/15/05
562	ETBE by D5599	0.00	Oxy Percent		TS	2/15/05
534	Ethanol by D5599	0.00	Oxy Percent		TS	2/15/05
534	Ethanol by D5599	0.00	Oxy Percent		TS	2/15/05
572	TAME by D5599	0.00	Oxy Percent		TS	2/15/05
572	TAME by D5599	0.00	Oxy Percent		TS	2/15/05
421	Sulfur in Gasoline D2622	178	Parts Per Million		NST	3/10/05
62	Vapor Pressure by D5191 (Modified)	11.43	PS I		NST	1/27/05
65	Percent Evaporated at 200 Degrees F D86	52.7	Volume Percent		MM	2/9/05
66	Percent Evaporated at 300 Degrees F D86	85.6	Volume Percent		MM	2/9/05
48	Aromatics in Gasoline MSD D5769	23.27	Volume Percent		TW	2/8/05
49	Olefins in by FIA D1319	7.4	Volume Percent		NST	2/14/05
64	Benzene in Gasoline D3606	0.91	Volume Percent		TW	2/18/05
532	Ethanol by D5599	0.00	Volume Percent		TS	2/15/05
55	MTBE by D5599	0.00	Volume Percent		TS	2/15/05
532	Ethanol by D5599	0.00	Volume Percent		TS	2/15/05
55	MTBE by D5599	0.00	Volume Percent		TS	2/15/05
59	Weight Percent Oxygen by D5599	0.00	Weight Percent		TS	2/15/05
59	Weight Percent Oxygen by D5599	0.00	Weight Percent		TS	2/15/05
57	TAME by D5599	0.00	Volume Percent		TS	2/15/05
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent		TS	2/15/05
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent		TS	2/15/05
57	TAME by D5599	0.00	Volume Percent		TS	2/15/05
56	ETBE by D5599	0.00	Volume Percent		TS	2/15/05
56	ETBE by D5599	0.00	Volume Percent		TS	2/15/05
63	Benzene in Gasoline by GC/MSD D5769	0.89	Volume Percent		TW	2/8/05
46	Aromatics by FIA D1319	22.6	Volume Percent		NST	2/14/05
630	Toluene in gasoline by MSD D5769	5.43	Volumn Percent		TW	2/8/05
69	Specific Gravity @ 60 deg F D4052	0.7263	60/60F		MM	2/3/05
692	Degrees API D4052	63.32	Degrees API		MM	2/3/05
691	Density @ 60 deg F D4052	0.72559	g/cm-03 @ 60 deg F		MM	2/3/05

101	Initial Boiling Point	D86	86	Degrees F	MM	2/9/05
110	10 Percent	D86	111.4	Degrees F	MM	2/9/05
150	50 Percent	D86	192.6	Degrees F	MM	2/9/05
190	90 Percent	D86	320.7	Degrees F	MM	2/9/05
200	End Point	D86	419.7	Degrees F	MM	2/9/05
201	Residue	D86	0.7	mL	MM	2/9/05
202	Total Recovery	D86	97.3	mL	MM	2/9/05
203	Loss	D86	2	mL	MM	2/9/05
543	Methanol	by D5599	0.00	Volume Percent	TS	2/15/05
543	Methanol	by D5599	0.00	Volume Percent	TS	2/15/05
584	Isopropanol	by D5599	0.00	Volume Percent	TS	2/15/05
584	Isopropanol	by D5599	0.00	Volume Percent	TS	2/15/05
585	t-Butanol	by D5599	0.00	Volume Percent	TS	2/15/05
585	t-Butanol	by D5599	0.00	Volume Percent	TS	2/15/05
586	n-Propanol	by D5599	0.00	Volume Percent	TS	2/15/05
586	n-Propanol	by D5599	0.00	Volume Percent	TS	2/15/05
587	sec-Butanol	by D5599	0.00	Volume Percent	TS	2/15/05
587	sec-Butanol	by D5599	0.00	Volume Percent	TS	2/15/05
588	DIPE	by D5599	0.00	Volume Percent	TS	2/15/05
588	DIPE	by D5599	0.00	Volume Percent	TS	2/15/05
589	Isobutanol	by D5599	0.00	Volume Percent	TS	2/15/05
589	Isobutanol	by D5599	0.00	Volume Percent	TS	2/15/05
5801	t-Amyl Alcohol	by D5599	0.00	Volume Percent	TS	2/15/05
5801	t-Amyl Alcohol	by D5599	0.00	Volume Percent	TS	2/15/05
5802	n-Butanol	by D5599	0.00	Volume Percent	TS	2/15/05
5802	n-Butanol	by D5599	0.00	Volume Percent	TS	2/15/05

NVFEL Fuel Analysis Report

13661

Batch#

Kansas City Samples

Facility Name: ERG Facility Type: In House

Owner: EPA Phone: (913) 299-9480

6636 Berger Avenue

U.S.

Samples Type: Correlation

VOC

Inspection information logged in by MM on 1/26/05.

Season: Winter

Kansas City Samples-154FFB(Mo) **FTAG: 13661** **Comments:** **Gasoline smell, overpack damp; ink on label partially dissolved**

Test Code	Test Method	Results	Units	Fuel_ Code: 41	Analys	Analysis Date
552	MTBE by D5599	0.00	Oxy Percent		TS	2/15/05
562	ETBE by D5599	0.00	Oxy Percent		TS	2/15/05
534	Ethanol by D5599	0.00	Oxy Percent		TS	2/15/05
572	TAME by D5599	0.00	Oxy Percent		TS	2/15/05
421	Sulfur in Gasoline D2622	67	Parts Per Million		NST	3/10/05
62	Vapor Pressure by D5191 (Modified)	6.53	PS I		NST	1/27/05
65	Percent Evaporated at 200 Degrees F D86	40.2	Volume Percent		MM	2/9/05
66	Percent Evaporated at 300 Degrees F D86	79.6	Volume Percent		MM	2/9/05
48	Aromatics in Gasoline MSD D5769	30.79	Volume Percent		TW	2/8/05
49	Olefins in by FIA D1319	10.7	Volume Percent		NST	2/14/05
64	Benzene in Gasoline D3606	1.10	Volume Percent		TW	2/18/05
532	Ethanol by D5599	0.00	Volume Percent		TS	2/15/05
55	MTBE by D5599	0.00	Volume Percent		TS	2/15/05
59	Weight Percent Oxygen by D5599	0.00	Weight Percent		TS	2/15/05
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent		TS	2/15/05
57	TAME by D5599	0.00	Volume Percent		TS	2/15/05
56	ETBE by D5599	0.00	Volume Percent		TS	2/15/05
63	Benzene in Gasoline by GC/MSD D5769	1.07	Volume Percent		TW	2/8/05
630	Toluene in gasoline by MSD D5769	7.32	Volumn Percent		TW	2/8/05
46	Aromatics by FIA D1319	32.2	Volume Percent		NST	2/14/05
69	Specific Gravity @ 60 deg F D4052	0.75388	60/60F		MM	2/3/05
692	Degrees API D4052	56.2	Degrees API		MM	2/3/05
691	Density @ 60 deg F D4052	0.75313	g/cm-03 @ 60 deg F		MM	2/3/05
101	Initial Boiling Point D86	103.1	Degrees F		MM	2/9/05
110	10 Percent D86	141.3	Degrees F		MM	2/9/05
150	50 Percent D86	221.9	Degrees F		MM	2/9/05
190	90 Percent D86	342.3	Degrees F		MM	2/9/05
200	End Point D86	435	Degrees F		MM	2/9/05
201	Residue D86	0.8	mL		MM	2/9/05
202	Total Recovery D86	97.5	mL		MM	2/9/05
203	Loss D86	1.7	mL		MM	2/9/05
543	Methanol by D5599	0.00	Volume Percent		TS	2/15/05
584	Isopropanol by D5599	0.00	Volume Percent		TS	2/15/05

585	t-Butanol	by D5599	0.00	Volume Percent	TS	2/15/05
586	n-Propanol	by D5599	0.00	Volume Percent	TS	2/15/05
587	sec-Butanol	by D5599	0.00	Volume Percent	TS	2/15/05
588	DIPE	by D5599	0.00	Volume Percent	TS	2/15/05
589	Isobutanol	by D5599	0.00	Volume Percent	TS	2/15/05
5801	t-Amyl Alcohol	by D5599	0.00	Volume Percent	TS	2/15/05
5802	n-Butanol	by D5599	0.00	Volume Percent	TS	2/15/05

NVFEL Fuel Analysis Report

13662

Batch#

Kansas City Samples

Facility Name: ERG Facility Type: In House
Owner: EPA Phone: (913) 299-9480
6636 Berger Avenue

U.S.

Samples Type: Correlation
VOC
Inspection information logged in by MM on 1/26/05.
Season: Winter

Kansas City Samples-217RBT(Mo) **FTAG: 13662** **Comments:** **Gasoline smell; overpack damp; tape glue dissolved; label damp but rea**

Fuel_ Code: 41

Test Code	Test Method	Results	Units	Analys	Analysis Date
552	MTBE by D5599	0.00	Oxy Percent	TS	2/16/05
562	ETBE by D5599	0.00	Oxy Percent	TS	2/16/05
534	Ethanol by D5599	0.00	Oxy Percent	TS	2/16/05
572	TAME by D5599	0.00	Oxy Percent	TS	2/16/05
421	Sulfur in Gasoline D2622	153	Parts Per Million	NST	3/10/05
62	Vapor Pressure by D5191 (Modified)	8.12	PS I	NST	1/27/05
65	Percent Evaporated at 200 Degrees F D86	45.1	Volume Percent	MM	2/9/05
66	Percent Evaporated at 300 Degrees F D86	82.2	Volume Percent	MM	2/9/05
48	Aromatics in Gasoline MSD D5769	27.34	Volume Percent	TW	2/8/05
49	Olefins in by FIA D1319	9.4	Volume Percent	NST	2/14/05
64	Benzene in Gasoline D3606	1.07	Volume Percent	TW	2/18/05
532	Ethanol by D5599	0.00	Volume Percent	TS	2/16/05
55	MTBE by D5599	0.00	Volume Percent	TS	2/16/05
59	Weight Percent Oxygen by D5599	0.00	Weight Percent	TS	2/16/05
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent	TS	2/16/05
57	TAME by D5599	0.00	Volume Percent	TS	2/16/05
56	ETBE by D5599	0.00	Volume Percent	TS	2/16/05
63	Benzene in Gasoline by GC/MSD D5769	1.05	Volume Percent	TW	2/8/05
630	Toluene in gasoline by MSD D5769	5.78	Volumn Percent	TW	2/8/05
46	Aromatics by FIA D1319	28	Volume Percent	NST	2/14/05
69	Specific Gravity @ 60 deg F D4052	0.74211	60/60F	MM	2/3/05
692	Degrees API D4052	59.17	Degrees API	MM	2/3/05
691	Density @ 60 deg F D4052	0.74138	g/cm-03 @ 60 deg F	MM	2/3/05
101	Initial Boiling Point D86	96.6	Degrees F	MM	2/9/05
110	10 Percent D86	129.2	Degrees F	MM	2/9/05
150	50 Percent D86	212.2	Degrees F	MM	2/9/05
190	90 Percent D86	329.2	Degrees F	MM	2/9/05
200	End Point D86	426.4	Degrees F	MM	2/9/05
201	Residue D86	0.8	mL	MM	2/9/05
202	Total Recovery D86	98.1	mL	MM	2/9/05
203	Loss D86	1.1	mL	MM	2/9/05
543	Methanol by D5599	0.00	Volume Percent	TS	2/16/05
584	Isopropanol by D5599	0.00	Volume Percent	TS	2/16/05

585	t-Butanol	by D5599	0.00	Volume Percent	TS	2/16/05
586	n-Propanol	by D5599	0.00	Volume Percent	TS	2/16/05
587	sec-Butanol	by D5599	0.00	Volume Percent	TS	2/16/05
588	DIPE	by D5599	0.00	Volume Percent	TS	2/16/05
589	Isobutanol	by D5599	0.00	Volume Percent	TS	2/16/05
5801	t-Amyl Alcohol	by D5599	0.00	Volume Percent	TS	2/16/05
5802	n-Butanol	by D5599	0.00	Volume Percent	TS	2/16/05

NVFEL Fuel Analysis Report

13663
Batch#

Kansas City Samples

Facility Name: ERG Facility Type: In House
Owner: EPA Phone: (913) 299-9480
6636 Berger Avenue

U.S.

Samples Type: Correlation
Inspection information logged in by MM on 1/26/05.

VOC
Season: Winter

Kansas City Samples-QKU162(Ks) **FTAG: 13663** **Comments:** **Gasoline smell; overpack damp; tape glue dissolved**

Fuel_ Code: 41

Test Code	Test Method	Results	Units	Analys	Analysis Date
552	MTBE by D5599	0.00	Oxy Percent	TS	2/16/05
562	ETBE by D5599	0.00	Oxy Percent	TS	2/16/05
534	Ethanol by D5599	0.00	Oxy Percent	TS	2/16/05
572	TAME by D5599	0.00	Oxy Percent	TS	2/16/05
421	Sulfur in Gasoline D2622	115	Parts Per Million	NST	3/10/05
421	Sulfur in Gasoline D2622	115	Parts Per Million	NST	3/10/05
62	Vapor Pressure by D5191 (Modified)	6.64	PS I	NST	1/27/05
65	Percent Evaporated at 200 Degrees F D86	39	Volume Percent	MM	2/9/05
66	Percent Evaporated at 300 Degrees F D86	78.8	Volume Percent	MM	2/9/05
48	Aromatics in Gasoline MSD D5769	30.39	Volume Percent	TW	2/8/05
49	Olefins in by FIA D1319	7.6	Volume Percent	NST	2/14/05
64	Benzene in Gasoline D3606	1.24	Volume Percent	TW	2/18/05
532	Ethanol by D5599	0.00	Volume Percent	TS	2/16/05
55	MTBE by D5599	0.00	Volume Percent	TS	2/16/05
59	Weight Percent Oxygen by D5599	0.00	Weight Percent	TS	2/16/05
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent	TS	2/16/05
57	TAME by D5599	0.00	Volume Percent	TS	2/16/05
56	ETBE by D5599	0.00	Volume Percent	TS	2/16/05
63	Benzene in Gasoline by GC/MSD D5769	1.22	Volume Percent	TW	2/8/05
630	Toluene in gasoline by MSD D5769	5.92	Volumn Percent	TW	2/8/05
46	Aromatics by FIA D1319	29.8	Volume Percent	NST	2/14/05
69	Specific Gravity @ 60 deg F D4052	0.74997	60/60F	MM	2/3/05
692	Degrees API D4052	57.18	Degrees API	MM	2/3/05
691	Density @ 60 deg F D4052	0.74922	g/cm-03 @ 60 deg F	MM	2/3/05
101	Initial Boiling Point D86	102.2	Degrees F	MM	2/9/05
110	10 Percent D86	139.6	Degrees F	MM	2/9/05
150	50 Percent D86	223.7	Degrees F	MM	2/9/05
190	90 Percent D86	343	Degrees F	MM	2/9/05
200	End Point D86	412.2	Degrees F	MM	2/9/05
201	Residue D86	0.8	mL	MM	2/9/05
202	Total Recovery D86	97.9	mL	MM	2/9/05
203	Loss D86	1.3	mL	MM	2/9/05
543	Methanol by D5599	0.00	Volume Percent	TS	2/16/05

NVFEL Fuel Analysis Report

584	Isopropanol	by D5599	0.00	Volume Percent	TS	2/16/05
585	t-Butanol	by D5599	0.00	Volume Percent	TS	2/16/05
586	n-Propanol	by D5599	0.00	Volume Percent	TS	2/16/05
587	sec-Butanol	by D5599	0.00	Volume Percent	TS	2/16/05
588	DIPE	by D5599	0.00	Volume Percent	TS	2/16/05
589	Isobutanol	by D5599	0.00	Volume Percent	TS	2/16/05
5801	t-Amyl Alcohol	by D5599	0.00	Volume Percent	TS	2/16/05
5802	n-Butanol	by D5599	0.00	Volume Percent	TS	2/16/05

NVFEL Fuel Analysis Report

13716

Kansas City Samples

Batch#

Facility Name: ERG   Facility Type: In House

Owner: EPA   Phone: (913) 299-9480

6636 Berger Avenue

U.S.

Samples Type: Correlation

VOC

Inspection information logged in by MM on 2/23/05.

Season: Winter

Kansas City Samples-206JKL(Mo)   **FTAG: 13716**   **Comments:** **620; 1-29-05**

Test Code	Test Method	Results	Units	Fuel_ Code: 41	Analys	Analysis Date
552	MTBE by D5599	0.00	Oxy Percent		TS	2/28/05
562	ETBE by D5599	0.00	Oxy Percent		TS	2/28/05
534	Ethanol by D5599	0.00	Oxy Percent		TS	2/28/05
572	TAME by D5599	0.00	Oxy Percent		TS	2/28/05
421	Sulfur in Gasoline D2622	208	Parts Per Million		NST	3/31/05
62	Vapor Pressure by D5191 (Modified)	14.39	PS I		NST	2/24/05
62	Vapor Pressure by D5191 (Modified)	14.39	PS I		NST	2/24/05
65	Percent Evaporated at 200 Degrees F D86	50.9	Volume Percent		MM	3/3/05
66	Percent Evaporated at 300 Degrees F D86	84.4	Volume Percent		MM	3/3/05
48	Aromatics in Gasoline MSD D5769	21.46	Volume Percent		TW	3/4/05
49	Olefins in by FIA D1319	9.7	Volume Percent		NST	6/6/05
64	Benzene in Gasoline D3606	0.97	Volume Percent		TW	3/2/05
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent		TS	2/28/05
57	TAME by D5599	0.00	Volume Percent		TS	2/28/05
59	Weight Percent Oxygen by D5599	0.00	Weight Percent		TS	2/28/05
55	MTBE by D5599	0.00	Volume Percent		TS	2/28/05
532	Ethanol by D5599	0.00	Volume Percent		TS	2/28/05
56	ETBE by D5599	0.00	Volume Percent		TS	2/28/05
63	Benzene in Gasoline by GC/MSD D5769	0.96	Volume Percent		TW	3/4/05
46	Aromatics by FIA D1319	21	Volume Percent		NST	6/6/05
630	Toluene in gasoline by MSD D5769	4.86	Volumn Percent		TW	3/4/05
69	Specific Gravity @ 60 deg F D4052	0.72547	60/60F		MM	2/24/05
692	Degrees API D4052	63.55	Degrees API		MM	2/24/05
691	Density @ 60 deg F D4052	0.72475	g/cm-03 @ 60 deg F		MM	2/24/05
101	Initial Boiling Point D86	80.8	Degrees F		MM	3/3/05
110	10 Percent D86	99.7	Degrees F		MM	3/3/05
150	50 Percent D86	197.6	Degrees F		MM	3/3/05
190	90 Percent D86	324.1	Degrees F		MM	3/3/05
200	End Point D86	423.5	Degrees F		MM	3/3/05
201	Residue D86	0.5	mL		MM	3/3/05
202	Total Recovery D86	96.9	mL		MM	3/3/05
203	Loss D86	2.6	mL		MM	3/3/05
543	Methanol by D5599	0.00	Volume Percent		TS	2/28/05

584	Isopropanol	by D5599	0.00 Volume Percent	TS	2/28/05
585	t-Butanol	by D5599	0.00 Volume Percent	TS	2/28/05
586	n-Propanol	by D5599	0.00 Volume Percent	TS	2/28/05
587	sec-Butanol	by D5599	0.00 Volume Percent	TS	2/28/05
588	DIPE	by D5599	0.00 Volume Percent	TS	2/28/05
589	Isobutanol	by D5599	0.00 Volume Percent	TS	2/28/05
5801	t-Amyl Alcohol	by D5599	0.00 Volume Percent	TS	2/28/05
5802	n-Butanol	by D5599	0.00 Volume Percent	TS	2/28/05

NVFEL Fuel Analysis Report

13717

Kansas City Samples

Batch#

Facility Name: ERG Facility Type: In House
Owner: EPA Phone: (913) 299-9480
6636 Berger Avenue

U.S.

Samples Type: Correlation
Inspection information logged in by MM on 2/23/05.

VOC
Season: Winter

Kansas City Samples-665PS4(Mo) **FTAG: 13717** **Comments:** **#466; 12/6/04**

Test Code	Test Method	Results	Units	Fuel_ Code: 41	Analys	Analysis Date
552	MTBE by D5599	0.00	Oxy Percent		TS	2/28/05
562	ETBE by D5599	0.00	Oxy Percent		TS	2/28/05
534	Ethanol by D5599	0.00	Oxy Percent		TS	2/28/05
572	TAME by D5599	0.00	Oxy Percent		TS	2/28/05
421	Sulfur in Gasoline D2622	110	Parts Per Million		NST	3/31/05
421	Sulfur in Gasoline D2622	100	Parts Per Million		NST	3/31/05
62	Vapor Pressure by D5191 (Modified)	10.92	PS I		NST	2/24/05
65	Percent Evaporated at 200 Degrees F D86	36.3	Volume Percent		MM	3/3/05
66	Percent Evaporated at 300 Degrees F D86	86.2	Volume Percent		MM	3/3/05
48	Aromatics in Gasoline MSD D5769	30.02	Volume Percent		TW	3/4/05
49	Olefins in by FIA D1319	3.7	Volume Percent		NST	6/6/05
64	Benzene in Gasoline D3606	0.85	Volume Percent		TW	3/2/05
532	Ethanol by D5599	0.00	Volume Percent		TS	2/28/05
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent		TS	2/28/05
55	MTBE by D5599	0.00	Volume Percent		TS	2/28/05
57	TAME by D5599	0.00	Volume Percent		TS	2/28/05
59	Weight Percent Oxygen by D5599	0.00	Weight Percent		TS	2/28/05
56	ETBE by D5599	0.00	Volume Percent		TS	2/28/05
63	Benzene in Gasoline by GC/MSD D5769	0.83	Volume Percent		TW	3/4/05
46	Aromatics by FIA D1319	29.3	Volume Percent		NST	6/6/05
630	Toluene in gasoline by MSD D5769	10.89	Volumn Percent		TW	3/4/05
69	Specific Gravity @ 60 deg F D4052	0.74339	60/60F		MM	2/24/05
692	Degrees API D4052	58.84	Degrees API		MM	2/24/05
691	Density @ 60 deg F D4052	0.74266	g/cm-03 @ 60 deg F		MM	2/24/05
101	Initial Boiling Point D86	84.6	Degrees F		MM	3/3/05
110	10 Percent D86	119.1	Degrees F		MM	3/3/05
150	50 Percent D86	224.6	Degrees F		MM	3/3/05
190	90 Percent D86	317.7	Degrees F		MM	3/3/05
200	End Point D86	413.1	Degrees F		MM	3/3/05
201	Residue D86	0.8	mL		MM	3/3/05
202	Total Recovery D86	96.9	mL		MM	3/3/05
203	Loss D86	2.3	mL		MM	3/3/05
543	Methanol by D5599	0.00	Volume Percent		TS	2/28/05

584	Isopropanol	by D5599	0.00 Volume Percent	TS	2/28/05
585	t-Butanol	by D5599	0.00 Volume Percent	TS	2/28/05
586	n-Propanol	by D5599	0.00 Volume Percent	TS	2/28/05
587	sec-Butanol	by D5599	0.00 Volume Percent	TS	2/28/05
588	DIPE	by D5599	0.00 Volume Percent	TS	2/28/05
589	Isobutanol	by D5599	0.00 Volume Percent	TS	2/28/05
5801	t-Amyl Alcohol	by D5599	0.00 Volume Percent	TS	2/28/05
5802	n-Butanol	by D5599	0.00 Volume Percent	TS	2/28/05

NVFEL Fuel Analysis Report

13718

Batch#

Kansas City Samples

Facility Name: ERG Facility Type: In House

Owner: EPA Phone: (913) 299-9480

6636 Berger Avenue

U.S.

Samples Type: Correlation

VOC

Inspection information logged in by MM on 2/23/05.

Season: Winter

Kansas City Samples-QPX590 **FTAG: 13718** **Comments:** **(504); 12/16/04**

Fuel_ Code: 41

Test Code	Test Method	Results	Units	Analys	Analysis Date
552	MTBE by D5599	0.00	Oxy Percent	TS	2/28/05
562	ETBE by D5599	0.00	Oxy Percent	TS	2/28/05
534	Ethanol by D5599	0.00	Oxy Percent	TS	2/28/05
572	TAME by D5599	0.00	Oxy Percent	TS	2/28/05
421	Sulfur in Gasoline D2622	135	Parts Per Million	NST	3/31/05
62	Vapor Pressure by D5191 (Modified)	12.26	PS I	NST	2/24/05
65	Percent Evaporated at 200 Degrees F D86	47.4	Volume Percent	MM	3/3/05
66	Percent Evaporated at 300 Degrees F D86	77.7	Volume Percent	MM	3/3/05
48	Aromatics in Gasoline MSD D5769	30.75	Volume Percent	TW	3/4/05
49	Olefins in by FIA D1319	9.6	Volume Percent	NST	6/6/05
64	Benzene in Gasoline D3606	0.88	Volume Percent	TW	3/2/05
55	MTBE by D5599	0.00	Volume Percent	TS	2/28/05
57	TAME by D5599	0.00	Volume Percent	TS	2/28/05
59	Weight Percent Oxygen by D5599	0.00	Weight Percent	TS	2/28/05
532	Ethanol by D5599	0.00	Volume Percent	TS	2/28/05
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent	TS	2/28/05
56	ETBE by D5599	0.00	Volume Percent	TS	2/28/05
46	Aromatics by FIA D1319	29.9	Volume Percent	NST	6/6/05
63	Benzene in Gasoline by GC/MSD D5769	0.87	Volume Percent	TW	3/4/05
630	Toluene in gasoline by MSD D5769	5.66	Volumn Percent	TW	3/4/05
69	Specific Gravity @ 60 deg F D4052	0.74529	60/60F	MM	2/24/05
692	Degrees API D4052	58.36	Degrees API	MM	2/24/05
691	Density @ 60 deg F D4052	0.74455	g/cm-03 @ 60 deg F	MM	2/24/05
101	Initial Boiling Point D86	84.4	Degrees F	MM	3/3/05
110	10 Percent D86	108.3	Degrees F	MM	3/3/05
150	50 Percent D86	209.5	Degrees F	MM	3/3/05
190	90 Percent D86	344.8	Degrees F	MM	3/3/05
200	End Point D86	427.1	Degrees F	MM	3/3/05
201	Residue D86	0.6	mL	MM	3/3/05
202	Total Recovery D86	97.5	mL	MM	3/3/05
203	Loss D86	1.9	mL	MM	3/3/05
543	Methanol by D5599	0.00	Volume Percent	TS	2/28/05
584	Isopropanol by D5599	0.00	Volume Percent	TS	2/28/05

NVFEL Fuel Analysis Report

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585	t-Butanol	by D5599	0.00 Volume Percent	TS	2/28/05
586	n-Propanol	by D5599	0.00 Volume Percent	TS	2/28/05
587	sec-Butanol	by D5599	0.00 Volume Percent	TS	2/28/05
588	DIPE	by D5599	0.00 Volume Percent	TS	2/28/05
589	Isobutanol	by D5599	0.00 Volume Percent	TS	2/28/05
5801	t-Amyl Alcohol	by D5599	0.00 Volume Percent	TS	2/28/05
5802	n-Butanol	by D5599	0.00 Volume Percent	TS	2/28/05

NVFEL Fuel Analysis Report

13719

Kansas City Samples

Batch#

Facility Name: ERG Facility Type: In House
Owner: EPA Phone: (913) 299-9480
6636 Berger Avenue

U.S.

Samples Type: Correlation
Inspection information logged in by MM on 2/23/05.

VOC
Season: Winter

Kansas City Samples-863JKM(Mo) **FTAG: 13719** **Comments:** **615; 1-28-05**

Fuel_Code: 41

Test Code	Test Method	Results	Units	Analys	Analysis Date
552	MTBE by D5599	0.00	Oxy Percent	TS	3/1/05
562	ETBE by D5599	0.00	Oxy Percent	TS	3/1/05
534	Ethanol by D5599	0.00	Oxy Percent	TS	3/1/05
572	TAME by D5599	0.00	Oxy Percent	TS	3/1/05
421	Sulfur In Gasoline D2622	144	Parts Per Million	NST	4/18/05
62	Vapor Pressure by D5191 (Modified)	13.21	PS I	NST	2/24/05
65	Percent Evaporated at 200 Degrees F D86	47.1	Volume Percent	MM	3/3/05
66	Percent Evaporated at 300 Degrees F D86	86.1	Volume Percent	MM	3/3/05
48	Aromatics in Gasoline MSD D5769	24.31	Volume Percent	TW	3/4/05
49	Olefins in by FIA D1319	6.1	Volume Percent	NST	6/8/05
64	Benzene in Gasoline D3606	0.79	Volume Percent	TW	3/2/05
55	MTBE by D5599	0.00	Volume Percent	TS	3/1/05
57	TAME by D5599	0.00	Volume Percent	TS	3/1/05
59	Weight Percent Oxygen by D5599	0.00	Weight Percent	TS	3/1/05
532	Ethanol by D5599	0.00	Volume Percent	TS	3/1/05
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent	TS	3/1/05
56	ETBE by D5599	0.00	Volume Percent	TS	3/1/05
46	Aromatics by FIA D1319	22.5	Volume Percent	NST	6/8/05
63	Benzene in Gasoline by GC/MSD D5769	0.78	Volume Percent	TW	3/4/05
630	Toluene in gasoline by MSD D5769	6.69	Volumn Percent	TW	3/4/05
69	Specific Gravity @ 60 deg F D4052	0.7288	60/60F	MM	2/24/05
692	Degrees API D4052	62.66	Degrees API	MM	2/24/05
691	Density @ 60 deg F D4052	0.72807	g/cm-03 @ 60 deg F	MM	2/24/05
101	Initial Boiling Point D86	82.6	Degrees F	MM	3/3/05
110	10 Percent D86	102.7	Degrees F	MM	3/3/05
150	50 Percent D86	208.4	Degrees F	MM	3/3/05
190	90 Percent D86	320.7	Degrees F	MM	3/3/05
200	End Point D86	416.5	Degrees F	MM	3/3/05
201	Residue D86	0.8	mL	MM	3/3/05
202	Total Recovery D86	96.9	mL	MM	3/3/05
203	Loss D86	2.3	mL	MM	3/3/05
543	Methanol by D5599	0.00	Volume Percent	TS	3/1/05
584	Isopropanol by D5599	0.00	Volume Percent	TS	3/1/05

585	t-Butanol	by D5599	0.00	Volume Percent	TS	3/1/05
586	n-Propanol	by D5599	0.00	Volume Percent	TS	3/1/05
587	sec-Butanol	by D5599	0.00	Volume Percent	TS	3/1/05
588	DIPE	by D5599	0.00	Volume Percent	TS	3/1/05
589	Isobutanol	by D5599	0.00	Volume Percent	TS	3/1/05
5801	t-Amyl Alcohol	by D5599	0.00	Volume Percent	TS	3/1/05
5802	n-Butanol	by D5599	0.00	Volume Percent	TS	3/1/05

NVFEL Fuel Analysis Report

13720

Kansas City Samples

Batch#

Facility Name: ERG Facility Type: In House

Owner: EPA Phone: (913) 299-9480

6636 Berger Avenue

U.S.

Samples Type: Correlation

VOC

Inspection information logged in by MM on 2/23/05.

Season: Winter

Kansas City Samples-952NS5(Mo) **FTAG: 13720** **Comments:** **685; 2-14-05 cap broken, transferred to a new sample bottle**

Test Code	Test Method	Results Units	Fuel_ Code: 41	Analys	Analysis Date
552	MTBE by D5599	0.00 Oxy Percent		TS	3/1/05
552	MTBE by D5599	0.00 Oxy Percent		TS	3/1/05
562	ETBE by D5599	0.00 Oxy Percent		TS	3/1/05
562	ETBE by D5599	0.00 Oxy Percent		TS	3/1/05
534	Ethanol by D5599	0.00 Oxy Percent		TS	3/1/05
534	Ethanol by D5599	0.00 Oxy Percent		TS	3/1/05
572	TAME by D5599	0.00 Oxy Percent		TS	3/1/05
572	TAME by D5599	0.00 Oxy Percent		TS	3/1/05
421	Sulfur in Gasoline D2622	258 Parts Per Million		NST	4/18/05
62	Vapor Pressure by D5191 (Modified)	13.62 PS I		NST	2/24/05
65	Percent Evaporated at 200 Degrees F D86	50.4 Volume Percent		MM	3/3/05
66	Percent Evaporated at 300 Degrees F D86	85.1 Volume Percent		MM	3/3/05
48	Aromatics in Gasoline MSD D5769	22.6 Volume Percent		TW	3/4/05
49	Olefins in by FIA D1319	9.5 Volume Percent		NST	6/8/05
64	Benzene in Gasoline D3606	1.18 Volume Percent		TW	3/2/05
532	Ethanol by D5599	0.00 Volume Percent		TS	3/1/05
532	Ethanol by D5599	0.00 Volume Percent		TS	3/1/05
55	MTBE by D5599	0.00 Volume Percent		TS	3/1/05
55	MTBE by D5599	0.00 Volume Percent		TS	3/1/05
593	Volume Percent Oxygenates by D5599	0.00 Volume Percent		TS	3/1/05
593	Volume Percent Oxygenates by D5599	0.00 Volume Percent		TS	3/1/05
57	TAME by D5599	0.00 Volume Percent		TS	3/1/05
59	Weight Percent Oxygen by D5599	0.00 Weight Percent		TS	3/1/05
59	Weight Percent Oxygen by D5599	0.00 Weight Percent		TS	3/1/05
57	TAME by D5599	0.00 Volume Percent		TS	3/1/05
56	ETBE by D5599	0.00 Volume Percent		TS	3/1/05
56	ETBE by D5599	0.00 Volume Percent		TS	3/1/05
46	Aromatics by FIA D1319	21.8 Volume Percent		NST	6/8/05
63	Benzene in Gasoline by GC/MSD D5769	1.16 Volume Percent		TW	3/4/05
630	Toluene in gasoline by MSD D5769	5.27 Volumn Percent		TW	3/4/05
69	Specific Gravity @ 60 deg F D4052	0.7276 60/60F		MM	2/24/05
692	Degrees API D4052	62.97 Degrees API		MM	2/24/05
691	Density @ 60 deg F D4052	0.72689 g/cm-03 @ 60 deg F		MM	2/24/05

101	Initial Boiling Point	D86	79.3	Degrees F	MM	3/3/05
110	10 Percent	D86	101.3	Degrees F	MM	3/3/05
150	50 Percent	D86	199	Degrees F	MM	3/3/05
190	90 Percent	D86	319.5	Degrees F	MM	3/3/05
200	End Point	D86	402.4	Degrees F	MM	3/3/05
201	Residue	D86	0.7	mL	MM	3/3/05
202	Total Recovery	D86	96.4	mL	MM	3/3/05
203	Loss	D86	2.9	mL	MM	3/3/05
543	Methanol	by D5599	0.00	Volume Percent	TS	3/1/05
543	Methanol	by D5599	0.00	Volume Percent	TS	3/1/05
584	Isopropanol	by D5599	0.00	Volume Percent	TS	3/1/05
584	Isopropanol	by D5599	0.00	Volume Percent	TS	3/1/05
585	t-Butanol	by D5599	0.00	Volume Percent	TS	3/1/05
585	t-Butanol	by D5599	0.00	Volume Percent	TS	3/1/05
586	n-Propanol	by D5599	0.00	Volume Percent	TS	3/1/05
586	n-Propanol	by D5599	0.00	Volume Percent	TS	3/1/05
587	sec-Butanol	by D5599	0.00	Volume Percent	TS	3/1/05
587	sec-Butanol	by D5599	0.00	Volume Percent	TS	3/1/05
588	DIPE	by D5599	0.00	Volume Percent	TS	3/1/05
588	DIPE	by D5599	0.00	Volume Percent	TS	3/1/05
589	Isobutanol	by D5599	0.00	Volume Percent	TS	3/1/05
589	Isobutanol	by D5599	0.00	Volume Percent	TS	3/1/05
5801	t-Amyl Alcohol	by D5599	0.00	Volume Percent	TS	3/1/05
5801	t-Amyl Alcohol	by D5599	0.00	Volume Percent	TS	3/1/05
5802	n-Butanol	by D5599	0.00	Volume Percent	TS	3/1/05
5802	n-Butanol	by D5599	0.00	Volume Percent	TS	3/1/05

NVFEL Fuel Analysis Report

13721

Kansas City Samples

Batch#

Facility Name: ERG Facility Type: In House

Owner: EPA Phone: (913) 299-9480

6636 Berger Avenue

U.S.

Samples Type: Correlation

VOC

Inspection information logged in by MM on 2/23/05.

Season: Winter

Kansas City Samples-43H6(Mo) **FTAG: 13721** **Comments:** **575; 1-20-05**

Test Code	Test Method	Results	Units	Fuel_ Code: 41	Analys	Analysis Date
552	MTBE by D5599	0.00	Oxy Percent		TS	3/1/05
562	ETBE by D5599	0.00	Oxy Percent		TS	3/1/05
534	Ethanol by D5599	0.00	Oxy Percent		TS	3/1/05
572	TAME by D5599	0.00	Oxy Percent		TS	3/1/05
421	Sulfur in Gasoline D2622	331	Parts Per Million		NST	4/18/05
421	Sulfur in Gasoline D2622	328	Parts Per Million		NST	4/18/05
62	Vapor Pressure by D5191 (Modified)	14.14	PS I		NST	2/24/05
65	Percent Evaporated at 200 Degrees F D86	51.6	Volume Percent		MM	3/3/05
66	Percent Evaporated at 300 Degrees F D86	86	Volume Percent		MM	3/3/05
48	Aromatics in Gasoline MSD D5769	22.58	Volume Percent		TW	3/4/05
49	Olefins in by FIA D1319	8.8	Volume Percent		NST	6/8/05
64	Benzene in Gasoline D3606	1.41	Volume Percent		TW	3/2/05
532	Ethanol by D5599	0.00	Volume Percent		TS	3/1/05
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent		TS	3/1/05
55	MTBE by D5599	0.00	Volume Percent		TS	3/1/05
57	TAME by D5599	0.00	Volume Percent		TS	3/1/05
59	Weight Percent Oxygen by D5599	0.00	Weight Percent		TS	3/1/05
56	ETBE by D5599	0.00	Volume Percent		TS	3/1/05
63	Benzene in Gasoline by GC/MSD D5769	1.41	Volume Percent		TW	3/4/05
46	Aromatics by FIA D1319	22.4	Volume Percent		NST	6/8/05
630	Toluene in gasoline by MSD D5769	5.36	Volumn Percent		TW	3/4/05
69	Specific Gravity @ 60 deg F D4052	0.72821	60/60F		MM	2/24/05
692	Degrees API D4052	62.81	Degrees API		MM	2/24/05
691	Density @ 60 deg F D4052	0.72749	g/cm-03 @ 60 deg F		MM	2/24/05
101	Initial Boiling Point D86	81.5	Degrees F		MM	3/3/05
110	10 Percent D86	100	Degrees F		MM	3/3/05
150	50 Percent D86	196.3	Degrees F		MM	3/3/05
190	90 Percent D86	320.4	Degrees F		MM	3/3/05
200	End Point D86	399	Degrees F		MM	3/3/05
201	Residue D86	0.9	mL		MM	3/3/05
202	Total Recovery D86	96.7	mL		MM	3/3/05
203	Loss D86	2.4	mL		MM	3/3/05
543	Methanol by D5599	0.00	Volume Percent		TS	3/1/05

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584	Isopropanol	by D5599	0.00 Volume Percent	TS	3/1/05
585	t-Butanol	by D5599	0.00 Volume Percent	TS	3/1/05
586	n-Propanol	by D5599	0.00 Volume Percent	TS	3/1/05
587	sec-Butanol	by D5599	0.00 Volume Percent	TS	3/1/05
588	DIPE	by D5599	0.00 Volume Percent	TS	3/1/05
589	Isobutanol	by D5599	0.00 Volume Percent	TS	3/1/05
5801	t-Amyl Alcohol	by D5599	0.00 Volume Percent	TS	3/1/05
5802	n-Butanol	by D5599	0.00 Volume Percent	TS	3/1/05

NVFEL Fuel Analysis Report

13722 Batch#

Kansas City Samples

Facility Name: ERG Facility Type: In House
Owner: EPA Phone: (913) 299-9480
6636 Berger Avenue

U.S.

Samples Type: Correlation
Inspection information logged in by MM on 2/23/05.

VOC
Season: Winter

Kansas City Samples-430ALN(Mo) **FTAG: 13722** **Comments:** **634; 2-2-05**

Fuel_ Code: 41

Test Code	Test Method	Results	Units	Analys	Analysis Date
552	MTBE by D5599	0.00	Oxy Percent	TS	3/1/05
562	ETBE by D5599	0.00	Oxy Percent	TS	3/1/05
534	Ethanol by D5599	0.00	Oxy Percent	TS	3/1/05
572	TAME by D5599	0.00	Oxy Percent	TS	3/1/05
421	Sulfur in Gasoline D2622	214	Parts Per Million	NST	4/18/05
62	Vapor Pressure by D5191 (Modified)	14.45	PS I	NST	2/24/05
65	Percent Evaporated at 200 Degrees F D86	50.5	Volume Percent	MM	3/3/05
66	Percent Evaporated at 300 Degrees F D86	84.6	Volume Percent	MM	3/3/05
48	Aromatics in Gasoline MSD D5769	22.86	Volume Percent	TW	3/4/05
49	Olefins in by FIA D1319	9.2	Volume Percent	NST	6/8/05
64	Benzene in Gasoline D3606	1.21	Volume Percent	TW	3/2/05
55	MTBE by D5599	0.00	Volume Percent	TS	3/1/05
57	TAME by D5599	0.00	Volume Percent	TS	3/1/05
59	Weight Percent Oxygen by D5599	0.00	Weight Percent	TS	3/1/05
532	Ethanol by D5599	0.00	Volume Percent	TS	3/1/05
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent	TS	3/1/05
56	ETBE by D5599	0.00	Volume Percent	TS	3/1/05
46	Aromatics by FIA D1319	21.5	Volume Percent	NST	6/8/05
63	Benzene in Gasoline by GC/MSD D5769	1.19	Volume Percent	TW	3/4/05
630	Toluene in gasoline by MSD D5769	5.2	Volumn Percent	TW	3/4/05
69	Specific Gravity @ 60 deg F D4052	0.72763	60/60F	MM	2/24/05
692	Degrees API D4052	62.97	Degrees API	MM	2/24/05
691	Density @ 60 deg F D4052	0.72691	g/cm-03 @ 60 deg F	MM	2/24/05
101	Initial Boiling Point D86	79	Degrees F	MM	3/3/05
110	10 Percent D86	97.7	Degrees F	MM	3/3/05
150	50 Percent D86	198.3	Degrees F	MM	3/3/05
190	90 Percent D86	323.2	Degrees F	MM	3/3/05
200	End Point D86	406.8	Degrees F	MM	3/3/05
201	Residue D86	0.7	mL	MM	3/3/05
202	Total Recovery D86	96.3	mL	MM	3/3/05
203	Loss D86	3	mL	MM	3/3/05
543	Methanol by D5599	0.00	Volume Percent	TS	3/1/05
584	Isopropanol by D5599	0.00	Volume Percent	TS	3/1/05

585	t-Butanol	by D5599	0.00 Volume Percent	TS	3/1/05
586	n-Propanol	by D5599	0.00 Volume Percent	TS	3/1/05
587	sec-Butanol	by D5599	0.00 Volume Percent	TS	3/1/05
588	DIPE	by D5599	0.00 Volume Percent	TS	3/1/05
589	Isobutanol	by D5599	0.00 Volume Percent	TS	3/1/05
5801	t-Amyl Alcohol	by D5599	0.00 Volume Percent	TS	3/1/05
5802	n-Butanol	by D5599	0.00 Volume Percent	TS	3/1/05

NVFEL Fuel Analysis Report

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Kansas City Samples

Batch#

Facility Name: ERG Facility Type: In House

Owner: EPA Phone: (913) 299-9480

6636 Berger Avenue

U.S.

Samples Type: Correlation

VOC

Inspection information logged in by MM on 2/23/05.

Season: Winter

Kansas City Samples-VEX191(Ks) **FTAG: 13723** **Comments:** **622; 1-31-05**

Test Code	Test Method	Results	Units	Fuel_Code: 41	Analys	Analysis Date
552	MTBE by D5599	0.00	Oxy Percent		TS	3/1/05
562	ETBE by D5599	0.00	Oxy Percent		TS	3/1/05
534	Ethanol by D5599	0.00	Oxy Percent		TS	3/1/05
572	TAME by D5599	0.00	Oxy Percent		TS	3/1/05
421	Sulfur in Gasoline D2622	153	Parts Per Million		NST	4/5/05
62	Vapor Pressure by D5191 (Modified)	14.47	PS I		NST	2/24/05
62	Vapor Pressure by D5191 (Modified)	14.47	PS I		NST	2/24/05
65	Percent Evaporated at 200 Degrees F D86	50.7	Volume Percent		MM	3/4/05
66	Percent Evaporated at 300 Degrees F D86	84	Volume Percent		MM	3/4/05
49	Olefins in by FIA D1319	10.5	Volume Percent		NST	6/8/05
64	Benzene in Gasoline D3606	0.89	Volume Percent		TW	3/2/05
64	Benzene in Gasoline D3606	0.90	Volume Percent		TW	3/2/05
532	Ethanol by D5599	0.00	Volume Percent		TS	3/1/05
55	MTBE by D5599	0.00	Volume Percent		TS	3/1/05
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent		TS	3/1/05
57	TAME by D5599	0.00	Volume Percent		TS	3/1/05
59	Weight Percent Oxygen by D5599	0.00	Weight Percent		TS	3/1/05
56	ETBE by D5599	0.00	Volume Percent		TS	3/1/05
46	Aromatics by FIA D1319	21.8	Volume Percent		NST	6/8/05
69	Specific Gravity @ 60 deg F D4052	0.72636	60/60F		MM	2/24/05
69	Specific Gravity @ 60 deg F D4052	0.72622	60/60F		MM	2/24/05
692	Degrees API D4052	63.35	Degrees API		MM	2/24/05
692	Degrees API D4052	63.31	Degrees API		MM	2/24/05
691	Density @ 60 deg F D4052	0.7255	g/cm-03 @ 60 deg F		MM	2/24/05
691	Density @ 60 deg F D4052	0.72564	g/cm-03 @ 60 deg F		MM	2/24/05
101	Initial Boiling Point D86	79.9	Degrees F		MM	3/4/05
110	10 Percent D86	99.3	Degrees F		MM	3/4/05
150	50 Percent D86	198	Degrees F		MM	3/4/05
190	90 Percent D86	327.9	Degrees F		MM	3/4/05
200	End Point D86	426.7	Degrees F		MM	3/4/05
201	Residue D86	0.8	mL		MM	3/4/05
202	Total Recovery D86	96.8	mL		MM	3/4/05
203	Loss D86	2.4	mL		MM	3/4/05

543	Methanol	by D5599	0.00	Volume Percent	TS	3/1/05
584	Isopropanol	by D5599	0.00	Volume Percent	TS	3/1/05
585	t-Butanol	by D5599	0.00	Volume Percent	TS	3/1/05
586	n-Propanol	by D5599	0.00	Volume Percent	TS	3/1/05
587	sec-Butanol	by D5599	0.00	Volume Percent	TS	3/1/05
588	DIPE	by D5599	0.00	Volume Percent	TS	3/1/05
589	Isobutanol	by D5599	0.00	Volume Percent	TS	3/1/05
5801	t-Amyl Alcohol	by D5599	0.00	Volume Percent	TS	3/1/05
5802	n-Butanol	by D5599	0.00	Volume Percent	TS	3/1/05

NVFEL Fuel Analysis Report

13724

Batch#

Kansas City Samples

Facility Name: ERG Facility Type: In House
Owner: EPA Phone: (913) 299-9480
6636 Berger Avenue

U.S.

Samples Type: Correlation
Inspection information logged in by MM on 2/23/05.

VOC
Season: Winter

Kansas City Samples-TCA013(Ks) **FTAG: 13724** **Comments:** **579; 1-21-05**

Fuel_ Code: 41

Test Code	Test Method	Results	Units	Analys	Analysis Date
552	MTBE by D5599	0.00	Oxy Percent	TS	3/1/05
562	ETBE by D5599	0.00	Oxy Percent	TS	3/1/05
534	Ethanol by D5599	0.00	Oxy Percent	TS	3/1/05
572	TAME by D5599	0.00	Oxy Percent	TS	3/1/05
421	Sulfur in Gasoline D2622	129	Parts Per Million	NST	4/5/05
62	Vapor Pressure by D5191 (Modified)	14.53	PS I	NST	2/24/05
65	Percent Evaporated at 200 Degrees F D86	50.5	Volume Percent	MM	3/4/05
66	Percent Evaporated at 300 Degrees F D86	84.4	Volume Percent	MM	3/4/05
49	Olefins in by FIA D1319	10	Volume Percent	NST	6/8/05
64	Benzene in Gasoline D3606	0.89	Volume Percent	TW	3/2/05
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent	TS	3/1/05
55	MTBE by D5599	0.00	Volume Percent	TS	3/1/05
532	Ethanol by D5599	0.00	Volume Percent	TS	3/1/05
57	TAME by D5599	0.00	Volume Percent	TS	3/1/05
59	Weight Percent Oxygen by D5599	0.00	Weight Percent	TS	3/1/05
56	ETBE by D5599	0.00	Volume Percent	TS	3/1/05
46	Aromatics by FIA D1319	20.5	Volume Percent	NST	6/8/05
69	Specific Gravity @ 60 deg F D4052	0.72433	60/60F	MM	2/24/05
692	Degrees API D4052	63.85	Degrees API	MM	2/24/05
691	Density @ 60 deg F D4052	0.72361	g/cm-03 @ 60 deg F	MM	2/24/05
101	Initial Boiling Point D86	78.1	Degrees F	MM	3/4/05
110	10 Percent D86	97.2	Degrees F	MM	3/4/05
150	50 Percent D86	198.7	Degrees F	MM	3/4/05
190	90 Percent D86	328.3	Degrees F	MM	3/4/05
200	End Point D86	433.2	Degrees F	MM	3/4/05
201	Residue D86	0.5	mL	MM	3/4/05
202	Total Recovery D86	97	mL	MM	3/4/05
203	Loss D86	2.5	mL	MM	3/4/05
543	Methanol by D5599	0.00	Volume Percent	TS	3/1/05
584	Isopropanol by D5599	0.00	Volume Percent	TS	3/1/05
585	t-Butanol by D5599	0.00	Volume Percent	TS	3/1/05
586	n-Propanol by D5599	0.00	Volume Percent	TS	3/1/05
587	sec-Butanol by D5599	0.00	Volume Percent	TS	3/1/05

588	DIPE	by D5599	0.00	Volume Percent	TS	3/1/05
589	Isobutanol	by D5599	0.00	Volume Percent	TS	3/1/05
5801	t-Amyl Alcohol	by D5599	0.00	Volume Percent	TS	3/1/05
5802	n-Butanol	by D5599	0.00	Volume Percent	TS	3/1/05

NVFEL Fuel Analysis Report

13725 Batch#

Kansas City Samples

Facility Name: ERG Facility Type: In House

Owner: EPA Phone: (913) 299-9480

6636 Berger Avenue

U.S.

Samples Type: Correlation

VOC

Inspection information logged in by MM on 2/23/05.

Season: Winter

Kansas City Samples-298MSB(Mo) **FTAG: 13725** **Comments:** **568; 1-19-05**

Test Code	Test Method	Results	Units	Fuel_ Code: 41	Analys	Analysis Date
552	MTBE by D5599	0.00	Oxy Percent		TS	3/1/05
562	ETBE by D5599	0.00	Oxy Percent		TS	3/1/05
534	Ethanol by D5599	0.00	Oxy Percent		TS	3/1/05
572	TAME by D5599	0.00	Oxy Percent		TS	3/1/05
421	Sulfur in Gasoline D2622	103	Parts Per Million		NST	4/5/05
62	Vapor Pressure by D5191 (Modified)	12.82	PSI		NST	2/24/05
65	Percent Evaporated at 200 Degrees F D86	44.3	Volume Percent		MM	3/8/05
66	Percent Evaporated at 300 Degrees F D86	85.7	Volume Percent		MM	3/8/05
49	Olefins in by FIA D1319	5.3	Volume Percent		NST	6/8/05
64	Benzene in Gasoline D3606	0.87	Volume Percent		TW	3/2/05
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent		TS	3/1/05
55	MTBE by D5599	0.00	Volume Percent		TS	3/1/05
532	Ethanol by D5599	0.00	Volume Percent		TS	3/1/05
57	TAME by D5599	0.00	Volume Percent		TS	3/1/05
59	Weight Percent Oxygen by D5599	0.00	Weight Percent		TS	3/1/05
56	ETBE by D5599	0.00	Volume Percent		TS	3/1/05
46	Aromatics by FIA D1319	24.5	Volume Percent		NST	6/8/05
69	Specific Gravity @ 60 deg F D4052	0.73125	60/60F		MM	2/24/05
692	Degrees API D4052	62.01	Degrees API		MM	2/24/05
691	Density @ 60 deg F D4052	0.73052	g/cm-03 @ 60 deg F		MM	2/24/05
101	Initial Boiling Point D86	82.4	Degrees F		MM	3/8/05
110	10 Percent D86	105.3	Degrees F		MM	3/8/05
150	50 Percent D86	214.7	Degrees F		MM	3/8/05
190	90 Percent D86	320.5	Degrees F		MM	3/8/05
200	End Point D86	409.5	Degrees F		MM	3/8/05
201	Residue D86	0.8	mL		MM	3/8/05
202	Total Recovery D86	96.9	mL		MM	3/8/05
203	Loss D86	2.3	mL		MM	3/8/05
543	Methanol by D5599	0.00	Volume Percent		TS	3/1/05
584	Isopropanol by D5599	0.00	Volume Percent		TS	3/1/05
585	t-Butanol by D5599	0.00	Volume Percent		TS	3/1/05
586	n-Propanol by D5599	0.00	Volume Percent		TS	3/1/05
587	sec-Butanol by D5599	0.00	Volume Percent		TS	3/1/05

588	DIPE	by D5599	0.00	Volume Percent	TS	3/1/05
589	Isobutanol	by D5599	0.00	Volume Percent	TS	3/1/05
5801	t-Amyl Alcohol	by D5599	0.00	Volume Percent	TS	3/1/05
5802	n-Butanol	by D5599	0.00	Volume Percent	TS	3/1/05

NVFEL Fuel Analysis Report

13726

Batch#

Kansas City Samples

Facility Name: ERG Facility Type: In House

Owner: EPA Phone: (913) 299-9480

6636 Berger Avenue

U.S.

Samples Type: Correlation

VOC

Inspection information logged in by MM on 2/23/05.

Season: Winter

Kansas City Samples-480EAA(Mo) **FTAG: 13726** **Comments:** **83; 7-30-04**

Test Code	Test Method	Results	Units	Fuel_ Code: 41	Analys	Analysis Date
552	MTBE by D5599	0.00	Oxy Percent		TS	3/1/05
562	ETBE by D5599	0.00	Oxy Percent		TS	3/1/05
534	Ethanol by D5599	0.00	Oxy Percent		TS	3/1/05
572	TAME by D5599	0.00	Oxy Percent		TS	3/1/05
421	Sulfur in Gasoline D2622	43	Parts Per Million		NST	4/5/05
62	Vapor Pressure by D5191 (Modified)	6.95	PS I		NST	2/24/05
65	Percent Evaporated at 200 Degrees F D86	30.8	Volume Percent		MM	3/8/05
66	Percent Evaporated at 300 Degrees F D86	85.3	Volume Percent		MM	3/8/05
49	Olefins in by FIA D1319	2.3	Volume Percent		NST	6/8/05
64	Benzene in Gasoline D3606	1.61	Volume Percent		TW	3/2/05
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent		TS	3/1/05
55	MTBE by D5599	0.00	Volume Percent		TS	3/1/05
532	Ethanol by D5599	0.00	Volume Percent		TS	3/1/05
57	TAME by D5599	0.00	Volume Percent		TS	3/1/05
59	Weight Percent Oxygen by D5599	0.00	Weight Percent		TS	3/1/05
56	ETBE by D5599	0.00	Volume Percent		TS	3/1/05
46	Aromatics by FIA D1319	27.9	Volume Percent		NST	6/8/05
69	Specific Gravity @ 60 deg F D4052	0.7468	60/60F		MM	2/24/05
692	Degrees API D4052	57.97	Degrees API		MM	2/24/05
691	Density @ 60 deg F D4052	0.74607	g/cm-03 @ 60 deg F		MM	2/24/05
101	Initial Boiling Point D86	98.4	Degrees F		MM	3/8/05
110	10 Percent D86	150.8	Degrees F		MM	3/8/05
150	50 Percent D86	227.3	Degrees F		MM	3/8/05
190	90 Percent D86	322.2	Degrees F		MM	3/8/05
200	End Point D86	406.2	Degrees F		MM	3/8/05
201	Residue D86	0.9	mL		MM	3/8/05
202	Total Recovery D86	98	mL		MM	3/8/05
203	Loss D86	1.1	mL		MM	3/8/05
543	Methanol by D5599	0.00	Volume Percent		TS	3/1/05
584	Isopropanol by D5599	0.00	Volume Percent		TS	3/1/05
585	t-Butanol by D5599	0.00	Volume Percent		TS	3/1/05
586	n-Propanol by D5599	0.00	Volume Percent		TS	3/1/05
587	sec-Butanol by D5599	0.00	Volume Percent		TS	3/1/05

588	DIPE	by D5599	0.00 Volume Percent	TS	3/1/05
589	Isobutanol	by D5599	0.00 Volume Percent	TS	3/1/05
5801	t-Amyl Alcohol	by D5599	0.00 Volume Percent	TS	3/1/05
5802	n-Butanol	by D5599	0.00 Volume Percent	TS	3/1/05

NVFEL Fuel Analysis Report

13727

Kansas City Samples

Batch#

Facility Name: ERG   Facility Type: In House

Owner: EPA   Phone: (913) 299-9480

6636 Berger Avenue

U.S.

Samples Type: Correlation

VOC

Inspection information logged in by MM on 2/23/05.

Season: Winter

Kansas City Samples-QPW234(Ks)   **FTAG: 13727**   **Comments:**   **#123; 8/7/04**

Test Code	Test Method	Results	Units	Fuel_ Code: 41	Analys	Analysis Date
552	MTBE by D5599	0.00	Oxy Percent		TS	3/1/05
562	ETBE by D5599	0.00	Oxy Percent		TS	3/1/05
534	Ethanol by D5599	0.00	Oxy Percent		TS	3/1/05
572	TAME by D5599	0.00	Oxy Percent		TS	3/1/05
421	Sulfur In Gasoline D2622	313	Parts Per Million		NST	4/5/05
62	Vapor Pressure by D5191 (Modified)	8.57	PS I		NST	2/24/05
65	Percent Evaporated at 200 Degrees F D86	44.1	Volume Percent		MM	3/8/05
66	Percent Evaporated at 300 Degrees F D86	82.5	Volume Percent		MM	3/8/05
49	Olefins In by FIA D1319	10	Volume Percent		NST	6/9/05
64	Benzene In Gasoline D3606	0.94	Volume Percent		TW	3/2/05
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent		TS	3/1/05
55	MTBE by D5599	0.00	Volume Percent		TS	3/1/05
532	Ethanol by D5599	0.00	Volume Percent		TS	3/1/05
57	TAME by D5599	0.00	Volume Percent		TS	3/1/05
59	Weight Percent Oxygen by D5599	0.00	Weight Percent		TS	3/1/05
56	ETBE by D5599	0.00	Volume Percent		TS	3/1/05
46	Aromatics by FIA D1319	21.2	Volume Percent		NST	6/9/05
69	Specific Gravity @ 60 deg F D4052	0.73475	60/60F		MM	2/24/05
692	Degrees API D4052	61.08	Degrees API		MM	2/24/05
691	Density @ 60 deg F D4052	0.73402	g/cm-03 @ 60 deg F		MM	2/24/05
101	Initial Boiling Point D86	93.9	Degrees F		MM	3/8/05
110	10 Percent D86	130.5	Degrees F		MM	3/8/05
150	50 Percent D86	212.7	Degrees F		MM	3/8/05
190	90 Percent D86	333.7	Degrees F		MM	3/8/05
200	End Point D86	411.3	Degrees F		MM	3/8/05
201	Residue D86	0.9	mL		MM	3/8/05
202	Total Recovery D86	97.6	mL		MM	3/8/05
203	Loss D86	1.5	mL		MM	3/8/05
543	Methanol by D5599	0.00	Volume Percent		TS	3/1/05
584	Isopropanol by D5599	0.00	Volume Percent		TS	3/1/05
585	t-Butanol by D5599	0.00	Volume Percent		TS	3/1/05
586	n-Propanol by D5599	0.00	Volume Percent		TS	3/1/05
587	sec-Butanol by D5599	0.00	Volume Percent		TS	3/1/05

588	DIPE	by D5599	0.00 Volume Percent	TS	3/1/05
589	Isobutanol	by D5599	0.00 Volume Percent	TS	3/1/05
5801	t-Amyl Alcohol	by D5599	0.00 Volume Percent	TS	3/1/05
5802	n-Butanol	by D5599	0.00 Volume Percent	TS	3/1/05

NVFEL Fuel Analysis Report

13728

Kansas City Samples

Batch#

Facility Name: ERG Facility Type: In House

Owner: EPA Phone: (913) 299-9480

6636 Berger Avenue

U.S.

Samples Type: Correlation

VOC

Inspection information logged in by MM on 2/23/05.

Season: Winter

Kansas City Samples-254EZ8 **FTAG: 13728** **Comments:** **(5); License #; 7/13/04**

Test Code	Test Method	Results	Units	Fuel_ Code: 41	Analys	Analysis Date
552	MTBE by D5599	0.00	Oxy Percent		TS	3/1/05
562	ETBE by D5599	0.00	Oxy Percent		TS	3/1/05
534	Ethanol by D5599	0.00	Oxy Percent		TS	3/1/05
572	TAME by D5599	0.00	Oxy Percent		TS	3/1/05
421	Sulfur in Gasoline D2622	70	Parts Per Million		NST	4/5/05
62	Vapor Pressure by D5191 (Modified)	6.77	PS I		NST	2/24/05
65	Percent Evaporated at 200 Degrees F D86	38.8	Volume Percent		MM	3/8/05
66	Percent Evaporated at 300 Degrees F D86	79	Volume Percent		MM	3/8/05
49	Olefins in by FIA D1319	11.4	Volume Percent		NST	6/9/05
49	Olefins in by FIA D1319	12.8	Volume Percent		NST	6/9/05
64	Benzene in Gasoline D3606	0.95	Volume Percent		TW	3/2/05
59	Weight Percent Oxygen by D5599	0.00	Weight Percent		TS	3/1/05
532	Ethanol by D5599	0.00	Volume Percent		TS	3/1/05
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent		TS	3/1/05
57	TAME by D5599	0.00	Volume Percent		TS	3/1/05
55	MTBE by D5599	0.00	Volume Percent		TS	3/1/05
56	ETBE by D5599	0.00	Volume Percent		TS	3/1/05
46	Aromatics by FIA D1319	29.2	Volume Percent		NST	6/9/05
46	Aromatics by FIA D1319	29.7	Volume Percent		NST	6/9/05
69	Specific Gravity @ 60 deg F D4052	0.75182	60/60F		MM	2/24/05
692	Degrees API D4052	56.71	Degrees API		MM	2/24/05
691	Density @ 60 deg F D4052	0.75108	g/cm-03 @ 60 deg F		MM	2/24/05
101	Initial Boiling Point D86	101.5	Degrees F		MM	3/8/05
110	10 Percent D86	141.4	Degrees F		MM	3/8/05
150	50 Percent D86	225.3	Degrees F		MM	3/8/05
190	90 Percent D86	347.7	Degrees F		MM	3/8/05
200	End Point D86	427.8	Degrees F		MM	3/8/05
201	Residue D86	0.9	mL		MM	3/8/05
202	Total Recovery D86	97.8	mL		MM	3/8/05
203	Loss D86	1.3	mL		MM	3/8/05
543	Methanol by D5599	0.00	Volume Percent		TS	3/1/05
584	Isopropanol by D5599	0.00	Volume Percent		TS	3/1/05
585	t-Butanol by D5599	0.00	Volume Percent		TS	3/1/05

586	n-Propanol	by D5599	0.00 Volume Percent	TS	3/1/05
587	sec-Butanol	by D5599	0.00 Volume Percent	TS	3/1/05
588	DIPE	by D5599	0.00 Volume Percent	TS	3/1/05
589	Isobutanol	by D5599	0.00 Volume Percent	TS	3/1/05
5801	t-Amyl Alcohol	by D5599	0.00 Volume Percent	TS	3/1/05
5802	n-Butanol	by D5599	0.00 Volume Percent	TS	3/1/05

NVFEL Fuel Analysis Report

13729

Batch#

Kansas City Samples

Facility Name: ERG Facility Type: In House
Owner: EPA Phone: (913) 299-9480
6636 Berger Avenue

U.S.

Samples Type: Correlation

VOC

Inspection information logged in by MM on 2/23/05.

Season: Winter

Kansas City Samples-TBG337(Ks) **FTAG: 13729** **Comments:** **306; 9/10/03**

Fuel_ Code: 41

Test Code	Test Method	Results	Units	Analys	Analysis Date
552	MTBE by D5599	0.00	Oxy Percent	TS	3/1/05
562	ETBE by D5599	0.00	Oxy Percent	TS	3/1/05
534	Ethanol by D5599	0.00	Oxy Percent	TS	3/1/05
572	TAME by D5599	0.00	Oxy Percent	TS	3/1/05
421	Sulfur in Gasoline D2622	154	Parts Per Million	NST	4/18/05
62	Vapor Pressure by D5191 (Modified)	6.77	PS I	NST	2/24/05
65	Percent Evaporated at 200 Degrees F D86	38.3	Volume Percent	MM	3/8/05
66	Percent Evaporated at 300 Degrees F D86	80.7	Volume Percent	MM	3/8/05
48	Aromatics in Gasoline MSD D5769	35.1	Volume Percent	TW	3/4/05
49	Olefins in by FIA D1319	9.7	Volume Percent	NST	6/9/05
64	Benzene in Gasoline D3606	1.81	Volume Percent	TW	3/2/05
59	Weight Percent Oxygen by D5599	0.00	Weight Percent	TS	3/1/05
532	Ethanol by D5599	0.00	Volume Percent	TS	3/1/05
55	MTBE by D5599	0.00	Volume Percent	TS	3/1/05
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent	TS	3/1/05
57	TAME by D5599	0.00	Volume Percent	TS	3/1/05
56	ETBE by D5599	0.00	Volume Percent	TS	3/1/05
46	Aromatics by FIA D1319	35.2	Volume Percent	NST	6/9/05
630	Toluene in gasoline by MSD D5769	8.06	Volumn Percent	TW	3/4/05
63	Benzene in Gasoline by GC/MSD D5769	1.81	Volume Percent	TW	3/4/05
69	Specific Gravity @ 60 deg F D4052	0.76097	60/60F	MM	2/24/05
69	Specific Gravity @ 60 deg F D4052	0.76093	60/60F	MM	2/24/05
692	Degrees API D4052	54.45	Degrees API	MM	2/24/05
692	Degrees API D4052	54.46	Degrees API	MM	2/24/05
691	Density @ 60 deg F D4052	0.76021	g/cm-03 @ 60 deg F	MM	2/24/05
691	Density @ 60 deg F D4052	0.76018	g/cm-03 @ 60 deg F	MM	2/24/05
101	Initial Boiling Point D86	101.3	Degrees F	MM	3/8/05
110	10 Percent D86	144.1	Degrees F	MM	3/8/05
150	50 Percent D86	226.4	Degrees F	MM	3/8/05
190	90 Percent D86	329.5	Degrees F	MM	3/8/05
200	End Point D86	414.7	Degrees F	MM	3/8/05
201	Residue D86	0.8	mL	MM	3/8/05
202	Total Recovery D86	98.2	mL	MM	3/8/05

203	Loss	D86	1 mL		MM	3/8/05
543	Methanol	by D5599	0.00	Volume Percent	TS	3/1/05
584	Isopropanol	by D5599	0.00	Volume Percent	TS	3/1/05
585	t-Butanol	by D5599	0.00	Volume Percent	TS	3/1/05
586	n-Propanol	by D5599	0.00	Volume Percent	TS	3/1/05
587	sec-Butanol	by D5599	0.00	Volume Percent	TS	3/1/05
588	DIPE	by D5599	0.00	Volume Percent	TS	3/1/05
589	Isobutanol	by D5599	0.00	Volume Percent	TS	3/1/05
5801	t-Amyl Alcohol	by D5599	0.00	Volume Percent	TS	3/1/05
5802	n-Butanol	by D5599	0.00	Volume Percent	TS	3/1/05

NVFEL Fuel Analysis Report

Batch# 13730

Kansas City Samples

Facility Name: ERG Facility Type: In House
Owner: EPA Phone: (913) 299-9480
6636 Berger Avenue

U.S.

Samples Type: Correlation
Inspection information logged in by MM on 2/24/05.

VOC
Season: Winter

Kansas City Samples-109 FTAG: 13730 Comments: 8/5/04

Fuel_ Code: 41

Test Code	Test Method	Results	Units	Analys	Analysis Date
552	MTBE by D5599	0.00	Oxy Percent	TS	3/1/05
552	MTBE by D5599	0.00	Oxy Percent	TS	3/1/05
562	ETBE by D5599	0.00	Oxy Percent	TS	3/1/05
562	ETBE by D5599	0.00	Oxy Percent	TS	3/1/05
534	Ethanol by D5599	0.00	Oxy Percent	TS	3/1/05
534	Ethanol by D5599	0.00	Oxy Percent	TS	3/1/05
572	TAME by D5599	0.00	Oxy Percent	TS	3/1/05
572	TAME by D5599	0.00	Oxy Percent	TS	3/1/05
421	Sulfur in Gasoline D2622	117	Parts Per Million	NST	4/18/05
62	Vapor Pressure by D5191 (Modified)	6.38	PS I	NST	2/24/05
65	Percent Evaporated at 200 Degrees F D86	36.6	Volume Percent	MM	3/8/05
66	Percent Evaporated at 300 Degrees F D86	80.9	Volume Percent	MM	3/8/05
48	Aromatics in Gasoline MSD D5769	30.08	Volume Percent	TW	3/4/05
49	Olefins in by FIA D1319	8.6	Volume Percent	NST	6/9/05
64	Benzene in Gasoline D3606	1.46	Volume Percent	TW	3/2/05
532	Ethanol by D5599	0.00	Volume Percent	TS	3/1/05
55	MTBE by D5599	0.00	Volume Percent	TS	3/1/05
55	MTBE by D5599	0.00	Volume Percent	TS	3/1/05
532	Ethanol by D5599	0.00	Volume Percent	TS	3/1/05
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent	TS	3/1/05
57	TAME by D5599	0.00	Volume Percent	TS	3/1/05
57	TAME by D5599	0.00	Volume Percent	TS	3/1/05
59	Weight Percent Oxygen by D5599	0.00	Weight Percent	TS	3/1/05
59	Weight Percent Oxygen by D5599	0.00	Weight Percent	TS	3/1/05
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent	TS	3/1/05
56	ETBE by D5599	0.00	Volume Percent	TS	3/1/05
56	ETBE by D5599	0.00	Volume Percent	TS	3/1/05
63	Benzene in Gasoline by GC/MSD D5769	1.45	Volume Percent	TW	3/4/05
630	Toluene in gasoline by MSD D5769	6.61	Volumn Percent	TW	3/4/05
46	Aromatics by FIA D1319	30	Volume Percent	NST	6/9/05
69	Specific Gravity @ 60 deg F D4052	0.75363	60/60F	MM	2/25/05
69	Specific Gravity @ 60 deg F D4052	0.75364	60/60F	MM	2/25/05
692	Degrees API D4052	56.26	Degrees API	MM	2/25/05

NVFEL Fuel Analysis Report

13730

692	Degrees API	D4052	56.26 Degrees API	MM	2/25/05
691	Density @ 60 deg F	D4052	0.75288 g/cm-03 @ 60 deg F	MM	2/25/05
691	Density @ 60 deg F	D4052	0.75289 g/cm-03 @ 60 deg F	MM	2/25/05
101	Initial Boiling Point	D86	103.5 Degrees F	MM	3/8/05
110	10 Percent	D86	148.3 Degrees F	MM	3/8/05
150	50 Percent	D86	224.8 Degrees F	MM	3/8/05
190	90 Percent	D86	334.9 Degrees F	MM	3/8/05
200	End Point	D86	432 Degrees F	MM	3/8/05
201	Residue	D86	0.9 mL	MM	3/8/05
202	Total Recovery	D86	98.2 mL	MM	3/8/05
203	Loss	D86	0.9 mL	MM	3/8/05
543	Methanol	by D5599	0.00 Volume Percent	TS	3/1/05
543	Methanol	by D5599	0.00 Volume Percent	TS	3/1/05
584	Isopropanol	by D5599	0.00 Volume Percent	TS	3/1/05
584	Isopropanol	by D5599	0.00 Volume Percent	TS	3/1/05
585	t-Butanol	by D5599	0.00 Volume Percent	TS	3/1/05
585	t-Butanol	by D5599	0.00 Volume Percent	TS	3/1/05
586	n-Propanol	by D5599	0.00 Volume Percent	TS	3/1/05
586	n-Propanol	by D5599	0.00 Volume Percent	TS	3/1/05
587	sec-Butanol	by D5599	0.00 Volume Percent	TS	3/1/05
587	sec-Butanol	by D5599	0.00 Volume Percent	TS	3/1/05
588	DIPE	by D5599	0.00 Volume Percent	TS	3/1/05
588	DIPE	by D5599	0.00 Volume Percent	TS	3/1/05
589	Isobutanol	by D5599	0.00 Volume Percent	TS	3/1/05
589	Isobutanol	by D5599	0.00 Volume Percent	TS	3/1/05
5801	t-Amyl Alcohol	by D5599	0.00 Volume Percent	TS	3/1/05
5801	t-Amyl Alcohol	by D5599	0.00 Volume Percent	TS	3/1/05
5802	n-Butanol	by D5599	0.00 Volume Percent	TS	3/1/05
5802	n-Butanol	by D5599	0.00 Volume Percent	TS	3/1/05

Batch#

Kansas City Samples

Facility Name: ERG Facility Type: In House
Owner: EPA Phone: (913) 299-9480
6636 Berger Avenue

U.S.

Samples Type: Correlation

VOC

Inspection information logged in by MM on 2/24/05.

Season: Winter

Kansas City Samples-765RBW(Mo) **FTAG: 13731** **Comments:** **8-4-04**

Test Code	Test Method	Results	Units	Fuel_ Code: 41	Analys	Analysis Date
552	MTBE by D5599	0.00	Oxy Percent		TS	3/2/05
562	ETBE by D5599	0.00	Oxy Percent		TS	3/2/05
534	Ethanol by D5599	0.00	Oxy Percent		TS	3/2/05
572	TAME by D5599	0.00	Oxy Percent		TS	3/2/05
421	Sulfur in Gasoline D2622	146	Parts Per Million		NST	4/18/05
62	Vapor Pressure by D5191 (Modified)	6.47	PS I		NST	2/24/05
65	Percent Evaporated at 200 Degrees F D86	38.5	Volume Percent		MM	3/9/05
66	Percent Evaporated at 300 Degrees F D86	81	Volume Percent		MM	3/9/05
48	Aromatics in Gasoline MSD D5769	31.7	Volume Percent		TW	3/4/05
49	Olefins in by FIA D1319	8.6	Volume Percent		NST	6/9/05
64	Benzene in Gasoline D3606	1.58	Volume Percent		TW	3/2/05
55	MTBE by D5599	0.00	Volume Percent		TS	3/2/05
59	Weight Percent Oxygen by D5599	0.00	Weight Percent		TS	3/2/05
57	TAME by D5599	0.00	Volume Percent		TS	3/2/05
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent		TS	3/2/05
532	Ethanol by D5599	0.00	Volume Percent		TS	3/2/05
56	ETBE by D5599	0.00	Volume Percent		TS	3/2/05
630	Toluene in gasoline by MSD D5769	6.95	Volumn Percent		TW	3/4/05
63	Benzene in Gasoline by GC/MSD D5769	1.58	Volume Percent		TW	3/4/05
46	Aromatics by FIA D1319	31.8	Volume Percent		NST	6/9/05
69	Specific Gravity @ 60 deg F D4052	0.75518	60/60F		MM	2/25/05
692	Degrees API D4052	55.87	Degrees API		MM	2/25/05
691	Density @ 60 deg F D4052	0.75444	g/cm-03 @ 60 deg F		MM	2/25/05
101	Initial Boiling Point D86	101.7	Degrees F		MM	3/9/05
110	10 Percent D86	144.9	Degrees F		MM	3/9/05
150	50 Percent D86	222.1	Degrees F		MM	3/9/05
190	90 Percent D86	332.1	Degrees F		MM	3/9/05
200	End Point D86	426.4	Degrees F		MM	3/9/05
201	Residue D86	0.9	mL		MM	3/9/05
202	Total Recovery D86	98.1	mL		MM	3/9/05
203	Loss D86	1	mL		MM	3/9/05
543	Methanol by D5599	0.00	Volume Percent		TS	3/2/05
584	Isopropanol by D5599	0.00	Volume Percent		TS	3/2/05

585	t-Butanol	by D5599	0.00	Volume Percent	TS	3/2/05
586	n-Propanol	by D5599	0.00	Volume Percent	TS	3/2/05
587	sec-Butanol	by D5599	0.00	Volume Percent	TS	3/2/05
588	DIPE	by D5599	0.00	Volume Percent	TS	3/2/05
589	Isobutanol	by D5599	0.00	Volume Percent	TS	3/2/05
5801	t-Amyl Alcohol	by D5599	0.00	Volume Percent	TS	3/2/05
5802	n-Butanol	by D5599	0.00	Volume Percent	TS	3/2/05

NVFEL Fuel Analysis Report

13732

Kansas City Samples

Batch#

Facility Name: ERG Facility Type: In House
Owner: EPA Phone: (913) 299-9480
6636 Berger Avenue

U.S.

Samples Type: Correlation
Inspection information logged in by MM on 2/24/05.

VOC
Season: Winter

Kansas City Samples-820WSN(Mo) **FTAG: 13732** **Comments:** **153; 8/13/04**

Test Code	Test Method	Results	Units	Fuel_ Code: 41	Analys	Analysis Date
552	MTBE by D5599	0.00	Oxy Percent		TS	3/2/05
562	ETBE by D5599	0.00	Oxy Percent		TS	3/2/05
534	Ethanol by D5599	0.00	Oxy Percent		TS	3/2/05
572	TAME by D5599	0.00	Oxy Percent		TS	3/2/05
421	Sulfur in Gasoline D2622	133	Parts Per Million		NST	4/18/05
62	Vapor Pressure by D5191 (Modified)	6.93	PS I		NST	2/24/05
65	Percent Evaporated at 200 Degrees F D86	38.9	Volume Percent		MM	3/9/05
66	Percent Evaporated at 300 Degrees F D86	80.5	Volume Percent		MM	3/9/05
48	Aromatics in Gasoline MSD D5769	33.96	Volume Percent		TW	3/4/05
49	Olefins in by FIA D1319	8.2	Volume Percent		NST	6/20/05
49	Olefins in by FIA D1319	8.4	Volume Percent		NST	6/20/05
64	Benzene in Gasoline D3606	1.86	Volume Percent		TW	3/2/05
532	Ethanol by D5599	0.00	Volume Percent		TS	3/2/05
57	TAME by D5599	0.00	Volume Percent		TS	3/2/05
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent		TS	3/2/05
59	Weight Percent Oxygen by D5599	0.00	Weight Percent		TS	3/2/05
55	MTBE by D5599	0.00	Volume Percent		TS	3/2/05
56	ETBE by D5599	0.00	Volume Percent		TS	3/2/05
46	Aromatics by FIA D1319	35.4	Volume Percent		NST	6/20/05
630	Toluene in gasoline by MSD D5769	7.61	Volumn Percent		TW	3/4/05
63	Benzene in Gasoline by GC/MSD D5769	1.84	Volume Percent		TW	3/4/05
46	Aromatics by FIA D1319	35.2	Volume Percent		NST	6/20/05
69	Specific Gravity @ 60 deg F D4052	0.75836	60/60F		MM	2/25/05
692	Degrees API D4052	55.09	Degrees API		MM	2/25/05
691	Density @ 60 deg F D4052	0.75761	g/cm-03 @ 60 deg F		MM	2/25/05
101	Initial Boiling Point D86	101.8	Degrees F		MM	3/9/05
110	10 Percent D86	141.8	Degrees F		MM	3/9/05
150	50 Percent D86	224.1	Degrees F		MM	3/9/05
190	90 Percent D86	335.8	Degrees F		MM	3/9/05
200	End Point D86	422.8	Degrees F		MM	3/9/05
201	Residue D86	0.9	mL		MM	3/9/05
202	Total Recovery D86	98.1	mL		MM	3/9/05
203	Loss D86	1	mL		MM	3/9/05

543	Methanol	by D5599	0.00	Volume Percent	TS	3/2/05
584	Isopropanol	by D5599	0.00	Volume Percent	TS	3/2/05
585	t-Butanol	by D5599	0.00	Volume Percent	TS	3/2/05
586	n-Propanol	by D5599	0.00	Volume Percent	TS	3/2/05
587	sec-Butanol	by D5599	0.00	Volume Percent	TS	3/2/05
588	DIPE	by D5599	0.00	Volume Percent	TS	3/2/05
589	Isobutanol	by D5599	0.00	Volume Percent	TS	3/2/05
5801	t-Amyl Alcohol	by D5599	0.00	Volume Percent	TS	3/2/05
5802	n-Butanol	by D5599	0.00	Volume Percent	TS	3/2/05

NVFEL Fuel Analysis Report

13733

Batch#

Kansas City Samples

Facility Name: ERG Facility Type: In House
Owner: EPA Phone: (913) 299-9480
6636 Berger Avenue

U.S.

Samples Type: Correlation
Inspection information logged in by MM on 2/24/05.

VOC
Season: Winter

Kansas City Samples-775- FTAG: 13733 Comments: 33; 7-21-04
XFJ

Fuel_Code: 41

Test Code	Test Method	Results	Units	Analys	Analysis Date
552	MTBE by D5599	0.00	Oxy Percent	TS	3/2/05
562	ETBE by D5599	0.00	Oxy Percent	TS	3/2/05
534	Ethanol by D5599	0.14	Oxy Percent	TS	3/2/05
572	TAME by D5599	0.00	Oxy Percent	TS	3/2/05
421	Sulfur in Gasoline D2622	106	Parts Per Million	NST	4/18/05
62	Vapor Pressure by D5191 (Modified)	6.66	PS I	NST	2/24/05
65	Percent Evaporated at 200 Degrees F D86	38.3	Volume Percent	MM	3/9/05
66	Percent Evaporated at 300 Degrees F D86	79.5	Volume Percent	MM	3/9/05
48	Aromatics in Gasoline MSD D5769	29.98	Volume Percent	TW	3/4/05
49	Olefins in by FIA D1319	9.4	Volume Percent	NST	6/20/05
49	Olefins in by FIA D1319	9.7	Volume Percent	NST	6/20/05
64	Benzene in Gasoline D3606	1.44	Volume Percent	TW	3/2/05
64	Benzene in Gasoline D3606	1.44	Volume Percent	TW	3/2/05
55	MTBE by D5599	0.00	Volume Percent	TS	3/2/05
57	TAME by D5599	0.00	Volume Percent	TS	3/2/05
59	Weight Percent Oxygen by D5599	0.14	Weight Percent	TS	3/2/05
532	Ethanol by D5599	0.39	Volume Percent	TS	3/2/05
593	Volume Percent Oxygenates by D5599	0.39	Volume Percent	TS	3/2/05
56	ETBE by D5599	0.00	Volume Percent	TS	3/2/05
46	Aromatics by FIA D1319	31.1	Volume Percent	NST	6/20/05
630	Toluene in gasoline by MSD D5769	6.41	Volumn Percent	TW	3/4/05
63	Benzene in Gasoline by GC/MSD D5769	1.45	Volume Percent	TW	3/4/05
46	Aromatics by FIA D1319	31	Volume Percent	NST	6/20/05
69	Specific Gravity @ 60 deg F D4052	0.75543	60/60F	MM	2/25/05
692	Degrees API D4052	55.81	Degrees API	MM	2/25/05
691	Density @ 60 deg F D4052	0.75469	g/cm-03 @ 60 deg F	MM	2/25/05
101	Initial Boiling Point D86	102.4	Degrees F	MM	3/9/05
110	10 Percent D86	141.3	Degrees F	MM	3/9/05
150	50 Percent D86	225.3	Degrees F	MM	3/9/05
190	90 Percent D86	339.8	Degrees F	MM	3/9/05
200	End Point D86	437.5	Degrees F	MM	3/9/05
201	Residue D86	0.8	mL	MM	3/9/05
202	Total Recovery D86	97.8	mL	MM	3/9/05

NVFEL Fuel Analysis Report

13733

203	Loss	D86	1.4 mL	MM	3/9/05
543	Methanol	by D5599	0.00 Volume Percent	TS	3/2/05
584	Isopropanol	by D5599	0.00 Volume Percent	TS	3/2/05
585	t-Butanol	by D5599	0.00 Volume Percent	TS	3/2/05
586	n-Propanol	by D5599	0.00 Volume Percent	TS	3/2/05
587	sec-Butanol	by D5599	0.00 Volume Percent	TS	3/2/05
588	DIPE	by D5599	0.00 Volume Percent	TS	3/2/05
589	Isobutanol	by D5599	0.00 Volume Percent	TS	3/2/05
5801	t-Amyl Alcohol	by D5599	0.00 Volume Percent	TS	3/2/05
5802	n-Butanol	by D5599	0.00 Volume Percent	TS	3/2/05

NVFEL Fuel Analysis Report

13734

Kansas City Samples

Batch#

Facility Name: ERG Facility Type: In House

Owner: EPA Phone: (913) 299-9480

6636 Berger Avenue

U.S.

Samples Type: Correlation

VOC

Inspection information logged in by MM on 2/24/05.

Season: Winter

Kansas City Samples-387FFR(Mo) **FTAG: 13734** **Comments:** **#384; 9-24-04**

Test Code	Test Method	Results	Units	Fuel_ Code: 41	Analys	Analysis Date
552	MTBE by D5599	0.00	Oxy Percent		TS	3/2/05
562	ETBE by D5599	0.00	Oxy Percent		TS	3/2/05
534	Ethanol by D5599	0.00	Oxy Percent		TS	3/2/05
572	TAME by D5599	0.00	Oxy Percent		TS	3/2/05
421	Sulfur in Gasoline D2622	134	Parts Per Million		NST	4/18/05
62	Vapor Pressure by D5191 (Modified)	8.24	PS I		NST	2/24/05
65	Percent Evaporated at 200 Degrees F D86	41.8	Volume Percent		MM	3/9/05
66	Percent Evaporated at 300 Degrees F D86	81.6	Volume Percent		MM	3/9/05
48	Aromatics in Gasoline MSD D5769	30.45	Volume Percent		TW	3/4/05
49	Olefins in by FIA D1319	8	Volume Percent		NST	6/20/05
64	Benzene in Gasoline D3606	1.50	Volume Percent		TW	3/3/05
55	MTBE by D5599	0.00	Volume Percent		TS	3/2/05
59	Weight Percent Oxygen by D5599	0.00	Weight Percent		TS	3/2/05
57	TAME by D5599	0.00	Volume Percent		TS	3/2/05
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent		TS	3/2/05
532	Ethanol by D5599	0.00	Volume Percent		TS	3/2/05
56	ETBE by D5599	0.00	Volume Percent		TS	3/2/05
630	Toluene in gasoline by MSD D5769	6.79	Volumn Percent		TW	3/4/05
63	Benzene in Gasoline by GC/MSD D5769	1.52	Volume Percent		TW	3/4/05
46	Aromatics by FIA D1319	30.5	Volume Percent		NST	6/20/05
69	Specific Gravity @ 60 deg F D4052	0.75047	60/60F		MM	2/25/05
692	Degrees API D4052	57.05	Degrees API		MM	2/25/05
691	Density @ 60 deg F D4052	0.74973	g/cm-03 @ 60 deg F		MM	2/25/05
101	Initial Boiling Point D86	96.1	Degrees F		MM	3/9/05
110	10 Percent D86	134.1	Degrees F		MM	3/9/05
150	50 Percent D86	218.8	Degrees F		MM	3/9/05
190	90 Percent D86	331.2	Degrees F		MM	3/9/05
200	End Point D86	415.8	Degrees F		MM	3/9/05
201	Residue D86	0.8	mL		MM	3/9/05
202	Total Recovery D86	97.9	mL		MM	3/9/05
203	Loss D86	1.3	mL		MM	3/9/05
543	Methanol by D5599	0.00	Volume Percent		TS	3/2/05
584	Isopropanol by D5599	0.00	Volume Percent		TS	3/2/05

585	t-Butanol	by D5599	0.00 Volume Percent	TS	3/2/05
586	n-Propanol	by D5599	0.00 Volume Percent	TS	3/2/05
587	sec-Butanol	by D5599	0.00 Volume Percent	TS	3/2/05
588	DIPE	by D5599	0.00 Volume Percent	TS	3/2/05
589	Isobutanol	by D5599	0.00 Volume Percent	TS	3/2/05
5801	t-Amyl Alcohol	by D5599	0.00 Volume Percent	TS	3/2/05
5802	n-Butanol	by D5599	0.00 Volume Percent	TS	3/2/05

NVFEL Fuel Analysis Report

13736

Batch#

Kansas City Samples

Facility Name: ERG Facility Type: In House

Owner: EPA Phone: (913) 299-9480

6636 Berger Avenue

U.S.

Samples Type: Correlation

VOC

Inspection information logged in by MM on 2/24/05.

Season: Winter

Kansas City Samples-SKN097(Ks) **FTAG: 13736** **Comments:** **670; 2-9-05**

Test Code	Test Method	Results	Units	Fuel_ Code: 41	Analys	Analysis Date
552	MTBE by D5599	0.00	Oxy Percent		TS	3/2/05
562	ETBE by D5599	0.00	Oxy Percent		TS	3/2/05
534	Ethanol by D5599	0.00	Oxy Percent		TS	3/2/05
572	TAME by D5599	0.00	Oxy Percent		TS	3/2/05
421	Sulfur in Gasoline D2622	255	Parts Per Million		NST	4/5/05
62	Vapor Pressure by D5191 (Modified)	14.33	PS I		NST	2/24/05
62	Vapor Pressure by D5191 (Modified)	14.33	PS I		NST	2/24/05
65	Percent Evaporated at 200 Degrees F D86	52.5	Volume Percent		MM	3/9/05
66	Percent Evaporated at 300 Degrees F D86	85.5	Volume Percent		MM	3/9/05
49	Olefins in by FIA D1319	8.9	Volume Percent		NST	6/20/05
64	Benzene in Gasoline D3606	1.26	Volume Percent		TW	3/3/05
57	TAME by D5599	0.00	Volume Percent		TS	3/2/05
532	Ethanol by D5599	0.00	Volume Percent		TS	3/2/05
55	MTBE by D5599	0.00	Volume Percent		TS	3/2/05
59	Weight Percent Oxygen by D5599	0.00	Weight Percent		TS	3/2/05
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent		TS	3/2/05
56	ETBE by D5599	0.00	Volume Percent		TS	3/2/05
46	Aromatics by FIA D1319	22.4	Volume Percent		NST	6/20/05
69	Specific Gravity @ 60 deg F D4052	0.72656	60/60F		MM	2/25/05
692	Degrees API D4052	63.25	Degrees API		MM	2/25/05
691	Density @ 60 deg F D4052	0.72584	g/cm-03 @ 60 deg F		MM	2/25/05
101	Initial Boiling Point D86	80.4	Degrees F		MM	3/9/05
110	10 Percent D86	96.3	Degrees F		MM	3/9/05
150	50 Percent D86	192.6	Degrees F		MM	3/9/05
190	90 Percent D86	319.1	Degrees F		MM	3/9/05
200	End Point D86	401.2	Degrees F		MM	3/9/05
201	Residue D86	0.9	mL		MM	3/9/05
202	Total Recovery D86	96.9	mL		MM	3/9/05
203	Loss D86	2.2	mL		MM	3/9/05
543	Methanol by D5599	0.00	Volume Percent		TS	3/2/05
584	Isopropanol by D5599	0.00	Volume Percent		TS	3/2/05
585	t-Butanol by D5599	0.00	Volume Percent		TS	3/2/05
586	n-Propanol by D5599	0.00	Volume Percent		TS	3/2/05

587	sec-Butanol by D5599	0.00	Volume Percent	TS	3/2/05
588	DIPE by D5599	0.00	Volume Percent	TS	3/2/05
589	Isobutanol by D5599	0.00	Volume Percent	TS	3/2/05
5801	t-Amyl Alcohol by D5599	0.00	Volume Percent	TS	3/2/05
5802	n-Butanol by D5599	0.00	Volume Percent	TS	3/2/05

NVFEL Fuel Analysis Report

13738

Batch#

Kansas City Samples

Facility Name: ERG Facility Type: In House

Owner: EPA Phone: (913) 299-9480

6636 Berger Avenue

U.S.

Samples Type: Correlation

VOC

Season: Winter

Inspection information logged in by MM on 2/24/05.

Kansas City Samples-VEP260(Ks) **FTAG: 13738** **Comments:** **#419; 9-27-04**

Fuel_ Code: 41

Test Code	Test Method	Results	Units	Analys	Analysis Date
552	MTBE by D5599	0.00	Oxy Percent	TS	3/2/05
562	ETBE by D5599	0.00	Oxy Percent	TS	3/2/05
534	Ethanol by D5599	0.00	Oxy Percent	TS	3/2/05
572	TAME by D5599	0.00	Oxy Percent	TS	3/2/05
421	Sulfur in Gasoline D2622	41	Parts Per Million	NST	4/5/05
62	Vapor Pressure by D5191 (Modified)	8.22	PS I	NST	2/24/05
65	Percent Evaporated at 200 Degrees F D86	32.9	Volume Percent	MM	3/9/05
66	Percent Evaporated at 300 Degrees F D86	85.8	Volume Percent	MM	3/9/05
49	Olefins in by FIA D1319	2.1	Volume Percent	NST	6/20/05
64	Benzene in Gasoline D3606	1.41	Volume Percent	TW	3/3/05
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent	TS	3/2/05
55	MTBE by D5599	0.00	Volume Percent	TS	3/2/05
532	Ethanol by D5599	0.00	Volume Percent	TS	3/2/05
57	TAME by D5599	0.00	Volume Percent	TS	3/2/05
59	Weight Percent Oxygen by D5599	0.00	Weight Percent	TS	3/2/05
56	ETBE by D5599	0.00	Volume Percent	TS	3/2/05
46	Aromatics by FIA D1319	26.3	Volume Percent	NST	6/20/05
69	Specific Gravity @ 60 deg F D4052	0.74159	60/60F	MM	2/25/05
692	Degrees API D4052	59.31	Degrees API	MM	2/25/05
691	Density @ 60 deg F D4052	0.74086	g/cm-03 @ 60 deg F	MM	2/25/05
101	Initial Boiling Point D86	93.2	Degrees F	MM	3/9/05
110	10 Percent D86	138.6	Degrees F	MM	3/9/05
150	50 Percent D86	226.2	Degrees F	MM	3/9/05
190	90 Percent D86	317.5	Degrees F	MM	3/9/05
200	End Point D86	405.9	Degrees F	MM	3/9/05
201	Residue D86	0.8	mL	MM	3/9/05
202	Total Recovery D86	97.5	mL	MM	3/9/05
203	Loss D86	1.7	mL	MM	3/9/05
543	Methanol by D5599	0.00	Volume Percent	TS	3/2/05
584	Isopropanol by D5599	0.00	Volume Percent	TS	3/2/05
585	t-Butanol by D5599	0.00	Volume Percent	TS	3/2/05
586	n-Propanol by D5599	0.00	Volume Percent	TS	3/2/05
587	sec-Butanol by D5599	0.00	Volume Percent	TS	3/2/05

588	DIPE	by D5599	0.00 Volume Percent	TS	3/2/05
589	Isobutanol	by D5599	0.00 Volume Percent	TS	3/2/05
5801	t-Amyl Alcohol	by D5599	0.00 Volume Percent	TS	3/2/05
5802	n-Butanol	by D5599	0.00 Volume Percent	TS	3/2/05

26-Sep-05

NVFEL Fuel Analysis Report

13739

Batch#

Kansas City Samples

Facility Name: ERG Facility Type: In House

Owner: EPA Phone: (913) 299-9480

6636 Berger Avenue

U.S.

VOC

Samples Type: Correlation

Season: Winter

Inspection information logged in by MM on 2/24/05.

Kansas City Samples-QAS380(Ks) **FTAG: 13739** **Comments:** **679; 02-11-05**

Fuel_Code: 41

Test Code	Test Method	Results	Units	Analys	Analysis Date
552	MTBE by D5599	0.00	Oxy Percent	TS	3/2/05
552	MTBE by D5599	0.00	Oxy Percent	TS	3/2/05
562	ETBE by D5599	0.00	Oxy Percent	TS	3/2/05
562	ETBE by D5599	0.00	Oxy Percent	TS	3/2/05
534	Ethanol by D5599	0.00	Oxy Percent	TS	3/2/05
534	Ethanol by D5599	0.00	Oxy Percent	TS	3/2/05
572	TAME by D5599	0.00	Oxy Percent	TS	3/2/05
572	TAME by D5599	0.00	Oxy Percent	TS	3/2/05
421	Sulfur in Gasoline D2622	346	Parts Per Million	NST	4/5/05
62	Vapor Pressure by D5191 (Modified)	13.81	PS I	NST	2/24/05
62	Vapor Pressure by D5191 (Modified)	13.79	PS I	NST	2/24/05
65	Percent Evaporated at 200 Degrees F D86	51.5	Volume Percent	MM	3/9/05
66	Percent Evaporated at 300 Degrees F D86	85.7	Volume Percent	MM	3/9/05
49	Olefins in by FIA D1319	9.7	Volume Percent	NST	6/20/05
64	Benzene in Gasoline D3606	1.25	Volume Percent	TW	3/3/05
532	Ethanol by D5599	0.00	Volume Percent	TS	3/2/05
532	Ethanol by D5599	0.00	Volume Percent	TS	3/2/05
55	MTBE by D5599	0.00	Volume Percent	TS	3/2/05
55	MTBE by D5599	0.00	Volume Percent	TS	3/2/05
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent	TS	3/2/05
59	Weight Percent Oxygen by D5599	0.00	Weight Percent	TS	3/2/05
57	TAME by D5599	0.00	Volume Percent	TS	3/2/05
59	Weight Percent Oxygen by D5599	0.00	Weight Percent	TS	3/2/05
57	TAME by D5599	0.00	Volume Percent	TS	3/2/05
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent	TS	3/2/05
56	ETBE by D5599	0.00	Volume Percent	TS	3/2/05
56	ETBE by D5599	0.00	Volume Percent	TS	3/2/05
46	Aromatics by FIA D1319	22.7	Volume Percent	NST	6/20/05
69	Specific Gravity @ 60 deg F D4052	0.72681	60/60F	MM	2/25/05
69	Specific Gravity @ 60 deg F D4052	0.72673	60/60F	MM	2/25/05
692	Degrees API D4052	63.21	Degrees API	MM	2/25/05
692	Degrees API D4052	63.19	Degrees API	MM	2/25/05
691	Density @ 60 deg F D4052	0.72609	g/cm-03 @ 60 deg F	MM	2/25/05

NVFEL Fuel Analysis Report

13739

691	Density @ 60 deg F	D4052	0.72602 g/cm-03 @ 60 deg F	MM	2/25/05
101	Initial Boiling Point	D86	81.7 Degrees F	MM	3/9/05
110	10 Percent	D86	102.2 Degrees F	MM	3/9/05
150	50 Percent	D86	196.3 Degrees F	MM	3/9/05
190	90 Percent	D86	318.2 Degrees F	MM	3/9/05
200	End Point	D86	403.2 Degrees F	MM	3/9/05
201	Residue	D86	0.7 mL	MM	3/9/05
202	Total Recovery	D86	96.8 mL	MM	3/9/05
203	Loss	D86	2.5 mL	MM	3/9/05
543	Methanol	by D5599	0.00 Volume Percent	TS	3/2/05
543	Methanol	by D5599	0.00 Volume Percent	TS	3/2/05
584	Isopropanol	by D5599	0.00 Volume Percent	TS	3/2/05
584	Isopropanol	by D5599	0.00 Volume Percent	TS	3/2/05
585	t-Butanol	by D5599	0.00 Volume Percent	TS	3/2/05
585	t-Butanol	by D5599	0.00 Volume Percent	TS	3/2/05
586	n-Propanol	by D5599	0.00 Volume Percent	TS	3/2/05
586	n-Propanol	by D5599	0.00 Volume Percent	TS	3/2/05
587	sec-Butanol	by D5599	0.00 Volume Percent	TS	3/2/05
587	sec-Butanol	by D5599	0.00 Volume Percent	TS	3/2/05
588	DIPE	by D5599	0.00 Volume Percent	TS	3/2/05
588	DIPE	by D5599	0.00 Volume Percent	TS	3/2/05
589	Isobutanol	by D5599	0.00 Volume Percent	TS	3/2/05
589	Isobutanol	by D5599	0.00 Volume Percent	TS	3/2/05
5801	t-Amyl Alcohol	by D5599	0.00 Volume Percent	TS	3/2/05
5801	t-Amyl Alcohol	by D5599	0.00 Volume Percent	TS	3/2/05
5802	n-Butanol	by D5599	0.00 Volume Percent	TS	3/2/05
5802	n-Butanol	by D5599	0.00 Volume Percent	TS	3/2/05

NVFEL Fuel Analysis Report

13822

Kansas City Samples

Batch#

Facility Name: ERG Facility Type: In House
Owner: EPA Phone: (913) 299-9480
6636 Berger Avenue

R.1.5

U.S.

Samples Type: Correlation

VOC

Inspection information logged in by MM on 4/8/2005.

Season: Winter

Kansas City Samples-608CNC(Mo) FTAG: 13822 Comments: 591; 1-24-05

Test Code	Test Method	Results	Units	Fuel_Code: 41	Analyst	Analysis Date
552	MTBE by D5599	0.00	Oxy Percent		TS	5/9/2005
562	ETBE by D5599	0.00	Oxy Percent		TS	5/9/2005
534	Ethanol by D5599	0.00	Oxy Percent		TS	5/9/2005
572	TAME by D5599	0.00	Oxy Percent		TS	5/9/2005
421	Sulfur in Gasoline D2622	246	Parts Per Million		NST	9/7/2005
62	Vapor Pressure by D5191 (Modified)	13.4	PS I		NST	4/11/2005
62	Vapor Pressure by D5191 (Modified)	13.42	PS I		NST	4/11/2005
65	Percent Evaporated at 200 Degrees F D86	47.2	Volume Percent		MM	4/22/2005
66	Percent Evaporated at 300 Degrees F D86	85	Volume Percent		MM	4/22/2005
48	Aromatics in Gasoline MSD D5769	24.72	Volume Percent		TW	10/27/2005
49	Olefins in by FIA D1319	7.7	Volume Percent		MM	7/27/2005
64	Benzene in Gasoline D3606	0.96	Volume Percent		TW	8/1/2005
59	Weight Percent Oxygen by D5599	0.00	Weight Percent		TS	5/9/2005
55	MTBE by D5599	0.00	Volume Percent		TS	5/9/2005
532	Ethanol by D5599	0.00	Volume Percent		TS	5/9/2005
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent		TS	5/9/2005
57	TAME by D5599	0.00	Volume Percent		TS	5/9/2005
56	ETBE by D5599	0.00	Volume Percent		TS	5/9/2005
630	Toluene in gasoline by MSD D5769	6.1	Volumn Percent		TW	10/27/2005
63	Benzene in Gasoline by GC/MSD D5769	0.95	Volume Percent		TW	10/27/2005
46	Aromatics by FIA D1319	23.2	Volume Percent		MM	7/27/2005
69	Specific Gravity @ 60 deg F D4052	0.73048	60/60F		MM	4/12/2005
692	Degrees API D4052	62.21	Degrees API		MM	4/12/2005
691	Density @ 60 deg F D4052	0.72976	g/cm-03 @ 60 deg F		MM	4/12/2005
101	Initial Boiling Point D86	83.1	Degrees F		MM	4/22/2005
110	10 Percent D86	104.4	Degrees F		MM	4/22/2005
150	50 Percent D86	207.3	Degrees F		MM	4/22/2005
190	90 Percent D86	322.3	Degrees F		MM	4/22/2005
200	End Point D86	403	Degrees F		MM	4/22/2005
201	Residue D86	0.8	mL		MM	4/22/2005
202	Total Recovery D86	97.3	mL		MM	4/22/2005
203	Loss D86	1.9	mL		MM	4/22/2005
543	Methanol by D5599	0.00	Volume Percent		TS	5/9/2005

584	Isopropanol	by D5599	0.00	Volume Percent	TS	5/9/2005
585	t-Butanol	by D5599	0.00	Volume Percent	TS	5/9/2005
586	n-Propanol	by D5599	0.00	Volume Percent	TS	5/9/2005
587	sec-Butanol	by D5599	0.00	Volume Percent	TS	5/9/2005
588	DIPE	by D5599	0.00	Volume Percent	TS	5/9/2005
589	Isobutanol	by D5599	0.00	Volume Percent	TS	5/9/2005
5801	t-Amyl Alcohol	by D5599	0.00	Volume Percent	TS	5/9/2005
5802	n-Butanol	by D5599	0.00	Volume Percent	TS	5/9/2005

NVFEL Fuel Analysis Report

13823

Kansas City Samples

Batch#

Facility Name: ERG Facility Type: In House

Owner: EPA Phone: (913) 299-9480

6636 Berger Avenue

U.S.

UZD777

84472 R2

Samples Type: Correlation

VOC

Inspection information logged in by MM on 4/11/2005.

Season: Winter

Kansas City Samples-UZO777(Ks) FTAG: 13823 Comments: 173; 8-17-04

Test Code	Test Method	Results	Units	Fuel_ Code: 41	Analyst	Analysis Date
552	MTBE by D5599	0.00	Oxy Percent		TS	5/9/2005
562	ETBE by D5599	0.00	Oxy Percent		TS	5/9/2005
534	Ethanol by D5599	0.00	Oxy Percent		TS	5/9/2005
572	TAME by D5599	0.00	Oxy Percent		TS	5/9/2005
421	Sulfur in Gasoline D2622	170	Parts Per Million		NST	9/7/2005
62	Vapor Pressure by D5191 (Modified)	6.27	PS I		NST	4/11/2005
65	Percent Evaporated at 200 Degrees F D86	36.8	Volume Percent		MM	4/22/2005
66	Percent Evaporated at 300 Degrees F D86	78.7	Volume Percent		MM	4/22/2005
48	Aromatics in Gasoline MSD D5769	32.4	Volume Percent		TW	10/27/2005
49	Olefins in by FIA D1319	9.5	Volume Percent		MM	7/27/2005
64	Benzene in Gasoline D3606	1.63	Volume Percent		TW	8/1/2005
55	MTBE by D5599	0.00	Volume Percent		TS	5/9/2005
59	Weight Percent Oxygen by D5599	0.00	Weight Percent		TS	5/9/2005
532	Ethanol by D5599	0.00	Volume Percent		TS	5/9/2005
57	TAME by D5599	0.00	Volume Percent		TS	5/9/2005
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent		TS	5/9/2005
56	ETBE by D5599	0.00	Volume Percent		TS	5/9/2005
46	Aromatics by FIA D1319	33.1	Volume Percent		MM	7/27/2005
630	Toluene in gasoline by MSD D5769	7.44	Volumn Percent		TW	10/27/2005
63	Benzene in Gasoline by GC/MSD D5769	1.59	Volume Percent		TW	10/27/2005
69	Specific Gravity @ 60 deg F D4052	0.75846	60/60F		MM	4/12/2005
692	Degrees API D4052	55.06	Degrees API		MM	4/12/2005
691	Density @ 60 deg F D4052	0.75771	g/cm-03 @ 60 deg F		MM	4/12/2005
101	Initial Boiling Point D86	100.8	Degrees F		MM	4/22/2005
110	10 Percent D86	146.5	Degrees F		MM	4/22/2005
150	50 Percent D86	226.2	Degrees F		MM	4/22/2005
190	90 Percent D86	341.8	Degrees F		MM	4/22/2005
200	End Point D86	432.7	Degrees F		MM	4/22/2005
201	Residue D86	0.8	mL		MM	4/22/2005
202	Total Recovery D86	98	mL		MM	4/22/2005
203	Loss D86	1.2	mL		MM	4/22/2005
543	Methanol by D5599	0.00	Volume Percent		TS	5/9/2005
584	Isopropanol by D5599	0.00	Volume Percent		TS	5/9/2005

585	t-Butanol	by D5599	0.00	Volume Percent	TS	5/9/2005
586	n-Propanol	by D5599	0.00	Volume Percent	TS	5/9/2005
587	sec-Butanol	by D5599	0.00	Volume Percent	TS	5/9/2005
588	DIPE	by D5599	0.00	Volume Percent	TS	5/9/2005
589	Isobutanol	by D5599	0.00	Volume Percent	TS	5/9/2005
5801	t-Amyl Alcohol	by D5599	0.00	Volume Percent	TS	5/9/2005
5802	n-Butanol	by D5599	0.00	Volume Percent	TS	5/9/2005

NVFEL Fuel Analysis Report

13824

Kansas City Samples

Batch#

Facility Name: ERG   Facility Type: In House
Owner: EPA   Phone: (913) 299-9480
6636 Berger Avenue

R1   Run 84189   U.S.

Samples Type: Correlation   VOC

Inspection information logged in by MM on 4/11/2005.   Season: Winter

Kansas City Samples-409PM5(Mo)   FTAG: 13824   Comments: 169; 8-17-04

Test Code	Test Method	Results	Units	Fuel_ Code: 41	Analyst	Analysis Date
552	MTBE by D5599	0.00	Oxy Percent		TS	5/9/2005
562	ETBE by D5599	0.00	Oxy Percent		TS	5/9/2005
534	Ethanol by D5599	0.00	Oxy Percent		TS	5/9/2005
572	TAME by D5599	0.00	Oxy Percent		TS	5/9/2005
421	Sulfur in Gasoline D2622	166	Parts Per Million		NST	9/7/2005
62	Vapor Pressure by D5191 (Modified)	6.56	PS I		NST	4/11/2005
65	Percent Evaporated at 200 Degrees F D86	38	Volume Percent		MM	4/22/2005
66	Percent Evaporated at 300 Degrees F D86	80.5	Volume Percent		MM	4/22/2005
48	Aromatics in Gasoline MSD D5769	28.81	Volume Percent		TW	10/27/2005
49	Olefins in by FIA D1319	9.5	Volume Percent		MM	7/27/2005
64	Benzene in Gasoline D3606	1.27	Volume Percent		TW	8/1/2005
55	MTBE by D5599	0.00	Volume Percent		TS	5/9/2005
59	Weight Percent Oxygen by D5599	0.00	Weight Percent		TS	5/9/2005
532	Ethanol by D5599	0.00	Volume Percent		TS	5/9/2005
57	TAME by D5599	0.00	Volume Percent		TS	5/9/2005
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent		TS	5/9/2005
56	ETBE by D5599	0.00	Volume Percent		TS	5/9/2005
46	Aromatics by FIA D1319	29.5	Volume Percent		MM	7/27/2005
630	Toluene in gasoline by MSD D5769	6.01	Volumn Percent		TW	10/27/2005
63	Benzene in Gasoline by GC/MSD D5769	1.25	Volume Percent		TW	10/27/2005
69	Specific Gravity @ 60 deg F D4052	0.75261	60/60F		MM	4/13/2005
692	Degrees API D4052	56.51	Degrees API		MM	4/13/2005
691	Density @ 60 deg F D4052	0.75187	g/cm-03 @ 60 deg F		MM	4/13/2005
101	Initial Boiling Point D86	98.7	Degrees F		MM	4/22/2005
110	10 Percent D86	143.3	Degrees F		MM	4/22/2005
150	50 Percent D86	224.6	Degrees F		MM	4/22/2005
190	90 Percent D86	340.1	Degrees F		MM	4/22/2005
200	End Point D86	452.6	Degrees F		MM	4/22/2005
201	Residue D86	0.8	mL		MM	4/22/2005
202	Total Recovery D86	97.7	mL		MM	4/22/2005
203	Loss D86	1.5	mL		MM	4/22/2005
543	Methanol by D5599	0.00	Volume Percent		TS	5/9/2005
584	Isopropanol by D5599	0.00	Volume Percent		TS	5/9/2005

585	t-Butanol	by D5599	0.00	Volume Percent	TS	5/9/2005
586	n-Propanol	by D5599	0.00	Volume Percent	TS	5/9/2005
587	sec-Butanol	by D5599	0.00	Volume Percent	TS	5/9/2005
588	DIPE	by D5599	0.00	Volume Percent	TS	5/9/2005
589	Isobutanol	by D5599	0.00	Volume Percent	TS	5/9/2005
5801	t-Amyl Alcohol	by D5599	0.00	Volume Percent	TS	5/9/2005
5802	n-Butanol	by D5599	0.00	Volume Percent	TS	5/9/2005

NVFEL Fuel Analysis Report

13825

Kansas City Samples

Batch#

Facility Name: ERG Facility Type: In House

Owner: EPA Phone: (913) 299-9480

6636 Berger Avenue

84339 R1

U.S.

Samples Type: Correlation

VOC

Inspection information logged in by MM on 4/11/2005.

Season: Winter

Kansas City Samples-SKZ544(Ks) FTAG: 13825 Comments: #367; 9-22-04

Test Code	Test Method	Results	Units	Fuel_ Code: 41	Analyst	Analysis Date
552	MTBE by D5599	0.00	Oxy Percent		TS	5/9/2005
562	ETBE by D5599	0.00	Oxy Percent		TS	5/9/2005
534	Ethanol by D5599	0.00	Oxy Percent		TS	5/9/2005
572	TAME by D5599	0.00	Oxy Percent		TS	5/9/2005
421	Sulfur in Gasoline D2622	141	Parts Per Million		NST	9/7/2005
62	Vapor Pressure by D5191 (Modified)	7.34	PS I		NST	4/11/2005
65	Percent Evaporated at 200 Degrees F D86	42.1	Volume Percent		MM	4/22/2005
66	Percent Evaporated at 300 Degrees F D86	78.8	Volume Percent		MM	4/22/2005
48	Aromatics in Gasoline MSD D5769	31.58	Volume Percent		TW	10/27/2005
49	Olefins in by FIA D1319	9.4	Volume Percent		MM	7/27/2005
64	Benzene in Gasoline D3606	1.15	Volume Percent		TW	8/1/2005
55	MTBE by D5599	0.00	Volume Percent		TS	5/9/2005
59	Weight Percent Oxygen by D5599	0.00	Weight Percent		TS	5/9/2005
532	Ethanol by D5599	0.00	Volume Percent		TS	5/9/2005
57	TAME by D5599	0.00	Volume Percent		TS	5/9/2005
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent		TS	5/9/2005
56	ETBE by D5599	0.00	Volume Percent		TS	5/9/2005
46	Aromatics by FIA D1319	32.2	Volume Percent		MM	7/27/2005
630	Toluene in gasoline by MSD D5769	6.85	Volumn Percent		TW	10/27/2005
63	Benzene in Gasoline by GC/MSD D5769	1.14	Volume Percent		TW	10/27/2005
69	Specific Gravity @ 60 deg F D4052	0.75431	60/60F		MM	4/13/2005
692	Degrees API D4052	56.09	Degrees API		MM	4/13/2005
691	Density @ 60 deg F D4052	0.75357	g/cm-03 @ 60 deg F		MM	4/13/2005
101	Initial Boiling Point D86	98.2	Degrees F		MM	4/22/2005
110	10 Percent D86	132.3	Degrees F		MM	4/22/2005
150	50 Percent D86	221	Degrees F		MM	4/22/2005
190	90 Percent D86	341.2	Degrees F		MM	4/22/2005
200	End Point D86	432.7	Degrees F		MM	4/22/2005
201	Residue D86	0.8	mL		MM	4/22/2005
202	Total Recovery D86	98.2	mL		MM	4/22/2005
203	Loss D86	1	mL		MM	4/22/2005
543	Methanol by D5599	0.00	Volume Percent		TS	5/9/2005
584	Isopropanol by D5599	0.00	Volume Percent		TS	5/9/2005

585	t-Butanol	by D5599	0.00	Volume Percent	TS	5/9/2005
586	n-Propanol	by D5599	0.00	Volume Percent	TS	5/9/2005
587	sec-Butanol	by D5599	0.00	Volume Percent	TS	5/9/2005
588	DIPE	by D5599	0.00	Volume Percent	TS	5/9/2005
589	Isobutanol	by D5599	0.00	Volume Percent	TS	5/9/2005
5801	t-Amyl Alcohol	by D5599	0.00	Volume Percent	TS	5/9/2005
5802	n-Butanol	by D5599	0.00	Volume Percent	TS	5/9/2005

NVFEL Fuel Analysis Report

13826

Kansas City Samples

Batch#

Facility Name: ERG Facility Type: In House

Owner: EPA Phone: (913) 299-9480

6636 Berger Avenue

84154 R1

U.S.

Samples Type: Correlation

VOC

Inspection information logged in by MM on 4/11/2005.

Season: Winter

Kansas City Samples- 169KT4(Mo) FTAG: 13826 Comments: #2; 8/9/04

Test Code	Test Method	Results	Units	Fuel_ Code: 41	Analyst	Analysis Date
552	MTBE by D5599	0.00	Oxy Percent		TS	5/9/2005
562	ETBE by D5599	0.00	Oxy Percent		TS	5/9/2005
534	Ethanol by D5599	0.00	Oxy Percent		TS	5/9/2005
572	TAME by D5599	0.00	Oxy Percent		TS	5/9/2005
421	Sulfur in Gasoline D2622	179	Parts Per Million		NST	9/7/2005
62	Vapor Pressure by D5191 (Modified)	6.54	PS I		NST	4/12/2005
65	Percent Evaporated at 200 Degrees F D86	37.1	Volume Percent		MM	4/22/2005
66	Percent Evaporated at 300 Degrees F D86	80.2	Volume Percent		MM	4/22/2005
48	Aromatics in Gasoline MSD D5769	32.74	Volume Percent		TW	10/27/2005
49	Olefins in by FIA D1319	7.8	Volume Percent		MM	7/27/2005
64	Benzene in Gasoline D3606	1.61	Volume Percent		TW	8/1/2005
55	MTBE by D5599	0.00	Volume Percent		TS	5/9/2005
59	Weight Percent Oxygen by D5599	0.00	Weight Percent		TS	5/9/2005
532	Ethanol by D5599	0.00	Volume Percent		TS	5/9/2005
57	TAME by D5599	0.00	Volume Percent		TS	5/9/2005
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent		TS	5/9/2005
56	ETBE by D5599	0.00	Volume Percent		TS	5/9/2005
46	Aromatics by FIA D1319	34.3	Volume Percent		MM	7/27/2005
630	Toluene in gasoline by MSD D5769	7.28	Volumn Percent		TW	10/27/2005
63	Benzene in Gasoline by GC/MSD D5769	1.55	Volume Percent		TW	10/27/2005
69	Specific Gravity @ 60 deg F D4052	0.75748	60/60F		MM	4/13/2005
692	Degrees API D4052	55.3	Degrees API		MM	4/13/2005
691	Density @ 60 deg F D4052	0.75673	g/cm-03 @ 60 deg F		MM	4/13/2005
101	Initial Boiling Point D86	105.8	Degrees F		MM	4/22/2005
110	10 Percent D86	147.6	Degrees F		MM	4/22/2005
150	50 Percent D86	226.2	Degrees F		MM	4/22/2005
190	90 Percent D86	331.5	Degrees F		MM	4/22/2005
200	End Point D86	421.9	Degrees F		MM	4/22/2005
201	Residue D86	0.8	mL		MM	4/22/2005
202	Total Recovery D86	98.2	mL		MM	4/22/2005
203	Loss D86	1	mL		MM	4/22/2005
543	Methanol by D5599	0.00	Volume Percent		TS	5/9/2005
584	Isopropanol by D5599	0.00	Volume Percent		TS	5/9/2005

585	t-Butanol	by D5599	0.00	Volume Percent	TS	5/9/2005
586	n-Propanol	by D5599	0.00	Volume Percent	TS	5/9/2005
587	sec-Butanol	by D5599	0.00	Volume Percent	TS	5/9/2005
588	DIPE	by D5599	0.00	Volume Percent	TS	5/9/2005
589	Isobutanol	by D5599	0.00	Volume Percent	TS	5/9/2005
5801	t-Amyl Alcohol	by D5599	0.00	Volume Percent	TS	5/9/2005
5802	n-Butanol	by D5599	0.00	Volume Percent	TS	5/9/2005

NVFEL Fuel Analysis Report

13827

Kansas City Samples

Batch#

Facility Name: ERG Facility Type: In House
Owner: EPA Phone: (913) 299-9480
6636 Berger Avenue

U.S.

#84048 R1

Samples Type: Correlation

VOC

Inspection information logged in by MM on 4/11/2005.

Season: Winter

Kansas City Samples-TJU404 FTAG: 13827 Comments: 605; 1-27-05

Fuel_Code: 41

Test Code	Test Method	Results	Units	Analyst	Analysis Date
552	MTBE by D5599	0.00	Oxy Percent	TS	5/9/2005
562	ETBE by D5599	0.00	Oxy Percent	TS	5/9/2005
534	Ethanol by D5599	0.00	Oxy Percent	TS	5/9/2005
572	TAME by D5599	0.00	Oxy Percent	TS	5/9/2005
421	Sulfur in Gasoline D2622	309	Parts Per Million	NST	9/7/2005
421	Sulfur in Gasoline D2622	310	Parts Per Million	NST	9/7/2005
62	Vapor Pressure by D5191 (Modified)	13.26	PS I	NST	4/12/2005
65	Percent Evaporated at 200 Degrees F D86	49.6	Volume Percent	MM	4/22/2005
66	Percent Evaporated at 300 Degrees F D86	84.9	Volume Percent	MM	4/22/2005
48	Aromatics in Gasoline MSD D5769	22.89	Volume Percent	TW	10/27/2005
49	Olefins in by FIA D1319	9.6	Volume Percent	MM	7/28/2005
64	Benzene in Gasoline D3606	1.16	Volume Percent	TW	8/1/2005
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent	TS	5/9/2005
532	Ethanol by D5599	0.00	Volume Percent	TS	5/9/2005
57	TAME by D5599	0.00	Volume Percent	TS	5/9/2005
55	MTBE by D5599	0.00	Volume Percent	TS	5/9/2005
59	Weight Percent Oxygen by D5599	0.00	Weight Percent	TS	5/9/2005
56	ETBE by D5599	0.00	Volume Percent	TS	5/9/2005
46	Aromatics by FIA D1319	21.8	Volume Percent	MM	7/28/2005
63	Benzene in Gasoline by GC/MSD D5769	1.15	Volume Percent	TW	10/27/2005
630	Toluene in gasoline by MSD D5769	5.3	Volumn Percent	TW	10/27/2005
69	Specific Gravity @ 60 deg F D4052	0.72758	60/60F	MM	4/13/2005
692	Degrees API D4052	62.98	Degrees API	MM	4/13/2005
691	Density @ 60 deg F D4052	0.72686	g/cm-03 @ 60 deg F	MM	4/13/2005
101	Initial Boiling Point D86	80.4	Degrees F	MM	4/22/2005
110	10 Percent D86	102.4	Degrees F	MM	4/22/2005
150	50 Percent D86	201	Degrees F	MM	4/22/2005
190	90 Percent D86	322.2	Degrees F	MM	4/22/2005
200	End Point D86	412.3	Degrees F	MM	4/22/2005
201	Residue D86	0.8	mL	MM	4/22/2005
202	Total Recovery D86	96.8	mL	MM	4/22/2005
203	Loss D86	2.4	mL	MM	4/22/2005
543	Methanol by D5599	0.00	Volume Percent	TS	5/9/2005

584	Isopropanol	by D5599	0.00	Volume Percent	TS	5/9/2005
585	t-Butanol	by D5599	0.00	Volume Percent	TS	5/9/2005
586	n-Propanol	by D5599	0.00	Volume Percent	TS	5/9/2005
587	sec-Butanol	by D5599	0.00	Volume Percent	TS	5/9/2005
588	DIPE	by D5599	0.00	Volume Percent	TS	5/9/2005
589	Isobutanol	by D5599	0.00	Volume Percent	TS	5/9/2005
5801	t-Amyl Alcohol	by D5599	0.00	Volume Percent	TS	5/9/2005
5802	n-Butanol	by D5599	0.00	Volume Percent	TS	5/9/2005

NVFEL Fuel Analysis Report

13828

Kansas City Samples

Batch#

Facility Name: ERG Facility Type: In House
Owner: EPA Phone: (913) 299-9480
6636 Berger Avenue

U.S.

84600 R2

Samples Type: Correlation

VOC

Inspection information logged in by MM on 4/11/2005.

Season: Winter

Kansas City Samples-QLZ917 FTAG: 13828 Comments: 756; 2-28-05

Test Code	Test Method	Results	Units	Fuel_ Code: 41	Analyst	Analysis Date
552	MTBE by D5599	0.00	Oxy Percent		TS	5/9/2005
562	ETBE by D5599	0.00	Oxy Percent		TS	5/9/2005
534	Ethanol by D5599	0.00	Oxy Percent		TS	5/9/2005
572	TAME by D5599	0.00	Oxy Percent		TS	5/9/2005
421	Sulfur in Gasoline D2622	163	Parts Per Million		NST	9/7/2005
62	Vapor Pressure by D5191 (Modified)	12.21	PS I		NST	4/12/2005
65	Percent Evaporated at 200 Degrees F D86	51.4	Volume Percent		MM	4/22/2005
66	Percent Evaporated at 300 Degrees F D86	83.8	Volume Percent		MM	4/22/2005
48	Aromatics in Gasoline MSD D5769	24.75	Volume Percent		TW	10/27/2005
49	Olefins in by FIA D1319	10.5	Volume Percent		MM	7/28/2005
64	Benzene in Gasoline D3606	1.01	Volume Percent		TW	8/1/2005
55	MTBE by D5599	0.00	Volume Percent		TS	5/9/2005
59	Weight Percent Oxygen by D5599	0.00	Weight Percent		TS	5/9/2005
532	Ethanol by D5599	0.00	Volume Percent		TS	5/9/2005
57	TAME by D5599	0.00	Volume Percent		TS	5/9/2005
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent		TS	5/9/2005
56	ETBE by D5599	0.00	Volume Percent		TS	5/9/2005
46	Aromatics by FIA D1319	24.4	Volume Percent		MM	7/28/2005
630	Toluene in gasoline by MSD D5769	5.52	Volumn Percent		TW	10/27/2005
63	Benzene in Gasoline by GC/MSD D5769	0.99	Volume Percent		TW	10/27/2005
69	Specific Gravity @ 60 deg F D4052	0.73229	60/60F		MM	4/13/2005
692	Degrees API D4052	61.73	Degrees API		MM	4/13/2005
691	Density @ 60 deg F D4052	0.73156	g/cm-03 @ 60 deg F		MM	4/13/2005
101	Initial Boiling Point D86	82.9	Degrees F		MM	4/22/2005
110	10 Percent D86	103.7	Degrees F		MM	4/22/2005
150	50 Percent D86	195.8	Degrees F		MM	4/22/2005
190	90 Percent D86	328.2	Degrees F		MM	4/22/2005
200	End Point D86	406	Degrees F		MM	4/22/2005
201	Residue D86	0.8	mL		MM	4/22/2005
202	Total Recovery D86	96.3	mL		MM	4/22/2005
203	Loss D86	2.9	mL		MM	4/22/2005
543	Methanol by D5599	0.00	Volume Percent		TS	5/9/2005
584	Isopropanol by D5599	0.00	Volume Percent		TS	5/9/2005

585	t-Butanol	by D5599	0.00 Volume Percent	TS	5/9/2005
586	n-Propanol	by D5599	0.00 Volume Percent	TS	5/9/2005
587	sec-Butanol	by D5599	0.00 Volume Percent	TS	5/9/2005
588	DIPE	by D5599	0.00 Volume Percent	TS	5/9/2005
589	Isobutanol	by D5599	0.00 Volume Percent	TS	5/9/2005
5801	t-Amyl Alcohol	by D5599	0.00 Volume Percent	TS	5/9/2005
5802	n-Butanol	by D5599	0.00 Volume Percent	TS	5/9/2005

NVFEL Fuel Analysis Report

13829

Kansas City Samples

Batch#

Facility Name: ERG   Facility Type: In House

Owner: EPA   Phone: (913) 299-9480

6636 Berger Avenue

84533 R2

U.S.

Samples Type: Correlation

VOC

Inspection information logged in by MM on 4/11/2005.

Season: Winter

Kansas City Samples-099MSP(Mo)   FTAG: 13829   Comments: 675; 2-10-05

Test Code	Test Method	Results	Units	Fuel_Code: 41	Analyst	Analysis Date
552	MTBE by D5599	0.00	Oxy Percent		TS	5/9/2005
562	ETBE by D5599	0.00	Oxy Percent		TS	5/9/2005
534	Ethanol by D5599	0.00	Oxy Percent		TS	5/9/2005
572	TAME by D5599	0.00	Oxy Percent		TS	5/9/2005
421	Sulfur in Gasoline D2622	235	Parts Per Million		NST	9/7/2005
62	Vapor Pressure by D5191 (Modified)	13.45	PS I		NST	4/12/2005
65	Percent Evaporated at 200 Degrees F D86	51.1	Volume Percent		MM	4/22/2005
66	Percent Evaporated at 300 Degrees F D86	84.3	Volume Percent		MM	4/22/2005
48	Aromatics in Gasoline MSD D5769	23.72	Volume Percent		TW	10/27/2005
49	Olefins in by FIA D1319	10.7	Volume Percent		MM	7/28/2005
64	Benzene in Gasoline D3606	1.17	Volume Percent		TW	8/1/2005
55	MTBE by D5599	0.00	Volume Percent		TS	5/9/2005
59	Weight Percent Oxygen by D5599	0.00	Weight Percent		TS	5/9/2005
532	Ethanol by D5599	0.00	Volume Percent		TS	5/9/2005
57	TAME by D5599	0.00	Volume Percent		TS	5/9/2005
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent		TS	5/9/2005
56	ETBE by D5599	0.00	Volume Percent		TS	5/9/2005
46	Aromatics by FIA D1319	24.1	Volume Percent		MM	7/28/2005
630	Toluene in gasoline by MSD D5769	5.2	Volumn Percent		TW	10/27/2005
63	Benzene in Gasoline by GC/MSD D5769	1.14	Volume Percent		TW	10/27/2005
69	Specific Gravity @ 60 deg F D4052	0.72986	60/60F		MM	4/13/2005
692	Degrees API D4052	62.37	Degrees API		MM	4/13/2005
691	Density @ 60 deg F D4052	0.72914	g/cm-03 @ 60 deg F		MM	4/13/2005
101	Initial Boiling Point D86	81.7	Degrees F		MM	4/22/2005
110	10 Percent D86	100.9	Degrees F		MM	4/22/2005
150	50 Percent D86	197.4	Degrees F		MM	4/22/2005
190	90 Percent D86	322.9	Degrees F		MM	4/22/2005
200	End Point D86	405.1	Degrees F		MM	4/22/2005
201	Residue D86	0.7	mL		MM	4/22/2005
202	Total Recovery D86	96.9	mL		MM	4/22/2005
203	Loss D86	2.4	mL		MM	4/22/2005
543	Methanol by D5599	0.00	Volume Percent		TS	5/9/2005
584	Isopropanol by D5599	0.00	Volume Percent		TS	5/9/2005

585	t-Butanol	by D5599	0.00 Volume Percent	TS	5/9/2005
586	n-Propanol	by D5599	0.00 Volume Percent	TS	5/9/2005
587	sec-Butanol	by D5599	0.00 Volume Percent	TS	5/9/2005
588	DIPE	by D5599	0.00 Volume Percent	TS	5/9/2005
589	Isobutanol	by D5599	0.00 Volume Percent	TS	5/9/2005
5801	t-Amyl Alcohol	by D5599	0.00 Volume Percent	TS	5/9/2005
5802	n-Butanol	by D5599	0.00 Volume Percent	TS	5/9/2005

NVFEL Fuel Analysis Report

13830

Kansas City Samples

Batch#

Facility Name: ERG Facility Type: In House
Owner: EPA Phone: (913) 299-9480
6636 Berger Avenue

A 84436 R2

U.S.

Samples Type: Correlation

VOC

Inspection information logged in by MM on 4/11/2005.

Season: Winter

Kansas City Samples-QMI147(Ks) FTAG: 13830 Comments: 569; 1-19-05

Test Code	Test Method	Results	Units	Fuel_ Code: 41	Analyst	Analysis Date
552	MTBE by D5599	0.00	Oxy Percent		TS	5/9/2005
552	MTBE by D5599	0.00	Oxy Percent		TS	5/9/2005
562	ETBE by D5599	0.00	Oxy Percent		TS	5/9/2005
562	ETBE by D5599	0.00	Oxy Percent		TS	5/9/2005
534	Ethanol by D5599	0.00	Oxy Percent		TS	5/9/2005
534	Ethanol by D5599	0.00	Oxy Percent		TS	5/9/2005
572	TAME by D5599	0.00	Oxy Percent		TS	5/9/2005
572	TAME by D5599	0.00	Oxy Percent		TS	5/9/2005
421	Sulfur in Gasoline D2622	101	Parts Per Million		NST	9/7/2005
62	Vapor Pressure by D5191 (Modified)	14.1	PS I		NST	4/12/2005
62	Vapor Pressure by D5191 (Modified)	14.1	PS I		NST	4/12/2005
65	Percent Evaporated at 200 Degrees F D86	52.6	Volume Percent		MM	4/22/2005
66	Percent Evaporated at 300 Degrees F D86	85.4	Volume Percent		MM	4/22/2005
48	Aromatics in Gasoline MSD D5769	23.61	Volume Percent		TW	10/27/2005
49	Olefins in by FIA D1319	11.4	Volume Percent		MM	7/28/2005
64	Benzene in Gasoline D3606	1.21	Volume Percent		TW	8/1/2005
55	MTBE by D5599	0.00	Volume Percent		TS	5/9/2005
55	MTBE by D5599	0.00	Volume Percent		TS	5/9/2005
532	Ethanol by D5599	0.00	Volume Percent		TS	5/9/2005
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent		TS	5/9/2005
532	Ethanol by D5599	0.00	Volume Percent		TS	5/9/2005
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent		TS	5/9/2005
57	TAME by D5599	0.00	Volume Percent		TS	5/9/2005
57	TAME by D5599	0.00	Volume Percent		TS	5/9/2005
59	Weight Percent Oxygen by D5599	0.00	Weight Percent		TS	5/9/2005
59	Weight Percent Oxygen by D5599	0.00	Weight Percent		TS	5/9/2005
56	ETBE by D5599	0.00	Volume Percent		TS	5/9/2005
56	ETBE by D5599	0.00	Volume Percent		TS	5/9/2005
46	Aromatics by FIA D1319	25.6	Volume Percent		MM	7/28/2005
63	Benzene in Gasoline by GC/MSD D5769	1.18	Volume Percent		TW	10/27/2005
630	Toluene in gasoline by MSD D5769	5.53	Volumn Percent		TW	10/27/2005
69	Specific Gravity @ 60 deg F D4052	0.72776	60/60F		MM	4/13/2005
692	Degrees API D4052	62.93	Degrees API		MM	4/13/2005

691	Density @ 60 deg F	D4052	0.72704 g/cm-03 @ 60 deg F	MM	4/13/2005
101	Initial Boiling Point	D86	82 Degrees F	MM	4/22/2005
110	10 Percent	D86	99.1 Degrees F	MM	4/22/2005
150	50 Percent	D86	192.7 Degrees F	MM	4/22/2005
190	90 Percent	D86	321.8 Degrees F	MM	4/22/2005
200	End Point	D86	412.3 Degrees F	MM	4/22/2005
201	Residue	D86	0.8 mL	MM	4/22/2005
202	Total Recovery	D86	96.8 mL	MM	4/22/2005
203	Loss	D86	2.4 mL	MM	4/22/2005
543	Methanol	by D5599	0.00 Volume Percent	TS	5/9/2005
543	Methanol	by D5599	0.00 Volume Percent	TS	5/9/2005
584	Isopropanol	by D5599	0.00 Volume Percent	TS	5/9/2005
584	Isopropanol	by D5599	0.00 Volume Percent	TS	5/9/2005
585	t-Butanol	by D5599	0.00 Volume Percent	TS	5/9/2005
585	t-Butanol	by D5599	0.00 Volume Percent	TS	5/9/2005
586	n-Propanol	by D5599	0.00 Volume Percent	TS	5/9/2005
586	n-Propanol	by D5599	0.00 Volume Percent	TS	5/9/2005
587	sec-Butanol	by D5599	0.00 Volume Percent	TS	5/9/2005
587	sec-Butanol	by D5599	0.00 Volume Percent	TS	5/9/2005
588	DIPE	by D5599	0.00 Volume Percent	TS	5/9/2005
588	DIPE	by D5599	0.00 Volume Percent	TS	5/9/2005
589	Isobutanol	by D5599	0.00 Volume Percent	TS	5/9/2005
589	Isobutanol	by D5599	0.00 Volume Percent	TS	5/9/2005
5801	t-Amyl Alcohol	by D5599	0.00 Volume Percent	TS	5/9/2005
5801	t-Amyl Alcohol	by D5599	0.00 Volume Percent	TS	5/9/2005
5802	n-Butanol	by D5599	0.00 Volume Percent	TS	5/9/2005
5802	n-Butanol	by D5599	0.00 Volume Percent	TS	5/9/2005

NVFEL Fuel Analysis Report

13831

Kansas City Samples

Batch#

Facility Name: ERG Facility Type: In House

Owner: EPA Phone: (913) 299-9480

6636 Berger Avenue

U.S.

#84457 R2

Samples Type: Correlation

VOC

Inspection information logged in by MM on 4/11/2005.

Season: Winter

Kansas City Samples-319ELX(Mo) FTAG: 13831 Comments: 596; 1-25-05, cap broken, transferred to a new bottle

Test Code	Test Method	Results	Units	Fuel_ Code: 41	Analyst	Analysis Date
552	MTBE by D5599	0.00	Oxy Percent		TS	5/9/2005
562	ETBE by D5599	0.00	Oxy Percent		TS	5/9/2005
534	Ethanol by D5599	0.00	Oxy Percent		TS	5/9/2005
572	TAME by D5599	0.00	Oxy Percent		TS	5/9/2005
421	Sulfur in Gasoline D2622	206	Parts Per Million		NST	9/7/2005
62	Vapor Pressure by D5191 (Modified)	13.79	PS I		NST	4/12/2005
65	Percent Evaporated at 200 Degrees F D86	50.1	Volume Percent		MM	4/22/2005
66	Percent Evaporated at 300 Degrees F D86	84.3	Volume Percent		MM	4/22/2005
48	Aromatics in Gasoline MSD D5769	23.07	Volume Percent		TW	10/27/2005
49	Olefins in by FIA D1319	9.4	Volume Percent		MM	7/28/2005
64	Benzene in Gasoline D3606	1.15	Volume Percent		TW	8/1/2005
64	Benzene in Gasoline D3606	1.14	Volume Percent		TW	8/1/2005
59	Weight Percent Oxygen by D5599	0.00	Weight Percent		TS	5/9/2005
532	Ethanol by D5599	0.00	Volume Percent		TS	5/9/2005
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent		TS	5/9/2005
57	TAME by D5599	0.00	Volume Percent		TS	5/9/2005
55	MTBE by D5599	0.00	Volume Percent		TS	5/9/2005
56	ETBE by D5599	0.00	Volume Percent		TS	5/9/2005
46	Aromatics by FIA D1319	21.7	Volume Percent		MM	7/28/2005
630	Toluene in gasoline by MSD D5769	5.27	Volumn Percent		TW	10/27/2005
63	Benzene in Gasoline by GC/MSD D5769	1.12	Volume Percent		TW	10/27/2005
69	Specific Gravity @ 60 deg F D4052	0.72818	60/60F		MM	4/13/2005
69	Specific Gravity @ 60 deg F D4052	0.7282	60/60F		MM	4/13/2005
692	Degrees API D4052	62.81	Degrees API		MM	4/13/2005
692	Degrees API D4052	62.82	Degrees API		MM	4/13/2005
691	Density @ 60 deg F D4052	0.72748	g/cm-03 @ 60 deg F		MM	4/13/2005
691	Density @ 60 deg F D4052	0.72746	g/cm-03 @ 60 deg F		MM	4/13/2005
101	Initial Boiling Point D86	79.3	Degrees F		MM	4/22/2005
110	10 Percent D86	99.5	Degrees F		MM	4/22/2005
150	50 Percent D86	199.6	Degrees F		MM	4/22/2005
190	90 Percent D86	323.6	Degrees F		MM	4/22/2005
200	End Point D86	430.2	Degrees F		MM	4/22/2005
201	Residue D86	0.8	mL		MM	4/22/2005

202	Total Recovery	D86	96.6 mL	MM	4/22/2005
203	Loss	D86	2.6 mL	MM	4/22/2005
543	Methanol	by D5599	0.00 Volume Percent	TS	5/9/2005
584	Isopropanol	by D5599	0.00 Volume Percent	TS	5/9/2005
585	t-Butanol	by D5599	0.00 Volume Percent	TS	5/9/2005
586	n-Propanol	by D5599	0.00 Volume Percent	TS	5/9/2005
587	sec-Butanol	by D5599	0.00 Volume Percent	TS	5/9/2005
588	DIPE	by D5599	0.00 Volume Percent	TS	5/9/2005
589	Isobutanol	by D5599	0.00 Volume Percent	TS	5/9/2005
5801	t-Amyl Alcohol	by D5599	0.00 Volume Percent	TS	5/9/2005
5802	n-Butanol	by D5599	0.00 Volume Percent	TS	5/9/2005

NVFEL Fuel Analysis Report

13832

Batch#

Kansas City Samples

Facility Name: ERG Facility Type: In House

Owner: EPA Phone: (913) 299-9480

6636 Berger Avenue

(254MS9)

NO DYNO
SEMTECH ONLY

U.S.

Samples Type: Correlation

VOC

Inspection information logged in by MM on 4/11/2005.

Season: Winter

Kansas City Samples-254M59(Mo) FTAG: 13832 Comments: 572; 1-20-05

Test Code	Test Method	Results	Units	Fuel_ Code: 41	Analyst	Analysis Date
552	MTBE by D5599	0.00	Oxy Percent		TS	5/9/2005
562	ETBE by D5599	0.00	Oxy Percent		TS	5/9/2005
534	Ethanol by D5599	0.00	Oxy Percent		TS	5/9/2005
572	TAME by D5599	0.00	Oxy Percent		TS	5/9/2005
421	Sulfur in Gasoline D2622	292	Parts Per Million		NST	9/7/2005
62	Vapor Pressure by D5191 (Modified)	14.17	PS I		NST	4/12/2005
65	Percent Evaporated at 200 Degrees F D86	50.2	Volume Percent		MM	4/22/2005
66	Percent Evaporated at 300 Degrees F D86	85.4	Volume Percent		MM	4/22/2005
48	Aromatics in Gasoline MSD D5769	22.07	Volume Percent		TW	10/27/2005
49	Olefins in by FIA D1319	9.7	Volume Percent		MM	7/28/2005
64	Benzene in Gasoline D3606	1.18	Volume Percent		TW	8/1/2005
55	MTBE by D5599	0.00	Volume Percent		TS	5/9/2005
59	Weight Percent Oxygen by D5599	0.00	Weight Percent		TS	5/9/2005
532	Ethanol by D5599	0.00	Volume Percent		TS	5/9/2005
57	TAME by D5599	0.00	Volume Percent		TS	5/9/2005
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent		TS	5/9/2005
56	ETBE by D5599	0.00	Volume Percent		TS	5/9/2005
46	Aromatics by FIA D1319	21.3	Volume Percent		MM	7/28/2005
630	Toluene in gasoline by MSD D5769	5.17	Volumn Percent		TW	10/27/2005
63	Benzene in Gasoline by GC/MSD D5769	1.16	Volume Percent		TW	10/27/2005
69	Specific Gravity @ 60 deg F D4052	0.72569	60/60F		MM	4/13/2005
692	Degrees API D4052	63.49	Degrees API		MM	4/13/2005
691	Density @ 60 deg F D4052	0.72497	g/cm-03 @ 60 deg F		MM	4/13/2005
101	Initial Boiling Point D86	81.4	Degrees F		MM	4/22/2005
110	10 Percent D86	95.7	Degrees F		MM	4/22/2005
150	50 Percent D86	199.4	Degrees F		MM	4/22/2005
190	90 Percent D86	321.1	Degrees F		MM	4/22/2005
200	End Point D86	406.4	Degrees F		MM	4/22/2005
201	Residue D86	0.6	mL		MM	4/22/2005
202	Total Recovery D86	96.4	mL		MM	4/22/2005
203	Loss D86	3	mL		MM	4/22/2005
543	Methanol by D5599	0.00	Volume Percent		TS	5/9/2005
584	Isopropanol by D5599	0.00	Volume Percent		TS	5/9/2005

585	t-Butanol	by D5599	0.00	Volume Percent	TS	5/9/2005
586	n-Propanol	by D5599	0.00	Volume Percent	TS	5/9/2005
587	sec-Butanol	by D5599	0.00	Volume Percent	TS	5/9/2005
588	DIPE	by D5599	0.00	Volume Percent	TS	5/9/2005
589	Isobutanol	by D5599	0.00	Volume Percent	TS	5/9/2005
5801	t-Amyl Alcohol	by D5599	0.00	Volume Percent	TS	5/9/2005
5802	n-Butanol	by D5599	0.00	Volume Percent	TS	5/9/2005

NVFEL Fuel Analysis Report

13834

Kansas City Samples

Batch#

Facility Name: ERG Facility Type: In House
Owner: EPA Phone: (913) 299-9480
6636 Berger Avenue

U.S.

84462 R2

Samples Type: Correlation

VOC

Inspection information logged in by MM on 4/11/2005.

Season: Winter

Kansas City Samples-374XZC FTAG: 13834 Comments: 594; 1-25-05

Test Code	Test Method	Results	Units	Fuel_ Code: 41	Analyst	Analysis Date
552	MTBE by D5599	0.00	Oxy Percent		TS	4/13/2005
562	ETBE by D5599	0.00	Oxy Percent		TS	4/13/2005
534	Ethanol by D5599	0.00	Oxy Percent		TS	4/13/2005
572	TAME by D5599	0.00	Oxy Percent		TS	4/13/2005
421	Sulfur in Gasoline D2622	130	Parts Per Million		NST	9/7/2005
62	Vapor Pressure by D5191 (Modified)	13.29	PS I		NST	4/12/2005
65	Percent Evaporated at 200 Degrees F D86	49.8	Volume Percent		MM	4/25/2005
66	Percent Evaporated at 300 Degrees F D86	83.9	Volume Percent		MM	4/25/2005
48	Aromatics in Gasoline MSD D5769	21.58	Volume Percent		TW	10/28/2005
49	Olefins in by FIA D1319	10.8	Volume Percent		MM	7/29/2005
64	Benzene in Gasoline D3606	0.98	Volume Percent		TW	8/1/2005
532	Ethanol by D5599	0.00	Volume Percent		TS	4/13/2005
57	TAME by D5599	0.00	Volume Percent		TS	4/13/2005
55	MTBE by D5599	0.00	Volume Percent		TS	4/13/2005
59	Weight Percent Oxygen by D5599	0.00	Weight Percent		TS	4/13/2005
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent		TS	4/13/2005
56	ETBE by D5599	0.00	Volume Percent		TS	4/13/2005
630	Toluene in gasoline by MSD D5769	4.78	Volumn Percent		TW	10/28/2005
63	Benzene in Gasoline by GC/MSD D5769	0.95	Volume Percent		TW	10/28/2005
46	Aromatics by FIA D1319	21.7	Volume Percent		MM	7/29/2005
69	Specific Gravity @ 60 deg F D4052	0.72702	60/60F		MM	4/18/2005
692	Degrees API D4052	63.13	Degrees API		MM	4/18/2005
691	Density @ 60 deg F D4052	0.7263	g/cm-03 @ 60 deg F		MM	4/18/2005
101	Initial Boiling Point D86	80.1	Degrees F		MM	4/25/2005
110	10 Percent D86	99.1	Degrees F		MM	4/25/2005
150	50 Percent D86	200.5	Degrees F		MM	4/25/2005
190	90 Percent D86	329.3	Degrees F		MM	4/25/2005
200	End Point D86	424.8	Degrees F		MM	4/25/2005
201	Residue D86	0.9	mL		MM	4/25/2005
202	Total Recovery D86	96.6	mL		MM	4/25/2005
203	Loss D86	2.5	mL		MM	4/25/2005
543	Methanol by D5599	0.00	Volume Percent		TS	4/13/2005
584	Isopropanol by D5599	0.00	Volume Percent		TS	4/13/2005

585	t-Butanol	by D5599	0.00	Volume Percent	TS	4/13/2005
586	n-Propanol	by D5599	0.00	Volume Percent	TS	4/13/2005
587	sec-Butanol	by D5599	0.00	Volume Percent	TS	4/13/2005
588	DIPE	by D5599	0.00	Volume Percent	TS	4/13/2005
589	Isobutanol	by D5599	0.00	Volume Percent	TS	4/13/2005
5801	t-Amyl Alcohol	by D5599	0.00	Volume Percent	TS	4/13/2005
5802	n-Butanol	by D5599	0.00	Volume Percent	TS	4/13/2005

NVFEL Fuel Analysis Report

13835

Kansas City Samples

Batch#

Facility Name: ERG Facility Type: In House

Owner: EPA Phone: (913) 299-9480

6636 Berger Avenue

NO DYNO
SEMTECH ONLY

U.S.

251 HR2

Samples Type: Correlation

VOC

Inspection information logged in by MM on 4/11/2005.

Season: Winter

Kansas City Samples-251HR2(Mo) FTAG: 13835 Comments: 786; 3-5-05; Both bottle & label damp with gasoline

Test Code	Test Method	Results	Units	Fuel_ Code: 41	Analyst	Analysis Date
552	MTBE by D5599	0.00	Oxy Percent		TS	4/13/2005
562	ETBE by D5599	0.00	Oxy Percent		TS	4/13/2005
534	Ethanol by D5599	3.33	Oxy Percent		TS	4/13/2005
572	TAME by D5599	0.00	Oxy Percent		TS	4/13/2005
421	Sulfur in Gasoline D2622	177	Parts Per Million		NST	9/7/2005
62	Vapor Pressure by D5191 (Modified)	12.84	PS I		NST	4/12/2005
65	Percent Evaporated at 200 Degrees F D86	56.4	Volume Percent		MM	4/25/2005
66	Percent Evaporated at 300 Degrees F D86	85	Volume Percent		MM	4/25/2005
48	Aromatics in Gasoline MSD D5769	21.59	Volume Percent		TW	10/28/2005
49	Olefins in by FIA D1319	9.3	Volume Percent		MM	7/29/2005
64	Benzene in Gasoline D3606	1.01	Volume Percent		TW	8/1/2005
532	Ethanol by D5599	8.89	Volume Percent		TS	4/13/2005
57	TAME by D5599	0.00	Volume Percent		TS	4/13/2005
55	MTBE by D5599	0.00	Volume Percent		TS	4/13/2005
59	Weight Percent Oxygen by D5599	3.33	Weight Percent		TS	4/13/2005
593	Volume Percent Oxygenates by D5599	8.89	Volume Percent		TS	4/13/2005
56	ETBE by D5599	0.00	Volume Percent		TS	4/13/2005
630	Toluene in gasoline by MSD D5769	4.78	Volumn Percent		TW	10/28/2005
63	Benzene in Gasoline by GC/MSD D5769	1	Volume Percent		TW	10/28/2005
46	Aromatics by FIA D1319	22.4	Volume Percent		MM	7/29/2005
69	Specific Gravity @ 60 deg F D4052	0.73655	60/60F		MM	4/18/2005
692	Degrees API D4052	60.61	Degrees API		MM	4/18/2005
691	Density @ 60 deg F D4052	0.73582	g/cm-03 @ 60 deg F		MM	4/18/2005
101	Initial Boiling Point D86	87.8	Degrees F		MM	4/25/2005
110	10 Percent D86	108.7	Degrees F		MM	4/25/2005
150	50 Percent D86	158.5	Degrees F		MM	4/25/2005
190	90 Percent D86	320.5	Degrees F		MM	4/25/2005
200	End Point D86	408	Degrees F		MM	4/25/2005
201	Residue D86	0.7	mL		MM	4/25/2005
202	Total Recovery D86	97.6	mL		MM	4/25/2005
203	Loss D86	1.7	mL		MM	4/25/2005
543	Methanol by D5599	0.00	Volume Percent		TS	4/13/2005
584	Isopropanol by D5599	0.00	Volume Percent		TS	4/13/2005

585	t-Butanol	by D5599	0.00	Volume Percent	TS	4/13/2005
586	n-Propanol	by D5599	0.00	Volume Percent	TS	4/13/2005
587	sec-Butanol	by D5599	0.00	Volume Percent	TS	4/13/2005
588	DIPE	by D5599	0.00	Volume Percent	TS	4/13/2005
589	Isobutanol	by D5599	0.00	Volume Percent	TS	4/13/2005
5801	t-Amyl Alcohol	by D5599	0.00	Volume Percent	TS	4/13/2005
5802	n-Butanol	by D5599	0.00	Volume Percent	TS	4/13/2005

NVFEL Fuel Analysis Report

13836

Kansas City Samples

Batch#

Facility Name: ERG Facility Type: In House

Owner: EPA Phone: (913) 299-9480

6636 Berger Avenue

#84489 R2
#84336 R1 Retest U.S.

Samples Type: Correlation

VOC

Inspection information logged in by MM on 4/11/2005.

Season: Winter

Kansas City Samples-QLX676(Ks) FTAG: 13836 Comments: 626: 2/1/05; cap loose and bottle damp with gasoline

Fuel_ Code: 41

Test Code	Test Method	Results	Units	Analyst	Analysis Date
552	MTBE by D5599	0.00	Oxy Percent	TS	4/13/2005
562	ETBE by D5599	0.00	Oxy Percent	TS	4/13/2005
534	Ethanol by D5599	0.00	Oxy Percent	TS	4/13/2005
572	TAME by D5599	0.00	Oxy Percent	TS	4/13/2005
421	Sulfur in Gasoline D2622	350	Parts Per Million	NST	9/7/2005
62	Vapor Pressure by D5191 (Modified)	13.53	PS I	NST	4/12/2005
65	Percent Evaporated at 200 Degrees F D86	50.8	Volume Percent	MM	4/25/2005
66	Percent Evaporated at 300 Degrees F D86	85.4	Volume Percent	MM	4/25/2005
48	Aromatics in Gasoline MSD D5769	22.68	Volume Percent	TW	10/28/2005
49	Olefins in by FIA D1319	10.6	Volume Percent	MM	7/29/2005
64	Benzene in Gasoline D3606	1.12	Volume Percent	TW	8/1/2005
532	Ethanol by D5599	0.00	Volume Percent	TS	4/13/2005
57	TAME by D5599	0.00	Volume Percent	TS	4/13/2005
55	MTBE by D5599	0.00	Volume Percent	TS	4/13/2005
59	Weight Percent Oxygen by D5599	0.00	Weight Percent	TS	4/13/2005
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent	TS	4/13/2005
56	ETBE by D5599	0.00	Volume Percent	TS	4/13/2005
630	Toluene in gasoline by MSD D5769	5.21	Volumn Percent	TW	10/28/2005
63	Benzene in Gasoline by GC/MSD D5769	1.1	Volume Percent	TW	10/28/2005
46	Aromatics by FIA D1319	24	Volume Percent	MM	7/29/2005
69	Specific Gravity @ 60 deg F D4052	0.72588	60/60F	MM	4/18/2005
692	Degrees API D4052	63.43	Degrees API	MM	4/18/2005
691	Density @ 60 deg F D4052	0.72517	g/cm-03 @ 60 deg F	MM	4/18/2005
101	Initial Boiling Point D86	80.4	Degrees F	MM	4/25/2005
110	10 Percent D86	100	Degrees F	MM	4/25/2005
150	50 Percent D86	197.7	Degrees F	MM	4/25/2005
190	90 Percent D86	319.4	Degrees F	MM	4/25/2005
200	End Point D86	401	Degrees F	MM	4/25/2005
201	Residue D86	0.9	mL	MM	4/25/2005
202	Total Recovery D86	96.8	mL	MM	4/25/2005
203	Loss D86	2.3	mL	MM	4/25/2005
543	Methanol by D5599	0.00	Volume Percent	TS	4/13/2005
584	Isopropanol by D5599	0.00	Volume Percent	TS	4/13/2005

585	t-Butanol	by D5599	0.00	Volume Percent	TS	4/13/2005
586	n-Propanol	by D5599	0.00	Volume Percent	TS	4/13/2005
587	sec-Butanol	by D5599	0.00	Volume Percent	TS	4/13/2005
588	DIPE	by D5599	0.00	Volume Percent	TS	4/13/2005
589	Isobutanol	by D5599	0.00	Volume Percent	TS	4/13/2005
5801	t-Amyl Alcohol	by D5599	0.00	Volume Percent	TS	4/13/2005
5802	n-Butanol	by D5599	0.00	Volume Percent	TS	4/13/2005

NVFEL Fuel Analysis Report

13838

Kansas City Samples

Batch#

Facility Name: ERG   Facility Type: In House

Owner: EPA   Phone: (913) 299-9480

6636 Berger Avenue

R1.5

U.S.

Samples Type: Correlation

VOC

Inspection information logged in by MM on 4/11/2005.

Season: Winter

Kansas City Samples-039SBR(Mo)   FTAG: 13838   Comments: 740; 2-24-05; cap loose, bottle and label damp with gasoline; styrofoam dissol

Fuel_Code: 41

Test Code	Test Method	Results	Units	Analyst	Analysis Date
552	MTBE by D5599	0.00	Oxy Percent	TS	4/14/2005
562	ETBE by D5599	0.00	Oxy Percent	TS	4/14/2005
534	Ethanol by D5599	0.00	Oxy Percent	TS	4/14/2005
572	TAME by D5599	0.00	Oxy Percent	TS	4/14/2005
421	Sulfur in Gasoline D2622	273	Parts Per Million	NST	9/7/2005
62	Vapor Pressure by D5191 (Modified)	13.13	PS I	NST	4/12/2005
65	Percent Evaporated at 200 Degrees F D86	49.4	Volume Percent	MM	4/25/2005
66	Percent Evaporated at 300 Degrees F D86	84.9	Volume Percent	MM	4/25/2005
48	Aromatics in Gasoline MSD D5769	22.15	Volume Percent	TW	10/28/2005
49	Olefins in by FIA D1319	9.8	Volume Percent	MM	7/29/2005
64	Benzene in Gasoline D3606	1.11	Volume Percent	TW	8/1/2005
532	Ethanol by D5599	0.00	Volume Percent	TS	4/14/2005
57	TAME by D5599	0.00	Volume Percent	TS	4/14/2005
55	MTBE by D5599	0.00	Volume Percent	TS	4/14/2005
59	Weight Percent Oxygen by D5599	0.00	Weight Percent	TS	4/14/2005
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent	TS	4/14/2005
56	ETBE by D5599	0.00	Volume Percent	TS	4/14/2005
630	Toluene in gasoline by MSD D5769	5.24	Volumn Percent	TW	10/28/2005
63	Benzene in Gasoline by GC/MSD D5769	1.09	Volume Percent	TW	10/28/2005
46	Aromatics by FIA D1319	21.2	Volume Percent	MM	7/29/2005
69	Specific Gravity @ 60 deg F D4052	0.72747	60/60F	MM	4/18/2005
692	Degrees API D4052	63.01	Degrees API	MM	4/18/2005
691	Density @ 60 deg F D4052	0.72675	g/cm-03 @ 60 deg F	MM	4/18/2005
101	Initial Boiling Point D86	81.3	Degrees F	MM	4/25/2005
110	10 Percent D86	103.3	Degrees F	MM	4/25/2005
150	50 Percent D86	201.6	Degrees F	MM	4/25/2005
190	90 Percent D86	321.1	Degrees F	MM	4/25/2005
200	End Point D86	410.9	Degrees F	MM	4/25/2005
201	Residue D86	0.9	mL	MM	4/25/2005
202	Total Recovery D86	96.7	mL	MM	4/25/2005
203	Loss D86	2.4	mL	MM	4/25/2005
543	Methanol by D5599	0.00	Volume Percent	TS	4/14/2005
584	Isopropanol by D5599	0.00	Volume Percent	TS	4/14/2005

585	t-Butanol	by D5599	0.00	Volume Percent	TS	4/14/2005
586	n-Propanol	by D5599	0.00	Volume Percent	TS	4/14/2005
587	sec-Butanol	by D5599	0.00	Volume Percent	TS	4/14/2005
588	DIPE	by D5599	0.00	Volume Percent	TS	4/14/2005
589	Isobutanol	by D5599	0.00	Volume Percent	TS	4/14/2005
5801	t-Amyl Alcohol	by D5599	0.00	Volume Percent	TS	4/14/2005
5802	n-Butanol	by D5599	0.00	Volume Percent	TS	4/14/2005

NVFEL Fuel Analysis Report

13841

Kansas City Samples

Batch#

Facility Name: ERG Facility Type: In House

Owner: EPA Phone: (913) 299-9480

6636 Berger Avenue

5JX693 84289 R1 U.S.

Samples Type: Correlation VOC

Inspection information logged in by MM on 4/11/2005. **Season:** Winter

Kansas City Samples-?JX693(Ks) FTAG: 13841 Comments: 317; 9-13-04; cap loose, bottle & label damp with gasoline-label partially oblit

Fuel_ Code: 41

Test Code	Test Method	Results	Units	Analyst	Analysis Date
552	MTBE by D5599	0.00	Oxy Percent	TS	4/14/2005
562	ETBE by D5599	0.00	Oxy Percent	TS	4/14/2005
534	Ethanol by D5599	0.00	Oxy Percent	TS	4/14/2005
572	TAME by D5599	0.00	Oxy Percent	TS	4/14/2005
421	Sulfur in Gasoline D2622	98	Parts Per Million	NST	8/24/2005
62	Vapor Pressure by D5191 (Modified)	6.4	PS I	NST	4/12/2005
65	Percent Evaporated at 200 Degrees F D86	36.9	Volume Percent	MM	4/25/2005
66	Percent Evaporated at 300 Degrees F D86	74.6	Volume Percent	MM	4/25/2005
48	Aromatics in Gasoline MSD D5769	37.68	Volume Percent	TW	10/5/2005
49	Olefins in by FIA D1319	10.6	Volume Percent	MM	8/8/2005
64	Benzene in Gasoline D3606	2.31	Volume Percent	TW	8/29/2005
64	Benzene in Gasoline D3606	2.31	Volume Percent	TW	8/29/2005
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent	TS	4/14/2005
57	TAME by D5599	0.00	Volume Percent	TS	4/14/2005
55	MTBE by D5599	0.00	Volume Percent	TS	4/14/2005
532	Ethanol by D5599	0.00	Volume Percent	TS	4/14/2005
59	Weight Percent Oxygen by D5599	0.00	Weight Percent	TS	4/14/2005
56	ETBE by D5599	0.00	Volume Percent	TS	4/14/2005
46	Aromatics by FIA D1319	40.8	Volume Percent	MM	8/8/2005
63	Benzene in Gasoline by GC/MSD D5769	2.27	Volume Percent	TW	10/5/2005
630	Toluene in gasoline by MSD D5769	10.69	Volumn Percent	TW	10/5/2005
69	Specific Gravity @ 60 deg F D4052	0.77083	60/60F	MM	4/18/2005
692	Degrees API D4052	52.07	Degrees API	MM	4/18/2005
691	Density @ 60 deg F D4052	0.77007	g/cm-03 @ 60 deg F	MM	4/18/2005
101	Initial Boiling Point D86	104.5	Degrees F	MM	4/25/2005
110	10 Percent D86	144.1	Degrees F	MM	4/25/2005
150	50 Percent D86	230	Degrees F	MM	4/25/2005
190	90 Percent D86	349.9	Degrees F	MM	4/25/2005
200	End Point D86	420.1	Degrees F	MM	4/25/2005
201	Residue D86	0.8	mL	MM	4/25/2005
202	Total Recovery D86	98.1	mL	MM	4/25/2005
203	Loss D86	1.1	mL	MM	4/25/2005
543	Methanol by D5599	0.00	Volume Percent	TS	4/14/2005

584	Isopropanol	by D5599	0.00 Volume Percent	TS	4/14/2005
585	t-Butanol	by D5599	0.00 Volume Percent	TS	4/14/2005
586	n-Propanol	by D5599	0.00 Volume Percent	TS	4/14/2005
587	sec-Butanol	by D5599	0.00 Volume Percent	TS	4/14/2005
588	DIPE	by D5599	0.00 Volume Percent	TS	4/14/2005
589	Isobutanol	by D5599	0.00 Volume Percent	TS	4/14/2005
5801	t-Amyl Alcohol	by D5599	0.00 Volume Percent	TS	4/14/2005
5802	n-Butanol	by D5599	0.00 Volume Percent	TS	4/14/2005

NVFEL Fuel Analysis Report

13842

Kansas City Samples

Batch#

Facility Name: ERG Facility Type: In House

Owner: EPA Phone: (913) 299-9480

6636 Berger Avenue

84295 R1

U.S.

Samples Type: Correlation

VOC

Inspection information logged in by MM on 4/11/2005.

Season: Winter

Kansas City Samples-950GMG(Mo) FTAG: 13842 Comments: 321; 9-14-04; cap loose & bottle damp with gasoline

Test Code	Test Method	Results	Units	Fuel_ Code: 41	Analyst	Analysis Date
552	MTBE by D5599	0.00	Oxy Percent		TS	4/14/2005
562	ETBE by D5599	0.00	Oxy Percent		TS	4/14/2005
534	Ethanol by D5599	0.00	Oxy Percent		TS	4/14/2005
572	TAME by D5599	0.00	Oxy Percent		TS	4/14/2005
421	Sulfur in Gasoline D2622	48	Parts Per Million		NST	8/24/2005
62	Vapor Pressure by D5191 (Modified)	6.79	PS I		NST	4/12/2005
65	Percent Evaporated at 200 Degrees F D86	40.3	Volume Percent		MM	4/25/2005
66	Percent Evaporated at 300 Degrees F D86	78.1	Volume Percent		MM	4/25/2005
48	Aromatics in Gasoline MSD D5769	29.12	Volume Percent		TW	10/6/2005
49	Olefins in by FIA D1319	11.7	Volume Percent		MM	8/8/2005
64	Benzene in Gasoline D3606	0.93	Volume Percent		TW	8/29/2005
64	Benzene in Gasoline D3606	0.93	Volume Percent		TW	8/29/2005
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent		TS	4/14/2005
57	TAME by D5599	0.00	Volume Percent		TS	4/14/2005
55	MTBE by D5599	0.00	Volume Percent		TS	4/14/2005
532	Ethanol by D5599	0.00	Volume Percent		TS	4/14/2005
59	Weight Percent Oxygen by D5599	0.00	Weight Percent		TS	4/14/2005
56	ETBE by D5599	0.00	Volume Percent		TS	4/14/2005
46	Aromatics by FIA D1319	30.3	Volume Percent		MM	8/8/2005
63	Benzene in Gasoline by GC/MSD D5769	0.92	Volume Percent		TW	10/6/2005
630	Toluene in gasoline by MSD D5769	6.17	Volumn Percent		TW	10/6/2005
69	Specific Gravity @ 60 deg F D4052	0.75382	60/60F		MM	4/18/2005
692	Degrees API D4052	56.21	Degrees API		MM	4/18/2005
691	Density @ 60 deg F D4052	0.75307	g/cm-03 @ 60 deg F		MM	4/18/2005
101	Initial Boiling Point D86	102.9	Degrees F		MM	4/25/2005
110	10 Percent D86	140.4	Degrees F		MM	4/25/2005
150	50 Percent D86	223.3	Degrees F		MM	4/25/2005
190	90 Percent D86	349.5	Degrees F		MM	4/25/2005
200	End Point D86	436.5	Degrees F		MM	4/25/2005
201	Residue D86	0.7	mL		MM	4/25/2005
202	Total Recovery D86	98.2	mL		MM	4/25/2005
203	Loss D86	1.1	mL		MM	4/25/2005
543	Methanol by D5599	0.00	Volume Percent		TS	4/14/2005

584	Isopropanol	by D5599	0.00	Volume Percent	TS	4/14/2005
585	t-Butanol	by D5599	0.00	Volume Percent	TS	4/14/2005
586	n-Propanol	by D5599	0.00	Volume Percent	TS	4/14/2005
587	sec-Butanol	by D5599	0.00	Volume Percent	TS	4/14/2005
588	DIPE	by D5599	0.00	Volume Percent	TS	4/14/2005
589	Isobutanol	by D5599	0.00	Volume Percent	TS	4/14/2005
5801	t-Amyl Alcohol	by D5599	0.00	Volume Percent	TS	4/14/2005
5802	n-Butanol	by D5599	0.00	Volume Percent	TS	4/14/2005

NVFEL Fuel Analysis Report

13843

Kansas City Samples

Batch#

Facility Name: ERG Facility Type: In House

Owner: EPA Phone: (913) 299-9480

6636 Berger Avenue

U.S.

#84601 R2

Samples Type: Correlation

VOC

Inspection information logged in by MM on 4/11/2005.

Season: Winter

Kansas City Samples-52187(Ks) FTAG: 13843 Comments: 757; 2-28-05; bottle & label damp with gasoline

Test Code	Test Method	Results	Units	Fuel_ Code: 41	Analyst	Analysis Date
552	MTBE by D5599	0.00	Oxy Percent		TS	4/14/2005
562	ETBE by D5599	0.00	Oxy Percent		TS	4/14/2005
534	Ethanol by D5599	0.00	Oxy Percent		TS	4/14/2005
572	TAME by D5599	0.00	Oxy Percent		TS	4/14/2005
421	Sulfur in Gasoline D2622	129	Parts Per Million		NST	8/24/2005
62	Vapor Pressure by D5191 (Modified)	12.2	PS I		NST	4/12/2005
65	Percent Evaporated at 200 Degrees F D86	51	Volume Percent		MM	4/25/2005
66	Percent Evaporated at 300 Degrees F D86	82.7	Volume Percent		MM	4/25/2005
48	Aromatics in Gasoline MSD D5769	25.53	Volume Percent		TW	10/6/2005
49	Olefins in by FIA D1319	10.3	Volume Percent		MM	8/8/2005
64	Benzene in Gasoline D3606	1.07	Volume Percent		TW	8/29/2005
64	Benzene in Gasoline D3606	1.07	Volume Percent		TW	8/29/2005
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent		TS	4/14/2005
57	TAME by D5599	0.00	Volume Percent		TS	4/14/2005
55	MTBE by D5599	0.00	Volume Percent		TS	4/14/2005
532	Ethanol by D5599	0.00	Volume Percent		TS	4/14/2005
59	Weight Percent Oxygen by D5599	0.00	Weight Percent		TS	4/14/2005
56	ETBE by D5599	0.00	Volume Percent		TS	4/14/2005
46	Aromatics by FIA D1319	25.9	Volume Percent		MM	8/8/2005
63	Benzene in Gasoline by GC/MSD D5769	1.06	Volume Percent		TW	10/6/2005
630	Toluene in gasoline by MSD D5769	5.37	Volumn Percent		TW	10/6/2005
69	Specific Gravity @ 60 deg F D4052	0.73348	60/60F		MM	4/18/2005
692	Degrees API D4052	61.42	Degrees API		MM	4/18/2005
691	Density @ 60 deg F D4052	0.73275	g/cm-03 @ 60 deg F		MM	4/18/2005
101	Initial Boiling Point D86	83.5	Degrees F		MM	4/25/2005
110	10 Percent D86	106.9	Degrees F		MM	4/25/2005
150	50 Percent D86	197.1	Degrees F		MM	4/25/2005
190	90 Percent D86	331.7	Degrees F		MM	4/25/2005
200	End Point D86	412.9	Degrees F		MM	4/25/2005
201	Residue D86	0.8	mL		MM	4/25/2005
202	Total Recovery D86	97.3	mL		MM	4/25/2005
203	Loss D86	1.9	mL		MM	4/25/2005
543	Methanol by D5599	0.00	Volume Percent		TS	4/14/2005

584	Isopropanol	by D5599	0.00 Volume Percent	TS	4/14/2005
585	t-Butanol	by D5599	0.00 Volume Percent	TS	4/14/2005
586	n-Propanol	by D5599	0.00 Volume Percent	TS	4/14/2005
587	sec-Butanol	by D5599	0.00 Volume Percent	TS	4/14/2005
588	DIPE	by D5599	0.00 Volume Percent	TS	4/14/2005
589	Isobutanol	by D5599	0.00 Volume Percent	TS	4/14/2005
5801	t-Amyl Alcohol	by D5599	0.00 Volume Percent	TS	4/14/2005
5802	n-Butanol	by D5599	0.00 Volume Percent	TS	4/14/2005

NVFEL Fuel Analysis Report

13844

Kansas City Samples

Batch#

Facility Name: ERG Facility Type: In House
Owner: EPA Phone: (913) 299-9480
6636 Berger Avenue

#84707 R2

U.S.

Samples Type: Correlation

VOC

Inspection information logged in by MM on 4/11/2005.

Season: Winter

Kansas City Samples-VYC662(Ks) FTAG: 13844 Comments: 872; 3-22-05; cap loose, gasoline between bottle & liner, bottle & label damp

Test Code	Test Method	Results	Units	Fuel_ Code: 41	Analyst	Analysis Date
552	MTBE by D5599	0.00	Oxy Percent		TS	4/14/2005
562	ETBE by D5599	0.00	Oxy Percent		TS	4/14/2005
534	Ethanol by D5599	0.00	Oxy Percent		TS	4/14/2005
572	TAME by D5599	0.00	Oxy Percent		TS	4/14/2005
421	Sulfur in Gasoline D2622	131	Parts Per Million		NST	9/7/2005
62	Vapor Pressure by D5191 (Modified)	11.33	PS I		NST	4/12/2005
62	Vapor Pressure by D5191 (Modified)	11.31	PS I		NST	4/12/2005
65	Percent Evaporated at 200 Degrees F D86	50.4	Volume Percent		MM	4/25/2005
66	Percent Evaporated at 300 Degrees F D86	83.2	Volume Percent		MM	4/25/2005
48	Aromatics in Gasoline MSD D5769	24.78	Volume Percent		TW	10/28/2005
48	Aromatics in Gasoline MSD D5769	24.66	Volume Percent		TW	10/28/2005
49	Olefins in by FIA D1319	9.5	Volume Percent		MM	8/9/2005
64	Benzene in Gasoline D3606	1.13	Volume Percent		TW	8/1/2005
57	TAME by D5599	0.00	Volume Percent		TS	4/14/2005
532	Ethanol by D5599	0.00	Volume Percent		TS	4/14/2005
55	MTBE by D5599	0.00	Volume Percent		TS	4/14/2005
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent		TS	4/14/2005
59	Weight Percent Oxygen by D5599	0.00	Weight Percent		TS	4/14/2005
56	ETBE by D5599	0.00	Volume Percent		TS	4/14/2005
46	Aromatics by FIA D1319	24.7	Volume Percent		MM	8/9/2005
63	Benzene in Gasoline by GC/MSD D5769	1.11	Volume Percent		TW	10/28/2005
63	Benzene in Gasoline by GC/MSD D5769	1.11	Volume Percent		TW	10/28/2005
630	Toluene in gasoline by MSD D5769	5.39	Volumn Percent		TW	10/28/2005
630	Toluene in gasoline by MSD D5769	5.36	Volumn Percent		TW	10/28/2005
69	Specific Gravity @ 60 deg F D4052	0.7346	60/60F		MM	4/18/2005
692	Degrees API D4052	61.12	Degrees API		MM	4/18/2005
691	Density @ 60 deg F D4052	0.73388	g/cm-03 @ 60 deg F		MM	4/18/2005
101	Initial Boiling Point D86	83.5	Degrees F		MM	4/25/2005
110	10 Percent D86	107.5	Degrees F		MM	4/25/2005
150	50 Percent D86	198.7	Degrees F		MM	4/25/2005
190	90 Percent D86	330	Degrees F		MM	4/25/2005
200	End Point D86	422.7	Degrees F		MM	4/25/2005
201	Residue D86	0.8	mL		MM	4/25/2005

202	Total Recovery	D86	96.6 mL	MM	4/25/2005
203	Loss	D86	2.6 mL	MM	4/25/2005
543	Methanol	by D5599	0.00 Volume Percent	TS	4/14/2005
584	Isopropanol	by D5599	0.00 Volume Percent	TS	4/14/2005
585	t-Butanol	by D5599	0.00 Volume Percent	TS	4/14/2005
586	n-Propanol	by D5599	0.00 Volume Percent	TS	4/14/2005
587	sec-Butanol	by D5599	0.00 Volume Percent	TS	4/14/2005
588	DIPE	by D5599	0.00 Volume Percent	TS	4/14/2005
589	Isobutanol	by D5599	0.00 Volume Percent	TS	4/14/2005
5801	t-Amyl Alcohol	by D5599	0.00 Volume Percent	TS	4/14/2005
5802	n-Butanol	by D5599	0.00 Volume Percent	TS	4/14/2005

NVFEL Fuel Analysis Report

13845

Kansas City Samples

Batch#

Facility Name: ERG Facility Type: In House

Owner: EPA Phone: (913) 299-9480

6636 Berger Avenue

NO DYNO
SEMTECH ONLY

U.S.

Samples Type: Correlation

VOC

Inspection information logged in by MM on 4/11/2005.

Season: Winter

Kansas City Samples-TDZ932(Ks) FTAG: 13845 Comments: 773; 3-3-05; bottle & label damp with gasoline

Test Code	Test Method	Results	Units	Fuel_ Code: 41	Analyst	Analysis Date
552	MTBE by D5599	0.00	Oxy Percent		TS	4/14/2005
562	ETBE by D5599	0.00	Oxy Percent		TS	4/14/2005
534	Ethanol by D5599	0.00	Oxy Percent		TS	4/14/2005
572	TAME by D5599	0.00	Oxy Percent		TS	4/14/2005
421	Sulfur in Gasoline D2622	128	Parts Per Million		NST	6/23/2005
62	Vapor Pressure by D5191 (Modified)	12.26	PS I		NST	4/12/2005
65	Percent Evaporated at 200 Degrees F D86	49.1	Volume Percent		MM	4/29/2005
66	Percent Evaporated at 300 Degrees F D86	83.4	Volume Percent		MM	4/29/2005
48	Aromatics in Gasoline MSD D5769	25.91	Volume Percent		TW	10/4/2005
49	Olefins in by FIA D1319	9.7	Volume Percent		MM	8/9/2005
64	Benzene in Gasoline D3606	1.29	Volume Percent		TW	8/11/2005
64	Benzene in Gasoline D3606	1.29	Volume Percent		TW	8/11/2005
59	Weight Percent Oxygen by D5599	0.00	Weight Percent		TS	4/14/2005
55	MTBE by D5599	0.00	Volume Percent		TS	4/14/2005
532	Ethanol by D5599	0.00	Volume Percent		TS	4/14/2005
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent		TS	4/14/2005
57	TAME by D5599	0.00	Volume Percent		TS	4/14/2005
56	ETBE by D5599	0.00	Volume Percent		TS	4/14/2005
630	Toluene in gasoline by MSD D5769	5.89	Volumn Percent		TW	10/4/2005
63	Benzene in Gasoline by GC/MSD D5769	1.29	Volume Percent		TW	10/4/2005
46	Aromatics by FIA D1319	25.6	Volume Percent		MM	8/9/2005
69	Specific Gravity @ 60 deg F D4052	0.73567	60/60F		MM	4/18/2005
692	Degrees API D4052	60.84	Degrees API		MM	4/18/2005
691	Density @ 60 deg F D4052	0.73494	g/cm-03 @ 60 deg F		MM	4/18/2005
101	Initial Boiling Point D86	86	Degrees F		MM	4/29/2005
110	10 Percent D86	112.1	Degrees F		MM	4/29/2005
150	50 Percent D86	202.6	Degrees F		MM	4/29/2005
190	90 Percent D86	328.3	Degrees F		MM	4/29/2005
200	End Point D86	411.4	Degrees F		MM	4/29/2005
201	Residue D86	0.8	mL		MM	4/29/2005
202	Total Recovery D86	97.5	mL		MM	4/29/2005
203	Loss D86	1.7	mL		MM	4/29/2005
543	Methanol by D5599	0.00	Volume Percent		TS	4/14/2005

584	Isopropanol	by D5599	0.00 Volume Percent	TS	4/14/2005
585	t-Butanol	by D5599	0.00 Volume Percent	TS	4/14/2005
586	n-Propanol	by D5599	0.00 Volume Percent	TS	4/14/2005
587	sec-Butanol	by D5599	0.00 Volume Percent	TS	4/14/2005
588	DIPE	by D5599	0.00 Volume Percent	TS	4/14/2005
589	Isobutanol	by D5599	0.00 Volume Percent	TS	4/14/2005
5801	t-Amyl Alcohol	by D5599	0.00 Volume Percent	TS	4/14/2005
5802	n-Butanol	by D5599	0.00 Volume Percent	TS	4/14/2005

NVFEL Fuel Analysis Report

13846

Kansas City Samples

Batch#

Facility Name: ERG   Facility Type: In House

Owner: EPA   Phone: (913) 299-9480

6636 Berger Avenue

U.S.

84752 R2

Samples Type: Correlation

VOC

Inspection information logged in by MM on 4/11/2005.

Season: Winter

Kansas City Samples- 552HPO   FTAG: 13846   Comments: 917; 4-2-05; cap loose & label damp with gasoline, neck chipped on bottle, tra

Test Code	Test Method	Results	Units	Fuel_ Code: 41	Analyst	Analysis Date
552	MTBE by D5599	0.00	Oxy Percent		TS	4/14/2005
562	ETBE by D5599	0.00	Oxy Percent		TS	4/14/2005
534	Ethanol by D5599	0.00	Oxy Percent		TS	4/14/2005
572	TAME by D5599	0.00	Oxy Percent		TS	4/14/2005
421	Sulfur in Gasoline D2622	197	Parts Per Million		NST	6/23/2005
62	Vapor Pressure by D5191 (Modified)	9.18	PS I		NST	4/12/2005
65	Percent Evaporated at 200 Degrees F D86	43.6	Volume Percent		MM	4/29/2005
66	Percent Evaporated at 300 Degrees F D86	82.8	Volume Percent		MM	4/29/2005
48	Aromatics in Gasoline MSD D5769	26.25	Volume Percent		TW	10/4/2005
49	Olefins in by FIA D1319	8.9	Volume Percent		MM	8/9/2005
64	Benzene in Gasoline D3606	1.29	Volume Percent		TW	8/11/2005
64	Benzene in Gasoline D3606	1.29	Volume Percent		TW	8/11/2005
59	Weight Percent Oxygen by D5599	0.00	Weight Percent		TS	4/14/2005
55	MTBE by D5599	0.00	Volume Percent		TS	4/14/2005
532	Ethanol by D5599	0.00	Volume Percent		TS	4/14/2005
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent		TS	4/14/2005
57	TAME by D5599	0.00	Volume Percent		TS	4/14/2005
56	ETBE by D5599	0.00	Volume Percent		TS	4/14/2005
630	Toluene in gasoline by MSD D5769	6	Volumn Percent		TW	10/4/2005
63	Benzene in Gasoline by GC/MSD D5769	1.28	Volume Percent		TW	10/4/2005
46	Aromatics by FIA D1319	26.5	Volume Percent		MM	8/9/2005
69	Specific Gravity @ 60 deg F D4052	0.7416	60/60F		MM	4/18/2005
692	Degrees API D4052	59.3	Degrees API		MM	4/18/2005
691	Density @ 60 deg F D4052	0.74087	g/cm-03 @ 60 deg F		MM	4/18/2005
101	Initial Boiling Point D86	91	Degrees F		MM	4/29/2005
110	10 Percent D86	126.7	Degrees F		MM	4/29/2005
150	50 Percent D86	214	Degrees F		MM	4/29/2005
190	90 Percent D86	328.8	Degrees F		MM	4/29/2005
200	End Point D86	408	Degrees F		MM	4/29/2005
201	Residue D86	0.9	mL		MM	4/29/2005
202	Total Recovery D86	97.7	mL		MM	4/29/2005
203	Loss D86	1.4	mL		MM	4/29/2005
543	Methanol by D5599	0.00	Volume Percent		TS	4/14/2005

584	Isopropanol	by D5599	0.00 Volume Percent	TS	4/14/2005
585	t-Butanol	by D5599	0.00 Volume Percent	TS	4/14/2005
586	n-Propanol	by D5599	0.00 Volume Percent	TS	4/14/2005
587	sec-Butanol	by D5599	0.00 Volume Percent	TS	4/14/2005
588	DIPE	by D5599	0.00 Volume Percent	TS	4/14/2005
589	Isobutanol	by D5599	0.00 Volume Percent	TS	4/14/2005
5801	t-Amyl Alcohol	by D5599	0.00 Volume Percent	TS	4/14/2005
5802	n-Butanol	by D5599	0.00 Volume Percent	TS	4/14/2005

NVFEL Fuel Analysis Report

13847

Kansas City Samples

Batch#

Facility Name: ERG Facility Type: In House

Owner: EPA Phone: (913) 299-9480

6636 Berger Avenue

84738 R2

U.S.

Samples Type: Correlation

VOC

Inspection information logged in by MM on 4/11/2005.

Season: Winter

Kansas City Samples-SIL313(Ks) FTAG: 13847 Comments: 910; 3-29-05; cazp loose & label damp with gasoline

Test Code	Test Method	Results	Units	Fuel_ Code: 41	Analyst	Analysis Date
552	MTBE by D5599	0.00	Oxy Percent		TS	4/14/2005
552	MTBE by D5599	0.00	Oxy Percent		TS	4/14/2005
562	ETBE by D5599	0.00	Oxy Percent		TS	4/14/2005
562	ETBE by D5599	0.00	Oxy Percent		TS	4/14/2005
534	Ethanol by D5599	0.00	Oxy Percent		TS	4/14/2005
534	Ethanol by D5599	0.00	Oxy Percent		TS	4/14/2005
572	TAME by D5599	0.00	Oxy Percent		TS	4/14/2005
572	TAME by D5599	0.00	Oxy Percent		TS	4/14/2005
421	Sulfur in Gasoline D2622	143	Parts Per Million		NST	6/23/2005
62	Vapor Pressure by D5191 (Modified)	11.02	PS I		NST	4/12/2005
65	Percent Evaporated at 200 Degrees F D86	50	Volume Percent		MM	4/29/2005
66	Percent Evaporated at 300 Degrees F D86	83.6	Volume Percent		MM	4/29/2005
48	Aromatics in Gasoline MSD D5769	22.72	Volume Percent		TW	10/4/2005
49	Olefins in by FIA D1319	11.7	Volume Percent		MM	8/9/2005
64	Benzene in Gasoline D3606	1.05	Volume Percent		TW	8/11/2005
64	Benzene in Gasoline D3606	1.05	Volume Percent		TW	8/11/2005
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent		TS	4/14/2005
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent		TS	4/14/2005
55	MTBE by D5599	0.00	Volume Percent		TS	4/14/2005
57	TAME by D5599	0.00	Volume Percent		TS	4/14/2005
57	TAME by D5599	0.00	Volume Percent		TS	4/14/2005
59	Weight Percent Oxygen by D5599	0.00	Weight Percent		TS	4/14/2005
59	Weight Percent Oxygen by D5599	0.00	Weight Percent		TS	4/14/2005
532	Ethanol by D5599	0.00	Volume Percent		TS	4/14/2005
532	Ethanol by D5599	0.00	Volume Percent		TS	4/14/2005
55	MTBE by D5599	0.00	Volume Percent		TS	4/14/2005
56	ETBE by D5599	0.00	Volume Percent		TS	4/14/2005
56	ETBE by D5599	0.00	Volume Percent		TS	4/14/2005
46	Aromatics by FIA D1319	23.9	Volume Percent		MM	8/9/2005
63	Benzene in Gasoline by GC/MSD D5769	1.05	Volume Percent		TW	10/4/2005
630	Toluene in gasoline by MSD D5769	5.21	Volumn Percent		TW	10/4/2005
69	Specific Gravity @ 60 deg F D4052	0.73319	60/60F		MM	4/18/2005
692	Degrees API D4052	61.49	Degrees API		MM	4/18/2005

NVFEL Fuel Analysis Report

691	Density @ 60 deg F	D4052	0.73246 g/cm-03 @ 60 deg F	MM	4/18/2005
101	Initial Boiling Point	D86	83.6 Degrees F	MM	4/29/2005
110	10 Percent	D86	111.4 Degrees F	MM	4/29/2005
150	50 Percent	D86	200 Degrees F	MM	4/29/2005
190	90 Percent	D86	329.8 Degrees F	MM	4/29/2005
200	End Point	D86	419 Degrees F	MM	4/29/2005
201	Residue	D86	0.9 mL	MM	4/29/2005
202	Total Recovery	D86	96.8 mL	MM	4/29/2005
203	Loss	D86	2.3 mL	MM	4/29/2005
543	Methanol	by D5599	0.00 Volume Percent	TS	4/14/2005
543	Methanol	by D5599	0.00 Volume Percent	TS	4/14/2005
584	Isopropanol	by D5599	0.00 Volume Percent	TS	4/14/2005
584	Isopropanol	by D5599	0.00 Volume Percent	TS	4/14/2005
585	t-Butanol	by D5599	0.00 Volume Percent	TS	4/14/2005
585	t-Butanol	by D5599	0.00 Volume Percent	TS	4/14/2005
586	n-Propanol	by D5599	0.00 Volume Percent	TS	4/14/2005
586	n-Propanol	by D5599	0.00 Volume Percent	TS	4/14/2005
587	sec-Butanol	by D5599	0.00 Volume Percent	TS	4/14/2005
587	sec-Butanol	by D5599	0.00 Volume Percent	TS	4/14/2005
588	DIPE	by D5599	0.00 Volume Percent	TS	4/14/2005
588	DIPE	by D5599	0.00 Volume Percent	TS	4/14/2005
589	Isobutanol	by D5599	0.00 Volume Percent	TS	4/14/2005
589	Isobutanol	by D5599	0.00 Volume Percent	TS	4/14/2005
5801	t-Amyl Alcohol	by D5599	0.00 Volume Percent	TS	4/14/2005
5801	t-Amyl Alcohol	by D5599	0.00 Volume Percent	TS	4/14/2005
5802	n-Butanol	by D5599	0.00 Volume Percent	TS	4/14/2005
5802	n-Butanol	by D5599	0.00 Volume Percent	TS	4/14/2005

NVFEL Fuel Analysis Report

13848

Kansas City Samples

Batch#

Facility Name: ERG   Facility Type: In House

Owner: EPA   Phone: (913) 299-9480

6636 Berger Avenue

#84627 R 2

U.S.

Samples Type: Correlation

VOC

Inspection information logged in by MM on 4/11/2005.

Season: Winter

Kansas City Samples-813NSI(Mo)   FTAG: 13848   Comments: 776; 3-4-05; bottle & label damp with gasoline

Test Code	Test Method	Results	Units	Fuel_ Code: 41	Analyst	Analysis Date
552	MTBE by D5599	0.00	Oxy Percent		TS	4/18/2005
562	ETBE by D5599	0.00	Oxy Percent		TS	4/18/2005
534	Ethanol by D5599	0.00	Oxy Percent		TS	4/18/2005
572	TAME by D5599	0.00	Oxy Percent		TS	4/18/2005
421	Sulfur in Gasoline D2622	121	Parts Per Million		NST	6/23/2005
62	Vapor Pressure by D5191 (Modified)	11.56	PS I		NST	4/12/2005
65	Percent Evaporated at 200 Degrees F D86	48.3	Volume Percent		MM	4/29/2005
66	Percent Evaporated at 300 Degrees F D86	83.3	Volume Percent		MM	4/29/2005
48	Aromatics in Gasoline MSD D5769	22.2	Volume Percent		TW	10/4/2005
49	Olefins in by FIA D1319	7.2	Volume Percent		MM	8/9/2005
64	Benzene in Gasoline D3606	0.82	Volume Percent		TW	8/11/2005
64	Benzene in Gasoline D3606	0.82	Volume Percent		TW	8/11/2005
59	Weight Percent Oxygen by D5599	0.00	Weight Percent		TS	4/18/2005
55	MTBE by D5599	0.00	Volume Percent		TS	4/18/2005
532	Ethanol by D5599	0.00	Volume Percent		TS	4/18/2005
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent		TS	4/18/2005
57	TAME by D5599	0.00	Volume Percent		TS	4/18/2005
56	ETBE by D5599	0.00	Volume Percent		TS	4/18/2005
630	Toluene in gasoline by MSD D5769	4.58	Volumn Percent		TW	10/4/2005
63	Benzene in Gasoline by GC/MSD D5769	0.81	Volume Percent		TW	10/4/2005
46	Aromatics by FIA D1319	22.3	Volume Percent		MM	8/9/2005
69	Specific Gravity @ 60 deg F D4052	0.73228	60/60F		MM	4/18/2005
692	Degrees API D4052	61.73	Degrees API		MM	4/18/2005
691	Density @ 60 deg F D4052	0.73155	g/cm-03 @ 60 deg F		MM	4/18/2005
101	Initial Boiling Point D86	85.5	Degrees F		MM	4/29/2005
110	10 Percent D86	112.6	Degrees F		MM	4/29/2005
150	50 Percent D86	203.9	Degrees F		MM	4/29/2005
190	90 Percent D86	331.7	Degrees F		MM	4/29/2005
200	End Point D86	426.4	Degrees F		MM	4/29/2005
201	Residue D86	0.7	mL		MM	4/29/2005
202	Total Recovery D86	97.6	mL		MM	4/29/2005
203	Loss D86	1.7	mL		MM	4/29/2005
543	Methanol by D5599	0.00	Volume Percent		TS	4/18/2005

584	Isopropanol	by D5599	0.00	Volume Percent	TS	4/18/2005
585	t-Butanol	by D5599	0.00	Volume Percent	TS	4/18/2005
586	n-Propanol	by D5599	0.00	Volume Percent	TS	4/18/2005
587	sec-Butanol	by D5599	0.00	Volume Percent	TS	4/18/2005
588	DIPE	by D5599	0.00	Volume Percent	TS	4/18/2005
589	Isobutanol	by D5599	0.00	Volume Percent	TS	4/18/2005
5801	t-Amyl Alcohol	by D5599	0.00	Volume Percent	TS	4/18/2005
5802	n-Butanol	by D5599	0.00	Volume Percent	TS	4/18/2005

NVFEL Fuel Analysis Report

13849

Kansas City Samples

Batch#

Facility Name: ERG Facility Type: In House
Owner: EPA Phone: (913) 299-9480
6636 Berger Avenue

U.S.

84754 R2

Samples Type: Correlation

VOC

Inspection information logged in by MM on 4/11/2005.

Season: Winter

Kansas City Samples-637DER(Mo) FTAG: 13849 Comments: 506; 4-4-05; cap very loose, label & bottle damp with gasoline

Fuel_ Code: 41

Test Code	Test Method	Results	Units	Analyst	Analysis Date
552	MTBE by D5599	0.00	Oxy Percent	TS	4/18/2005
562	ETBE by D5599	0.00	Oxy Percent	TS	4/18/2005
534	Ethanol by D5599	0.00	Oxy Percent	TS	4/18/2005
572	TAME by D5599	0.00	Oxy Percent	TS	4/18/2005
421	Sulfur in Gasoline D2622	173	Parts Per Million	NST	6/23/2005
62	Vapor Pressure by D5191 (Modified)	11.15	PS I	NST	4/12/2005
65	Percent Evaporated at 200 Degrees F D86	49.5	Volume Percent	MM	4/29/2005
66	Percent Evaporated at 300 Degrees F D86	84.4	Volume Percent	MM	4/29/2005
48	Aromatics in Gasoline MSD D5769	23.88	Volume Percent	TW	10/4/2005
49	Olefins in by FIA D1319	8.9	Volume Percent	MM	8/9/2005
64	Benzene in Gasoline D3606	1.17	Volume Percent	TW	8/9/2005
64	Benzene in Gasoline D3606	1.17	Volume Percent	TW	8/9/2005
59	Weight Percent Oxygen by D5599	0.00	Weight Percent	TS	4/18/2005
55	MTBE by D5599	0.00	Volume Percent	TS	4/18/2005
532	Ethanol by D5599	0.00	Volume Percent	TS	4/18/2005
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent	TS	4/18/2005
57	TAME by D5599	0.00	Volume Percent	TS	4/18/2005
56	ETBE by D5599	0.00	Volume Percent	TS	4/18/2005
630	Toluene in gasoline by MSD D5769	5.27	Volumn Percent	TW	10/4/2005
63	Benzene in Gasoline by GC/MSD D5769	1.15	Volume Percent	TW	10/4/2005
46	Aromatics by FIA D1319	23.2	Volume Percent	MM	8/9/2005
69	Specific Gravity @ 60 deg F D4052	0.73312	60/60F	MM	4/18/2005
692	Degrees API D4052	61.51	Degrees API	MM	4/18/2005
691	Density @ 60 deg F D4052	0.73239	g/cm-03 @ 60 deg F	MM	4/18/2005
101	Initial Boiling Point D86	87.6	Degrees F	MM	4/29/2005
110	10 Percent D86	113.5	Degrees F	MM	4/29/2005
150	50 Percent D86	201.2	Degrees F	MM	4/29/2005
190	90 Percent D86	324.9	Degrees F	MM	4/29/2005
200	End Point D86	411.6	Degrees F	MM	4/29/2005
201	Residue D86	0.8	mL	MM	4/29/2005
202	Total Recovery D86	97.8	mL	MM	4/29/2005
203	Loss D86	1.4	mL	MM	4/29/2005
543	Methanol by D5599	0.00	Volume Percent	TS	4/18/2005

584	Isopropanol	by D5599	0.00 Volume Percent	TS	4/18/2005
585	t-Butanol	by D5599	0.00 Volume Percent	TS	4/18/2005
586	n-Propanol	by D5599	0.00 Volume Percent	TS	4/18/2005
587	sec-Butanol	by D5599	0.00 Volume Percent	TS	4/18/2005
588	DIPE	by D5599	0.00 Volume Percent	TS	4/18/2005
589	Isobutanol	by D5599	0.00 Volume Percent	TS	4/18/2005
5801	t-Amyl Alcohol	by D5599	0.00 Volume Percent	TS	4/18/2005
5802	n-Butanol	by D5599	0.00 Volume Percent	TS	4/18/2005

NVFEL Fuel Analysis Report

13850

Kansas City Samples

Batch#

Facility Name: ERG Facility Type: In House

Owner: EPA Phone: (913) 299-9480

6636 Berger Avenue

84485 R2

U.S.

Samples Type: Correlation

VOC

Inspection information logged in by MM on 4/11/2005.

Season: Winter

Kansas City Samples-VVJ245(Ks) FTAG: 13850 Comments: 623; 1-31-05; cap loose - bottle & label damp with gasoline

Test Code	Test Method	Results	Units	Fuel_ Code: 41	Analyst	Analysis Date
552	MTBE by D5599	0.00	Oxy Percent		TS	4/18/2005
552	MTBE by D5599	0.00	Oxy Percent		TS	4/18/2005
562	ETBE by D5599	0.00	Oxy Percent		TS	4/18/2005
562	ETBE by D5599	0.00	Oxy Percent		TS	4/18/2005
534	Ethanol by D5599	0.00	Oxy Percent		TS	4/18/2005
534	Ethanol by D5599	0.00	Oxy Percent		TS	4/18/2005
572	TAME by D5599	0.00	Oxy Percent		TS	4/18/2005
572	TAME by D5599	0.00	Oxy Percent		TS	4/18/2005
421	Sulfur in Gasoline D2622	84	Parts Per Million		NST	6/23/2005
62	Vapor Pressure by D5191 (Modified)	12.24	PS I		NST	4/12/2005
65	Percent Evaporated at 200 Degrees F D86	43.3	Volume Percent		MM	4/29/2005
66	Percent Evaporated at 300 Degrees F D86	84.4	Volume Percent		MM	4/29/2005
48	Aromatics in Gasoline MSD D5769	27.15	Volume Percent		TW	10/4/2005
49	Olefins in by FIA D1319	5	Volume Percent		MM	8/11/2005
64	Benzene in Gasoline D3606	0.73	Volume Percent		TW	8/11/2005
64	Benzene in Gasoline D3606	0.73	Volume Percent		TW	8/11/2005
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent		TS	4/18/2005
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent		TS	4/18/2005
55	MTBE by D5599	0.00	Volume Percent		TS	4/18/2005
57	TAME by D5599	0.00	Volume Percent		TS	4/18/2005
57	TAME by D5599	0.00	Volume Percent		TS	4/18/2005
59	Weight Percent Oxygen by D5599	0.00	Weight Percent		TS	4/18/2005
59	Weight Percent Oxygen by D5599	0.00	Weight Percent		TS	4/18/2005
532	Ethanol by D5599	0.00	Volume Percent		TS	4/18/2005
532	Ethanol by D5599	0.00	Volume Percent		TS	4/18/2005
55	MTBE by D5599	0.00	Volume Percent		TS	4/18/2005
56	ETBE by D5599	0.00	Volume Percent		TS	4/18/2005
56	ETBE by D5599	0.00	Volume Percent		TS	4/18/2005
46	Aromatics by FIA D1319	25.5	Volume Percent		MM	8/11/2005
63	Benzene in Gasoline by GC/MSD D5769	0.73	Volume Percent		TW	10/4/2005
630	Toluene in gasoline by MSD D5769	7.07	Volumn Percent		TW	10/4/2005
69	Specific Gravity @ 60 deg F D4052	0.73377	60/60F		MM	4/18/2005
692	Degrees API D4052	61.34	Degrees API		MM	4/18/2005

691	Density @ 60 deg F	D4052	0.73305 g/cm-03 @ 60 deg F	MM	4/18/2005
101	Initial Boiling Point	D86	83.3 Degrees F	MM	4/29/2005
110	10 Percent	D86	107.8 Degrees F	MM	4/29/2005
150	50 Percent	D86	219.2 Degrees F	MM	4/29/2005
190	90 Percent	D86	323.4 Degrees F	MM	4/29/2005
200	End Point	D86	409.3 Degrees F	MM	4/29/2005
201	Residue	D86	0.7 mL	MM	4/29/2005
202	Total Recovery	D86	97.3 mL	MM	4/29/2005
203	Loss	D86	2 mL	MM	4/29/2005
543	Methanol	by D5599	0.00 Volume Percent	TS	4/18/2005
543	Methanol	by D5599	0.00 Volume Percent	TS	4/18/2005
584	Isopropanol	by D5599	0.00 Volume Percent	TS	4/18/2005
584	Isopropanol	by D5599	0.00 Volume Percent	TS	4/18/2005
585	t-Butanol	by D5599	0.00 Volume Percent	TS	4/18/2005
585	t-Butanol	by D5599	0.00 Volume Percent	TS	4/18/2005
586	n-Propanol	by D5599	0.00 Volume Percent	TS	4/18/2005
586	n-Propanol	by D5599	0.00 Volume Percent	TS	4/18/2005
587	sec-Butanol	by D5599	0.00 Volume Percent	TS	4/18/2005
587	sec-Butanol	by D5599	0.00 Volume Percent	TS	4/18/2005
588	DIPE	by D5599	0.00 Volume Percent	TS	4/18/2005
588	DIPE	by D5599	0.00 Volume Percent	TS	4/18/2005
589	Isobutanol	by D5599	0.00 Volume Percent	TS	4/18/2005
589	Isobutanol	by D5599	0.00 Volume Percent	TS	4/18/2005
5801	t-Amyl Alcohol	by D5599	0.00 Volume Percent	TS	4/18/2005
5801	t-Amyl Alcohol	by D5599	0.00 Volume Percent	TS	4/18/2005
5802	n-Butanol	by D5599	0.00 Volume Percent	TS	4/18/2005
5802	n-Butanol	by D5599	0.00 Volume Percent	TS	4/18/2005

NVFEL Fuel Analysis Report

13851

Kansas City Samples

Batch#

Facility Name: ERG Facility Type: In House

Owner: EPA Phone: (913) 299-9480

6636 Berger Avenue

U.S.

R1.5

Samples Type: Correlation

VOC

Inspection information logged in by MM on 4/11/2005.

Season: Winter

Kansas City Samples-UMK459(Ks) FTAG: 13851 Comments: 741; 2-24-05; bottle & label damp with gasoline

Test Code	Test Method	Results	Units	Fuel_ Code: 41	Analyst	Analysis Date
552	MTBE by D5599	0.00	Oxy Percent		TS	4/21/2005
552	MTBE by D5599	0.00	Oxy Percent		TS	4/21/2005
562	ETBE by D5599	0.00	Oxy Percent		TS	4/21/2005
562	ETBE by D5599	0.00	Oxy Percent		TS	4/21/2005
534	Ethanol by D5599	0.00	Oxy Percent		TS	4/21/2005
534	Ethanol by D5599	0.00	Oxy Percent		TS	4/21/2005
572	TAME by D5599	0.00	Oxy Percent		TS	4/21/2005
572	TAME by D5599	0.00	Oxy Percent		TS	4/21/2005
421	Sulfur in Gasoline D2622	166	Parts Per Million		NST	6/23/2005
421	Sulfur in Gasoline D2622	168	Parts Per Million		NST	6/23/2005
62	Vapor Pressure by D5191 (Modified)	13.01	PS I		NST	4/12/2005
62	Vapor Pressure by D5191 (Modified)	13.01	PS I		NST	4/12/2005
65	Percent Evaporated at 200 Degrees F D86	51	Volume Percent		MM	4/29/2005
66	Percent Evaporated at 300 Degrees F D86	84.7	Volume Percent		MM	4/29/2005
48	Aromatics in Gasoline MSD D5769	23.35	Volume Percent		TW	10/4/2005
49	Olefins in by FIA D1319	9.3	Volume Percent		MM	8/11/2005
64	Benzene in Gasoline D3606	1.13	Volume Percent		TW	8/11/2005
64	Benzene in Gasoline D3606	1.13	Volume Percent		TW	8/11/2005
64	Benzene in Gasoline D3606	1.13	Volume Percent		TW	8/11/2005
64	Benzene in Gasoline D3606	1.13	Volume Percent		TW	8/11/2005
532	Ethanol by D5599	0.00	Volume Percent		TS	4/21/2005
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent		TS	4/21/2005
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent		TS	4/21/2005
55	MTBE by D5599	0.00	Volume Percent		TS	4/21/2005
55	MTBE by D5599	0.00	Volume Percent		TS	4/21/2005
532	Ethanol by D5599	0.00	Volume Percent		TS	4/21/2005
57	TAME by D5599	0.00	Volume Percent		TS	4/21/2005
57	TAME by D5599	0.00	Volume Percent		TS	4/21/2005
59	Weight Percent Oxygen by D5599	0.00	Weight Percent		TS	4/21/2005
59	Weight Percent Oxygen by D5599	0.00	Weight Percent		TS	4/21/2005
56	ETBE by D5599	0.00	Volume Percent		TS	4/21/2005
56	ETBE by D5599	0.00	Volume Percent		TS	4/21/2005
630	Toluene in gasoline by MSD D5769	5.5	Volumn Percent		TW	10/4/2005

46	Aromatics by FIA D1319	23.3 Volume Percent	MM	8/11/2005
63	Benzene in Gasoline by GC/MSD D5769	1.12 Volume Percent	TW	10/4/2005
69	Specific Gravity @ 60 deg F D4052	0.72948 60/60F	MM	4/18/2005
69	Specific Gravity @ 60 deg F D4052	0.72946 60/60F	MM	4/18/2005
692	Degrees API D4052	62.47 Degrees API	MM	4/18/2005
692	Degrees API D4052	62.48 Degrees API	MM	4/18/2005
691	Density @ 60 deg F D4052	0.72874 g/cm-03 @ 60 deg F	MM	4/18/2005
691	Density @ 60 deg F D4052	0.72876 g/cm-03 @ 60 deg F	MM	4/18/2005
101	Initial Boiling Point D86	80.7 Degrees F	MM	4/29/2005
110	10 Percent D86	101.5 Degrees F	MM	4/29/2005
150	50 Percent D86	197.7 Degrees F	MM	4/29/2005
190	90 Percent D86	324.7 Degrees F	MM	4/29/2005
200	End Point D86	411.8 Degrees F	MM	4/29/2005
201	Residue D86	0.8 mL	MM	4/29/2005
202	Total Recovery D86	96.2 mL	MM	4/29/2005
203	Loss D86	3 mL	MM	4/29/2005
543	Methanol by D5599	0.00 Volume Percent	TS	4/21/2005
543	Methanol by D5599	0.00 Volume Percent	TS	4/21/2005
584	Isopropanol by D5599	0.00 Volume Percent	TS	4/21/2005
584	Isopropanol by D5599	0.00 Volume Percent	TS	4/21/2005
585	t-Butanol by D5599	0.00 Volume Percent	TS	4/21/2005
585	t-Butanol by D5599	0.00 Volume Percent	TS	4/21/2005
586	n-Propanol by D5599	0.00 Volume Percent	TS	4/21/2005
586	n-Propanol by D5599	0.00 Volume Percent	TS	4/21/2005
587	sec-Butanol by D5599	0.00 Volume Percent	TS	4/21/2005
587	sec-Butanol by D5599	0.00 Volume Percent	TS	4/21/2005
588	DIPE by D5599	0.00 Volume Percent	TS	4/21/2005
588	DIPE by D5599	0.00 Volume Percent	TS	4/21/2005
589	Isobutanol by D5599	0.00 Volume Percent	TS	4/21/2005
589	Isobutanol by D5599	0.00 Volume Percent	TS	4/21/2005
5801	t-Amyl Alcohol by D5599	0.00 Volume Percent	TS	4/21/2005
5801	t-Amyl Alcohol by D5599	0.00 Volume Percent	TS	4/21/2005
5802	n-Butanol by D5599	0.00 Volume Percent	TS	4/21/2005
5802	n-Butanol by D5599	0.00 Volume Percent	TS	4/21/2005

NVFEL Fuel Analysis Report

13839

Kansas City Samples

Batch#

Facility Name: ERG Facility Type: In House

Owner: EPA Phone: (913) 299-9480

6636 Berger Avenue

236FZJ — # 84334 121

U.S.

Samples Type: Correlation

VOC

Inspection information logged in by MM on 4/11/2005.

Season: Winter

Kansas City Samples-230FZJ(Mo) FTAG: 13839 Comments: #355; 9-21-04; cap very loose, bottle and label damp with gasoline, label parti

Fuel_Code: 41

Test Code	Test Method	Results	Units	Analyst	Analysis Date
552	MTBE by D5599	0.00	Oxy Percent	TS	4/14/2005
562	ETBE by D5599	0.00	Oxy Percent	TS	4/14/2005
534	Ethanol by D5599	0.00	Oxy Percent	TS	4/14/2005
572	TAME by D5599	0.00	Oxy Percent	TS	4/14/2005
421	Sulfur in Gasoline D2622	149	Parts Per Million	NST	8/24/2005
62	Vapor Pressure by D5191 (Modified)	7.21	PS I	NST	4/12/2005
65	Percent Evaporated at 200 Degrees F D86	38.5	Volume Percent	MM	4/25/2005
66	Percent Evaporated at 300 Degrees F D86	80.5	Volume Percent	MM	4/25/2005
48	Aromatics in Gasoline MSD D5769	32.61	Volume Percent	TW	11/8/2005
49	Olefins in by FIA D1319	8.9	Volume Percent	MM	8/8/2005
64	Benzene in Gasoline D3606	1.63	Volume Percent	TW	8/24/2005
532	Ethanol by D5599	0.00	Volume Percent	TS	4/14/2005
57	TAME by D5599	0.00	Volume Percent	TS	4/14/2005
55	MTBE by D5599	0.00	Volume Percent	TS	4/14/2005
59	Weight Percent Oxygen by D5599	0.00	Weight Percent	TS	4/14/2005
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent	TS	4/14/2005
56	ETBE by D5599	0.00	Volume Percent	TS	4/14/2005
630	Toluene in gasoline by MSD D5769	7.39	Volumn Percent	TW	11/8/2005
63	Benzene in Gasoline by GC/MSD D5769	1.61	Volume Percent	TW	11/8/2005
46	Aromatics by FIA D1319	33	Volume Percent	MM	8/8/2005
69	Specific Gravity @ 60 deg F D4052	0.75546	60/60F	MM	4/18/2005
692	Degrees API D4052	55.8	Degrees API	MM	4/18/2005
691	Density @ 60 deg F D4052	0.75471	g/cm-03 @ 60 deg F	MM	4/18/2005
101	Initial Boiling Point D86	101.5	Degrees F	MM	4/25/2005
110	10 Percent D86	140.9	Degrees F	MM	4/25/2005
150	50 Percent D86	224.6	Degrees F	MM	4/25/2005
190	90 Percent D86	334.2	Degrees F	MM	4/25/2005
200	End Point D86	417.9	Degrees F	MM	4/25/2005
201	Residue D86	0.9	mL	MM	4/25/2005
202	Total Recovery D86	98	mL	MM	4/25/2005
203	Loss D86	1.1	mL	MM	4/25/2005
543	Methanol by D5599	0.00	Volume Percent	TS	4/14/2005
584	Isopropanol by D5599	0.00	Volume Percent	TS	4/14/2005

NVFEL Fuel Analysis Report

585	t-Butanol	by D5599	0.00	Volume Percent	TS	4/14/2005
586	n-Propanol	by D5599	0.00	Volume Percent	TS	4/14/2005
587	sec-Butanol	by D5599	0.00	Volume Percent	TS	4/14/2005
588	DIPE	by D5599	0.00	Volume Percent	TS	4/14/2005
589	Isobutanol	by D5599	0.00	Volume Percent	TS	4/14/2005
5801	t-Amyl Alcohol	by D5599	0.00	Volume Percent	TS	4/14/2005
5802	n-Butanol	by D5599	0.00	Volume Percent	TS	4/14/2005

NVFEL Fuel Analysis Report

13833

Kansas City Samples

Batch#

Facility Name: ERG Facility Type: In House

Owner: EPA Phone: (913) 299-9480

6636 Berger Avenue

84420 R2

R1 Retest (84151)

U.S.

Samples Type: Correlation

VOC

Inspection information logged in by MM on 4/11/2005.

Season: Winter

Kansas City Samples-QHM049 FTAG: 13833 Comments: 556; 1-17-05

Test Code	Test Method	Results	Units	Fuel_ Code: 41	Analyst	Analysis Date
552	MTBE by D5599	0.00	Oxy Percent		TS	4/13/2005
562	ETBE by D5599	0.00	Oxy Percent		TS	4/13/2005
534	Ethanol by D5599	0.00	Oxy Percent		TS	4/13/2005
572	TAME by D5599	0.00	Oxy Percent		TS	4/13/2005
421	Sulfur in Gasoline D2622	373	Parts Per Million		NST	8/24/2005
62	Vapor Pressure by D5191 (Modified)	14.24	PS I		NST	4/12/2005
62	Vapor Pressure by D5191 (Modified)	14.24	PS I		NST	4/12/2005
65	Percent Evaporated at 200 Degrees F D86	50.4	Volume Percent		MM	4/25/2005
66	Percent Evaporated at 300 Degrees F D86	85.2	Volume Percent		MM	4/25/2005
48	Aromatics in Gasoline MSD D5769	22.58	Volume Percent		TW	11/8/2005
48	Aromatics in Gasoline MSD D5769	22.57	Volume Percent		TW	11/8/2005
49	Olefins in by FIA D1319	10.2	Volume Percent		MM	7/29/2005
64	Benzene in Gasoline D3606	1.27	Volume Percent		TW	8/24/2005
57	TAME by D5599	0.00	Volume Percent		TS	4/13/2005
532	Ethanol by D5599	0.00	Volume Percent		TS	4/13/2005
55	MTBE by D5599	0.00	Volume Percent		TS	4/13/2005
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent		TS	4/13/2005
59	Weight Percent Oxygen by D5599	0.00	Weight Percent		TS	4/13/2005
56	ETBE by D5599	0.00	Volume Percent		TS	4/13/2005
46	Aromatics by FIA D1319	22.3	Volume Percent		MM	7/29/2005
63	Benzene in Gasoline by GC/MSD D5769	1.25	Volume Percent		TW	11/8/2005
63	Benzene in Gasoline by GC/MSD D5769	1.25	Volume Percent		TW	11/8/2005
630	Toluene in gasoline by MSD D5769	5.14	Volumn Percent		TW	11/8/2005
630	Toluene in gasoline by MSD D5769	5.1	Volumn Percent		TW	11/8/2005
69	Specific Gravity @ 60 deg F D4052	0.72724	60/60F		MM	4/18/2005
692	Degrees API D4052	63.07	Degrees API		MM	4/18/2005
691	Density @ 60 deg F D4052	0.72652	g/cm-03 @ 60 deg F		MM	4/18/2005
101	Initial Boiling Point D86	81	Degrees F		MM	4/25/2005
110	10 Percent D86	99.5	Degrees F		MM	4/25/2005
150	50 Percent D86	199.2	Degrees F		MM	4/25/2005
190	90 Percent D86	318.4	Degrees F		MM	4/25/2005
200	End Point D86	402.6	Degrees F		MM	4/25/2005
201	Residue D86	0.8	mL		MM	4/25/2005

202	Total Recovery	D86	96.8 mL	MM	4/25/2005
203	Loss	D86	2.4 mL	MM	4/25/2005
543	Methanol	by D5599	0.00 Volume Percent	TS	4/13/2005
584	Isopropanol	by D5599	0.00 Volume Percent	TS	4/13/2005
585	t-Butanol	by D5599	0.00 Volume Percent	TS	4/13/2005
586	n-Propanol	by D5599	0.00 Volume Percent	TS	4/13/2005
587	sec-Butanol	by D5599	0.00 Volume Percent	TS	4/13/2005
588	DIPE	by D5599	0.00 Volume Percent	TS	4/13/2005
589	Isobutanol	by D5599	0.00 Volume Percent	TS	4/13/2005
5801	t-Amyl Alcohol	by D5599	0.00 Volume Percent	TS	4/13/2005
5802	n-Butanol	by D5599	0.00 Volume Percent	TS	4/13/2005

NVFEL Fuel Analysis Report

13837

Kansas City Samples

Batch#

Facility Name: ERG Facility Type: In House
Owner: EPA Phone: (913) 299-9480
6636 Berger Avenue

Redraft # 84349
84444 R2

U.S.

Samples Type: Correlation

VOC

Inspection information logged in by MM on 4/11/2005.

Season: Winter

Kansas City Samples-612GLS(Mo) FTAG: 13837 Comments: 582; 1-21-05; bottle, label and overpack damp with gasoline

Test Code	Test Method	Results	Units	Fuel_ Code: 41	Analyst	Analysis Date
552	MTBE by D5599	0.00	Oxy Percent		TS	4/13/2005
552	MTBE by D5599	0.00	Oxy Percent		TS	4/13/2005
562	ETBE by D5599	0.00	Oxy Percent		TS	4/13/2005
562	ETBE by D5599	0.00	Oxy Percent		TS	4/13/2005
534	Ethanol by D5599	0.00	Oxy Percent		TS	4/13/2005
534	Ethanol by D5599	0.00	Oxy Percent		TS	4/13/2005
572	TAME by D5599	0.00	Oxy Percent		TS	4/13/2005
572	TAME by D5599	0.00	Oxy Percent		TS	4/13/2005
421	Sulfur in Gasoline D2622	351	Parts Per Million		NST	8/24/2005
62	Vapor Pressure by D5191 (Modified)	14.16	PS I		NST	4/12/2005
65	Percent Evaporated at 200 Degrees F D86	52	Volume Percent		MM	4/25/2005
66	Percent Evaporated at 300 Degrees F D86	85.9	Volume Percent		MM	4/25/2005
48	Aromatics in Gasoline MSD D5769	22.69	Volume Percent		TW	11/8/2005
49	Olefins in by FIA D1319	9.4	Volume Percent		MM	7/29/2005
64	Benzene in Gasoline D3606	1.39	Volume Percent		TW	8/24/2005
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent		TS	4/13/2005
532	Ethanol by D5599	0.00	Volume Percent		TS	4/13/2005
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent		TS	4/13/2005
55	MTBE by D5599	0.00	Volume Percent		TS	4/13/2005
57	TAME by D5599	0.00	Volume Percent		TS	4/13/2005
57	TAME by D5599	0.00	Volume Percent		TS	4/13/2005
59	Weight Percent Oxygen by D5599	0.00	Weight Percent		TS	4/13/2005
55	MTBE by D5599	0.00	Volume Percent		TS	4/13/2005
532	Ethanol by D5599	0.00	Volume Percent		TS	4/13/2005
59	Weight Percent Oxygen by D5599	0.00	Weight Percent		TS	4/13/2005
56	ETBE by D5599	0.00	Volume Percent		TS	4/13/2005
56	ETBE by D5599	0.00	Volume Percent		TS	4/13/2005
46	Aromatics by FIA D1319	21.9	Volume Percent		MM	7/29/2005
63	Benzene in Gasoline by GC/MSD D5769	1.36	Volume Percent		TW	11/8/2005
630	Toluene in gasoline by MSD D5769	5.26	Volumn Percent		TW	11/8/2005
69	Specific Gravity @ 60 deg F D4052	0.72622	60/60F		MM	4/18/2005
692	Degrees API D4052	63.34	Degrees API		MM	4/18/2005
691	Density @ 60 deg F D4052	0.7255	g/cm-03 @ 60 deg F		MM	4/18/2005

NVFEL Fuel Analysis Report

101	Initial Boiling Point	D86	83.7	Degrees F	MM	4/25/2005
110	10 Percent	D86	99.5	Degrees F	MM	4/25/2005
150	50 Percent	D86	195.1	Degrees F	MM	4/25/2005
190	90 Percent	D86	318.9	Degrees F	MM	4/25/2005
200	End Point	D86	405	Degrees F	MM	4/25/2005
201	Residue	D86	0.8	mL	MM	4/25/2005
202	Total Recovery	D86	96.7	mL	MM	4/25/2005
203	Loss	D86	2.5	mL	MM	4/25/2005
543	Methanol	by D5599	0.00	Volume Percent	TS	4/13/2005
543	Methanol	by D5599	0.00	Volume Percent	TS	4/13/2005
584	Isopropanol	by D5599	0.00	Volume Percent	TS	4/13/2005
584	Isopropanol	by D5599	0.00	Volume Percent	TS	4/13/2005
585	t-Butanol	by D5599	0.00	Volume Percent	TS	4/13/2005
585	t-Butanol	by D5599	0.00	Volume Percent	TS	4/13/2005
586	n-Propanol	by D5599	0.00	Volume Percent	TS	4/13/2005
586	n-Propanol	by D5599	0.00	Volume Percent	TS	4/13/2005
587	sec-Butanol	by D5599	0.00	Volume Percent	TS	4/13/2005
587	sec-Butanol	by D5599	0.00	Volume Percent	TS	4/13/2005
588	DIPE	by D5599	0.00	Volume Percent	TS	4/13/2005
588	DIPE	by D5599	0.00	Volume Percent	TS	4/13/2005
589	Isobutanol	by D5599	0.00	Volume Percent	TS	4/13/2005
589	Isobutanol	by D5599	0.00	Volume Percent	TS	4/13/2005
5801	t-Amyl Alcohol	by D5599	0.00	Volume Percent	TS	4/13/2005
5801	t-Amyl Alcohol	by D5599	0.00	Volume Percent	TS	4/13/2005
5802	n-Butanol	by D5599	0.00	Volume Percent	TS	4/13/2005
5802	n-Butanol	by D5599	0.00	Volume Percent	TS	4/13/2005

NVFEL Fuel Analysis Report

13840

Kansas City Samples

Batch#

Facility Name: ERG Facility Type: In House

Owner: EPA Phone: (913) 299-9480

6636 Berger Avenue

84277 R1

U.S.

Samples Type: Correlation

VOC

Inspection information logged in by MM on 4/11/2005.

Season: Winter

Kansas City Samples- VMI391(Ks) FTAG: 13840 Comments: 308; 9-10-04; cap loose

Fuel_ Code: 41

Test Code	Test Method	Results	Units	Analyst	Analysis Date
552	MTBE by D5599	0.00	Oxy Percent	TS	4/14/2005
562	ETBE by D5599	0.00	Oxy Percent	TS	4/14/2005
534	Ethanol by D5599	0.00	Oxy Percent	TS	4/14/2005
572	TAME by D5599	0.00	Oxy Percent	TS	4/14/2005
421	Sulfur in Gasoline D2622	174	Parts Per Million	NST	8/24/2005
62	Vapor Pressure by D5191 (Modified)	6.22	PS I	NST	4/12/2005
65	Percent Evaporated at 200 Degrees F D86	36.7	Volume Percent	MM	4/25/2005
66	Percent Evaporated at 300 Degrees F D86	80.8	Volume Percent	MM	4/25/2005
48	Aromatics in Gasoline MSD D5769	34.83	Volume Percent	TW	11/8/2005
49	Olefins in by FIA D1319	7.7	Volume Percent	MM	8/8/2005
64	Benzene in Gasoline D3606	2.01	Volume Percent	TW	8/24/2005
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent	TS	4/14/2005
57	TAME by D5599	0.00	Volume Percent	TS	4/14/2005
59	Weight Percent Oxygen by D5599	0.00	Weight Percent	TS	4/14/2005
532	Ethanol by D5599	0.00	Volume Percent	TS	4/14/2005
55	MTBE by D5599	0.00	Volume Percent	TS	4/14/2005
56	ETBE by D5599	0.00	Volume Percent	TS	4/14/2005
63	Benzene in Gasoline by GC/MSD D5769	1.97	Volume Percent	TW	11/8/2005
630	Toluene in gasoline by MSD D5769	8.13	Volumn Percent	TW	11/8/2005
46	Aromatics by FIA D1319	35.7	Volume Percent	MM	8/8/2005
69	Specific Gravity @ 60 deg F D4052	0.76029	60/60F	MM	4/18/2005
69	Specific Gravity @ 60 deg F D4052	0.76026	60/60F	MM	4/18/2005
692	Degrees API D4052	54.62	Degrees API	MM	4/18/2005
692	Degrees API D4052	54.61	Degrees API	MM	4/18/2005
691	Density @ 60 deg F D4052	0.75951	g/cm-03 @ 60 deg F	MM	4/18/2005
691	Density @ 60 deg F D4052	0.75954	g/cm-03 @ 60 deg F	MM	4/18/2005
101	Initial Boiling Point D86	99.1	Degrees F	MM	4/25/2005
110	10 Percent D86	146.1	Degrees F	MM	4/25/2005
150	50 Percent D86	227.3	Degrees F	MM	4/25/2005
190	90 Percent D86	331.3	Degrees F	MM	4/25/2005
200	End Point D86	417.8	Degrees F	MM	4/25/2005
201	Residue D86	0.8	mL	MM	4/25/2005
202	Total Recovery D86	97.6	mL	MM	4/25/2005

203	Loss	D86	1.6 mL	MM	4/25/2005
543	Methanol	by D5599	0.00 Volume Percent	TS	4/14/2005
584	Isopropanol	by D5599	0.00 Volume Percent	TS	4/14/2005
585	t-Butanol	by D5599	0.00 Volume Percent	TS	4/14/2005
586	n-Propanol	by D5599	0.00 Volume Percent	TS	4/14/2005
587	sec-Butanol	by D5599	0.00 Volume Percent	TS	4/14/2005
588	DIPE	by D5599	0.00 Volume Percent	TS	4/14/2005
589	Isobutanol	by D5599	0.00 Volume Percent	TS	4/14/2005
5801	t-Amyl Alcohol	by D5599	0.00 Volume Percent	TS	4/14/2005
5802	n-Butanol	by D5599	0.00 Volume Percent	TS	4/14/2005

NVFEL Fuel Analysis Report

14276

Kansas City Samples

Batch#

Facility Name: ERG Facility Type: In House

Owner: EPA Phone: (913) 299-9480

6636 Berger Avenue

U.S.

Samples Type: Correlation

VOC

Inspection information logged in by MM on 11/23/05.

Season: Winter

Kansas City Samples-891LAC(Mo) **FTAG: 14276** **Comments:** **782; 3-5-05**

Test Code	Test Method	Results	Units	Fuel_ Code: **41**	Analys	Analysis Date
552	MTBE by D5599	0.00	Oxy Percent		TS	12/5/05
562	ETBE by D5599	0.00	Oxy Percent		TS	12/5/05
534	Ethanol by D5599	0.00	Oxy Percent		TS	12/5/05
572	TAME by D5599	0.00	Oxy Percent		TS	12/5/05
421	Sulfur in Gasoline D2622	119	Parts Per Million		NST	3/2/06
62	Vapor Pressure by D5191 (Modified)	12.59	PSI		MM	11/25/05
65	Percent Evaporated at 200 Degrees F D86	53.3	Volume Percent		MM	11/28/05
66	Percent Evaporated at 300 Degrees F D86	85.6	Volume Percent		MM	11/28/05
48	Aromatics in Gasoline MSD D5769	22.63	Volume Percent		TW	12/17/05
49	Olefins in by FIA D1319	7.8	Volume Percent		MM	11/28/05
64	Benzene in Gasoline D3606	1.17	Volume Percent		TW	12/6/05
532	Ethanol by D5599	0.00	Volume Percent		TS	12/5/05
55	MTBE by D5599	0.00	Volume Percent		TS	12/5/05
59	Weight Percent Oxygen by D5599	0.00	Weight Percent		TS	12/5/05
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent		TS	12/5/05
57	TAME by D5599	0.00	Volume Percent		TS	12/5/05
56	ETBE by D5599	0.00	Volume Percent		TS	12/5/05
630	Toluene in gasoline by MSD D5769	5.26	Volumn Percent		TW	12/17/05
63	Benzene in Gasoline by GC/MSD D5769	1.11	Volume Percent		TW	12/17/05
46	Aromatics by FIA D1319	21.8	Volume Percent		MM	11/28/05
69	Specific Gravity @ 60 deg F D4052	0.72652	60/60F		MM	11/25/05
69	Specific Gravity @ 60 deg F D4052	0.72653	60/60F		MM	11/25/05
692	Degrees API D4052	63.26	Degrees API		MM	11/25/05
692	Degrees API D4052	63.26	Degrees API		MM	11/25/05
691	Density @ 60 deg F D4052	0.7258	g/cm-03 @ 60 deg F		MM	11/25/05
691	Density @ 60 deg F D4052	0.72581	g/cm-03 @ 60 deg F		MM	11/25/05
101	Initial Boiling Point D86	81.9	Degrees F		MM	11/28/05
110	10 Percent D86	104.5	Degrees F		MM	11/28/05
150	50 Percent D86	192.1	Degrees F		MM	11/28/05
190	90 Percent D86	322.5	Degrees F		MM	11/28/05
200	End Point D86	414	Degrees F		MM	11/28/05
201	Residue D86	0.9	mL		MM	11/28/05
202	Total Recovery D86	96.8	mL		MM	11/28/05

203	Loss	D86	2.3 mL	MM	11/28/05
543	Methanol	by D5599	0.00 Volume Percent	TS	12/5/05
584	Isopropanol	by D5599	0.00 Volume Percent	TS	12/5/05
585	t-Butanol	by D5599	0.00 Volume Percent	TS	12/5/05
586	n-Propanol	by D5599	0.00 Volume Percent	TS	12/5/05
587	sec-Butanol	by D5599	0.00 Volume Percent	TS	12/5/05
588	DIPE	by D5599	0.00 Volume Percent	TS	12/5/05
589	Isobutanol	by D5599	0.00 Volume Percent	TS	12/5/05
5801	t-Amyl Alcohol	by D5599	0.00 Volume Percent	TS	12/5/05
5802	n-Butanol	by D5599	0.00 Volume Percent	TS	12/5/05

NVFEL Fuel Analysis Report

14277 Batch#

Kansas City Samples

Facility Name: ERG Facility Type: In House

Owner: EPA Phone: (913) 299-9480

6636 Berger Avenue

U.S.

Samples Type: Correlation

VOC

Inspection information logged in by MM on 11/23/05.

Season: Winter

Kansas City Samples-218KZS(Mo) **FTAG: 14277** **Comments:** **299; 9-9-04**

Test Code	Test Method	Results	Units	Fuel_ Code: 41	Analys	Analysis Date
552	MTBE by D5599	0.00	Oxy Percent		TS	12/5/05
562	ETBE by D5599	0.00	Oxy Percent		TS	12/5/05
534	Ethanol by D5599	0.00	Oxy Percent		TS	12/5/05
572	TAME by D5599	0.00	Oxy Percent		TS	12/5/05
421	Sulfur in Gasoline D2622	13	Parts Per Million		NST	3/2/06
62	Vapor Pressure by D5191 (Modified)	6.38	PS I		MM	11/25/05
62	Vapor Pressure by D5191 (Modified)	6.38	PS I		MM	11/25/05
65	Percent Evaporated at 200 Degrees F D86	29.1	Volume Percent		MM	11/28/05
66	Percent Evaporated at 300 Degrees F D86	85.7	Volume Percent		MM	11/28/05
48	Aromatics in Gasoline MSD D5769	27.74	Volume Percent		TW	12/17/05
49	Olefins in by FIA D1319	2.1	Volume Percent		MM	11/28/05
64	Benzene in Gasoline D3606	1.71	Volume Percent		TW	12/6/05
59	Weight Percent Oxygen by D5599	0.00	Weight Percent		TS	12/5/05
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent		TS	12/5/05
55	MTBE by D5599	0.00	Volume Percent		TS	12/5/05
532	Ethanol by D5599	0.00	Volume Percent		TS	12/5/05
57	TAME by D5599	0.00	Volume Percent		TS	12/5/05
56	ETBE by D5599	0.00	Volume Percent		TS	12/5/05
630	Toluene in gasoline by MSD D5769	8.31	Volumn Percent		TW	12/17/05
46	Aromatics by FIA D1319	27.2	Volume Percent		MM	11/28/05
63	Benzene in Gasoline by GC/MSD D5769	1.65	Volume Percent		TW	12/17/05
69	Specific Gravity @ 60 deg F D4052	0.74496	60/60F		MM	11/25/05
69	Specific Gravity @ 60 deg F D4052	0.74504	60/60F		MM	11/25/05
692	Degrees API D4052	58.44	Degrees API		MM	11/25/05
692	Degrees API D4052	58.42	Degrees API		MM	11/25/05
691	Density @ 60 deg F D4052	0.74423	g/cm-03 @ 60 deg F		MM	11/25/05
691	Density @ 60 deg F D4052	0.74431	g/cm-03 @ 60 deg F		MM	11/25/05
101	Initial Boiling Point D86	98.9	Degrees F		MM	11/28/05
110	10 Percent D86	154.8	Degrees F		MM	11/28/05
150	50 Percent D86	227.2	Degrees F		MM	11/28/05
190	90 Percent D86	318.9	Degrees F		MM	11/28/05
200	End Point D86	401.9	Degrees F		MM	11/28/05
201	Residue D86	0.9	mL		MM	11/28/05

202	Total Recovery	D86	97.5 mL	MM	11/28/05
203	Loss	D86	1.6 mL	MM	11/28/05
543	Methanol	by D5599	0.00 Volume Percent	TS	12/5/05
584	Isopropanol	by D5599	0.00 Volume Percent	TS	12/5/05
585	t-Butanol	by D5599	0.00 Volume Percent	TS	12/5/05
586	n-Propanol	by D5599	0.00 Volume Percent	TS	12/5/05
587	sec-Butanol	by D5599	0.00 Volume Percent	TS	12/5/05
588	DIPE	by D5599	0.00 Volume Percent	TS	12/5/05
589	Isobutanol	by D5599	0.00 Volume Percent	TS	12/5/05
5801	t-Amyl Alcohol	by D5599	0.00 Volume Percent	TS	12/5/05
5802	n-Butanol	by D5599	0.00 Volume Percent	TS	12/5/05

NVFEL Fuel Analysis Report

14278

Kansas City Samples

Batch#

Facility Name: ERG Facility Type: In House

Owner: EPA Phone: (913) 299-9480

6636 Berger Avenue

U.S.

Samples Type: Correlation

VOC

Inspection information logged in by MM on 11/23/05.

Season: Winter

Kansas City Samples-202GMB(Mo) **FTAG: 14278** **Comments:** **725; 2-22-05**

Test Code	Test Method	Results	Units	Fuel_ Code: 41	Analys	Analysis Date
552	MTBE by D5599	0.00	Oxy Percent		TS	12/5/05
562	ETBE by D5599	0.00	Oxy Percent		TS	12/5/05
534	Ethanol by D5599	0.00	Oxy Percent		TS	12/5/05
572	TAME by D5599	0.00	Oxy Percent		TS	12/5/05
421	Sulfur in Gasoline D2622	195	Parts Per Million		NST	3/2/06
62	Vapor Pressure by D5191 (Modified)	12.71	PSI		MM	11/25/05
65	Percent Evaporated at 200 Degrees F D86	50.4	Volume Percent		MM	11/28/05
66	Percent Evaporated at 300 Degrees F D86	84.7	Volume Percent		MM	11/28/05
48	Aromatics in Gasoline MSD D5769	23.18	Volume Percent		TW	12/17/05
48	Aromatics in Gasoline MSD D5769	23.22	Volume Percent		TW	12/17/05
49	Olefins in by FIA D1319	9.4	Volume Percent		MM	11/28/05
64	Benzene in Gasoline D3606	1.19	Volume Percent		TW	12/6/05
64	Benzene in Gasoline D3606	1.21	Volume Percent		TW	12/6/05
55	MTBE by D5599	0.00	Volume Percent		TS	12/5/05
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent		TS	12/5/05
59	Weight Percent Oxygen by D5599	0.00	Weight Percent		TS	12/5/05
532	Ethanol by D5599	0.00	Volume Percent		TS	12/5/05
57	TAME by D5599	0.00	Volume Percent		TS	12/5/05
56	ETBE by D5599	0.00	Volume Percent		TS	12/5/05
46	Aromatics by FIA D1319	22.4	Volume Percent		MM	11/28/05
630	Toluene in gasoline by MSD D5769	5.65	Volumn Percent		TW	12/17/05
630	Toluene in gasoline by MSD D5769	5.64	Volumn Percent		TW	12/17/05
63	Benzene in Gasoline by GC/MSD D5769	1.14	Volume Percent		TW	12/17/05
63	Benzene in Gasoline by GC/MSD D5769	1.14	Volume Percent		TW	12/17/05
69	Specific Gravity @ 60 deg F D4052	0.7288	60/60F		MM	11/25/05
69	Specific Gravity @ 60 deg F D4052	0.72875	60/60F		MM	11/25/05
692	Degrees API D4052	62.67	Degrees API		MM	11/25/05
692	Degrees API D4052	62.66	Degrees API		MM	11/25/05
691	Density @ 60 deg F D4052	0.72808	g/cm-03 @ 60 deg F		MM	11/25/05
691	Density @ 60 deg F D4052	0.72803	g/cm-03 @ 60 deg F		MM	11/25/05
101	Initial Boiling Point D86	82.8	Degrees F		MM	11/28/05
110	10 Percent D86	103.4	Degrees F		MM	11/28/05
150	50 Percent D86	198.7	Degrees F		MM	11/28/05

190	90 Percent	D86	321.7	Degrees F	MM	11/28/05
200	End Point	D86	406.7	Degrees F	MM	11/28/05
201	Residue	D86	0.9	mL	MM	11/28/05
202	Total Recovery	D86	96.7	mL	MM	11/28/05
203	Loss	D86	2.4	mL	MM	11/28/05
543	Methanol	by D5599	0.00	Volume Percent	TS	12/5/05
584	Isopropanol	by D5599	0.00	Volume Percent	TS	12/5/05
585	t-Butanol	by D5599	0.00	Volume Percent	TS	12/5/05
586	n-Propanol	by D5599	0.00	Volume Percent	TS	12/5/05
587	sec-Butanol	by D5599	0.00	Volume Percent	TS	12/5/05
588	DIPE	by D5599	0.00	Volume Percent	TS	12/5/05
589	Isobutanol	by D5599	0.00	Volume Percent	TS	12/5/05
5801	t-Amyl Alcohol	by D5599	0.00	Volume Percent	TS	12/5/05
5802	n-Butanol	by D5599	0.00	Volume Percent	TS	12/5/05

NVFEL Fuel Analysis Report

14279

Kansas City Samples

Batch#

Facility Name: ERG   Facility Type: In House

Owner: EPA   Phone: (913) 299-9480

6636 Berger Avenue

U.S.

Samples Type: Correlation

VOC

Inspection information logged in by MM on 11/23/05.

Season: Winter

Kansas City Samples-601NZR(Mo)   **FTAG: 14279**   **Comments:** **736; 2-24-05**

Test Code	Test Method	Results	Units	Fuel_ Code: 41	Analys	Analysis Date
552	MTBE by D5599	0.00	Oxy Percent		TS	12/5/05
562	ETBE by D5599	0.00	Oxy Percent		TS	12/5/05
534	Ethanol by D5599	0.00	Oxy Percent		TS	12/5/05
572	TAME by D5599	0.00	Oxy Percent		TS	12/5/05
421	Sulfur in Gasoline D2622	230	Parts Per Million		NST	3/6/06
62	Vapor Pressure by D5191 (Modified)	12.4	PS I		MM	11/25/05
65	Percent Evaporated at 200 Degrees F D86	51.8	Volume Percent		MM	11/28/05
66	Percent Evaporated at 300 Degrees F D86	84.8	Volume Percent		MM	11/28/05
48	Aromatics in Gasoline MSD D5769	24.09	Volume Percent		TW	12/21/05
49	Olefins in by FIA D1319	9.7	Volume Percent		MM	12/1/05
64	Benzene in Gasoline D3606	1.02	Volume Percent		TW	12/20/05
64	Benzene in Gasoline D3606	1.02	Volume Percent		TW	12/20/05
532	Ethanol by D5599	0.00	Volume Percent		TS	12/5/05
55	MTBE by D5599	0.00	Volume Percent		TS	12/5/05
59	Weight Percent Oxygen by D5599	0.00	Weight Percent		TS	12/5/05
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent		TS	12/5/05
57	TAME by D5599	0.00	Volume Percent		TS	12/5/05
56	ETBE by D5599	0.00	Volume Percent		TS	12/5/05
630	Toluene in gasoline by MSD D5769	5.5	Volumn Percent		TW	12/21/05
63	Benzene in Gasoline by GC/MSD D5769	0.99	Volume Percent		TW	12/21/05
46	Aromatics by FIA D1319	22.6	Volume Percent		MM	12/1/05
69	Specific Gravity @ 60 deg F D4052	0.72854	60/60F		MM	11/25/05
69	Specific Gravity @ 60 deg F D4052	0.72855	60/60F		MM	11/25/05
692	Degrees API D4052	62.72	Degrees API		MM	11/25/05
692	Degrees API D4052	62.73	Degrees API		MM	11/25/05
691	Density @ 60 deg F D4052	0.72782	g/cm-03 @ 60 deg F		MM	11/25/05
691	Density @ 60 deg F D4052	0.72783	g/cm-03 @ 60 deg F		MM	11/25/05
101	Initial Boiling Point D86	82.6	Degrees F		MM	11/28/05
110	10 Percent D86	104.3	Degrees F		MM	11/28/05
150	50 Percent D86	195.1	Degrees F		MM	11/28/05
190	90 Percent D86	321.1	Degrees F		MM	11/28/05
200	End Point D86	408.1	Degrees F		MM	11/28/05
201	Residue D86	0.8	mL		MM	11/28/05

NVFEL Fuel Analysis Report

202	Total Recovery	D86	96.8 mL	MM	11/28/05
203	Loss	D86	2.4 mL	MM	11/28/05
543	Methanol	by D5599	0.00 Volume Percent	TS	12/5/05
584	Isopropanol	by D5599	0.00 Volume Percent	TS	12/5/05
585	t-Butanol	by D5599	0.00 Volume Percent	TS	12/5/05
586	n-Propanol	by D5599	0.00 Volume Percent	TS	12/5/05
587	sec-Butanol	by D5599	0.00 Volume Percent	TS	12/5/05
588	DIPE	by D5599	0.00 Volume Percent	TS	12/5/05
589	Isobutanol	by D5599	0.00 Volume Percent	TS	12/5/05
5801	t-Amyl Alcohol	by D5599	0.00 Volume Percent	TS	12/5/05
5802	n-Butanol	by D5599	0.00 Volume Percent	TS	12/5/05

NVFEL Fuel Analysis Report

14280 Batch#

Kansas City Samples

Facility Name: ERG Facility Type: In House

Owner: EPA Phone: (913) 299-9480

6636 Berger Avenue

U.S.

Samples Type: Correlation

VOC

Inspection information logged in by MM on 11/23/05.

Season: Winter

Kansas City Samples-218KZS(Mo) **FTAG: 14280** **Comments: 618; 1-29-05**

Fuel_ Code: 41

Test Code	Test Method	Results	Units	Analys	Analysis Date
552	MTBE by D5599	0.00	Oxy Percent	TS	12/5/05
552	MTBE by D5599	0.00	Oxy Percent	TS	12/5/05
562	ETBE by D5599	0.00	Oxy Percent	TS	12/5/05
562	ETBE by D5599	0.00	Oxy Percent	TS	12/5/05
534	Ethanol by D5599	0.00	Oxy Percent	TS	12/5/05
534	Ethanol by D5599	0.00	Oxy Percent	TS	12/5/05
572	TAME by D5599	0.00	Oxy Percent	TS	12/5/05
572	TAME by D5599	0.00	Oxy Percent	TS	12/5/05
421	Sulfur in Gasoline D2622	172	Parts Per Million	NST	3/6/06
62	Vapor Pressure by D5191 (Modified)	13.97	PSI	MM	11/25/05
65	Percent Evaporated at 200 Degrees F D86	50.3	Volume Percent	MM	11/28/05
66	Percent Evaporated at 300 Degrees F D86	84.2	Volume Percent	MM	11/28/05
48	Aromatics in Gasoline MSD D5769	21.44	Volume Percent	TW	12/21/05
49	Olefins in by FIA D1319	10.7	Volume Percent	MM	12/1/05
64	Benzene in Gasoline D3606	0.94	Volume Percent	TW	12/20/05
64	Benzene in Gasoline D3606	0.94	Volume Percent	TW	12/20/05
532	Ethanol by D5599	0.00	Volume Percent	TS	12/5/05
55	MTBE by D5599	0.00	Volume Percent	TS	12/5/05
532	Ethanol by D5599	0.00	Volume Percent	TS	12/5/05
55	MTBE by D5599	0.00	Volume Percent	TS	12/5/05
59	Weight Percent Oxygen by D5599	0.00	Weight Percent	TS	12/5/05
57	TAME by D5599	0.00	Volume Percent	TS	12/5/05
57	TAME by D5599	0.00	Volume Percent	TS	12/5/05
59	Weight Percent Oxygen by D5599	0.00	Weight Percent	TS	12/5/05
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent	TS	12/5/05
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent	TS	12/5/05
56	ETBE by D5599	0.00	Volume Percent	TS	12/5/05
56	ETBE by D5599	0.00	Volume Percent	TS	12/5/05
46	Aromatics by FIA D1319	20.5	Volume Percent	MM	12/1/05
630	Toluene in gasoline by MSD D5769	4.85	Volumn Percent	TW	12/21/05
63	Benzene in Gasoline by GC/MSD D5769	0.91	Volume Percent	TW	12/21/05
69	Specific Gravity @ 60 deg F D4052	0.72381	60/60F	MM	11/25/05
69	Specific Gravity @ 60 deg F D4052	0.72383	60/60F	MM	11/25/05

692	Degrees API	D4052	63.99	Degrees API	MM	11/25/05
692	Degrees API	D4052	63.99	Degrees API	MM	11/25/05
691	Density @ 60 deg F	D4052	0.72309	g/cm-03 @ 60 deg F	MM	11/25/05
691	Density @ 60 deg F	D4052	0.72312	g/cm-03 @ 60 deg F	MM	11/25/05
101	Initial Boiling Point	D86	81.1	Degrees F	MM	11/28/05
110	10 Percent	D86	98.1	Degrees F	MM	11/28/05
150	50 Percent	D86	199.2	Degrees F	MM	11/28/05
190	90 Percent	D86	328.5	Degrees F	MM	11/28/05
200	End Point	D86	424.8	Degrees F	MM	11/28/05
201	Residue	D86	0.9	mL	MM	11/28/05
202	Total Recovery	D86	96.6	mL	MM	11/28/05
203	Loss	D86	2.5	mL	MM	11/28/05
543	Methanol	by D5599	0.00	Volume Percent	TS	12/5/05
543	Methanol	by D5599	0.00	Volume Percent	TS	12/5/05
584	Isopropanol	by D5599	0.00	Volume Percent	TS	12/5/05
584	Isopropanol	by D5599	0.00	Volume Percent	TS	12/5/05
585	t-Butanol	by D5599	0.00	Volume Percent	TS	12/5/05
585	t-Butanol	by D5599	0.00	Volume Percent	TS	12/5/05
586	n-Propanol	by D5599	0.00	Volume Percent	TS	12/5/05
586	n-Propanol	by D5599	0.00	Volume Percent	TS	12/5/05
587	sec-Butanol	by D5599	0.00	Volume Percent	TS	12/5/05
587	sec-Butanol	by D5599	0.00	Volume Percent	TS	12/5/05
588	DIPE	by D5599	0.00	Volume Percent	TS	12/5/05
588	DIPE	by D5599	0.00	Volume Percent	TS	12/5/05
589	Isobutanol	by D5599	0.00	Volume Percent	TS	12/5/05
589	Isobutanol	by D5599	0.00	Volume Percent	TS	12/5/05
5801	t-Amyl Alcohol	by D5599	0.00	Volume Percent	TS	12/5/05
5801	t-Amyl Alcohol	by D5599	0.00	Volume Percent	TS	12/5/05
5802	n-Butanol	by D5599	0.00	Volume Percent	TS	12/5/05
5802	n-Butanol	by D5599	0.00	Volume Percent	TS	12/5/05

NVFEL Fuel Analysis Report

14281

Kansas City Samples

Batch#

Facility Name: ERG Facility Type: In House

Owner: EPA Phone: (913) 299-9480

6636 Berger Avenue

U.S.

Samples Type: Correlation

VOC

Inspection information logged in by MM on 11/23/05.

Season: Winter

Kansas City Samples-QMH404(Mo) **FTAG: 14281** **Comments:** **727; 2-22-05**

Fuel_ Code: 41

Test Code	Test Method	Results	Units	Analys	Analysis Date
552	MTBE by D5599	0.00	Oxy Percent	TS	12/6/05
562	ETBE by D5599	0.00	Oxy Percent	TS	12/6/05
534	Ethanol by D5599	0.00	Oxy Percent	TS	12/6/05
572	TAME by D5599	0.00	Oxy Percent	TS	12/6/05
421	Sulfur in Gasoline D2622	139	Parts Per Million	NST	3/6/06
62	Vapor Pressure by D5191 (Modified)	12.68	PS I	MM	11/25/05
65	Percent Evaporated at 200 Degrees F D86	52	Volume Percent	MM	11/28/05
66	Percent Evaporated at 300 Degrees F D86	83	Volume Percent	MM	11/28/05
48	Aromatics in Gasoline MSD D5769	23.68	Volume Percent	TW	12/21/05
49	Olefins in by FIA D1319	13.1	Volume Percent	MM	12/1/05
64	Benzene in Gasoline D3606	1.03	Volume Percent	TW	12/20/05
64	Benzene in Gasoline D3606	1.03	Volume Percent	TW	12/20/05
532	Ethanol by D5599	0.00	Volume Percent	TS	12/6/05
55	MTBE by D5599	0.00	Volume Percent	TS	12/6/05
59	Weight Percent Oxygen by D5599	0.00	Weight Percent	TS	12/6/05
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent	TS	12/6/05
57	TAME by D5599	0.00	Volume Percent	TS	12/6/05
56	ETBE by D5599	0.00	Volume Percent	TS	12/6/05
630	Toluene in gasoline by MSD D5769	5.19	Volumn Percent	TW	12/21/05
63	Benzene in Gasoline by GC/MSD D5769	0.99	Volume Percent	TW	12/21/05
46	Aromatics by FIA D1319	24	Volume Percent	MM	12/1/05
69	Specific Gravity @ 60 deg F D4052	0.72948	60/60F	MM	11/25/05
69	Specific Gravity @ 60 deg F D4052	0.7295	60/60F	MM	11/25/05
692	Degrees API D4052	62.47	Degrees API	MM	11/25/05
692	Degrees API D4052	62.47	Degrees API	MM	11/25/05
691	Density @ 60 deg F D4052	0.72876	g/cm-03 @ 60 deg F	MM	11/25/05
691	Density @ 60 deg F D4052	0.72878	g/cm-03 @ 60 deg F	MM	11/25/05
101	Initial Boiling Point D86	84.2	Degrees F	MM	11/28/05
110	10 Percent D86	103.6	Degrees F	MM	11/28/05
150	50 Percent D86	194.4	Degrees F	MM	11/28/05
190	90 Percent D86	330.5	Degrees F	MM	11/28/05
200	End Point D86	412.9	Degrees F	MM	11/28/05
201	Residue D86	1	mL	MM	11/28/05

202	Total Recovery	D86	96.9 mL	MM	11/28/05
203	Loss	D86	2.1 mL	MM	11/28/05
543	Methanol	by D5599	0.00 Volume Percent	TS	12/6/05
584	Isopropanol	by D5599	0.00 Volume Percent	TS	12/6/05
585	t-Butanol	by D5599	0.00 Volume Percent	TS	12/6/05
586	n-Propanol	by D5599	0.00 Volume Percent	TS	12/6/05
587	sec-Butanol	by D5599	0.00 Volume Percent	TS	12/6/05
588	DIPE	by D5599	0.00 Volume Percent	TS	12/6/05
589	Isobutanol	by D5599	0.00 Volume Percent	TS	12/6/05
5801	t-Amyl Alcohol	by D5599	0.00 Volume Percent	TS	12/6/05
5802	n-Butanol	by D5599	0.00 Volume Percent	TS	12/6/05

NVFEL Fuel Analysis Report

14282

Kansas City Samples

Batch#

Facility Name: ERG Facility Type: In House

Owner: EPA Phone: (913) 299-9480

6636 Berger Avenue

U.S.

Samples Type: Correlation

VOC

Inspection information logged in by MM on 11/23/05.

Season: Winter

Kansas City Samples-SIX770(Ks) **FTAG: 14282** **Comments:** **632; 2-2-05**

Test Code	Test Method	Results	Units	Fuel_ Code: 41	Analys	Analysis Date
552	MTBE by D5599	0.00	Oxy Percent		TS	12/6/05
562	ETBE by D5599	0.00	Oxy Percent		TS	12/6/05
534	Ethanol by D5599	0.00	Oxy Percent		TS	12/6/05
572	TAME by D5599	0.00	Oxy Percent		TS	12/6/05
421	Sulfur in Gasoline D2622	348	Parts Per Million		NST	3/6/06
421	Sulfur in Gasoline D2622	346	Parts Per Million		NST	3/6/06
62	Vapor Pressure by D5191 (Modified)	14.01	PS I		MM	11/25/05
65	Percent Evaporated at 200 Degrees F D86	50.7	Volume Percent		MM	11/29/05
66	Percent Evaporated at 300 Degrees F D86	85.6	Volume Percent		MM	11/29/05
48	Aromatics in Gasoline MSD D5769	22.12	Volume Percent		TW	12/21/05
49	Olefins in by FIA D1319	9.2	Volume Percent		MM	12/1/05
64	Benzene in Gasoline D3606	1.08	Volume Percent		TW	12/20/05
64	Benzene in Gasoline D3606	1.08	Volume Percent		TW	12/20/05
532	Ethanol by D5599	0.00	Volume Percent		TS	12/6/05
55	MTBE by D5599	0.00	Volume Percent		TS	12/6/05
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent		TS	12/6/05
59	Weight Percent Oxygen by D5599	0.00	Weight Percent		TS	12/6/05
57	TAME by D5599	0.00	Volume Percent		TS	12/6/05
56	ETBE by D5599	0.00	Volume Percent		TS	12/6/05
46	Aromatics by FIA D1319	20.6	Volume Percent		MM	12/1/05
630	Toluene in gasoline by MSD D5769	5.14	Volumn Percent		TW	12/21/05
63	Benzene in Gasoline by GC/MSD D5769	1.04	Volume Percent		TW	12/21/05
69	Specific Gravity @ 60 deg F D4052	0.72335	60/60F		MM	11/25/05
69	Specific Gravity @ 60 deg F D4052	0.72337	60/60F		MM	11/25/05
692	Degrees API D4052	64.11	Degrees API		MM	11/25/05
692	Degrees API D4052	64.12	Degrees API		MM	11/25/05
691	Density @ 60 deg F D4052	0.72263	g/cm-03 @ 60 deg F		MM	11/25/05
691	Density @ 60 deg F D4052	0.72266	g/cm-03 @ 60 deg F		MM	11/25/05
101	Initial Boiling Point D86	78.7	Degrees F		MM	11/29/05
110	10 Percent D86	98.1	Degrees F		MM	11/29/05
150	50 Percent D86	198	Degrees F		MM	11/29/05
190	90 Percent D86	317.6	Degrees F		MM	11/29/05
200	End Point D86	401	Degrees F		MM	11/29/05

201	Residue	D86	0.9	mL	MM	11/29/05
202	Total Recovery	D86	96.7	mL	MM	11/29/05
203	Loss	D86	2.4	mL	MM	11/29/05
543	Methanol	by D5599	0.00	Volume Percent	TS	12/6/05
584	Isopropanol	by D5599	0.00	Volume Percent	TS	12/6/05
585	t-Butanol	by D5599	0.00	Volume Percent	TS	12/6/05
586	n-Propanol	by D5599	0.00	Volume Percent	TS	12/6/05
587	sec-Butanol	by D5599	0.00	Volume Percent	TS	12/6/05
588	DIPE	by D5599	0.00	Volume Percent	TS	12/6/05
589	Isobutanol	by D5599	0.00	Volume Percent	TS	12/6/05
5801	t-Amyl Alcohol	by D5599	0.00	Volume Percent	TS	12/6/05
5802	n-Butanol	by D5599	0.00	Volume Percent	TS	12/6/05

NVFEL Fuel Analysis Report

14283

Kansas City Samples

Batch#

Facility Name: ERG Facility Type: In House

Owner: EPA Phone: (913) 299-9480

6636 Berger Avenue

U.S.

Samples Type: Correlation

VOC

Inspection information logged in by MM on 11/23/05.

Season: Winter

Kansas City Samples-ULU101(Ks) **FTAG: 14283** **Comments:** **619; 1-29-05**

Test Code	Test Method	Results	Units	Fuel_ Code: 41	Analys	Analysis Date
552	MTBE by D5599	0.00	Oxy Percent		TS	12/6/05
562	ETBE by D5599	0.00	Oxy Percent		TS	12/6/05
534	Ethanol by D5599	0.00	Oxy Percent		TS	12/6/05
572	TAME by D5599	0.00	Oxy Percent		TS	12/6/05
421	Sulfur in Gasoline D2622	389	Parts Per Million		NST	3/6/06
62	Vapor Pressure by D5191 (Modified)	13.69	PSI		MM	11/25/05
65	Percent Evaporated at 200 Degrees F D86	50.8	Volume Percent		MM	11/29/05
66	Percent Evaporated at 300 Degrees F D86	85.7	Volume Percent		MM	11/29/05
48	Aromatics in Gasoline MSD D5769	21.8	Volume Percent		TW	12/21/05
49	Olefins in by FIA D1319	9.8	Volume Percent		MM	12/1/05
64	Benzene in Gasoline D3606	1.20	Volume Percent		TW	12/20/05
64	Benzene in Gasoline D3606	1.20	Volume Percent		TW	12/20/05
532	Ethanol by D5599	0.00	Volume Percent		TS	12/6/05
55	MTBE by D5599	0.00	Volume Percent		TS	12/6/05
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent		TS	12/6/05
59	Weight Percent Oxygen by D5599	0.00	Weight Percent		TS	12/6/05
57	TAME by D5599	0.00	Volume Percent		TS	12/6/05
56	ETBE by D5599	0.00	Volume Percent		TS	12/6/05
46	Aromatics by FIA D1319	20.6	Volume Percent		MM	12/1/05
630	Toluene in gasoline by MSD D5769	5.15	Volumn Percent		TW	12/21/05
63	Benzene in Gasoline by GC/MSD D5769	1.16	Volume Percent		TW	12/21/05
69	Specific Gravity @ 60 deg F D4052	0.72446	60/60F		MM	11/25/05
69	Specific Gravity @ 60 deg F D4052	0.7245	60/60F		MM	11/25/05
692	Degrees API D4052	63.81	Degrees API		MM	11/25/05
692	Degrees API D4052	63.82	Degrees API		MM	11/25/05
691	Density @ 60 deg F D4052	0.72374	g/cm-03 @ 60 deg F		MM	11/25/05
691	Density @ 60 deg F D4052	0.72379	g/cm-03 @ 60 deg F		MM	11/25/05
101	Initial Boiling Point D86	78.9	Degrees F		MM	11/29/05
110	10 Percent D86	99.1	Degrees F		MM	11/29/05
150	50 Percent D86	198	Degrees F		MM	11/29/05
190	90 Percent D86	317.1	Degrees F		MM	11/29/05
200	End Point D86	397.2	Degrees F		MM	11/29/05
201	Residue D86	0.9	mL		MM	11/29/05

202	Total Recovery	D86	96.7 mL	MM	11/29/05
203	Loss	D86	2.4 mL	MM	11/29/05
543	Methanol	by D5599	0.00 Volume Percent	TS	12/6/05
584	Isopropanol	by D5599	0.00 Volume Percent	TS	12/6/05
585	t-Butanol	by D5599	0.00 Volume Percent	TS	12/6/05
586	n-Propanol	by D5599	0.00 Volume Percent	TS	12/6/05
587	sec-Butanol	by D5599	0.00 Volume Percent	TS	12/6/05
588	DIPE	by D5599	0.00 Volume Percent	TS	12/6/05
589	Isobutanol	by D5599	0.00 Volume Percent	TS	12/6/05
5801	t-Amyl Alcohol	by D5599	0.00 Volume Percent	TS	12/6/05
5802	n-Butanol	by D5599	0.00 Volume Percent	TS	12/6/05

NVFEL Fuel Analysis Report

14284

Kansas City Samples

Batch#

Facility Name: ERG   Facility Type: In House

Owner: EPA   Phone: (913) 299-9480

6636 Berger Avenue

U.S.

Samples Type: Correlation

VOC

Inspection information logged in by MM on 11/23/05.

Season: Winter

Kansas City Samples-100RC7(Mo)   **FTAG: 14284**   **Comments:** **#7; 7/14/04**

Test Code	Test Method	Results	Units	Fuel_ Code: 41	Analys	Analysis Date
552	MTBE by D5599	0.00	Oxy Percent		TS	12/6/05
562	ETBE by D5599	0.00	Oxy Percent		TS	12/6/05
534	Ethanol by D5599	0.00	Oxy Percent		TS	12/6/05
572	TAME by D5599	0.00	Oxy Percent		TS	12/6/05
421	Sulfur in Gasoline D2622	56	Parts Per Million		NST	3/6/06
421	Sulfur in Gasoline D2622	53	Parts Per Million		NST	3/6/06
62	Vapor Pressure by D5191 (Modified)	6.47	PS I		MM	11/25/05
65	Percent Evaporated at 200 Degrees F D86	34.1	Volume Percent		MM	11/29/05
66	Percent Evaporated at 300 Degrees F D86	81.3	Volume Percent		MM	11/29/05
48	Aromatics in Gasoline MSD D5769	34.9	Volume Percent		TW	12/21/05
49	Olefins in by FIA D1319	10.5	Volume Percent		MM	12/5/05
49	Olefins in by FIA D1319	10.5	Volume Percent		MM	12/5/05
64	Benzene in Gasoline D3606	0.71	Volume Percent		TW	12/20/05
64	Benzene in Gasoline D3606	0.71	Volume Percent		TW	12/20/05
532	Ethanol by D5599	0.00	Volume Percent		TS	12/6/05
55	MTBE by D5599	0.00	Volume Percent		TS	12/6/05
57	TAME by D5599	0.00	Volume Percent		TS	12/6/05
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent		TS	12/6/05
59	Weight Percent Oxygen by D5599	0.00	Weight Percent		TS	12/6/05
56	ETBE by D5599	0.00	Volume Percent		TS	12/6/05
630	Toluene in gasoline by MSD D5769	12.37	Volumn Percent		TW	12/21/05
46	Aromatics by FIA D1319	35.4	Volume Percent		MM	12/5/05
63	Benzene in Gasoline by GC/MSD D5769	0.68	Volume Percent		TW	12/21/05
46	Aromatics by FIA D1319	35.5	Volume Percent		MM	12/5/05
69	Specific Gravity @ 60 deg F D4052	0.76139	60/60F		MM	11/25/05
69	Specific Gravity @ 60 deg F D4052	0.76133	60/60F		MM	11/25/05
692	Degrees API D4052	54.36	Degrees API		MM	11/25/05
692	Degrees API D4052	54.35	Degrees API		MM	11/25/05
691	Density @ 60 deg F D4052	0.76063	g/cm-03 @ 60 deg F		MM	11/25/05
691	Density @ 60 deg F D4052	0.76058	g/cm-03 @ 60 deg F		MM	11/25/05
101	Initial Boiling Point D86	98.4	Degrees F		MM	11/29/05
110	10 Percent D86	143.9	Degrees F		MM	11/29/05
150	50 Percent D86	232.3	Degrees F		MM	11/29/05

190	90 Percent	D86	339.2	Degrees F	MM	11/29/05
200	End Point	D86	428.1	Degrees F	MM	11/29/05
201	Residue	D86	1	mL	MM	11/29/05
202	Total Recovery	D86	97.5	mL	MM	11/29/05
203	Loss	D86	1.5	mL	MM	11/29/05
543	Methanol	by D5599	0.00	Volume Percent	TS	12/6/05
584	Isopropanol	by D5599	0.00	Volume Percent	TS	12/6/05
585	t-Butanol	by D5599	0.00	Volume Percent	TS	12/6/05
586	n-Propanol	by D5599	0.00	Volume Percent	TS	12/6/05
587	sec-Butanol	by D5599	0.00	Volume Percent	TS	12/6/05
588	DIPE	by D5599	0.00	Volume Percent	TS	12/6/05
589	Isobutanol	by D5599	0.00	Volume Percent	TS	12/6/05
5801	t-Amyl Alcohol	by D5599	0.00	Volume Percent	TS	12/6/05
5802	n-Butanol	by D5599	0.00	Volume Percent	TS	12/6/05

NVFEL Fuel Analysis Report

14284

Kansas City Samples

Batch#

Facility Name: ERG Facility Type: In House

Owner: EPA Phone: (913) 299-9480

6636 Berger Avenue

U.S.

Samples Type: Correlation

VOC

Inspection information logged in by MM on 11/23/05.

Season: Winter

Kansas City Samples-100RC7(Mo) **FTAG: 14284** **Comments:** **#7; 7/14/04**

Test Code	Test Method	Results	Units	Fuel_ Code: 41	Analys	Analysis Date
552	MTBE by D5599	0.00	Oxy Percent		TS	12/6/05
562	ETBE by D5599	0.00	Oxy Percent		TS	12/6/05
534	Ethanol by D5599	0.00	Oxy Percent		TS	12/6/05
572	TAME by D5599	0.00	Oxy Percent		TS	12/6/05
421	Sulfur in Gasoline D2622	56	Parts Per Million		NST	3/6/06
421	Sulfur in Gasoline D2622	53	Parts Per Million		NST	3/6/06
62	Vapor Pressure by D5191 (Modified)	6.47	PS I		MM	11/25/05
65	Percent Evaporated at 200 Degrees F D86	34.1	Volume Percent		MM	11/29/05
66	Percent Evaporated at 300 Degrees F D86	81.3	Volume Percent		MM	11/29/05
48	Aromatics in Gasoline MSD D5769	34.9	Volume Percent		TW	12/21/05
49	Olefins in by FIA D1319	10.5	Volume Percent		MM	12/5/05
49	Olefins in by FIA D1319	10.5	Volume Percent		MM	12/5/05
64	Benzene in Gasoline D3606	0.71	Volume Percent		TW	12/20/05
64	Benzene in Gasoline D3606	0.71	Volume Percent		TW	12/20/05
532	Ethanol by D5599	0.00	Volume Percent		TS	12/6/05
55	MTBE by D5599	0.00	Volume Percent		TS	12/6/05
57	TAME by D5599	0.00	Volume Percent		TS	12/6/05
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent		TS	12/6/05
59	Weight Percent Oxygen by D5599	0.00	Weight Percent		TS	12/6/05
56	ETBE by D5599	0.00	Volume Percent		TS	12/6/05
630	Toluene in gasoline by MSD D5769	12.37	Volumn Percent		TW	12/21/05
46	Aromatics by FIA D1319	35.4	Volume Percent		MM	12/5/05
63	Benzene in Gasoline by GC/MSD D5769	0.68	Volume Percent		TW	12/21/05
46	Aromatics by FIA D1319	35.5	Volume Percent		MM	12/5/05
69	Specific Gravity @ 60 deg F D4052	0.76139	60/60F		MM	11/25/05
69	Specific Gravity @ 60 deg F D4052	0.76133	60/60F		MM	11/25/05
692	Degrees API D4052	54.36	Degrees API		MM	11/25/05
692	Degrees API D4052	54.35	Degrees API		MM	11/25/05
691	Density @ 60 deg F D4052	0.76063	g/cm-03 @ 60 deg F		MM	11/25/05
691	Density @ 60 deg F D4052	0.76058	g/cm-03 @ 60 deg F		MM	11/25/05
101	Initial Boiling Point D86	98.4	Degrees F		MM	11/29/05
110	10 Percent D86	143.9	Degrees F		MM	11/29/05
150	50 Percent D86	232.3	Degrees F		MM	11/29/05

NVFEL Fuel Analysis Report

14284

190	90 Percent	D86	339.2	Degrees F	MM	11/29/05
200	End Point	D86	428.1	Degrees F	MM	11/29/05
201	Residue	D86	1	mL	MM	11/29/05
202	Total Recovery	D86	97.5	mL	MM	11/29/05
203	Loss	D86	1.5	mL	MM	11/29/05
543	Methanol	by D5599	0.00	Volume Percent	TS	12/6/05
584	Isopropanol	by D5599	0.00	Volume Percent	TS	12/6/05
585	t-Butanol	by D5599	0.00	Volume Percent	TS	12/6/05
586	n-Propanol	by D5599	0.00	Volume Percent	TS	12/6/05
587	sec-Butanol	by D5599	0.00	Volume Percent	TS	12/6/05
588	DIPE	by D5599	0.00	Volume Percent	TS	12/6/05
589	Isobutanol	by D5599	0.00	Volume Percent	TS	12/6/05
5801	t-Amyl Alcohol	by D5599	0.00	Volume Percent	TS	12/6/05
5802	n-Butanol	by D5599	0.00	Volume Percent	TS	12/6/05

NVFEL Fuel Analysis Report

14285

Kansas City Samples

Batch#

Facility Name: ERG Facility Type: In House

Owner: EPA Phone: (913) 299-9480

6636 Berger Avenue

U.S.

Samples Type: Correlation

VOC

Inspection information logged in by MM on 11/23/05.

Season: Winter

Kansas City Samples-VHW541(Ks) **FTAG: 14285** **Comments:** **640; 2-3-05**

Test Code	Test Method	Results	Units	Fuel_ Code: 41	Analys	Analysis Date
552	MTBE by D5599	0.00	Oxy Percent		TS	12/6/05
562	ETBE by D5599	0.00	Oxy Percent		TS	12/6/05
534	Ethanol by D5599	0.00	Oxy Percent		TS	12/6/05
572	TAME by D5599	0.00	Oxy Percent		TS	12/6/05
421	Sulfur in Gasoline D2622	86	Parts Per Million		NST	3/6/06
62	Vapor Pressure by D5191 (Modified)	12.71	PSI		MM	11/25/05
65	Percent Evaporated at 200 Degrees F D86	43.7	Volume Percent		MM	11/29/05
66	Percent Evaporated at 300 Degrees F D86	84.8	Volume Percent		MM	11/29/05
48	Aromatics in Gasoline MSD D5769	28.16	Volume Percent		TW	12/21/05
49	Olefins in by FIA D1319	5.2	Volume Percent		MM	12/5/05
64	Benzene in Gasoline D3606	0.57	Volume Percent		TW	12/20/05
64	Benzene in Gasoline D3606	0.57	Volume Percent		TW	12/20/05
532	Ethanol by D5599	0.00	Volume Percent		TS	12/6/05
55	MTBE by D5599	0.00	Volume Percent		TS	12/6/05
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent		TS	12/6/05
59	Weight Percent Oxygen by D5599	0.00	Weight Percent		TS	12/6/05
57	TAME by D5599	0.00	Volume Percent		TS	12/6/05
56	ETBE by D5599	0.00	Volume Percent		TS	12/6/05
46	Aromatics by FIA D1319	25.7	Volume Percent		MM	12/5/05
630	Toluene in gasoline by MSD D5769	8.41	Volumn Percent		TW	12/21/05
63	Benzene in Gasoline by GC/MSD D5769	0.54	Volume Percent		TW	12/21/05
69	Specific Gravity @ 60 deg F D4052	0.73285	60/60F		MM	11/25/05
69	Specific Gravity @ 60 deg F D4052	0.7329	60/60F		MM	11/25/05
692	Degrees API D4052	61.57	Degrees API		MM	11/25/05
692	Degrees API D4052	61.58	Degrees API		MM	11/25/05
691	Density @ 60 deg F D4052	0.73212	g/cm-03 @ 60 deg F		MM	11/25/05
691	Density @ 60 deg F D4052	0.73218	g/cm-03 @ 60 deg F		MM	11/25/05
101	Initial Boiling Point D86	80.8	Degrees F		MM	11/29/05
110	10 Percent D86	103	Degrees F		MM	11/29/05
150	50 Percent D86	218	Degrees F		MM	11/29/05
190	90 Percent D86	321.8	Degrees F		MM	11/29/05
200	End Point D86	407.5	Degrees F		MM	11/29/05
201	Residue D86	0.9	mL		MM	11/29/05

202	Total Recovery	D86	96.8	mL	MM	11/29/05
203	Loss	D86	2.3	mL	MM	11/29/05
543	Methanol	by D5599	0.00	Volume Percent	TS	12/6/05
584	Isopropanol	by D5599	0.00	Volume Percent	TS	12/6/05
585	t-Butanol	by D5599	0.00	Volume Percent	TS	12/6/05
586	n-Propanol	by D5599	0.00	Volume Percent	TS	12/6/05
587	sec-Butanol	by D5599	0.00	Volume Percent	TS	12/6/05
588	DIPE	by D5599	0.00	Volume Percent	TS	12/6/05
589	Isobutanol	by D5599	0.00	Volume Percent	TS	12/6/05
5801	t-Amyl Alcohol	by D5599	0.00	Volume Percent	TS	12/6/05
5802	n-Butanol	by D5599	0.00	Volume Percent	TS	12/6/05

NVFEL Fuel Analysis Report

14286

Batch#

Kansas City Samples

Facility Name: ERG Facility Type: In House

Owner: EPA Phone: (913) 299-9480

6636 Berger Avenue

U.S.

Samples Type: Correlation

VOC

Inspection information logged in by MM on 11/23/05.

Season: Winter

Kansas City Samples-VQH913(Ks) **FTAG: 14286** **Comments:** **633; 2-2-05**

Fuel_ Code: 41

Test Code	Test Method	Results	Units	Analys	Analysis Date
552	MTBE by D5599	0.00	Oxy Percent	TS	12/6/05
562	ETBE by D5599	0.00	Oxy Percent	TS	12/6/05
534	Ethanol by D5599	0.00	Oxy Percent	TS	12/6/05
572	TAME by D5599	0.00	Oxy Percent	TS	12/6/05
421	Sulfur in Gasoline D2622	77	Parts Per Million	NST	3/6/06
62	Vapor Pressure by D5191 (Modified)	12.13	PS I	MM	11/25/05
65	Percent Evaporated at 200 Degrees F D86	39.5	Volume Percent	MM	11/29/05
66	Percent Evaporated at 300 Degrees F D86	87	Volume Percent	MM	11/29/05
48	Aromatics in Gasoline MSD D5769	30.17	Volume Percent	TW	12/21/05
49	Olefins in by FIA D1319	3.7	Volume Percent	MM	12/5/05
64	Benzene in Gasoline D3606	0.67	Volume Percent	TW	12/20/05
64	Benzene in Gasoline D3606	0.67	Volume Percent	TW	12/20/05
532	Ethanol by D5599	0.00	Volume Percent	TS	12/6/05
55	MTBE by D5599	0.00	Volume Percent	TS	12/6/05
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent	TS	12/6/05
59	Weight Percent Oxygen by D5599	0.00	Weight Percent	TS	12/6/05
57	TAME by D5599	0.00	Volume Percent	TS	12/6/05
56	ETBE by D5599	0.00	Volume Percent	TS	12/6/05
46	Aromatics by FIA D1319	27.8	Volume Percent	MM	12/5/05
630	Toluene in gasoline by MSD D5769	11.3	Volumn Percent	TW	12/21/05
63	Benzene in Gasoline by GC/MSD D5769	0.65	Volume Percent	TW	12/21/05
69	Specific Gravity @ 60 deg F D4052	0.7383	60/60F	MM	11/25/05
69	Specific Gravity @ 60 deg F D4052	0.73829	60/60F	MM	11/25/05
692	Degrees API D4052	60.16	Degrees API	MM	11/25/05
692	Degrees API D4052	60.16	Degrees API	MM	11/25/05
691	Density @ 60 deg F D4052	0.73757	g/cm-03 @ 60 deg F	MM	11/25/05
691	Density @ 60 deg F D4052	0.73756	g/cm-03 @ 60 deg F	MM	11/25/05
101	Initial Boiling Point D86	83.8	Degrees F	MM	11/29/05
110	10 Percent D86	108.3	Degrees F	MM	11/29/05
150	50 Percent D86	221.4	Degrees F	MM	11/29/05
190	90 Percent D86	314.9	Degrees F	MM	11/29/05
200	End Point D86	407.5	Degrees F	MM	11/29/05
201	Residue D86	0.8	mL	MM	11/29/05

202	Total Recovery	D86	96.9 mL	MM	11/29/05
203	Loss	D86	2.3 mL	MM	11/29/05
543	Methanol	by D5599	0.00 Volume Percent	TS	12/6/05
584	Isopropanol	by D5599	0.00 Volume Percent	TS	12/6/05
585	t-Butanol	by D5599	0.00 Volume Percent	TS	12/6/05
586	n-Propanol	by D5599	0.00 Volume Percent	TS	12/6/05
587	sec-Butanol	by D5599	0.00 Volume Percent	TS	12/6/05
588	DIPE	by D5599	0.00 Volume Percent	TS	12/6/05
589	Isobutanol	by D5599	0.00 Volume Percent	TS	12/6/05
5801	t-Amyl Alcohol	by D5599	0.00 Volume Percent	TS	12/6/05
5802	n-Butanol	by D5599	0.00 Volume Percent	TS	12/6/05

NVFEL Fuel Analysis Report

14287

Kansas City Samples

Batch#

Facility Name: ERG   Facility Type: In House

Owner: EPA   Phone: (913) 299-9480

6636 Berger Avenue

U.S.

Samples Type: Correlation

VOC

Inspection information logged in by MM on 11/23/05.

Season: Winter

Kansas City Samples-374CL9(Mo)   **FTAG: 14287**   **Comments:** **819; 3-12-05**

Test Code	Test Method	Results	Units	Fuel_ Code: 41	Analys	Analysis Date
552	MTBE by D5599	0.00	Oxy Percent		TS	12/6/05
562	ETBE by D5599	0.00	Oxy Percent		TS	12/6/05
534	Ethanol by D5599	0.00	Oxy Percent		TS	12/6/05
572	TAME by D5599	0.00	Oxy Percent		TS	12/6/05
421	Sulfur in Gasoline D2622	146	Parts Per Million		NST	3/6/06
62	Vapor Pressure by D5191 (Modified)	11.39	PSI		MM	11/25/05
62	Vapor Pressure by D5191 (Modified)	11.37	PSI		MM	11/25/05
65	Percent Evaporated at 200 Degrees F D86	51	Volume Percent		MM	11/29/05
66	Percent Evaporated at 300 Degrees F D86	84.3	Volume Percent		MM	11/29/05
48	Aromatics in Gasoline MSD D5769	24.68	Volume Percent		TW	12/21/05
49	Olefins in by FIA D1319	8.9	Volume Percent		MM	12/5/05
64	Benzene in Gasoline D3606	1.01	Volume Percent		TW	12/20/05
64	Benzene in Gasoline D3606	1.01	Volume Percent		TW	12/20/05
532	Ethanol by D5599	0.00	Volume Percent		TS	12/6/05
55	MTBE by D5599	0.00	Volume Percent		TS	12/6/05
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent		TS	12/6/05
59	Weight Percent Oxygen by D5599	0.00	Weight Percent		TS	12/6/05
57	TAME by D5599	0.00	Volume Percent		TS	12/6/05
56	ETBE by D5599	0.00	Volume Percent		TS	12/6/05
630	Toluene in gasoline by MSD D5769	5.92	Volumn Percent		TW	12/21/05
63	Benzene in Gasoline by GC/MSD D5769	0.97	Volume Percent		TW	12/21/05
46	Aromatics by FIA D1319	24	Volume Percent		MM	12/5/05
69	Specific Gravity @ 60 deg F D4052	0.7312	60/60F		MM	11/25/05
69	Specific Gravity @ 60 deg F D4052	0.73118	60/60F		MM	11/25/05
692	Degrees API D4052	62.02	Degrees API		MM	11/25/05
692	Degrees API D4052	62.02	Degrees API		MM	11/25/05
691	Density @ 60 deg F D4052	0.73046	g/cm-03 @ 60 deg F		MM	11/25/05
691	Density @ 60 deg F D4052	0.73048	g/cm-03 @ 60 deg F		MM	11/25/05
101	Initial Boiling Point D86	84.9	Degrees F		MM	11/29/05
110	10 Percent D86	109.8	Degrees F		MM	11/29/05
150	50 Percent D86	197.6	Degrees F		MM	11/29/05
190	90 Percent D86	328.6	Degrees F		MM	11/29/05
200	End Point D86	416.1	Degrees F		MM	11/29/05

NVFEL Fuel Analysis Report

14287

201	Residue	D86	1 mL	MM	11/29/05
202	Total Recovery	D86	97.1 mL	MM	11/29/05
203	Loss	D86	1.9 mL	MM	11/29/05
543	Methanol	by D5599	0.00 Volume Percent	TS	12/6/05
584	Isopropanol	by D5599	0.00 Volume Percent	TS	12/6/05
585	t-Butanol	by D5599	0.00 Volume Percent	TS	12/6/05
586	n-Propanol	by D5599	0.00 Volume Percent	TS	12/6/05
587	sec-Butanol	by D5599	0.00 Volume Percent	TS	12/6/05
588	DIPE	by D5599	0.00 Volume Percent	TS	12/6/05
589	Isobutanol	by D5599	0.00 Volume Percent	TS	12/6/05
5801	t-Amyl Alcohol	by D5599	0.00 Volume Percent	TS	12/6/05
5802	n-Butanol	by D5599	0.00 Volume Percent	TS	12/6/05

NVFEL Fuel Analysis Report

14288

Kansas City Samples

Batch#

Facility Name: ERG Facility Type: In House

Owner: EPA Phone: (913) 299-9480

6636 Berger Avenue

U.S.

Samples Type: Correlation

VOC

Inspection information logged in by MM on 11/23/05.

Season: Winter

Kansas City Samples-108CTB(Mo) **FTAG: 14288** **Comments:** **801; 3-9-05**

Test Code	Test Method	Results	Units	Fuel_ Code: 41	Analys	Analysis Date
552	MTBE by D5599	0.00	Oxy Percent		TS	12/6/05
562	ETBE by D5599	0.00	Oxy Percent		TS	12/6/05
534	Ethanol by D5599	0.00	Oxy Percent		TS	12/6/05
572	TAME by D5599	0.00	Oxy Percent		TS	12/6/05
421	Sulfur in Gasoline D2622	94	Parts Per Million		NST	3/6/06
62	Vapor Pressure by D5191 (Modified)	13.1	PSI		MM	11/25/05
65	Percent Evaporated at 200 Degrees F D86	51.7	Volume Percent		MM	11/29/05
66	Percent Evaporated at 300 Degrees F D86	85	Volume Percent		MM	11/29/05
48	Aromatics in Gasoline MSD D5769	20.58	Volume Percent		TW	12/21/05
49	Olefins in by FIA D1319	8.9	Volume Percent		MM	12/6/05
64	Benzene in Gasoline D3606	1.01	Volume Percent		TW	12/20/05
64	Benzene in Gasoline D3606	1.01	Volume Percent		TW	12/20/05
64	Benzene in Gasoline D3606	1.01	Volume Percent		TW	12/20/05
64	Benzene in Gasoline D3606	1.01	Volume Percent		TW	12/20/05
55	MTBE by D5599	0.00	Volume Percent		TS	12/6/05
532	Ethanol by D5599	0.00	Volume Percent		TS	12/6/05
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent		TS	12/6/05
59	Weight Percent Oxygen by D5599	0.00	Weight Percent		TS	12/6/05
57	TAME by D5599	0.00	Volume Percent		TS	12/6/05
56	ETBE by D5599	0.00	Volume Percent		TS	12/6/05
46	Aromatics by FIA D1319	20.2	Volume Percent		MM	12/6/05
630	Toluene in gasoline by MSD D5769	4.49	Volumn Percent		TW	12/21/05
63	Benzene in Gasoline by GC/MSD D5769	0.97	Volume Percent		TW	12/21/05
69	Specific Gravity @ 60 deg F D4052	0.72308	60/60F		MM	11/25/05
69	Specific Gravity @ 60 deg F D4052	0.72315	60/60F		MM	11/25/05
692	Degrees API D4052	64.17	Degrees API		MM	11/25/05
692	Degrees API D4052	64.19	Degrees API		MM	11/25/05
691	Density @ 60 deg F D4052	0.72237	g/cm-03 @ 60 deg F		MM	11/25/05
691	Density @ 60 deg F D4052	0.72244	g/cm-03 @ 60 deg F		MM	11/25/05
101	Initial Boiling Point D86	80.3	Degrees F		MM	11/29/05
110	10 Percent D86	101.5	Degrees F		MM	11/29/05
150	50 Percent D86	195.9	Degrees F		MM	11/29/05
190	90 Percent D86	322.6	Degrees F		MM	11/29/05

NVFEL Fuel Analysis Report

200	End Point	D86	416	Degrees F	MM	11/29/05
201	Residue	D86	1	mL	MM	11/29/05
202	Total Recovery	D86	96.7	mL	MM	11/29/05
203	Loss	D86	2.3	mL	MM	11/29/05
543	Methanol	by D5599	0.00	Volume Percent	TS	12/6/05
584	Isopropanol	by D5599	0.00	Volume Percent	TS	12/6/05
585	t-Butanol	by D5599	0.00	Volume Percent	TS	12/6/05
586	n-Propanol	by D5599	0.00	Volume Percent	TS	12/6/05
587	sec-Butanol	by D5599	0.00	Volume Percent	TS	12/6/05
588	DIPE	by D5599	0.00	Volume Percent	TS	12/6/05
589	Isobutanol	by D5599	0.00	Volume Percent	TS	12/6/05
5801	t-Amyl Alcohol	by D5599	0.00	Volume Percent	TS	12/6/05
5802	n-Butanol	by D5599	0.00	Volume Percent	TS	12/6/05

NVFEL Fuel Analysis Report

14288

Kansas City Samples

Batch#

Facility Name: ERG Facility Type: In House

Owner: EPA Phone: (913) 299-9480

6636 Berger Avenue

U.S.

Samples Type: Correlation

VOC

Inspection information logged in by MM on 11/23/05.

Season: Winter

Kansas City Samples-108CTB(Mo) **FTAG: 14288** **Comments:** **801; 3-9-05**

Test Code	Test Method	Results	Units	Fuel_ Code: 41	Analys	Analysis Date
552	MTBE by D5599	0.00	Oxy Percent		TS	12/6/05
562	ETBE by D5599	0.00	Oxy Percent		TS	12/6/05
534	Ethanol by D5599	0.00	Oxy Percent		TS	12/6/05
572	TAME by D5599	0.00	Oxy Percent		TS	12/6/05
421	Sulfur in Gasoline D2622	94	Parts Per Million		NST	3/6/06
62	Vapor Pressure by D5191 (Modified)	13.1	PS I		MM	11/25/05
65	Percent Evaporated at 200 Degrees F D86	51.7	Volume Percent		MM	11/29/05
66	Percent Evaporated at 300 Degrees F D86	85	Volume Percent		MM	11/29/05
48	Aromatics in Gasoline MSD D5769	20.58	Volume Percent		TW	12/21/05
49	Olefins in by FIA D1319	8.9	Volume Percent		MM	12/6/05
64	Benzene in Gasoline D3606	1.01	Volume Percent		TW	12/20/05
64	Benzene in Gasoline D3606	1.01	Volume Percent		TW	12/20/05
64	Benzene in Gasoline D3606	1.01	Volume Percent		TW	12/20/05
64	Benzene in Gasoline D3606	1.01	Volume Percent		TW	12/20/05
55	MTBE by D5599	0.00	Volume Percent		TS	12/6/05
532	Ethanol by D5599	0.00	Volume Percent		TS	12/6/05
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent		TS	12/6/05
59	Weight Percent Oxygen by D5599	0.00	Weight Percent		TS	12/6/05
57	TAME by D5599	0.00	Volume Percent		TS	12/6/05
56	ETBE by D5599	0.00	Volume Percent		TS	12/6/05
46	Aromatics by FIA D1319	20.2	Volume Percent		MM	12/6/05
630	Toluene in gasoline by MSD D5769	4.49	Volumn Percent		TW	12/21/05
63	Benzene in Gasoline by GC/MSD D5769	0.97	Volume Percent		TW	12/21/05
69	Specific Gravity @ 60 deg F D4052	0.72308	60/60F		MM	11/25/05
69	Specific Gravity @ 60 deg F D4052	0.72315	60/60F		MM	11/25/05
692	Degrees API D4052	64.17	Degrees API		MM	11/25/05
692	Degrees API D4052	64.19	Degrees API		MM	11/25/05
691	Density @ 60 deg F D4052	0.72237	g/cm-03 @ 60 deg F		MM	11/25/05
691	Density @ 60 deg F D4052	0.72244	g/cm-03 @ 60 deg F		MM	11/25/05
101	Initial Boiling Point D86	80.3	Degrees F		MM	11/29/05
110	10 Percent D86	101.5	Degrees F		MM	11/29/05
150	50 Percent D86	195.9	Degrees F		MM	11/29/05
190	90 Percent D86	322.6	Degrees F		MM	11/29/05

200	End Point	D86	416	Degrees F	MM	11/29/05
201	Residue	D86	1	mL	MM	11/29/05
202	Total Recovery	D86	96.7	mL	MM	11/29/05
203	Loss	D86	2.3	mL	MM	11/29/05
543	Methanol	by D5599	0.00	Volume Percent	TS	12/6/05
584	Isopropanol	by D5599	0.00	Volume Percent	TS	12/6/05
585	t-Butanol	by D5599	0.00	Volume Percent	TS	12/6/05
586	n-Propanol	by D5599	0.00	Volume Percent	TS	12/6/05
587	sec-Butanol	by D5599	0.00	Volume Percent	TS	12/6/05
588	DIPE	by D5599	0.00	Volume Percent	TS	12/6/05
589	Isobutanol	by D5599	0.00	Volume Percent	TS	12/6/05
5801	t-Amyl Alcohol	by D5599	0.00	Volume Percent	TS	12/6/05
5802	n-Butanol	by D5599	0.00	Volume Percent	TS	12/6/05

NVFEL Fuel Analysis Report

14289

Batch#

Kansas City Samples

Facility Name: ERG Facility Type: In House

Owner: EPA Phone: (913) 299-9480

6636 Berger Avenue

U.S.

Samples Type: Correlation

VOC

Inspection information logged in by MM on 11/23/05.

Season: Winter

Kansas City Samples-VIW630 **FTAG: 14289** **Comments:** **(4); 7/13/04**

Test Code	Test Method	Results	Units	Fuel_ Code: 41	Analys	Analysis Date
552	MTBE by D5599	0.00	Oxy Percent		TS	12/6/05
562	ETBE by D5599	0.00	Oxy Percent		TS	12/6/05
534	Ethanol by D5599	0.00	Oxy Percent		TS	12/6/05
572	TAME by D5599	0.00	Oxy Percent		TS	12/6/05
421	Sulfur in Gasoline D2622	321	Parts Per Million		NST	3/6/06
62	Vapor Pressure by D5191 (Modified)	6.43	PS I		MM	11/25/05
65	Percent Evaporated at 200 Degrees F D86	35.5	Volume Percent		MM	11/29/05
66	Percent Evaporated at 300 Degrees F D86	80.9	Volume Percent		MM	11/29/05
48	Aromatics in Gasoline MSD D5769	27.79	Volume Percent		TW	12/21/05
49	Olefins in by FIA D1319	8.7	Volume Percent		MM	12/6/05
64	Benzene in Gasoline D3606	1.39	Volume Percent		TW	12/20/05
64	Benzene in Gasoline D3606	1.39	Volume Percent		TW	12/20/05
532	Ethanol by D5599	0.00	Volume Percent		TS	12/6/05
55	MTBE by D5599	0.00	Volume Percent		TS	12/6/05
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent		TS	12/6/05
59	Weight Percent Oxygen by D5599	0.00	Weight Percent		TS	12/6/05
57	TAME by D5599	0.00	Volume Percent		TS	12/6/05
56	ETBE by D5599	0.00	Volume Percent		TS	12/6/05
46	Aromatics by FIA D1319	27.9	Volume Percent		MM	12/6/05
630	Toluene in gasoline by MSD D5769	6.25	Volumn Percent		TW	12/21/05
63	Benzene in Gasoline by GC/MSD D5769	1.34	Volume Percent		TW	12/21/05
69	Specific Gravity @ 60 deg F D4052	0.75055	60/60F		MM	11/25/05
69	Specific Gravity @ 60 deg F D4052	0.7506	60/60F		MM	11/25/05
692	Degrees API D4052	57.02	Degrees API		MM	11/25/05
692	Degrees API D4052	57.03	Degrees API		MM	11/25/05
691	Density @ 60 deg F D4052	0.74981	g/cm-03 @ 60 deg F		MM	11/25/05
691	Density @ 60 deg F D4052	0.74986	g/cm-03 @ 60 deg F		MM	11/25/05
101	Initial Boiling Point D86	102.8	Degrees F		MM	11/29/05
110	10 Percent D86	146.9	Degrees F		MM	11/29/05
150	50 Percent D86	227.3	Degrees F		MM	11/29/05
190	90 Percent D86	334.2	Degrees F		MM	11/29/05
200	End Point D86	421.7	Degrees F		MM	11/29/05
201	Residue D86	1	mL		MM	11/29/05

202	Total Recovery	D86	97.5	mL	MM	11/29/05
203	Loss	D86	1.5	mL	MM	11/29/05
543	Methanol	by D5599	0.00	Volume Percent	TS	12/6/05
584	Isopropanol	by D5599	0.00	Volume Percent	TS	12/6/05
585	t-Butanol	by D5599	0.00	Volume Percent	TS	12/6/05
586	n-Propanol	by D5599	0.00	Volume Percent	TS	12/6/05
587	sec-Butanol	by D5599	0.00	Volume Percent	TS	12/6/05
588	DIPE	by D5599	0.00	Volume Percent	TS	12/6/05
589	Isobutanol	by D5599	0.00	Volume Percent	TS	12/6/05
5801	t-Amyl Alcohol	by D5599	0.00	Volume Percent	TS	12/6/05
5802	n-Butanol	by D5599	0.00	Volume Percent	TS	12/6/05

NVFEL Fuel Analysis Report

14290

Kansas City Samples

Batch#

Facility Name: ERG Facility Type: In House

Owner: EPA Phone: (913) 299-9480

6636 Berger Avenue

U.S.

Samples Type: Correlation

VOC

Inspection information logged in by MM on 11/23/05.

Season: Winter

Kansas City Samples-705DFG(Mo) **FTAG: 14290** **Comments:** **721; 2-21-05**

Test Code	Test Method	Results	Units	Fuel_ Code: 41	Analys	Analysis Date
552	MTBE by D5599	0.00	Oxy Percent		TS	12/6/05
552	MTBE by D5599	0.00	Oxy Percent		TS	12/6/05
562	ETBE by D5599	0.00	Oxy Percent		TS	12/6/05
562	ETBE by D5599	0.00	Oxy Percent		TS	12/6/05
534	Ethanol by D5599	0.88	Oxy Percent		TS	12/6/05
534	Ethanol by D5599	0.90	Oxy Percent		TS	12/6/05
572	TAME by D5599	0.00	Oxy Percent		TS	12/6/05
572	TAME by D5599	0.00	Oxy Percent		TS	12/6/05
421	Sulfur in Gasoline D2622	290	Parts Per Million		NST	3/6/06
62	Vapor Pressure by D5191 (Modified)	13.69	PS I		MM	11/25/05
65	Percent Evaporated at 200 Degrees F D86	51	Volume Percent		MM	11/30/05
66	Percent Evaporated at 300 Degrees F D86	85.7	Volume Percent		MM	11/30/05
48	Aromatics in Gasoline MSD D5769	22.38	Volume Percent		TW	12/21/05
49	Olefins in by FIA D1319	9	Volume Percent		MM	12/6/05
64	Benzene in Gasoline D3606	1.17	Volume Percent		TW	12/20/05
64	Benzene in Gasoline D3606	1.17	Volume Percent		TW	12/20/05
532	Ethanol by D5599	2.39	Volume Percent		TS	12/6/05
55	MTBE by D5599	0.00	Volume Percent		TS	12/6/05
532	Ethanol by D5599	2.33	Volume Percent		TS	12/6/05
55	MTBE by D5599	0.00	Volume Percent		TS	12/6/05
59	Weight Percent Oxygen by D5599	0.90	Weight Percent		TS	12/6/05
59	Weight Percent Oxygen by D5599	0.88	Weight Percent		TS	12/6/05
57	TAME by D5599	0.00	Volume Percent		TS	12/6/05
593	Volume Percent Oxygenates by D5599	2.33	Volume Percent		TS	12/6/05
593	Volume Percent Oxygenates by D5599	2.39	Volume Percent		TS	12/6/05
57	TAME by D5599	0.00	Volume Percent		TS	12/6/05
56	ETBE by D5599	0.00	Volume Percent		TS	12/6/05
56	ETBE by D5599	0.00	Volume Percent		TS	12/6/05
46	Aromatics by FIA D1319	22.8	Volume Percent		MM	12/6/05
63	Benzene in Gasoline by GC/MSD D5769	1.13	Volume Percent		TW	12/21/05
630	Toluene in gasoline by MSD D5769	5.23	Volumn Percent		TW	12/21/05
69	Specific Gravity @ 60 deg F D4052	0.72875	60/60F		MM	11/25/05
69	Specific Gravity @ 60 deg F D4052	0.72872	60/60F		MM	11/25/05

NVFEL Fuel Analysis Report

14290

692	Degrees API	D4052	62.67	Degrees API	MM	11/25/05
692	Degrees API	D4052	62.68	Degrees API	MM	11/25/05
691	Density @ 60 deg F	D4052	0.72803	g/cm-03 @ 60 deg F	MM	11/25/05
691	Density @ 60 deg F	D4052	0.728	g/cm-03 @ 60 deg F	MM	11/25/05
101	Initial Boiling Point	D86	80.9	Degrees F	MM	11/30/05
110	10 Percent	D86	100.9	Degrees F	MM	11/30/05
150	50 Percent	D86	197.1	Degrees F	MM	11/30/05
190	90 Percent	D86	320	Degrees F	MM	11/30/05
200	End Point	D86	399.5	Degrees F	MM	11/30/05
201	Residue	D86	0.9	mL	MM	11/30/05
202	Total Recovery	D86	96.8	mL	MM	11/30/05
203	Loss	D86	2.3	mL	MM	11/30/05
543	Methanol	by D5599	0.00	Volume Percent	TS	12/6/05
543	Methanol	by D5599	0.00	Volume Percent	TS	12/6/05
584	Isopropanol	by D5599	0.00	Volume Percent	TS	12/6/05
584	Isopropanol	by D5599	0.00	Volume Percent	TS	12/6/05
585	t-Butanol	by D5599	0.00	Volume Percent	TS	12/6/05
585	t-Butanol	by D5599	0.00	Volume Percent	TS	12/6/05
586	n-Propanol	by D5599	0.00	Volume Percent	TS	12/6/05
586	n-Propanol	by D5599	0.00	Volume Percent	TS	12/6/05
587	sec-Butanol	by D5599	0.00	Volume Percent	TS	12/6/05
587	sec-Butanol	by D5599	0.00	Volume Percent	TS	12/6/05
588	DIPE	by D5599	0.00	Volume Percent	TS	12/6/05
588	DIPE	by D5599	0.00	Volume Percent	TS	12/6/05
589	Isobutanol	by D5599	0.00	Volume Percent	TS	12/6/05
589	Isobutanol	by D5599	0.00	Volume Percent	TS	12/6/05
5801	t-Amyl Alcohol	by D5599	0.00	Volume Percent	TS	12/6/05
5801	t-Amyl Alcohol	by D5599	0.00	Volume Percent	TS	12/6/05
5802	n-Butanol	by D5599	0.00	Volume Percent	TS	12/6/05
5802	n-Butanol	by D5599	0.00	Volume Percent	TS	12/6/05

NVFEL Fuel Analysis Report

14525

Batch#

Kansas City Samples

Facility Name: ERG Facility Type: In House

Owner: EPA Phone: (913) 299-9480

6636 Berger Avenue

U.S.

Samples Type: Correlation

VOC

Inspection information logged in by MM on 5/15/2006.

Season: Winter

Kansas City Samples-685SBB(MO) **FTAG: 14525** **Comments:** **870; 4/7/05**

Fuel_ Code: 21

Test Code	Test Method	Results	Units	Analyst	Analysis Date
552	MTBE by D5599	0.00	Oxy Percent	TS	5/22/2006
562	ETBE by D5599	0.00	Oxy Percent	TS	5/22/2006
534	Ethanol by D5599	0.00	Oxy Percent	TS	5/22/2006
572	TAME by D5599	0.00	Oxy Percent	TS	5/22/2006
421	Sulfur in Gasoline D2622	191	Parts Per Million	NST	5/23/2006
62	Vapor Pressure by D5191 (Modified)	9.95	PS I	NST	5/15/2006
62	Vapor Pressure by D5191 (Modified)	9.95	PS I	NST	5/15/2006
65	Percent Evaporated at 200 Degrees F D86	45.4	Volume Percent	MM	5/18/2006
66	Percent Evaporated at 300 Degrees F D86	83.5	Volume Percent	MM	5/18/2006
48	Aromatics in Gasoline MSD D5769	24.6	Volume Percent	TW	5/23/2006
64	Benzene in Gasoline D3606	1.20	Volume Percent	TW	5/23/2006
59	Weight Percent Oxygen by D5599	0.00	Weight Percent	TS	5/22/2006
57	TAME by D5599	0.00	Volume Percent	TS	5/22/2006
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent	TS	5/22/2006
55	MTBE by D5599	0.00	Volume Percent	TS	5/22/2006
532	Ethanol by D5599	0.00	Volume Percent	TS	5/22/2006
56	ETBE by D5599	0.00	Volume Percent	TS	5/22/2006
63	Benzene in Gasoline by GC/MSD D5769	1.18	Volume Percent	TW	5/23/2006
630	Toluene in gasoline by MSD D5769	5.66	Volumn Percent	TW	5/23/2006
69	Specific Gravity @ 60 deg F D4052	0.73771	60/60F	MM	5/16/2006
69	Specific Gravity @ 60 deg F D4052	0.73763	60/60F	MM	5/16/2006
692	Degrees API D4052	60.31	Degrees API	MM	5/16/2006
692	Degrees API D4052	60.33	Degrees API	MM	5/16/2006
691	Density @ 60 deg F D4052	0.73698	g/cm-03 @ 60 deg F	MM	5/16/2006
691	Density @ 60 deg F D4052	0.7369	g/cm-03 @ 60 deg F	MM	5/16/2006
101	Initial Boiling Point D86	90.1	Degrees F	MM	5/18/2006
110	10 Percent D86	121.9	Degrees F	MM	5/18/2006
150	50 Percent D86	210.2	Degrees F	MM	5/18/2006
190	90 Percent D86	328.6	Degrees F	MM	5/18/2006
200	End Point D86	408.9	Degrees F	MM	5/18/2006
201	Residue D86	1	mL	MM	5/18/2006
202	Total Recovery D86	98.1	mL	MM	5/18/2006
203	Loss D86	0.9	mL	MM	5/18/2006

543	Methanol	by D5599	0.00	Volume Percent	TS	5/22/2006
584	Isopropanol	by D5599	0.00	Volume Percent	TS	5/22/2006
585	t-Butanol	by D5599	0.00	Volume Percent	TS	5/22/2006
586	n-Propanol	by D5599	0.00	Volume Percent	TS	5/22/2006
587	sec-Butanol	by D5599	0.00	Volume Percent	TS	5/22/2006
588	DIPE	by D5599	0.00	Volume Percent	TS	5/22/2006
589	Isobutanol	by D5599	0.00	Volume Percent	TS	5/22/2006
5801	t-Amyl Alcohol	by D5599	0.00	Volume Percent	TS	5/22/2006
5802	n-Butanol	by D5599	0.00	Volume Percent	TS	5/22/2006

NVFEL Fuel Analysis Report

14524

Kansas City Samples

Batch#

Facility Name: ERG Facility Type: In House

Owner: EPA Phone: (913) 299-9480

6636 Berger Avenue

U.S.

Samples Type: Correlation

VOC

Inspection information logged in by MM on 5/15/2006.

Season: Winter

Kansas City Samples-192GE3(MO) **FTAG: 14524** **Comments:** **877; 3/22/05**

Test Code	Test Method	Results	Units	Fuel_ Code: 21	Analyst	Analysis Date
552	MTBE by D5599	0.00	Oxy Percent		TS	5/22/2006
562	ETBE by D5599	0.00	Oxy Percent		TS	5/22/2006
534	Ethanol by D5599	0.00	Oxy Percent		TS	5/22/2006
572	TAME by D5599	0.00	Oxy Percent		TS	5/22/2006
421	Sulfur in Gasoline D2622	154	Parts Per Million		NST	5/23/2006
62	Vapor Pressure by D5191 (Modified)	11.08	PS I		NST	5/15/2006
62	Vapor Pressure by D5191 (Modified)	11.07	PS I		NST	5/15/2006
65	Percent Evaporated at 200 Degrees F D86	48.4	Volume Percent		MM	5/18/2006
66	Percent Evaporated at 300 Degrees F D86	82	Volume Percent		MM	5/18/2006
48	Aromatics in Gasoline MSD D5769	24.03	Volume Percent		TW	5/23/2006
64	Benzene in Gasoline D3606	0.98	Volume Percent		TW	5/23/2006
59	Weight Percent Oxygen by D5599	0.00	Weight Percent		TS	5/22/2006
57	TAME by D5599	0.00	Volume Percent		TS	5/22/2006
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent		TS	5/22/2006
55	MTBE by D5599	0.00	Volume Percent		TS	5/22/2006
532	Ethanol by D5599	0.00	Volume Percent		TS	5/22/2006
56	ETBE by D5599	0.00	Volume Percent		TS	5/22/2006
63	Benzene in Gasoline by GC/MSD D5769	0.96	Volume Percent		TW	5/23/2006
630	Toluene in gasoline by MSD D5769	4.79	Volumn Percent		TW	5/23/2006
69	Specific Gravity @ 60 deg F D4052	0.73449	60/60F		MM	5/16/2006
69	Specific Gravity @ 60 deg F D4052	0.73449	60/60F		MM	5/16/2006
692	Degrees API D4052	61.15	Degrees API		MM	5/16/2006
692	Degrees API D4052	61.15	Degrees API		MM	5/16/2006
691	Density @ 60 deg F D4052	0.73377	g/cm-03 @ 60 deg F		MM	5/16/2006
691	Density @ 60 deg F D4052	0.73377	g/cm-03 @ 60 deg F		MM	5/16/2006
101	Initial Boiling Point D86	87.6	Degrees F		MM	5/18/2006
110	10 Percent D86	114.3	Degrees F		MM	5/18/2006
150	50 Percent D86	204.1	Degrees F		MM	5/18/2006
190	90 Percent D86	331.5	Degrees F		MM	5/18/2006
200	End Point D86	414.4	Degrees F		MM	5/18/2006
201	Residue D86	1	mL		MM	5/18/2006
202	Total Recovery D86	97.8	mL		MM	5/18/2006
203	Loss D86	1.2	mL		MM	5/18/2006

543	Methanol	by D5599	0.00	Volume Percent	TS	5/22/2006
584	Isopropanol	by D5599	0.00	Volume Percent	TS	5/22/2006
585	t-Butanol	by D5599	0.00	Volume Percent	TS	5/22/2006
586	n-Propanol	by D5599	0.00	Volume Percent	TS	5/22/2006
587	sec-Butanol	by D5599	0.00	Volume Percent	TS	5/22/2006
588	DIPE	by D5599	0.00	Volume Percent	TS	5/22/2006
589	Isobutanol	by D5599	0.00	Volume Percent	TS	5/22/2006
5801	t-Amyl Alcohol	by D5599	0.00	Volume Percent	TS	5/22/2006
5802	n-Butanol	by D5599	0.00	Volume Percent	TS	5/22/2006

NVFEL Fuel Analysis Report

14523

Kansas City Samples

Batch#

Facility Name: ERG Facility Type: In House
Owner: EPA Phone: (913) 299-9480
6636 Berger Avenue

U.S.

Samples Type: Correlation

VOC

Inspection information logged in by MM on 5/15/2006.

Season: Winter

Kansas City Samples-TIY708(KS) **FTAG: 14523** **Comments:** **698; 2/16/05**

Test Code	Test Method	Results	Units	Fuel_ Code: 21	Analyst	Analysis Date
552	MTBE by D5599	0.00	Oxy Percent		TS	5/22/2006
562	ETBE by D5599	0.00	Oxy Percent		TS	5/22/2006
534	Ethanol by D5599	0.00	Oxy Percent		TS	5/22/2006
572	TAME by D5599	0.00	Oxy Percent		TS	5/22/2006
421	Sulfur in Gasoline D2622	98	Parts Per Million		NST	5/23/2006
62	Vapor Pressure by D5191 (Modified)	13.74	PS I		NST	5/15/2006
65	Percent Evaporated at 200 Degrees F D86	52.8	Volume Percent		MM	5/17/2006
66	Percent Evaporated at 300 Degrees F D86	84.8	Volume Percent		MM	5/17/2006
48	Aromatics in Gasoline MSD D5769	21.47	Volume Percent		TW	5/23/2006
64	Benzene in Gasoline D3606	1.02	Volume Percent		TW	5/23/2006
59	Weight Percent Oxygen by D5599	0.00	Weight Percent		TS	5/22/2006
57	TAME by D5599	0.00	Volume Percent		TS	5/22/2006
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent		TS	5/22/2006
55	MTBE by D5599	0.00	Volume Percent		TS	5/22/2006
532	Ethanol by D5599	0.00	Volume Percent		TS	5/22/2006
56	ETBE by D5599	0.00	Volume Percent		TS	5/22/2006
63	Benzene in Gasoline by GC/MSD D5769	0.98	Volume Percent		TW	5/23/2006
630	Toluene in gasoline by MSD D5769	5.03	Volumn Percent		TW	5/23/2006
69	Specific Gravity @ 60 deg F D4052	0.72484	60/60F		MM	5/16/2006
69	Specific Gravity @ 60 deg F D4052	0.72483	60/60F		MM	5/16/2006
692	Degrees API D4052	63.72	Degrees API		MM	5/16/2006
692	Degrees API D4052	63.72	Degrees API		MM	5/16/2006
691	Density @ 60 deg F D4052	0.72412	g/cm-03 @ 60 deg F		MM	5/16/2006
691	Density @ 60 deg F D4052	0.72412	g/cm-03 @ 60 deg F		MM	5/16/2006
101	Initial Boiling Point D86	82.6	Degrees F		MM	5/17/2006
110	10 Percent D86	101.2	Degrees F		MM	5/17/2006
150	50 Percent D86	192	Degrees F		MM	5/17/2006
190	90 Percent D86	325.5	Degrees F		MM	5/17/2006
200	End Point D86	416.4	Degrees F		MM	5/17/2006
201	Residue D86	1	mL		MM	5/17/2006
202	Total Recovery D86	97.7	mL		MM	5/17/2006
203	Loss D86	1.3	mL		MM	5/17/2006
543	Methanol by D5599	0.00	Volume Percent		TS	5/22/2006

584	Isopropanol	by D5599	0.00 Volume Percent	TS	5/22/2006
585	t-Butanol	by D5599	0.00 Volume Percent	TS	5/22/2006
586	n-Propanol	by D5599	0.00 Volume Percent	TS	5/22/2006
587	sec-Butanol	by D5599	0.00 Volume Percent	TS	5/22/2006
588	DIPE	by D5599	0.00 Volume Percent	TS	5/22/2006
589	Isobutanol	by D5599	0.00 Volume Percent	TS	5/22/2006
5801	t-Amyl Alcohol	by D5599	0.00 Volume Percent	TS	5/22/2006
5802	n-Butanol	by D5599	0.00 Volume Percent	TS	5/22/2006

NVFEL Fuel Analysis Report

14517

Batch#

Kansas City Samples

Facility Name: ERG Facility Type: In House

Owner: EPA Phone: (913) 299-9480

6636 Berger Avenue

U.S.

Samples Type: Correlation

VOC

Inspection information logged in by MM on 5/15/2006.

Season: Winter

Kansas City Samples-487SKA(MO) **FTAG: 14517** **Comments:** **118; 8/6/04**

Fuel_Code: 41

Test Code	Test Method	Results	Units	Analyst	Analysis Date
552	MTBE by D5599	0.00	Oxy Percent	TS	5/18/2006
562	ETBE by D5599	0.00	Oxy Percent	TS	5/18/2006
534	Ethanol by D5599	0.00	Oxy Percent	TS	5/18/2006
572	TAME by D5599	0.00	Oxy Percent	TS	5/18/2006
421	Sulfur in Gasoline D2622	159	Parts Per Million	NST	5/18/2006
62	Vapor Pressure by D5191 (Modified)	8.01	PS I	NST	5/15/2006
65	Percent Evaporated at 200 Degrees F D86	45.8	Volume Percent	MM	5/17/2006
66	Percent Evaporated at 300 Degrees F D86	81.2	Volume Percent	MM	5/17/2006
48	Aromatics in Gasoline MSD D5769	23.91	Volume Percent	TW	5/22/2006
64	Benzene in Gasoline D3606	0.98	Volume Percent	TW	5/23/2006
57	TAME by D5599	0.00	Volume Percent	TS	5/18/2006
59	Weight Percent Oxygen by D5599	0.00	Weight Percent	TS	5/18/2006
532	Ethanol by D5599	0.00	Volume Percent	TS	5/18/2006
55	MTBE by D5599	0.00	Volume Percent	TS	5/18/2006
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent	TS	5/18/2006
56	ETBE by D5599	0.00	Volume Percent	TS	5/18/2006
63	Benzene in Gasoline by GC/MSD D5769	0.97	Volume Percent	TW	5/22/2006
630	Toluene in gasoline by MSD D5769	4.83	Volumn Percent	TW	5/22/2006
69	Specific Gravity @ 60 deg F D4052	0.73992	60/60F	MM	5/16/2006
69	Specific Gravity @ 60 deg F D4052	0.73989	60/60F	MM	5/16/2006
692	Degrees API D4052	59.74	Degrees API	MM	5/16/2006
692	Degrees API D4052	59.75	Degrees API	MM	5/16/2006
691	Density @ 60 deg F D4052	0.73919	g/cm-03 @ 60 deg F	MM	5/16/2006
691	Density @ 60 deg F D4052	0.73916	g/cm-03 @ 60 deg F	MM	5/16/2006
101	Initial Boiling Point D86	94.5	Degrees F	MM	5/17/2006
110	10 Percent D86	130.3	Degrees F	MM	5/17/2006
150	50 Percent D86	210	Degrees F	MM	5/17/2006
190	90 Percent D86	339.7	Degrees F	MM	5/17/2006
200	End Point D86	438.1	Degrees F	MM	5/17/2006
201	Residue D86	1.1	mL	MM	5/17/2006
202	Total Recovery D86	98.1	mL	MM	5/17/2006
203	Loss D86	0.8	mL	MM	5/17/2006
543	Methanol by D5599	0.00	Volume Percent	TS	5/18/2006

584	Isopropanol	by D5599	0.00	Volume Percent	TS	5/18/2006
585	t-Butanol	by D5599	0.00	Volume Percent	TS	5/18/2006
586	n-Propanol	by D5599	0.00	Volume Percent	TS	5/18/2006
587	sec-Butanol	by D5599	0.00	Volume Percent	TS	5/18/2006
588	DIPE	by D5599	0.00	Volume Percent	TS	5/18/2006
589	Isobutanol	by D5599	0.00	Volume Percent	TS	5/18/2006
5801	t-Amyl Alcohol	by D5599	0.00	Volume Percent	TS	5/18/2006
5802	n-Butanol	by D5599	0.00	Volume Percent	TS	5/18/2006

NVFEL Fuel Analysis Report

14516

Kansas City Samples

Batch#

Facility Name: ERG Facility Type: In House

Owner: EPA Phone: (913) 299-9480

6636 Berger Avenue

U.S.

Samples Type: Correlation

VOC

Inspection information logged in by MM on 5/15/2006.

Season: Winter

Kansas City Samples-340CLR(MO) **FTAG: 14516** **Comments:** **21; 7/19/04**

Test Code	Test Method	Results	Units	Fuel_ Code: 21	Analyst	Analysis Date
552	MTBE by D5599	0.00	Oxy Percent		TS	5/18/2006
562	ETBE by D5599	0.00	Oxy Percent		TS	5/18/2006
534	Ethanol by D5599	0.00	Oxy Percent		TS	5/18/2006
572	TAME by D5599	0.00	Oxy Percent		TS	5/18/2006
421	Sulfur in Gasoline D2622	197	Parts Per Million		NST	5/18/2006
62	Vapor Pressure by D5191 (Modified)	6.56	PS I		NST	5/15/2006
65	Percent Evaporated at 200 Degrees F D86	37.4	Volume Percent		MM	5/17/2006
66	Percent Evaporated at 300 Degrees F D86	82	Volume Percent		MM	5/17/2006
48	Aromatics in Gasoline MSD D5769	34.58	Volume Percent		TW	5/22/2006
64	Benzene in Gasoline D3606	1.96	Volume Percent		TW	5/23/2006
57	TAME by D5599	0.00	Volume Percent		TS	5/18/2006
59	Weight Percent Oxygen by D5599	0.00	Weight Percent		TS	5/18/2006
532	Ethanol by D5599	0.00	Volume Percent		TS	5/18/2006
55	MTBE by D5599	0.00	Volume Percent		TS	5/18/2006
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent		TS	5/18/2006
56	ETBE by D5599	0.00	Volume Percent		TS	5/18/2006
63	Benzene in Gasoline by GC/MSD D5769	1.93	Volume Percent		TW	5/22/2006
630	Toluene in gasoline by MSD D5769	8.15	Volumn Percent		TW	5/22/2006
69	Specific Gravity @ 60 deg F D4052	0.75855	60/60F		MM	5/16/2006
69	Specific Gravity @ 60 deg F D4052	0.75854	60/60F		MM	5/16/2006
692	Degrees API D4052	55.04	Degrees API		MM	5/16/2006
692	Degrees API D4052	55.04	Degrees API		MM	5/16/2006
691	Density @ 60 deg F D4052	0.7578	g/cm-03 @ 60 deg F		MM	5/16/2006
691	Density @ 60 deg F D4052	0.75779	g/cm-03 @ 60 deg F		MM	5/16/2006
101	Initial Boiling Point D86	99.1	Degrees F		MM	5/17/2006
110	10 Percent D86	145.2	Degrees F		MM	5/17/2006
150	50 Percent D86	226.4	Degrees F		MM	5/17/2006
190	90 Percent D86	326.9	Degrees F		MM	5/17/2006
200	End Point D86	413.3	Degrees F		MM	5/17/2006
201	Residue D86	1	mL		MM	5/17/2006
202	Total Recovery D86	98.2	mL		MM	5/17/2006
203	Loss D86	0.8	mL		MM	5/17/2006
543	Methanol by D5599	0.00	Volume Percent		TS	5/18/2006

NVFEL Fuel Analysis Report

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584	Isopropanol	by D5599	0.00	Volume Percent	TS	5/18/2006
585	t-Butanol	by D5599	0.00	Volume Percent	TS	5/18/2006
586	n-Propanol	by D5599	0.00	Volume Percent	TS	5/18/2006
587	sec-Butanol	by D5599	0.00	Volume Percent	TS	5/18/2006
588	DIPE	by D5599	0.00	Volume Percent	TS	5/18/2006
589	Isobutanol	by D5599	0.00	Volume Percent	TS	5/18/2006
5801	t-Amyl Alcohol	by D5599	0.00	Volume Percent	TS	5/18/2006
5802	n-Butanol	by D5599	0.00	Volume Percent	TS	5/18/2006

Batch#

Kansas City Samples

Facility Name: ERG Facility Type: In House
Owner: EPA Phone: (913) 299-9480
6636 Berger Avenue

U.S.

Samples Type: Correlation
Inspection information logged in by MM on 5/22/2006.

VOC
Season: Winter

Kansas City Samples-03VV FTAG: 14541 Comments: 36; 7/21/04

Fuel_ Code: 21

Test Code	Test Method	Results	Units	Analyst	Analysis Date
552	MTBE by D5599	0.00	Oxy Percent	TS	5/24/2006
562	ETBE by D5599	0.00	Oxy Percent	TS	5/24/2006
534	Ethanol by D5599	0.00	Oxy Percent	TS	5/24/2006
572	TAME by D5599	0.00	Oxy Percent	TS	5/24/2006
421	Sulfur in Gasoline D2622	137	Parts Per Million	NST	5/24/2006
62	Vapor Pressure by D5191 (Modified)	8.24	PS I	NST	5/22/2006
65	Percent Evaporated at 200 Degrees F D86	47	Volume Percent	MM	5/23/2006
66	Percent Evaporated at 300 Degrees F D86	82.6	Volume Percent	MM	5/23/2006
48	Aromatics in Gasoline MSD D5769	26.34	Volume Percent	TW	6/1/2006
49	Olefins in by FIA D1319	7.9	Volume Percent	NST	7/6/2006
64	Benzene in Gasoline D3606	1.24	Volume Percent	TW	5/31/2006
57	TAME by D5599	0.00	Volume Percent	TS	5/24/2006
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent	TS	5/24/2006
59	Weight Percent Oxygen by D5599	0.00	Weight Percent	TS	5/24/2006
55	MTBE by D5599	0.00	Volume Percent	TS	5/24/2006
532	Ethanol by D5599	0.00	Volume Percent	TS	5/24/2006
56	ETBE by D5599	0.00	Volume Percent	TS	5/24/2006
46	Aromatics by FIA D1319	25.8	Volume Percent	NST	7/6/2006
63	Benzene in Gasoline by GC/MSD D5769	1.24	Volume Percent	TW	6/1/2006
630	Toluene in gasoline by MSD D5769	5.73	Volumn Percent	TW	6/1/2006
69	Specific Gravity @ 60 deg F D4052	0.73988	60/60F	MM	5/23/2006
69	Specific Gravity @ 60 deg F D4052	0.73996	60/60F	MM	5/23/2006
692	Degrees API D4052	59.73	Degrees API	MM	5/23/2006
692	Degrees API D4052	59.75	Degrees API	MM	5/23/2006
691	Density @ 60 deg F D4052	0.73915	g/cm-03 @ 60 deg F	MM	5/23/2006
691	Density @ 60 deg F D4052	0.73923	g/cm-03 @ 60 deg F	MM	5/23/2006
101	Initial Boiling Point D86	92.2	Degrees F	MM	5/23/2006
110	10 Percent D86	128.9	Degrees F	MM	5/23/2006
150	50 Percent D86	207.2	Degrees F	MM	5/23/2006
190	90 Percent D86	331.6	Degrees F	MM	5/23/2006
200	End Point D86	433.4	Degrees F	MM	5/23/2006
201	Residue D86	1.2	mL	MM	5/23/2006
202	Total Recovery D86	97.9	mL	MM	5/23/2006

203	Loss	D86	0.9 mL	MM	5/23/2006
543	Methanol	by D5599	0.00 Volume Percent	TS	5/24/2006
584	Isopropanol	by D5599	0.00 Volume Percent	TS	5/24/2006
585	t-Butanol	by D5599	0.00 Volume Percent	TS	5/24/2006
586	n-Propanol	by D5599	0.00 Volume Percent	TS	5/24/2006
587	sec-Butanol	by D5599	0.00 Volume Percent	TS	5/24/2006
588	DIPE	by D5599	0.00 Volume Percent	TS	5/24/2006
589	Isobutanol	by D5599	0.00 Volume Percent	TS	5/24/2006
5801	t-Amyl Alcohol	by D5599	0.00 Volume Percent	TS	5/24/2006
5802	n-Butanol	by D5599	0.00 Volume Percent	TS	5/24/2006

NVFEL Fuel Analysis Report

14542
Batch#

Kansas City Samples

Facility Name: ERG Facility Type: In House
Owner: EPA Phone: (913) 299-9480
6636 Berger Avenue

U.S.

Samples Type: Correlation
Inspection information logged in by MM on 5/22/2006.

VOC
Season: Winter

Kansas City Samples-SKA566(KS) FTAG: 14542 Comments: 117; 8/6/04

Fuel_ Code: 21

Test Code	Test Method	Results	Units	Analyst	Analysis Date
552	MTBE by D5599	0.00	Oxy Percent	TS	5/24/2006
562	ETBE by D5599	0.00	Oxy Percent	TS	5/24/2006
534	Ethanol by D5599	0.00	Oxy Percent	TS	5/24/2006
572	TAME by D5599	0.00	Oxy Percent	TS	5/24/2006
421	Sulfur in Gasoline D2622	111	Parts Per Million	NST	5/24/2006
62	Vapor Pressure by D5191 (Modified)	6.21	PS I	NST	5/22/2006
65	Percent Evaporated at 200 Degrees F D86	36.8	Volume Percent	MM	5/24/2006
66	Percent Evaporated at 300 Degrees F D86	77.9	Volume Percent	MM	5/24/2006
48	Aromatics in Gasoline MSD D5769	35.87	Volume Percent	TW	6/1/2006
49	Olefins in by FIA D1319	8.1	Volume Percent	NST	7/6/2006
64	Benzene in Gasoline D3606	2.12	Volume Percent	TW	5/31/2006
57	TAME by D5599	0.00	Volume Percent	TS	5/24/2006
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent	TS	5/24/2006
55	MTBE by D5599	0.00	Volume Percent	TS	5/24/2006
59	Weight Percent Oxygen by D5599	0.00	Weight Percent	TS	5/24/2006
532	Ethanol by D5599	0.00	Volume Percent	TS	5/24/2006
56	ETBE by D5599	0.00	Volume Percent	TS	5/24/2006
46	Aromatics by FIA D1319	36.3	Volume Percent	NST	7/6/2006
63	Benzene in Gasoline by GC/MSD D5769	2.11	Volume Percent	TW	6/1/2006
630	Toluene in gasoline by MSD D5769	8.96	Volumn Percent	TW	6/1/2006
69	Specific Gravity @ 60 deg F D4052	0.76317	60/60F	MM	5/23/2006
69	Specific Gravity @ 60 deg F D4052	0.76314	60/60F	MM	5/23/2006
692	Degrees API D4052	53.92	Degrees API	MM	5/23/2006
692	Degrees API D4052	53.91	Degrees API	MM	5/23/2006
691	Density @ 60 deg F D4052	0.76238	g/cm-03 @ 60 deg F	MM	5/23/2006
691	Density @ 60 deg F D4052	0.76242	g/cm-03 @ 60 deg F	MM	5/23/2006
101	Initial Boiling Point D86	98.8	Degrees F	MM	5/24/2006
110	10 Percent D86	147	Degrees F	MM	5/24/2006
150	50 Percent D86	227.6	Degrees F	MM	5/24/2006
190	90 Percent D86	344	Degrees F	MM	5/24/2006
200	End Point D86	420.8	Degrees F	MM	5/24/2006
201	Residue D86	1	mL	MM	5/24/2006
202	Total Recovery D86	98.1	mL	MM	5/24/2006

NVFEL Fuel Analysis Report

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203	Loss	D86	0.9 mL	MM	5/24/2006
543	Methanol	by D5599	0.00 Volume Percent	TS	5/24/2006
584	Isopropanol	by D5599	0.00 Volume Percent	TS	5/24/2006
585	t-Butanol	by D5599	0.00 Volume Percent	TS	5/24/2006
586	n-Propanol	by D5599	0.00 Volume Percent	TS	5/24/2006
587	sec-Butanol	by D5599	0.00 Volume Percent	TS	5/24/2006
588	DIPE	by D5599	0.00 Volume Percent	TS	5/24/2006
589	Isobutanol	by D5599	0.00 Volume Percent	TS	5/24/2006
5801	t-Amyl Alcohol	by D5599	0.00 Volume Percent	TS	5/24/2006
5802	n-Butanol	by D5599	0.00 Volume Percent	TS	5/24/2006

NVFEL Fuel Analysis Report

14543 Batch#

Kansas City Samples

Facility Name: ERG Facility Type: In House
Owner: EPA Phone: (913) 299-9480
6636 Berger Avenue

U.S.

Samples Type: Correlation
Inspection information logged in by MM on 5/22/2006.

VOC
Season: Winter

Kansas City Samples-LHDACH(MO) FTAG: 14543 Comments: 142; 8/11/04

Fuel_Code: 21

Test Code	Test Method	Results	Units	Analyst	Analysis Date
552	MTBE by D5599	0.00	Oxy Percent	TS	5/24/2006
552	MTBE by D5599	0.00	Oxy Percent	TS	5/24/2006
562	ETBE by D5599	0.00	Oxy Percent	TS	5/24/2006
562	ETBE by D5599	0.00	Oxy Percent	TS	5/24/2006
534	Ethanol by D5599	0.00	Oxy Percent	TS	5/24/2006
534	Ethanol by D5599	0.00	Oxy Percent	TS	5/24/2006
572	TAME by D5599	0.00	Oxy Percent	TS	5/24/2006
572	TAME by D5599	0.00	Oxy Percent	TS	5/24/2006
421	Sulfur in Gasoline D2622	140	Parts Per Million	NST	5/24/2006
421	Sulfur in Gasoline D2622	140	Parts Per Million	NST	5/24/2006
62	Vapor Pressure by D5191 (Modified)	6.48	PS I	NST	5/22/2006
65	Percent Evaporated at 200 Degrees F D86	37	Volume Percent	MM	5/24/2006
66	Percent Evaporated at 300 Degrees F D86	80.5	Volume Percent	MM	5/24/2006
48	Aromatics in Gasoline MSD D5769	33.69	Volume Percent	TW	6/1/2006
49	Olefins in by FIA D1319	8.5	Volume Percent	NST	7/6/2006
64	Benzene in Gasoline D3606	1.76	Volume Percent	TW	5/31/2006
532	Ethanol by D5599	0.00	Volume Percent	TS	5/24/2006
532	Ethanol by D5599	0.00	Volume Percent	TS	5/24/2006
55	MTBE by D5599	0.00	Volume Percent	TS	5/24/2006
55	MTBE by D5599	0.00	Volume Percent	TS	5/24/2006
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent	TS	5/24/2006
57	TAME by D5599	0.00	Volume Percent	TS	5/24/2006
57	TAME by D5599	0.00	Volume Percent	TS	5/24/2006
59	Weight Percent Oxygen by D5599	0.00	Weight Percent	TS	5/24/2006
59	Weight Percent Oxygen by D5599	0.00	Weight Percent	TS	5/24/2006
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent	TS	5/24/2006
56	ETBE by D5599	0.00	Volume Percent	TS	5/24/2006
56	ETBE by D5599	0.00	Volume Percent	TS	5/24/2006
46	Aromatics by FIA D1319	34.5	Volume Percent	NST	7/6/2006
63	Benzene in Gasoline by GC/MSD D5769	1.77	Volume Percent	TW	6/1/2006
630	Toluene in gasoline by MSD D5769	7.61	Volumn Percent	TW	6/1/2006
69	Specific Gravity @ 60 deg F D4052	0.75881	60/60F	MM	5/23/2006
69	Specific Gravity @ 60 deg F D4052	0.75872	60/60F	MM	5/23/2006

692	Degrees API	D4052	55 Degrees API	MM	5/23/2006
692	Degrees API	D4052	54.98 Degrees API	MM	5/23/2006
691	Density @ 60 deg F	D4052	0.75806 g/cm-03 @ 60 deg F	MM	5/23/2006
691	Density @ 60 deg F	D4052	0.75797 g/cm-03 @ 60 deg F	MM	5/23/2006
101	Initial Boiling Point	D86	99.1 Degrees F	MM	5/24/2006
110	10 Percent	D86	146.7 Degrees F	MM	5/24/2006
150	50 Percent	D86	226.6 Degrees F	MM	5/24/2006
190	90 Percent	D86	335.9 Degrees F	MM	5/24/2006
200	End Point	D86	424.8 Degrees F	MM	5/24/2006
201	Residue	D86	1 mL	MM	5/24/2006
202	Total Recovery	D86	98.1 mL	MM	5/24/2006
203	Loss	D86	0.9 mL	MM	5/24/2006
543	Methanol	by D5599	0.00 Volume Percent	TS	5/24/2006
543	Methanol	by D5599	0.00 Volume Percent	TS	5/24/2006
584	Isopropanol	by D5599	0.00 Volume Percent	TS	5/24/2006
584	Isopropanol	by D5599	0.00 Volume Percent	TS	5/24/2006
585	t-Butanol	by D5599	0.00 Volume Percent	TS	5/24/2006
585	t-Butanol	by D5599	0.00 Volume Percent	TS	5/24/2006
586	n-Propanol	by D5599	0.00 Volume Percent	TS	5/24/2006
586	n-Propanol	by D5599	0.00 Volume Percent	TS	5/24/2006
587	sec-Butanol	by D5599	0.00 Volume Percent	TS	5/24/2006
587	sec-Butanol	by D5599	0.00 Volume Percent	TS	5/24/2006
588	DIPE	by D5599	0.00 Volume Percent	TS	5/24/2006
588	DIPE	by D5599	0.00 Volume Percent	TS	5/24/2006
589	Isobutanol	by D5599	0.00 Volume Percent	TS	5/24/2006
589	Isobutanol	by D5599	0.00 Volume Percent	TS	5/24/2006
5801	t-Amyl Alcohol	by D5599	0.00 Volume Percent	TS	5/24/2006
5801	t-Amyl Alcohol	by D5599	0.00 Volume Percent	TS	5/24/2006
5802	n-Butanol	by D5599	0.00 Volume Percent	TS	5/24/2006
5802	n-Butanol	by D5599	0.00 Volume Percent	TS	5/24/2006

NVFEL Fuel Analysis Report

14544 Batch#

Kansas City Samples

Facility Name: ERG Facility Type: In House

Owner: EPA Phone: (913) 299-9480

6636 Berger Avenue

U.S.

Samples Type: Correlation

VOC

Inspection information logged in by MM on 5/22/2006.

Season: Winter

Kansas City Samples-QPN-387 FTAG: 14544 Comments: 164; 8/16/04

Test Code	Test Method	Results	Units	Fuel_ Code: 21	Analyst	Analysis Date
552	MTBE by D5599	0.01	Oxy Percent		TS	5/24/2006
562	ETBE by D5599	0.00	Oxy Percent		TS	5/24/2006
534	Ethanol by D5599	0.00	Oxy Percent		TS	5/24/2006
572	TAME by D5599	0.00	Oxy Percent		TS	5/24/2006
421	Sulfur in Gasoline D2622	128	Parts Per Million		NST	5/30/2006
62	Vapor Pressure by D5191 (Modified)	8.22	PS I		NST	5/22/2006
65	Percent Evaporated at 200 Degrees F D86	45.7	Volume Percent		MM	5/24/2006
66	Percent Evaporated at 300 Degrees F D86	78.4	Volume Percent		MM	5/24/2006
48	Aromatics in Gasoline MSD D5769	26.26	Volume Percent		TW	6/1/2006
49	Olefins in by FIA D1319	10.9	Volume Percent		NST	7/6/2006
64	Benzene in Gasoline D3606	0.84	Volume Percent		TW	5/31/2006
532	Ethanol by D5599	0.00	Volume Percent		TS	5/24/2006
55	MTBE by D5599	0.06	Volume Percent		TS	5/24/2006
57	TAME by D5599	0.00	Volume Percent		TS	5/24/2006
593	Volume Percent Oxygenates by D5599	0.06	Volume Percent		TS	5/24/2006
59	Weight Percent Oxygen by D5599	0.01	Weight Percent		TS	5/24/2006
56	ETBE by D5599	0.00	Volume Percent		TS	5/24/2006
630	Toluene in gasoline by MSD D5769	4.9	Volumn Percent		TW	6/1/2006
63	Benzene in Gasoline by GC/MSD D5769	0.84	Volume Percent		TW	6/1/2006
46	Aromatics by FIA D1319	27.4	Volume Percent		NST	7/6/2006
69	Specific Gravity @ 60 deg F D4052	0.74492	60/60F		MM	5/23/2006
69	Specific Gravity @ 60 deg F D4052	0.74489	60/60F		MM	5/23/2006
692	Degrees API D4052	58.46	Degrees API		MM	5/23/2006
692	Degrees API D4052	58.45	Degrees API		MM	5/23/2006
691	Density @ 60 deg F D4052	0.74419	g/cm-03 @ 60 deg F		MM	5/23/2006
691	Density @ 60 deg F D4052	0.74415	g/cm-03 @ 60 deg F		MM	5/23/2006
101	Initial Boiling Point D86	92.8	Degrees F		MM	5/24/2006
110	10 Percent D86	126.8	Degrees F		MM	5/24/2006
150	50 Percent D86	212.9	Degrees F		MM	5/24/2006
190	90 Percent D86	348.8	Degrees F		MM	5/24/2006
200	End Point D86	426.4	Degrees F		MM	5/24/2006
201	Residue D86	1	mL		MM	5/24/2006
202	Total Recovery D86	98	mL		MM	5/24/2006

203	Loss	D86	1 mL		MM	5/24/2006
543	Methanol	by D5599	0.00	Volume Percent	TS	5/24/2006
584	Isopropanol	by D5599	0.00	Volume Percent	TS	5/24/2006
585	t-Butanol	by D5599	0.00	Volume Percent	TS	5/24/2006
586	n-Propanol	by D5599	0.00	Volume Percent	TS	5/24/2006
587	sec-Butanol	by D5599	0.00	Volume Percent	TS	5/24/2006
588	DIPE	by D5599	0.00	Volume Percent	TS	5/24/2006
589	Isobutanol	by D5599	0.00	Volume Percent	TS	5/24/2006
5801	t-Amyl Alcohol	by D5599	0.00	Volume Percent	TS	5/24/2006
5802	n-Butanol	by D5599	0.00	Volume Percent	TS	5/24/2006

NVFEL Fuel Analysis Report

14545

Kansas City Samples

Batch#

Facility Name: ERG Facility Type: In House

Owner: EPA Phone: (913) 299-9480

6636 Berger Avenue

U.S.

Samples Type: Correlation

VOC

Inspection information logged in by MM on 5/22/06.

Season: Winter

Kansas City Samples- 4085EB(MO) **FTAG: 14545** **Comments:** **188; 8/20/04**

Fuel_ Code: 21

Test Code	Test Method	Results	Units	Analys	Analysis Date
552	MTBE by D5599	0.00	Oxy Percent	TS	5/24/06
562	ETBE · by D5599	0.00	Oxy Percent	TS	5/24/06
534	Ethanol by D5599	0.00	Oxy Percent	TS	5/24/06
572	TAME by D5599	0.00	Oxy Percent	TS	5/24/06
421	Sulfur in Gasoline D2622	70	Parts Per Million	NST	5/30/06
62	Vapor Pressure by D5191 (Modified)	6.72	PS I	NST	5/22/06
65	Percent Evaporated at 200 Degrees F D86	41.2	Volume Percent	MM	5/24/06
66	Percent Evaporated at 300 Degrees F D86	78.5	Volume Percent	MM	5/24/06
48	Aromatics in Gasoline MSD D5769	28.52	Volume Percent	TW	6/1/06
49	Olefins in by FIA D1319	13	Volume Percent	NST	7/12/06
64	Benzene in Gasoline D3606	1.03	Volume Percent	TW	5/31/06
532	Ethanol by D5599	0.00	Volume Percent	TS	5/24/06
55	MTBE by D5599	0.00	Volume Percent	TS	5/24/06
57	TAME by D5599	0.00	Volume Percent	TS	5/24/06
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent	TS	5/24/06
59	Weight Percent Oxygen by D5599	0.00	Weight Percent	TS	5/24/06
56	ETBE by D5599	0.00	Volume Percent	TS	5/24/06
630	Toluene in gasoline by MSD D5769	6.02	Volumn Percent	TW	6/1/06
63	Benzene in Gasoline by GC/MSD D5769	1.04	Volume Percent	TW	6/1/06
46	Aromatics by FIA D1319	29.7	Volume Percent	NST	7/12/06
69	Specific Gravity @ 60 deg F D4052	0.75344	60/60F	MM	5/23/06
69	Specific Gravity @ 60 deg F D4052	0.75343	60/60F	MM	5/23/06
692	Degrees API D4052	56.31	Degrees API	MM	5/23/06
692	Degrees API D4052	56.31	Degrees API	MM	5/23/06
691	Density @ 60 deg F D4052	0.7527	g/cm-03 @ 60 deg F	MM	5/23/06
691	Density @ 60 deg F D4052	0.75268	g/cm-03 @ 60 deg F	MM	5/23/06
101	Initial Boiling Point D86	99.7	Degrees F	MM	5/24/06
110	10 Percent D86	140.2	Degrees F	MM	5/24/06
150	50 Percent D86	220.2	Degrees F	MM	5/24/06
190	90 Percent D86	346.8	Degrees F	MM	5/24/06
200	End Point D86	428	Degrees F	MM	5/24/06
201	Residue D86	1	mL	MM	5/24/06
202	Total Recovery D86	97.9	mL	MM	5/24/06

203	Loss	D86	1.1 mL	MM	5/24/06
543	Methanol	by D5599	0.00 Volume Percent	TS	5/24/06
584	Isopropanol	by D5599	0.00 Volume Percent	TS	5/24/06
585	t-Butanol	by D5599	0.00 Volume Percent	TS	5/24/06
586	n-Propanol	by D5599	0.00 Volume Percent	TS	5/24/06
587	sec-Butanol	by D5599	0.00 Volume Percent	TS	5/24/06
588	DIPE	by D5599	0.00 Volume Percent	TS	5/24/06
589	Isobutanol	by D5599	0.00 Volume Percent	TS	5/24/06
5801	t-Amyl Alcohol	by D5599	0.00 Volume Percent	TS	5/24/06
5802	n-Butanol	by D5599	0.00 Volume Percent	TS	5/24/06

NVFEL Fuel Analysis Report

Batch# 14546

Kansas City Samples

Facility Name: ERG Facility Type: In House
Owner: EPA Phone: (913) 299-9480
6636 Berger Avenue

U.S.

Samples Type: Correlation

VOC

Inspection information logged in by MM on 5/22/06.

Season: Winter

Kansas City Samples-877XFG(MO) **FTAG: 14546** **Comments:** **232; 8/28/04**

Fuel_ Code: 21

Test Code	Test Method	Results	Units	Analys	Analysis Date
552	MTBE by D5599	0.00	Oxy Percent	TS	5/24/06
562	ETBE by D5599	0.00	Oxy Percent	TS	5/24/06
534	Ethanol by D5599	0.00	Oxy Percent	TS	5/24/06
572	TAME by D5599	0.00	Oxy Percent	TS	5/24/06
421	Sulfur in Gasoline D2622	64	Parts Per Million	NST	5/30/06
62	Vapor Pressure by D5191 (Modified)	6.74	PS I	NST	5/22/06
65	Percent Evaporated at 200 Degrees F D86	35.3	Volume Percent	MM	5/24/06
66	Percent Evaporated at 300 Degrees F D86	81	Volume Percent	MM	5/24/06
48	Aromatics in Gasoline MSD D5769	34.61	Volume Percent	TW	6/1/06
49	Olefins in by FIA D1319	9.3	Volume Percent	NST	7/12/06
64	Benzene in Gasoline D3606	0.93	Volume Percent	TW	5/31/06
64	Benzene in Gasoline D3606	0.93	Volume Percent	TW	5/31/06
532	Ethanol by D5599	0.00	Volume Percent	TS	5/24/06
55	MTBE by D5599	0.00	Volume Percent	TS	5/24/06
57	TAME by D5599	0.00	Volume Percent	TS	5/24/06
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent	TS	5/24/06
59	Weight Percent Oxygen by D5599	0.00	Weight Percent	TS	5/24/06
56	ETBE by D5599	0.00	Volume Percent	TS	5/24/06
630	Toluene in gasoline by MSD D5769	11.49	Volumn Percent	TW	6/1/06
63	Benzene in Gasoline by GC/MSD D5769	0.93	Volume Percent	TW	6/1/06
46	Aromatics by FIA D1319	35.3	Volume Percent	NST	7/12/06
69	Specific Gravity @ 60 deg F D4052	0.7617	60/60F	MM	5/23/06
69	Specific Gravity @ 60 deg F D4052	0.76169	60/60F	MM	5/23/06
692	Degrees API D4052	54.27	Degrees API	MM	5/23/06
692	Degrees API D4052	54.27	Degrees API	MM	5/23/06
691	Density @ 60 deg F D4052	0.76095	g/cm-03 @ 60 deg F	MM	5/23/06
691	Density @ 60 deg F D4052	0.76094	g/cm-03 @ 60 deg F	MM	5/23/06
101	Initial Boiling Point D86	95.4	Degrees F	MM	5/24/06
110	10 Percent D86	143.3	Degrees F	MM	5/24/06
150	50 Percent D86	230.3	Degrees F	MM	5/24/06
190	90 Percent D86	341.1	Degrees F	MM	5/24/06
200	End Point D86	424.3	Degrees F	MM	5/24/06
201	Residue D86	0.9	mL	MM	5/24/06

202	Total Recovery	D86	98.1 mL	MM	5/24/06
203	Loss	D86	1 mL	MM	5/24/06
543	Methanol	by D5599	0.00 Volume Percent	TS	5/24/06
584	Isopropanol	by D5599	0.00 Volume Percent	TS	5/24/06
585	t-Butanol	by D5599	0.00 Volume Percent	TS	5/24/06
586	n-Propanol	by D5599	0.00 Volume Percent	TS	5/24/06
587	sec-Butanol	by D5599	0.00 Volume Percent	TS	5/24/06
588	DIPE	by D5599	0.00 Volume Percent	TS	5/24/06
589	Isobutanol	by D5599	0.00 Volume Percent	TS	5/24/06
5801	t-Amyl Alcohol	by D5599	0.00 Volume Percent	TS	5/24/06
5802	n-Butanol	by D5599	0.00 Volume Percent	TS	5/24/06

NVFEL Fuel Analysis Report

14547

Kansas City Samples

Batch#

Facility Name: ERG Facility Type: In House

Owner: EPA Phone: (913) 299-9480

6636 Berger Avenue

U.S.

Samples Type: Correlation

VOC

Inspection information logged in by MM on 5/22/06.

Season: Winter

Kansas City Samples-853ALT(AR) **FTAG: 14547** **Comments:** **417; 9/27/04**

Fuel_Code: 21

Test Code	Test Method	Results	Units	Analys	Analysis Date
552	MTBE by D5599	0.00	Oxy Percent	TS	5/24/06
552	MTBE by D5599	0.00	Oxy Percent	TS	5/24/06
562	ETBE by D5599	0.00	Oxy Percent	TS	5/24/06
562	ETBE by D5599	0.00	Oxy Percent	TS	5/24/06
534	Ethanol by D5599	0.00	Oxy Percent	TS	5/24/06
534	Ethanol by D5599	0.00	Oxy Percent	TS	5/24/06
572	TAME by D5599	0.00	Oxy Percent	TS	5/24/06
572	TAME by D5599	0.00	Oxy Percent	TS	5/24/06
421	Sulfur in Gasoline D2622	50	Parts Per Million	NST	5/30/06
62	Vapor Pressure by D5191 (Modified)	8.44	PS I	NST	5/22/06
62	Vapor Pressure by D5191 (Modified)	8.43	PS I	NST	5/22/06
65	Percent Evaporated at 200 Degrees F D86	45.1	Volume Percent	MM	5/24/06
66	Percent Evaporated at 300 Degrees F D86	81.3	Volume Percent	MM	5/24/06
48	Aromatics in Gasoline MSD D5769	24.78	Volume Percent	TW	6/2/06
49	Olefins in by FIA D1319	9.6	Volume Percent	NST	7/12/06
64	Benzene in Gasoline D3606	0.85	Volume Percent	TW	6/7/06
532	Ethanol by D5599	0.00	Volume Percent	TS	5/24/06
532	Ethanol by D5599	0.00	Volume Percent	TS	5/24/06
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent	TS	5/24/06
57	TAME by D5599	0.00	Volume Percent	TS	5/24/06
57	TAME by D5599	0.00	Volume Percent	TS	5/24/06
59	Weight Percent Oxygen by D5599	0.00	Weight Percent	TS	5/24/06
55	MTBE by D5599	0.00	Volume Percent	TS	5/24/06
55	MTBE by D5599	0.00	Volume Percent	TS	5/24/06
59	Weight Percent Oxygen by D5599	0.00	Weight Percent	TS	5/24/06
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent	TS	5/24/06
56	ETBE by D5599	0.00	Volume Percent	TS	5/24/06
56	ETBE by D5599	0.00	Volume Percent	TS	5/24/06
46	Aromatics by FIA D1319	24.4	Volume Percent	NST	7/12/06
63	Benzene in Gasoline by GC/MSD D5769	0.84	Volume Percent	TW	6/2/06
630	Toluene in gasoline by MSD D5769	5.16	Volumn Percent	TW	6/2/06
69	Specific Gravity @ 60 deg F D4052	0.74233	60/60F	MM	5/23/06
69	Specific Gravity @ 60 deg F D4052	0.74233	60/60F	MM	5/23/06

NVFEL Fuel Analysis Report

14547

692	Degrees API	D4052	59.12 Degrees API	MM	5/23/06
692	Degrees API	D4052	59.12 Degrees API	MM	5/23/06
691	Density @ 60 deg F	D4052	0.7416 g/cm-03 @ 60 deg F	MM	5/23/06
691	Density @ 60 deg F	D4052	0.7416 g/cm-03 @ 60 deg F	MM	5/23/06
101	Initial Boiling Point	D86	92.4 Degrees F	MM	5/24/06
110	10 Percent	D86	129.5 Degrees F	MM	5/24/06
150	50 Percent	D86	210.8 Degrees F	MM	5/24/06
190	90 Percent	D86	341.7 Degrees F	MM	5/24/06
200	End Point	D86	429.2 Degrees F	MM	5/24/06
201	Residue	D86	1 mL	MM	5/24/06
202	Total Recovery	D86	97.9 mL	MM	5/24/06
203	Loss	D86	1.1 mL	MM	5/24/06
543	Methanol	by D5599	0.00 Volume Percent	TS	5/24/06
543	Methanol	by D5599	0.00 Volume Percent	TS	5/24/06
584	Isopropanol	by D5599	0.00 Volume Percent	TS	5/24/06
584	Isopropanol	by D5599	0.00 Volume Percent	TS	5/24/06
585	t-Butanol	by D5599	0.00 Volume Percent	TS	5/24/06
585	t-Butanol	by D5599	0.00 Volume Percent	TS	5/24/06
586	n-Propanol	by D5599	0.00 Volume Percent	TS	5/24/06
586	n-Propanol	by D5599	0.00 Volume Percent	TS	5/24/06
587	sec-Butanol	by D5599	0.00 Volume Percent	TS	5/24/06
587	sec-Butanol	by D5599	0.00 Volume Percent	TS	5/24/06
588	DIPE	by D5599	0.00 Volume Percent	TS	5/24/06
588	DIPE	by D5599	0.00 Volume Percent	TS	5/24/06
589	Isobutanol	by D5599	0.00 Volume Percent	TS	5/24/06
589	Isobutanol	by D5599	0.00 Volume Percent	TS	5/24/06
5801	t-Amyl Alcohol	by D5599	0.00 Volume Percent	TS	5/24/06
5801	t-Amyl Alcohol	by D5599	0.00 Volume Percent	TS	5/24/06
5802	n-Butanol	by D5599	0.00 Volume Percent	TS	5/24/06
5802	n-Butanol	by D5599	0.00 Volume Percent	TS	5/24/06

NVFEL Fuel Analysis Report

14548

Kansas City Samples

Batch#

Facility Name: ERG Facility Type: In House

Owner: EPA Phone: (913) 299-9480

6636 Berger Avenue

U.S.

Samples Type: Correlation

VOC

Inspection information logged in by MM on 5/22/06.

Season: Winter

Kansas City Samples-QMY157 **FTAG: 14548** **Comments:** **434; 9/29/04**

Fuel_ Code: 21

Test Code	Test Method	Results Units	Analys	Analysis Date
552	MTBE by D5599	0.00 Oxy Percent	TS	6/5/06
562	ETBE by D5599	0.00 Oxy Percent	TS	6/5/06
534	Ethanol by D5599	0.00 Oxy Percent	TS	6/5/06
572	TAME by D5599	0.00 Oxy Percent	TS	6/5/06
421	Sulfur in Gasoline D2622	90 Parts Per Million	NST	5/30/06
62	Vapor Pressure by D5191 (Modified)	7.35 PS I	NST	5/22/06
62	Vapor Pressure by D5191 (Modified)	7.37 PS I	NST	5/22/06
65	Percent Evaporated at 200 Degrees F D86	38 Volume Percent	MM	5/24/06
66	Percent Evaporated at 300 Degrees F D86	82.1 Volume Percent	MM	5/24/06
48	Aromatics in Gasoline MSD D5769	27.93 Volume Percent	TW	6/2/06
49	Olefins in by FIA D1319	6.2 Volume Percent	NST	7/12/06
64	Benzene in Gasoline D3606	1.18 Volume Percent	TW	6/7/06
57	TAME by D5599	0.00 Volume Percent	TS	6/5/06
59	Weight Percent Oxygen by D5599	0.00 Weight Percent	TS	6/5/06
55	MTBE by D5599	0.00 Volume Percent	TS	6/5/06
532	Ethanol by D5599	0.00 Volume Percent	TS	6/5/06
593	Volume Percent Oxygenates by D5599	0.00 Volume Percent	TS	6/5/06
56	ETBE by D5599	0.00 Volume Percent	TS	6/5/06
630	Toluene in gasoline by MSD D5769	6.84 Volumn Percent	TW	6/2/06
46	Aromatics by FIA D1319	27 Volume Percent	NST	7/12/06
63	Benzene in Gasoline by GC/MSD D5769	1.17 Volume Percent	TW	6/2/06
69	Specific Gravity @ 60 deg F D4052	0.7461 60/60F	MM	5/23/06
69	Specific Gravity @ 60 deg F D4052	0.74611 60/60F	MM	5/23/06
692	Degrees API D4052	58.15 Degrees API	MM	5/23/06
692	Degrees API D4052	58.15 Degrees API	MM	5/23/06
691	Density @ 60 deg F D4052	0.74537 g/cm-03 @ 60 deg F	MM	5/23/06
691	Density @ 60 deg F D4052	0.74536 g/cm-03 @ 60 deg F	MM	5/23/06
101	Initial Boiling Point D86	96.2 Degrees F	MM	5/24/06
110	10 Percent D86	139.3 Degrees F	MM	5/24/06
150	50 Percent D86	223.6 Degrees F	MM	5/24/06
190	90 Percent D86	332.1 Degrees F	MM	5/24/06
200	End Point D86	412.4 Degrees F	MM	5/24/06
201	Residue D86	1.2 mL	MM	5/24/06

202	Total Recovery	D86	97.60001 mL	MM	5/24/06
203	Loss	D86	1.2 mL	MM	5/24/06
543	Methanol	by D5599	0.00 Volume Percent	TS	6/5/06
584	Isopropanol	by D5599	0.00 Volume Percent	TS	6/5/06
585	t-Butanol	by D5599	0.00 Volume Percent	TS	6/5/06
586	n-Propanol	by D5599	0.00 Volume Percent	TS	6/5/06
587	sec-Butanol	by D5599	0.00 Volume Percent	TS	6/5/06
588	DIPE	by D5599	0.00 Volume Percent	TS	6/5/06
589	Isobutanol	by D5599	0.00 Volume Percent	TS	6/5/06
5801	t-Amyl Alcohol	by D5599	0.00 Volume Percent	TS	6/5/06
5802	n-Butanol	by D5599	0.00 Volume Percent	TS	6/5/06

NVFEL Fuel Analysis Report

14564

Kansas City Samples

Batch#

Facility Name: ERG Facility Type: In House

Owner: EPA Phone: (913) 299-9480

6636 Berger Avenue

U.S.

Samples Type: Correlation

VOC

Inspection information logged in by MM on 5/25/06.

Season: Winter

Kansas City Samples-QEH690(Ks) **FTAG: 14564** **Comments:** **Label partially obliterated.**

Fuel_Code: 21

Test Code	Test Method	Results Units	Analys	Analysis Date
552	MTBE by D5599	0.00 Oxy Percent	TS	6/5/06
562	ETBE by D5599	0.00 Oxy Percent	TS	6/5/06
534	Ethanol by D5599	0.00 Oxy Percent	TS	6/5/06
572	TAME by D5599	0.00 Oxy Percent	TS	6/5/06
421	Sulfur in Gasoline D2622	138 Parts Per Million	NST	6/6/06
62	Vapor Pressure by D5191 (Modified)	6.53 PS I	MM	5/26/06
65	Percent Evaporated at 200 Degrees F D86	36.7 Volume Percent	MM	6/2/06
66	Percent Evaporated at 300 Degrees F D86	79.2 Volume Percent	MM	6/2/06
48	Aromatics in Gasoline MSD D5769	30.59 Volume Percent	TW	6/8/06
49	Olefins in by FIA D1319	11.9 Volume Percent	NST	7/12/06
64	Benzene in Gasoline D3606	1.38 Volume Percent	TW	6/7/06
532	Ethanol by D5599	0.00 Volume Percent	TS	6/5/06
55	MTBE by D5599	0.00 Volume Percent	TS	6/5/06
57	TAME by D5599	0.00 Volume Percent	TS	6/5/06
593	Volume Percent Oxygenates by D5599	0.00 Volume Percent	TS	6/5/06
59	Weight Percent Oxygen by D5599	0.00 Weight Percent	TS	6/5/06
56	ETBE by D5599	0.00 Volume Percent	TS	6/5/06
46	Aromatics by FIA D1319	30.1 Volume Percent	NST	7/12/06
63	Benzene in Gasoline by GC/MSD D5769	1.37 Volume Percent	TW	6/8/06
630	Toluene in gasoline by MSD D5769	6.46 Volumn Percent	TW	6/8/06
69	Specific Gravity @ 60 deg F D4052	0.75573 60/60F	MM	5/31/06
69	Specific Gravity @ 60 deg F D4052	0.75569 60/60F	MM	5/31/06
692	Degrees API D4052	55.75 Degrees API	MM	5/31/06
692	Degrees API D4052	55.74 Degrees API	MM	5/31/06
691	Density @ 60 deg F D4052	0.75499 g/cm-03 @ 60 deg F	MM	5/31/06
691	Density @ 60 deg F D4052	0.75495 g/cm-03 @ 60 deg F	MM	5/31/06
101	Initial Boiling Point D86	98.6 Degrees F	MM	6/2/06
110	10 Percent D86	146.7 Degrees F	MM	6/2/06
150	50 Percent D86	226.9 Degrees F	MM	6/2/06
190	90 Percent D86	342.7 Degrees F	MM	6/2/06
200	End Point D86	433.2 Degrees F	MM	6/2/06
201	Residue D86	0.9 mL	MM	6/2/06
202	Total Recovery D86	98.4 mL	MM	6/2/06

203	Loss	D86	0.7 mL	MM	6/2/06
543	Methanol	by D5599	0.00 Volume Percent	TS	6/5/06
584	Isopropanol	by D5599	0.00 Volume Percent	TS	6/5/06
585	t-Butanol	by D5599	0.00 Volume Percent	TS	6/5/06
586	n-Propanol	by D5599	0.00 Volume Percent	TS	6/5/06
587	sec-Butanol	by D5599	0.00 Volume Percent	TS	6/5/06
588	DIPE	by D5599	0.00 Volume Percent	TS	6/5/06
589	Isobutanol	by D5599	0.00 Volume Percent	TS	6/5/06
5801	t-Amyl Alcohol	by D5599	0.00 Volume Percent	TS	6/5/06
5802	n-Butanol	by D5599	0.00 Volume Percent	TS	6/5/06

NVFEL Fuel Analysis Report

14565

Kansas City Samples

Batch#

Facility Name: ERG Facility Type: In House

Owner: EPA Phone: (913) 299-9480

6636 Berger Avenue

U.S.

Samples Type: Correlation

VOC

Inspection information logged in by MM on 5/25/06.

Season: Winter

Kansas City Samples-QJG007(Ks) **FTAG: 14565** **Comments:**

Test Code	Test Method	Results	Units	Fuel_ Code: 21	Analys	Analysis Date
552	MTBE by D5599	0.00	Oxy Percent		TS	6/5/06
562	ETBE by D5599	0.00	Oxy Percent		TS	6/5/06
534	Ethanol by D5599	0.00	Oxy Percent		TS	6/5/06
572	TAME by D5599	0.00	Oxy Percent		TS	6/5/06
421	Sulfur in Gasoline D2622	172	Parts Per Million		NST	6/6/06
62	Vapor Pressure by D5191 (Modified)	7.82	PS I		MM	5/26/06
65	Percent Evaporated at 200 Degrees F D86	42.9	Volume Percent		MM	6/2/06
66	Percent Evaporated at 300 Degrees F D86	78.7	Volume Percent		MM	6/2/06
48	Aromatics in Gasoline MSD D5769	26.87	Volume Percent		TW	6/8/06
49	Olefins in by FIA D1319	11.9	Volume Percent		NST	7/12/06
64	Benzene in Gasoline D3606	0.98	Volume Percent		TW	6/7/06
532	Ethanol by D5599	0.00	Volume Percent		TS	6/5/06
55	MTBE by D5599	0.00	Volume Percent		TS	6/5/06
57	TAME by D5599	0.00	Volume Percent		TS	6/5/06
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent		TS	6/5/06
59	Weight Percent Oxygen by D5599	0.00	Weight Percent		TS	6/5/06
56	ETBE by D5599	0.00	Volume Percent		TS	6/5/06
46	Aromatics by FIA D1319	26.1	Volume Percent		NST	7/12/06
63	Benzene in Gasoline by GC/MSD D5769	0.98	Volume Percent		TW	6/8/06
630	Toluene in gasoline by MSD D5769	4.96	Volumn Percent		TW	6/8/06
69	Specific Gravity @ 60 deg F D4052	0.74648	60/60F		MM	5/31/06
69	Specific Gravity @ 60 deg F D4052	0.74643	60/60F		MM	5/31/06
692	Degrees API D4052	58.07	Degrees API		MM	5/31/06
692	Degrees API D4052	58.06	Degrees API		MM	5/31/06
691	Density @ 60 deg F D4052	0.74575	g/cm-03 @ 60 deg F		MM	5/31/06
691	Density @ 60 deg F D4052	0.74569	g/cm-03 @ 60 deg F		MM	5/31/06
101	Initial Boiling Point D86	94.2	Degrees F		MM	6/2/06
110	10 Percent D86	132.8	Degrees F		MM	6/2/06
150	50 Percent D86	217.8	Degrees F		MM	6/2/06
190	90 Percent D86	344.8	Degrees F		MM	6/2/06
200	End Point D86	428.3	Degrees F		MM	6/2/06
201	Residue D86	1	mL		MM	6/2/06
202	Total Recovery D86	98.3	mL		MM	6/2/06

NVFEL Fuel Analysis Report

203	Loss	D86	0.7 mL	MM	6/2/06
543	Methanol	by D5599	0.00 Volume Percent	TS	6/5/06
584	Isopropanol	by D5599	0.00 Volume Percent	TS	6/5/06
585	t-Butanol	by D5599	0.00 Volume Percent	TS	6/5/06
586	n-Propanol	by D5599	0.00 Volume Percent	TS	6/5/06
587	sec-Butanol	by D5599	0.00 Volume Percent	TS	6/5/06
588	DIPE	by D5599	0.00 Volume Percent	TS	6/5/06
589	Isobutanol	by D5599	0.00 Volume Percent	TS	6/5/06
5801	t-Amyl Alcohol	by D5599	0.00 Volume Percent	TS	6/5/06
5802	n-Butanol	by D5599	0.00 Volume Percent	TS	6/5/06

NVFEL Fuel Analysis Report

14566

Kansas City Samples

Batch#

Facility Name: ERG Facility Type: In House

Owner: EPA Phone: (913) 299-9480

6636 Berger Avenue

U.S.

Samples Type: Correlation

VOC

Inspection information logged in by MM on 5/25/06.

Season: Winter

Kansas City Samples-450FCW(Mo) **FTAG: 14566** **Comments:** **734; 2-23-05**

Test Code	Test Method	Results Units	Fuel_Code: 21	Analys	Analysis Date
552	MTBE by D5599	0.00 Oxy Percent		TS	6/5/06
562	ETBE by D5599	0.00 Oxy Percent		TS	6/5/06
534	Ethanol by D5599	0.00 Oxy Percent		TS	6/5/06
572	TAME by D5599	0.00 Oxy Percent		TS	6/5/06
421	Sulfur in Gasoline D2622	157 Parts Per Million		NST	6/6/06
62	Vapor Pressure by D5191 (Modified)	13.45 PSI		MM	5/26/06
65	Percent Evaporated at 200 Degrees F D86	53.2 Volume Percent		MM	6/2/06
66	Percent Evaporated at 300 Degrees F D86	85.5 Volume Percent		MM	6/2/06
48	Aromatics in Gasoline MSD D5769	21.55 Volume Percent		TW	6/8/06
49	Olefins in by FIA D1319	7.8 Volume Percent		NST	7/12/06
64	Benzene in Gasoline D3606	1.10 Volume Percent		TW	6/7/06
532	Ethanol by D5599	0.00 Volume Percent		TS	6/5/06
55	MTBE by D5599	0.00 Volume Percent		TS	6/5/06
57	TAME by D5599	0.00 Volume Percent		TS	6/5/06
593	Volume Percent Oxygenates by D5599	0.00 Volume Percent		TS	6/5/06
59	Weight Percent Oxygen by D5599	0.00 Weight Percent		TS	6/5/06
56	ETBE by D5599	0.00 Volume Percent		TS	6/5/06
46	Aromatics by FIA D1319	20.2 Volume Percent		NST	7/12/06
63	Benzene in Gasoline by GC/MSD D5769	1.1 Volume Percent		TW	6/8/06
630	Toluene in gasoline by MSD D5769	5.09 Volumn Percent		TW	6/8/06
69	Specific Gravity @ 60 deg F D4052	0.72445 60/60F		MM	5/31/06
69	Specific Gravity @ 60 deg F D4052	0.72445 60/60F		MM	5/31/06
692	Degrees API D4052	63.82 Degrees API		MM	5/31/06
692	Degrees API D4052	63.82 Degrees API		MM	5/31/06
691	Density @ 60 deg F D4052	0.72373 g/cm-03 @ 60 deg F		MM	5/31/06
691	Density @ 60 deg F D4052	0.72373 g/cm-03 @ 60 deg F		MM	5/31/06
101	Initial Boiling Point D86	82 Degrees F		MM	6/2/06
110	10 Percent D86	103 Degrees F		MM	6/2/06
150	50 Percent D86	191.8 Degrees F		MM	6/2/06
190	90 Percent D86	323.7 Degrees F		MM	6/2/06
200	End Point D86	416.2 Degrees F		MM	6/2/06
201	Residue D86	1 mL		MM	6/2/06
202	Total Recovery D86	97.6 mL		MM	6/2/06

203	Loss	D86	1.4 mL	MM	6/2/06
543	Methanol	by D5599	0.00 Volume Percent	TS	6/5/06
584	Isopropanol	by D5599	0.00 Volume Percent	TS	6/5/06
585	t-Butanol	by D5599	0.00 Volume Percent	TS	6/5/06
586	n-Propanol	by D5599	0.00 Volume Percent	TS	6/5/06
587	sec-Butanol	by D5599	0.00 Volume Percent	TS	6/5/06
588	DIPE	by D5599	0.00 Volume Percent	TS	6/5/06
589	Isobutanol	by D5599	0.00 Volume Percent	TS	6/5/06
5801	t-Amyl Alcohol	by D5599	0.00 Volume Percent	TS	6/5/06
5802	n-Butanol	by D5599	0.00 Volume Percent	TS	6/5/06

NVFEL Fuel Analysis Report

Kansas City Samples Batch#

Facility Name: ERG Facility Type: In House
Owner: EPA Phone: (913) 299-9480
6636 Berger Avenue

U.S.

Samples Type: Correlation VOC

Inspection information logged in by MM on 5/25/06. **Season:** Winter

Kansas City Samples-QIS160(Ks) **FTAG: 14567** **Comments:** **Label partially obliterated.**

Test Code	Test Method	Results	Units	Fuel_ Code: 21	Analys	Analysis Date
552	MTBE by D5599	0.00	Oxy Percent		TS	6/5/06
562	ETBE by D5599	0.00	Oxy Percent		TS	6/5/06
534	Ethanol by D5599	0.00	Oxy Percent		TS	6/5/06
572	TAME by D5599	0.00	Oxy Percent		TS	6/5/06
421	Sulfur in Gasoline D2622	287	Parts Per Million		NST	6/6/06
62	Vapor Pressure by D5191 (Modified)	5.4	PS I		MM	5/26/06
65	Percent Evaporated at 200 Degrees F D86	30.8	Volume Percent		MM	6/2/06
66	Percent Evaporated at 300 Degrees F D86	80.6	Volume Percent		MM	6/2/06
48	Aromatics in Gasoline MSD D5769	31.96	Volume Percent		TW	6/8/06
49	Olefins in by FIA D1319	8.9	Volume Percent		NST	7/12/06
64	Benzene in Gasoline D3606	1.57	Volume Percent		TW	6/7/06
532	Ethanol by D5599	0.00	Volume Percent		TS	6/5/06
55	MTBE by D5599	0.00	Volume Percent		TS	6/5/06
57	TAME by D5599	0.00	Volume Percent		TS	6/5/06
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent		TS	6/5/06
59	Weight Percent Oxygen by D5599	0.00	Weight Percent		TS	6/5/06
56	ETBE by D5599	0.00	Volume Percent		TS	6/5/06
630	Toluene in gasoline by MSD D5769	7.51	Volumn Percent		TW	6/8/06
63	Benzene in Gasoline by GC/MSD D5769	1.56	Volume Percent		TW	6/8/06
46	Aromatics by FIA D1319	30.7	Volume Percent		NST	7/12/06
69	Specific Gravity @ 60 deg F D4052	0.75983	60/60F		MM	5/31/06
69	Specific Gravity @ 60 deg F D4052	0.75975	60/60F		MM	5/31/06
692	Degrees API D4052	54.75	Degrees API		MM	5/31/06
692	Degrees API D4052	54.73	Degrees API		MM	5/31/06
691	Density @ 60 deg F D4052	0.75908	g/cm-03 @ 60 deg F		MM	5/31/06
691	Density @ 60 deg F D4052	0.759	g/cm-03 @ 60 deg F		MM	5/31/06
101	Initial Boiling Point D86	104.4	Degrees F		MM	6/2/06
110	10 Percent D86	158.8	Degrees F		MM	6/2/06
150	50 Percent D86	234.6	Degrees F		MM	6/2/06
190	90 Percent D86	333.3	Degrees F		MM	6/2/06
200	End Point D86	405.5	Degrees F		MM	6/2/06
201	Residue D86	1.1	mL		MM	6/2/06
202	Total Recovery D86	98.3	mL		MM	6/2/06

203	Loss	D86	0.6 mL	MM	6/2/06
543	Methanol	by D5599	0.00 Volume Percent	TS	6/5/06
584	Isopropanol	by D5599	0.00 Volume Percent	TS	6/5/06
585	t-Butanol	by D5599	0.00 Volume Percent	TS	6/5/06
586	n-Propanol	by D5599	0.00 Volume Percent	TS	6/5/06
587	sec-Butanol	by D5599	0.00 Volume Percent	TS	6/5/06
588	DIPE	by D5599	0.00 Volume Percent	TS	6/5/06
589	Isobutanol	by D5599	0.00 Volume Percent	TS	6/5/06
5801	t-Amyl Alcohol	by D5599	0.00 Volume Percent	TS	6/5/06
5802	n-Butanol	by D5599	0.00 Volume Percent	TS	6/5/06

NVFEL Fuel Analysis Report

14568

Kansas City Samples

Batch#

Facility Name: ERG Facility Type: In House

Owner: EPA Phone: (913) 299-9480

6636 Berger Avenue

U.S.

Samples Type: Correlation

VOC

Inspection information logged in by MM on 5/25/2006.

Season: Winter

Kansas City Samples-20430(Ks) **FTAG: 14568** **Comments:** **(600); 1/26/05**

Test Code	Test Method	Results	Units	Fuel_ Code: 21	Analyst	Analysis Date
552	MTBE by D5599	0.00	Oxy Percent		TS	6/5/2006
552	MTBE by D5599	0.00	Oxy Percent		TS	6/5/2006
562	ETBE by D5599	0.00	Oxy Percent		TS	6/5/2006
562	ETBE by D5599	0.00	Oxy Percent		TS	6/5/2006
534	Ethanol by D5599	0.00	Oxy Percent		TS	6/5/2006
534	Ethanol by D5599	0.00	Oxy Percent		TS	6/5/2006
572	TAME by D5599	0.00	Oxy Percent		TS	6/5/2006
572	TAME by D5599	0.00	Oxy Percent		TS	6/5/2006
421	Sulfur in Gasoline D2622	379	Parts Per Million		NST	6/6/2006
62	Vapor Pressure by D5191 (Modified)	13.56	PS I		MM	5/26/2006
65	Percent Evaporated at 200 Degrees F D86	49.1	Volume Percent		MM	6/2/2006
66	Percent Evaporated at 300 Degrees F D86	84.9	Volume Percent		MM	6/2/2006
48	Aromatics in Gasoline MSD D5769	22.67	Volume Percent		TW	6/8/2006
49	Olefins in by FIA D1319	8.4	Volume Percent		NST	7/25/2006
64	Benzene in Gasoline D3606	1.19	Volume Percent		TW	6/7/2006
532	Ethanol by D5599	0.00	Volume Percent		TS	6/5/2006
57	TAME by D5599	0.00	Volume Percent		TS	6/5/2006
57	TAME by D5599	0.00	Volume Percent		TS	6/5/2006
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent		TS	6/5/2006
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent		TS	6/5/2006
59	Weight Percent Oxygen by D5599	0.00	Weight Percent		TS	6/5/2006
59	Weight Percent Oxygen by D5599	0.00	Weight Percent		TS	6/5/2006
55	MTBE by D5599	0.00	Volume Percent		TS	6/5/2006
55	MTBE by D5599	0.00	Volume Percent		TS	6/5/2006
532	Ethanol by D5599	0.00	Volume Percent		TS	6/5/2006
56	ETBE by D5599	0.00	Volume Percent		TS	6/5/2006
56	ETBE by D5599	0.00	Volume Percent		TS	6/5/2006
63	Benzene in Gasoline by GC/MSD D5769	1.2	Volume Percent		TW	6/8/2006
46	Aromatics by FIA D1319	21.5	Volume Percent		NST	7/25/2006
630	Toluene in gasoline by MSD D5769	5.22	Volumn Percent		TW	6/8/2006
69	Specific Gravity @ 60 deg F D4052	0.727	60/60F		MM	5/31/2006
69	Specific Gravity @ 60 deg F D4052	0.72691	60/60F		MM	5/31/2006
692	Degrees API D4052	63.14	Degrees API		MM	5/31/2006

692	Degrees API	D4052	63.16 Degrees API	MM	5/31/2006
691	Density @ 60 deg F	D4052	0.72628 g/cm-03 @ 60 deg F	MM	5/31/2006
691	Density @ 60 deg F	D4052	0.72619 g/cm-03 @ 60 deg F	MM	5/31/2006
101	Initial Boiling Point	D86	81.7 Degrees F	MM	6/2/2006
110	10 Percent	D86	103.8 Degrees F	MM	6/2/2006
150	50 Percent	D86	201.8 Degrees F	MM	6/2/2006
190	90 Percent	D86	321.3 Degrees F	MM	6/2/2006
200	End Point	D86	393.8 Degrees F	MM	6/2/2006
201	Residue	D86	1.2 mL	MM	6/2/2006
202	Total Recovery	D86	97.3 mL	MM	6/2/2006
203	Loss	D86	1.5 mL	MM	6/2/2006
543	Methanol	by D5599	0.00 Volume Percent	TS	6/5/2006
543	Methanol	by D5599	0.00 Volume Percent	TS	6/5/2006
584	Isopropanol	by D5599	0.00 Volume Percent	TS	6/5/2006
584	Isopropanol	by D5599	0.00 Volume Percent	TS	6/5/2006
585	t-Butanol	by D5599	0.00 Volume Percent	TS	6/5/2006
585	t-Butanol	by D5599	0.00 Volume Percent	TS	6/5/2006
586	n-Propanol	by D5599	0.00 Volume Percent	TS	6/5/2006
586	n-Propanol	by D5599	0.00 Volume Percent	TS	6/5/2006
587	sec-Butanol	by D5599	0.00 Volume Percent	TS	6/5/2006
587	sec-Butanol	by D5599	0.00 Volume Percent	TS	6/5/2006
588	DIPE	by D5599	0.00 Volume Percent	TS	6/5/2006
588	DIPE	by D5599	0.00 Volume Percent	TS	6/5/2006
589	Isobutanol	by D5599	0.00 Volume Percent	TS	6/5/2006
589	Isobutanol	by D5599	0.00 Volume Percent	TS	6/5/2006
5801	t-Amyl Alcohol	by D5599	0.00 Volume Percent	TS	6/5/2006
5801	t-Amyl Alcohol	by D5599	0.00 Volume Percent	TS	6/5/2006
5802	n-Butanol	by D5599	0.00 Volume Percent	TS	6/5/2006
5802	n-Butanol	by D5599	0.00 Volume Percent	TS	6/5/2006

NVFEL Fuel Analysis Report

14569

Kansas City Samples

Batch#

Facility Name: ERG   Facility Type: In House

Owner: EPA   Phone: (913) 299-9480

6636 Berger Avenue

U.S.

Samples Type: Correlation

VOC

Inspection information logged in by MM on 5/25/2006.

Season: Winter

Kansas City Samples-QBI693(Mo)   **FTAG: 14569**   **Comments:**   **780; 3-5-05**

Fuel_ Code: 21

Test Code	Test Method	Results	Units	Analyst	Analysis Date
552	MTBE by D5599	0.00	Oxy Percent	TS	6/8/2006
562	ETBE by D5599	0.00	Oxy Percent	TS	6/8/2006
534	Ethanol by D5599	0.00	Oxy Percent	TS	6/8/2006
572	TAME by D5599	0.00	Oxy Percent	TS	6/8/2006
421	Sulfur in Gasoline D2622	136	Parts Per Million	NST	6/6/2006
421	Sulfur in Gasoline D2622	140	Parts Per Million	NST	6/6/2006
62	Vapor Pressure by D5191 (Modified)	12.02	PS I	MM	5/26/2006
65	Percent Evaporated at 200 Degrees F D86	51.7	Volume Percent	MM	6/2/2006
66	Percent Evaporated at 300 Degrees F D86	82.8	Volume Percent	MM	6/2/2006
48	Aromatics in Gasoline MSD D5769	24.06	Volume Percent	TW	6/8/2006
49	Olefins in by FIA D1319	9.3	Volume Percent	NST	7/25/2006
64	Benzene in Gasoline D3606	1.04	Volume Percent	TW	6/7/2006
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent	TS	6/8/2006
55	MTBE by D5599	0.00	Volume Percent	TS	6/8/2006
532	Ethanol by D5599	0.00	Volume Percent	TS	6/8/2006
59	Weight Percent Oxygen by D5599	0.00	Weight Percent	TS	6/8/2006
57	TAME by D5599	0.00	Volume Percent	TS	6/8/2006
56	ETBE by D5599	0.00	Volume Percent	TS	6/8/2006
46	Aromatics by FIA D1319	23.5	Volume Percent	NST	7/25/2006
630	Toluene in gasoline by MSD D5769	5.05	Volumn Percent	TW	6/8/2006
63	Benzene in Gasoline by GC/MSD D5769	1.04	Volume Percent	TW	6/8/2006
69	Specific Gravity @ 60 deg F D4052	0.73215	60/60F	MM	5/31/2006
69	Specific Gravity @ 60 deg F D4052	0.73219	60/60F	MM	5/31/2006
692	Degrees API D4052	61.77	Degrees API	MM	5/31/2006
692	Degrees API D4052	61.76	Degrees API	MM	5/31/2006
691	Density @ 60 deg F D4052	0.73142	g/cm-03 @ 60 deg F	MM	5/31/2006
691	Density @ 60 deg F D4052	0.73147	g/cm-03 @ 60 deg F	MM	5/31/2006
101	Initial Boiling Point D86	84.4	Degrees F	MM	6/2/2006
110	10 Percent D86	108.9	Degrees F	MM	6/2/2006
150	50 Percent D86	195.8	Degrees F	MM	6/2/2006
190	90 Percent D86	332.3	Degrees F	MM	6/2/2006
200	End Point D86	408	Degrees F	MM	6/2/2006
201	Residue D86	1.1	mL	MM	6/2/2006

NVFEL Fuel Analysis Report

202	Total Recovery	D86	97.6 mL	MM	6/2/2006
203	Loss	D86	1.3 mL	MM	6/2/2006
543	Methanol	by D5599	0.00 Volume Percent	TS	6/8/2006
584	Isopropanol	by D5599	0.00 Volume Percent	TS	6/8/2006
585	t-Butanol	by D5599	0.00 Volume Percent	TS	6/8/2006
586	n-Propanol	by D5599	0.00 Volume Percent	TS	6/8/2006
587	sec-Butanol	by D5599	0.00 Volume Percent	TS	6/8/2006
588	DIPE	by D5599	0.00 Volume Percent	TS	6/8/2006
589	Isobutanol	by D5599	0.00 Volume Percent	TS	6/8/2006
5801	t-Amyl Alcohol	by D5599	0.00 Volume Percent	TS	6/8/2006
5802	n-Butanol	by D5599	0.00 Volume Percent	TS	6/8/2006

NVFEL Fuel Analysis Report 14570

Kansas City Samples

Batch#

Facility Name: ERG Facility Type: In House

Owner: EPA Phone: (913) 299-9480

6636 Berger Avenue

U.S.

Samples Type: Correlation

VOC

Inspection information logged in by MM on 5/25/2006.

Season: Winter

Kansas City Samples-JO??2Z(Mo) **FTAG: 14570** **Comments:** **#383; 9-??-04; Label partially obliterated.**

Fuel_ Code: 21

Test Code	Test Method	Results	Units	Analyst	Analysis Date
552	MTBE by D5599	0.00	Oxy Percent	TS	6/8/2006
562	ETBE by D5599	0.00	Oxy Percent	TS	6/8/2006
534	Ethanol by D5599	0.00	Oxy Percent	TS	6/8/2006
572	TAME by D5599	0.00	Oxy Percent	TS	6/8/2006
421	Sulfur in Gasoline D2622	136	Parts Per Million	NST	6/8/2006
62	Vapor Pressure by D5191 (Modified)	6.54	PS I	MM	5/26/2006
65	Percent Evaporated at 200 Degrees F D86	36.5	Volume Percent	MM	6/2/2006
66	Percent Evaporated at 300 Degrees F D86	80.4	Volume Percent	MM	6/2/2006
48	Aromatics in Gasoline MSD D5769	34.82	Volume Percent	TW	6/8/2006
49	Olefins in by FIA D1319	8	Volume Percent	NST	7/25/2006
64	Benzene in Gasoline D3606	1.76	Volume Percent	TW	6/7/2006
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent	TS	6/8/2006
55	MTBE by D5599	0.00	Volume Percent	TS	6/8/2006
57	TAME by D5599	0.00	Volume Percent	TS	6/8/2006
532	Ethanol by D5599	0.00	Volume Percent	TS	6/8/2006
59	Weight Percent Oxygen by D5599	0.00	Weight Percent	TS	6/8/2006
56	ETBE by D5599	0.00	Volume Percent	TS	6/8/2006
46	Aromatics by FIA D1319	34.7	Volume Percent	NST	7/25/2006
63	Benzene in Gasoline by GC/MSD D5769	1.74	Volume Percent	TW	6/8/2006
630	Toluene in gasoline by MSD D5769	7.73	Volumn Percent	TW	6/8/2006
69	Specific Gravity @ 60 deg F D4052	0.75968	60/60F	MM	5/31/2006
69	Specific Gravity @ 60 deg F D4052	0.75968	60/60F	MM	5/31/2006
692	Degrees API D4052	54.76	Degrees API	MM	5/31/2006
692	Degrees API D4052	54.76	Degrees API	MM	5/31/2006
691	Density @ 60 deg F D4052	0.75893	g/cm-03 @ 60 deg F	MM	5/31/2006
691	Density @ 60 deg F D4052	0.75893	g/cm-03 @ 60 deg F	MM	5/31/2006
101	Initial Boiling Point D86	99.7	Degrees F	MM	6/2/2006
110	10 Percent D86	146.3	Degrees F	MM	6/2/2006
150	50 Percent D86	229.2	Degrees F	MM	6/2/2006
190	90 Percent D86	332.1	Degrees F	MM	6/2/2006
200	End Point D86	400.6	Degrees F	MM	6/2/2006
201	Residue D86	1.1	mL	MM	6/2/2006
202	Total Recovery D86	98.1	mL	MM	6/2/2006

203	Loss	D86	0.8 mL	MM	6/2/2006
543	Methanol	by D5599	0.00 Volume Percent	TS	6/8/2006
584	Isopropanol	by D5599	0.00 Volume Percent	TS	6/8/2006
585	t-Butanol	by D5599	0.00 Volume Percent	TS	6/8/2006
586	n-Propanol	by D5599	0.00 Volume Percent	TS	6/8/2006
587	sec-Butanol	by D5599	0.00 Volume Percent	TS	6/8/2006
588	DIPE	by D5599	0.00 Volume Percent	TS	6/8/2006
589	Isobutanol	by D5599	0.00 Volume Percent	TS	6/8/2006
5801	t-Amyl Alcohol	by D5599	0.00 Volume Percent	TS	6/8/2006
5802	n-Butanol	by D5599	0.00 Volume Percent	TS	6/8/2006

NVFEL Fuel Analysis Report

14571

Batch#

Kansas City Samples

Facility Name: ERG Facility Type: In House

Owner: EPA Phone: (913) 299-9480

6636 Berger Avenue

U.S.

Samples Type: Correlation

VOC

Inspection information logged in by MM on 5/25/2006.

Season: Winter

Kansas City Samples-TBL970(Ks) **FTAG: 14571** **Comments:** **792; 3-8-05**

Test Code	Test Method	Results	Units	Fuel_ Code: 21	Analyst	Analysis Date
552	MTBE by D5599	0.00	Oxy Percent		TS	6/8/2006
562	ETBE by D5599	0.00	Oxy Percent		TS	6/8/2006
534	Ethanol by D5599	0.00	Oxy Percent		TS	6/8/2006
572	TAME by D5599	0.00	Oxy Percent		TS	6/8/2006
421	Sulfur in Gasoline D2622	174	Parts Per Million		NST	6/8/2006
62	Vapor Pressure by D5191 (Modified)	11.59	PS I		MM	5/26/2006
65	Percent Evaporated at 200 Degrees F D86	50.5	Volume Percent		MM	6/2/2006
65	Percent Evaporated at 200 Degrees F D86	50.5	Volume Percent		MM	6/2/2006
66	Percent Evaporated at 300 Degrees F D86	83.3	Volume Percent		MM	6/2/2006
66	Percent Evaporated at 300 Degrees F D86	83.4	Volume Percent		MM	6/2/2006
48	Aromatics in Gasoline MSD D5769	24.23	Volume Percent		TW	6/8/2006
49	Olefins in by FIA D1319	9.5	Volume Percent		NST	7/25/2006
64	Benzene in Gasoline D3606	0.97	Volume Percent		TW	6/7/2006
64	Benzene in Gasoline D3606	0.97	Volume Percent		TW	6/7/2006
532	Ethanol by D5599	0.00	Volume Percent		TS	6/8/2006
57	TAME by D5599	0.00	Volume Percent		TS	6/8/2006
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent		TS	6/8/2006
55	MTBE by D5599	0.00	Volume Percent		TS	6/8/2006
59	Weight Percent Oxygen by D5599	0.00	Weight Percent		TS	6/8/2006
56	ETBE by D5599	0.00	Volume Percent		TS	6/8/2006
46	Aromatics by FIA D1319	22.6	Volume Percent		NST	7/25/2006
630	Toluene in gasoline by MSD D5769	5.38	Volumn Percent		TW	6/8/2006
63	Benzene in Gasoline by GC/MSD D5769	0.97	Volume Percent		TW	6/8/2006
69	Specific Gravity @ 60 deg F D4052	0.73273	60/60F		MM	5/31/2006
69	Specific Gravity @ 60 deg F D4052	0.73268	60/60F		MM	5/31/2006
692	Degrees API D4052	61.63	Degrees API		MM	5/31/2006
692	Degrees API D4052	61.61	Degrees API		MM	5/31/2006
691	Density @ 60 deg F D4052	0.73201	g/cm-03 @ 60 deg F		MM	5/31/2006
691	Density @ 60 deg F D4052	0.73196	g/cm-03 @ 60 deg F		MM	5/31/2006
101	Initial Boiling Point D86	86.6	Degrees F		MM	6/2/2006
101	Initial Boiling Point D86	84.8	Degrees F		MM	6/2/2006
110	10 Percent D86	110.8	Degrees F		MM	6/2/2006
110	10 Percent D86	111.1	Degrees F		MM	6/2/2006

NVFEL Fuel Analysis Report 14571

150	50 Percent	D86	199 Degrees F	MM	6/2/2006
150	50 Percent	D86	198.7 Degrees F	MM	6/2/2006
190	90 Percent	D86	328.7 Degrees F	MM	6/2/2006
190	90 Percent	D86	328.9 Degrees F	MM	6/2/2006
200	End Point	D86	411.7 Degrees F	MM	6/2/2006
200	End Point	D86	414.3 Degrees F	MM	6/2/2006
201	Residue	D86	0.9 mL	MM	6/2/2006
201	Residue	D86	1 mL	MM	6/2/2006
202	Total Recovery	D86	97.8 mL	MM	6/2/2006
202	Total Recovery	D86	97.6 mL	MM	6/2/2006
203	Loss	D86	1.2 mL	MM	6/2/2006
203	Loss	D86	1.5 mL	MM	6/2/2006
543	Methanol	by D5599	0.00 Volume Percent	TS	6/8/2006
584	Isopropanol	by D5599	0.00 Volume Percent	TS	6/8/2006
585	t-Butanol	by D5599	0.00 Volume Percent	TS	6/8/2006
586	n-Propanol	by D5599	0.00 Volume Percent	TS	6/8/2006
587	sec-Butanol	by D5599	0.00 Volume Percent	TS	6/8/2006
588	DIPE	by D5599	0.00 Volume Percent	TS	6/8/2006
589	Isobutanol	by D5599	0.00 Volume Percent	TS	6/8/2006
5801	t-Amyl Alcohol	by D5599	0.00 Volume Percent	TS	6/8/2006
5802	n-Butanol	by D5599	0.00 Volume Percent	TS	6/8/2006

NVFEL Fuel Analysis Report

14572

Kansas City Samples

Batch#

Facility Name: ERG Facility Type: In House

Owner: EPA Phone: (913) 299-9480

6636 Berger Avenue

U.S.

Samples Type: Correlation

VOC

Inspection information logged in by MM on 5/25/2006.

Season: Winter

Kansas City Samples-SIY808(Ks) **FTAG: 14572** **Comments:** **868; 3-21-05**

Test Code	Test Method	Results	Units	Fuel_ Code: 21	Analyst	Analysis Date
552	MTBE by D5599	0.00	Oxy Percent		TS	6/8/2006
562	ETBE by D5599	0.00	Oxy Percent		TS	6/8/2006
534	Ethanol by D5599	0.00	Oxy Percent		TS	6/8/2006
572	TAME by D5599	0.00	Oxy Percent		TS	6/8/2006
421	Sulfur in Gasoline D2622	145	Parts Per Million		NST	6/8/2006
62	Vapor Pressure by D5191 (Modified)	11.6	PS I		MM	5/26/2006
65	Percent Evaporated at 200 Degrees F D86	49	Volume Percent		MM	6/6/2006
66	Percent Evaporated at 300 Degrees F D86	82.5	Volume Percent		MM	6/6/2006
48	Aromatics in Gasoline MSD D5769	24.46	Volume Percent		TW	6/8/2006
49	Olefins in by FIA D1319	10.1	Volume Percent		NST	7/25/2006
64	Benzene in Gasoline D3606	1.07	Volume Percent		TW	6/7/2006
59	Weight Percent Oxygen by D5599	0.08	Weight Percent		TS	6/8/2006
57	TAME by D5599	0.00	Volume Percent		TS	6/8/2006
593	Volume Percent Oxygenates by D5599	0.14	Volume Percent		TS	6/8/2006
55	MTBE by D5599	0.00	Volume Percent		TS	6/8/2006
532	Ethanol by D5599	0.00	Volume Percent		TS	6/8/2006
56	ETBE by D5599	0.00	Volume Percent		TS	6/8/2006
46	Aromatics by FIA D1319	22.7	Volume Percent		NST	7/25/2006
63	Benzene in Gasoline by GC/MSD D5769	1.06	Volume Percent		TW	6/8/2006
630	Toluene in gasoline by MSD D5769	5.21	Volumn Percent		TW	6/8/2006
69	Specific Gravity @ 60 deg F D4052	0.73535	60/60F		MM	5/31/2006
69	Specific Gravity @ 60 deg F D4052	0.73533	60/60F		MM	5/31/2006
692	Degrees API D4052	60.93	Degrees API		MM	5/31/2006
692	Degrees API D4052	60.93	Degrees API		MM	5/31/2006
691	Density @ 60 deg F D4052	0.73462	g/cm-03 @ 60 deg F		MM	5/31/2006
691	Density @ 60 deg F D4052	0.7346	g/cm-03 @ 60 deg F		MM	5/31/2006
101	Initial Boiling Point D86	84.3	Degrees F		MM	6/6/2006
110	10 Percent D86	112.8	Degrees F		MM	6/6/2006
150	50 Percent D86	202.3	Degrees F		MM	6/6/2006
190	90 Percent D86	332.1	Degrees F		MM	6/6/2006
200	End Point D86	409.9	Degrees F		MM	6/6/2006
201	Residue D86	1.1	mL		MM	6/6/2006
202	Total Recovery D86	97.7	mL		MM	6/6/2006

203	Loss	D86	1.2 mL	MM	6/6/2006
543	Methanol	by D5599	0.14 Volume Percent	TS	6/8/2006
533	Ethanol by D4815		8.965607 Volume Percent	TS	
584	Isopropanol	by D5599	0.00 Volume Percent	TS	6/8/2006
585	t-Butanol	by D5599	0.00 Volume Percent	TS	6/8/2006
586	n-Propanol	by D5599	0.00 Volume Percent	TS	6/8/2006
587	sec-Butanol	by D5599	0.00 Volume Percent	TS	6/8/2006
588	DIPE	by D5599	0.00 Volume Percent	TS	6/8/2006
589	Isobutanol	by D5599	0.00 Volume Percent	TS	6/8/2006
5801	t-Amyl Alcohol	by D5599	0.00 Volume Percent	TS	6/8/2006
5802	n-Butanol	by D5599	0.00 Volume Percent	TS	6/8/2006

NVFEL Fuel Analysis Report

14573

Kansas City Samples

Batch#

Facility Name: ERG Facility Type: In House

Owner: EPA Phone: (913) 299-9480

6636 Berger Avenue

U.S.

Samples Type: Correlation

VOC

Inspection information logged in by MM on 5/25/06.

Season: Winter

Kansas City Samples-QGU468(Ks) **FTAG: 14573** **Comments:** **779; 3-4-05; Label shows evidence of solvent exposure.**

Test Code	Test Method	Results	Units	Fuel_ Code: 21	Analys	Analysis Date
552	MTBE by D5599	0.00	Oxy Percent		TS	6/8/06
562	ETBE by D5599	0.00	Oxy Percent		TS	6/8/06
534	Ethanol by D5599	0.00	Oxy Percent		TS	6/8/06
572	TAME by D5599	0.00	Oxy Percent		TS	6/8/06
421	Sulfur in Gasoline D2622	154	Parts Per Million		NST	6/8/06
62	Vapor Pressure by D5191 (Modified)	6.66	PS I		MM	5/26/06
65	Percent Evaporated at 200 Degrees F D86	39.6	Volume Percent		MM	6/6/06
66	Percent Evaporated at 300 Degrees F D86	81.1	Volume Percent		MM	6/6/06
48	Aromatics in Gasoline MSD D5769	27.68	Volume Percent		TW	6/9/06
49	Olefins in by FIA D1319	9.1	Volume Percent		NST	7/27/06
64	Benzene in Gasoline D3606	1.26	Volume Percent		TW	6/7/06
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent		TS	6/8/06
55	MTBE by D5599	0.00	Volume Percent		TS	6/8/06
57	TAME by D5599	0.00	Volume Percent		TS	6/8/06
532	Ethanol by D5599	0.00	Volume Percent		TS	6/8/06
59	Weight Percent Oxygen by D5599	0.00	Weight Percent		TS	6/8/06
56	ETBE by D5599	0.00	Volume Percent		TS	6/8/06
46	Aromatics by FIA D1319	27.1	Volume Percent		NST	7/27/06
63	Benzene in Gasoline by GC/MSD D5769	1.27	Volume Percent		TW	6/9/06
630	Toluene in gasoline by MSD D5769	6.37	Volumn Percent		TW	6/9/06
69	Specific Gravity @ 60 deg F D4052	0.75118	60/60F		MM	5/31/06
69	Specific Gravity @ 60 deg F D4052	0.75112	60/60F		MM	5/31/06
692	Degrees API D4052	56.88	Degrees API		MM	5/31/06
692	Degrees API D4052	56.87	Degrees API		MM	5/31/06
691	Density @ 60 deg F D4052	0.75038	g/cm-03 @ 60 deg F		MM	5/31/06
691	Density @ 60 deg F D4052	0.75044	g/cm-03 @ 60 deg F		MM	5/31/06
101	Initial Boiling Point D86	98.9	Degrees F		MM	6/6/06
110	10 Percent D86	145.5	Degrees F		MM	6/6/06
150	50 Percent D86	219.1	Degrees F		MM	6/6/06
190	90 Percent D86	340.1	Degrees F		MM	6/6/06
200	End Point D86	425.2	Degrees F		MM	6/6/06
201	Residue D86	0.9	mL		MM	6/6/06
202	Total Recovery D86	98.3	mL		MM	6/6/06

203	Loss	D86	0.8 mL		MM	6/6/06
543	Methanol	by D5599	0.00	Volume Percent	TS	6/8/06
584	Isopropanol	by D5599	0.00	Volume Percent	TS	6/8/06
585	t-Butanol	by D5599	0.00	Volume Percent	TS	6/8/06
586	n-Propanol	by D5599	0.00	Volume Percent	TS	6/8/06
587	sec-Butanol	by D5599	0.00	Volume Percent	TS	6/8/06
588	DIPE	by D5599	0.00	Volume Percent	TS	6/8/06
589	Isobutanol	by D5599	0.00	Volume Percent	TS	6/8/06
5801	t-Amyl Alcohol	by D5599	0.00	Volume Percent	TS	6/8/06
5802	n-Butanol	by D5599	0.00	Volume Percent	TS	6/8/06

NVFEL Fuel Analysis Report

14574

Batch#

Kansas City Samples

Facility Name: ERG Facility Type: In House

Owner: EPA Phone: (913) 299-9480

6636 Berger Avenue

U.S.

Samples Type: Correlation

VOC

Inspection information logged in by MM on 5/25/06.

Season: Winter

Kansas City Samples- OGU467(Ks) **FTAG: 14574** **Comments:** **778; 3-4-05**

Fuel_ Code: 21

Test Code	Test Method	Results	Units	Analys	Analysis Date
552	MTBE by D5599	0.00	Oxy Percent	TS	6/8/06
562	ETBE by D5599	0.00	Oxy Percent	TS	6/8/06
534	Ethanol by D5599	0.02	Oxy Percent	TS	6/8/06
572	TAME by D5599	0.00	Oxy Percent	TS	6/8/06
421	Sulfur in Gasoline D2622	106	Parts Per Million	NST	6/8/06
62	Vapor Pressure by D5191 (Modified)	9.99	PS I	MM	5/26/06
65	Percent Evaporated at 200 Degrees F D86	48.9	Volume Percent	MM	6/6/06
66	Percent Evaporated at 300 Degrees F D86	83.9	Volume Percent	MM	6/6/06
48	Aromatics in Gasoline MSD D5769	24.73	Volume Percent	TW	6/9/06
48	Aromatics in Gasoline MSD D5769	24.75	Volume Percent	TW	6/9/06
49	Olefins in by FIA D1319	7.3	Volume Percent	NST	7/27/06
64	Benzene in Gasoline D3606	1.00	Volume Percent	TW	6/7/06
593	Volume Percent Oxygenates by D5599	0.05	Volume Percent	TS	6/8/06
55	MTBE by D5599	0.00	Volume Percent	TS	6/8/06
59	Weight Percent Oxygen by D5599	0.02	Weight Percent	TS	6/8/06
532	Ethanol by D5599	0.05	Volume Percent	TS	6/8/06
57	TAME by D5599	0.00	Volume Percent	TS	6/8/06
56	ETBE by D5599	0.00	Volume Percent	TS	6/8/06
630	Toluene in gasoline by MSD D5769	5.74	Volumn Percent	TW	6/9/06
63	Benzene in Gasoline by GC/MSD D5769	1.01	Volume Percent	TW	6/9/06
46	Aromatics by FIA D1319	23	Volume Percent	NST	7/27/06
63	Benzene in Gasoline by GC/MSD D5769	1.01	Volume Percent	TW	6/9/06
630	Toluene in gasoline by MSD D5769	5.73	Volumn Percent	TW	6/9/06
69	Specific Gravity @ 60 deg F D4052	0.73578	60/60F	MM	5/31/06
69	Specific Gravity @ 60 deg F D4052	0.7358	60/60F	MM	5/31/06
692	Degrees API D4052	60.81	Degrees API	MM	5/31/06
692	Degrees API D4052	60.81	Degrees API	MM	5/31/06
691	Density @ 60 deg F D4052	0.73507	g/cm-03 @ 60 deg F	MM	5/31/06
691	Density @ 60 deg F D4052	0.73505	g/cm-03 @ 60 deg F	MM	5/31/06
101	Initial Boiling Point D86	87.7	Degrees F	MM	6/6/06
110	10 Percent D86	120.1	Degrees F	MM	6/6/06
150	50 Percent D86	202.7	Degrees F	MM	6/6/06
190	90 Percent D86	325.9	Degrees F	MM	6/6/06

200	End Point	D86	423.2	Degrees F	MM	6/6/06
201	Residue	D86	1	mL	MM	6/6/06
202	Total Recovery	D86	98.1	mL	MM	6/6/06
203	Loss	D86	0.9	mL	MM	6/6/06
543	Methanol	by D5599	0.00	Volume Percent	TS	6/8/06
584	Isopropanol	by D5599	0.00	Volume Percent	TS	6/8/06
585	t-Butanol	by D5599	0.00	Volume Percent	TS	6/8/06
586	n-Propanol	by D5599	0.00	Volume Percent	TS	6/8/06
587	sec-Butanol	by D5599	0.00	Volume Percent	TS	6/8/06
588	DIPE	by D5599	0.00	Volume Percent	TS	6/8/06
589	Isobutanol	by D5599	0.00	Volume Percent	TS	6/8/06
5801	t-Amyl Alcohol	by D5599	0.00	Volume Percent	TS	6/8/06
5802	n-Butanol	by D5599	0.00	Volume Percent	TS	6/8/06

Batch#

Kansas City Samples

Facility Name: ERG Facility Type: In House
Owner: EPA Phone: (913) 299-9480
6636 Berger Avenue

U.S.

Samples Type: Correlation
Inspection information logged in by MM on 6/7/06.

VOC
Season: Winter

Kansas City Samples-24F1 FTAG: 14593 Comments: 935; 4-6-05

Fuel_ Code: 21

Test Code	Test Method	Results	Units	Analys	Analysis Date
552	MTBE by D5599	0.00	Oxy Percent	TS	6/16/06
562	ETBE by D5599	0.00	Oxy Percent	TS	6/16/06
534	Ethanol by D5599	0.00	Oxy Percent	TS	6/16/06
572	TAME by D5599	0.00	Oxy Percent	TS	6/16/06
421	Sulfur in Gasoline D2622	174	Parts Per Million	NST	6/20/06
62	Vapor Pressure by D5191 (Modified)	8.82	PS I	MM	6/8/06
65	Percent Evaporated at 200 Degrees F D86	44.4	Volume Percent	MM	6/9/06
66	Percent Evaporated at 300 Degrees F D86	80.6	Volume Percent	MM	6/9/06
48	Aromatics in Gasoline MSD D5769	26.3	Volume Percent	TW	6/14/06
48	Aromatics in Gasoline MSD D5769	26.46	Volume Percent	TW	6/13/06
49	Olefins in by FIA D1319	11.4	Volume Percent	RCG	8/9/06
64	Benzene in Gasoline D3606	1.10	Volume Percent	TW	6/14/06
55	MTBE by D5599	0.00	Volume Percent	TS	6/16/06
532	Ethanol by D5599	0.00	Volume Percent	TS	6/16/06
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent	TS	6/16/06
59	Weight Percent Oxygen by D5599	0.00	Weight Percent	TS	6/16/06
57	TAME by D5599	0.00	Volume Percent	TS	6/16/06
56	ETBE by D5599	0.00	Volume Percent	TS	6/16/06
630	Toluene in gasoline by MSD D5769	5.61	Volumn Percent	TW	6/13/06
46	Aromatics by FIA D1319	24.7	Volume Percent	RCG	8/9/06
63	Benzene in Gasoline by GC/MSD D5769	1.11	Volume Percent	TW	6/14/06
630	Toluene in gasoline by MSD D5769	5.58	Volumn Percent	TW	6/14/06
63	Benzene in Gasoline by GC/MSD D5769	1.11	Volume Percent	TW	6/13/06
69	Specific Gravity @ 60 deg F D4052	0.7438	60/60F	MM	6/8/06
69	Specific Gravity @ 60 deg F D4052	0.74383	60/60F	MM	6/8/06
692	Degrees API D4052	58.73	Degrees API	MM	6/8/06
692	Degrees API D4052	58.74	Degrees API	MM	6/8/06
691	Density @ 60 deg F D4052	0.74309	g/cm-03 @ 60 deg F	MM	6/8/06
691	Density @ 60 deg F D4052	0.74306	g/cm-03 @ 60 deg F	MM	6/8/06
101	Initial Boiling Point D86	90.4	Degrees F	MM	6/9/06
110	10 Percent D86	127.4	Degrees F	MM	6/9/06
150	50 Percent D86	213.1	Degrees F	MM	6/9/06
190	90 Percent D86	337.6	Degrees F	MM	6/9/06

200	End Point	D86	418.8 Degrees F	MM	6/9/06
201	Residue	D86	1 mL	MM	6/9/06
202	Total Recovery	D86	98 mL	MM	6/9/06
203	Loss	D86	1 mL	MM	6/9/06
543	Methanol	by D5599	0.00 Volume Percent	TS	6/16/06
584	Isopropanol	by D5599	0.00 Volume Percent	TS	6/16/06
585	t-Butanol	by D5599	0.00 Volume Percent	TS	6/16/06
586	n-Propanol	by D5599	0.00 Volume Percent	TS	6/16/06
587	sec-Butanol	by D5599	0.00 Volume Percent	TS	6/16/06
588	DIPE	by D5599	0.00 Volume Percent	TS	6/16/06
589	Isobutanol	by D5599	0.00 Volume Percent	TS	6/16/06
5801	t-Amyl Alcohol	by D5599	0.00 Volume Percent	TS	6/16/06
5802	n-Butanol	by D5599	0.00 Volume Percent	TS	6/16/06

NVFEL Fuel Analysis Report

14591 Batch#

Kansas City Samples

Facility Name: ERG Facility Type: In House
Owner: EPA Phone: (913) 299-9480
6636 Berger Avenue

U.S.

Samples Type: Correlation
Inspection information logged in by MM on 6/7/06.

VOC
Season: Winter

Kansas City Samples-42453(Ks) **FTAG: 14591** **Comments:** **700; 2-16-05**

Test Code	Test Method	Results	Units	Fuel_ Code: 21	Analys	Analysis Date
552	MTBE by D5599	0.00	Oxy Percent		TS	6/12/06
552	MTBE by D5599	0.00	Oxy Percent		TS	6/12/06
562	ETBE by D5599	0.00	Oxy Percent		TS	6/12/06
562	ETBE by D5599	0.00	Oxy Percent		TS	6/12/06
534	Ethanol by D5599	0.00	Oxy Percent		TS	6/12/06
534	Ethanol by D5599	0.00	Oxy Percent		TS	6/12/06
572	TAME by D5599	0.00	Oxy Percent		TS	6/12/06
572	TAME by D5599	0.00	Oxy Percent		TS	6/12/06
421	Sulfur in Gasoline D2622	346	Parts Per Million		NST	6/15/06
62	Vapor Pressure by D5191 (Modified)	13.3	PS I		MM	6/8/06
65	Percent Evaporated at 200 Degrees F D86	50.8	Volume Percent		MM	6/9/06
65	Percent Evaporated at 200 Degrees F D86	51	Volume Percent		MM	6/9/06
66	Percent Evaporated at 300 Degrees F D86	85	Volume Percent		MM	6/9/06
66	Percent Evaporated at 300 Degrees F D86	85.5	Volume Percent		MM	6/9/06
48	Aromatics in Gasoline MSD D5769	21.81	Volume Percent		TW	6/13/06
49	Olefins in by FIA D1319	10.9	Volume Percent		RCG	8/9/06
64	Benzene in Gasoline D3606	1.18	Volume Percent		TW	6/14/06
64	Benzene in Gasoline D3606	1.18	Volume Percent		TW	6/14/06
55	MTBE by D5599	0.00	Volume Percent		TS	6/12/06
55	MTBE by D5599	0.00	Volume Percent		TS	6/12/06
532	Ethanol by D5599	0.00	Volume Percent		TS	6/12/06
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent		TS	6/12/06
532	Ethanol by D5599	0.00	Volume Percent		TS	6/12/06
57	TAME by D5599	0.00	Volume Percent		TS	6/12/06
57	TAME by D5599	0.00	Volume Percent		TS	6/12/06
59	Weight Percent Oxygen by D5599	0.00	Weight Percent		TS	6/12/06
59	Weight Percent Oxygen by D5599	0.00	Weight Percent		TS	6/12/06
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent		TS	6/12/06
56	ETBE by D5599	0.00	Volume Percent		TS	6/12/06
56	ETBE by D5599	0.00	Volume Percent		TS	6/12/06
46	Aromatics by FIA D1319	20.1	Volume Percent		RCG	8/9/06
63	Benzene in Gasoline by GC/MSD D5769	1.19	Volume Percent		TW	6/13/06
630	Toluene in gasoline by MSD D5769	5.13	Volumn Percent		TW	6/13/06

69	Specific Gravity @ 60 deg F	D4052	0.72472	60/60F	MM	6/8/06
69	Specific Gravity @ 60 deg F	D4052	0.72472	60/60F	MM	6/8/06
692	Degrees API	D4052	63.75	Degrees API	MM	6/8/06
692	Degrees API	D4052	63.75	Degrees API	MM	6/8/06
691	Density @ 60 deg F	D4052	0.724	g/cm-03 @ 60 deg F	MM	6/8/06
691	Density @ 60 deg F	D4052	0.724	g/cm-03 @ 60 deg F	MM	6/8/06
101	Initial Boiling Point	D86	78.6	Degrees F	MM	6/9/06
101	Initial Boiling Point	D86	80.9	Degrees F	MM	6/9/06
110	10 Percent	D86	102.8	Degrees F	MM	6/9/06
110	10 Percent	D86	103.5	Degrees F	MM	6/9/06
150	50 Percent	D86	198	Degrees F	MM	6/9/06
150	50 Percent	D86	197.5	Degrees F	MM	6/9/06
190	90 Percent	D86	320.2	Degrees F	MM	6/9/06
190	90 Percent	D86	319.6	Degrees F	MM	6/9/06
200	End Point	D86	398.4	Degrees F	MM	6/9/06
200	End Point	D86	397.3	Degrees F	MM	6/9/06
201	Residue	D86	0.9	mL	MM	6/9/06
201	Residue	D86	1	mL	MM	6/9/06
202	Total Recovery	D86	97.6	mL	MM	6/9/06
202	Total Recovery	D86	97.4	mL	MM	6/9/06
203	Loss	D86	1.5	mL	MM	6/9/06
203	Loss	D86	1.6	mL	MM	6/9/06
543	Methanol	by D5599	0.00	Volume Percent	TS	6/12/06
543	Methanol	by D5599	0.00	Volume Percent	TS	6/12/06
584	Isopropanol	by D5599	0.00	Volume Percent	TS	6/12/06
584	Isopropanol	by D5599	0.00	Volume Percent	TS	6/12/06
585	t-Butanol	by D5599	0.00	Volume Percent	TS	6/12/06
585	t-Butanol	by D5599	0.00	Volume Percent	TS	6/12/06
586	n-Propanol	by D5599	0.00	Volume Percent	TS	6/12/06
586	n-Propanol	by D5599	0.00	Volume Percent	TS	6/12/06
587	sec-Butanol	by D5599	0.00	Volume Percent	TS	6/12/06
587	sec-Butanol	by D5599	0.00	Volume Percent	TS	6/12/06
588	DIPE	by D5599	0.00	Volume Percent	TS	6/12/06
588	DIPE	by D5599	0.00	Volume Percent	TS	6/12/06
589	Isobutanol	by D5599	0.00	Volume Percent	TS	6/12/06
589	Isobutanol	by D5599	0.00	Volume Percent	TS	6/12/06
5801	t-Amyl Alcohol	by D5599	0.00	Volume Percent	TS	6/12/06
5801	t-Amyl Alcohol	by D5599	0.00	Volume Percent	TS	6/12/06
5802	n-Butanol	by D5599	0.00	Volume Percent	TS	6/12/06
5802	n-Butanol	by D5599	0.00	Volume Percent	TS	6/12/06

NVFEL Fuel Analysis Report

14590

Kansas City Samples

Batch#

Facility Name: ERG Facility Type: In House
Owner: EPA Phone: (913) 299-9480
6636 Berger Avenue

U.S.

Samples Type: Correlation

VOC

Inspection information logged in by MM on 6/7/06.

Season: Winter

Kansas City Samples-QMY157(Ks) **FTAG: 14590** **Comments:** **667B; 2-9-05**

Fuel_ Code: 21

Test Code	Test Method	Results	Units	Analys	Analysis Date
552	MTBE by D5599	0.00	Oxy Percent	TS	6/12/06
562	ETBE by D5599	0.00	Oxy Percent	TS	6/12/06
534	Ethanol by D5599	0.00	Oxy Percent	TS	6/12/06
572	TAME by D5599	0.00	Oxy Percent	TS	6/12/06
421	Sulfur in Gasoline D2622	235	Parts Per Million	NST	6/15/06
62	Vapor Pressure by D5191 (Modified)	14	PS I	MM	6/8/06
65	Percent Evaporated at 200 Degrees F D86	51.1	Volume Percent	MM	6/8/06
66	Percent Evaporated at 300 Degrees F D86	85	Volume Percent	MM	6/8/06
48	Aromatics in Gasoline MSD D5769	22.88	Volume Percent	TW	6/13/06
49	Olefins in by FIA D1319	10.6	Volume Percent	RCG	8/9/06
64	Benzene in Gasoline D3606	1.18	Volume Percent	TW	6/14/06
532	Ethanol by D5599	0.00	Volume Percent	TS	6/12/06
55	MTBE by D5599	0.00	Volume Percent	TS	6/12/06
57	TAME by D5599	0.00	Volume Percent	TS	6/12/06
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent	TS	6/12/06
59	Weight Percent Oxygen by D5599	0.00	Weight Percent	TS	6/12/06
56	ETBE by D5599	0.00	Volume Percent	TS	6/12/06
630	Toluene in gasoline by MSD D5769	5.34	Volumn Percent	TW	6/13/06
63	Benzene in Gasoline by GC/MSD D5769	1.18	Volume Percent	TW	6/13/06
46	Aromatics by FIA D1319	21.2	Volume Percent	RCG	8/9/06
69	Specific Gravity @ 60 deg F D4052	0.72558	60/60F	MM	6/8/06
69	Specific Gravity @ 60 deg F D4052	0.72557	60/60F	MM	6/8/06
692	Degrees API D4052	63.52	Degrees API	MM	6/8/06
692	Degrees API D4052	63.52	Degrees API	MM	6/8/06
691	Density @ 60 deg F D4052	0.72486	g/cm-03 @ 60 deg F	MM	6/8/06
691	Density @ 60 deg F D4052	0.72485	g/cm-03 @ 60 deg F	MM	6/8/06
101	Initial Boiling Point D86	80.7	Degrees F	MM	6/8/06
110	10 Percent D86	100.4	Degrees F	MM	6/8/06
150	50 Percent D86	197.2	Degrees F	MM	6/8/06
190	90 Percent D86	322.8	Degrees F	MM	6/8/06
200	End Point D86	404.2	Degrees F	MM	6/8/06
201	Residue D86	1	mL	MM	6/8/06
202	Total Recovery D86	97.2	mL	MM	6/8/06

203	Loss	D86	1.8 mL	MM	6/8/06
543	Methanol	by D5599	0.00 Volume Percent	TS	6/12/06
584	Isopropanol	by D5599	0.00 Volume Percent	TS	6/12/06
585	t-Butanol	by D5599	0.00 Volume Percent	TS	6/12/06
586	n-Propanol	by D5599	0.00 Volume Percent	TS	6/12/06
587	sec-Butanol	by D5599	0.00 Volume Percent	TS	6/12/06
588	DIPE	by D5599	0.00 Volume Percent	TS	6/12/06
589	Isobutanol	by D5599	0.00 Volume Percent	TS	6/12/06
5801	t-Amyl Alcohol	by D5599	0.00 Volume Percent	TS	6/12/06
5802	n-Butanol	by D5599	0.00 Volume Percent	TS	6/12/06

NVFEL Fuel Analysis Report

Batch# 14588

Kansas City Samples

Facility Name: ERG Facility Type: In House
Owner: EPA Phone: (913) 299-9480
6636 Berger Avenue

U.S.

Samples Type: Correlation VOC
Inspection information logged in by MM on 6/7/06. **Season:** Winter

Kansas City Samples-VUE539(Ks) **FTAG: 14588** **Comments:** **655; 2-7-05**

Test Code	Test Method	Results	Units	Fuel_ Code: 21	Analys	Analysis Date
552	MTBE by D5599	0.00	Oxy Percent		TS	6/12/06
562	ETBE by D5599	0.00	Oxy Percent		TS	6/12/06
534	Ethanol by D5599	3.35	Oxy Percent		TS	6/12/06
572	TAME by D5599	0.00	Oxy Percent		TS	6/12/06
421	Sulfur in Gasoline D2622	186	Parts Per Million		NST	6/15/06
62	Vapor Pressure by D5191 (Modified)	14.21	PS I		MM	6/8/06
65	Percent Evaporated at 200 Degrees F D86	57.6	Volume Percent		MM	6/8/06
66	Percent Evaporated at 300 Degrees F D86	85.9	Volume Percent		MM	6/8/06
48	Aromatics in Gasoline MSD D5769	20.65	Volume Percent		TW	6/13/06
49	Olefins in by FIA D1319	8.9	Volume Percent		RCG	8/9/06
64	Benzene in Gasoline D3606	1.06	Volume Percent		TW	6/14/06
532	Ethanol by D5599	8.90	Volume Percent		TS	6/12/06
55	MTBE by D5599	0.00	Volume Percent		TS	6/12/06
57	TAME by D5599	0.00	Volume Percent		TS	6/12/06
593	Volume Percent Oxygenates by D5599	8.90	Volume Percent		TS	6/12/06
59	Weight Percent Oxygen by D5599	3.35	Weight Percent		TS	6/12/06
56	ETBE by D5599	0.00	Volume Percent		TS	6/12/06
630	Toluene in gasoline by MSD D5769	4.91	Volumn Percent		TW	6/13/06
63	Benzene in Gasoline by GC/MSD D5769	1.08	Volume Percent		TW	6/13/06
46	Aromatics by FIA D1319	19.9	Volume Percent		RCG	8/9/06
69	Specific Gravity @ 60 deg F D4052	0.73207	60/60F		MM	6/8/06
69	Specific Gravity @ 60 deg F D4052	0.73207	60/60F		MM	6/8/06
692	Degrees API D4052	61.79	Degrees API		MM	6/8/06
692	Degrees API D4052	61.79	Degrees API		MM	6/8/06
691	Density @ 60 deg F D4052	0.73135	g/cm-03 @ 60 deg F		MM	6/8/06
691	Density @ 60 deg F D4052	0.73135	g/cm-03 @ 60 deg F		MM	6/8/06
101	Initial Boiling Point D86	83.8	Degrees F		MM	6/8/06
110	10 Percent D86	104.1	Degrees F		MM	6/8/06
150	50 Percent D86	157.8	Degrees F		MM	6/8/06
190	90 Percent D86	320.5	Degrees F		MM	6/8/06
200	End Point D86	401.5	Degrees F		MM	6/8/06
201	Residue D86	0.9	mL		MM	6/8/06
202	Total Recovery D86	97.5	mL		MM	6/8/06

203	Loss	D86	1.6 mL	MM	6/8/06
543	Methanol	by D5599	0.00 Volume Percent	TS	6/12/06
584	Isopropanol	by D5599	0.00 Volume Percent	TS	6/12/06
585	t-Butanol	by D5599	0.00 Volume Percent	TS	6/12/06
586	n-Propanol	by D5599	0.00 Volume Percent	TS	6/12/06
587	sec-Butanol	by D5599	0.00 Volume Percent	TS	6/12/06
588	DIPE	by D5599	0.00 Volume Percent	TS	6/12/06
589	Isobutanol	by D5599	0.00 Volume Percent	TS	6/12/06
5801	t-Amyl Alcohol	by D5599	0.00 Volume Percent	TS	6/12/06
5802	n-Butanol	by D5599	0.00 Volume Percent	TS	6/12/06

NVFEL Fuel Analysis Report

14589

Batch#

Kansas City Samples

Facility Name: ERG Facility Type: In House
Owner: EPA Phone: (913) 299-9480
6636 Berger Avenue

U.S.

Samples Type: Correlation
Inspection information logged in by MM on 6/7/06.

VOC
Season: Winter

Kansas City Samples-775ESO(Mo) **FTAG: 14589** **Comments:** **667; 2-8-05**

Test Code	Test Method	Results	Units	Fuel_ Code: 21	Analys	Analysis Date
552	MTBE by D5599	0.00	Oxy Percent		TS	6/12/06
562	ETBE by D5599	0.00	Oxy Percent		TS	6/12/06
534	Ethanol by D5599	0.00	Oxy Percent		TS	6/12/06
572	TAME by D5599	0.00	Oxy Percent		TS	6/12/06
421	Sulfur in Gasoline D2622	178	Parts Per Million		NST	6/15/06
62	Vapor Pressure by D5191 (Modified)	13.29	PS I		MM	6/8/06
65	Percent Evaporated at 200 Degrees F D86	49.4	Volume Percent		MM	6/8/06
66	Percent Evaporated at 300 Degrees F D86	84.5	Volume Percent		MM	6/8/06
48	Aromatics in Gasoline MSD D5769	23.67	Volume Percent		TW	6/13/06
49	Olefins in by FIA D1319	9.5	Volume Percent		RCG	8/9/06
64	Benzene in Gasoline D3606	1.19	Volume Percent		TW	6/14/06
532	Ethanol by D5599	0.00	Volume Percent		TS	6/12/06
55	MTBE by D5599	0.00	Volume Percent		TS	6/12/06
57	TAME by D5599	0.00	Volume Percent		TS	6/12/06
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent		TS	6/12/06
59	Weight Percent Oxygen by D5599	0.00	Weight Percent		TS	6/12/06
56	ETBE by D5599	0.00	Volume Percent		TS	6/12/06
630	Toluene in gasoline by MSD D5769	5.46	Volumn Percent		TW	6/13/06
63	Benzene in Gasoline by GC/MSD D5769	1.2	Volume Percent		TW	6/13/06
46	Aromatics by FIA D1319	21.8	Volume Percent		RCG	8/9/06
69	Specific Gravity @ 60 deg F D4052	0.72818	60/60F		MM	6/8/06
69	Specific Gravity @ 60 deg F D4052	0.72811	60/60F		MM	6/8/06
692	Degrees API D4052	62.84	Degrees API		MM	6/8/06
692	Degrees API D4052	62.82	Degrees API		MM	6/8/06
691	Density @ 60 deg F D4052	0.72746	g/cm-03 @ 60 deg F		MM	6/8/06
691	Density @ 60 deg F D4052	0.72739	g/cm-03 @ 60 deg F		MM	6/8/06
101	Initial Boiling Point D86	82.9	Degrees F		MM	6/8/06
110	10 Percent D86	104.6	Degrees F		MM	6/8/06
150	50 Percent D86	201.4	Degrees F		MM	6/8/06
190	90 Percent D86	323.7	Degrees F		MM	6/8/06
200	End Point D86	407.1	Degrees F		MM	6/8/06
201	Residue D86	0.9	mL		MM	6/8/06
202	Total Recovery D86	97.4	mL		MM	6/8/06

203	Loss	D86	1.7 mL	MM	6/8/06
543	Methanol	by D5599	0.00 Volume Percent	TS	6/12/06
584	Isopropanol	by D5599	0.00 Volume Percent	TS	6/12/06
585	t-Butanol	by D5599	0.00 Volume Percent	TS	6/12/06
586	n-Propanol	by D5599	0.00 Volume Percent	TS	6/12/06
587	sec-Butanol	by D5599	0.00 Volume Percent	TS	6/12/06
588	DIPE	by D5599	0.00 Volume Percent	TS	6/12/06
589	Isobutanol	by D5599	0.00 Volume Percent	TS	6/12/06
5801	t-Amyl Alcohol	by D5599	0.00 Volume Percent	TS	6/12/06
5802	n-Butanol	by D5599	0.00 Volume Percent	TS	6/12/06

Kansas City Samples

Batch#

Facility Name: ERG Facility Type: In House
Owner: EPA Phone: (913) 299-9480
6636 Berger Avenue

U.S.

Samples Type: Correlation

VOC

Inspection information logged in by MM on 6/7/06.

Season: Winter

Kansas City Samples-STJ1M3(Mo) **FTAG: 14585** **Comments:** **356; 9-20-04**

Test Code	Test Method	Results	Units	Fuel_Code: 21	Analys	Analysis Date
552	MTBE by D5599	0.00	Oxy Percent		TS	6/12/06
562	ETBE by D5599	0.00	Oxy Percent		TS	6/12/06
534	Ethanol by D5599	0.11	Oxy Percent		TS	6/12/06
572	TAME by D5599	0.00	Oxy Percent		TS	6/12/06
421	Sulfur in Gasoline D2622	31	Parts Per Million		NST	6/15/06
62	Vapor Pressure by D5191 (Modified)	8.35	PS I		MM	6/8/06
65	Percent Evaporated at 200 Degrees F D86	45.3	Volume Percent		MM	6/8/06
66	Percent Evaporated at 300 Degrees F D86	77.8	Volume Percent		MM	6/8/06
48	Aromatics in Gasoline MSD D5769	21.63	Volume Percent		TW	6/13/06
49	Olefins in by FIA D1319	5.9	Volume Percent		RCG	8/9/06
64	Benzene in Gasoline D3606	0.44	Volume Percent		TW	6/14/06
532	Ethanol by D5599	0.29	Volume Percent		TS	6/12/06
55	MTBE by D5599	0.00	Volume Percent		TS	6/12/06
57	TAME by D5599	0.00	Volume Percent		TS	6/12/06
593	Volume Percent Oxygenates by D5599	0.29	Volume Percent		TS	6/12/06
59	Weight Percent Oxygen by D5599	0.11	Weight Percent		TS	6/12/06
56	ETBE by D5599	0.00	Volume Percent		TS	6/12/06
630	Toluene in gasoline by MSD D5769	2.09	Volumn Percent		TW	6/13/06
63	Benzene in Gasoline by GC/MSD D5769	0.44	Volume Percent		TW	6/13/06
46	Aromatics by FIA D1319	22	Volume Percent		RCG	8/9/06
69	Specific Gravity @ 60 deg F D4052	0.7346	60/60F		MM	6/8/06
69	Specific Gravity @ 60 deg F D4052	0.7346	60/60F		MM	6/8/06
692	Degrees API D4052	61.12	Degrees API		MM	6/8/06
692	Degrees API D4052	61.12	Degrees API		MM	6/8/06
691	Density @ 60 deg F D4052	0.73387	g/cm-03 @ 60 deg F		MM	6/8/06
691	Density @ 60 deg F D4052	0.73387	g/cm-03 @ 60 deg F		MM	6/8/06
101	Initial Boiling Point D86	91.4	Degrees F		MM	6/8/06
110	10 Percent D86	127.3	Degrees F		MM	6/8/06
150	50 Percent D86	212.7	Degrees F		MM	6/8/06
190	90 Percent D86	341.8	Degrees F		MM	6/8/06
200	End Point D86	391.1	Degrees F		MM	6/8/06
201	Residue D86	0.9	mL		MM	6/8/06
202	Total Recovery D86	97.9	mL		MM	6/8/06

203	Loss	D86	1.2 mL		MM	6/8/06
543	Methanol	by D5599	0.00	Volume Percent	TS	6/12/06
584	Isopropanol	by D5599	0.00	Volume Percent	TS	6/12/06
585	t-Butanol	by D5599	0.00	Volume Percent	TS	6/12/06
586	n-Propanol	by D5599	0.00	Volume Percent	TS	6/12/06
587	sec-Butanol	by D5599	0.00	Volume Percent	TS	6/12/06
588	DIPE	by D5599	0.00	Volume Percent	TS	6/12/06
589	Isobutanol	by D5599	0.00	Volume Percent	TS	6/12/06
5801	t-Amyl Alcohol	by D5599	0.00	Volume Percent	TS	6/12/06
5802	n-Butanol	by D5599	0.00	Volume Percent	TS	6/12/06

NVFEL Fuel Analysis Report

14584

Batch#

Kansas City Samples

Facility Name: ERG Facility Type: In House

Owner: EPA Phone: (913) 299-9480

6636 Berger Avenue

U.S.

Samples Type: Correlation

VOC

Inspection information logged in by MM on 6/7/06.

Season: Winter

Kansas City Samples-ASHARK(Mo) **FTAG: 14584** **Comments:** **65; 7-27-04**

Test Code	Test Method	Results	Units	Fuel_ Code: 21	Analys	Analysis Date
552	MTBE by D5599	0.00	Oxy Percent		TS	6/12/06
562	ETBE by D5599	0.00	Oxy Percent		TS	6/12/06
534	Ethanol by D5599	0.00	Oxy Percent		TS	6/12/06
572	TAME by D5599	0.00	Oxy Percent		TS	6/12/06
421	Sulfur in Gasoline D2622	75	Parts Per Million		NST	6/15/06
62	Vapor Pressure by D5191 (Modified)	8.18	PS I		MM	6/8/06
65	Percent Evaporated at 200 Degrees F D86	48.2	Volume Percent		MM	6/8/06
66	Percent Evaporated at 300 Degrees F D86	83.9	Volume Percent		MM	6/8/06
48	Aromatics in Gasoline MSD D5769	19.71	Volume Percent		TW	6/13/06
49	Olefins in by FIA D1319	12	Volume Percent		RCG	8/9/06
64	Benzene in Gasoline D3606	0.75	Volume Percent		TW	6/14/06
532	Ethanol by D5599	0.00	Volume Percent		TS	6/12/06
55	MTBE by D5599	0.00	Volume Percent		TS	6/12/06
57	TAME by D5599	0.00	Volume Percent		TS	6/12/06
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent		TS	6/12/06
59	Weight Percent Oxygen by D5599	0.00	Weight Percent		TS	6/12/06
56	ETBE by D5599	0.00	Volume Percent		TS	6/12/06
630	Toluene in gasoline by MSD D5769	4.99	Volumn Percent		TW	6/13/06
63	Benzene in Gasoline by GC/MSD D5769	0.75	Volume Percent		TW	6/13/06
46	Aromatics by FIA D1319	19.5	Volume Percent		RCG	8/9/06
69	Specific Gravity @ 60 deg F D4052	0.73044	60/60F		MM	6/8/06
69	Specific Gravity @ 60 deg F D4052	0.73041	60/60F		MM	6/8/06
692	Degrees API D4052	62.23	Degrees API		MM	6/8/06
692	Degrees API D4052	62.22	Degrees API		MM	6/8/06
691	Density @ 60 deg F D4052	0.72972	g/cm-03 @ 60 deg F		MM	6/8/06
691	Density @ 60 deg F D4052	0.72969	g/cm-03 @ 60 deg F		MM	6/8/06
101	Initial Boiling Point D86	92.8	Degrees F		MM	6/8/06
110	10 Percent D86	128.8	Degrees F		MM	6/8/06
150	50 Percent D86	203.6	Degrees F		MM	6/8/06
190	90 Percent D86	336.2	Degrees F		MM	6/8/06
200	End Point D86	427.7	Degrees F		MM	6/8/06
201	Residue D86	1	mL		MM	6/8/06
202	Total Recovery D86	97.9	mL		MM	6/8/06

203	Loss	D86	1.1 mL	MM	6/8/06
543	Methanol	by D5599	0.00 Volume Percent	TS	6/12/06
584	Isopropanol	by D5599	0.00 Volume Percent	TS	6/12/06
585	t-Butanol	by D5599	0.00 Volume Percent	TS	6/12/06
586	n-Propanol	by D5599	0.00 Volume Percent	TS	6/12/06
587	sec-Butanol	by D5599	0.00 Volume Percent	TS	6/12/06
588	DIPE	by D5599	0.00 Volume Percent	TS	6/12/06
589	Isobutanol	by D5599	0.00 Volume Percent	TS	6/12/06
5801	t-Amyl Alcohol	by D5599	0.00 Volume Percent	TS	6/12/06
5802	n-Butanol	by D5599	0.00 Volume Percent	TS	6/12/06

Kansas City Samples Batch#

Facility Name: ERG Facility Type: In House

Owner: EPA Phone: (913) 299-9480

6636 Berger Avenue

U.S.

Samples Type: Correlation VOC

Inspection information logged in by MM on 6/7/06. **Season:** Winter

Kansas City Samples-SHU066(Ks) **FTAG: 14582** **Comments:** **17; 7/17/04**

Test Code	Test Method	Results	Units	Fuel_ Code: 21	Analys	Analysis Date
552	MTBE by D5599	0.00	Oxy Percent		TS	6/12/06
562	ETBE by D5599	0.00	Oxy Percent		TS	6/12/06
534	Ethanol by D5599	0.00	Oxy Percent		TS	6/12/06
572	TAME by D5599	0.00	Oxy Percent		TS	6/12/06
421	Sulfur in Gasoline D2622	33	Parts Per Million		NST	6/15/06
62	Vapor Pressure by D5191 (Modified)	6.61	PS I		MM	6/8/06
65	Percent Evaporated at 200 Degrees F D86	32.7	Volume Percent		MM	6/8/06
66	Percent Evaporated at 300 Degrees F D86	82.4	Volume Percent		MM	6/8/06
48	Aromatics in Gasoline MSD D5769	37.76	Volume Percent		TW	6/13/06
49	Olefins in by FIA D1319	6.6	Volume Percent		RCG	8/8/06
64	Benzene in Gasoline D3606	0.68	Volume Percent		TW	6/14/06
532	Ethanol by D5599	0.00	Volume Percent		TS	6/12/06
55	MTBE by D5599	0.00	Volume Percent		TS	6/12/06
57	TAME by D5599	0.00	Volume Percent		TS	6/12/06
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent		TS	6/12/06
59	Weight Percent Oxygen by D5599	0.00	Weight Percent		TS	6/12/06
56	ETBE by D5599	0.00	Volume Percent		TS	6/12/06
630	Toluene in gasoline by MSD D5769	15.3	Volumn Percent		TW	6/13/06
63	Benzene in Gasoline by GC/MSD D5769	0.67	Volume Percent		TW	6/13/06
46	Aromatics by FIA D1319	37.7	Volume Percent		RCG	8/8/06
69	Specific Gravity @ 60 deg F D4052	0.76351	60/60F		MM	6/8/06
69	Specific Gravity @ 60 deg F D4052	0.76341	60/60F		MM	6/8/06
692	Degrees API D4052	53.85	Degrees API		MM	6/8/06
692	Degrees API D4052	53.83	Degrees API		MM	6/8/06
691	Density @ 60 deg F D4052	0.76276	g/cm-03 @ 60 deg F		MM	6/8/06
691	Density @ 60 deg F D4052	0.76266	g/cm-03 @ 60 deg F		MM	6/8/06
101	Initial Boiling Point D86	94.4	Degrees F		MM	6/8/06
110	10 Percent D86	143.6	Degrees F		MM	6/8/06
150	50 Percent D86	233.8	Degrees F		MM	6/8/06
190	90 Percent D86	332.6	Degrees F		MM	6/8/06
200	End Point D86	416	Degrees F		MM	6/8/06
201	Residue D86	1	mL		MM	6/8/06
202	Total Recovery D86	98	mL		MM	6/8/06

203	Loss	D86	1 mL	MM	6/8/06
543	Methanol	by D5599	0.00 Volume Percent	TS	6/12/06
584	Isopropanol	by D5599	0.00 Volume Percent	TS	6/12/06
585	t-Butanol	by D5599	0.00 Volume Percent	TS	6/12/06
586	n-Propanol	by D5599	0.00 Volume Percent	TS	6/12/06
587	sec-Butanol	by D5599	0.00 Volume Percent	TS	6/12/06
588	DIPE	by D5599	0.00 Volume Percent	TS	6/12/06
589	Isobutanol	by D5599	0.00 Volume Percent	TS	6/12/06
5801	t-Amyl Alcohol	by D5599	0.00 Volume Percent	TS	6/12/06
5802	n-Butanol	by D5599	0.00 Volume Percent	TS	6/12/06

NVFEL Fuel Analysis Report

14583

Kansas City Samples

Batch#

Facility Name: ERG Facility Type: In House
Owner: EPA Phone: (913) 299-9480
6636 Berger Avenue

U.S.

Samples Type: Correlation

VOC

Inspection information logged in by MM on 6/7/06.

Season: Winter

Kansas City Samples- JO69660Ks **FTAG: 14583** **Comments:** **46; 7-23-04**

Test Code	Test Method	Results	Units	Fuel_ Code: 21	Analys	Analysis Date
552	MTBE by D5599	0.00	Oxy Percent		TS	6/12/06
562	ETBE by D5599	0.00	Oxy Percent		TS	6/12/06
534	Ethanol by D5599	0.00	Oxy Percent		TS	6/12/06
572	TAME by D5599	0.00	Oxy Percent		TS	6/12/06
421	Sulfur in Gasoline D2622	123	Parts Per Million		NST	6/15/06
62	Vapor Pressure by D5191 (Modified)	6.51	PS I		MM	6/8/06
65	Percent Evaporated at 200 Degrees F D86	37.7	Volume Percent		MM	6/8/06
66	Percent Evaporated at 300 Degrees F D86	79.9	Volume Percent		MM	6/8/06
48	Aromatics in Gasoline MSD D5769	31.89	Volume Percent		TW	6/13/06
49	Olefins in by FIA D1319	9	Volume Percent		RCG	8/8/06
64	Benzene in Gasoline D3606	1.66	Volume Percent		TW	6/14/06
532	Ethanol by D5599	0.00	Volume Percent		TS	6/12/06
55	MTBE by D5599	0.00	Volume Percent		TS	6/12/06
57	TAME by D5599	0.00	Volume Percent		TS	6/12/06
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent		TS	6/12/06
59	Weight Percent Oxygen by D5599	0.00	Weight Percent		TS	6/12/06
56	ETBE by D5599	0.00	Volume Percent		TS	6/12/06
630	Toluene in gasoline by MSD D5769	7.02	Volumn Percent		TW	6/13/06
63	Benzene in Gasoline by GC/MSD D5769	1.65	Volume Percent		TW	6/13/06
46	Aromatics by FIA D1319	32.1	Volume Percent		RCG	8/8/06
69	Specific Gravity @ 60 deg F D4052	0.75534	60/60F		MM	6/8/06
69	Specific Gravity @ 60 deg F D4052	0.75533	60/60F		MM	6/8/06
692	Degrees API D4052	55.84	Degrees API		MM	6/8/06
692	Degrees API D4052	55.83	Degrees API		MM	6/8/06
691	Density @ 60 deg F D4052	0.7546	g/cm-03 @ 60 deg F		MM	6/8/06
691	Density @ 60 deg F D4052	0.75458	g/cm-03 @ 60 deg F		MM	6/8/06
101	Initial Boiling Point D86	99.7	Degrees F		MM	6/8/06
110	10 Percent D86	145.5	Degrees F		MM	6/8/06
150	50 Percent D86	226.1	Degrees F		MM	6/8/06
190	90 Percent D86	338.7	Degrees F		MM	6/8/06
200	End Point D86	428.8	Degrees F		MM	6/8/06
201	Residue D86	0.9	mL		MM	6/8/06
202	Total Recovery D86	98.10001	mL		MM	6/8/06

203	Loss	D86	1 mL	MM	6/8/06
543	Methanol	by D5599	0.00 Volume Percent	TS	6/12/06
584	Isopropanol	by D5599	0.00 Volume Percent	TS	6/12/06
585	t-Butanol	by D5599	0.00 Volume Percent	TS	6/12/06
586	n-Propanol	by D5599	0.00 Volume Percent	TS	6/12/06
587	sec-Butanol	by D5599	0.00 Volume Percent	TS	6/12/06
588	DIPE	by D5599	0.00 Volume Percent	TS	6/12/06
589	Isobutanol	by D5599	0.00 Volume Percent	TS	6/12/06
5801	t-Amyl Alcohol	by D5599	0.00 Volume Percent	TS	6/12/06
5802	n-Butanol	by D5599	0.00 Volume Percent	TS	6/12/06

NVFEL Fuel Analysis Report

14595

Batch#

Kansas City Samples

Facility Name: ERG Facility Type: In House
Owner: EPA Phone: (913) 299-9480
6636 Berger Avenue

U.S.

Samples Type: Correlation
Inspection information logged in by MM on 6/13/06.

VOC

Season: Winter

Kansas City Samples-VOX458(Ks) **FTAG: 14595** **Comments:** **215; 2-15-04**

Test Code	Test Method	Results	Units	Fuel_ Code: 21	Analys	Analysis Date
552	MTBE by D5599	0.00	Oxy Percent		TS	6/16/06
562	ETBE by D5599	0.00	Oxy Percent		TS	6/16/06
534	Ethanol by D5599	0.00	Oxy Percent		TS	6/16/06
572	TAME by D5599	0.00	Oxy Percent		TS	6/16/06
421	Sulfur in Gasoline D2622	346	Parts Per Million		NST	6/20/06
62	Vapor Pressure by D5191 (Modified)	6.8	PS I		MM	6/14/06
65	Percent Evaporated at 200 Degrees F D86	35.9	Volume Percent		MM	6/15/06
66	Percent Evaporated at 300 Degrees F D86	80.2	Volume Percent		MM	6/15/06
48	Aromatics in Gasoline MSD D5769	30.45	Volume Percent		TW	6/20/06
49	Olefins in by FIA D1319	11.9	Volume Percent		RCG	8/9/06
64	Benzene in Gasoline D3606	1.40	Volume Percent		TW	6/14/06
532	Ethanol by D5599	0.00	Volume Percent		TS	6/16/06
55	MTBE by D5599	0.00	Volume Percent		TS	6/16/06
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent		TS	6/16/06
59	Weight Percent Oxygen by D5599	0.00	Weight Percent		TS	6/16/06
57	TAME by D5599	0.00	Volume Percent		TS	6/16/06
56	ETBE by D5599	0.00	Volume Percent		TS	6/16/06
63	Benzene in Gasoline by GC/MSD D5769	1.42	Volume Percent		TW	6/20/06
46	Aromatics by FIA D1319	29.1	Volume Percent		RCG	8/9/06
630	Toluene in gasoline by MSD D5769	6.95	Volumn Percent		TW	6/20/06
69	Specific Gravity @ 60 deg F D4052	0.75513	60/60F		MM	6/14/06
69	Specific Gravity @ 60 deg F D4052	0.75523	60/60F		MM	6/14/06
692	Degrees API D4052	55.86	Degrees API		MM	6/14/06
692	Degrees API D4052	55.88	Degrees API		MM	6/14/06
691	Density @ 60 deg F D4052	0.75439	g/cm-03 @ 60 deg F		MM	6/14/06
691	Density @ 60 deg F D4052	0.75449	g/cm-03 @ 60 deg F		MM	6/14/06
101	Initial Boiling Point D86	98.9	Degrees F		MM	6/15/06
110	10 Percent D86	145.7	Degrees F		MM	6/15/06
150	50 Percent D86	229.2	Degrees F		MM	6/15/06
190	90 Percent D86	331.3	Degrees F		MM	6/15/06
200	End Point D86	405.5	Degrees F		MM	6/15/06
201	Residue D86	1	mL		MM	6/15/06
202	Total Recovery D86	97.89999	mL		MM	6/15/06

NVFEL Fuel Analysis Report

203	Loss	D86	1.1 mL		MM	6/15/06
543	Methanol	by D5599	0.00	Volume Percent	TS	6/16/06
584	Isopropanol	by D5599	0.00	Volume Percent	TS	6/16/06
585	t-Butanol	by D5599	0.00	Volume Percent	TS	6/16/06
586	n-Propanol	by D5599	0.00	Volume Percent	TS	6/16/06
587	sec-Butanol	by D5599	0.00	Volume Percent	TS	6/16/06
588	DIPE	by D5599	0.00	Volume Percent	TS	6/16/06
589	Isobutanol	by D5599	0.00	Volume Percent	TS	6/16/06
5801	t-Amyl Alcohol	by D5599	0.00	Volume Percent	TS	6/16/06
5802	n-Butanol	by D5599	0.00	Volume Percent	TS	6/16/06

NVFEL Fuel Analysis Report

14601

Batch#

Kansas City Samples

Facility Name: ERG Facility Type: In House

Owner: EPA Phone: (913) 299-9480

6636 Berger Avenue

U.S.

Samples Type: Correlation

VOC

Inspection information logged in by MM on 6/13/06.

Season: Winter

Kansas City Samples-554CLW(Mo) **FTAG: 14601** **Comments:** **#120; 8/6/04**

Fuel_ Code: 21

Test Code	Test Method	Results	Units	Analys	Analysis Date
552	MTBE by D5599	0.00	Oxy Percent	TS	6/19/06
562	ETBE by D5599	0.00	Oxy Percent	TS	6/19/06
534	Ethanol by D5599	0.00	Oxy Percent	TS	6/19/06
572	TAME by D5599	0.00	Oxy Percent	TS	6/19/06
421	Sulfur in Gasoline D2622	85	Parts Per Million	NST	6/20/06
62	Vapor Pressure by D5191 (Modified)	6.85	PSI	MM	6/14/06
65	Percent Evaporated at 200 Degrees F D86	40.5	Volume Percent	MM	6/16/06
66	Percent Evaporated at 300 Degrees F D86	80.5	Volume Percent	MM	6/16/06
48	Aromatics in Gasoline MSD D5769	31.4	Volume Percent	TW	6/21/06
49	Olefins in by FIA D1319	12.6	Volume Percent	RCG	8/15/06
64	Benzene in Gasoline D3606	1.31	Volume Percent	TW	6/14/06
64	Benzene in Gasoline D3606	1.30	Volume Percent	TW	6/15/06
57	TAME by D5599	0.00	Volume Percent	TS	6/19/06
59	Weight Percent Oxygen by D5599	0.00	Weight Percent	TS	6/19/06
55	MTBE by D5599	0.00	Volume Percent	TS	6/19/06
532	Ethanol by D5599	0.00	Volume Percent	TS	6/19/06
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent	TS	6/19/06
56	ETBE by D5599	0.00	Volume Percent	TS	6/19/06
46	Aromatics by FIA D1319	30.4	Volume Percent	RCG	8/15/06
630	Toluene in gasoline by MSD D5769	8.24	Volumn Percent	TW	6/21/06
63	Benzene in Gasoline by GC/MSD D5769	1.29	Volume Percent	TW	6/21/06
69	Specific Gravity @ 60 deg F D4052	0.75508	60/60F	MM	6/14/06
69	Specific Gravity @ 60 deg F D4052	0.75506	60/60F	MM	6/14/06
692	Degrees API D4052	55.9	Degrees API	MM	6/14/06
692	Degrees API D4052	55.9	Degrees API	MM	6/14/06
691	Density @ 60 deg F D4052	0.75433	g/cm-03 @ 60 deg F	MM	6/14/06
691	Density @ 60 deg F D4052	0.75431	g/cm-03 @ 60 deg F	MM	6/14/06
101	Initial Boiling Point D86	99.2	Degrees F	MM	6/16/06
110	10 Percent D86	142.6	Degrees F	MM	6/16/06
150	50 Percent D86	220.4	Degrees F	MM	6/16/06
190	90 Percent D86	340.5	Degrees F	MM	6/16/06
200	End Point D86	425.7	Degrees F	MM	6/16/06
201	Residue D86	1.1	mL	MM	6/16/06

202	Total Recovery	D86	98 mL	MM	6/16/06
203	Loss	D86	0.9 mL	MM	6/16/06
543	Methanol	by D5599	0.00 Volume Percent	TS	6/19/06
584	Isopropanol	by D5599	0.00 Volume Percent	TS	6/19/06
585	t-Butanol	by D5599	0.00 Volume Percent	TS	6/19/06
586	n-Propanol	by D5599	0.00 Volume Percent	TS	6/19/06
587	sec-Butanol	by D5599	0.00 Volume Percent	TS	6/19/06
588	DIPE	by D5599	0.00 Volume Percent	TS	6/19/06
589	Isobutanol	by D5599	0.00 Volume Percent	TS	6/19/06
5801	t-Amyl Alcohol	by D5599	0.00 Volume Percent	TS	6/19/06
5802	n-Butanol	by D5599	0.00 Volume Percent	TS	6/19/06

NVFEL Fuel Analysis Report 14602

Kansas City Samples

Batch#

Facility Name: ERG Facility Type: In House
Owner: EPA Phone: (913) 299-9480
6636 Berger Avenue

U.S.

Samples Type: Correlation
Inspection information logged in by MM on 6/13/06.

VOC
Season: Winter

Kansas City Samples-703SCZ(Mo) **FTAG: 14602** **Comments:** **#154; 8/14/04**

Fuel_ Code: 21

Test Code	Test Method	Results	Units	Analys	Analysis Date
552	MTBE by D5599	0.00	Oxy Percent	TS	6/16/06
552	MTBE by D5599	0.00	Oxy Percent	TS	6/16/06
562	ETBE by D5599	0.00	Oxy Percent	TS	6/16/06
562	ETBE by D5599	0.00	Oxy Percent	TS	6/16/06
534	Ethanol by D5599	0.00	Oxy Percent	TS	6/16/06
534	Ethanol by D5599	0.00	Oxy Percent	TS	6/16/06
572	TAME by D5599	0.00	Oxy Percent	TS	6/16/06
572	TAME by D5599	0.00	Oxy Percent	TS	6/16/06
421	Sulfur in Gasoline D2622	211	Parts Per Million	NST	6/20/06
62	Vapor Pressure by D5191 (Modified)	6.47	PS I	MM	6/14/06
65	Percent Evaporated at 200 Degrees F D86	36.6	Volume Percent	MM	6/15/06
66	Percent Evaporated at 300 Degrees F D86	80.2	Volume Percent	MM	6/15/06
48	Aromatics in Gasoline MSD D5769	33.17	Volume Percent	TW	6/21/06
49	Olefins in by FIA D1319	10.9	Volume Percent	RCG	8/15/06
64	Benzene in Gasoline D3606	1.63	Volume Percent	TW	6/19/06
532	Ethanol by D5599	0.00	Volume Percent	TS	6/16/06
57	TAME by D5599	0.00	Volume Percent	TS	6/16/06
57	TAME by D5599	0.00	Volume Percent	TS	6/16/06
59	Weight Percent Oxygen by D5599	0.00	Weight Percent	TS	6/16/06
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent	TS	6/16/06
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent	TS	6/16/06
59	Weight Percent Oxygen by D5599	0.00	Weight Percent	TS	6/16/06
55	MTBE by D5599	0.00	Volume Percent	TS	6/16/06
55	MTBE by D5599	0.00	Volume Percent	TS	6/16/06
532	Ethanol by D5599	0.00	Volume Percent	TS	6/16/06
56	ETBE by D5599	0.00	Volume Percent	TS	6/16/06
56	ETBE by D5599	0.00	Volume Percent	TS	6/16/06
46	Aromatics by FIA D1319	31.4	Volume Percent	RCG	8/15/06
63	Benzene in Gasoline by GC/MSD D5769	1.61	Volume Percent	TW	6/21/06
630	Toluene in gasoline by MSD D5769	7.22	Volumn Percent	TW	6/21/06
69	Specific Gravity @ 60 deg F D4052	0.75701	60/60F	MM	6/14/06
69	Specific Gravity @ 60 deg F D4052	0.757	60/60F	MM	6/14/06
692	Degrees API D4052	55.42	Degrees API	MM	6/14/06

692	Degrees API	D4052	55.42 Degrees API	MM	6/14/06
691	Density @ 60 deg F	D4052	0.75626 g/cm-03 @ 60 deg F	MM	6/14/06
691	Density @ 60 deg F	D4052	0.75625 g/cm-03 @ 60 deg F	MM	6/14/06
101	Initial Boiling Point	D86	99.5 Degrees F	MM	6/15/06
110	10 Percent	D86	146.8 Degrees F	MM	6/15/06
150	50 Percent	D86	228.1 Degrees F	MM	6/15/06
190	90 Percent	D86	333.1 Degrees F	MM	6/15/06
200	End Point	D86	413.8 Degrees F	MM	6/15/06
201	Residue	D86	1 mL	MM	6/15/06
202	Total Recovery	D86	98.1 mL	MM	6/15/06
203	Loss	D86	0.9 mL	MM	6/15/06
543	Methanol	by D5599	0.00 Volume Percent	TS	6/16/06
543	Methanol	by D5599	0.00 Volume Percent	TS	6/16/06
584	Isopropanol	by D5599	0.00 Volume Percent	TS	6/16/06
584	Isopropanol	by D5599	0.00 Volume Percent	TS	6/16/06
585	t-Butanol	by D5599	0.00 Volume Percent	TS	6/16/06
585	t-Butanol	by D5599	0.00 Volume Percent	TS	6/16/06
586	n-Propanol	by D5599	0.00 Volume Percent	TS	6/16/06
586	n-Propanol	by D5599	0.00 Volume Percent	TS	6/16/06
587	sec-Butanol	by D5599	0.00 Volume Percent	TS	6/16/06
587	sec-Butanol	by D5599	0.00 Volume Percent	TS	6/16/06
588	DIPE	by D5599	0.00 Volume Percent	TS	6/16/06
588	DIPE	by D5599	0.00 Volume Percent	TS	6/16/06
589	Isobutanol	by D5599	0.00 Volume Percent	TS	6/16/06
589	Isobutanol	by D5599	0.00 Volume Percent	TS	6/16/06
5801	t-Amyl Alcohol	by D5599	0.00 Volume Percent	TS	6/16/06
5801	t-Amyl Alcohol	by D5599	0.00 Volume Percent	TS	6/16/06
5802	n-Butanol	by D5599	0.00 Volume Percent	TS	6/16/06
5802	n-Butanol	by D5599	0.00 Volume Percent	TS	6/16/06

NVFEL Fuel Analysis Report

14603

Batch#

Kansas City Samples

Facility Name: ERG Facility Type: In House
Owner: EPA Phone: (913) 299-9480
6636 Berger Avenue

U.S.

Samples Type: Correlation

VOC

Inspection information logged in by MM on 6/13/06.

Season: Winter

Kansas City Samples-VSU617(Ks) **FTAG: 14603** **Comments:** **179; 8-18-04**

Test Code	Test Method	Results	Units	Fuel_Code: 21	Analys	Analysis Date
552	MTBE by D5599	0.00	Oxy Percent		TS	6/19/06
562	ETBE by D5599	0.00	Oxy Percent		TS	6/19/06
534	Ethanol by D5599	0.00	Oxy Percent		TS	6/19/06
572	TAME by D5599	0.00	Oxy Percent		TS	6/19/06
421	Sulfur in Gasoline D2622	261	Parts Per Million		NST	6/20/06
62	Vapor Pressure by D5191 (Modified)	6.47	PS I		MM	6/14/06
65	Percent Evaporated at 200 Degrees F D86	36.3	Volume Percent		MM	6/15/06
66	Percent Evaporated at 300 Degrees F D86	79.9	Volume Percent		MM	6/15/06
48	Aromatics in Gasoline MSD D5769	31.77	Volume Percent		TW	6/21/06
49	Olefins in by FIA D1319	11.8	Volume Percent		RCG	8/15/06
64	Benzene in Gasoline D3606	1.50	Volume Percent		TW	6/19/06
532	Ethanol by D5599	0.00	Volume Percent		TS	6/19/06
55	MTBE by D5599	0.00	Volume Percent		TS	6/19/06
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent		TS	6/19/06
59	Weight Percent Oxygen by D5599	0.00	Weight Percent		TS	6/19/06
57	TAME by D5599	0.00	Volume Percent		TS	6/19/06
56	ETBE by D5599	0.00	Volume Percent		TS	6/19/06
63	Benzene in Gasoline by GC/MSD D5769	1.48	Volume Percent		TW	6/21/06
46	Aromatics by FIA D1319	30.8	Volume Percent		RCG	8/15/06
630	Toluene in gasoline by MSD D5769	6.89	Volumn Percent		TW	6/21/06
69	Specific Gravity @ 60 deg F D4052	0.75584	60/60F		MM	6/14/06
69	Specific Gravity @ 60 deg F D4052	0.75588	60/60F		MM	6/14/06
692	Degrees API D4052	55.7	Degrees API		MM	6/14/06
692	Degrees API D4052	55.71	Degrees API		MM	6/14/06
691	Density @ 60 deg F D4052	0.7551	g/cm-03 @ 60 deg F		MM	6/14/06
691	Density @ 60 deg F D4052	0.75514	g/cm-03 @ 60 deg F		MM	6/14/06
101	Initial Boiling Point D86	100.2	Degrees F		MM	6/15/06
110	10 Percent D86	146.3	Degrees F		MM	6/15/06
150	50 Percent D86	228.9	Degrees F		MM	6/15/06
190	90 Percent D86	334.2	Degrees F		MM	6/15/06
200	End Point D86	414.3	Degrees F		MM	6/15/06
201	Residue D86	1.1	mL		MM	6/15/06
202	Total Recovery D86	97.8	mL		MM	6/15/06

203	Loss	D86	1.1 mL		MM	6/15/06
543	Methanol	by D5599	0.00	Volume Percent	TS	6/19/06
584	Isopropanol	by D5599	0.00	Volume Percent	TS	6/19/06
585	t-Butanol	by D5599	0.00	Volume Percent	TS	6/19/06
586	n-Propanol	by D5599	0.00	Volume Percent	TS	6/19/06
587	sec-Butanol	by D5599	0.00	Volume Percent	TS	6/19/06
588	DIPE	by D5599	0.00	Volume Percent	TS	6/19/06
589	Isobutanol	by D5599	0.00	Volume Percent	TS	6/19/06
5801	t-Amyl Alcohol	by D5599	0.00	Volume Percent	TS	6/19/06
5802	n-Butanol	by D5599	0.00	Volume Percent	TS	6/19/06

NVFEL Fuel Analysis Report

14604

Kansas City Samples

Batch#

Facility Name: ERG   Facility Type: In House
Owner: EPA   Phone: (913) 299-9480
6636 Berger Avenue

U.S.

Samples Type: Correlation
Inspection information logged in by MM on 6/13/06.

VOC
Season: Winter

Kansas City Samples-VVI325(Ks)   **FTAG: 14604**   **Comments:** **322; 9-15-04**

Test Code	Test Method	Results	Units	Fuel_ Code: 21	Analys	Analysis Date
552	MTBE by D5599	0.00	Oxy Percent		TS	6/19/06
562	ETBE by D5599	0.00	Oxy Percent		TS	6/19/06
534	Ethanol by D5599	0.00	Oxy Percent		TS	6/19/06
572	TAME by D5599	0.00	Oxy Percent		TS	6/19/06
421	Sulfur in Gasoline D2622	137	Parts Per Million		NST	6/20/06
421	Sulfur in Gasoline D2622	136	Parts Per Million		NST	6/20/06
62	Vapor Pressure by D5191 (Modified)	6.63	PS I		MM	6/14/06
65	Percent Evaporated at 200 Degrees F D86	37.6	Volume Percent		MM	6/15/06
66	Percent Evaporated at 300 Degrees F D86	80.5	Volume Percent		MM	6/15/06
48	Aromatics in Gasoline MSD D5769	34.38	Volume Percent		TW	6/21/06
49	Olefins in by FIA D1319	9.6	Volume Percent		RCG	8/15/06
64	Benzene in Gasoline D3606	1.79	Volume Percent		TW	6/19/06
532	Ethanol by D5599	0.00	Volume Percent		TS	6/19/06
55	MTBE by D5599	0.00	Volume Percent		TS	6/19/06
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent		TS	6/19/06
59	Weight Percent Oxygen by D5599	0.00	Weight Percent		TS	6/19/06
57	TAME by D5599	0.00	Volume Percent		TS	6/19/06
56	ETBE by D5599	0.00	Volume Percent		TS	6/19/06
63	Benzene in Gasoline by GC/MSD D5769	1.77	Volume Percent		TW	6/21/06
46	Aromatics by FIA D1319	33.4	Volume Percent		RCG	8/15/06
630	Toluene in gasoline by MSD D5769	7.68	Volumn Percent		TW	6/21/06
69	Specific Gravity @ 60 deg F D4052	0.75744	60/60F		MM	6/14/06
69	Specific Gravity @ 60 deg F D4052	0.7575	60/60F		MM	6/14/06
692	Degrees API D4052	55.3	Degrees API		MM	6/14/06
692	Degrees API D4052	55.31	Degrees API		MM	6/14/06
691	Density @ 60 deg F D4052	0.75669	g/cm-03 @ 60 deg F		MM	6/14/06
691	Density @ 60 deg F D4052	0.75675	g/cm-03 @ 60 deg F		MM	6/14/06
101	Initial Boiling Point D86	100.1	Degrees F		MM	6/15/06
110	10 Percent D86	143.6	Degrees F		MM	6/15/06
150	50 Percent D86	227.1	Degrees F		MM	6/15/06
190	90 Percent D86	329.4	Degrees F		MM	6/15/06
200	End Point D86	406.3	Degrees F		MM	6/15/06
201	Residue D86	1.1	mL		MM	6/15/06

202	Total Recovery	D86	97.8 mL	MM	6/15/06
203	Loss	D86	1.1 mL	MM	6/15/06
543	Methanol	by D5599	0.00 Volume Percent	TS	6/19/06
584	Isopropanol	by D5599	0.00 Volume Percent	TS	6/19/06
585	t-Butanol	by D5599	0.00 Volume Percent	TS	6/19/06
586	n-Propanol	by D5599	0.00 Volume Percent	TS	6/19/06
587	sec-Butanol	by D5599	0.00 Volume Percent	TS	6/19/06
588	DIPE	by D5599	0.00 Volume Percent	TS	6/19/06
589	Isobutanol	by D5599	0.00 Volume Percent	TS	6/19/06
5801	t-Amyl Alcohol	by D5599	0.00 Volume Percent	TS	6/19/06
5802	n-Butanol	by D5599	0.00 Volume Percent	TS	6/19/06

NVFEL Fuel Analysis Report

14605

Kansas City Samples

Batch#

Facility Name: ERG Facility Type: In House

Owner: EPA Phone: (913) 299-9480

6636 Berger Avenue

U.S.

Samples Type: Correlation

VOC

Inspection information logged in by MM on 6/13/06.

Season: Winter

Kansas City Samples-532NZX(Mo) **FTAG: 14605** **Comments:** **795; 3-9-05**

Test Code	Test Method	Results	Units	Fuel_ Code: 21	Analys	Analysis Date
552	MTBE by D5599	0.00	Oxy Percent		TS	6/19/06
562	ETBE by D5599	0.00	Oxy Percent		TS	6/19/06
534	Ethanol by D5599	0.00	Oxy Percent		TS	6/19/06
572	TAME by D5599	0.00	Oxy Percent		TS	6/19/06
421	Sulfur In Gasoline D2622	169	Parts Per Million		NST	6/20/06
62	Vapor Pressure by D5191 (Modified)	12.79	PS I		MM	6/14/06
65	Percent Evaporated at 200 Degrees F D86	51.1	Volume Percent		MM	6/16/06
66	Percent Evaporated at 300 Degrees F D86	84.7	Volume Percent		MM	6/16/06
48	Aromatics in Gasoline MSD D5769	22.64	Volume Percent		TW	6/21/06
49	Olefins in by FIA D1319	9.2	Volume Percent		RCG	8/15/06
64	Benzene in Gasoline D3606	1.08	Volume Percent		TW	6/19/06
532	Ethanol by D5599	0.00	Volume Percent		TS	6/19/06
55	MTBE by D5599	0.00	Volume Percent		TS	6/19/06
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent		TS	6/19/06
59	Weight Percent Oxygen by D5599	0.00	Weight Percent		TS	6/19/06
57	TAME by D5599	0.00	Volume Percent		TS	6/19/06
56	ETBE by D5599	0.00	Volume Percent		TS	6/19/06
63	Benzene in Gasoline by GC/MSD D5769	1.07	Volume Percent		TW	6/21/06
46	Aromatics by FIA D1319	20.5	Volume Percent		RCG	8/15/06
630	Toluene in gasoline by MSD D5769	5.24	Volumn Percent		TW	6/21/06
69	Specific Gravity @ 60 deg F D4052	0.72674	60/60F		MM	6/14/06
69	Specific Gravity @ 60 deg F D4052	0.72676	60/60F		MM	6/14/06
692	Degrees API D4052	63.2	Degrees API		MM	6/14/06
692	Degrees API D4052	63.21	Degrees API		MM	6/14/06
691	Density @ 60 deg F D4052	0.72602	g/cm-03 @ 60 deg F		MM	6/14/06
691	Density @ 60 deg F D4052	0.72604	g/cm-03 @ 60 deg F		MM	6/14/06
101	Initial Boiling Point D86	84.2	Degrees F		MM	6/16/06
110	10 Percent D86	106	Degrees F		MM	6/16/06
150	50 Percent D86	197	Degrees F		MM	6/16/06
190	90 Percent D86	325.1	Degrees F		MM	6/16/06
200	End Point D86	412.6	Degrees F		MM	6/16/06
201	Residue D86	1.1	mL		MM	6/16/06
202	Total Recovery D86	97.5	mL		MM	6/16/06

203	Loss	D86	1.4 mL	MM	6/16/06
543	Methanol	by D5599	0.00 Volume Percent	TS	6/19/06
584	Isopropanol	by D5599	0.00 Volume Percent	TS	6/19/06
585	t-Butanol	by D5599	0.00 Volume Percent	TS	6/19/06
586	n-Propanol	by D5599	0.00 Volume Percent	TS	6/19/06
587	sec-Butanol	by D5599	0.00 Volume Percent	TS	6/19/06
588	DIPE	by D5599	0.00 Volume Percent	TS	6/19/06
589	Isobutanol	by D5599	0.00 Volume Percent	TS	6/19/06
5801	t-Amyl Alcohol	by D5599	0.00 Volume Percent	TS	6/19/06
5802	n-Butanol	by D5599	0.00 Volume Percent	TS	6/19/06

NVFEL Fuel Analysis Report

14606

Batch#

Kansas City Samples

Facility Name: ERG Facility Type: In House
Owner: EPA Phone: (913) 299-9480
6636 Berger Avenue

U.S.

Samples Type: Correlation
Inspection information logged in by MM on 6/13/06.

VOC
Season: Winter

Kansas City Samples-453FEX(Mo) **FTAG: 14606** **Comments:** **835; 3-16-05**

Test Code	Test Method	Results	Units	Fuel_ Code: 21	Analys	Analysis Date
552	MTBE by D5599	0.00	Oxy Percent		TS	6/19/06
562	ETBE by D5599	0.00	Oxy Percent		TS	6/19/06
534	Ethanol by D5599	0.00	Oxy Percent		TS	6/19/06
572	TAME by D5599	0.00	Oxy Percent		TS	6/19/06
421	Sulfur in Gasoline D2622	153	Parts Per Million		NST	6/20/06
62	Vapor Pressure by D5191 (Modified)	11.43	PS I		MM	6/14/06
65	Percent Evaporated at 200 Degrees F D86	49.7	Volume Percent		MM	6/16/06
66	Percent Evaporated at 300 Degrees F D86	82.6	Volume Percent		MM	6/16/06
48	Aromatics in Gasoline MSD D5769	25.01	Volume Percent		TW	6/21/06
49	Olefins in by FIA D1319	11.2	Volume Percent		RCG	8/15/06
64	Benzene in Gasoline D3606	1.05	Volume Percent		TW	6/19/06
532	Ethanol by D5599	0.00	Volume Percent		TS	6/19/06
57	TAME by D5599	0.00	Volume Percent		TS	6/19/06
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent		TS	6/19/06
59	Weight Percent Oxygen by D5599	0.00	Weight Percent		TS	6/19/06
55	MTBE by D5599	0.00	Volume Percent		TS	6/19/06
56	ETBE by D5599	0.00	Volume Percent		TS	6/19/06
63	Benzene in Gasoline by GC/MSD D5769	1.05	Volume Percent		TW	6/21/06
630	Toluene in gasoline by MSD D5769	5.24	Volumn Percent		TW	6/21/06
46	Aromatics by FIA D1319	22.9	Volume Percent		RCG	8/15/06
69	Specific Gravity @ 60 deg F D4052	0.73345	60/60F		MM	6/14/06
69	Specific Gravity @ 60 deg F D4052	0.73338	60/60F		MM	6/14/06
692	Degrees API D4052	61.44	Degrees API		MM	6/14/06
692	Degrees API D4052	61.42	Degrees API		MM	6/14/06
691	Density @ 60 deg F D4052	0.73266	g/cm-03 @ 60 deg F		MM	6/14/06
691	Density @ 60 deg F D4052	0.73273	g/cm-03 @ 60 deg F		MM	6/14/06
101	Initial Boiling Point D86	84.6	Degrees F		MM	6/16/06
110	10 Percent D86	111	Degrees F		MM	6/16/06
150	50 Percent D86	200.8	Degrees F		MM	6/16/06
190	90 Percent D86	329.1	Degrees F		MM	6/16/06
200	End Point D86	405.3	Degrees F		MM	6/16/06
201	Residue D86	1.1	mL		MM	6/16/06
202	Total Recovery D86	97.3	mL		MM	6/16/06

203	Loss	D86	1.6 mL		MM	6/16/06
543	Methanol	by D5599	0.00	Volume Percent	TS	6/19/06
584	Isopropanol	by D5599	0.00	Volume Percent	TS	6/19/06
585	t-Butanol	by D5599	0.00	Volume Percent	TS	6/19/06
586	n-Propanol	by D5599	0.00	Volume Percent	TS	6/19/06
587	sec-Butanol	by D5599	0.00	Volume Percent	TS	6/19/06
588	DIPE	by D5599	0.00	Volume Percent	TS	6/19/06
589	Isobutanol	by D5599	0.00	Volume Percent	TS	6/19/06
5801	t-Amyl Alcohol	by D5599	0.00	Volume Percent	TS	6/19/06
5802	n-Butanol	by D5599	0.00	Volume Percent	TS	6/19/06

NVFEL Fuel Analysis Report

14586

Kansas City Samples

Batch#

Facility Name: ERG Facility Type: In House

Owner: EPA Phone: (913) 299-9480

6636 Berger Avenue

U.S.

Samples Type: Correlation

VOC

Inspection information logged in by MM on 6/7/06.

Season: Winter

Kansas City Samples-VPB730(Ks) **FTAG: 14586** **Comments:** **576; 1-20-05**

Test Code	Test Method	Results	Units	Fuel_ Code: 21	Analys	Analysis Date
552	MTBE by D5599	0.00	Oxy Percent		TS	6/12/06
562	ETBE by D5599	0.00	Oxy Percent		TS	6/12/06
534	Ethanol by D5599	0.00	Oxy Percent		TS	6/12/06
572	TAME by D5599	0.00	Oxy Percent		TS	6/12/06
421	Sulfur in Gasoline D2622	172	Parts Per Million		NST	6/15/06
62	Vapor Pressure by D5191 (Modified)	13.36	PS I		MM	6/8/06
65	Percent Evaporated at 200 Degrees F D86	54.1	Volume Percent		MM	6/8/06
66	Percent Evaporated at 300 Degrees F D86	84.8	Volume Percent		MM	6/8/06
48	Aromatics in Gasoline MSD D5769	23.58	Volume Percent		TW	6/13/06
49	Olefins in by FIA D1319	12	Volume Percent		RCG	8/14/06
64	Benzene in Gasoline D3606	1.28	Volume Percent		TW	6/14/06
532	Ethanol by D5599	0.00	Volume Percent		TS	6/12/06
55	MTBE by D5599	0.00	Volume Percent		TS	6/12/06
57	TAME by D5599	0.00	Volume Percent		TS	6/12/06
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent		TS	6/12/06
59	Weight Percent Oxygen by D5599	0.00	Weight Percent		TS	6/12/06
56	ETBE by D5599	0.00	Volume Percent		TS	6/12/06
630	Toluene in gasoline by MSD D5769	6.69	Volumn Percent		TW	6/13/06
63	Benzene in Gasoline by GC/MSD D5769	1.28	Volume Percent		TW	6/13/06
46	Aromatics by FIA D1319	21.5	Volume Percent		RCG	8/14/06
69	Specific Gravity @ 60 deg F D4052	0.72631	60/60F		MM	6/8/06
69	Specific Gravity @ 60 deg F D4052	0.72624	60/60F		MM	6/8/06
692	Degrees API D4052	63.34	Degrees API		MM	6/8/06
692	Degrees API D4052	63.32	Degrees API		MM	6/8/06
691	Density @ 60 deg F D4052	0.72559	g/cm-03 @ 60 deg F		MM	6/8/06
691	Density @ 60 deg F D4052	0.72552	g/cm-03 @ 60 deg F		MM	6/8/06
101	Initial Boiling Point D86	81.3	Degrees F		MM	6/8/06
110	10 Percent D86	101	Degrees F		MM	6/8/06
150	50 Percent D86	187.9	Degrees F		MM	6/8/06
190	90 Percent D86	323.9	Degrees F		MM	6/8/06
200	End Point D86	414.2	Degrees F		MM	6/8/06
201	Residue D86	0.7	mL		MM	6/8/06
202	Total Recovery D86	97.1	mL		MM	6/8/06

203	Loss	D86	2.2 mL	MM	6/8/06
543	Methanol	by D5599	0.00 Volume Percent	TS	6/12/06
584	Isopropanol	by D5599	0.00 Volume Percent	TS	6/12/06
585	t-Butanol	by D5599	0.00 Volume Percent	TS	6/12/06
586	n-Propanol	by D5599	0.00 Volume Percent	TS	6/12/06
587	sec-Butanol	by D5599	0.00 Volume Percent	TS	6/12/06
588	DIPE	by D5599	0.00 Volume Percent	TS	6/12/06
589	Isobutanol	by D5599	0.00 Volume Percent	TS	6/12/06
5801	t-Amyl Alcohol	by D5599	0.00 Volume Percent	TS	6/12/06
5802	n-Butanol	by D5599	0.00 Volume Percent	TS	6/12/06

NVFEL Fuel Analysis Report

14587

Batch#

Kansas City Samples

Facility Name: ERG Facility Type: In House

Owner: EPA Phone: (913) 299-9480

6636 Berger Avenue

U.S.

Samples Type: Correlation

VOC

Inspection information logged in by MM on 6/7/06.

Season: Winter

Kansas City Samples-568FFA(Mo) **FTAG: 14587** **Comments:** **611; 1-28-05**

Test Code	Test Method	Results	Units	Fuel_ Code: 21	Analys	Analysis Date
552	MTBE by D5599	0.00	Oxy Percent		TS	6/12/06
562	ETBE by D5599	0.00	Oxy Percent		TS	6/12/06
534	Ethanol by D5599	0.00	Oxy Percent		TS	6/12/06
572	TAME by D5599	0.00	Oxy Percent		TS	6/12/06
421	Sulfur in Gasoline D2622	113	Parts Per Million		NST	6/15/06
62	Vapor Pressure by D5191 (Modified)	13.31	PS I		MM	6/8/06
65	Percent Evaporated at 200 Degrees F D86	49.7	Volume Percent		MM	6/8/06
66	Percent Evaporated at 300 Degrees F D86	82.9	Volume Percent		MM	6/8/06
48	Aromatics in Gasoline MSD D5769	23.14	Volume Percent		TW	6/13/06
49	Olefins in by FIA D1319	10.4	Volume Percent		RCG	8/14/06
64	Benzene in Gasoline D3606	0.92	Volume Percent		TW	6/14/06
532	Ethanol by D5599	0.00	Volume Percent		TS	6/12/06
55	MTBE by D5599	0.00	Volume Percent		TS	6/12/06
57	TAME by D5599	0.00	Volume Percent		TS	6/12/06
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent		TS	6/12/06
59	Weight Percent Oxygen by D5599	0.00	Weight Percent		TS	6/12/06
56	ETBE by D5599	0.00	Volume Percent		TS	6/12/06
630	Toluene in gasoline by MSD D5769	4.85	Volumn Percent		TW	6/13/06
63	Benzene in Gasoline by GC/MSD D5769	0.92	Volume Percent		TW	6/13/06
46	Aromatics by FIA D1319	21.3	Volume Percent		RCG	8/14/06
69	Specific Gravity @ 60 deg F D4052	0.72738	60/60F		MM	6/8/06
69	Specific Gravity @ 60 deg F D4052	0.72738	60/60F		MM	6/8/06
692	Degrees API D4052	63.03	Degrees API		MM	6/8/06
692	Degrees API D4052	63.03	Degrees API		MM	6/8/06
691	Density @ 60 deg F D4052	0.72666	g/cm-03 @ 60 deg F		MM	6/8/06
691	Density @ 60 deg F D4052	0.72666	g/cm-03 @ 60 deg F		MM	6/8/06
101	Initial Boiling Point D86	81.8	Degrees F		MM	6/8/06
110	10 Percent D86	102.7	Degrees F		MM	6/8/06
150	50 Percent D86	201.1	Degrees F		MM	6/8/06
190	90 Percent D86	332.2	Degrees F		MM	6/8/06
200	End Point D86	418.6	Degrees F		MM	6/8/06
201	Residue D86	0.9	mL		MM	6/8/06
202	Total Recovery D86	97.4	mL		MM	6/8/06

203	Loss	D86	1.7 mL	MM	6/8/06
543	Methanol	by D5599	0.00 Volume Percent	TS	6/12/06
584	Isopropanol	by D5599	0.00 Volume Percent	TS	6/12/06
585	t-Butanol	by D5599	0.00 Volume Percent	TS	6/12/06
586	n-Propanol	by D5599	0.00 Volume Percent	TS	6/12/06
587	sec-Butanol	by D5599	0.00 Volume Percent	TS	6/12/06
588	DIPE	by D5599	0.00 Volume Percent	TS	6/12/06
589	Isobutanol	by D5599	0.00 Volume Percent	TS	6/12/06
5801	t-Amyl Alcohol	by D5599	0.00 Volume Percent	TS	6/12/06
5802	n-Butanol	by D5599	0.00 Volume Percent	TS	6/12/06

NVFEL Fuel Analysis Report

14596

Batch#

Kansas City Samples

Facility Name: ERG Facility Type: In House

Owner: EPA Phone: (913) 299-9480

6636 Berger Avenue

U.S.

Samples Type: Correlation

VOC

Inspection information logged in by MM on 6/13/06.

Season: Winter

Kansas City Samples-S1Q677(Ka) **FTAG: 14596** **Comments:** **#20; 7-19-04**

Fuel_ Code: 21

Test Code	Test Method	Results	Units	Analys	Analysis Date
552	MTBE by D5599	0.00	Oxy Percent	TS	6/16/06
562	ETBE by D5599	0.00	Oxy Percent	TS	6/16/06
534	Ethanol by D5599	0.00	Oxy Percent	TS	6/16/06
572	TAME by D5599	0.00	Oxy Percent	TS	6/16/06
421	Sulfur in Gasoline D2622	163	Parts Per Million	NST	6/20/06
62	Vapor Pressure by D5191 (Modified)	7.56	PS I	MM	6/14/06
65	Percent Evaporated at 200 Degrees F D86	43.3	Volume Percent	MM	6/15/06
66	Percent Evaporated at 300 Degrees F D86	80.9	Volume Percent	MM	6/15/06
48	Aromatics in Gasoline MSD D5769	27.43	Volume Percent	TW	6/20/06
49	Olefins in by FIA D1319	10.4	Volume Percent	RCG	8/14/06
64	Benzene in Gasoline D3606	1.37	Volume Percent	TW	6/14/06
532	Ethanol by D5599	0.00	Volume Percent	TS	6/16/06
55	MTBE by D5599	0.00	Volume Percent	TS	6/16/06
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent	TS	6/16/06
59	Weight Percent Oxygen by D5599	0.00	Weight Percent	TS	6/16/06
57	TAME by D5599	0.00	Volume Percent	TS	6/16/06
56	ETBE by D5599	0.00	Volume Percent	TS	6/16/06
63	Benzene in Gasoline by GC/MSD D5769	1.39	Volume Percent	TW	6/20/06
46	Aromatics by FIA D1319	28.4	Volume Percent	RCG	8/14/06
630	Toluene in gasoline by MSD D5769	6.2	Volumn Percent	TW	6/20/06
69	Specific Gravity @ 60 deg F D4052	0.7465	60/60F	MM	6/14/06
69	Specific Gravity @ 60 deg F D4052	0.74655	60/60F	MM	6/14/06
692	Degrees API D4052	58.04	Degrees API	MM	6/14/06
692	Degrees API D4052	58.05	Degrees API	MM	6/14/06
691	Density @ 60 deg F D4052	0.74577	g/cm-03 @ 60 deg F	MM	6/14/06
691	Density @ 60 deg F D4052	0.74581	g/cm-03 @ 60 deg F	MM	6/14/06
101	Initial Boiling Point D86	96.2	Degrees F	MM	6/15/06
110	10 Percent D86	134.8	Degrees F	MM	6/15/06
150	50 Percent D86	215.8	Degrees F	MM	6/15/06
190	90 Percent D86	336.1	Degrees F	MM	6/15/06
200	End Point D86	420.6	Degrees F	MM	6/15/06
201	Residue D86	1	mL	MM	6/15/06
202	Total Recovery D86	97.9	mL	MM	6/15/06

203	Loss	D86	1.1	mL	MM	6/15/06
543	Methanol	by D5599	0.00	Volume Percent	TS	6/16/06
584	Isopropanol	by D5599	0.00	Volume Percent	TS	6/16/06
585	t-Butanol	by D5599	0.00	Volume Percent	TS	6/16/06
586	n-Propanol	by D5599	0.00	Volume Percent	TS	6/16/06
587	sec-Butanol	by D5599	0.00	Volume Percent	TS	6/16/06
588	DIPE	by D5599	0.00	Volume Percent	TS	6/16/06
589	Isobutanol	by D5599	0.00	Volume Percent	TS	6/16/06
5801	t-Amyl Alcohol	by D5599	0.00	Volume Percent	TS	6/16/06
5802	n-Butanol	by D5599	0.00	Volume Percent	TS	6/16/06

NVFEL Fuel Analysis Report

Batch#

Kansas City Samples

Facility Name: ERG Facility Type: In House
Owner: EPA Phone: (913) 299-9480
6636 Berger Avenue

U.S.

Samples Type: Correlation
VOC
Inspection information logged in by MM on 6/13/06.
Season: Winter

Kansas City Samples-JUP4TR(Mo) **FTAG: 14597** **Comments:** **32; 7-21-04**

Fuel_ Code: 21

Test Code	Test Method	Results	Units	Analys	Analysis Date
552	MTBE by D5599	0.00	Oxy Percent	TS	6/16/06
562	ETBE by D5599	0.00	Oxy Percent	TS	6/16/06
534	Ethanol by D5599	0.00	Oxy Percent	TS	6/16/06
572	TAME by D5599	0.00	Oxy Percent	TS	6/16/06
421	Sulfur in Gasoline D2622	114	Parts Per Million	NST	6/20/06
62	Vapor Pressure by D5191 (Modified)	6.14	PS I	MM	6/14/06
65	Percent Evaporated at 200 Degrees F D86	36.8	Volume Percent	MM	6/15/06
66	Percent Evaporated at 300 Degrees F D86	75.3	Volume Percent	MM	6/15/06
48	Aromatics in Gasoline MSD D5769	36.93	Volume Percent	TW	6/20/06
49	Olefins in by FIA D1319	10.2	Volume Percent	RCG	8/14/06
49	Olefins in by FIA D1319	9.9	Volume Percent	RCG	8/14/06
64	Benzene in Gasoline D3606	2.44	Volume Percent	TW	6/14/06
532	Ethanol by D5599	0.00	Volume Percent	TS	6/16/06
55	MTBE by D5599	0.00	Volume Percent	TS	6/16/06
59	Weight Percent Oxygen by D5599	0.00	Weight Percent	TS	6/16/06
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent	TS	6/16/06
57	TAME by D5599	0.00	Volume Percent	TS	6/16/06
56	ETBE by D5599	0.00	Volume Percent	TS	6/16/06
46	Aromatics by FIA D1319	35.8	Volume Percent	RCG	8/14/06
46	Aromatics by FIA D1319	36.8	Volume Percent	RCG	8/14/06
630	Toluene in gasoline by MSD D5769	9.93	Volumn Percent	TW	6/20/06
63	Benzene in Gasoline by GC/MSD D5769	2.47	Volume Percent	TW	6/20/06
69	Specific Gravity @ 60 deg F D4052	0.76624	60/60F	MM	6/14/06
69	Specific Gravity @ 60 deg F D4052	0.7663	60/60F	MM	6/14/06
692	Degrees API D4052	53.15	Degrees API	MM	6/14/06
692	Degrees API D4052	53.17	Degrees API	MM	6/14/06
691	Density @ 60 deg F D4052	0.76549	g/cm-03 @ 60 deg F	MM	6/14/06
691	Density @ 60 deg F D4052	0.76554	g/cm-03 @ 60 deg F	MM	6/14/06
101	Initial Boiling Point D86	103.6	Degrees F	MM	6/15/06
110	10 Percent D86	147.5	Degrees F	MM	6/15/06
150	50 Percent D86	228.4	Degrees F	MM	6/15/06
190	90 Percent D86	350.5	Degrees F	MM	6/15/06
200	End Point D86	419.4	Degrees F	MM	6/15/06

NVFEL Fuel Analysis Report

201	Residue	D86	0.9 mL	MM	6/15/06
202	Total Recovery	D86	98.2 mL	MM	6/15/06
203	Loss	D86	0.9 mL	MM	6/15/06
543	Methanol	by D5599	0.00 Volume Percent	TS	6/16/06
584	Isopropanol	by D5599	0.00 Volume Percent	TS	6/16/06
585	t-Butanol	by D5599	0.00 Volume Percent	TS	6/16/06
586	n-Propanol	by D5599	0.00 Volume Percent	TS	6/16/06
587	sec-Butanol	by D5599	0.00 Volume Percent	TS	6/16/06
588	DIPE	by D5599	0.00 Volume Percent	TS	6/16/06
589	Isobutanol	by D5599	0.00 Volume Percent	TS	6/16/06
5801	t-Amyl Alcohol	by D5599	0.00 Volume Percent	TS	6/16/06
5802	n-Butanol	by D5599	0.00 Volume Percent	TS	6/16/06

NVFEL Fuel Analysis Report

14598

Batch#

Kansas City Samples

Facility Name: ERG Facility Type: In House

Owner: EPA Phone: (913) 299-9480

6636 Berger Avenue

U.S.

Samples Type: Correlation

VOC

Inspection information logged in by MM on 6/13/06.

Season: Winter

Kansas City Samples-670DEB(Mo) **FTAG: 14598** **Comments:** **64; 7-27-04**

Test Code	Test Method	Results	Units	Fuel_ Code: 21	Analys	Analysis Date
552	MTBE by D5599	0.00	Oxy Percent		TS	6/16/06
562	ETBE by D5599	0.00	Oxy Percent		TS	6/16/06
534	Ethanol by D5599	0.00	Oxy Percent		TS	6/16/06
572	TAME by D5599	0.00	Oxy Percent		TS	6/16/06
421	Sulfur in Gasoline D2622	102	Parts Per Million		NST	6/20/06
62	Vapor Pressure by D5191 (Modified)	6.54	PS I		MM	6/14/06
65	Percent Evaporated at 200 Degrees F D86	38.2	Volume Percent		MM	6/15/06
66	Percent Evaporated at 300 Degrees F D86	79.5	Volume Percent		MM	6/15/06
48	Aromatics in Gasoline MSD D5769	29.11	Volume Percent		TW	6/20/06
49	Olefins in by FIA D1319	10.3	Volume Percent		RCG	8/14/06
64	Benzene in Gasoline D3606	1.41	Volume Percent		TW	6/14/06
532	Ethanol by D5599	0.00	Volume Percent		TS	6/16/06
55	MTBE by D5599	0.00	Volume Percent		TS	6/16/06
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent		TS	6/16/06
59	Weight Percent Oxygen by D5599	0.00	Weight Percent		TS	6/16/06
57	TAME by D5599	0.00	Volume Percent		TS	6/16/06
56	ETBE by D5599	0.00	Volume Percent		TS	6/16/06
63	Benzene in Gasoline by GC/MSD D5769	1.44	Volume Percent		TW	6/20/06
46	Aromatics by FIA D1319	29.5	Volume Percent		RCG	8/14/06
630	Toluene in gasoline by MSD D5769	6.25	Volumn Percent		TW	6/20/06
69	Specific Gravity @ 60 deg F D4052	0.75185	60/60F		MM	6/14/06
69	Specific Gravity @ 60 deg F D4052	0.7519	60/60F		MM	6/14/06
692	Degrees API D4052	56.69	Degrees API		MM	6/14/06
692	Degrees API D4052	56.7	Degrees API		MM	6/14/06
691	Density @ 60 deg F D4052	0.75111	g/cm-03 @ 60 deg F		MM	6/14/06
691	Density @ 60 deg F D4052	0.75116	g/cm-03 @ 60 deg F		MM	6/14/06
101	Initial Boiling Point D86	101.5	Degrees F		MM	6/15/06
110	10 Percent D86	144.8	Degrees F		MM	6/15/06
150	50 Percent D86	224.5	Degrees F		MM	6/15/06
190	90 Percent D86	340.3	Degrees F		MM	6/15/06
200	End Point D86	434.1	Degrees F		MM	6/15/06
201	Residue D86	1	mL		MM	6/15/06
202	Total Recovery D86	98	mL		MM	6/15/06

203	Loss	D86	1 mL		MM	6/15/06
543	Methanol	by D5599	0.00	Volume Percent	TS	6/16/06
584	Isopropanol	by D5599	0.00	Volume Percent	TS	6/16/06
585	t-Butanol	by D5599	0.00	Volume Percent	TS	6/16/06
586	n-Propanol	by D5599	0.00	Volume Percent	TS	6/16/06
587	sec-Butanol	by D5599	0.00	Volume Percent	TS	6/16/06
588	DIPE	by D5599	0.00	Volume Percent	TS	6/16/06
589	Isobutanol	by D5599	0.00	Volume Percent	TS	6/16/06
5801	t-Amyl Alcohol	by D5599	0.00	Volume Percent	TS	6/16/06
5802	n-Butanol	by D5599	0.00	Volume Percent	TS	6/16/06

NVFEL Fuel Analysis Report

14599

Kansas City Samples

Batch#

Facility Name: ERG Facility Type: In House

Owner: EPA Phone: (913) 299-9480

6636 Berger Avenue

U.S.

Samples Type: Correlation

VOC

Inspection information logged in by MM on 6/13/06.

Season: Winter

Kansas City Samples-275SWL(Mo) **FTAG: 14599** **Comments:** **69; 7-28-04**

Test Code	Test Method	Results	Units	Fuel_ Code: 21	Analys	Analysis Date
552	MTBE by D5599	0.00	Oxy Percent		TS	6/16/06
562	ETBE by D5599	0.00	Oxy Percent		TS	6/16/06
534	Ethanol by D5599	0.00	Oxy Percent		TS	6/16/06
572	TAME by D5599	0.00	Oxy Percent		TS	6/16/06
421	Sulfur in Gasoline D2622	146	Parts Per Million		NST	6/20/06
62	Vapor Pressure by D5191 (Modified)	7.57	PS I		MM	6/14/06
65	Percent Evaporated at 200 Degrees F D86	43.5	Volume Percent		MM	6/15/06
66	Percent Evaporated at 300 Degrees F D86	82.7	Volume Percent		MM	6/15/06
48	Aromatics in Gasoline MSD D5769	29.93	Volume Percent		TW	6/20/06
49	Olefins in by FIA D1319	8.1	Volume Percent		RCG	8/14/06
64	Benzene in Gasoline D3606	1.62	Volume Percent		TW	6/14/06
532	Ethanol by D5599	0.00	Volume Percent		TS	6/16/06
55	MTBE by D5599	0.00	Volume Percent		TS	6/16/06
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent		TS	6/16/06
59	Weight Percent Oxygen by D5599	0.00	Weight Percent		TS	6/16/06
57	TAME by D5599	0.00	Volume Percent		TS	6/16/06
56	ETBE by D5599	0.00	Volume Percent		TS	6/16/06
63	Benzene in Gasoline by GC/MSD D5769	1.66	Volume Percent		TW	6/20/06
46	Aromatics by FIA D1319	29.7	Volume Percent		RCG	8/14/06
630	Toluene in gasoline by MSD D5769	6.86	Volumn Percent		TW	6/20/06
69	Specific Gravity @ 60 deg F D4052	0.74651	60/60F		MM	6/14/06
69	Specific Gravity @ 60 deg F D4052	0.74653	60/60F		MM	6/14/06
692	Degrees API D4052	58.04	Degrees API		MM	6/14/06
692	Degrees API D4052	58.05	Degrees API		MM	6/14/06
691	Density @ 60 deg F D4052	0.74577	g/cm-03 @ 60 deg F		MM	6/14/06
691	Density @ 60 deg F D4052	0.7458	g/cm-03 @ 60 deg F		MM	6/14/06
101	Initial Boiling Point D86	97	Degrees F		MM	6/15/06
110	10 Percent D86	135.3	Degrees F		MM	6/15/06
150	50 Percent D86	214.8	Degrees F		MM	6/15/06
190	90 Percent D86	327.7	Degrees F		MM	6/15/06
200	End Point D86	420	Degrees F		MM	6/15/06
201	Residue D86	1.2	mL		MM	6/15/06
202	Total Recovery D86	97.89999	mL		MM	6/15/06

203	Loss	D86	0.9 mL	MM	6/15/06
543	Methanol	by D5599	0.00 Volume Percent	TS	6/16/06
584	Isopropanol	by D5599	0.00 Volume Percent	TS	6/16/06
585	t-Butanol	by D5599	0.00 Volume Percent	TS	6/16/06
586	n-Propanol	by D5599	0.00 Volume Percent	TS	6/16/06
587	sec-Butanol	by D5599	0.00 Volume Percent	TS	6/16/06
588	DIPE	by D5599	0.00 Volume Percent	TS	6/16/06
589	Isobutanol	by D5599	0.00 Volume Percent	TS	6/16/06
5801	t-Amyl Alcohol	by D5599	0.00 Volume Percent	TS	6/16/06
5802	n-Butanol	by D5599	0.00 Volume Percent	TS	6/16/06

NVFEL Fuel Analysis Report

14600

Batch#

Kansas City Samples

Facility Name: ERG Facility Type: In House

Owner: EPA Phone: (913) 299-9480

6636 Berger Avenue

U.S.

Samples Type: Correlation

VOC

Inspection information logged in by MM on 6/13/06.

Season: Winter

Kansas City Samples-977WEZ(Mo) **FTAG: 14600** **Comments:** **105; 8/4/06**

Fuel_ Code: 21

Test Code	Test Method	Results	Units	Analys	Analysis Date
552	MTBE by D5599	0.00	Oxy Percent	TS	6/16/06
562	ETBE by D5599	0.00	Oxy Percent	TS	6/16/06
534	Ethanol by D5599	0.00	Oxy Percent	TS	6/16/06
572	TAME by D5599	0.00	Oxy Percent	TS	6/16/06
421	Sulfur in Gasoline D2622	102	Parts Per Million	NST	6/20/06
62	Vapor Pressure by D5191 (Modified)	6.35	PS I	MM	6/14/06
65	Percent Evaporated at 200 Degrees F D86	37.1	Volume Percent	MM	6/15/06
66	Percent Evaporated at 300 Degrees F D86	81	Volume Percent	MM	6/15/06
48	Aromatics in Gasoline MSD D5769	36.48	Volume Percent	TW	6/21/06
49	Olefins in by FIA D1319	6.8	Volume Percent	RCG	8/14/06
64	Benzene in Gasoline D3606	2.14	Volume Percent	TW	6/14/06
532	Ethanol by D5599	0.00	Volume Percent	TS	6/16/06
55	MTBE by D5599	0.00	Volume Percent	TS	6/16/06
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent	TS	6/16/06
59	Weight Percent Oxygen by D5599	0.00	Weight Percent	TS	6/16/06
57	TAME by D5599	0.00	Volume Percent	TS	6/16/06
56	ETBE by D5599	0.00	Volume Percent	TS	6/16/06
63	Benzene in Gasoline by GC/MSD D5769	2.11	Volume Percent	TW	6/21/06
46	Aromatics by FIA D1319	35.7	Volume Percent	RCG	8/14/06
630	Toluene in gasoline by MSD D5769	8.45	Volumn Percent	TW	6/21/06
69	Specific Gravity @ 60 deg F D4052	0.75991	60/60F	MM	6/14/06
69	Specific Gravity @ 60 deg F D4052	0.76	60/60F	MM	6/14/06
692	Degrees API D4052	54.69	Degrees API	MM	6/14/06
692	Degrees API D4052	54.71	Degrees API	MM	6/14/06
691	Density @ 60 deg F D4052	0.75916	g/cm-03 @ 60 deg F	MM	6/14/06
691	Density @ 60 deg F D4052	0.75924	g/cm-03 @ 60 deg F	MM	6/14/06
101	Initial Boiling Point D86	101.8	Degrees F	MM	6/15/06
110	10 Percent D86	147.4	Degrees F	MM	6/15/06
150	50 Percent D86	226.6	Degrees F	MM	6/15/06
190	90 Percent D86	327.7	Degrees F	MM	6/15/06
200	End Point D86	411.9	Degrees F	MM	6/15/06
201	Residue D86	1.2	mL	MM	6/15/06
202	Total Recovery D86	98	mL	MM	6/15/06

203	Loss	D86	0.8	mL	MM	6/15/06
543	Methanol	by D5599	0.00	Volume Percent	TS	6/16/06
584	Isopropanol	by D5599	0.00	Volume Percent	TS	6/16/06
585	t-Butanol	by D5599	0.00	Volume Percent	TS	6/16/06
586	n-Propanol	by D5599	0.00	Volume Percent	TS	6/16/06
587	sec-Butanol	by D5599	0.00	Volume Percent	TS	6/16/06
588	DIPE	by D5599	0.00	Volume Percent	TS	6/16/06
589	Isobutanol	by D5599	0.00	Volume Percent	TS	6/16/06
5801	t-Amyl Alcohol	by D5599	0.00	Volume Percent	TS	6/16/06
5802	n-Butanol	by D5599	0.00	Volume Percent	TS	6/16/06

NVFEL Fuel Analysis Report

14607

Kansas City Samples

Batch#

Facility Name: ERG Facility Type: In House

Owner: EPA Phone: (913) 299-9480

6636 Berger Avenue

U.S.

Samples Type: Correlation

VOC

Inspection information logged in by MM on 6/13/2006.

Season: Winter

Kansas City Samples-078RC3(Mo) **FTAG: 14607** **Comments:** **840; 3-17-05**

Test Code	Test Method	Results	Units	Fuel_ Code: 21	Analyst	Analysis Date
552	MTBE by D5599	0.00	Oxy Percent		TS	6/19/2006
562	ETBE by D5599	0.00	Oxy Percent		TS	6/19/2006
534	Ethanol by D5599	0.00	Oxy Percent		TS	6/19/2006
572	TAME by D5599	0.00	Oxy Percent		TS	6/19/2006
421	Sulfur in Gasoline D2622	146	Parts Per Million		NST	6/20/2006
62	Vapor Pressure by D5191 (Modified)	10.95	PS I		MM	6/14/2006
65	Percent Evaporated at 200 Degrees F D86	49.5	Volume Percent		MM	6/16/2006
66	Percent Evaporated at 300 Degrees F D86	82	Volume Percent		MM	6/16/2006
48	Aromatics in Gasoline MSD D5769	25.63	Volume Percent		TW	6/21/2006
49	Olefins in by FIA D1319	11.8	Volume Percent		RCG	8/16/2006
49	Olefins in by FIA D1319	12.3	Volume Percent		RCG	8/16/2006
64	Benzene in Gasoline D3606	1.02	Volume Percent		TW	6/19/2006
59	Weight Percent Oxygen by D5599	0.00	Weight Percent		TS	6/19/2006
55	MTBE by D5599	0.00	Volume Percent		TS	6/19/2006
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent		TS	6/19/2006
57	TAME by D5599	0.00	Volume Percent		TS	6/19/2006
532	Ethanol by D5599	0.00	Volume Percent		TS	6/19/2006
56	ETBE by D5599	0.00	Volume Percent		TS	6/19/2006
63	Benzene in Gasoline by GC/MSD D5769	1	Volume Percent		TW	6/21/2006
630	Toluene in gasoline by MSD D5769	5.14	Volumn Percent		TW	6/21/2006
46	Aromatics by FIA D1319	22.8	Volume Percent		RCG	8/16/2006
46	Aromatics by FIA D1319	23.8	Volume Percent		RCG	8/16/2006
69	Specific Gravity @ 60 deg F D4052	0.73568	60/60F		MM	6/14/2006
69	Specific Gravity @ 60 deg F D4052	0.73567	60/60F		MM	6/14/2006
692	Degrees API D4052	60.84	Degrees API		MM	6/14/2006
692	Degrees API D4052	60.84	Degrees API		MM	6/14/2006
691	Density @ 60 deg F D4052	0.73495	g/cm-03 @ 60 deg F		MM	6/14/2006
691	Density @ 60 deg F D4052	0.73496	g/cm-03 @ 60 deg F		MM	6/14/2006
101	Initial Boiling Point D86	85.6	Degrees F		MM	6/16/2006
110	10 Percent D86	113.7	Degrees F		MM	6/16/2006
150	50 Percent D86	201.3	Degrees F		MM	6/16/2006
190	90 Percent D86	335.1	Degrees F		MM	6/16/2006
200	End Point D86	411.9	Degrees F		MM	6/16/2006

201	Residue	D86	1.1 mL	MM	6/16/2006
202	Total Recovery	D86	97.5 mL	MM	6/16/2006
203	Loss	D86	1.4 mL	MM	6/16/2006
543	Methanol	by D5599	0.00 Volume Percent	TS	6/19/2006
584	Isopropanol	by D5599	0.00 Volume Percent	TS	6/19/2006
585	t-Butanol	by D5599	0.00 Volume Percent	TS	6/19/2006
586	n-Propanol	by D5599	0.00 Volume Percent	TS	6/19/2006
587	sec-Butanol	by D5599	0.00 Volume Percent	TS	6/19/2006
588	DIPE	by D5599	0.00 Volume Percent	TS	6/19/2006
589	Isobutanol	by D5599	0.00 Volume Percent	TS	6/19/2006
5801	t-Amyl Alcohol	by D5599	0.00 Volume Percent	TS	6/19/2006
5802	n-Butanol	by D5599	0.00 Volume Percent	TS	6/19/2006

NVFEL Fuel Analysis Report

14608

Kansas City Samples

Batch#

Facility Name: ERG   Facility Type: In House

Owner: EPA   Phone: (913) 299-9480

6636 Berger Avenue

U.S.

Samples Type: Correlation

VOC

Inspection information logged in by MM on 6/13/2006.

Season: Winter

Kansas City Samples-837CZ2(Mo)   **FTAG: 14608**   **Comments:**   **858; 3-19-05**

Fuel_ Code: 21

Test Code	Test Method	Results	Units	Analyst	Analysis Date
552	MTBE by D5599	0.00	Oxy Percent	TS	6/19/2006
562	ETBE by D5599	0.00	Oxy Percent	TS	6/19/2006
534	Ethanol by D5599	0.00	Oxy Percent	TS	6/19/2006
572	TAME by D5599	0.00	Oxy Percent	TS	6/19/2006
421	Sulfur in Gasoline D2622	178	Parts Per Million	NST	6/20/2006
62	Vapor Pressure by D5191 (Modified)	11.02	PS I	MM	6/14/2006
65	Percent Evaporated at 200 Degrees F D86	48	Volume Percent	MM	6/16/2006
66	Percent Evaporated at 300 Degrees F D86	81.7	Volume Percent	MM	6/16/2006
48	Aromatics in Gasoline MSD D5769	24.27	Volume Percent	TW	6/21/2006
49	Olefins in by FIA D1319	12.5	Volume Percent	RCG	8/16/2006
64	Benzene in Gasoline D3606	1.00	Volume Percent	TW	6/19/2006
57	TAME by D5599	0.00	Volume Percent	TS	6/19/2006
532	Ethanol by D5599	0.00	Volume Percent	TS	6/19/2006
59	Weight Percent Oxygen by D5599	0.00	Weight Percent	TS	6/19/2006
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent	TS	6/19/2006
55	MTBE by D5599	0.00	Volume Percent	TS	6/19/2006
56	ETBE by D5599	0.00	Volume Percent	TS	6/19/2006
630	Toluene in gasoline by MSD D5769	4.82	Volumn Percent	TW	6/21/2006
46	Aromatics by FIA D1319	22.5	Volume Percent	RCG	8/16/2006
63	Benzene in Gasoline by GC/MSD D5769	0.99	Volume Percent	TW	6/21/2006
69	Specific Gravity @ 60 deg F D4052	0.73465	60/60F	MM	6/14/2006
69	Specific Gravity @ 60 deg F D4052	0.7347	60/60F	MM	6/14/2006
692	Degrees API D4052	61.11	Degrees API	MM	6/14/2006
692	Degrees API D4052	61.1	Degrees API	MM	6/14/2006
691	Density @ 60 deg F D4052	0.73397	g/cm-03 @ 60 deg F	MM	6/14/2006
691	Density @ 60 deg F D4052	0.73393	g/cm-03 @ 60 deg F	MM	6/14/2006
101	Initial Boiling Point D86	85.8	Degrees F	MM	6/16/2006
110	10 Percent D86	114.4	Degrees F	MM	6/16/2006
150	50 Percent D86	205.3	Degrees F	MM	6/16/2006
190	90 Percent D86	335.1	Degrees F	MM	6/16/2006
200	End Point D86	420.3	Degrees F	MM	6/16/2006
201	Residue D86	1.1	mL	MM	6/16/2006
202	Total Recovery D86	97.7	mL	MM	6/16/2006

203	Loss	D86	1.2 mL	MM	6/16/2006
543	Methanol	by D5599	0.00 Volume Percent	TS	6/19/2006
584	Isopropanol	by D5599	0.00 Volume Percent	TS	6/19/2006
585	t-Butanol	by D5599	0.00 Volume Percent	TS	6/19/2006
586	n-Propanol	by D5599	0.00 Volume Percent	TS	6/19/2006
587	sec-Butanol	by D5599	0.00 Volume Percent	TS	6/19/2006
588	DIPE	by D5599	0.00 Volume Percent	TS	6/19/2006
589	Isobutanol	by D5599	0.00 Volume Percent	TS	6/19/2006
5801	t-Amyl Alcohol	by D5599	0.00 Volume Percent	TS	6/19/2006
5802	n-Butanol	by D5599	0.00 Volume Percent	TS	6/19/2006

NVFEL Fuel Analysis Report

14609

Kansas City Samples

Batch#

Facility Name: ERG Facility Type: In House

Owner: EPA Phone: (913) 299-9480

6636 Berger Avenue

U.S.

Samples Type: Correlation

VOC

Inspection information logged in by MM on 6/13/2006.

Season: Winter

Kansas City Samples-QQF730(Ks) **FTAG: 14609** **Comments:** **875; 3-22-05**

Test Code	Test Method	Results	Units	Fuel_ Code: 21	Analyst	Analysis Date
552	MTBE by D5599	0.00	Oxy Percent		TS	6/19/2006
562	ETBE by D5599	0.00	Oxy Percent		TS	6/19/2006
534	Ethanol by D5599	0.00	Oxy Percent		TS	6/19/2006
572	TAME by D5599	0.00	Oxy Percent		TS	6/19/2006
421	Sulfur in Gasoline D2622	247	Parts Per Million		NST	6/20/2006
62	Vapor Pressure by D5191 (Modified)	12.4	PS I		MM	6/14/2006
65	Percent Evaporated at 200 Degrees F D86	49.1	Volume Percent		MM	6/16/2006
66	Percent Evaporated at 300 Degrees F D86	84.7	Volume Percent		MM	6/16/2006
48	Aromatics in Gasoline MSD D5769	24.18	Volume Percent		TW	6/21/2006
49	Olefins in by FIA D1319	10.5	Volume Percent		RCG	8/16/2006
64	Benzene in Gasoline D3606	1.34	Volume Percent		TW	6/19/2006
57	TAME by D5599	0.00	Volume Percent		TS	6/19/2006
532	Ethanol by D5599	0.00	Volume Percent		TS	6/19/2006
59	Weight Percent Oxygen by D5599	0.00	Weight Percent		TS	6/19/2006
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent		TS	6/19/2006
55	MTBE by D5599	0.00	Volume Percent		TS	6/19/2006
56	ETBE by D5599	0.00	Volume Percent		TS	6/19/2006
630	Toluene in gasoline by MSD D5769	5.56	Volumn Percent		TW	6/21/2006
46	Aromatics by FIA D1319	21.6	Volume Percent		RCG	8/16/2006
63	Benzene in Gasoline by GC/MSD D5769	1.32	Volume Percent		TW	6/21/2006
69	Specific Gravity @ 60 deg F D4052	0.73019	60/60F		MM	6/14/2006
69	Specific Gravity @ 60 deg F D4052	0.7302	60/60F		MM	6/14/2006
692	Degrees API D4052	62.29	Degrees API		MM	6/14/2006
692	Degrees API D4052	62.28	Degrees API		MM	6/14/2006
691	Density @ 60 deg F D4052	0.72948	g/cm-03 @ 60 deg F		MM	6/14/2006
691	Density @ 60 deg F D4052	0.72947	g/cm-03 @ 60 deg F		MM	6/14/2006
101	Initial Boiling Point D86	83.8	Degrees F		MM	6/16/2006
110	10 Percent D86	108.4	Degrees F		MM	6/16/2006
150	50 Percent D86	202.4	Degrees F		MM	6/16/2006
190	90 Percent D86	322.1	Degrees F		MM	6/16/2006
200	End Point D86	401	Degrees F		MM	6/16/2006
201	Residue D86	1.2	mL		MM	6/16/2006
202	Total Recovery D86	97.4	mL		MM	6/16/2006

203	Loss	D86	1.4	mL	MM	6/16/2006
543	Methanol	by D5599	0.00	Volume Percent	TS	6/19/2006
584	Isopropanol	by D5599	0.00	Volume Percent	TS	6/19/2006
585	t-Butanol	by D5599	0.00	Volume Percent	TS	6/19/2006
586	n-Propanol	by D5599	0.00	Volume Percent	TS	6/19/2006
587	sec-Butanol	by D5599	0.00	Volume Percent	TS	6/19/2006
588	DIPE	by D5599	0.00	Volume Percent	TS	6/19/2006
589	Isobutanol	by D5599	0.00	Volume Percent	TS	6/19/2006
5801	t-Amyl Alcohol	by D5599	0.00	Volume Percent	TS	6/19/2006
5802	n-Butanol	by D5599	0.00	Volume Percent	TS	6/19/2006

NVFEL Fuel Analysis Report

14610

Kansas City Samples

Batch#

Facility Name: ERG Facility Type: In House
Owner: EPA Phone: (913) 299-9480
6636 Berger Avenue

U.S.

Samples Type: Correlation

VOC

Inspection information logged in by MM on 6/13/2006.

Season: Winter

Kansas City Samples-446HJ2(Mo) **FTAG: 14610** **Comments:** **881; 3-23-05**

Fuel_ Code: 21

Test Code	Test Method	Results	Units	Analyst	Analysis Date
552	MTBE by D5599	0.00	Oxy Percent	TS	6/19/2006
562	ETBE by D5599	0.00	Oxy Percent	TS	6/19/2006
534	Ethanol by D5599	0.00	Oxy Percent	TS	6/19/2006
572	TAME by D5599	0.00	Oxy Percent	TS	6/19/2006
421	Sulfur in Gasoline D2622	170	Parts Per Million	NST	6/20/2006
62	Vapor Pressure by D5191 (Modified)	12.18	PS I	MM	6/14/2006
65	Percent Evaporated at 200 Degrees F D86	52.8	Volume Percent	MM	6/16/2006
65	Percent Evaporated at 200 Degrees F D86	52.8	Volume Percent	MM	6/16/2006
66	Percent Evaporated at 300 Degrees F D86	83.5	Volume Percent	MM	6/16/2006
66	Percent Evaporated at 300 Degrees F D86	83.8	Volume Percent	MM	6/16/2006
48	Aromatics in Gasoline MSD D5769	23.03	Volume Percent	TW	6/21/2006
49	Olefins in by FIA D1319	10.3	Volume Percent	RCG	8/16/2006
64	Benzene in Gasoline D3606	1.12	Volume Percent	TW	6/19/2006
64	Benzene in Gasoline D3606	1.12	Volume Percent	TW	6/19/2006
55	MTBE by D5599	0.00	Volume Percent	TS	6/19/2006
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent	TS	6/19/2006
59	Weight Percent Oxygen by D5599	0.00	Weight Percent	TS	6/19/2006
532	Ethanol by D5599	0.00	Volume Percent	TS	6/19/2006
57	TAME by D5599	0.00	Volume Percent	TS	6/19/2006
56	ETBE by D5599	0.00	Volume Percent	TS	6/19/2006
630	Toluene in gasoline by MSD D5769	4.89	Volumn Percent	TW	6/21/2006
63	Benzene in Gasoline by GC/MSD D5769	1.11	Volume Percent	TW	6/21/2006
46	Aromatics by FIA D1319	21.5	Volume Percent	RCG	8/16/2006
69	Specific Gravity @ 60 deg F D4052	0.72908	60/60F	MM	6/14/2006
69	Specific Gravity @ 60 deg F D4052	0.72915	60/60F	MM	6/14/2006
692	Degrees API D4052	62.58	Degrees API	MM	6/14/2006
692	Degrees API D4052	62.56	Degrees API	MM	6/14/2006
691	Density @ 60 deg F D4052	0.72843	g/cm-03 @ 60 deg F	MM	6/14/2006
691	Density @ 60 deg F D4052	0.72836	g/cm-03 @ 60 deg F	MM	6/14/2006
101	Initial Boiling Point D86	84.4	Degrees F	MM	6/16/2006
101	Initial Boiling Point D86	84.4	Degrees F	MM	6/16/2006
110	10 Percent D86	107.2	Degrees F	MM	6/16/2006
110	10 Percent D86	107.8	Degrees F	MM	6/16/2006

NVFEL Fuel Analysis Report

150	50 Percent	D86	192.1	Degrees F	MM	6/16/2006
150	50 Percent	D86	192.5	Degrees F	MM	6/16/2006
190	90 Percent	D86	329.8	Degrees F	MM	6/16/2006
190	90 Percent	D86	332	Degrees F	MM	6/16/2006
200	End Point	D86	419.8	Degrees F	MM	6/16/2006
200	End Point	D86	420.1	Degrees F	MM	6/16/2006
201	Residue	D86	1.1	mL	MM	6/16/2006
201	Residue	D86	1.1	mL	MM	6/16/2006
202	Total Recovery	D86	97.3	mL	MM	6/16/2006
202	Total Recovery	D86	97.60001	mL	MM	6/16/2006
203	Loss	D86	1.6	mL	MM	6/16/2006
203	Loss	D86	1.3	mL	MM	6/16/2006
543	Methanol	by D5599	0.00	Volume Percent	TS	6/19/2006
584	Isopropanol	by D5599	0.00	Volume Percent	TS	6/19/2006
585	t-Butanol	by D5599	0.00	Volume Percent	TS	6/19/2006
586	n-Propanol	by D5599	0.00	Volume Percent	TS	6/19/2006
587	sec-Butanol	by D5599	0.00	Volume Percent	TS	6/19/2006
588	DIPE	by D5599	0.00	Volume Percent	TS	6/19/2006
589	Isobutanol	by D5599	0.00	Volume Percent	TS	6/19/2006
5801	t-Amyl Alcohol	by D5599	0.00	Volume Percent	TS	6/19/2006
5802	n-Butanol	by D5599	0.00	Volume Percent	TS	6/19/2006

NVFEL Fuel Analysis Report

14611

Kansas City Samples

Batch#

Facility Name: ERG Facility Type: In House

Owner: EPA Phone: (913) 299-9480

6636 Berger Avenue

U.S.

Samples Type: Correlation

VOC

Inspection information logged in by MM on 6/13/2006.

Season: Winter

Kansas City Samples-144RBJ(Mo) **FTAG: 14611** **Comments:** **903; 3-26-05**

Test Code	Test Method	Results	Units	Fuel_ Code: 21	Analyst	Analysis Date
552	MTBE by D5599	0.00	Oxy Percent		TS	6/19/2006
562	ETBE by D5599	0.00	Oxy Percent		TS	6/19/2006
534	Ethanol by D5599	0.00	Oxy Percent		TS	6/19/2006
572	TAME by D5599	0.00	Oxy Percent		TS	6/19/2006
421	Sulfur in Gasoline D2622	115	Parts Per Million		NST	6/20/2006
62	Vapor Pressure by D5191 (Modified)	11.6	PS I		MM	6/14/2006
65	Percent Evaporated at 200 Degrees F D86	50.9	Volume Percent		MM	6/16/2006
66	Percent Evaporated at 300 Degrees F D86	84.2	Volume Percent		MM	6/16/2006
48	Aromatics in Gasoline MSD D5769	23.94	Volume Percent		TW	6/22/2006
49	Olefins in by FIA D1319	10.8	Volume Percent		RCG	8/16/2006
64	Benzene in Gasoline D3606	1.12	Volume Percent		TW	6/19/2006
57	TAME by D5599	0.00	Volume Percent		TS	6/19/2006
532	Ethanol by D5599	0.00	Volume Percent		TS	6/19/2006
59	Weight Percent Oxygen by D5599	0.00	Weight Percent		TS	6/19/2006
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent		TS	6/19/2006
55	MTBE by D5599	0.00	Volume Percent		TS	6/19/2006
56	ETBE by D5599	0.00	Volume Percent		TS	6/19/2006
630	Toluene in gasoline by MSD D5769	5.5	Volumn Percent		TW	6/22/2006
46	Aromatics by FIA D1319	22	Volume Percent		RCG	8/16/2006
63	Benzene in Gasoline by GC/MSD D5769	1.1	Volume Percent		TW	6/22/2006
69	Specific Gravity @ 60 deg F D4052	0.73093	60/60F		MM	6/14/2006
69	Specific Gravity @ 60 deg F D4052	0.73097	60/60F		MM	6/14/2006
692	Degrees API D4052	62.09	Degrees API		MM	6/14/2006
692	Degrees API D4052	62.08	Degrees API		MM	6/14/2006
691	Density @ 60 deg F D4052	0.73025	g/cm-03 @ 60 deg F		MM	6/14/2006
691	Density @ 60 deg F D4052	0.73021	g/cm-03 @ 60 deg F		MM	6/14/2006
101	Initial Boiling Point D86	85	Degrees F		MM	6/16/2006
110	10 Percent D86	111.4	Degrees F		MM	6/16/2006
150	50 Percent D86	197.6	Degrees F		MM	6/16/2006
190	90 Percent D86	328.7	Degrees F		MM	6/16/2006
200	End Point D86	413.1	Degrees F		MM	6/16/2006
201	Residue D86	1	mL		MM	6/16/2006
202	Total Recovery D86	97.7	mL		MM	6/16/2006

203	Loss	D86	1.3	mL	MM	6/16/2006
543	Methanol	by D5599	0.00	Volume Percent	TS	6/19/2006
584	Isopropanol	by D5599	0.00	Volume Percent	TS	6/19/2006
585	t-Butanol	by D5599	0.00	Volume Percent	TS	6/19/2006
586	n-Propanol	by D5599	0.00	Volume Percent	TS	6/19/2006
587	sec-Butanol	by D5599	0.00	Volume Percent	TS	6/19/2006
588	DIPE	by D5599	0.00	Volume Percent	TS	6/19/2006
589	Isobutanol	by D5599	0.00	Volume Percent	TS	6/19/2006
5801	t-Amyl Alcohol	by D5599	0.00	Volume Percent	TS	6/19/2006
5802	n-Butanol	by D5599	0.00	Volume Percent	TS	6/19/2006

NVFEL Fuel Analysis Report

14647

Batch#

Kansas City Samples

Facility Name: ERG Facility Type: In House
Owner: EPA Phone: (913) 299-9480
6636 Berger Avenue

U.S.

Samples Type: Correlation
Inspection information logged in by MM on 6/23/06.

VOC
Season: Winter

Kansas City Samples-722KFE(Ks) **FTAG: 14647** **Comments:** **94; 7-31-04; #2 Refuel**

Fuel_ Code: 21

Test Code	Test Method	Results	Units	Analys	Analysis Date
552	MTBE by D5599	0.00	Oxy Percent	TS	6/28/06
562	ETBE by D5599	0.00	Oxy Percent	TS	6/28/06
534	Ethanol by D5599	0.00	Oxy Percent	TS	6/28/06
572	TAME by D5599	0.00	Oxy Percent	TS	6/28/06
421	Sulfur in Gasoline D2622	169	Parts Per Million	NST	6/29/06
62	Vapor Pressure by D5191 (Modified)	6.56	PS I	NST	6/26/06
65	Percent Evaporated at 200 Degrees F D86	37.5	Volume Percent	MM	6/27/06
66	Percent Evaporated at 300 Degrees F D86	79.8	Volume Percent	MM	6/27/06
48	Aromatics in Gasoline MSD D5769	31.48	Volume Percent	TW	6/29/06
49	Olefins in by FIA D1319	9.9	Volume Percent	RCG	8/23/06
64	Benzene in Gasoline D3606	1.42	Volume Percent	TW	6/28/06
532	Ethanol by D5599	0.00	Volume Percent	TS	6/28/06
55	MTBE by D5599	0.00	Volume Percent	TS	6/28/06
57	TAME by D5599	0.00	Volume Percent	TS	6/28/06
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent	TS	6/28/06
59	Weight Percent Oxygen by D5599	0.00	Weight Percent	TS	6/28/06
56	ETBE by D5599	0.00	Volume Percent	TS	6/28/06
630	Toluene in gasoline by MSD D5769	6.65	Volumn Percent	TW	6/29/06
63	Benzene in Gasoline by GC/MSD D5769	1.4	Volume Percent	TW	6/29/06
46	Aromatics by FIA D1319	30.6	Volume Percent	RCG	8/23/06
69	Specific Gravity @ 60 deg F D4052	0.75623	60/60F	MM	6/27/06
69	Specific Gravity @ 60 deg F D4052	0.75618	60/60F	MM	6/27/06
692	Degrees API D4052	55.63	Degrees API	MM	6/27/06
692	Degrees API D4052	55.61	Degrees API	MM	6/27/06
691	Density @ 60 deg F D4052	0.75549	g/cm-03 @ 60 deg F	MM	6/27/06
691	Density @ 60 deg F D4052	0.75543	g/cm-03 @ 60 deg F	MM	6/27/06
101	Initial Boiling Point D86	97.7	Degrees F	MM	6/27/06
110	10 Percent D86	146.8	Degrees F	MM	6/27/06
150	50 Percent D86	225	Degrees F	MM	6/27/06
190	90 Percent D86	337.9	Degrees F	MM	6/27/06
200	End Point D86	433	Degrees F	MM	6/27/06
201	Residue D86	1	mL	MM	6/27/06
202	Total Recovery D86	98	mL	MM	6/27/06

203	Loss	D86	1 mL	MM	6/27/06
543	Methanol	by D5599	0.00 Volume Percent	TS	6/28/06
584	Isopropanol	by D5599	0.00 Volume Percent	TS	6/28/06
585	t-Butanol	by D5599	0.00 Volume Percent	TS	6/28/06
586	n-Propanol	by D5599	0.00 Volume Percent	TS	6/28/06
587	sec-Butanol	by D5599	0.00 Volume Percent	TS	6/28/06
588	DIPE	by D5599	0.00 Volume Percent	TS	6/28/06
589	Isobutanol	by D5599	0.00 Volume Percent	TS	6/28/06
5801	t-Amyl Alcohol	by D5599	0.00 Volume Percent	TS	6/28/06
5802	n-Butanol	by D5599	0.00 Volume Percent	TS	6/28/06

NVFEL Fuel Analysis Report

14648

Batch#

Kansas City Samples

Facility Name: ERG Facility Type: In House
Owner: EPA Phone: (913) 299-9480
6636 Berger Avenue

U.S.

Samples Type: Correlation

VOC

Inspection information logged in by MM on 6/23/06.

Season: Winter

Kansas City Samples- FTAG: 14648 Comments: 104; 8/14/04

Test Code	Test Method	Results	Units	Fuel_ Code: 21	Analys	Analysis Date
552	MTBE by D5599	0.00	Oxy Percent		TS	6/28/06
562	ETBE by D5599	0.00	Oxy Percent		TS	6/28/06
534	Ethanol by D5599	0.15	Oxy Percent		TS	6/28/06
572	TAME by D5599	0.00	Oxy Percent		TS	6/28/06
421	Sulfur in Gasoline D2622	132	Parts Per Million		NST	6/27/06
62	Vapor Pressure by D5191 (Modified)	8.82	PS I		NST	6/26/06
65	Percent Evaporated at 200 Degrees F D86	46.8	Volume Percent		MM	6/27/06
66	Percent Evaporated at 300 Degrees F D86	81.7	Volume Percent		MM	6/27/06
48	Aromatics in Gasoline MSD D5769	25.83	Volume Percent		TW	6/29/06
49	Olefins in by FIA D1319	10.5	Volume Percent		RCG	8/23/06
64	Benzene in Gasoline D3606	1.15	Volume Percent		TW	6/28/06
593	Volume Percent Oxygenates by D5599	0.41	Volume Percent		TS	6/28/06
57	TAME by D5599	0.00	Volume Percent		TS	6/28/06
55	MTBE by D5599	0.00	Volume Percent		TS	6/28/06
59	Weight Percent Oxygen by D5599	0.15	Weight Percent		TS	6/28/06
532	Ethanol by D5599	0.41	Volume Percent		TS	6/28/06
56	ETBE by D5599	0.00	Volume Percent		TS	6/28/06
46	Aromatics by FIA D1319	26	Volume Percent		RCG	8/23/06
63	Benzene in Gasoline by GC/MSD D5769	1.15	Volume Percent		TW	6/29/06
630	Toluene in gasoline by MSD D5769	5.33	Volumn Percent		TW	6/29/06
69	Specific Gravity @ 60 deg F D4052	0.74096	60/60F		MM	6/27/06
69	Specific Gravity @ 60 deg F D4052	0.74102	60/60F		MM	6/27/06
692	Degrees API D4052	59.47	Degrees API		MM	6/27/06
692	Degrees API D4052	59.45	Degrees API		MM	6/27/06
691	Density @ 60 deg F D4052	0.74022	g/cm-03 @ 60 deg F		MM	6/27/06
691	Density @ 60 deg F D4052	0.74029	g/cm-03 @ 60 deg F		MM	6/27/06
101	Initial Boiling Point D86	91.4	Degrees F		MM	6/27/06
110	10 Percent D86	125.1	Degrees F		MM	6/27/06
150	50 Percent D86	208.3	Degrees F		MM	6/27/06
190	90 Percent D86	334.4	Degrees F		MM	6/27/06
200	End Point D86	414.7	Degrees F		MM	6/27/06
201	Residue D86	1.2	mL		MM	6/27/06
202	Total Recovery D86	97.4	mL		MM	6/27/06

203	Loss	D86	1.4 mL	MM	6/27/06
543	Methanol	by D5599	0.00 Volume Percent	TS	6/28/06
584	Isopropanol	by D5599	0.00 Volume Percent	TS	6/28/06
585	t-Butanol	by D5599	0.00 Volume Percent	TS	6/28/06
586	n-Propanol	by D5599	0.00 Volume Percent	TS	6/28/06
587	sec-Butanol	by D5599	0.00 Volume Percent	TS	6/28/06
588	DIPE	by D5599	0.00 Volume Percent	TS	6/28/06
589	Isobutanol	by D5599	0.00 Volume Percent	TS	6/28/06
5801	t-Amyl Alcohol	by D5599	0.00 Volume Percent	TS	6/28/06
5802	n-Butanol	by D5599	0.00 Volume Percent	TS	6/28/06

NVFEL Fuel Analysis Report

14649

Batch#

Kansas City Samples

Facility Name: ERG Facility Type: In House
Owner: EPA Phone: (913) 299-9480
6636 Berger Avenue

U.S.

Samples Type: Correlation
Inspection information logged in by MM on 6/23/06.

VOC
Season: Winter

Kansas City Samples-QBL235(Ks) **FTAG: 14649** **Comments:** **#116; 8/6/04**

Fuel_ Code: 21

Test Code	Test Method	Results	Units	Analys	Analysis Date
552	MTBE by D5599	0.00	Oxy Percent	TS	6/28/06
562	ETBE by D5599	0.00	Oxy Percent	TS	6/28/06
534	Ethanol by D5599	0.14	Oxy Percent	TS	6/28/06
572	TAME by D5599	0.00	Oxy Percent	TS	6/28/06
421	Sulfur in Gasoline D2622	207	Parts Per Million	NST	6/27/06
62	Vapor Pressure by D5191 (Modified)	8.01	PS I	NST	6/26/06
65	Percent Evaporated at 200 Degrees F D86	43.9	Volume Percent	MM	6/27/06
66	Percent Evaporated at 300 Degrees F D86	80.3	Volume Percent	MM	6/27/06
48	Aromatics in Gasoline MSD D5769	26.53	Volume Percent	TW	6/29/06
49	Olefins in by FIA D1319	10.6	Volume Percent	RCG	8/23/06
64	Benzene in Gasoline D3606	1.02	Volume Percent	TW	6/28/06
64	Benzene in Gasoline D3606	1.03	Volume Percent	TW	6/28/06
59	Weight Percent Oxygen by D5599	0.14	Weight Percent	TS	6/28/06
593	Volume Percent Oxygenates by D5599	0.38	Volume Percent	TS	6/28/06
57	TAME by D5599	0.00	Volume Percent	TS	6/28/06
55	MTBE by D5599	0.00	Volume Percent	TS	6/28/06
532	Ethanol by D5599	0.38	Volume Percent	TS	6/28/06
56	ETBE by D5599	0.00	Volume Percent	TS	6/28/06
46	Aromatics by FIA D1319	26.1	Volume Percent	RCG	8/23/06
63	Benzene in Gasoline by GC/MSD D5769	1.02	Volume Percent	TW	6/29/06
630	Toluene in gasoline by MSD D5769	5.15	Volumn Percent	TW	6/29/06
69	Specific Gravity @ 60 deg F D4052	0.74565	60/60F	MM	6/27/06
69	Specific Gravity @ 60 deg F D4052	0.74562	60/60F	MM	6/27/06
692	Degrees API D4052	58.28	Degrees API	MM	6/27/06
692	Degrees API D4052	58.27	Degrees API	MM	6/27/06
691	Density @ 60 deg F D4052	0.74488	g/cm-03 @ 60 deg F	MM	6/27/06
691	Density @ 60 deg F D4052	0.74491	g/cm-03 @ 60 deg F	MM	6/27/06
101	Initial Boiling Point D86	94.1	Degrees F	MM	6/27/06
110	10 Percent D86	131.1	Degrees F	MM	6/27/06
150	50 Percent D86	215.2	Degrees F	MM	6/27/06
190	90 Percent D86	338.9	Degrees F	MM	6/27/06
200	End Point D86	426.7	Degrees F	MM	6/27/06
201	Residue D86	1	mL	MM	6/27/06

202	Total Recovery	D86	97.9 mL	MM	6/27/06
203	Loss	D86	1.1 mL	MM	6/27/06
543	Methanol	by D5599	0.00 Volume Percent	TS	6/28/06
584	Isopropanol	by D5599	0.00 Volume Percent	TS	6/28/06
585	t-Butanol	by D5599	0.00 Volume Percent	TS	6/28/06
586	n-Propanol	by D5599	0.00 Volume Percent	TS	6/28/06
587	sec-Butanol	by D5599	0.00 Volume Percent	TS	6/28/06
588	DIPE	by D5599	0.00 Volume Percent	TS	6/28/06
589	Isobutanol	by D5599	0.00 Volume Percent	TS	6/28/06
5801	t-Amyl Alcohol	by D5599	0.00 Volume Percent	TS	6/28/06
5802	n-Butanol	by D5599	0.00 Volume Percent	TS	6/28/06

NVFEL Fuel Analysis Report

Kansas City Samples

Batch#

Facility Name: ERG Facility Type: In House

Owner: EPA Phone: (913) 299-9480

6636 Berger Avenue

U.S.

Samples Type: Correlation

VOC

Inspection information logged in by MM on 6/23/06.

Season: Winter

Kansas City Samples-461GLI(Mo) **FTAG: 14650** **Comments:** **#129; 8/9/04**

Fuel_Code: 21

Test Code	Test Method	Results	Units	Analys	Analysis Date
552	MTBE by D5599	0.00	Oxy Percent	TS	6/29/06
562	ETBE by D5599	0.00	Oxy Percent	TS	6/29/06
534	Ethanol by D5599	0.00	Oxy Percent	TS	6/29/06
572	TAME by D5599	0.00	Oxy Percent	TS	6/29/06
421	Sulfur in Gasoline D2622	89	Parts Per Million	NST	6/27/06
421	Sulfur in Gasoline D2622	90	Parts Per Million	NST	6/27/06
62	Vapor Pressure by D5191 (Modified)	6.57	PS I	NST	6/26/06
65	Percent Evaporated at 200 Degrees F D86	39.3	Volume Percent	MM	6/27/06
66	Percent Evaporated at 300 Degrees F D86	79.5	Volume Percent	MM	6/27/06
48	Aromatics in Gasoline MSD D5769	31.89	Volume Percent	TW	6/29/06
49	Olefins in by FIA D1319	11.7	Volume Percent	RCG	8/23/06
64	Benzene in Gasoline D3606	1.46	Volume Percent	TW	7/5/06
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent	TS	6/29/06
55	MTBE by D5599	0.00	Volume Percent	TS	6/29/06
532	Ethanol by D5599	0.00	Volume Percent	TS	6/29/06
59	Weight Percent Oxygen by D5599	0.00	Weight Percent	TS	6/29/06
57	TAME by D5599	0.00	Volume Percent	TS	6/29/06
56	ETBE by D5599	0.00	Volume Percent	TS	6/29/06
630	Toluene in gasoline by MSD D5769	8.08	Volumn Percent	TW	6/29/06
63	Benzene in Gasoline by GC/MSD D5769	1.44	Volume Percent	TW	6/29/06
46	Aromatics by FIA D1319	31.9	Volume Percent	RCG	8/23/06
69	Specific Gravity @ 60 deg F D4052	0.75758	60/60F	MM	6/27/06
69	Specific Gravity @ 60 deg F D4052	0.75754	60/60F	MM	6/27/06
692	Degrees API D4052	55.28	Degrees API	MM	6/27/06
692	Degrees API D4052	55.29	Degrees API	MM	6/27/06
691	Density @ 60 deg F D4052	0.75683	g/cm-03 @ 60 deg F	MM	6/27/06
691	Density @ 60 deg F D4052	0.7568	g/cm-03 @ 60 deg F	MM	6/27/06
101	Initial Boiling Point D86	100.2	Degrees F	MM	6/27/06
110	10 Percent D86	144.6	Degrees F	MM	6/27/06
150	50 Percent D86	222.6	Degrees F	MM	6/27/06
190	90 Percent D86	343.2	Degrees F	MM	6/27/06
200	End Point D86	426.2	Degrees F	MM	6/27/06
201	Residue D86	0.9	mL	MM	6/27/06

NVFEL Fuel Analysis Report

202	Total Recovery	D86	98.3 mL	MM	6/27/06
203	Loss	D86	0.8 mL	MM	6/27/06
543	Methanol	by D5599	0.00 Volume Percent	TS	6/29/06
584	Isopropanol	by D5599	0.00 Volume Percent	TS	6/29/06
585	t-Butanol	by D5599	0.00 Volume Percent	TS	6/29/06
586	n-Propanol	by D5599	0.00 Volume Percent	TS	6/29/06
587	sec-Butanol	by D5599	0.00 Volume Percent	TS	6/29/06
588	DIPE	by D5599	0.00 Volume Percent	TS	6/29/06
589	Isobutanol	by D5599	0.00 Volume Percent	TS	6/29/06
5801	t-Amyl Alcohol	by D5599	0.00 Volume Percent	TS	6/29/06
5802	n-Butanol	by D5599	0.00 Volume Percent	TS	6/29/06

NVFEL Fuel Analysis Report

14651

Batch#

Kansas City Samples

Facility Name: ERG Facility Type: In House

Owner: EPA Phone: (913) 299-9480

6636 Berger Avenue

U.S.

Samples Type: Correlation

VOC

Inspection information logged in by MM on 6/23/06.

Season: Winter

Kansas City Samples-660SEC(Mo) **FTAG: 14651** **Comments:** **149; 8/12/04**

Test Code	Test Method	Results	Units	Fuel_ Code: 21	Analys	Analysis Date
552	MTBE by D5599	0.00	Oxy Percent		TS	6/29/06
562	ETBE by D5599	0.00	Oxy Percent		TS	6/29/06
534	Ethanol by D5599	0.01	Oxy Percent		TS	6/29/06
572	TAME by D5599	0.00	Oxy Percent		TS	6/29/06
421	Sulfur in Gasoline D2622	93	Parts Per Million		NST	6/29/06
62	Vapor Pressure by D5191 (Modified)	6.79	PS I		NST	6/26/06
65	Percent Evaporated at 200 Degrees F D86	38.1	Volume Percent		MM	6/28/06
66	Percent Evaporated at 300 Degrees F D86	80.1	Volume Percent		MM	6/28/06
48	Aromatics in Gasoline MSD D5769	33.87	Volume Percent		TW	6/29/06
49	Olefins in by FIA D1319	9.5	Volume Percent		RCG	8/23/06
64	Benzene in Gasoline D3606	1.66	Volume Percent		TW	7/5/06
55	MTBE by D5599	0.00	Volume Percent		TS	6/29/06
593	Volume Percent Oxygenates by D5599	0.03	Volume Percent		TS	6/29/06
57	TAME by D5599	0.00	Volume Percent		TS	6/29/06
532	Ethanol by D5599	0.03	Volume Percent		TS	6/29/06
59	Weight Percent Oxygen by D5599	0.01	Weight Percent		TS	6/29/06
56	ETBE by D5599	0.00	Volume Percent		TS	6/29/06
630	Toluene in gasoline by MSD D5769	7.94	Volumn Percent		TW	6/29/06
46	Aromatics by FIA D1319	33.7	Volume Percent		RCG	8/23/06
63	Benzene in Gasoline by GC/MSD D5769	1.65	Volume Percent		TW	6/29/06
69	Specific Gravity @ 60 deg F D4052	0.75814	60/60F		MM	6/27/06
69	Specific Gravity @ 60 deg F D4052	0.75818	60/60F		MM	6/27/06
692	Degrees API D4052	55.14	Degrees API		MM	6/27/06
692	Degrees API D4052	55.13	Degrees API		MM	6/27/06
691	Density @ 60 deg F D4052	0.75739	g/cm-03 @ 60 deg F		MM	6/27/06
691	Density @ 60 deg F D4052	0.75743	g/cm-03 @ 60 deg F		MM	6/27/06
101	Initial Boiling Point D86	99.3	Degrees F		MM	6/28/06
110	10 Percent D86	144.7	Degrees F		MM	6/28/06
150	50 Percent D86	225.6	Degrees F		MM	6/28/06
190	90 Percent D86	335.3	Degrees F		MM	6/28/06
200	End Point D86	422.2	Degrees F		MM	6/28/06
201	Residue D86	1	mL		MM	6/28/06
202	Total Recovery D86	98.2	mL		MM	6/28/06

203	Loss	D86	0.8 mL	MM	6/28/06
543	Methanol	by D5599	0.00 Volume Percent	TS	6/29/06
584	Isopropanol	by D5599	0.00 Volume Percent	TS	6/29/06
585	t-Butanol	by D5599	0.00 Volume Percent	TS	6/29/06
586	n-Propanol	by D5599	0.00 Volume Percent	TS	6/29/06
587	sec-Butanol	by D5599	0.00 Volume Percent	TS	6/29/06
588	DIPE	by D5599	0.00 Volume Percent	TS	6/29/06
589	Isobutanol	by D5599	0.00 Volume Percent	TS	6/29/06
5801	t-Amyl Alcohol	by D5599	0.00 Volume Percent	TS	6/29/06
5802	n-Butanol	by D5599	0.00 Volume Percent	TS	6/29/06

NVFEL Fuel Analysis Report

14652

Batch#

Kansas City Samples

Facility Name: ERG   Facility Type: In House

Owner: EPA   Phone: (913) 299-9480

6636 Berger Avenue

U.S.

Samples Type: Correlation

VOC

Inspection information logged in by MM on 6/23/06.

Season: Winter

Kansas City Samples-087FXJ(Mo)   **FTAG: 14652**   **Comments:** **203; 8-23-04**

Fuel_ Code: 21

Test Code	Test Method	Results	Units	Analys	Analysis Date
552	MTBE by D5599	0.00	Oxy Percent	TS	6/29/06
562	ETBE by D5599	0.00	Oxy Percent	TS	6/29/06
534	Ethanol by D5599	0.00	Oxy Percent	TS	6/29/06
572	TAME by D5599	0.00	Oxy Percent	TS	6/29/06
421	Sulfur in Gasoline D2622	197	Parts Per Million	NST	6/29/06
62	Vapor Pressure by D5191 (Modified)	5.79	PS I	NST	6/26/06
65	Percent Evaporated at 200 Degrees F D86	34.1	Volume Percent	MM	6/28/06
66	Percent Evaporated at 300 Degrees F D86	79.3	Volume Percent	MM	6/28/06
48	Aromatics in Gasoline MSD D5769	35.11	Volume Percent	TW	6/29/06
49	Olefins in by FIA D1319	10	Volume Percent	RCG	8/23/06
64	Benzene in Gasoline D3606	1.72	Volume Percent	TW	7/5/06
55	MTBE by D5599	0.00	Volume Percent	TS	6/29/06
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent	TS	6/29/06
57	TAME by D5599	0.00	Volume Percent	TS	6/29/06
532	Ethanol by D5599	0.00	Volume Percent	TS	6/29/06
59	Weight Percent Oxygen by D5599	0.00	Weight Percent	TS	6/29/06
56	ETBE by D5599	0.00	Volume Percent	TS	6/29/06
630	Toluene in gasoline by MSD D5769	7.8	Volumn Percent	TW	6/29/06
46	Aromatics by FIA D1319	34.3	Volume Percent	RCG	8/23/06
63	Benzene in Gasoline by GC/MSD D5769	1.72	Volume Percent	TW	6/29/06
69	Specific Gravity @ 60 deg F D4052	0.76241	60/60F	MM	6/27/06
69	Specific Gravity @ 60 deg F D4052	0.76249	60/60F	MM	6/27/06
692	Degrees API D4052	54.09	Degrees API	MM	6/27/06
692	Degrees API D4052	54.07	Degrees API	MM	6/27/06
691	Density @ 60 deg F D4052	0.76166	g/cm-03 @ 60 deg F	MM	6/27/06
691	Density @ 60 deg F D4052	0.76174	g/cm-03 @ 60 deg F	MM	6/27/06
101	Initial Boiling Point D86	103.1	Degrees F	MM	6/28/06
110	10 Percent D86	152.6	Degrees F	MM	6/28/06
150	50 Percent D86	232.8	Degrees F	MM	6/28/06
190	90 Percent D86	337.8	Degrees F	MM	6/28/06
200	End Point D86	422	Degrees F	MM	6/28/06
201	Residue D86	1	mL	MM	6/28/06
202	Total Recovery D86	98.2	mL	MM	6/28/06

203	Loss	D86	0.8 mL	MM	6/28/06
543	Methanol	by D5599	0.00 Volume Percent	TS	6/29/06
584	Isopropanol	by D5599	0.00 Volume Percent	TS	6/29/06
585	t-Butanol	by D5599	0.00 Volume Percent	TS	6/29/06
586	n-Propanol	by D5599	0.00 Volume Percent	TS	6/29/06
587	sec-Butanol	by D5599	0.00 Volume Percent	TS	6/29/06
588	DIPE	by D5599	0.00 Volume Percent	TS	6/29/06
589	Isobutanol	by D5599	0.00 Volume Percent	TS	6/29/06
5801	t-Amyl Alcohol	by D5599	0.00 Volume Percent	TS	6/29/06
5802	n-Butanol	by D5599	0.00 Volume Percent	TS	6/29/06

NVFEL Fuel Analysis Report

14653

Batch#

Kansas City Samples

Facility Name: ERG Facility Type: In House

Owner: EPA Phone: (913) 299-9480

6636 Berger Avenue

U.S.

Samples Type: Correlation

VOC

Inspection information logged in by MM on 6/23/06.

Season: Winter

Kansas City Samples-254HPF **FTAG: 14653** **Comments:** **437; 9-30-04**

Test Code	Test Method	Results	Units	Fuel_ Code: 21	Analys	Analysis Date
552	MTBE by D5599	0.00	Oxy Percent		TS	6/29/06
562	ETBE by D5599	0.00	Oxy Percent		TS	6/29/06
534	Ethanol by D5599	0.00	Oxy Percent		TS	6/29/06
572	TAME by D5599	0.00	Oxy Percent		TS	6/29/06
421	Sulfur in Gasoline D2622	54	Parts Per Million		NST	6/29/06
62	Vapor Pressure by D5191 (Modified)	9.27	PSI		NST	6/26/06
65	Percent Evaporated at 200 Degrees F D86	48.4	Volume Percent		MM	6/28/06
66	Percent Evaporated at 300 Degrees F D86	82.9	Volume Percent		MM	6/28/06
48	Aromatics in Gasoline MSD D5769	22.43	Volume Percent		TW	6/30/06
49	Olefins in by FIA D1319	9.6	Volume Percent		RCG	8/23/06
64	Benzene in Gasoline D3606	0.82	Volume Percent		TW	7/5/06
55	MTBE by D5599	0.00	Volume Percent		TS	6/29/06
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent		TS	6/29/06
57	TAME by D5599	0.00	Volume Percent		TS	6/29/06
532	Ethanol by D5599	0.00	Volume Percent		TS	6/29/06
59	Weight Percent Oxygen by D5599	0.00	Weight Percent		TS	6/29/06
56	ETBE by D5599	0.00	Volume Percent		TS	6/29/06
630	Toluene in gasoline by MSD D5769	4.76	Volumn Percent		TW	6/30/06
46	Aromatics by FIA D1319	21.4	Volume Percent		RCG	8/23/06
63	Benzene in Gasoline by GC/MSD D5769	0.83	Volume Percent		TW	6/30/06
69	Specific Gravity @ 60 deg F D4052	0.73507	60/60F		MM	6/27/06
69	Specific Gravity @ 60 deg F D4052	0.73508	60/60F		MM	6/27/06
692	Degrees API D4052	61	Degrees API		MM	6/27/06
692	Degrees API D4052	61	Degrees API		MM	6/27/06
691	Density @ 60 deg F D4052	0.73435	g/cm-03 @ 60 deg F		MM	6/27/06
691	Density @ 60 deg F D4052	0.73435	g/cm-03 @ 60 deg F		MM	6/27/06
101	Initial Boiling Point D86	89.9	Degrees F		MM	6/28/06
110	10 Percent D86	124.7	Degrees F		MM	6/28/06
150	50 Percent D86	203.7	Degrees F		MM	6/28/06
190	90 Percent D86	335.3	Degrees F		MM	6/28/06
200	End Point D86	427.5	Degrees F		MM	6/28/06
201	Residue D86	1.1	mL		MM	6/28/06
202	Total Recovery D86	97.7	mL		MM	6/28/06

NVFEL Fuel Analysis Report

203	Loss	D86	1.2 mL		MM	6/28/06
543	Methanol	by D5599	0.00	Volume Percent	TS	6/29/06
584	Isopropanol	by D5599	0.00	Volume Percent	TS	6/29/06
585	t-Butanol	by D5599	0.00	Volume Percent	TS	6/29/06
586	n-Propanol	by D5599	0.00	Volume Percent	TS	6/29/06
587	sec-Butanol	by D5599	0.00	Volume Percent	TS	6/29/06
588	DIPE	by D5599	0.00	Volume Percent	TS	6/29/06
589	Isobutanol	by D5599	0.00	Volume Percent	TS	6/29/06
5801	t-Amyl Alcohol	by D5599	0.00	Volume Percent	TS	6/29/06
5802	n-Butanol	by D5599	0.00	Volume Percent	TS	6/29/06

NVFEL Fuel Analysis Report

14654

Batch#

Kansas City Samples

Facility Name: ERG Facility Type: In House
Owner: EPA Phone: (913) 299-9480
6636 Berger Avenue

U.S.

Samples Type: Correlation
Inspection information logged in by MM on 6/23/06.

VOC
Season: Winter

Kansas City Samples-722KFE **FTAG: 14654** **Comments:** **537; 1-12-05**

Fuel_Code: 21

Test Code	Test Method	Results	Units	Analys	Analysis Date
552	MTBE by D5599	0.00	Oxy Percent	TS	6/29/06
562	ETBE by D5599	0.00	Oxy Percent	TS	6/29/06
534	Ethanol by D5599	0.00	Oxy Percent	TS	6/29/06
572	TAME by D5599	0.00	Oxy Percent	TS	6/29/06
421	Sulfur in Gasoline D2622	395	Parts Per Million	NST	6/29/06
62	Vapor Pressure by D5191 (Modified)	14.13	PS I	NST	6/26/06
65	Percent Evaporated at 200 Degrees F D86	49.7	Volume Percent	MM	6/28/06
66	Percent Evaporated at 300 Degrees F D86	85.1	Volume Percent	MM	6/28/06
48	Aromatics in Gasoline MSD D5769	22.34	Volume Percent	TW	6/30/06
49	Olefins in by FIA D1319	11.2	Volume Percent	RCG	8/23/06
64	Benzene in Gasoline D3606	1.17	Volume Percent	TW	7/5/06
55	MTBE by D5599	0.00	Volume Percent	TS	6/29/06
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent	TS	6/29/06
57	TAME by D5599	0.00	Volume Percent	TS	6/29/06
532	Ethanol by D5599	0.00	Volume Percent	TS	6/29/06
59	Weight Percent Oxygen by D5599	0.00	Weight Percent	TS	6/29/06
56	ETBE by D5599	0.00	Volume Percent	TS	6/29/06
630	Toluene in gasoline by MSD D5769	5.02	Volumn Percent	TW	6/30/06
46	Aromatics by FIA D1319	20.3	Volume Percent	RCG	8/23/06
63	Benzene in Gasoline by GC/MSD D5769	1.17	Volume Percent	TW	6/30/06
69	Specific Gravity @ 60 deg F D4052	0.72664	60/60F	MM	6/27/06
69	Specific Gravity @ 60 deg F D4052	0.72665	60/60F	MM	6/27/06
692	Degrees API D4052	63.23	Degrees API	MM	6/27/06
692	Degrees API D4052	63.23	Degrees API	MM	6/27/06
691	Density @ 60 deg F D4052	0.72592	g/cm-03 @ 60 deg F	MM	6/27/06
691	Density @ 60 deg F D4052	0.72593	g/cm-03 @ 60 deg F	MM	6/27/06
101	Initial Boiling Point D86	79.6	Degrees F	MM	6/28/06
110	10 Percent D86	100.1	Degrees F	MM	6/28/06
150	50 Percent D86	200.8	Degrees F	MM	6/28/06
190	90 Percent D86	319.7	Degrees F	MM	6/28/06
200	End Point D86	395.7	Degrees F	MM	6/28/06
201	Residue D86	1.1	mL	MM	6/28/06
202	Total Recovery D86	96.8	mL	MM	6/28/06

203	Loss	D86	2.1 mL	MM	6/28/06
543	Methanol	by D5599	0.00 Volume Percent	TS	6/29/06
584	Isopropanol	by D5599	0.00 Volume Percent	TS	6/29/06
585	t-Butanol	by D5599	0.00 Volume Percent	TS	6/29/06
586	n-Propanol	by D5599	0.00 Volume Percent	TS	6/29/06
587	sec-Butanol	by D5599	0.00 Volume Percent	TS	6/29/06
588	DIPE	by D5599	0.00 Volume Percent	TS	6/29/06
589	Isobutanol	by D5599	0.00 Volume Percent	TS	6/29/06
5801	t-Amyl Alcohol	by D5599	0.00 Volume Percent	TS	6/29/06
5802	n-Butanol	by D5599	0.00 Volume Percent	TS	6/29/06

NVFEL Fuel Analysis Report

14655

Batch#

Kansas City Samples

Facility Name: ERG Facility Type: In House

Owner: EPA Phone: (913) 299-9480

6636 Berger Avenue

U.S.

VOC

Samples Type: Correlation

Season: Winter

Inspection information logged in by MM on 6/23/06.

Kansas City Samples- VSV986(Ks) **FTAG: 14655** **Comments:** **570; 1-19-05**

Fuel_ Code: 21

Test Code	Test Method	Results	Units	Analys	Analysis Date
552	MTBE by D5599	0.00	Oxy Percent	TS	6/29/06
562	ETBE by D5599	0.00	Oxy Percent	TS	6/29/06
534	Ethanol by D5599	0.00	Oxy Percent	TS	6/29/06
572	TAME by D5599	0.00	Oxy Percent	TS	6/29/06
421	Sulfur in Gasoline D2622	65	Parts Per Million	NST	6/29/06
62	Vapor Pressure by D5191 (Modified)	12.55	PS I	NST	6/26/06
65	Percent Evaporated at 200 Degrees F D86	51.3	Volume Percent	MM	6/28/06
66	Percent Evaporated at 300 Degrees F D86	85.3	Volume Percent	MM	6/28/06
48	Aromatics in Gasoline MSD D5769	25.91	Volume Percent	TW	6/30/06
49	Olefins in by FIA D1319	8.9	Volume Percent	RCG	8/23/06
64	Benzene in Gasoline D3606	1.47	Volume Percent	TW	7/5/06
55	MTBE by D5599	0.00	Volume Percent	TS	6/29/06
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent	TS	6/29/06
57	TAME by D5599	0.00	Volume Percent	TS	6/29/06
532	Ethanol by D5599	0.00	Volume Percent	TS	6/29/06
59	Weight Percent Oxygen by D5599	0.00	Weight Percent	TS	6/29/06
56	ETBE by D5599	0.00	Volume Percent	TS	6/29/06
630	Toluene in gasoline by MSD D5769	6.41	Volumn Percent	TW	6/30/06
46	Aromatics by FIA D1319	23.2	Volume Percent	RCG	8/23/06
63	Benzene in Gasoline by GC/MSD D5769	1.47	Volume Percent	TW	6/30/06
69	Specific Gravity @ 60 deg F D4052	0.73199	60/60F	MM	6/27/06
69	Specific Gravity @ 60 deg F D4052	0.732	60/60F	MM	6/27/06
692	Degrees API D4052	61.81	Degrees API	MM	6/27/06
692	Degrees API D4052	61.8	Degrees API	MM	6/27/06
691	Density @ 60 deg F D4052	0.73127	g/cm-03 @ 60 deg F	MM	6/27/06
691	Density @ 60 deg F D4052	0.73128	g/cm-03 @ 60 deg F	MM	6/27/06
101	Initial Boiling Point D86	81.4	Degrees F	MM	6/28/06
110	10 Percent D86	105.9	Degrees F	MM	6/28/06
150	50 Percent D86	196.7	Degrees F	MM	6/28/06
190	90 Percent D86	318.2	Degrees F	MM	6/28/06
200	End Point D86	402.5	Degrees F	MM	6/28/06
201	Residue D86	1	mL	MM	6/28/06
202	Total Recovery D86	97.3	mL	MM	6/28/06

NVFEL Fuel Analysis Report

203	Loss	D86	1.7 mL	MM	6/28/06
543	Methanol	by D5599	0.00 Volume Percent	TS	6/29/06
584	Isopropanol	by D5599	0.00 Volume Percent	TS	6/29/06
585	t-Butanol	by D5599	0.00 Volume Percent	TS	6/29/06
586	n-Propanol	by D5599	0.00 Volume Percent	TS	6/29/06
587	sec-Butanol	by D5599	0.00 Volume Percent	TS	6/29/06
588	DIPE	by D5599	0.00 Volume Percent	TS	6/29/06
589	Isobutanol	by D5599	0.00 Volume Percent	TS	6/29/06
5801	t-Amyl Alcohol	by D5599	0.00 Volume Percent	TS	6/29/06
5802	n-Butanol	by D5599	0.00 Volume Percent	TS	6/29/06

NVFEL Fuel Analysis Report

14656

Batch#

Kansas City Samples

Facility Name: ERG Facility Type: In House

Owner: EPA Phone: (913) 299-9480

6636 Berger Avenue

U.S.

Samples Type: Correlation

VOC

Inspection information logged in by MM on 6/23/06.

Season: Winter

Kansas City Samples-284MC6(Mo) **FTAG: 14656** **Comments:** **631; 2-2-05**

Test Code	Test Method	Results	Units	Fuel_ Code: 21	Analys	Analysis Date
421	Sulfur in Gasoline D2622	265	Parts Per Million		NST	6/29/06
62	Vapor Pressure by D5191 (Modified)	13.6	PS I		NST	6/26/06
65	Percent Evaporated at 200 Degrees F D86	50.9	Volume Percent		MM	6/28/06
65	Percent Evaporated at 200 Degrees F D86	51.1	Volume Percent		MM	6/28/06
66	Percent Evaporated at 300 Degrees F D86	85.1	Volume Percent		MM	6/28/06
66	Percent Evaporated at 300 Degrees F D86	85.1	Volume Percent		MM	6/28/06
48	Aromatics in Gasoline MSD D5769	23.45	Volume Percent		TW	6/30/06
49	Olefins in by FIA D1319	10.1	Volume Percent		RCG	8/28/06
64	Benzene in Gasoline D3606	1.21	Volume Percent		TW	7/5/06
46	Aromatics by FIA D1319	21.4	Volume Percent		RCG	8/28/06
63	Benzene in Gasoline by GC/MSD D5769	1.21	Volume Percent		TW	6/30/06
630	Toluene in gasoline by MSD D5769	5.39	Volumn Percent		TW	6/30/06
69	Specific Gravity @ 60 deg F D4052	0.72682	60/60F		MM	6/27/06
69	Specific Gravity @ 60 deg F D4052	0.72677	60/60F		MM	6/27/06
692	Degrees API D4052	63.18	Degrees API		MM	6/27/06
692	Degrees API D4052	63.2	Degrees API		MM	6/27/06
691	Density @ 60 deg F D4052	0.7261	g/cm-03 @ 60 deg F		MM	6/27/06
691	Density @ 60 deg F D4052	0.72605	g/cm-03 @ 60 deg F		MM	6/27/06
101	Initial Boiling Point D86	80.3	Degrees F		MM	6/28/06
101	Initial Boiling Point D86	81	Degrees F		MM	6/28/06
110	10 Percent D86	101.9	Degrees F		MM	6/28/06
110	10 Percent D86	101.1	Degrees F		MM	6/28/06
150	50 Percent D86	196.9	Degrees F		MM	6/28/06
150	50 Percent D86	197.9	Degrees F		MM	6/28/06
190	90 Percent D86	322.2	Degrees F		MM	6/28/06
190	90 Percent D86	319.2	Degrees F		MM	6/28/06
200	End Point D86	401.3	Degrees F		MM	6/28/06
200	End Point D86	401.2	Degrees F		MM	6/28/06
201	Residue D86	1.1	mL		MM	6/28/06
201	Residue D86	1	mL		MM	6/28/06
202	Total Recovery D86	96.60001	mL		MM	6/28/06
202	Total Recovery D86	97.1	mL		MM	6/28/06
203	Loss D86	1.9	mL		MM	6/28/06

203 Loss	D86	2.3 mL	MM	6/28/06

NVFEL Fuel Analysis Report

14657

Batch#

Kansas City Samples

Facility Name: ERG Facility Type: In House
Owner: EPA Phone: (913) 299-9480
6636 Berger Avenue

U.S.

Samples Type: Correlation
Inspection information logged in by MM on 6/23/06.

VOC
Season: Winter

Kansas City Samples-406JR6(Mo) **FTAG: 14657** **Comments:** **645; 2-4-05**

Fuel_ Code: 21

Test Code	Test Method	Results	Units	Analys	Analysis Date
552	MTBE by D5599	0.00	Oxy Percent	TS	6/29/06
562	ETBE by D5599	0.00	Oxy Percent	TS	6/29/06
534	Ethanol by D5599	0.00	Oxy Percent	TS	6/29/06
572	TAME by D5599	0.00	Oxy Percent	TS	6/29/06
421	Sulfur in Gasoline D2622	202	Parts Per Million	NST	6/29/06
62	Vapor Pressure by D5191 (Modified)	13.94	PS I	NST	6/26/06
65	Percent Evaporated at 200 Degrees F D86	37.5	Volume Percent	MM	6/27/06
65	Percent Evaporated at 200 Degrees F D86	50.2	Volume Percent	MM	6/28/06
66	Percent Evaporated at 300 Degrees F D86	79.8	Volume Percent	MM	6/27/06
66	Percent Evaporated at 300 Degrees F D86	84.1	Volume Percent	MM	6/28/06
48	Aromatics in Gasoline MSD D5769	20.58	Volume Percent	TW	6/30/06
49	Olefins in by FIA D1319	11.5	Volume Percent	RCG	8/28/06
64	Benzene in Gasoline D3606	0.99	Volume Percent	TW	7/5/06
64	Benzene in Gasoline D3606	0.99	Volume Percent	TW	7/5/06
59	Weight Percent Oxygen by D5599	0.00	Weight Percent	TS	6/29/06
532	Ethanol by D5599	0.00	Volume Percent	TS	6/29/06
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent	TS	6/29/06
55	MTBE by D5599	0.00	Volume Percent	TS	6/29/06
57	TAME by D5599	0.00	Volume Percent	TS	6/29/06
56	ETBE by D5599	0.00	Volume Percent	TS	6/29/06
63	Benzene in Gasoline by GC/MSD D5769	0.99	Volume Percent	TW	6/30/06
46	Aromatics by FIA D1319	19	Volume Percent	RCG	8/28/06
630	Toluene in gasoline by MSD D5769	4.49	Volumn Percent	TW	6/30/06
69	Specific Gravity @ 60 deg F D4052	0.72419	60/60F	MM	6/27/06
69	Specific Gravity @ 60 deg F D4052	0.7242	60/60F	MM	6/27/06
692	Degrees API D4052	63.89	Degrees API	MM	6/27/06
692	Degrees API D4052	63.89	Degrees API	MM	6/27/06
691	Density @ 60 deg F D4052	0.72349	g/cm-03 @ 60 deg F	MM	6/27/06
691	Density @ 60 deg F D4052	0.72348	g/cm-03 @ 60 deg F	MM	6/27/06
101	Initial Boiling Point D86	97.7	Degrees F	MM	6/27/06
101	Initial Boiling Point D86	80.7	Degrees F	MM	6/28/06
110	10 Percent D86	146.8	Degrees F	MM	6/27/06
110	10 Percent D86	100.3	Degrees F	MM	6/28/06

NVFEL Fuel Analysis Report

14657

150	50 Percent	D86	225 Degrees F	MM	6/27/06
150	50 Percent	D86	199.4 Degrees F	MM	6/28/06
190	90 Percent	D86	337.9 Degrees F	MM	6/27/06
190	90 Percent	D86	329.9 Degrees F	MM	6/28/06
200	End Point	D86	422.9 Degrees F	MM	6/28/06
200	End Point	D86	433 Degrees F	MM	6/27/06
201	Residue	D86	1 mL	MM	6/27/06
201	Residue	D86	1 mL	MM	6/28/06
202	Total Recovery	D86	98 mL	MM	6/27/06
202	Total Recovery	D86	97 mL	MM	6/28/06
203	Loss	D86	1 mL	MM	6/27/06
203	Loss	D86	2 mL	MM	6/28/06
543	Methanol	by D5599	0.00 Volume Percent	TS	6/29/06
584	Isopropanol	by D5599	0.00 Volume Percent	TS	6/29/06
585	t-Butanol	by D5599	0.00 Volume Percent	TS	6/29/06
586	n-Propanol	by D5599	0.00 Volume Percent	TS	6/29/06
587	sec-Butanol	by D5599	0.00 Volume Percent	TS	6/29/06
588	DIPE	by D5599	0.00 Volume Percent	TS	6/29/06
589	Isobutanol	by D5599	0.00 Volume Percent	TS	6/29/06
5801	t-Amyl Alcohol	by D5599	0.00 Volume Percent	TS	6/29/06
5802	n-Butanol	by D5599	0.00 Volume Percent	TS	6/29/06

NVFEL Fuel Analysis Report

14660

Batch#

Kansas City Samples

Facility Name: ERG Facility Type: In House
Owner: EPA Phone: (913) 299-9480
6636 Berger Avenue

U.S.

Samples Type: Correlation

VOC

Inspection information logged in by MM on 6/26/06.

Season: Winter

Kansas City Samples- 790LWF(MO) **FTAG: 14660** **Comments:** **27; 7-20-04**

Test Code	Test Method	Results	Units	Fuel_ Code: 21	Analys	Analysis Date
552	MTBE by D5599	0.00	Oxy Percent		TS	6/28/06
552	MTBE by D5599	0.00	Oxy Percent		TS	6/28/06
562	ETBE by D5599	0.00	Oxy Percent		TS	6/28/06
562	ETBE by D5599	0.00	Oxy Percent		TS	6/28/06
534	Ethanol by D5599	0.00	Oxy Percent		TS	6/28/06
534	Ethanol by D5599	0.00	Oxy Percent		TS	6/28/06
572	TAME by D5599	0.00	Oxy Percent		TS	6/28/06
572	TAME by D5599	0.00	Oxy Percent		TS	6/28/06
421	Sulfur in Gasoline D2622	67	Parts Per Million		NST	6/29/06
62	Vapor Pressure by D5191 (Modified)	6.83	PSI		NST	6/26/06
65	Percent Evaporated at 200 Degrees F D86	38.8	Volume Percent		MM	6/28/06
66	Percent Evaporated at 300 Degrees F D86	80.3	Volume Percent		MM	6/28/06
48	Aromatics in Gasoline MSD D5769	28.31	Volume Percent		TW	6/30/06
48	Aromatics in Gasoline MSD D5769	28.29	Volume Percent		TW	6/30/06
49	Olefins in by FIA D1319	12.2	Volume Percent		RCG	8/28/06
64	Benzene in Gasoline D3606	0.81	Volume Percent		TW	7/5/06
532	Ethanol by D5599	0.00	Volume Percent		TS	6/28/06
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent		TS	6/28/06
532	Ethanol by D5599	0.00	Volume Percent		TS	6/28/06
55	MTBE by D5599	0.00	Volume Percent		TS	6/28/06
55	MTBE by D5599	0.00	Volume Percent		TS	6/28/06
57	TAME by D5599	0.00	Volume Percent		TS	6/28/06
59	Weight Percent Oxygen by D5599	0.00	Weight Percent		TS	6/28/06
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent		TS	6/28/06
57	TAME by D5599	0.00	Volume Percent		TS	6/28/06
59	Weight Percent Oxygen by D5599	0.00	Weight Percent		TS	6/28/06
56	ETBE by D5599	0.00	Volume Percent		TS	6/28/06
56	ETBE by D5599	0.00	Volume Percent		TS	6/28/06
63	Benzene in Gasoline by GC/MSD D5769	0.81	Volume Percent		TW	6/30/06
46	Aromatics by FIA D1319	28.7	Volume Percent		RCG	8/28/06
630	Toluene in gasoline by MSD D5769	7.41	Volumn Percent		TW	6/30/06
630	Toluene in gasoline by MSD D5769	7.38	Volumn Percent		TW	6/30/06
63	Benzene in Gasoline by GC/MSD D5769	0.81	Volume Percent		TW	6/30/06

69	Specific Gravity @ 60 deg F	D4052	0.75166 60/60F	MM	6/27/06
69	Specific Gravity @ 60 deg F	D4052	0.75163 60/60F	MM	6/27/06
692	Degrees API	D4052	56.75 Degrees API	MM	6/27/06
692	Degrees API	D4052	56.76 Degrees API	MM	6/27/06
691	Density @ 60 deg F	D4052	0.75092 g/cm-03 @ 60 deg F	MM	6/27/06
691	Density @ 60 deg F	D4052	0.75089 g/cm-03 @ 60 deg F	MM	6/27/06
101	Initial Boiling Point	D86	98.8 Degrees F	MM	6/28/06
110	10 Percent	D86	141.9 Degrees F	MM	6/28/06
150	50 Percent	D86	224.4 Degrees F	MM	6/28/06
190	90 Percent	D86	346 Degrees F	MM	6/28/06
200	End Point	D86	429.7 Degrees F	MM	6/28/06
201	Residue	D86	1 mL	MM	6/28/06
202	Total Recovery	D86	98.2 mL	MM	6/28/06
203	Loss	D86	0.8 mL	MM	6/28/06
543	Methanol	by D5599	0.00 Volume Percent	TS	6/28/06
543	Methanol	by D5599	0.00 Volume Percent	TS	6/28/06
584	Isopropanol	by D5599	0.00 Volume Percent	TS	6/28/06
584	Isopropanol	by D5599	0.00 Volume Percent	TS	6/28/06
585	t-Butanol	by D5599	0.00 Volume Percent	TS	6/28/06
585	t-Butanol	by D5599	0.00 Volume Percent	TS	6/28/06
586	n-Propanol	by D5599	0.00 Volume Percent	TS	6/28/06
586	n-Propanol	by D5599	0.00 Volume Percent	TS	6/28/06
587	sec-Butanol	by D5599	0.00 Volume Percent	TS	6/28/06
587	sec-Butanol	by D5599	0.00 Volume Percent	TS	6/28/06
588	DIPE	by D5599	0.00 Volume Percent	TS	6/28/06
588	DIPE	by D5599	0.00 Volume Percent	TS	6/28/06
589	Isobutanol	by D5599	0.00 Volume Percent	TS	6/28/06
589	Isobutanol	by D5599	0.00 Volume Percent	TS	6/28/06
5801	t-Amyl Alcohol	by D5599	0.00 Volume Percent	TS	6/28/06
5801	t-Amyl Alcohol	by D5599	0.00 Volume Percent	TS	6/28/06
5802	n-Butanol	by D5599	0.00 Volume Percent	TS	6/28/06
5802	n-Butanol	by D5599	0.00 Volume Percent	TS	6/28/06

NVFEL Fuel Analysis Report

14661

Batch#

Kansas City Samples

Facility Name: ERG Facility Type: In House

Owner: EPA Phone: (913) 299-9480

6636 Berger Avenue

U.S.

Samples Type: Correlation

VOC

Inspection information logged in by MM on 6/26/06.

Season: Winter

Kansas City Samples-884DFT **FTAG: 14661** **Comments:** **25; 7-20-04**

Test Code	Test Method	Results	Units	Fuel_ Code: 21	Analys	Analysis Date
552	MTBE by D5599	0.00	Oxy Percent		TS	6/29/06
562	ETBE by D5599	0.00	Oxy Percent		TS	6/29/06
534	Ethanol by D5599	0.00	Oxy Percent		TS	6/29/06
572	TAME by D5599	0.00	Oxy Percent		TS	6/29/06
421	Sulfur in Gasoline D2622	84	Parts Per Million		NST	6/29/06
421	Sulfur in Gasoline D2622	85	Parts Per Million		NST	6/29/06
62	Vapor Pressure by D5191 (Modified)	6.21	PS I		NST	6/26/06
65	Percent Evaporated at 200 Degrees F D86	36.4	Volume Percent		MM	6/29/06
66	Percent Evaporated at 300 Degrees F D86	78.9	Volume Percent		MM	6/29/06
48	Aromatics in Gasoline MSD D5769	30.45	Volume Percent		TW	7/11/06
49	Olefins in by FIA D1319	11.4	Volume Percent		RCG	8/28/06
64	Benzene in Gasoline D3606	1.49	Volume Percent		TW	7/5/06
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent		TS	6/29/06
59	Weight Percent Oxygen by D5599	0.00	Weight Percent		TS	6/29/06
57	TAME by D5599	0.00	Volume Percent		TS	6/29/06
55	MTBE by D5599	0.00	Volume Percent		TS	6/29/06
532	Ethanol by D5599	0.00	Volume Percent		TS	6/29/06
56	ETBE by D5599	0.00	Volume Percent		TS	6/29/06
46	Aromatics by FIA D1319	29	Volume Percent		RCG	8/28/06
63	Benzene in Gasoline by GC/MSD D5769	1.49	Volume Percent		TW	7/11/06
630	Toluene in gasoline by MSD D5769	6.49	Volumn Percent		TW	7/11/06
69	Specific Gravity @ 60 deg F D4052	0.75535	60/60F		MM	6/27/06
69	Specific Gravity @ 60 deg F D4052	0.75529	60/60F		MM	6/27/06
692	Degrees API D4052	55.85	Degrees API		MM	6/27/06
692	Degrees API D4052	55.83	Degrees API		MM	6/27/06
691	Density @ 60 deg F D4052	0.75454	g/cm-03 @ 60 deg F		MM	6/27/06
691	Density @ 60 deg F D4052	0.7546	g/cm-03 @ 60 deg F		MM	6/27/06
101	Initial Boiling Point D86	100.4	Degrees F		MM	6/29/06
110	10 Percent D86	148.5	Degrees F		MM	6/29/06
150	50 Percent D86	228	Degrees F		MM	6/29/06
190	90 Percent D86	343.5	Degrees F		MM	6/29/06
200	End Point D86	431.2	Degrees F		MM	6/29/06
201	Residue D86	1.3	mL		MM	6/29/06

202	Total Recovery	D86	97.9 mL		MM	6/29/06
203	Loss	D86	0.8 mL		MM	6/29/06
543	Methanol	by D5599	0.00	Volume Percent	TS	6/29/06
584	Isopropanol	by D5599	0.00	Volume Percent	TS	6/29/06
585	t-Butanol	by D5599	0.00	Volume Percent	TS	6/29/06
586	n-Propanol	by D5599	0.00	Volume Percent	TS	6/29/06
587	sec-Butanol	by D5599	0.00	Volume Percent	TS	6/29/06
588	DIPE	by D5599	0.00	Volume Percent	TS	6/29/06
589	Isobutanol	by D5599	0.00	Volume Percent	TS	6/29/06
5801	t-Amyl Alcohol	by D5599	0.00	Volume Percent	TS	6/29/06
5802	n-Butanol	by D5599	0.00	Volume Percent	TS	6/29/06

NVFEL Fuel Analysis Report

14662

Batch#

Kansas City Samples

Facility Name: ERG Facility Type: In House

Owner: EPA Phone: (913) 299-9480

6636 Berger Avenue

U.S.

Samples Type: Correlation

VOC

Inspection information logged in by MM on 6/26/06.

Season: Winter

Kansas City Samples-550SAT(MO) **FTAG: 14662** **Comments:** **57; 07-26-04**

Fuel_ Code: 21

Test Code	Test Method	Results	Units	Analys	Analysis Date
552	MTBE by D5599	0.00	Oxy Percent	TS	6/29/06
562	ETBE by D5599	0.00	Oxy Percent	TS	6/29/06
534	Ethanol by D5599	0.00	Oxy Percent	TS	6/29/06
572	TAME by D5599	0.00	Oxy Percent	TS	6/29/06
421	Sulfur in Gasoline D2622	181	Parts Per Million	NST	7/6/06
62	Vapor Pressure by D5191 (Modified)	6.25	PS I	NST	6/26/06
65	Percent Evaporated at 200 Degrees F D86	36.8	Volume Percent	MM	6/29/06
66	Percent Evaporated at 300 Degrees F D86	79.9	Volume Percent	MM	6/29/06
48	Aromatics in Gasoline MSD D5769	32.35	Volume Percent	TW	7/11/06
49	Olefins in by FIA D1319	9.6	Volume Percent	RCG	8/28/06
64	Benzene in Gasoline D3606	1.58	Volume Percent	TW	7/5/06
532	Ethanol by D5599	0.00	Volume Percent	TS	6/29/06
55	MTBE by D5599	0.00	Volume Percent	TS	6/29/06
57	TAME by D5599	0.00	Volume Percent	TS	6/29/06
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent	TS	6/29/06
59	Weight Percent Oxygen by D5599	0.00	Weight Percent	TS	6/29/06
56	ETBE by D5599	0.00	Volume Percent	TS	6/29/06
630	Toluene in gasoline by MSD D5769	7.09	Volumn Percent	TW	7/11/06
63	Benzene in Gasoline by GC/MSD D5769	1.57	Volume Percent	TW	7/11/06
46	Aromatics by FIA D1319	32.5	Volume Percent	RCG	8/28/06
69	Specific Gravity @ 60 deg F D4052	0.75698	60/60F	MM	6/27/06
69	Specific Gravity @ 60 deg F D4052	0.75692	60/60F	MM	6/27/06
692	Degrees API D4052	55.44	Degrees API	MM	6/27/06
692	Degrees API D4052	55.43	Degrees API	MM	6/27/06
691	Density @ 60 deg F D4052	0.75623	g/cm-03 @ 60 deg F	MM	6/27/06
691	Density @ 60 deg F D4052	0.75617	g/cm-03 @ 60 deg F	MM	6/27/06
101	Initial Boiling Point D86	101.4	Degrees F	MM	6/29/06
110	10 Percent D86	148.6	Degrees F	MM	6/29/06
150	50 Percent D86	226.6	Degrees F	MM	6/29/06
190	90 Percent D86	336.2	Degrees F	MM	6/29/06
200	End Point D86	427.9	Degrees F	MM	6/29/06
201	Residue D86	1	mL	MM	6/29/06
202	Total Recovery D86	98.2	mL	MM	6/29/06

NVFEL Fuel Analysis Report

14662

203	Loss	D86	0.8 mL	MM	6/29/06
543	Methanol	by D5599	0.00 Volume Percent	TS	6/29/06
584	Isopropanol	by D5599	0.00 Volume Percent	TS	6/29/06
585	t-Butanol	by D5599	0.00 Volume Percent	TS	6/29/06
586	n-Propanol	by D5599	0.00 Volume Percent	TS	6/29/06
587	sec-Butanol	by D5599	0.00 Volume Percent	TS	6/29/06
588	DIPE	by D5599	0.00 Volume Percent	TS	6/29/06
589	Isobutanol	by D5599	0.00 Volume Percent	TS	6/29/06
5801	t-Amyl Alcohol	by D5599	0.00 Volume Percent	TS	6/29/06
5802	n-Butanol	by D5599	0.00 Volume Percent	TS	6/29/06

NVFEL Fuel Analysis Report

14663

Batch#

Kansas City Samples

Facility Name: ERG Facility Type: In House
Owner: EPA Phone: (913) 299-9480
6636 Berger Avenue

U.S.

Samples Type: Correlation

VOC

Inspection information logged in by MM on 6/26/06.

Season: Winter

Kansas City Samples-SIE276(KS) **FTAG: 14663** **Comments:** **76; 8-2-04**

Test Code	Test Method	Results	Units	Fuel_ Code: 21	Analys	Analysis Date
552	MTBE by D5599	0.00	Oxy Percent		TS	6/29/06
562	ETBE by D5599	0.00	Oxy Percent		TS	6/29/06
534	Ethanol by D5599	0.00	Oxy Percent		TS	6/29/06
572	TAME by D5599	0.00	Oxy Percent		TS	6/29/06
421	Sulfur in Gasoline D2622	172	Parts Per Million		NST	7/6/06
62	Vapor Pressure by D5191 (Modified)	7.89	PS I		NST	6/26/06
65	Percent Evaporated at 200 Degrees F D86	41.4	Volume Percent		MM	6/29/06
66	Percent Evaporated at 300 Degrees F D86	80.2	Volume Percent		MM	6/29/06
48	Aromatics in Gasoline MSD D5769	31.81	Volume Percent		TW	7/11/06
49	Olefins in by FIA D1319	8.7	Volume Percent		RCG	8/28/06
64	Benzene in Gasoline D3606	1.79	Volume Percent		TW	7/5/06
532	Ethanol by D5599	0.00	Volume Percent		TS	6/29/06
55	MTBE by D5599	0.00	Volume Percent		TS	6/29/06
57	TAME by D5599	0.00	Volume Percent		TS	6/29/06
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent		TS	6/29/06
59	Weight Percent Oxygen by D5599	0.00	Weight Percent		TS	6/29/06
56	ETBE by D5599	0.00	Volume Percent		TS	6/29/06
630	Toluene in gasoline by MSD D5769	7.2	Volumn Percent		TW	7/11/06
63	Benzene in Gasoline by GC/MSD D5769	1.8	Volume Percent		TW	7/11/06
46	Aromatics by FIA D1319	31.3	Volume Percent		RCG	8/28/06
69	Specific Gravity @ 60 deg F D4052	0.75296	60/60F		MM	6/27/06
69	Specific Gravity @ 60 deg F D4052	0.75286	60/60F		MM	6/27/06
692	Degrees API D4052	56.45	Degrees API		MM	6/27/06
692	Degrees API D4052	56.43	Degrees API		MM	6/27/06
691	Density @ 60 deg F D4052	0.75221	g/cm-03 @ 60 deg F		MM	6/27/06
691	Density @ 60 deg F D4052	0.75212	g/cm-03 @ 60 deg F		MM	6/27/06
101	Initial Boiling Point D86	95.8	Degrees F		MM	6/29/06
110	10 Percent D86	133.9	Degrees F		MM	6/29/06
150	50 Percent D86	220.4	Degrees F		MM	6/29/06
190	90 Percent D86	334.8	Degrees F		MM	6/29/06
200	End Point D86	418.8	Degrees F		MM	6/29/06
201	Residue D86	1.1	mL		MM	6/29/06
202	Total Recovery D86	97.7	mL		MM	6/29/06

203	Loss	D86	1.2 mL	MM	6/29/06
543	Methanol	by D5599	0.00 Volume Percent	TS	6/29/06
584	Isopropanol	by D5599	0.00 Volume Percent	TS	6/29/06
585	t-Butanol	by D5599	0.00 Volume Percent	TS	6/29/06
586	n-Propanol	by D5599	0.00 Volume Percent	TS	6/29/06
587	sec-Butanol	by D5599	0.00 Volume Percent	TS	6/29/06
588	DIPE	by D5599	0.00 Volume Percent	TS	6/29/06
589	Isobutanol	by D5599	0.00 Volume Percent	TS	6/29/06
5801	t-Amyl Alcohol	by D5599	0.00 Volume Percent	TS	6/29/06
5802	n-Butanol	by D5599	0.00 Volume Percent	TS	6/29/06

NVFEL Fuel Analysis Report

14664

Batch#

Kansas City Samples

Facility Name: ERG Facility Type: In House
Owner: EPA Phone: (913) 299-9480
6636 Berger Avenue

U.S.

Samples Type: Correlation
Inspection information logged in by MM on 6/26/06.

VOC
Season: Winter

Kansas City Samples-750NBW(MO) **FTAG: 14664** **Comments:** **99; 8-3-04**

Fuel_Code: 21

Test Code	Test Method	Results	Units	Analys	Analysis Date
552	MTBE by D5599	0.00	Oxy Percent	TS	6/29/06
562	ETBE by D5599	0.00	Oxy Percent	TS	6/29/06
534	Ethanol by D5599	0.00	Oxy Percent	TS	6/29/06
572	TAME by D5599	0.00	Oxy Percent	TS	6/29/06
421	Sulfur in Gasoline D2622	50	Parts Per Million	NST	7/6/06
62	Vapor Pressure by D5191 (Modified)	6.74	PSI	NST	6/26/06
62	Vapor Pressure by D5191 (Modified)	6.74	PSI	NST	6/26/06
65	Percent Evaporated at 200 Degrees F D86	39.7	Volume Percent	MM	6/29/06
66	Percent Evaporated at 300 Degrees F D86	75.2	Volume Percent	MM	6/29/06
48	Aromatics in Gasoline MSD D5769	32.18	Volume Percent	TW	7/11/06
49	Olefins in by FIA D1319	8	Volume Percent	RCG	8/28/06
49	Olefins in by FIA D1319	8.6	Volume Percent	RCG	8/28/06
64	Benzene in Gasoline D3606	1.47	Volume Percent	TW	7/5/06
532	Ethanol by D5599	0.00	Volume Percent	TS	6/29/06
55	MTBE by D5599	0.00	Volume Percent	TS	6/29/06
57	TAME by D5599	0.00	Volume Percent	TS	6/29/06
59	Weight Percent Oxygen by D5599	0.00	Weight Percent	TS	6/29/06
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent	TS	6/29/06
56	ETBE by D5599	0.00	Volume Percent	TS	6/29/06
46	Aromatics by FIA D1319	31.1	Volume Percent	RCG	8/28/06
46	Aromatics by FIA D1319	31.5	Volume Percent	RCG	8/28/06
63	Benzene in Gasoline by GC/MSD D5769	1.48	Volume Percent	TW	7/11/06
630	Toluene in gasoline by MSD D5769	6	Volumn Percent	TW	7/11/06
69	Specific Gravity @ 60 deg F D4052	0.75462	60/60F	MM	6/27/06
69	Specific Gravity @ 60 deg F D4052	0.75463	60/60F	MM	6/27/06
692	Degrees API D4052	56.01	Degrees API	MM	6/27/06
692	Degrees API D4052	56.01	Degrees API	MM	6/27/06
691	Density @ 60 deg F D4052	0.75388	g/cm-03 @ 60 deg F	MM	6/27/06
691	Density @ 60 deg F D4052	0.75388	g/cm-03 @ 60 deg F	MM	6/27/06
101	Initial Boiling Point D86	100.7	Degrees F	MM	6/29/06
110	10 Percent D86	139.9	Degrees F	MM	6/29/06
150	50 Percent D86	225.6	Degrees F	MM	6/29/06
190	90 Percent D86	350.7	Degrees F	MM	6/29/06

200	End Point	D86	417 Degrees F	MM	6/29/06
201	Residue	D86	1 mL	MM	6/29/06
202	Total Recovery	D86	97.89999 mL	MM	6/29/06
203	Loss	D86	1.1 mL	MM	6/29/06
543	Methanol	by D5599	0.00 Volume Percent	TS	6/29/06
584	Isopropanol	by D5599	0.00 Volume Percent	TS	6/29/06
585	t-Butanol	by D5599	0.00 Volume Percent	TS	6/29/06
586	n-Propanol	by D5599	0.00 Volume Percent	TS	6/29/06
587	sec-Butanol	by D5599	0.00 Volume Percent	TS	6/29/06
588	DIPE	by D5599	0.00 Volume Percent	TS	6/29/06
589	Isobutanol	by D5599	0.00 Volume Percent	TS	6/29/06
5801	t-Amyl Alcohol	by D5599	0.00 Volume Percent	TS	6/29/06
5802	n-Butanol	by D5599	0.00 Volume Percent	TS	6/29/06

28-Aug-06

NVFEL Fuel Analysis Report

14665

Batch#

Kansas City Samples

Facility Name: ERG Facility Type: In House

Owner: EPA Phone: (913) 299-9480

6636 Berger Avenue

U.S.

VOC

Samples Type: Correlation

Season: Winter

Inspection information logged in by MM on 6/26/06.

Kansas City Samples-116MGP **FTAG: 14665** **Comments:** **443; 9-30-04**

Fuel_ Code: 21

Test Code	Test Method	Results	Units	Analys	Analysis Date
552	MTBE by D5599	0.00	Oxy Percent	TS	6/29/06
552	MTBE by D5599	0.00	Oxy Percent	TS	6/29/06
562	ETBE by D5599	0.00	Oxy Percent	TS	6/29/06
562	ETBE by D5599	0.00	Oxy Percent	TS	6/29/06
534	Ethanol by D5599	0.00	Oxy Percent	TS	6/29/06
534	Ethanol by D5599	0.00	Oxy Percent	TS	6/29/06
572	TAME by D5599	0.00	Oxy Percent	TS	6/29/06
572	TAME by D5599	0.00	Oxy Percent	TS	6/29/06
421	Sulfur in Gasoline D2622	76	Parts Per Million	NST	7/6/06
62	Vapor Pressure by D5191 (Modified)	8.89	PS I	NST	6/26/06
62	Vapor Pressure by D5191 (Modified)	8.88	PS I	NST	6/26/06
65	Percent Evaporated at 200 Degrees F D86	47.1	Volume Percent	MM	6/29/06
66	Percent Evaporated at 300 Degrees F D86	82.6	Volume Percent	MM	6/29/06
48	Aromatics in Gasoline MSD D5769	23.79	Volume Percent	TW	7/11/06
49	Olefins in by FIA D1319	9.7	Volume Percent	RCG	8/28/06
64	Benzene in Gasoline D3606	0.96	Volume Percent	TW	7/5/06
532	Ethanol by D5599	0.00	Volume Percent	TS	6/29/06
532	Ethanol by D5599	0.00	Volume Percent	TS	6/29/06
57	TAME by D5599	0.00	Volume Percent	TS	6/29/06
57	TAME by D5599	0.00	Volume Percent	TS	6/29/06
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent	TS	6/29/06
59	Weight Percent Oxygen by D5599	0.00	Weight Percent	TS	6/29/06
59	Weight Percent Oxygen by D5599	0.00	Weight Percent	TS	6/29/06
55	MTBE by D5599	0.00	Volume Percent	TS	6/29/06
55	MTBE by D5599	0.00	Volume Percent	TS	6/29/06
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent	TS	6/29/06
56	ETBE by D5599	0.00	Volume Percent	TS	6/29/06
56	ETBE by D5599	0.00	Volume Percent	TS	6/29/06
46	Aromatics by FIA D1319	23.6	Volume Percent	RCG	8/28/06
63	Benzene in Gasoline by GC/MSD D5769	0.96	Volume Percent	TW	7/11/06
630	Toluene in gasoline by MSD D5769	5.01	Volumn Percent	TW	7/11/06
69	Specific Gravity @ 60 deg F D4052	0.73774	60/60F	MM	6/27/06
69	Specific Gravity @ 60 deg F D4052	0.7378	60/60F	MM	6/27/06

NVFEL Fuel Analysis Report

692	Degrees API	D4052	60.29 Degrees API	MM	6/27/06
692	Degrees API	D4052	60.3 Degrees API	MM	6/27/06
691	Density @ 60 deg F	D4052	0.73707 g/cm-03 @ 60 deg F	MM	6/27/06
691	Density @ 60 deg F	D4052	0.73701 g/cm-03 @ 60 deg F	MM	6/27/06
101	Initial Boiling Point	D86	92.2 Degrees F	MM	6/29/06
110	10 Percent	D86	126 Degrees F	MM	6/29/06
150	50 Percent	D86	206.1 Degrees F	MM	6/29/06
190	90 Percent	D86	334.7 Degrees F	MM	6/29/06
200	End Point	D86	418.1 Degrees F	MM	6/29/06
201	Residue	D86	1.2 mL	MM	6/29/06
202	Total Recovery	D86	97.3 mL	MM	6/29/06
203	Loss	D86	1.5 mL	MM	6/29/06
543	Methanol	by D5599	0.00 Volume Percent	TS	6/29/06
543	Methanol	by D5599	0.00 Volume Percent	TS	6/29/06
584	Isopropanol	by D5599	0.00 Volume Percent	TS	6/29/06
584	Isopropanol	by D5599	0.00 Volume Percent	TS	6/29/06
585	t-Butanol	by D5599	0.00 Volume Percent	TS	6/29/06
585	t-Butanol	by D5599	0.00 Volume Percent	TS	6/29/06
586	n-Propanol	by D5599	0.00 Volume Percent	TS	6/29/06
586	n-Propanol	by D5599	0.00 Volume Percent	TS	6/29/06
587	sec-Butanol	by D5599	0.00 Volume Percent	TS	6/29/06
587	sec-Butanol	by D5599	0.00 Volume Percent	TS	6/29/06
588	DIPE	by D5599	0.00 Volume Percent	TS	6/29/06
588	DIPE	by D5599	0.00 Volume Percent	TS	6/29/06
589	Isobutanol	by D5599	0.00 Volume Percent	TS	6/29/06
589	Isobutanol	by D5599	0.00 Volume Percent	TS	6/29/06
5801	t-Amyl Alcohol	by D5599	0.00 Volume Percent	TS	6/29/06
5801	t-Amyl Alcohol	by D5599	0.00 Volume Percent	TS	6/29/06
5802	n-Butanol	by D5599	0.00 Volume Percent	TS	6/29/06
5802	n-Butanol	by D5599	0.00 Volume Percent	TS	6/29/06

NVFEL Fuel Analysis Report

14612

Batch#

Kansas City Samples

Facility Name: ERG Facility Type: In House

Owner: EPA Phone: (913) 299-9480

6636 Berger Avenue

U.S.

Samples Type: Correlation

VOC

Inspection information logged in by MM on 6/13/06.

Season: Winter

Kansas City Samples-979GS8(Mo) **FTAG: 14612** **Comments:** **926; 4-6-05**

Fuel_ Code: 21

Test Code	Test Method	Results	Units	Analys	Analysis Date
552	MTBE by D5599	0.00	Oxy Percent	TS	6/19/06
552	MTBE by D5599	0.00	Oxy Percent	TS	6/19/06
562	ETBE by D5599	0.00	Oxy Percent	TS	6/19/06
562	ETBE by D5599	0.00	Oxy Percent	TS	6/19/06
534	Ethanol by D5599	0.00	Oxy Percent	TS	6/19/06
534	Ethanol by D5599	0.00	Oxy Percent	TS	6/19/06
572	TAME by D5599	0.00	Oxy Percent	TS	6/19/06
572	TAME by D5599	0.00	Oxy Percent	TS	6/19/06
421	Sulfur in Gasoline D2622	63	Parts Per Million	NST	6/20/06
62	Vapor Pressure by D5191 (Modified)	10.23	PS I	MM	6/14/06
65	Percent Evaporated at 200 Degrees F D86	34.8	Volume Percent	MM	6/16/06
66	Percent Evaporated at 300 Degrees F D86	88.5	Volume Percent	MM	6/16/06
48	Aromatics in Gasoline MSD D5769	22.03	Volume Percent	TW	6/22/06
49	Olefins in by FIA D1319	3.2	Volume Percent	RCG	8/21/06
64	Benzene in Gasoline D3606	1.17	Volume Percent	TW	6/19/06
532	Ethanol by D5599	0.00	Volume Percent	TS	6/19/06
57	TAME by D5599	0.00	Volume Percent	TS	6/19/06
57	TAME by D5599	0.00	Volume Percent	TS	6/19/06
59	Weight Percent Oxygen by D5599	0.00	Weight Percent	TS	6/19/06
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent	TS	6/19/06
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent	TS	6/19/06
59	Weight Percent Oxygen by D5599	0.00	Weight Percent	TS	6/19/06
55	MTBE by D5599	0.00	Volume Percent	TS	6/19/06
55	MTBE by D5599	0.00	Volume Percent	TS	6/19/06
532	Ethanol by D5599	0.00	Volume Percent	TS	6/19/06
56	ETBE by D5599	0.00	Volume Percent	TS	6/19/06
56	ETBE by D5599	0.00	Volume Percent	TS	6/19/06
46	Aromatics by FIA D1319	20.1	Volume Percent	RCG	8/21/06
63	Benzene in Gasoline by GC/MSD D5769	1.15	Volume Percent	TW	6/22/06
630	Toluene in gasoline by MSD D5769	5.76	Volumn Percent	TW	6/22/06
69	Specific Gravity @ 60 deg F D4052	0.7292	60/60F	MM	6/14/06
69	Specific Gravity @ 60 deg F D4052	0.72913	60/60F	MM	6/14/06
692	Degrees API D4052	62.57	Degrees API	MM	6/14/06

692	Degrees API	D4052	62.55 Degrees API	MM	6/14/06
691	Density @ 60 deg F	D4052	0.72848 g/cm-03 @ 60 deg F	MM	6/14/06
691	Density @ 60 deg F	D4052	0.72841 g/cm-03 @ 60 deg F	MM	6/14/06
101	Initial Boiling Point	D86	87.6 Degrees F	MM	6/16/06
110	10 Percent	D86	126.3 Degrees F	MM	6/16/06
150	50 Percent	D86	222.6 Degrees F	MM	6/16/06
190	90 Percent	D86	308.3 Degrees F	MM	6/16/06
200	End Point	D86	391 Degrees F	MM	6/16/06
201	Residue	D86	1.2 mL	MM	6/16/06
202	Total Recovery	D86	97.4 mL	MM	6/16/06
203	Loss	D86	1.4 mL	MM	6/16/06
543	Methanol	by D5599	0.00 Volume Percent	TS	6/19/06
543	Methanol	by D5599	0.00 Volume Percent	TS	6/19/06
584	Isopropanol	by D5599	0.00 Volume Percent	TS	6/19/06
584	Isopropanol	by D5599	0.00 Volume Percent	TS	6/19/06
585	t-Butanol	by D5599	0.00 Volume Percent	TS	6/19/06
585	t-Butanol	by D5599	0.00 Volume Percent	TS	6/19/06
586	n-Propanol	by D5599	0.00 Volume Percent	TS	6/19/06
586	n-Propanol	by D5599	0.00 Volume Percent	TS	6/19/06
587	sec-Butanol	by D5599	0.00 Volume Percent	TS	6/19/06
587	sec-Butanol	by D5599	0.00 Volume Percent	TS	6/19/06
588	DIPE	by D5599	0.00 Volume Percent	TS	6/19/06
588	DIPE	by D5599	0.00 Volume Percent	TS	6/19/06
589	Isobutanol	by D5599	0.00 Volume Percent	TS	6/19/06
589	Isobutanol	by D5599	0.00 Volume Percent	TS	6/19/06
5801	t-Amyl Alcohol	by D5599	0.00 Volume Percent	TS	6/19/06
5801	t-Amyl Alcohol	by D5599	0.00 Volume Percent	TS	6/19/06
5802	n-Butanol	by D5599	0.00 Volume Percent	TS	6/19/06
5802	n-Butanol	by D5599	0.00 Volume Percent	TS	6/19/06

NVFEL Fuel Analysis Report

14628

Kansas City Samples

Batch#

Facility Name: ERG   Facility Type: In House
Owner: EPA   Phone: (913) 299-9480
6636 Berger Avenue

U.S.

Samples Type: Correlation

VOC

Inspection information logged in by MM on 6/19/06.

Season: Winter

Kansas City Samples-HD 2   FTAG: 14628   Comments: 41; 7-22-04
LEW

Test Code	Test Method	Results	Units	Fuel_ Code: 21	Analys	Analysis Date
552	MTBE by D5599	0.00	Oxy Percent		TS	6/22/06
562	ETBE by D5599	0.00	Oxy Percent		TS	6/22/06
534	Ethanol by D5599	0.00	Oxy Percent		TS	6/22/06
572	TAME by D5599	0.00	Oxy Percent		TS	6/22/06
421	Sulfur in Gasoline D2622	227	Parts Per Million		NST	6/27/06
62	Vapor Pressure by D5191 (Modified)	6.48	PS I		NST	6/19/06
65	Percent Evaporated at 200 Degrees F D86	37.1	Volume Percent		MM	6/20/06
66	Percent Evaporated at 300 Degrees F D86	81.1	Volume Percent		MM	6/20/06
48	Aromatics in Gasoline MSD D5769	33.32	Volume Percent		TW	6/22/06
48	Aromatics in Gasoline MSD D5769	33.29	Volume Percent		TW	6/22/06
49	Olefins in by FIA D1319	8.5	Volume Percent		RCG	8/21/06
64	Benzene in Gasoline D3606	1.79	Volume Percent		TW	6/19/06
64	Benzene in Gasoline D3606	1.80	Volume Percent		TW	6/19/06
55	MTBE by D5599	0.00	Volume Percent		TS	6/22/06
532	Ethanol by D5599	0.00	Volume Percent		TS	6/22/06
59	Weight Percent Oxygen by D5599	0.00	Weight Percent		TS	6/22/06
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent		TS	6/22/06
57	TAME by D5599	0.00	Volume Percent		TS	6/22/06
56	ETBE by D5599	0.00	Volume Percent		TS	6/22/06
630	Toluene in gasoline by MSD D5769	7.73	Volumn Percent		TW	6/22/06
63	Benzene in Gasoline by GC/MSD D5769	1.77	Volume Percent		TW	6/22/06
630	Toluene in gasoline by MSD D5769	7.69	Volumn Percent		TW	6/22/06
63	Benzene in Gasoline by GC/MSD D5769	1.77	Volume Percent		TW	6/22/06
46	Aromatics by FIA D1319	32.6	Volume Percent		RCG	8/21/06
69	Specific Gravity @ 60 deg F D4052	0.75755	60/60F		MM	6/20/06
69	Specific Gravity @ 60 deg F D4052	0.75748	60/60F		MM	6/20/06
692	Degrees API D4052	55.3	Degrees API		MM	6/20/06
692	Degrees API D4052	55.29	Degrees API		MM	6/20/06
691	Density @ 60 deg F D4052	0.75673	g/cm-03 @ 60 deg F		MM	6/20/06
691	Density @ 60 deg F D4052	0.7568	g/cm-03 @ 60 deg F		MM	6/20/06
101	Initial Boiling Point D86	99.2	Degrees F		MM	6/20/06
110	10 Percent D86	145	Degrees F		MM	6/20/06
150	50 Percent D86	226.9	Degrees F		MM	6/20/06

190	90 Percent	D86	331 Degrees F	MM	6/20/06
200	End Point	D86	410.9 Degrees F	MM	6/20/06
201	Residue	D86	1.1 mL	MM	6/20/06
202	Total Recovery	D86	97.8 mL	MM	6/20/06
203	Loss	D86	1.1 mL	MM	6/20/06
543	Methanol	by D5599	0.00 Volume Percent	TS	6/22/06
584	Isopropanol	by D5599	0.00 Volume Percent	TS	6/22/06
585	t-Butanol	by D5599	0.00 Volume Percent	TS	6/22/06
586	n-Propanol	by D5599	0.00 Volume Percent	TS	6/22/06
587	sec-Butanol	by D5599	0.00 Volume Percent	TS	6/22/06
588	DIPE	by D5599	0.00 Volume Percent	TS	6/22/06
589	Isobutanol	by D5599	0.00 Volume Percent	TS	6/22/06
5801	t-Amyl Alcohol	by D5599	0.00 Volume Percent	TS	6/22/06
5802	n-Butanol	by D5599	0.00 Volume Percent	TS	6/22/06

NVFEL Fuel Analysis Report

14629

Batch#

Kansas City Samples

Facility Name: ERG Facility Type: In House

Owner: EPA Phone: (913) 299-9480

6636 Berger Avenue

U.S.

Samples Type: Correlation

VOC

Inspection information logged in by MM on 6/19/06.

Season: Winter

Kansas City Samples-SKI006(KS) **FTAG: 14629** **Comments:** **66; 7-27-04**

Fuel_ Code: 21

Test Code	Test Method	Results	Units	Analys	Analysis Date
552	MTBE by D5599	0.00	Oxy Percent	TS	6/22/06
562	ETBE by D5599	0.00	Oxy Percent	TS	6/22/06
534	Ethanol by D5599	0.00	Oxy Percent	TS	6/22/06
572	TAME by D5599	0.00	Oxy Percent	TS	6/22/06
421	Sulfur in Gasoline D2622	15	Parts Per Million	NST	6/27/06
62	Vapor Pressure by D5191 (Modified)	6.19	PS I	NST	6/19/06
65	Percent Evaporated at 200 Degrees F D86	27.5	Volume Percent	MM	6/20/06
66	Percent Evaporated at 300 Degrees F D86	85.2	Volume Percent	MM	6/20/06
48	Aromatics in Gasoline MSD D5769	27.84	Volume Percent	TW	6/22/06
49	Olefins in by FIA D1319	2.4	Volume Percent	RCG	8/21/06
64	Benzene in Gasoline D3606	1.73	Volume Percent	TW	6/28/06
532	Ethanol by D5599	0.00	Volume Percent	TS	6/22/06
55	MTBE by D5599	0.00	Volume Percent	TS	6/22/06
57	TAME by D5599	0.00	Volume Percent	TS	6/22/06
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent	TS	6/22/06
59	Weight Percent Oxygen by D5599	0.00	Weight Percent	TS	6/22/06
56	ETBE by D5599	0.00	Volume Percent	TS	6/22/06
630	Toluene in gasoline by MSD D5769	7.58	Volumn Percent	TW	6/22/06
63	Benzene in Gasoline by GC/MSD D5769	1.69	Volume Percent	TW	6/22/06
46	Aromatics by FIA D1319	25.9	Volume Percent	RCG	8/21/06
69	Specific Gravity @ 60 deg F D4052	0.74681	60/60F	MM	6/20/06
69	Specific Gravity @ 60 deg F D4052	0.74675	60/60F	MM	6/20/06
692	Degrees API D4052	57.99	Degrees API	MM	6/20/06
692	Degrees API D4052	57.97	Degrees API	MM	6/20/06
691	Density @ 60 deg F D4052	0.74607	g/cm-03 @ 60 deg F	MM	6/20/06
691	Density @ 60 deg F D4052	0.74601	g/cm-03 @ 60 deg F	MM	6/20/06
101	Initial Boiling Point D86	99.3	Degrees F	MM	6/20/06
110	10 Percent D86	159.8	Degrees F	MM	6/20/06
150	50 Percent D86	228.9	Degrees F	MM	6/20/06
190	90 Percent D86	321.5	Degrees F	MM	6/20/06
200	End Point D86	403.4	Degrees F	MM	6/20/06
201	Residue D86	1.1	mL	MM	6/20/06
202	Total Recovery D86	97.7	mL	MM	6/20/06

203	Loss	D86	1.2 mL	MM	6/20/06
543	Methanol	by D5599	0.00 Volume Percent	TS	6/22/06
584	Isopropanol	by D5599	0.00 Volume Percent	TS	6/22/06
585	t-Butanol	by D5599	0.00 Volume Percent	TS	6/22/06
586	n-Propanol	by D5599	0.00 Volume Percent	TS	6/22/06
587	sec-Butanol	by D5599	0.00 Volume Percent	TS	6/22/06
588	DIPE	by D5599	0.00 Volume Percent	TS	6/22/06
589	Isobutanol	by D5599	0.00 Volume Percent	TS	6/22/06
5801	t-Amyl Alcohol	by D5599	0.00 Volume Percent	TS	6/22/06
5802	n-Butanol	by D5599	0.00 Volume Percent	TS	6/22/06

NVFEL Fuel Analysis Report

14630

Batch#

Kansas City Samples

Facility Name: ERG Facility Type: In House

Owner: EPA Phone: (913) 299-9480

6636 Berger Avenue

U.S.

Samples Type: Correlation

VOC

Inspection information logged in by MM on 6/19/06.

Season: Winter

Kansas City Samples-130RJ3(MO) **FTAG: 14630** **Comments:** **208; 8-24-04**

Fuel_Code: 21

Test Code	Test Method	Results	Units	Analys	Analysis Date
552	MTBE by D5599	0.00	Oxy Percent	TS	6/22/06
562	ETBE by D5599	0.00	Oxy Percent	TS	6/22/06
534	Ethanol by D5599	0.00	Oxy Percent	TS	6/22/06
572	TAME by D5599	0.00	Oxy Percent	TS	6/22/06
421	Sulfur in Gasoline D2622	165	Parts Per Million	NST	6/27/06
62	Vapor Pressure by D5191 (Modified)	7.08	PS I	NST	6/19/06
65	Percent Evaporated at 200 Degrees F D86	38.6	Volume Percent	MM	6/21/06
66	Percent Evaporated at 300 Degrees F D86	80.4	Volume Percent	MM	6/21/06
48	Aromatics in Gasoline MSD D5769	33.35	Volume Percent	TW	6/22/06
49	Olefins in by FIA D1319	10.3	Volume Percent	RCG	8/21/06
64	Benzene in Gasoline D3606	1.73	Volume Percent	TW	6/28/06
532	Ethanol by D5599	0.00	Volume Percent	TS	6/22/06
55	MTBE by D5599	0.00	Volume Percent	TS	6/22/06
57	TAME by D5599	0.00	Volume Percent	TS	6/22/06
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent	TS	6/22/06
59	Weight Percent Oxygen by D5599	0.00	Weight Percent	TS	6/22/06
56	ETBE by D5599	0.00	Volume Percent	TS	6/22/06
630	Toluene in gasoline by MSD D5769	7.52	Volumn Percent	TW	6/22/06
46	Aromatics by FIA D1319	32.7	Volume Percent	RCG	8/21/06
63	Benzene in Gasoline by GC/MSD D5769	1.7	Volume Percent	TW	6/22/06
69	Specific Gravity @ 60 deg F D4052	0.7568	60/60F	MM	6/20/06
69	Specific Gravity @ 60 deg F D4052	0.75676	60/60F	MM	6/20/06
692	Degrees API D4052	55.47	Degrees API	MM	6/20/06
692	Degrees API D4052	55.48	Degrees API	MM	6/20/06
691	Density @ 60 deg F D4052	0.75601	g/cm-03 @ 60 deg F	MM	6/20/06
691	Density @ 60 deg F D4052	0.75605	g/cm-03 @ 60 deg F	MM	6/20/06
101	Initial Boiling Point D86	97	Degrees F	MM	6/21/06
110	10 Percent D86	140.7	Degrees F	MM	6/21/06
150	50 Percent D86	225.4	Degrees F	MM	6/21/06
190	90 Percent D86	332.9	Degrees F	MM	6/21/06
200	End Point D86	413	Degrees F	MM	6/21/06
201	Residue D86	0.9	mL	MM	6/21/06
202	Total Recovery D86	98.10001	mL	MM	6/21/06

203	Loss	D86	1 mL	MM	6/21/06
543	Methanol	by D5599	0.00 Volume Percent	TS	6/22/06
584	Isopropanol	by D5599	0.00 Volume Percent	TS	6/22/06
585	t-Butanol	by D5599	0.00 Volume Percent	TS	6/22/06
586	n-Propanol	by D5599	0.00 Volume Percent	TS	6/22/06
587	sec-Butanol	by D5599	0.00 Volume Percent	TS	6/22/06
588	DIPE	by D5599	0.00 Volume Percent	TS	6/22/06
589	Isobutanol	by D5599	0.00 Volume Percent	TS	6/22/06
5801	t-Amyl Alcohol	by D5599	0.00 Volume Percent	TS	6/22/06
5802	n-Butanol	by D5599	0.00 Volume Percent	TS	6/22/06

NVFEL Fuel Analysis Report

14631

Batch#

Kansas City Samples

Facility Name: ERG   Facility Type: In House

Owner: EPA   Phone: (913) 299-9480

6636 Berger Avenue

U.S.

Samples Type: Correlation

VOC

Inspection information logged in by MM on 6/19/06.

Season: Winter

Kansas City Samples-052DYF(MO)   **FTAG: 14631**   **Comments:** **221; 8-26-04**

Test Code	Test Method	Results	Units	Fuel_ Code: 21	Analys	Analysis Date
552	MTBE by D5599	0.00	Oxy Percent		TS	6/22/06
562	ETBE by D5599	0.00	Oxy Percent		TS	6/22/06
534	Ethanol by D5599	0.00	Oxy Percent		TS	6/22/06
572	TAME by D5599	0.00	Oxy Percent		TS	6/22/06
421	Sulfur in Gasoline D2622	133	Parts Per Million		NST	6/27/06
421	Sulfur in Gasoline D2622	130	Parts Per Million		NST	6/27/06
62	Vapor Pressure by D5191 (Modified)	6.51	PS I		NST	6/19/06
65	Percent Evaporated at 200 Degrees F D86	36.9	Volume Percent		MM	6/21/06
66	Percent Evaporated at 300 Degrees F D86	79.2	Volume Percent		MM	6/21/06
48	Aromatics in Gasoline MSD D5769	29.64	Volume Percent		TW	6/22/06
49	Olefins in by FIA D1319	11.6	Volume Percent		RCG	8/21/06
64	Benzene in Gasoline D3606	1.28	Volume Percent		TW	6/28/06
532	Ethanol by D5599	0.00	Volume Percent		TS	6/22/06
55	MTBE by D5599	0.00	Volume Percent		TS	6/22/06
57	TAME by D5599	0.00	Volume Percent		TS	6/22/06
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent		TS	6/22/06
59	Weight Percent Oxygen by D5599	0.00	Weight Percent		TS	6/22/06
56	ETBE by D5599	0.00	Volume Percent		TS	6/22/06
630	Toluene in gasoline by MSD D5769	6.18	Volumn Percent		TW	6/22/06
46	Aromatics by FIA D1319	29.9	Volume Percent		RCG	8/21/06
63	Benzene in Gasoline by GC/MSD D5769	1.27	Volume Percent		TW	6/22/06
69	Specific Gravity @ 60 deg F D4052	0.75447	60/60F		MM	6/20/06
69	Specific Gravity @ 60 deg F D4052	0.75438	60/60F		MM	6/20/06
692	Degrees API D4052	56.05	Degrees API		MM	6/20/06
692	Degrees API D4052	56.07	Degrees API		MM	6/20/06
691	Density @ 60 deg F D4052	0.75363	g/cm-03 @ 60 deg F		MM	6/20/06
691	Density @ 60 deg F D4052	0.75373	g/cm-03 @ 60 deg F		MM	6/20/06
101	Initial Boiling Point D86	100.1	Degrees F		MM	6/21/06
110	10 Percent D86	146.3	Degrees F		MM	6/21/06
150	50 Percent D86	226.4	Degrees F		MM	6/21/06
190	90 Percent D86	342.2	Degrees F		MM	6/21/06
200	End Point D86	439.5	Degrees F		MM	6/21/06
201	Residue D86	1.1	mL		MM	6/21/06

NVFEL Fuel Analysis Report

202	Total Recovery	D86	97.89999 mL	MM	6/21/06
203	Loss	D86	1 mL	MM	6/21/06
543	Methanol	by D5599	0.00 Volume Percent	TS	6/22/06
584	Isopropanol	by D5599	0.00 Volume Percent	TS	6/22/06
585	t-Butanol	by D5599	0.00 Volume Percent	TS	6/22/06
586	n-Propanol	by D5599	0.00 Volume Percent	TS	6/22/06
587	sec-Butanol	by D5599	0.00 Volume Percent	TS	6/22/06
588	DIPE	by D5599	0.00 Volume Percent	TS	6/22/06
589	Isobutanol	by D5599	0.00 Volume Percent	TS	6/22/06
5801	t-Amyl Alcohol	by D5599	0.00 Volume Percent	TS	6/22/06
5802	n-Butanol	by D5599	0.00 Volume Percent	TS	6/22/06

NVFEL Fuel Analysis Report

14632

Batch#

Kansas City Samples

Facility Name: ERG Facility Type: In House

Owner: EPA Phone: (913) 299-9480

6636 Berger Avenue

U.S.

Samples Type: Correlation

VOC

Inspection information logged in by MM on 6/19/06.

Season: Winter

Kansas City Samples-852HBL(MO) **FTAG: 14632** **Comments:** **254; 9-1-04**

Test Code	Test Method	Results	Units	Fuel_ Code: 21	Analys	Analysis Date
552	MTBE by D5599	0.00	Oxy Percent		TS	6/22/06
562	ETBE by D5599	0.00	Oxy Percent		TS	6/22/06
534	Ethanol by D5599	0.00	Oxy Percent		TS	6/22/06
572	TAME by D5599	0.00	Oxy Percent		TS	6/22/06
421	Sulfur in Gasoline D2622	153	Parts Per Million		NST	6/27/06
62	Vapor Pressure by D5191 (Modified)	6.21	PS I		NST	6/19/06
65	Percent Evaporated at 200 Degrees F D86	35.7	Volume Percent		MM	6/21/06
66	Percent Evaporated at 300 Degrees F D86	79.9	Volume Percent		MM	6/21/06
48	Aromatics in Gasoline MSD D5769	38.24	Volume Percent		TW	6/22/06
49	Olefins in by FIA D1319	8	Volume Percent		RCG	8/21/06
64	Benzene in Gasoline D3606	2.18	Volume Percent		TW	6/28/06
532	Ethanol by D5599	0.00	Volume Percent		TS	6/22/06
55	MTBE by D5599	0.00	Volume Percent		TS	6/22/06
57	TAME by D5599	0.00	Volume Percent		TS	6/22/06
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent		TS	6/22/06
59	Weight Percent Oxygen by D5599	0.00	Weight Percent		TS	6/22/06
56	ETBE by D5599	0.00	Volume Percent		TS	6/22/06
630	Toluene in gasoline by MSD D5769	8.73	Volumn Percent		TW	6/22/06
46	Aromatics by FIA D1319	38.9	Volume Percent		RCG	8/21/06
63	Benzene in Gasoline by GC/MSD D5769	2.14	Volume Percent		TW	6/22/06
69	Specific Gravity @ 60 deg F D4052	0.76474	60/60F		MM	6/20/06
69	Specific Gravity @ 60 deg F D4052	0.7647	60/60F		MM	6/20/06
692	Degrees API D4052	53.54	Degrees API		MM	6/20/06
692	Degrees API D4052	53.53	Degrees API		MM	6/20/06
691	Density @ 60 deg F D4052	0.76398	g/cm-03 @ 60 deg F		MM	6/20/06
691	Density @ 60 deg F D4052	0.76395	g/cm-03 @ 60 deg F		MM	6/20/06
101	Initial Boiling Point D86	101.7	Degrees F		MM	6/21/06
110	10 Percent D86	148.5	Degrees F		MM	6/21/06
150	50 Percent D86	231	Degrees F		MM	6/21/06
190	90 Percent D86	332.8	Degrees F		MM	6/21/06
200	End Point D86	410.8	Degrees F		MM	6/21/06
201	Residue D86	1	mL		MM	6/21/06
202	Total Recovery D86	98.3	mL		MM	6/21/06

203	Loss	D86	0.7 mL	MM	6/21/06
543	Methanol	by D5599	0.00 Volume Percent	TS	6/22/06
584	Isopropanol	by D5599	0.00 Volume Percent	TS	6/22/06
585	t-Butanol	by D5599	0.00 Volume Percent	TS	6/22/06
586	n-Propanol	by D5599	0.00 Volume Percent	TS	6/22/06
587	sec-Butanol	by D5599	0.00 Volume Percent	TS	6/22/06
588	DIPE	by D5599	0.00 Volume Percent	TS	6/22/06
589	Isobutanol	by D5599	0.00 Volume Percent	TS	6/22/06
5801	t-Amyl Alcohol	by D5599	0.00 Volume Percent	TS	6/22/06
5802	n-Butanol	by D5599	0.00 Volume Percent	TS	6/22/06

NVFEL Fuel Analysis Report

14633

Batch#

Kansas City Samples

Facility Name: ERG Facility Type: In House

Owner: EPA Phone: (913) 299-9480

6636 Berger Avenue

U.S.

Samples Type: Correlation

VOC

Inspection information logged in by MM on 6/19/06.

Season: Winter

Kansas City Samples-TDN989(KS) **FTAG: 14633** **Comments:** **301; 9-9-04**

Test Code	Test Method	Results	Units	Fuel_ Code: 21	Analys	Analysis Date
552	MTBE by D5599	0.00	Oxy Percent		TS	6/22/06
552	MTBE by D5599	0.00	Oxy Percent		TS	6/22/06
562	ETBE by D5599	0.00	Oxy Percent		TS	6/22/06
562	ETBE by D5599	0.00	Oxy Percent		TS	6/22/06
534	Ethanol by D5599	0.00	Oxy Percent		TS	6/22/06
534	Ethanol by D5599	0.00	Oxy Percent		TS	6/22/06
572	TAME by D5599	0.00	Oxy Percent		TS	6/22/06
572	TAME by D5599	0.00	Oxy Percent		TS	6/22/06
421	Sulfur in Gasoline D2622	61	Parts Per Million		NST	6/27/06
62	Vapor Pressure by D5191 (Modified)	6.63	PS I		NST	6/19/06
65	Percent Evaporated at 200 Degrees F D86	37.6	Volume Percent		MM	6/21/06
66	Percent Evaporated at 300 Degrees F D86	80.7	Volume Percent		MM	6/21/06
48	Aromatics in Gasoline MSD D5769	28.29	Volume Percent		TW	6/22/06
49	Olefins in by FIA D1319	11.6	Volume Percent		RCG	8/22/06
64	Benzene in Gasoline D3606	0.79	Volume Percent		TW	6/28/06
57	TAME by D5599	0.00	Volume Percent		TS	6/22/06
532	Ethanol by D5599	0.00	Volume Percent		TS	6/22/06
57	TAME by D5599	0.00	Volume Percent		TS	6/22/06
59	Weight Percent Oxygen by D5599	0.00	Weight Percent		TS	6/22/06
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent		TS	6/22/06
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent		TS	6/22/06
59	Weight Percent Oxygen by D5599	0.00	Weight Percent		TS	6/22/06
55	MTBE by D5599	0.00	Volume Percent		TS	6/22/06
55	MTBE by D5599	0.00	Volume Percent		TS	6/22/06
532	Ethanol by D5599	0.00	Volume Percent		TS	6/22/06
56	ETBE by D5599	0.00	Volume Percent		TS	6/22/06
56	ETBE by D5599	0.00	Volume Percent		TS	6/22/06
63	Benzene in Gasoline by GC/MSD D5769	0.78	Volume Percent		TW	6/22/06
46	Aromatics by FIA D1319	28.6	Volume Percent		RCG	8/22/06
630	Toluene in gasoline by MSD D5769	8.54	Volumn Percent		TW	6/22/06
69	Specific Gravity @ 60 deg F D4052	0.75231	60/60F		MM	6/20/06
69	Specific Gravity @ 60 deg F D4052	0.75227	60/60F		MM	6/20/06
692	Degrees API D4052	56.59	Degrees API		MM	6/20/06

692	Degrees API	D4052	56.6 Degrees API	MM	6/20/06
691	Density @ 60 deg F	D4052	0.75157 g/cm-03 @ 60 deg F	MM	6/20/06
691	Density @ 60 deg F	D4052	0.75153 g/cm-03 @ 60 deg F	MM	6/20/06
101	Initial Boiling Point	D86	98.6 Degrees F	MM	6/21/06
110	10 Percent	D86	145.5 Degrees F	MM	6/21/06
150	50 Percent	D86	223.8 Degrees F	MM	6/21/06
190	90 Percent	D86	343.7 Degrees F	MM	6/21/06
200	End Point	D86	429.1 Degrees F	MM	6/21/06
201	Residue	D86	1 mL	MM	6/21/06
202	Total Recovery	D86	98.1 mL	MM	6/21/06
203	Loss	D86	0.9 mL	MM	6/21/06
543	Methanol	by D5599	0.00 Volume Percent	TS	6/22/06
543	Methanol	by D5599	0.00 Volume Percent	TS	6/22/06
584	Isopropanol	by D5599	0.00 Volume Percent	TS	6/22/06
584	Isopropanol	by D5599	0.00 Volume Percent	TS	6/22/06
585	t-Butanol	by D5599	0.00 Volume Percent	TS	6/22/06
585	t-Butanol	by D5599	0.00 Volume Percent	TS	6/22/06
586	n-Propanol	by D5599	0.00 Volume Percent	TS	6/22/06
586	n-Propanol	by D5599	0.00 Volume Percent	TS	6/22/06
587	sec-Butanol	by D5599	0.00 Volume Percent	TS	6/22/06
587	sec-Butanol	by D5599	0.00 Volume Percent	TS	6/22/06
588	DIPE	by D5599	0.00 Volume Percent	TS	6/22/06
588	DIPE	by D5599	0.00 Volume Percent	TS	6/22/06
589	Isobutanol	by D5599	0.00 Volume Percent	TS	6/22/06
589	Isobutanol	by D5599	0.00 Volume Percent	TS	6/22/06
5801	t-Amyl Alcohol	by D5599	0.00 Volume Percent	TS	6/22/06
5801	t-Amyl Alcohol	by D5599	0.00 Volume Percent	TS	6/22/06
5802	n-Butanol	by D5599	0.00 Volume Percent	TS	6/22/06
5802	n-Butanol	by D5599	0.00 Volume Percent	TS	6/22/06

NVFEL Fuel Analysis Report

14634

Batch#

Kansas City Samples

Facility Name: ERG Facility Type: In House

Owner: EPA Phone: (913) 299-9480

6636 Berger Avenue

U.S.

Samples Type: Correlation

VOC

Inspection information logged in by MM on 6/19/06.

Season: Winter

Kansas City Samples-309PNM(MO) **FTAG: 14634** **Comments:** **343; 9-17-04**

Fuel_Code: 21

Test Code	Test Method	Results	Units	Analys	Analysis Date
552	MTBE by D5599	0.00	Oxy Percent	TS	6/22/06
562	ETBE by D5599	0.00	Oxy Percent	TS	6/22/06
534	Ethanol by D5599	0.00	Oxy Percent	TS	6/22/06
572	TAME by D5599	0.00	Oxy Percent	TS	6/22/06
421	Sulfur in Gasoline D2622	139	Parts Per Million	NST	6/27/06
62	Vapor Pressure by D5191 (Modified)	6.74	PS I	NST	6/19/06
65	Percent Evaporated at 200 Degrees F D86	37.9	Volume Percent	MM	6/21/06
66	Percent Evaporated at 300 Degrees F D86	80.5	Volume Percent	MM	6/21/06
48	Aromatics in Gasoline MSD D5769	34.89	Volume Percent	TW	6/22/06
49	Olefins in by FIA D1319	8.6	Volume Percent	RCG	8/22/06
64	Benzene in Gasoline D3606	1.89	Volume Percent	TW	6/28/06
532	Ethanol by D5599	0.00	Volume Percent	TS	6/22/06
55	MTBE by D5599	0.00	Volume Percent	TS	6/22/06
57	TAME by D5599	0.00	Volume Percent	TS	6/22/06
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent	TS	6/22/06
59	Weight Percent Oxygen by D5599	0.00	Weight Percent	TS	6/22/06
56	ETBE by D5599	0.00	Volume Percent	TS	6/22/06
630	Toluene in gasoline by MSD D5769	7.84	Volumn Percent	TW	6/22/06
63	Benzene in Gasoline by GC/MSD D5769	1.86	Volume Percent	TW	6/22/06
46	Aromatics by FIA D1319	35.1	Volume Percent	RCG	8/22/06
69	Specific Gravity @ 60 deg F D4052	0.75868	60/60F	MM	6/20/06
69	Specific Gravity @ 60 deg F D4052	0.7586	60/60F	MM	6/20/06
692	Degrees API D4052	55.03	Degrees API	MM	6/20/06
692	Degrees API D4052	55.01	Degrees API	MM	6/20/06
691	Density @ 60 deg F D4052	0.75793	g/cm-03 @ 60 deg F	MM	6/20/06
691	Density @ 60 deg F D4052	0.75785	g/cm-03 @ 60 deg F	MM	6/20/06
101	Initial Boiling Point D86	98.8	Degrees F	MM	6/21/06
110	10 Percent D86	143.3	Degrees F	MM	6/21/06
150	50 Percent D86	226.7	Degrees F	MM	6/21/06
190	90 Percent D86	331.5	Degrees F	MM	6/21/06
200	End Point D86	414.1	Degrees F	MM	6/21/06
201	Residue D86	0.9	mL	MM	6/21/06
202	Total Recovery D86	98.10001	mL	MM	6/21/06

203	Loss	D86	1 mL	MM	6/21/06
543	Methanol	by D5599	0.00 Volume Percent	TS	6/22/06
584	Isopropanol	by D5599	0.00 Volume Percent	TS	6/22/06
585	t-Butanol	by D5599	0.00 Volume Percent	TS	6/22/06
586	n-Propanol	by D5599	0.00 Volume Percent	TS	6/22/06
587	sec-Butanol	by D5599	0.00 Volume Percent	TS	6/22/06
588	DIPE	by D5599	0.00 Volume Percent	TS	6/22/06
589	Isobutanol	by D5599	0.00 Volume Percent	TS	6/22/06
5801	t-Amyl Alcohol	by D5599	0.00 Volume Percent	TS	6/22/06
5802	n-Butanol	by D5599	0.00 Volume Percent	TS	6/22/06

NVFEL Fuel Analysis Report

14635
Batch#

Kansas City Samples

Facility Name: ERG Facility Type: In House
Owner: EPA Phone: (913) 299-9480
6636 Berger Avenue

U.S.

Samples Type: Correlation
VOC
Inspection information logged in by MM on 6/19/06.
Season: Winter

Kansas City Samples-615TSB(MO) **FTAG: 14635** **Comments:** **557; 1/17/05**

Fuel_Code: 21

Test Code	Test Method	Results	Units	Analys	Analysis Date
552	MTBE by D5599	0.00	Oxy Percent	TS	6/22/06
552	MTBE by D5599	0.00	Oxy Percent	TS	6/22/06
562	ETBE by D5599	0.00	Oxy Percent	TS	6/22/06
562	ETBE by D5599	0.00	Oxy Percent	TS	6/22/06
534	Ethanol by D5599	0.00	Oxy Percent	TS	6/22/06
534	Ethanol by D5599	0.00	Oxy Percent	TS	6/22/06
572	TAME by D5599	0.00	Oxy Percent	TS	6/22/06
572	TAME by D5599	0.00	Oxy Percent	TS	6/22/06
421	Sulfur in Gasoline D2622	54	Parts Per Million	NST	6/20/06
421	Sulfur in Gasoline D2622	52	Parts Per Million	NST	6/20/06
62	Vapor Pressure by D5191 (Modified)	13.36	PSI	NST	6/19/06
65	Percent Evaporated at 200 Degrees F D86	43.8	Volume Percent	MM	6/21/06
66	Percent Evaporated at 300 Degrees F D86	88.1	Volume Percent	MM	6/21/06
48	Aromatics in Gasoline MSD D5769	25.48	Volume Percent	TW	6/22/06
49	Olefins in by FIA D1319	3.9	Volume Percent	RCG	8/22/06
64	Benzene in Gasoline D3606	0.41	Volume Percent	TW	6/28/06
532	Ethanol by D5599	0.00	Volume Percent	TS	6/22/06
532	Ethanol by D5599	0.00	Volume Percent	TS	6/22/06
55	MTBE by D5599	0.00	Volume Percent	TS	6/22/06
55	MTBE by D5599	0.00	Volume Percent	TS	6/22/06
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent	TS	6/22/06
57	TAME by D5599	0.00	Volume Percent	TS	6/22/06
57	TAME by D5599	0.00	Volume Percent	TS	6/22/06
59	Weight Percent Oxygen by D5599	0.00	Weight Percent	TS	6/22/06
59	Weight Percent Oxygen by D5599	0.00	Weight Percent	TS	6/22/06
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent	TS	6/22/06
56	ETBE by D5599	0.00	Volume Percent	TS	6/22/06
56	ETBE by D5599	0.00	Volume Percent	TS	6/22/06
46	Aromatics by FIA D1319	23.7	Volume Percent	RCG	8/22/06
630	Toluene in gasoline by MSD D5769	10.55	Volumn Percent	TW	6/22/06
63	Benzene in Gasoline by GC/MSD D5769	0.4	Volume Percent	TW	6/22/06
69	Specific Gravity @ 60 deg F D4052	0.72749	60/60F	MM	6/20/06
69	Specific Gravity @ 60 deg F D4052	0.72748	60/60F	MM	6/20/06

NVFEL Fuel Analysis Report

14635

692	Degrees API	D4052	63.01	Degrees API	MM	6/20/06
692	Degrees API	D4052	63.01	Degrees API	MM	6/20/06
691	Density @ 60 deg F	D4052	0.72677	g/cm-03 @ 60 deg F	MM	6/20/06
691	Density @ 60 deg F	D4052	0.72676	g/cm-03 @ 60 deg F	MM	6/20/06
101	Initial Boiling Point	D86	81.2	Degrees F	MM	6/21/06
110	10 Percent	D86	102.9	Degrees F	MM	6/21/06
150	50 Percent	D86	214.3	Degrees F	MM	6/21/06
190	90 Percent	D86	310.8	Degrees F	MM	6/21/06
200	End Point	D86	395.9	Degrees F	MM	6/21/06
201	Residue	D86	1.1	mL	MM	6/21/06
202	Total Recovery	D86	96.9	mL	MM	6/21/06
203	Loss	D86	2	mL	MM	6/21/06
543	Methanol	by D5599	0.00	Volume Percent	TS	6/22/06
543	Methanol	by D5599	0.00	Volume Percent	TS	6/22/06
584	Isopropanol	by D5599	0.00	Volume Percent	TS	6/22/06
584	Isopropanol	by D5599	0.00	Volume Percent	TS	6/22/06
585	t-Butanol	by D5599	0.00	Volume Percent	TS	6/22/06
585	t-Butanol	by D5599	0.00	Volume Percent	TS	6/22/06
586	n-Propanol	by D5599	0.00	Volume Percent	TS	6/22/06
586	n-Propanol	by D5599	0.00	Volume Percent	TS	6/22/06
587	sec-Butanol	by D5599	0.00	Volume Percent	TS	6/22/06
587	sec-Butanol	by D5599	0.00	Volume Percent	TS	6/22/06
588	DIPE	by D5599	0.00	Volume Percent	TS	6/22/06
588	DIPE	by D5599	0.00	Volume Percent	TS	6/22/06
589	Isobutanol	by D5599	0.00	Volume Percent	TS	6/22/06
589	Isobutanol	by D5599	0.00	Volume Percent	TS	6/22/06
5801	t-Amyl Alcohol	by D5599	0.00	Volume Percent	TS	6/22/06
5801	t-Amyl Alcohol	by D5599	0.00	Volume Percent	TS	6/22/06
5802	n-Butanol	by D5599	0.00	Volume Percent	TS	6/22/06
5802	n-Butanol	by D5599	0.00	Volume Percent	TS	6/22/06

NVFEL Fuel Analysis Report

14636

Batch#

Kansas City Samples

Facility Name: ERG Facility Type: In House

Owner: EPA Phone: (913) 299-9480

6636 Berger Avenue

U.S.

Samples Type: Correlation

VOC

Inspection information logged in by MM on 6/19/06.

Season: Winter

Kansas City Samples- SJ495(KS) **FTAG: 14636** **Comments:** **606; 1-27-05**

Fuel_ Code: 21

Test Code	Test Method	Results	Units	Analys	Analysis Date
552	MTBE by D5599	0.00	Oxy Percent	TS	6/28/06
562	ETBE by D5599	0.00	Oxy Percent	TS	6/28/06
534	Ethanol by D5599	0.00	Oxy Percent	TS	6/28/06
572	TAME by D5599	0.00	Oxy Percent	TS	6/28/06
421	Sulfur in Gasoline D2622	89	Parts Per Million	NST	6/27/06
62	Vapor Pressure by D5191 (Modified)	13.55	PS I	NST	6/19/06
65	Percent Evaporated at 200 Degrees F D86	46.5	Volume Percent	MM	6/22/06
65	Percent Evaporated at 200 Degrees F D86	46.5	Volume Percent	MM	6/22/06
66	Percent Evaporated at 300 Degrees F D86	85.9	Volume Percent	MM	6/22/06
66	Percent Evaporated at 300 Degrees F D86	85.8	Volume Percent	MM	6/22/06
48	Aromatics in Gasoline MSD D5769	23.54	Volume Percent	TW	6/22/06
49	Olefins in by FIA D1319	6.7	Volume Percent	RCG	8/22/06
64	Benzene in Gasoline D3606	0.73	Volume Percent	TW	6/28/06
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent	TS	6/28/06
532	Ethanol by D5599	0.00	Volume Percent	TS	6/28/06
57	TAME by D5599	0.00	Volume Percent	TS	6/28/06
59	Weight Percent Oxygen by D5599	0.00	Weight Percent	TS	6/28/06
55	MTBE by D5599	0.00	Volume Percent	TS	6/28/06
56	ETBE by D5599	0.00	Volume Percent	TS	6/28/06
46	Aromatics by FIA D1319	22.9	Volume Percent	RCG	8/22/06
630	Toluene in gasoline by MSD D5769	7.75	Volumn Percent	TW	6/22/06
63	Benzene in Gasoline by GC/MSD D5769	0.72	Volume Percent	TW	6/22/06
69	Specific Gravity @ 60 deg F D4052	0.7289	60/60F	MM	6/20/06
69	Specific Gravity @ 60 deg F D4052	0.72888	60/60F	MM	6/20/06
692	Degrees API D4052	62.63	Degrees API	MM	6/20/06
692	Degrees API D4052	62.63	Degrees API	MM	6/20/06
691	Density @ 60 deg F D4052	0.72816	g/cm-03 @ 60 deg F	MM	6/20/06
691	Density @ 60 deg F D4052	0.72818	g/cm-03 @ 60 deg F	MM	6/20/06
101	Initial Boiling Point D86	80.4	Degrees F	MM	6/22/06
101	Initial Boiling Point D86	80.3	Degrees F	MM	6/22/06
110	10 Percent D86	102.2	Degrees F	MM	6/22/06
110	10 Percent D86	101.8	Degrees F	MM	6/22/06
150	50 Percent D86	208.7	Degrees F	MM	6/22/06

150	50 Percent	D86	208.4	Degrees F	MM	6/22/06
190	90 Percent	D86	321.5	Degrees F	MM	6/22/06
190	90 Percent	D86	322.2	Degrees F	MM	6/22/06
200	End Point	D86	416.7	Degrees F	MM	6/22/06
200	End Point	D86	409.6	Degrees F	MM	6/22/06
201	Residue	D86	0.9	mL	MM	6/22/06
201	Residue	D86	1.2	mL	MM	6/22/06
202	Total Recovery	D86	97	mL	MM	6/22/06
202	Total Recovery	D86	97	mL	MM	6/22/06
203	Loss	D86	1.8	mL	MM	6/22/06
203	Loss	D86	2.1	mL	MM	6/22/06
543	Methanol	by D5599	0.00	Volume Percent	TS	6/28/06
584	Isopropanol	by D5599	0.00	Volume Percent	TS	6/28/06
585	t-Butanol	by D5599	0.00	Volume Percent	TS	6/28/06
586	n-Propanol	by D5599	0.00	Volume Percent	TS	6/28/06
587	sec-Butanol	by D5599	0.00	Volume Percent	TS	6/28/06
588	DIPE	by D5599	0.00	Volume Percent	TS	6/28/06
589	Isobutanol	by D5599	0.00	Volume Percent	TS	6/28/06
5801	t-Amyl Alcohol	by D5599	0.00	Volume Percent	TS	6/28/06
5802	n-Butanol	by D5599	0.00	Volume Percent	TS	6/28/06

NVFEL Fuel Analysis Report

14637

Batch#

Kansas City Samples

Facility Name: ERG Facility Type: In House

Owner: EPA Phone: (913) 299-9480

6636 Berger Avenue

U.S.

Samples Type: Correlation

VOC

Inspection information logged in by MM on 6/19/06.

Season: Winter

Kansas City Samples-154FFB(MO) **FTAG: 14637** **Comments:** **608; 1-27-05**

Test Code	Test Method	Results	Units	Fuel_ Code: 21	Analys	Analysis Date
552	MTBE by D5599	0.00	Oxy Percent		TS	6/28/06
562	ETBE by D5599	0.00	Oxy Percent		TS	6/28/06
534	Ethanol by D5599	0.00	Oxy Percent		TS	6/28/06
572	TAME by D5599	0.00	Oxy Percent		TS	6/28/06
421	Sulfur in Gasoline D2622	103	Parts Per Million		NST	6/27/06
62	Vapor Pressure by D5191 (Modified)	14.49	PS I		NST	6/19/06
65	Percent Evaporated at 200 Degrees F D86	50.2	Volume Percent		MM	6/22/06
66	Percent Evaporated at 300 Degrees F D86	83.7	Volume Percent		MM	6/22/06
48	Aromatics in Gasoline MSD D5769	21.86	Volume Percent		TW	6/22/06
49	Olefins in by FIA D1319	10	Volume Percent		RCG	8/22/06
64	Benzene in Gasoline D3606	1.00	Volume Percent		TW	6/28/06
59	Weight Percent Oxygen by D5599	0.07	Weight Percent		TS	6/28/06
57	TAME by D5599	0.00	Volume Percent		TS	6/28/06
532	Ethanol by D5599	0.00	Volume Percent		TS	6/28/06
593	Volume Percent Oxygenates by D5599	0.24	Volume Percent		TS	6/28/06
55	MTBE by D5599	0.00	Volume Percent		TS	6/28/06
56	ETBE by D5599	0.00	Volume Percent		TS	6/28/06
630	Toluene in gasoline by MSD D5769	4.94	Volumn Percent		TW	6/22/06
63	Benzene in Gasoline by GC/MSD D5769	0.99	Volume Percent		TW	6/22/06
46	Aromatics by FIA D1319	19.8	Volume Percent		RCG	8/22/06
69	Specific Gravity @ 60 deg F D4052	0.72618	60/60F		MM	6/20/06
69	Specific Gravity @ 60 deg F D4052	0.72617	60/60F		MM	6/20/06
692	Degrees API D4052	63.36	Degrees API		MM	6/20/06
692	Degrees API D4052	63.36	Degrees API		MM	6/20/06
691	Density @ 60 deg F D4052	0.72546	g/cm-03 @ 60 deg F		MM	6/20/06
691	Density @ 60 deg F D4052	0.72546	g/cm-03 @ 60 deg F		MM	6/20/06
101	Initial Boiling Point D86	79.4	Degrees F		MM	6/22/06
110	10 Percent D86	98.6	Degrees F		MM	6/22/06
150	50 Percent D86	199.5	Degrees F		MM	6/22/06
190	90 Percent D86	330.3	Degrees F		MM	6/22/06
200	End Point D86	443.3	Degrees F		MM	6/22/06
201	Residue D86	1.2	mL		MM	6/22/06
202	Total Recovery D86	97	mL		MM	6/22/06

203	Loss	D86	1.8 mL	MM	6/22/06
543	Methanol	by D5599	0.00 Volume Percent	TS	6/28/06
584	Isopropanol	by D5599	0.24 Volume Percent	TS	6/28/06
585	t-Butanol	by D5599	0.00 Volume Percent	TS	6/28/06
586	n-Propanol	by D5599	0.00 Volume Percent	TS	6/28/06
587	sec-Butanol	by D5599	0.00 Volume Percent	TS	6/28/06
588	DIPE	by D5599	0.00 Volume Percent	TS	6/28/06
589	Isobutanol	by D5599	0.00 Volume Percent	TS	6/28/06
5801	t-Amyl Alcohol	by D5599	0.00 Volume Percent	TS	6/28/06
5802	n-Butanol	by D5599	0.00 Volume Percent	TS	6/28/06

NVFEL Fuel Analysis Report

14638

Kansas City Samples

Batch#

Facility Name: ERG Facility Type: In House

Owner: EPA Phone: (913) 299-9480

6636 Berger Avenue

U.S.

Samples Type: Correlation

VOC

Inspection information logged in by MM on 6/19/06.

Season: Winter

Kansas City Samples-066RHM(MO) **FTAG: 14638** **Comments:** **646; 2-5-05**

Fuel_ Code: 21

Test Code	Test Method	Results	Units	Analys	Analysis Date
552	MTBE by D5599	0.00	Oxy Percent	TS	6/28/06
562	ETBE by D5599	0.00	Oxy Percent	TS	6/28/06
534	Ethanol by D5599	0.00	Oxy Percent	TS	6/28/06
572	TAME by D5599	0.00	Oxy Percent	TS	6/28/06
421	Sulfur in Gasoline D2622	215	Parts Per Million	NST	6/27/06
62	Vapor Pressure by D5191 (Modified)	13.2	PS I	NST	6/19/06
65	Percent Evaporated at 200 Degrees F D86	50.7	Volume Percent	MM	6/22/06
66	Percent Evaporated at 300 Degrees F D86	84.4	Volume Percent	MM	6/22/06
48	Aromatics in Gasoline MSD D5769	23.75	Volume Percent	TW	6/22/06
49	Olefins in by FIA D1319	10.5	Volume Percent	RCG	8/22/06
64	Benzene in Gasoline D3606	1.20	Volume Percent	TW	6/28/06
64	Benzene in Gasoline D3606	1.20	Volume Percent	TW	6/28/06
59	Weight Percent Oxygen by D5599	0.00	Weight Percent	TS	6/28/06
57	TAME by D5599	0.00	Volume Percent	TS	6/28/06
55	MTBE by D5599	0.00	Volume Percent	TS	6/28/06
532	Ethanol by D5599	0.00	Volume Percent	TS	6/28/06
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent	TS	6/28/06
56	ETBE by D5599	0.00	Volume Percent	TS	6/28/06
630	Toluene in gasoline by MSD D5769	5.38	Volumn Percent	TW	6/22/06
46	Aromatics by FIA D1319	21.9	Volume Percent	RCG	8/22/06
63	Benzene in Gasoline by GC/MSD D5769	1.18	Volume Percent	TW	6/22/06
69	Specific Gravity @ 60 deg F D4052	0.7288	60/60F	MM	6/20/06
69	Specific Gravity @ 60 deg F D4052	0.72881	60/60F	MM	6/20/06
692	Degrees API D4052	62.65	Degrees API	MM	6/20/06
692	Degrees API D4052	62.65	Degrees API	MM	6/20/06
691	Density @ 60 deg F D4052	0.72809	g/cm-03 @ 60 deg F	MM	6/20/06
691	Density @ 60 deg F D4052	0.72808	g/cm-03 @ 60 deg F	MM	6/20/06
101	Initial Boiling Point D86	83.7	Degrees F	MM	6/22/06
110	10 Percent D86	103.6	Degrees F	MM	6/22/06
150	50 Percent D86	198.1	Degrees F	MM	6/22/06
190	90 Percent D86	323.2	Degrees F	MM	6/22/06
200	End Point D86	399.5	Degrees F	MM	6/22/06
201	Residue D86	1.1	mL	MM	6/22/06

202	Total Recovery	D86	97.2 mL		MM	6/22/06
203	Loss	D86	1.7 mL		MM	6/22/06
543	Methanol	by D5599	0.00	Volume Percent	TS	6/28/06
584	Isopropanol	by D5599	0.00	Volume Percent	TS	6/28/06
585	t-Butanol	by D5599	0.00	Volume Percent	TS	6/28/06
586	n-Propanol	by D5599	0.00	Volume Percent	TS	6/28/06
587	sec-Butanol	by D5599	0.00	Volume Percent	TS	6/28/06
588	DIPE	by D5599	0.00	Volume Percent	TS	6/28/06
589	Isobutanol	by D5599	0.00	Volume Percent	TS	6/28/06
5801	t-Amyl Alcohol	by D5599	0.00	Volume Percent	TS	6/28/06
5802	n-Butanol	by D5599	0.00	Volume Percent	TS	6/28/06

NVFEL Fuel Analysis Report

14639

Batch#

Kansas City Samples

Facility Name: ERG   Facility Type: In House

Owner: EPA   Phone: (913) 299-9480

6636 Berger Avenue

U.S.

Samples Type: Correlation

VOC

Inspection information logged in by MM on 6/19/06.

Season: Winter

Kansas City Samples-697PAX(MO)   **FTAG: 14639**   **Comments:** **660; 2-7-05**

Test Code	Test Method	Results	Units	Fuel_ Code: 21	Analys	Analysis Date
552	MTBE by D5599	0.00	Oxy Percent		TS	6/28/06
562	ETBE by D5599	0.00	Oxy Percent		TS	6/28/06
534	Ethanol by D5599	0.00	Oxy Percent		TS	6/28/06
572	TAME by D5599	0.00	Oxy Percent		TS	6/28/06
421	Sulfur in Gasoline D2622	237	Parts Per Million		NST	6/27/06
62	Vapor Pressure by D5191 (Modified)	12.15	PS I		NST	6/19/06
65	Percent Evaporated at 200 Degrees F D86	48	Volume Percent		MM	6/22/06
66	Percent Evaporated at 300 Degrees F D86	83.1	Volume Percent		MM	6/22/06
48	Aromatics in Gasoline MSD D5769	25.65	Volume Percent		TW	6/22/06
49	Olefins in by FIA D1319	10.3	Volume Percent		RCG	8/22/06
64	Benzene in Gasoline D3606	1.31	Volume Percent		TW	6/28/06
59	Weight Percent Oxygen by D5599	0.00	Weight Percent		TS	6/28/06
57	TAME by D5599	0.00	Volume Percent		TS	6/28/06
532	Ethanol by D5599	0.00	Volume Percent		TS	6/28/06
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent		TS	6/28/06
55	MTBE by D5599	0.00	Volume Percent		TS	6/28/06
56	ETBE by D5599	0.00	Volume Percent		TS	6/28/06
630	Toluene in gasoline by MSD D5769	5.64	Volumn Percent		TW	6/22/06
63	Benzene in Gasoline by GC/MSD D5769	1.29	Volume Percent		TW	6/22/06
46	Aromatics by FIA D1319	24.5	Volume Percent		RCG	8/22/06
69	Specific Gravity @ 60 deg F D4052	0.73581	60/60F		MM	6/20/06
69	Specific Gravity @ 60 deg F D4052	0.73582	60/60F		MM	6/20/06
692	Degrees API D4052	60.8	Degrees API		MM	6/20/06
692	Degrees API D4052	60.81	Degrees API		MM	6/20/06
691	Density @ 60 deg F D4052	0.73508	g/cm-03 @ 60 deg F		MM	6/20/06
691	Density @ 60 deg F D4052	0.73509	g/cm-03 @ 60 deg F		MM	6/20/06
101	Initial Boiling Point D86	85.3	Degrees F		MM	6/22/06
110	10 Percent D86	108.9	Degrees F		MM	6/22/06
150	50 Percent D86	204.9	Degrees F		MM	6/22/06
190	90 Percent D86	327.4	Degrees F		MM	6/22/06
200	End Point D86	401.1	Degrees F		MM	6/22/06
201	Residue D86	1.1	mL		MM	6/22/06
202	Total Recovery D86	97.1	mL		MM	6/22/06

203	Loss	D86	1.8 mL	MM	6/22/06
543	Methanol	by D5599	0.00 Volume Percent	TS	6/28/06
584	Isopropanol	by D5599	0.00 Volume Percent	TS	6/28/06
585	t-Butanol	by D5599	0.00 Volume Percent	TS	6/28/06
586	n-Propanol	by D5599	0.00 Volume Percent	TS	6/28/06
587	sec-Butanol	by D5599	0.00 Volume Percent	TS	6/28/06
588	DIPE	by D5599	0.00 Volume Percent	TS	6/28/06
589	Isobutanol	by D5599	0.00 Volume Percent	TS	6/28/06
5801	t-Amyl Alcohol	by D5599	0.00 Volume Percent	TS	6/28/06
5802	n-Butanol	by D5599	0.00 Volume Percent	TS	6/28/06

NVFEL Fuel Analysis Report

14640 Batch#

Kansas City Samples

Facility Name: ERG Facility Type: In House

Owner: EPA Phone: (913) 299-9480

6636 Berger Avenue

U.S.

Samples Type: Correlation

VOC

Inspection information logged in by MM on 6/19/06.

Season: Winter

Kansas City Samples-SLE053(KS) **FTAG: 14640** **Comments:** **671; 2-9-05**

Test Code	Test Method	Results	Units	Fuel_ Code: 21	Analys	Analysis Date
552	MTBE by D5599	0.00	Oxy Percent		TS	6/28/06
562	ETBE by D5599	0.00	Oxy Percent		TS	6/28/06
534	Ethanol by D5599	0.00	Oxy Percent		TS	6/28/06
572	TAME by D5599	0.00	Oxy Percent		TS	6/28/06
421	Sulfur in Gasoline D2622	245	Parts Per Million		NST	6/27/06
62	Vapor Pressure by D5191 (Modified)	13.56	PS I		NST	6/19/06
62	Vapor Pressure by D5191 (Modified)	13.58	PS I		NST	6/19/06
65	Percent Evaporated at 200 Degrees F D86	50.4	Volume Percent		MM	6/22/06
66	Percent Evaporated at 300 Degrees F D86	84.1	Volume Percent		MM	6/22/06
48	Aromatics in Gasoline MSD D5769	23.79	Volume Percent		TW	6/22/06
49	Olefins in by FIA D1319	11.2	Volume Percent		RCG	8/22/06
64	Benzene in Gasoline D3606	1.20	Volume Percent		TW	6/28/06
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent		TS	6/28/06
55	MTBE by D5599	0.00	Volume Percent		TS	6/28/06
532	Ethanol by D5599	0.00	Volume Percent		TS	6/28/06
57	TAME by D5599	0.00	Volume Percent		TS	6/28/06
59	Weight Percent Oxygen by D5599	0.00	Weight Percent		TS	6/28/06
56	ETBE by D5599	0.00	Volume Percent		TS	6/28/06
630	Toluene in gasoline by MSD D5769	5.42	Volumn Percent		TW	6/22/06
46	Aromatics by FIA D1319	21.8	Volume Percent		RCG	8/22/06
63	Benzene in Gasoline by GC/MSD D5769	1.17	Volume Percent		TW	6/22/06
69	Specific Gravity @ 60 deg F D4052	0.72941	60/60F		MM	6/20/06
69	Specific Gravity @ 60 deg F D4052	0.72944	60/60F		MM	6/20/06
692	Degrees API D4052	62.48	Degrees API		MM	6/20/06
692	Degrees API D4052	62.49	Degrees API		MM	6/20/06
691	Density @ 60 deg F D4052	0.72869	g/cm-03 @ 60 deg F		MM	6/20/06
691	Density @ 60 deg F D4052	0.72872	g/cm-03 @ 60 deg F		MM	6/20/06
101	Initial Boiling Point D86	82.7	Degrees F		MM	6/22/06
110	10 Percent D86	103.3	Degrees F		MM	6/22/06
150	50 Percent D86	198.9	Degrees F		MM	6/22/06
190	90 Percent D86	323.5	Degrees F		MM	6/22/06
200	End Point D86	405.6	Degrees F		MM	6/22/06
201	Residue D86	1	mL		MM	6/22/06

NVFEL Fuel Analysis Report

202	Total Recovery	D86	97.2 mL	MM	6/22/06
203	Loss	D86	1.8 mL	MM	6/22/06
543	Methanol	by D5599	0.00 Volume Percent	TS	6/28/06
584	Isopropanol	by D5599	0.00 Volume Percent	TS	6/28/06
585	t-Butanol	by D5599	0.00 Volume Percent	TS	6/28/06
586	n-Propanol	by D5599	0.00 Volume Percent	TS	6/28/06
587	sec-Butanol	by D5599	0.00 Volume Percent	TS	6/28/06
588	DIPE	by D5599	0.00 Volume Percent	TS	6/28/06
589	Isobutanol	by D5599	0.00 Volume Percent	TS	6/28/06
5801	t-Amyl Alcohol	by D5599	0.00 Volume Percent	TS	6/28/06
5802	n-Butanol	by D5599	0.00 Volume Percent	TS	6/28/06

NVFEL Fuel Analysis Report

14646

Batch#

Kansas City Samples

Facility Name: ERG Facility Type: In House
Owner: EPA Phone: (913) 299-9480
6636 Berger Avenue

U.S.

Samples Type: Correlation

VOC

Inspection information logged in by MM on 6/23/06.

Season: Winter

Kansas City Samples-293RAY(Mo) **FTAG: 14646** **Comments:** **74; 7-29-04**

Test Code	Test Method	Results	Units	Fuel_ Code: 21	Analys	Analysis Date
552	MTBE by D5599	0.00	Oxy Percent		TS	6/28/06
552	MTBE by D5599	0.00	Oxy Percent		TS	6/28/06
562	ETBE by D5599	0.00	Oxy Percent		TS	6/28/06
562	ETBE by D5599	0.00	Oxy Percent		TS	6/28/06
534	Ethanol by D5599	0.00	Oxy Percent		TS	6/28/06
534	Ethanol by D5599	0.00	Oxy Percent		TS	6/28/06
572	TAME by D5599	0.00	Oxy Percent		TS	6/28/06
572	TAME by D5599	0.00	Oxy Percent		TS	6/28/06
421	Sulfur in Gasoline D2622	114	Parts Per Million		NST	6/27/06
62	Vapor Pressure by D5191 (Modified)	6.41	PS I		NST	6/26/06
65	Percent Evaporated at 200 Degrees F D86	36.9	Volume Percent		MM	6/27/06
66	Percent Evaporated at 300 Degrees F D86	79.7	Volume Percent		MM	6/27/06
48	Aromatics in Gasoline MSD D5769	29.91	Volume Percent		TW	6/29/06
49	Olefins in by FIA D1319	11.1	Volume Percent		RCG	8/23/06
64	Benzene in Gasoline D3606	1.38	Volume Percent		TW	6/28/06
532	Ethanol by D5599	0.00	Volume Percent		TS	6/28/06
55	MTBE by D5599	0.00	Volume Percent		TS	6/28/06
55	MTBE by D5599	0.00	Volume Percent		TS	6/28/06
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent		TS	6/28/06
532	Ethanol by D5599	0.00	Volume Percent		TS	6/28/06
57	TAME by D5599	0.00	Volume Percent		TS	6/28/06
57	TAME by D5599	0.00	Volume Percent		TS	6/28/06
59	Weight Percent Oxygen by D5599	0.00	Weight Percent		TS	6/28/06
59	Weight Percent Oxygen by D5599	0.00	Weight Percent		TS	6/28/06
593	Volume Percent Oxygenates by D5599	0.00	Volume Percent		TS	6/28/06
56	ETBE by D5599	0.00	Volume Percent		TS	6/28/06
56	ETBE by D5599	0.00	Volume Percent		TS	6/28/06
46	Aromatics by FIA D1319	29.2	Volume Percent		RCG	8/23/06
63	Benzene in Gasoline by GC/MSD D5769	1.36	Volume Percent		TW	6/29/06
630	Toluene in gasoline by MSD D5769	6.83	Volumn Percent		TW	6/29/06
69	Specific Gravity @ 60 deg F D4052	0.75394	60/60F		MM	6/27/06
69	Specific Gravity @ 60 deg F D4052	0.75396	60/60F		MM	6/27/06
692	Degrees API D4052	56.18	Degrees API		MM	6/27/06

692	Degrees API	D4052	56.18 Degrees API	MM	6/27/06
691	Density @ 60 deg F	D4052	0.75322 g/cm-03 @ 60 deg F	MM	6/27/06
691	Density @ 60 deg F	D4052	0.75319 g/cm-03 @ 60 deg F	MM	6/27/06
101	Initial Boiling Point	D86	100.7 Degrees F	MM	6/27/06
110	10 Percent	D86	147 Degrees F	MM	6/27/06
150	50 Percent	D86	226.4 Degrees F	MM	6/27/06
190	90 Percent	D86	341.4 Degrees F	MM	6/27/06
200	End Point	D86	431.9 Degrees F	MM	6/27/06
201	Residue	D86	1 mL	MM	6/27/06
202	Total Recovery	D86	98 mL	MM	6/27/06
203	Loss	D86	1 mL	MM	6/27/06
543	Methanol	by D5599	0.00 Volume Percent	TS	6/28/06
543	Methanol	by D5599	0.00 Volume Percent	TS	6/28/06
584	Isopropanol	by D5599	0.00 Volume Percent	TS	6/28/06
584	Isopropanol	by D5599	0.00 Volume Percent	TS	6/28/06
585	t-Butanol	by D5599	0.00 Volume Percent	TS	6/28/06
585	t-Butanol	by D5599	0.00 Volume Percent	TS	6/28/06
586	n-Propanol	by D5599	0.00 Volume Percent	TS	6/28/06
586	n-Propanol	by D5599	0.00 Volume Percent	TS	6/28/06
587	sec-Butanol	by D5599	0.00 Volume Percent	TS	6/28/06
587	sec-Butanol	by D5599	0.00 Volume Percent	TS	6/28/06
588	DIPE	by D5599	0.00 Volume Percent	TS	6/28/06
588	DIPE	by D5599	0.00 Volume Percent	TS	6/28/06
589	Isobutanol	by D5599	0.00 Volume Percent	TS	6/28/06
589	Isobutanol	by D5599	0.00 Volume Percent	TS	6/28/06
5801	t-Amyl Alcohol	by D5599	0.00 Volume Percent	TS	6/28/06
5801	t-Amyl Alcohol	by D5599	0.00 Volume Percent	TS	6/28/06
5802	n-Butanol	by D5599	0.00 Volume Percent	TS	6/28/06
5802	n-Butanol	by D5599	0.00 Volume Percent	TS	6/28/06

Kansas City PM Characterization Study
Final Report

Appendix GG
Round 1 Gravimetric vs Quartz Crystal Microbalance

Assessment and Standards Division
Office of Transportation and Air Quality
U.S. Environmental Protection Agency

Sponsors:

National Renewable Energy Laboratory, U.S. Department of Energy
Federal Highway Administration, U.S. Department of Transportation
STAPPA-ALAPCO Emission Inventory Improvement Program
Coordinating Research Council Inc. (Project No. E-69)

Prepared for EPA by
Eastern Research Group, Incorporated
Austin, TX

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NuStats LLC
Austin, TX

Desert Research Institute
Reno, NV

EPA Contract No. GS 10F-0036K

October 27,2006
Revised April 2008 by EPA staff

EPA United States Environmental Protection Agency

EPA420-R-08-009
April 2008

File No	QCM Bag1	QCM Bag2	QCM Bag3	QCM FTP	Grav Bag1	Grav Bag2	Grav Bag3	Grav Comp	Bin No.	Assigned Bin	QC Code	Comment
84037	40.07	41.61	7.58	39.18	11.7	9.5	2.37	9.12	1	A.Truck-Pre 1981		
84154	83.98	59.69	37.57	59.44	163.2	80.5	15.2	80.3	1	A.Truck-Pre 1981	VQ;2	
Average	62.025	50.65	22.575	49.31	87.45	45	8.785	44.71				
Std. Dev.	31.04906	12.78449	21.20613	14.32598	107.1267	50.20458	9.07218	50.33186				
84048	236.6	9.68	50.14	24.21	239.36	47.14	89.03	59.98	2	B.Truck-1981-1990		
84074	27.2	8.68	5.9	9.46	21.74	5.96	0.45	6.41	2	B.Truck-1981-1990		
84145	13.8	2.43	7.38	3.36	3.43	1.14	1.16	1.26	2	B.Truck-1981-1990	FD;1	Stalled at start of Z1
84146	16.17	12.75	8.82	12.65	6.59	10.18	-2.15	9.16	2	B.Truck-1981-1990		
84189									2	B.Truck-1981-1990	VQ;2,4	
84201	42.64	20.87	28.06	22.51	28.19	1.01	147.53	12.49	2	B.Truck-1981-1990		
84216	5.45	18.84	-0.4	16.86	4.55	14.5	1.57	13.13	2	B.Truck-1981-1990		
84248	9.96	21.11	5.41	19.38	5.85	15.97	6.44	14.75	2	B.Truck-1981-1990		
84256	46.03	16.03	12.57	17.4	47.94	4.16	0.61	6.26	2	B.Truck-1981-1990		
84263									2	B.Truck-1981-1990	VQ;2	
84278	34.6	7.02	31.84	10.14	40.07	10.42	3.05	11.43	2	B.Truck-1981-1990		
84283									2	B.Truck-1981-1990	VQ;2	
84336	17.05	30.92	9.71	28.51	9.55	11.44	0.35	10.44	2	B.Truck-1981-1990		
84354	30.38	42.66	32.46	41.33	12.39	25.27	12.61	23.73	2	B.Truck-1981-1990		
84373	50.93	9.84	14.5	12.38	59.97	6.13	-3.35	8.37	2	B.Truck-1981-1990		
Average	44.23417	16.73583	17.19917	18.1825	39.96917	12.77667	21.44167	14.78417				
Std. Dev.	62.34937	11.24754	15.00945	10.11778	65.53638	12.80245	47.10206	15.25325				
84054	3.72	5.13	3.07	4.91	7.34	1.19	16.41	2.56	3	C.Truck-1991-1995		
84064	12.47	2.79	2.65	3.28	2.71	0.45	-0.75	0.48	3	C.Truck-1991-1995		
84066	8.31	8.97	7.18	8.81	2.27	7	1.52	6.37	3	C.Truck-1991-1995		Tunnel heater off
84067	13.58	4.94	6.24	5.47	4.15	1.73	1.76	1.86	3	C.Truck-1991-1995		
84073	16.58	7	5.68	7.41	6.07	2.98	0.88	3	3	C.Truck-1991-1995		
84094	13.04	4.81	9.56	5.55	1.5	2.06	1.38	1.98	3	C.Truck-1991-1995		
84119	26.99	19.43	20.97	19.93	-2.65	7.15	-0.83	6.1	3	C.Truck-1991-1995		
84125	9.38	6.63	5.5	6.69	2.43	3.6	1.39	3.39	3	C.Truck-1991-1995		
84132	16.64	4.16	11.33	5.31	15.01	3.55	6.19	4.33	3	C.Truck-1991-1995		
84137	17.68	5.58	45.02	8.93	5.94	4.53	1.83	4.41	3	C.Truck-1991-1995	FQ;3	DUPLICATE
84138	17.58	6.68	3.23	7.02	11.11	5.32	2.15	5.41	3	C.Truck-1991-1995		
84144	22.16	2.76	5.39	3.94	19.74	6.72	-0.42	6.9	3	C.Truck-1991-1995		
84196	1.02	0.72	0.38	0.72	1.15	3.94	64.29	8.01	3	C.Truck-1991-1995		
84206	8.54	3.84	1.8	3.95	2.9	1.22	1.32	1.31	3	C.Truck-1991-1995	FQPAD	Engine skiping on accel.
84268									3	C.Truck-1991-1995	VQ;2	
84281	27.26	9.12	0.64	9.48	9.02	10.35	3.61	9.81	3	C.Truck-1991-1995		
84287									3	C.Truck-1991-1995	VQ;2	
84302	9.44	12.42	8.48	11.99	6.95	7.04	6.47	7	3	C.Truck-1991-1995		
84315	97.26	32.56	65.02	38.05	105.61	56.09	86.42	60.67	3	C.Truck-1991-1995		
Average	18.92059	8.090588	11.89059	8.908235	11.83824	7.348235	11.38941	7.858235				
Std. Dev.	21.4384	7.63763	17.31145	8.628843	24.77363	12.8434	24.72355	13.85121				

File No	QCM Bag1	QCM Bag2	QCM Bag3	QCM FTP	Grav Bag1	Grav Bag2	Grav Bag3	Grav Comp	Bin No.	Assigned Bin	QC Code	Comment
84034	1.35	1.18	1.46	1.21	9.08	2.16	4.06	2.65	4	D.Truck-1996-Newer	FDP	
84035	2.44	2.34	0.45	2.22	6.14	6.25	0.82	5.86	4	D.Truck-1996-Newer		
84039	11.13	5.15	4.87	5.45	7.65	2.36	2	2.61	4	D.Truck-1996-Newer		
84055	10.95	8.45	11.39	8.78	4.9	4.62	7	4.8	4	D.Truck-1996-Newer		Rattling catalyst possibly bad
84056	2.45	2.26	0.44	2.15	2.11	1.42	0.34	1.39	4	D.Truck-1996-Newer		
84069	9.97	2.24	1.86	2.62	2.13	0.43	-0.03	0.49	4	D.Truck-1996-Newer		
84072	4.31	4.52	0.43	4.22	2.57	1.52	0.86	1.53	4	D.Truck-1996-Newer		Zero drift on torque readout
84086									4	D.Truck-1996-Newer	VQ;3	Traction control was engaged
84096									4	D.Truck-1996-Newer	VQ;2	
84098	4.31	0.67	1.03	0.89	2.88	0.31	1.35	0.51	4	D.Truck-1996-Newer		
84104	9.62	2.58	0.5	2.8	3.55	1.5	0.73	1.56	4	D.Truck-1996-Newer		
84109	10.68	1.94	3.38	2.49	3.17	1.03	-0.05	1.07	4	D.Truck-1996-Newer		DUPLICATE
84111	10.1	3.95	2.22	4.15	47.55	1.76	0.87	4.07	4	D.Truck-1996-Newer		
84116	12.82	3.45	3.88	3.96	2.96	1.77	1.1	1.79	4	D.Truck-1996-Newer		DUPLICATE
84122	9.49	1.75	0.55	2.07	5.05	1.65	0.66	1.76	4	D.Truck-1996-Newer		
84127									4	D.Truck-1996-Newer	VQ;2	
84140									4	D.Truck-1996-Newer		
84150									4	D.Truck-1996-Newer	VQ;2	
84153									4	D.Truck-1996-Newer	VQ;2	
84167	8.14	1.75	0.94	2.02	5.64	0.67	0.06	0.89	4	D.Truck-1996-Newer		
84179	7.54	7	6.24	6.98	2.04	1.84	2.42	1.89	4	D.Truck-1996-Newer		
84192	0.12	-0.14	0.24	-0.1	0.13	5.87	-0.17	5.17	4	D.Truck-1996-Newer		
84193	0.24	0.14	0.33	0.16	8.73	5.86	2.26	5.76	4	D.Truck-1996-Newer		
84204									4	D.Truck-1996-Newer	FQ;2 VQ;3	Dyno malfunction
84205	32.81	12.5	3.43	12.92	15.85	8.58	1.07	8.44	4	D.Truck-1996-Newer		
84223	6.8	1.82	3.09	2.17	5.5	0.77	-1.05	0.89	4	D.Truck-1996-Newer		
84229	14.9	13.31	2.21	12.62	4.15	7.05	2.63	6.59	4	D.Truck-1996-Newer		
84242	29.8	7.22	4.38	8.21	14.3	1.35	-0.52	1.9	4	D.Truck-1996-Newer		
84286	25.15	9.23	18.46	10.66	4.33	2.63	3.83	2.8	4	D.Truck-1996-Newer		
84298									4	D.Truck-1996-Newer	VQ;2	
84303	6.11	5.1	3.18	5.02	2.84	2.4	2.84	2.45	4	D.Truck-1996-Newer		
84310	23.94	5.31	1.25	6	13.14	5.84	0.92	5.88	4	D.Truck-1996-Newer		
84329									4	D.Truck-1996-Newer	VQ;2	
84337	4.46	4.38	2.46	4.25	0.09	0.38	-0.18	0.32	4	D.Truck-1996-Newer		
84339	18.86	6.75	6.75	7.39	7.43	3.45	1.97	3.56	4	D.Truck-1996-Newer		
84343	12.66	1.3	2.5	1.97	5.45	1.09	0.23	1.25	4	D.Truck-1996-Newer	FD;2,3,4?	
84344	58.85	5.98	6.67	8.83	15.16	2.36	-0.13	2.86	4	D.Truck-1996-Newer		
84349	14.14	4.89	3.87	5.31	2.8	0.83	-0.6	0.84	4	D.Truck-1996-Newer		
84375									4	D.Truck-1996-Newer	VQ;2	
84376	31.96	8.74	4.61	9.64	13.88	5.24	-0.07	5.3	4	D.Truck-1996-Newer		
Average	13.20333	4.525333	3.435667	4.902	7.373333	2.766333	1.174	2.896				
Std. Dev.	12.52145	3.450489	3.782561	3.597116	8.795765	2.274557	1.689566	2.148722				
84076	86.68	3.92	25.46	9.6	56.41	14.47	5.73	15.99	5	E.Car-Pre 1981		
84188	538.87	6.56	45.72	37.9	326.23	25.61	9.46	40.64	5	E.Car-Pre 1981		Stalled at start of Z1
84271	48.17	2.46	7.74	5.16	57.2	2.78	3.12	5.66	5	E.Car-Pre 1981		
84277									5	E.Car-Pre 1981	VQ;2	
84309	223.24	40.51	68.96	51.91	134.01	40.2	16.79	43.42	5	E.Car-Pre 1981		
84367	117.84	22.33	18	26.88	138	89.06	144.55	95.34	5	E.Car-Pre 1981		
Average	202.96	15.156	33.176	26.29	142.37	34.424	35.93	40.21				
Std. Dev.	198.7292	16.24514	24.36537	19.4715	110.155	33.52479	60.93817	34.74952				

File No	QCM Bag1	QCM Bag2	QCM Bag3	QCM FTP	Grav Bag1	Grav Bag2	Grav Bag3	Grav Comp	Bin No.	Assigned Bin	QC Code	Comment
84040	11.05	11.54	5.63	11.11	2.35	4.93	4.87	4.79	6	F.Car-1981-1990		
84052									6	F.Car-1981-1990	VQ;2	AC switch broken
84071	32.71	9.06	29.45	11.7	72.47	34.86	58.32	38.43	6	F.Car-1981-1990		
84079	40.1	2.04	0.18	3.86	286.41	19.69	6.22	32.43	6	F.Car-1981-1990	VD;2,4	
84107									6	F.Car-1981-1990	VQ;1,2	
84120	3.38	2.57	-0.46	2.41	2.92	5.8	3	5.47	6	F.Car-1981-1990		
84123									6	F.Car-1981-1990	VQ;2	DUPLICATE
84126	10.8	5.93	4.66	6.09	9.56	2.56	2.07	2.89	6	F.Car-1981-1990		
84141	17.96	3.32	2.7	4.02	14.43	11.38	3.61	11	6	F.Car-1981-1990	FPA;2,3,4	Torque not recorded
84159									8	H.Car-1996-Newer		DUPLICATE
84162	25.42	43.79	8.42	40.42	14.94	27.89	2.63	25.49	6	F.Car-1981-1990		
84171									6	F.Car-1981-1990	VQ;2	Stalled twice in Z2
84172	23.51	7.67	2.75	8.16	26.91	13.56	2.07	13.47	6	F.Car-1981-1990		
84175	26.77	2.26	6.86	3.86	20.35	2.88	0.64	3.64	6	F.Car-1981-1990		
84180	37.22	5.41	8.12	7.23	25.73	8.93	1.26	9.26	6	F.Car-1981-1990		
84197	10.52	2.99	2.96	3.38	3.46	0.7	1.29	0.89	6	F.Car-1981-1990		Hard cold start
84208	216.41	13.39	63.74	27.4	209.33	42.73	86.8	54.42	6	F.Car-1981-1990	FS	
84210	46.2	7.61	11.62	9.8	101.5	7.24	8.46	12.01	6	F.Car-1981-1990		
84211	12.21	6.22	2.8	6.3	14.04	34.89	7.12	31.9	6	F.Car-1981-1990		
84213									6	F.Car-1981-1990	VQ;2	
84221	51.8	12.57	12.01	14.57	27.45	10.99	2.55	11.26	6	F.Car-1981-1990		
84233	21.64	7.61	8.94	8.42	34.33	5.74	7.5	7.31	6	F.Car-1981-1990		
84235	41.06	43.22	29.01	42.12	29.48	44.96	8.74	41.64	6	F.Car-1981-1990		
84238	16.09	5.3	4.97	5.83	5.47	11.43	0.85	10.4	6	F.Car-1981-1990		Shut off twice during initial idle
84239									6	F.Car-1981-1990	VQ;2	
84245	10.45	79.87	28.37	72.69	5.57	54.38	6.22	48.49	6	F.Car-1981-1990		
84250									6	F.Car-1981-1990	FQ;2,3,4	
84257	21.91	9.25	12.76	10.15	-1.5	4.46	3.44	4.08	6	F.Car-1981-1990		
84261									6	F.Car-1981-1990	VQ;2	
84265									6	F.Car-1981-1990	VQ;2	
84267	22.82	6.38	8.31	7.36	9.36	3.26	2.51	3.52	6	F.Car-1981-1990		
84270	23.68	8.25	6.6	8.94	14.15	26.59	4.86	24.44	6	F.Car-1981-1990		
84276	20.79	5.15	2.63	5.79	13.36	1.26	1.18	1.89	6	F.Car-1981-1990		
84284	13.44	24.64	23.49	23.97	20.16	79.97	14.95	72.28	6	F.Car-1981-1990		
84289	55.73	293.03	193.28	274.02	51.6	181.75	15.14	163.67	6	F.Car-1981-1990		
84293									6	F.Car-1981-1990		Stalled in Z1
84295									6	F.Car-1981-1990	VQ;2	Stalled inZ1
84300	17.01	8.64	6.17	8.9	6.42	0.85	2.12	1.23	6	F.Car-1981-1990		
84301	23.07	13.54	19.44	14.43	12.58	9.86	4.96	9.66	6	F.Car-1981-1990	FQPAD	
84311									6	F.Car-1981-1990	VQ;2	
84314	15.15	11.14	10.08	11.27	11.32	3.44	1	3.68	6	F.Car-1981-1990		
84322	11.85	9.62	3.58	9.32	7.62	10.47	4.51	9.91	6	F.Car-1981-1990	FS	
84334	152.34	98.46	57.74	98.46	113.25	99	16.48	94.05	6	F.Car-1981-1990		
84335	14.89	3.09	3.18	3.73	6.58	5.71	0.9	5.42	6	F.Car-1981-1990	FD;2	
84366	10.21	21.57	10.02	20.17	4.42	7.61	0.33	6.94	6	F.Car-1981-1990		
84386	29.27	2.73	9.98	4.37	21.08	1.34	4.25	2.38	6	F.Car-1981-1990		would not go into gear for Z1
Average	32.95333	23.87455	18.18152	23.94697	36.27576	23.67	8.813636	23.28303				
Std. Dev.	41.83713	52.91356	34.72499	49.37687	61.40097	36.65589	17.3325	33.5535				

File No	QCM Bag1	QCM Bag2	QCM Bag3	QCM FTP	Grav Bag1	Grav Bag2	Grav Bag3	Grav Comp	Bin No.	Assigned Bin	QC Code	Comment
84036	5.27	2.86	2.36	2.95	6.42	1.6	0.55	1.78	7	G.Car-1991-1995		
84043	11.33	6.11	7.83	6.5	5.7	3.54	0.66	3.45	7	G.Car-1991-1995		
84091	10.76	-1.69	0.26	-0.91	1.34	0.93	1.21	0.97	7	G.Car-1991-1995		
84101	22.7	5.8	6.07	6.7	37.87	9.05	2.86	10.12	7	G.Car-1991-1995		
84108	11.64	-0.65	6.49	0.46	11.39	2.73	-0.4	2.96	7	G.Car-1991-1995	FA	
84110									7	G.Car-1991-1995	VQ;2	
84113									7	G.Car-1991-1995	VQ;2	
84115									7	G.Car-1991-1995	VQ;2	DUPLICATE
84135	24.18	-1.84	-0.69	-0.44	16.16	1.34	2.5	2.17	7	G.Car-1991-1995		
84148	47.1	14.45	19.74	16.52	51.67	47.56	25.42	46.24	7	G.Car-1991-1995		
84157									7	G.Car-1991-1995	VQ;4 VD;2,3,4	
84165	36.72	8.28	18.06	10.42	30.35	19.9	3.78	19.33	7	G.Car-1991-1995		
84166	6.9	-0.11	1.77	0.37	1.9	0.35	2.94	0.6	7	G.Car-1991-1995		
84169	9.45	4.49	4.26	4.72	0.49	0.12	-1.23	0.04	7	G.Car-1991-1995		DUPLICATE
84174	8.83	6.2	3.65	6.16	4.16	4.12	-0.98	3.76	7	G.Car-1991-1995		
84182	13.06	5.92	6.24	6.31	25.13	11.45	9.27	12	7	G.Car-1991-1995		
84198	19.87	1.54	-0.21	2.38	8.94	1.76	0.87	2.07	7	G.Car-1991-1995		
84200									7	G.Car-1991-1995	VQ;1,2 FS	DUPLICATE
84214	47.49	15.14	4.53	16.03	21.13	6.23	2	6.69	7	G.Car-1991-1995	FQ;1	Late crank, ~20 sec.
84215	-2.15	7.27	4.43	6.58	2.95	3.96	1.38	3.73	7	G.Car-1991-1995		
84219	11.43	5.11	14.46	6.07	7.58	9.34	0.73	8.66	7	G.Car-1991-1995	FQ;2	
84220	18.28	6.99	8.05	7.65	28.14	3.71	1.98	4.85	7	G.Car-1991-1995		
84228									7	G.Car-1991-1995	VQ;2	Stalled once
84230	8.96	4.7	0.38	4.62	7.5	3.07	2.18	3.24	7	G.Car-1991-1995		
84231	11.18	4.21	1.11	4.36	11.18	5.17	0.66	5.17	7	G.Car-1991-1995		
84234	7.73	4.78	6.05	5.02	4.06	1.45	2.78	1.67	7	G.Car-1991-1995		
84236	15.83	7.03	13.61	7.93	1.32	1.84	1.21	1.77	7	G.Car-1991-1995		
84244	19.41	22.51	17.42	22	7.93	24.55	1.17	22.08	7	G.Car-1991-1995		
84246	23.16	1.27	-0.13	2.3	38.13	23.68	9.76	23.46	7	G.Car-1991-1995		Cut off during first 10 sec. of Z1
84254	15.04	18.55	16.71	17.89	4.19	2.07	0.96	2.26	7	G.Car-1991-1995		
84258	12.61	6.45	-4.66	6.01	6.77	5.02	0.41	4.8	7	G.Car-1991-1995		
84262	30.06	8.19	15.12	9.8	7.16	3.27	1.04	3.32	7	G.Car-1991-1995		DUPLICATE
84274									7	G.Car-1991-1995	VQ;2	
84307	12.44	3.48	1.91	3.83	6.46	1.37	1.29	1.62	7	G.Car-1991-1995		
84308	19.4	7.67	8.93	8.36	6.73	3.93	1.65	3.91	7	G.Car-1991-1995		
84312	13.03	6.54	9.76	7.1	1.15	0.83	2.4	0.96	7	G.Car-1991-1995		DUPLICATE
84342	14.02	2.66	2.47	3.25	2.28	0.19	-0.29	0.27	7	G.Car-1991-1995		
84347									7	G.Car-1991-1995	VQ;2	
84353	11.79	8.86	0.83	8.45	9.41	5.46	3	5.49	7	G.Car-1991-1995	FS FTA	SPEED/TORQUE
84357	12.87	18.65	14.96	18.09	5.8	8.26	5.2	7.91	7	G.Car-1991-1995		
84359	11.25	13.15	7.45	12.66	4.97	5.67	-0.48	5.2	7	G.Car-1991-1995		
84365	14.45	7.18	3.8	7.32	3.64	3.5	2.77	3.46	7	G.Car-1991-1995		
84370	13.47	3.36	5.78	4.05	2.16	0.69	-1.43	0.62	7	G.Car-1991-1995		
84372	16.74	2.88	2.54	3.59	-1.59	0.38	-0.66	0.2	7	G.Car-1991-1995		
84380									7	G.Car-1991-1995	VQ;2	
84381	15.95	18.64	28.25	19.17	9.42	32.32	37.6	31.49	7	G.Car-1991-1995		
Average	16.27703	6.935946	7.015946	7.412703	10.81054	7.038108	3.371892	6.981622				
Std. Dev.	10.20265	5.888016	7.074836	5.705035	12.23035	10.12428	7.356661	9.751139				

File No	QCM Bag1	QCM Bag2	QCM Bag3	QCM FTP	Grav Bag1	Grav Bag2	Grav Bag3	Grav Comp	Bin No.	Assigned Bin	QC Code	Comment
84032	0.87	0.62	0.82	0.65	15.65	1.59	5.81	2.58	8	H.Car-1996-Newer	FDP	
84042	17.2	2.86	1.15	3.46	15.18	1.78	4.47	2.63	8	H.Car-1996-Newer		Engine stalled several times
84047	7.58	1.25	0.17	1.51	9.48	1.07	3.06	1.64	8	H.Car-1996-Newer		
84050	3.53	3.05	1.81	2.99	1.58	1.51	0.37	1.43	8	H.Car-1996-Newer		Coolant on dyno after testing
84051	5.61	4.26	2.25	4.19	0.37	0.52	6.22	0.9	8	H.Car-1996-Newer		
84057	2.94	3.06	0.98	2.91	1.82	1.12	0.75	1.13	8	H.Car-1996-Newer		
84058	9.37	0.84	0.71	1.27	1.62	1.04	0.64	1.04	8	H.Car-1996-Newer		
84060	1.73	3.97	2.25	3.73	1.29	1.04	0.23	0.99	8	H.Car-1996-Newer		
84061	7.1	3.51	4.13	3.74	4.46	1.32	1.41	1.49	8	H.Car-1996-Newer		
84062	3.56	3.28	3.23	3.29	2.41	1.01	3.2	1.24	8	H.Car-1996-Newer		DUPLICATE
84063									8	H.Car-1996-Newer	VQ;2	
84068	3.09	3.28	0.13	3.05	2.51	0.2	0.19	0.32	8	H.Car-1996-Newer		
84077	5.08	2.42	1.39	2.49	2.63	0.73	0.7	0.82	8	H.Car-1996-Newer		Exhaust leaks
84078	3.78	3.97	1.4	3.79	-0.16	0.48	0.79	0.47	8	H.Car-1996-Newer		
84082	2.69	2.22	-0.19	2.08	3.52	0.69	2.93	0.98	8	H.Car-1996-Newer		
84083	4.9	2	0.12	2.02	4.02	0.59	0.56	0.77	8	H.Car-1996-Newer		
84084	3.66	1.71	-0.05	1.69	0.49	0.64	0.61	0.63	8	H.Car-1996-Newer		
84087	20.54	1.04	-0.24	1.96	11.09	1.27	0.31	1.71	8	H.Car-1996-Newer	FQ;2	
84088	4.14	1.84	1.67	1.94	1.81	1.17	1.43	1.22	8	H.Car-1996-Newer		
84090	4.84	0.48	1.55	0.78	4.06	0.48	-0.25	0.61	8	H.Car-1996-Newer		
84092	3.6	1.48	1.17	1.57	2.47	1.24	2.12	1.37	8	H.Car-1996-Newer		
84093	7.31	1.05	2.97	1.51	3.09	1.16	0.87	1.24	8	H.Car-1996-Newer		
84097	7.32	1	0.33	1.29	3.9	0.42	2.26	0.73	8	H.Car-1996-Newer		
84099	36.14	0.98	1.85	2.83	14.72	2.74	1.43	3.26	8	H.Car-1996-Newer		
84102	7.15	2.58	3.19	2.86	2.5	0.54	0.47	0.63	8	H.Car-1996-Newer		
84103	7.55	0.17	0.71	0.59	2.04	0.3	0.1	0.38	8	H.Car-1996-Newer		
84105	17.77	2.01	3.84	2.95	4.7	1.01	0.67	1.18	8	H.Car-1996-Newer		
84121	4.87	0.32	0.1	0.54	0.08	0.73	-0.21	0.63	8	H.Car-1996-Newer		
84128									8	H.Car-1996-Newer	VQ;2	
84129	9.77	1.83	0.52	2.15	10.09	2.18	0.07	2.45	8	H.Car-1996-Newer		
84131	5.57	2.57	0.81	2.6	1.68	2.3	0.21	2.13	8	H.Car-1996-Newer		
84133	6.84	0.96	-0.85	1.14	2.92	0.66	1.24	0.82	8	H.Car-1996-Newer		
84134	11.93	2.57	0.36	2.91	6.08	1.86	0.23	1.97	8	H.Car-1996-Newer		
84139	2.78	1.61	1.33	1.65	1.13			0.06	8	H.Car-1996-Newer		
84149	9.28	1.12	0.17	1.48	4.46	0.68	0.67	0.88	8	H.Car-1996-Newer		
84151									8	H.Car-1996-Newer	VQ;2	
84155									8	H.Car-1996-Newer	VQ;3 VD	
84156	22.72	0.99	1.49	2.16	7.75	1.66	2.25	2.02	7	G.Car-1991-1995		
84160									8	H.Car-1996-Newer	VQ;1,2,3,4	
84161									8	H.Car-1996-Newer	VQ;1 FQ;2	
84168	4.77	1.65	2.8	1.89	1.94	0.19	-1.22	0.19	8	H.Car-1996-Newer		
84173	19.73	0.71	2.07	1.79	16.6	0.72	-2.14	1.35	8	H.Car-1996-Newer		
84178	4.8	3.08	0.15	2.97	8.56	0.75	-0.19	1.09	8	H.Car-1996-Newer		
84183									8	H.Car-1996-Newer	VQ;2,4	
84184	10.32	8.37	-1.78	7.77	3.65	1.88	0.26	1.86	8	H.Car-1996-Newer		
84185	1.97	2.96	0.49	2.75	5.99	3.34	-0.17	3.24	8	H.Car-1996-Newer		
84191									8	H.Car-1996-Newer	VQ;3	

File No	QCM Bag1	QCM Bag2	QCM Bag3	QCM FTP	Grav Bag1	Grav Bag2	Grav Bag3	Grav Comp	Bin No.	Assigned Bin	QC Code	Comment
84195	-0.45	-0.2	-0.38	-0.22	1.8	0.35	1.29	0.49	8	H.Car-1996-Newer		
84209	8.66	5.51	4.55	5.61	3.53	2.12	-1.93	1.92	8	H.Car-1996-Newer		
84224	5.73	3	2.4	3.1	0.93	0.42	-0.14	0.41	8	H.Car-1996-Newer		
84225	8.38	2.47	2.75	2.8	1.66	0.8	-0.78	0.74	8	H.Car-1996-Newer		
84227									8	H.Car-1996-Newer	FQPAD	
84240	10.42	2.87	3.09	3.28	2.78	1.55	4.24	1.8	8	H.Car-1996-Newer		
84241	13.35	7.46	4.62	7.57	6.91	0.97	-0.52	1.18	8	H.Car-1996-Newer		
84252	16.72	-0.32	0.34	0.62	8.12	0.41	-1.27	0.69	8	H.Car-1996-Newer	FA; PA	
84266	19.28	2.47	2.3	3.34	5.38	2.11	0.89	2.19	8	H.Car-1996-Newer		
84272	13.23	2.56	2.73	3.12	6.41	1.63	1.71	1.89	8	H.Car-1996-Newer		
84279	8.68	3.85	2.3	3.99	3.14	4.92	3.12	4.71	8	H.Car-1996-Newer	FD	Torque zero board dislodged
84280	6.87	2.96	1.97	3.09	2.91	0.87	1.09	1	8	H.Car-1996-Newer		Stalled 230 sec.into Z1
84285	14.86	3.84	1.71	4.26	6	1.85	-0.19	1.92	8	H.Car-1996-Newer		
84291	24.21	3.77	5.48	4.95	7.14	5.37	4.05	5.37	8	H.Car-1996-Newer	FQ;4 NAN?	
84292	150.41	14.95	13	21.83	61.62	9.12	1.43	11.31	8	H.Car-1996-Newer		
84296	12.81	1.14	-1.94	1.53	6.66	2.93	1.04	2.99	8	H.Car-1996-Newer		Stalled in Z1 ~200 sec.
84297	21.62	4.86	5.81	5.79	3.53	1.71	-0.2	1.68	8	H.Car-1996-Newer		
84304	6.27	5.36	2.78	5.22	2.77	2.16	0.49	2.07	8	H.Car-1996-Newer		
84305	6.03	3.79	3.5	3.89	1.6	1.25	0.59	1.22	8	H.Car-1996-Newer		
84316	21.62	21.31	22.79	21.43	52.54	51.07	27.77	49.53	8	H.Car-1996-Newer		Car smoking heavily at startup
84317									8	H.Car-1996-Newer	VQ;2	
84318									8	H.Car-1996-Newer	VQ;2	
84319	71.57	9.63	7.81	12.66	12.13	3.9	0.12	4.06	8	H.Car-1996-Newer		
84321	12.75	4.13	3.97	4.57	2.89	1.37	0.22	1.37	8	H.Car-1996-Newer		
84323	4.66	1.45	2.15	1.66	2.1	1.19	3.27	1.38	8	H.Car-1996-Newer		
84324	23.19	2.5	0.58	3.43	7.52	2.99	0.54	3.05	8	H.Car-1996-Newer		
84325	52.44	3.26	5.41	5.98	13.83	2.46	1.94	3.02	8	H.Car-1996-Newer		
84327	7.55	3.94	4.99	4.2	2.22	0.46	0.1	0.53	8	H.Car-1996-Newer		
84328	19.01	2.3	3.32	3.23	2.42	0.35	-0.67	0.39	8	H.Car-1996-Newer		DUPLICATE
84330	17.57	0.66	1.22	1.57	9.05	1.18	-0.59	1.47	8	H.Car-1996-Newer		
84331	9.02	1.37	0.81	1.74	2.41	0.37	-0.01	0.45	8	H.Car-1996-Newer		
84332	18.8	5.35	3.66	5.92	3.29	2.37	-0.16	2.24	8	H.Car-1996-Newer		
84338	8.22	2.56	2.64	2.86	2.71	0.9	-1.16	0.85	8	H.Car-1996-Newer		DUPLICATE
84341	23.91	4.63	3.56	5.57	17.96	2.49	65.53	7.65	8	H.Car-1996-Newer		DUPLICATE
84345	13.47	2.44	3.16	3.06	0.17	0.39	-0.41	0.33	8	H.Car-1996-Newer		
84350	11.28	1.95	4.63	2.62	0.62	0.32	1.86	0.44	8	H.Car-1996-Newer		DUPLICATE
84351									8	H.Car-1996-Newer	VQ;2	
84355	10.51	4.51	3.99	4.79	2.05	0.98	1.3	1.06	8	H.Car-1996-Newer	PAFA	
84356									8	H.Car-1996-Newer	VQ;2	
84361	6.53	0.59	2.58	1.04	0.54	0.49	0.38	0.49	8	H.Car-1996-Newer		
84362	8.96	2.38	5.18	2.92	0.88	0.07	-0.84	0.05	8	H.Car-1996-Newer		
84363	119.89	21.02	32	26.89	42.59	5.41	1.76	7.09	8	H.Car-1996-Newer		
84368	12.17	0.77	2.55	1.49	16.78	2.86	1.69	3.52	8	H.Car-1996-Newer	FDR	
84369									8	H.Car-1996-Newer	VQ;1,2	
84377	5.01	3.18	2.05	3.2	2.67	0.49	-3.04	0.36	8	H.Car-1996-Newer		
84379	11.02	4.08	6.54	4.6	2.39	1.51	1.97	1.59	8	H.Car-1996-Newer		
84382	11.88	3.16	2.9	3.58	1.29	1.02	1.66	1.08	8	H.Car-1996-Newer		
84383	12.17	2.46	4.01	3.08	1.82	0.79	1.34	0.88	8	H.Car-1996-Newer		
84384	53.51	5.79	8.23	8.48	16.71	3.06	-0.05	3.56	8	H.Car-1996-Newer		
Average	14.97793	3.285732	2.960244	3.869268	6.593293	2.119012	1.997284	2.318293				
Std. Dev.	22.45523	3.623911	4.573243	4.328042	10.13502	5.684796	7.908866	5.563265				

Kansas City PM Characterization Study
Final Report

Appendix HH
Round 2 Gravimetric vs Quartz Crystal Microbalance

Assessment and Standards Division
Office of Transportation and Air Quality
U.S. Environmental Protection Agency

Sponsors:

National Renewable Energy Laboratory, U.S. Department of Energy
Federal Highway Administration, U.S. Department of Transportation
STAPPA-ALAPCO Emission Inventory Improvement Program
Coordinating Research Council Inc. (Project No. E-69)

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United States
Environmental Protection
Agency

EPA420-R-08-009
April 2008

File No	QCM Bag1	QCM Bag2	QCM Bag3	QCM FTP (	Grav Bag1	Grav Bag2	Grav Bag3	Grav Comp	Model Year	model	Vehicle Typ	odometer	stratum	replicate?	QC Code	Comment
84397	162.07	56.25	65.19	62.31	212.5	71.45	95.79	80.37	1975	Silverado 2	truck	2893	1		VPA	
84413	99.22	143.51	24.65	133.29	66.55	154.46	18.26	140.81	1979	F250	truck	5797	1		VG2	
84653	488.02	49.78	27.75	72	595.57	89.16	14.55	111.44	1977	C-20 Pu	truck	37697	1			
84680									1973	Pu	truck	57484	1		VQ,VG1,2	
84687	227.79	-1.89	9	11.23	332.21	16.49	3.39	32.49	1976	El Camino	truck	61809	1			
84700	40.9	50.33	18.22	47.55	57.92	73.77	17.41	68.93	1978	Pu	truck	73447	1			
84732	24.4	9.4	18.14	10.79	13.28	7.37	8.62	7.77	1979	Cj76	truck	8518	1			
84752	5.77	6.37	5.05	6.25	4.9	6.78	2.34	6.38	1978	F100 Pu	truck	58917	1			
84758	64.17	4.55	10.16	8.09	100.98	12.85	0.89	16.67	1979	C10 Beauvi	truck	84025	1			
Ave.	139.0425	39.7875	22.27	43.93875	172.9888	54.04125	20.15625	58.1075								
Std Dev.	159.4275	48.19483	19.01336	44.71481	203.1901	52.818	31.31825	50.53955								
84462	226.55	13.08	42.99	26.4	350.55	21.88	5.92	38.05	1989	Voyager	truck	145307	2			
84467	80.7	18.51	11.79	21.25	83.28	21	7.87	23.3	1988	Ranger Pu	truck	77528	2			
84469	595.45	69.39	127.73	100.92	701.87	105.05	140.2	138.64	1989	Caravan	truck	162878	2			
84477	253.55	32.08	25.17	43.08	320.83	64.22	17.88	74.3	1989	Ram 50	truck	133981	2			
84489	42.68	25.7	11.19	25.58	33.31	14.94	7.49	15.39	1987	Pu	truck	232098	2		FG2	
84492									1984	C-10 Silvera	truck	82259	2		VG1	
84623	70.33	34.3	13.78	34.78	155.01	21	6.8	27.04	1989	Acclaim	truck	164203	2		VDP	
84626	47.92	17.32	8.76	18.39	180.85	11.16	-0.49	19.58	1987	D100 Pu	truck	23200	2		VDP	
84627	153.22	86.9	68.12	88.93	199.37	242.55	125.61	231.92	1987	F150 Pu	truck	410	2		VDP	
84632	158.01	88.87	54.11	90.17	164.9	98.61	57.38	99.33	1987	F150 Pu	truck	428	2	84627		
84634	111.43	7.5	22.16	13.9	158.59	15.51	18.7	23.15	1988	Voyager	truck	162874	2			
84648	36.46	16.01	13.44	16.9	43.37	39.15	6.84	37.09	1987	Dakota	truck	112838	2			
84650	41.42	11.22	10.76	12.73	33.87	6.46	3.21	7.63	1990	Lumina Apv	truck	136313	2			
84656	14.26	4.54	7.51	5.25	26.57	7.12	3.26	7.84	1990	Lumina Apv	truck	123632	2			
84658	43.97	3.08	-4.24	4.95	92.68	1.3	1.57	6.64	1989	Astro Lt	truck	215908	2			
84660	519.44	97.9	100.84	119.31	717.1	127.83	119.87	156.93	1988	Caravan	truck	61439	2			
84665	37.23	12.02	18.97	13.87	65.44	7.21	2.69	10.03	1989	4X4 Pu	truck	262316	2			
84666	43.5	7.55	15.02	10.03	44.44	11.29	6.4	12.76	1988	F150 Pu	truck	14075	2			
84667	74.7	7.37	16.04	11.33	76.48	9.28	5.59	12.39	1982	F250 Pu	truck	85513	2			
84673									1983	Vandura	truck	52728	2		VG	
84676	26.38	5.08	4.34	6.19	25.57	8.24	2.53	8.77	1990	Bronco	truck	25202	2			
84679	42.15	3.88	3.54	5.82	72.66	4.34	4.45	7.86	1983	Pu	truck	97635	2			
84683	20.47	12.47	7	12.52	14.38	9.07	6.53	9.18	1990	Ranger	truck	72976	2			
84685	15.5	64.08	15.52	58.25	11.5	73.85	5.79	65.97	1988	F150 Pu	truck	62947	2			
84686	97.64	-0.35	18.28	6.42	281.96	12.37	10.97	27.27	1986	F150 Pu	truck	94737	2			
84693	16.16	5.65	8.72	6.41	15.68	5.29	2.44	5.65	1988	F150 Pu	truck	97172	2			
84694	76.95	-1.61	28.27	4.3	251.79	15.92	5.16	26.67	1983	C10 Pu	truck	98799	2			
84696	199.84	18.28	7.41	26.97	371.73	35.68	14.42	51.69	1987	Pu	truck	169293	2			
84701	6.35	8.99	3.29	8.44	12.51	12.06	5.05	11.58	1990	F150	truck	38803	2			
84702	31.96	1.39	4.73	3.21	108.3	3.06	3.18	8.52	1989	G20 Van	Van	27435	2			
84703	24.87	3.03	6.88	4.46	37.37	10.3	2.38	11.18	1987	Blazer	truck	153398	2			
84709	20.74	2.73	9.3	4.12	15.14	2.78	1.94	3.36	1989	Ranger Pu	truck	28864	2			
84715	275.22	-3.08	10.72	12.67	517.14	35.17	13.32	59.2	1988	B2200 Pu	truck	220307	2			
84720	54.34	8.34	6.17	10.55	94.26	5.32	0.92	9.57	1989	1500 Pu	truck	140678	2			
84726	2.74	5.27	6.84	5.24	12.65	2.42	1.07	2.86	1990	Aerostar	truck	19648	2			
Ave.	104.913	20.83303	21.36818	25.25273	160.3379	32.16455	18.69515	37.91939								
Std Dev.	137.7096	27.84338	28.31384	30.92508	189.0099	49.56868	36.77111	51.26138								

84424	7.06	17.78	0.68	16.06	5.44	14.8	8.85	13.9	1995	Explorer	truck	162634	3			
84425	76.98	19.14	23.77	22.58	90.68	26.24	5.92	28.27	1995	Grand Cher	truck	179121	3			
84436	29.19	9.35	17.35	10.95	8.93	3.71	1.92	3.87	1995	S10 P/U	truck	124976	3			
84458	45.98	16.97	8.61	17.84	21.07	21.18	3.05	19.92	1993	Aerostar Mi	truck	147319	3			
84459	32.77	14.14	9.44	14.78	12.96	4.45	1.59	4.69	1992	Aerostar Mi	truck	164560	3			
84465									1994	Lumina Apv	truck	124172	3		RDM,VG2	
84468	29.73	7.32	8.85	8.6	18.83	4.61	2.73	5.22	1994	Lumina Apv	truck	124200	3	84465		
84487	85.67	18.66	12.05	21.79	152.8	15.82	6.17	22.49	1992	B2200	truck	101090	3			
84497	30.64	30.04	1.44	28.02	22.87	26.34	1.66	24.38	1995	4 Runner	truck	85898	3		RDM	
84509	74.07	9.23	14.06	13.06	125.84	8.01	4.02	14.09	1992	Astro	truck	217165	3		RDM	DOUBLE RUN?
84510	64.47	17.9	14.43	20.13	48.11	22.36	2.14	22.32	1994	Suburban	truck	187410	3		VG2	
84519	125.6	23.42	27.13	29.04	129.18	17.42	13.14	23	1992	Caravan	truck	213493	3			
84524	26.09	6.75	0.96	7.4	30	3	-0.13	4.25	1995	Pu	truck	87225	3			
84527	40.04	20.87	3.05	20.65	30.65	15.58	1.18	15.38	1995	Ram 1500 I	truck	93425	3			
84531	67.4	16.59	5.52	18.45	68.02	16.98	2.14	18.6	1992	Tracker	truck	48704	3			
84554	39.44	12.01	10.53	13.34	20.78	14.29	1.71	13.75	1992	F50 Pu	truck	134791	3			
84566	49.43	37.21	23.81	36.92	108.66	33.8	20.52	36.73	1995	Odyssey	truck	109044	3			
84570	11.71	11.46	15.98	11.79	3.99	0.87	0.41	1.01	1994	S10 Pu	truck	63902	3			
84584	18.22	10.32	0.97	10.09	21.31	5.09	2.93	5.81	1995	Pu	truck	86705	3			
84591	18.41	22.93	10.84	21.83	6.77	24.35	0.93	21.77	1993	4Runner	truck	178462	3			
84600	26.8	18.62	3.26	17.97	57.28	22.16	5.48	22.82	1993	Explorer	truck	47980	3			
84618	25.8	40.61	28.4	39.01	19.44	5.71	3.82	6.31	1992	Voyager	truck	154297	3		VDP	
84620	22.34	14.77	5.19	14.45	17.55	7.94	3	8.05	1992	Ranger	truck	19758	3		VDP	
84621	11.54	23.86	17.31	22.8	8.18	4.26	5.67	4.56	1992	Ranger	truck	13586	3		VDP	
84640									1994	Explorer	truck	98974	3		VG2,3	
84649	38.46	1.9	4.1	3.98	26.97	5.6	2.06	6.48	1995	Sonoma Pu	truck	56578	3			
84689	13.02	2.51	4.18	3.19	35.1	0.58	0.39	2.41	1992	Jimmy	truck	90871	3			
84730	19.4	1.51	2.73	2.56	31.95	4.48	13.21	6.56	1995	S10 Pu	truck	75640	3			
84734	25.4	2.98	5.12	4.27	22.94	2.65	1.38	3.6	1993	Voyager	truck	166916	3			
84768									1995	F150	truck	147342	3		VQ2,HS	
84770	26.42	23.3	7.67	22.33	26.45	25.22	2.25	23.62	1995	F250	truck	52586	3			
84771	49.93	33.31	35.7	34.33	80.49	44.37	26.44	44.99	1994	Astrovan	truck	133318	3			
84772	15.49	2.92	5.23	3.73	18.48	6.07	1.56	6.4	1992	Caravan	truck	143971	3			
84774									1995	Caravan	truck	136837	3		VQ2,HS	
Ave.	38.25	16.27933	10.94533	17.06467	42.39067	13.598	4.871333	14.50833								
Std Dev.	26.55828	10.30526	9.225074	9.889951	40.84414	10.96547	6.078263	10.9622								

84394									2000	Odyssey	truck	74601	4		VQ1,2.HS	Dup Rnd 1
84401									1998	Voyager	truck	168876	4		VQ2,HS	
84403	105.47	6.21	6.25	11.28	97.34	2.48	5.11	7.5	2000	Caravan	truck	85198	4			
84404	122.08	11.7	14.92	17.74	205.2	10.09	3.72	19.93	1997	Caravan	truck	96455	4		FQ3	
84415	29.7	11.23	15.66	12.53	25.17	28.74	6.4	27.01	1999	Durango	truck	95999	4			
84422	29.74	21	24.29	21.67	8.44	19.89	10.8	18.67	1998	Cherokee	truck	137053	4			
84433	13.67	22.28	-3.32	20.07	11.52	30.16	6.05	27.53	1997	Wrangler	truck	97532	4			
84444									2003	Tracker	truck	29519	4		VQ2,HS	
84446	167.98	5.14	2.35	13.43	192.59	22.59	6.06	30.29	2000	Sienna Mini	truck	137493	4			
84448	76.64	16.94	-0.14	18.87	102.58	19.29	6.46	22.74	1999	Voyager Mi	truck	79230	4		RDM	
84473	12.3	9.38	3.92	9.15	21.98	13.14	7.47	13.21	1996	Explorer	truck	109593	4			
84479									1996	Caravan	truck	118369	4		VG1	
84493	6.57	0.68	6.89	1.42	5.89	0.74	1.86	1.09	2004	Freestar Mi	truck	14714	4			
84494	11.95	7.72	1.21	7.48	11.93	2.2	2.93	2.75	1997	Ranger Pu	truck	118470	4			
84494	11.73	7.69	1.2	7.44	11.93	2.2	2.93	2.75	1997	Ranger Pu	truck	118470	4			
84495	13.54	10.26	5.46	10.1	9.37	1.7	1.41	2.08	1996	Sonoma Pu	truck	51863	4			
84498	28.01	11.42	6.66	11.95	35.14	9.21	2.8	10.1	2001	Sienna Mini	truck	59734	4			
84500	33.3	8.22	17.65	10.21	24.2	3.82	2.41	4.81	1998	Frontier Pu	truck	112521	4			
84517	108.16	17.13	19.98	22.06	124.53	17.13	3.11	21.75	1998	Caravan	truck	80989	4			
84522	17.15	7.1	2.14	7.3	10.49	5.73	2.1	5.73	1996	1500 Pu	truck	46711	4			
84532	22.58	8.6	5.49	9.14	10.92	5.83	1.61	5.81	2003	Montana	truck	49337	4			
84533	18.06	9.24	8.62	9.66	11.86	6.46	2.28	6.46	1999	Suburban	truck	88900	4			
84537									2000	Cherokee	truck	88513	4		FQ3	EXCURSION
84538	-9.87	22.12	-1.61	18.78	3.49	0.93	1.09	1.07	1998	Ranger	truck	48208	4			
84539	33.55	6.52	0.87	7.55	27.41	2.59	3.59	3.95	1996	Tahoe	truck	69010	4			
84541	75.23	8.21	5.93	11.53	64.89	3.09	3.64	6.33	1996	Caravan	truck	161280	4			
84542	48.42	4.09	19.5	7.47	48.31	2.43	3.63	4.91	1996	Caravan	truck	161308	4	84541	FQ,FPA	
84543	23.65	10.21	14.68	11.24	12.76	3.57	2.35	3.98	2000	Cherokee	truck	88541	4	84537		
84546	6.53	10.98	10.73	10.73	8.19	1.98	7.85	2.71	1999	Dakota Pu	truck	64155	4			
84551	25.25	7.84	7.75	8.77	16.48	5.21	2.67	5.64	2002	Axiom	truck	46363	4		FQ1	
84552	11.89	4.12	-1.75	4.11	8.71	1.77	0.35	2.03	2002	Silouette	truck	61168	4			
84556	49.71	4.75	10.78	7.54	46.81	2.32	1.66	4.62	2001	Town&Cou	truck	75545	4			
84558	139.71	7.73	11.7	14.92	601.42	4.98	1.44	36.03	2001	S-10 Pu	truck	106236	4			
84560	13.09	6.26	2.47	6.35	11.2	6.1	2.25	6.1	1998	Dakota Spo	truck	49775	4			
84562	10.36	5.38	7.23	5.77	7.65	4.41	1.63	4.39	2004	Dakota Pu	truck	8627	4			
84563	5.41	19.33	1.45	17.37	5.36	0.73	0	0.92	2003	Ranger 4X4	truck	18757	4			
84564	36.44	10.92	0.17	11.5	36.98	3.7	3.63	5.44	1998	Caravan	truck	127230	4			
84568	17.09	6.96	8.58	7.57	15.68	3.54	3	4.1	1999	Ranger Pu	truck	126851	4			
84577	37.8	20.59	32.26	22.28	32.78	4.65	2.62	5.96	1998	Aerostar	truck	0	4			
84580	30.78	13.16	1.44	13.18	35.21	8.1	2.37	8.97	2002	Town & Co	truck	84580	4		FD	TORQUE MISSING BAG 2
84587	96.29	6.16	7.74	10.98	148.27	4.89	1.06	12.12	1996	Villager	truck	166799	4			
84608	48.36	11.68	7.27	13.35	70.98	1.12	1.48	4.89	1996	Quest	truck	125651	4		VDP	
84612	15.04	12.31	10.42	12.32	2.94	0.56	1.49	0.74	2000	Ranger	truck	33680	4		VDP	
84616	11.02	5.88	2.34	5.89	4.65	0.78	1.82	1.05	1999	Voyager	truck	113389	4		VDP	
84617									1997	Suburban	truck	145147	4		VDP, VQ3	
84628	42.7	10.42	12.44	12.29	64.21	12.17	6.74	14.58	2002	Trailblazer	truck	77758	4			
84638	33.57	8.99	9.73	10.32	13.85	2	1.39	2.57	1996	Town And (	truck	213656	4			
84644	34.59	5.8	8.78	7.56	16.86	4.55	2.12	5.04	2001	Pathfinder	truck	66284	4			
84708	13.01	0.42	2.42	1.21	44.81	9.64	5.74	11.19	2003	Caravan	truck	10200	4			
84713	7.68	5.01	5.63	5.19	6.81	2.22	1.99	2.44	1996	Blazer	truck	94350	4			
84722	16.59	1.53	6.55	2.66	20.35	1.94	1.58	2.87	1998	Windstar	truck	99476	4			
84728	28.87	2.49	3.81	3.94	27	4.85	3.34	5.89	2002	Escape 2W	truck	36209	4			
84748	20.24	5.71	7.74	6.6	7.6	1.29	1.27	1.62	2002	Caravan	truck	60790	4			
84749	17.93	4.8	7.46	5.67	3.69	0.86	2.56	1.12	2001	Sienna	truck	80227	4			
84753	28.22	2.46	4.96	3.98	21.45	5.52	2.47	6.14	2003	Caravan	truck	47649	4			
84754	19.54	3.21	4.19	4.17	11.2	3.06	1.24	3.37	2003	Town And (	truck	20787	4			
84755	12.63	5.39	5.8	5.8	3.97	3.03	0.05	2.88	2002	Odyssey	truck	60753	4			
84757	17.26	4.27	5.63	5.05	4.42	1.93	1.3	2.02	2001	Grand Cher	truck	90011	4			
84760	10.67	3.96	4.79	4.36	3.87	1.31	1.56	1.46	2004	Escape	truck	10519	4			
84761	17.4	2.78	4.92	3.66	7.25	2.35	0.92	2.51	2004	Sedona	truck	16609	4			
84763	14.09	7.52	6.38	7.78	3.17	3.89	-1.09	3.51	2003	Odyssey	truck	44752	4			
84766	17.4	2.29	5.97	3.31	10.88	1.51	-1.87	1.76	2000	Caravan	truck	93162	4			
84767	14.93	5.11	9.1	5.88	7.85	2.88	1.34	3.03	1998	Frontier	truck	107615	4			
84773	9.39	2.8	5.13	3.32	1.88	1.61	0.54	1.54	1998	4Runner	truck	115768	4			
84775	35.58	12.33	22.22	14.23	11.64	3.68	-1.36	3.76	1997	Suburban	truck	137630	4			
Ave.	33.33339	8.380169	7.505593	9.621695	41.08492	5.748136	2.660339	7.380678								
Std Dev.	35.01278	5.315011	6.682011	5.297703	86.19264	6.641589	2.31839	8.091062								

84470									1973	280 Se	car	86134	5		VQ2,HS	
84472									1977	Monte Carl	car	36999	5		FHS, VG1	
84482	74.86	0.9	9.67	5.47	106.01	9.24	4.31	14.09	1979	Lasabre	car	40364	5			
84484	90.33	1.88	4.2	6.57	110.07	3.19	2.8	8.63	1979	Lesabre	car	40385	5	84482		
84588	87.76	14.13	0.21	17.05	160.18	11.48	9.95	19.28	1978	Regal	car	81379	5			
84592	89.69	0.09	3.09	5.42	247.06	74.43	12.38	79.09	1979	Ltd	car	65850	5			
84601	118.11	9.25	7.76	14.77	180.11	42.54	17.75	47.9	1979	Regal	car	5864	5			
84603	31.82	3.4	10.12	5.3	32.31	6.41	2.66	7.45	1979	210 Wagon	car	47114	5		VDP	
84605	4.61	52.98	13.07	47.8	148.24	48.46	12.1	50.97	1977	280Z	car	94782	5		VDP	
84609	79.19	15.19	23.96	19.23	100.13	22.73	2.79	25.52	1978	Regal	car	64571	5		VDP	
84614									1978	Delta 88	car	73729	5		VDP,VG1	
84637									1980	Cutlass Sup	car	79420	5		VG1,2	
84674	31.32	6.13	8.42	7.61	48.43	6.72	7.64	8.97	1979	Firebird	car	45370	5			
84705	59.51	-0.03	8.57	3.63	123.16	23.13	7.33	27.23	1980	Malibu	car	31253	5			
84707	129.28	20.5	15.84	24.67	284.32	72.39	26.91	77.97	1973	Impala	car	94178	5			
84712	106.5	0.09	10.54	6.34	354.43	13.71	6.81	31	1979	Nova	car	86117	5			
84717									1979	Mustang	car	45551	5		VG1,2,3	
84738	71.35	1.76	8.34	6.17	69.79	12.51	4.66	15.23	1976	Gran Prix	car	60909	5			
Ave.	74.94846	9.713077	9.522308	13.07923	151.0954	26.68769	9.083846	31.79462								
Std Dev.	35.83373	14.64358	5.954041	12.34282	94.68802	24.81404	6.991913	24.91923								

84407	377.85	115.61	73.6	126.71	469.64	136.99	85.54	151.19	1989	Grandam	car	123575	6			
84430	56.04	22.37	14.78	23.58	66.34	22.17	10.35	23.62	1990	Spirit	car	93661	6			
84474	61.15	37.4	2.77	36.26	76.17	66.51	19.82	63.82	1988	Civic	car	207265	6			
84475	59.86	11.72	2.69	13.57	172.4	38.55	11.35	43.55	1986	Tempo	car	70396	6			
84512									1982	Caprice	car	88587	6		VQ2,HS,V(	SMOKER
84550	127.09	3.47	4.92	9.78	125.25	17.46	8.66	22.25	1988	Continental	car	31667	6			
84582	49.85	13.5	33.41	16.79	55.78	13.04	17.45	15.56	1988	528E	car	287806	6			
84595	7.28	6.88	0.54	6.46	12.87	1.56	1.1	2.12	1988	Escort	car	133085	6			
84611	21.27	11.01	11.1	11.56	39.59	3.68	1.53	5.42	1989	Camry	car	168091	6		VDP	
84613	55.42	24.63	19.63	25.87	42.71	10.9	2.42	11.96	1990	Delta 88	car	185694	6		VDP	
84630	51.4	9.37	8.21	11.49	44.06	7.57	23.04	10.55	1989	Accord	car	139963	6			
84633									1987	740 Turbo	car	248178	6		VG	
84635	144.85	13.35	40.6	22.22	206.33	54.97	94.76	65.81	1989	Crown Vic	car	62847	6			
84642	27.63	19.18	7.38	18.82	36.63	4.06	4	5.77	1989	Spirit	car	139488	6			
84643	322.78	70.1	22	79.59	459.03	136.44	35.84	145.92	1987	Escort	car	12845	6			
84646	17.42	10.29	7.14	10.43	15.13	6	3.12	6.27	1988	Accord	car	209194	6			
84654									1990	Cutlass Cie	car	97522	6		FDP	
84655	20.85	5.92	6.08	6.73	20.71	4.73	1.48	5.35	1990	Electra Parl	car	169860	6			
84659	44.91	14.61	11.3	15.9	66.88	12.8	12.87	15.52	1988	Le Baron	car	117003	6			
84661	8.95	4.29	4.62	4.56	20.69	3.17	2.83	4.07	1990	Century	car	148959	6			
84662	53.37	9.86	15.42	12.58	57.83	17.82	4.76	19.05	1990	Eldorado	car	185384	6			
84663	25.39	4.06	9.03	5.52	63.53	19.95	19.71	22.21	1989	Corsica	car	98999	6			
84669									1990	Spirit	car	109931	6		VG1	
84670	25.44	9.74	11.44	10.68	28.8	10.03	3.51	10.56	1989	Topaz	car	6137	6			
84672	15.31	5.01	0.37	5.22	14.98	4.29	5.14	4.91	1983	Tercel	car	87900	6			
84677									1988	Park Avenu	car	146833	6		VG23	
84682	47.19	2.25	18.7	5.65	64.44	18.67	5.39	20.08	1990	Camry	car	138235	6			
84690	5.22	8.1	7.74	7.92	7.01	1.69	2.26	2.01	1989	Cutlass Cie	car	220970	6			
84692	20.46	17.55	20.44	17.89	12.11	20.24	9.7	19.1	1988	Century	car	94555	6			
84695	11.04	1.37	-1.82	1.65	6.83	1.86	1.84	2.12	1989	Cutlass Cie	car	220989	6	84690		
84699	538.46	57.89	86.83	77.81	1038.48	124.64	116.82	158.08	1985	Caprice	car	58223	6			
84710	76.01	0.39	8.65	5.07	641.15	5.31	4.45	39.87	1984	Monte Carlo	car	68810	6			
84719	11.75	2.33	4.79	2.98	8.08	0.82	1.53	1.24	1990	Cutlass Sup	car	85449	6			
84724	18.01	1.4	6.75	2.67	21.97	3.38	2.36	4.3	1990	Cutlass Cie	car	171475	6			
84727	68.5	25.24	3.17	26.07	29.57	37.38	4.53	34.76	1982	Grenada	car	64654	6			
84735	12.33	2.57	0.66	2.96	21.49	5.04	3.63	5.82	1988	Accord	car	209393	6			
84737	8.17	2.82	6.09	3.33	35.04	9.03	4.39	10.09	1984	Celebrity	car	64091	6			
84740	28.62	10.33	5.06	10.93	28.56	5.64	3.59	6.7	1990	Lesabre	car	107876	6			
84745	60.98	18.93	20.25	21.28	110.58	11.99	2.21	16.6	1990	Civic	car	133966	6			
84765	62.77	0.98	6.25	4.59	267.93	97.92	22.33	101.65	1985	Impala	car	75914	6			
84777	37	1.78	5.84	3.88	42.79	1.78	-1.83	3.65	1987	Cutlass	car	87020	6			
Ave.	71.68389	16.00833	14.0675	18.58333	123.0939	26.05778	15.34667	30.04306								
Std Dev.	112.119	22.77881	18.65997	25.51973	213.2474	38.44189	27.08784	42.85465								

84396	13.85	9.13	6.52	9.2	59.17	8.26	2.22	10.49	1995	Escort	car	106996	7		VPA	Dup Rnd 1
84402	147.93	13.11	18.21	20.37	179.87	12.27	3.98	20.3	1991	Civic	car	220022	7			
84406	132.31	24.22	8.73	28.85	212.89	57.54	11.36	62.57	1995	Corolla	car	107983	7			
84431	80.15	5.71	7.75	9.71	84.02	25.86	4.28	27.37	1991	Grand Marc	car	19292	7			
84437	17.48	5.67	-4.3	5.6	16.18	1.28	1.53	2.08	1994	Camry	car	131874	7			
84439	23.25	12.52	4.06	12.49	31.65	6.3	1.9	7.31	1995	Bonneville	car	168145	7			
84440	37.48	15.14	8.57	15.86	60.61	11.41	12.25	14.07	1995	Park Avenu	car	144956	7			
84442	17.98	5.92	-3.57	5.9	17.67	1.72	1.45	2.53	1994	Camry	car	131894	7	84437		
84443									1991	Prizm	car	132326	7		FQ2	
84449									1994	Regal	car	92177	7		VQ	CARONA CURRENT UNSTABLE
84451	33.02	11.93	5.09	12.55	39.05	2.84	1.46	4.62	1994	Regal	car	92214	7	84449		
84452	28.1	16.26	8.62	16.32	10.3	6.23	1.04	6.07	1995	Taurus	car	139316	7			
84453	55	6.51	10.6	9.36	34.83	5.19	1.89	6.52	1995	Maxima	car	181395	7			
84455	22.08	8.29	5.49	8.82	10.96	1.29	1.83	1.83	1995	Mustang	car	146289	7			
84456	81.17	30.81	22.58	32.83	70.83	36.62	20.53	37.27	1993	Grand Prix	car	177931	7			
84457	73.31	13.19	13.23	16.4	86.03	19.07	12.7	22.2	1995	Crown Victc	car	179731	7			
84463	18.79	35.72	16.33	33.47	16.75	112.52	21.48	101.1	1995	Contour	car	104083	7			
84464	98.07	6.61	2.87	11.18	96.79	31.1	7.25	32.92	1994	Intrepid	car	145950	7			
84485	76.38	5.03	7.74	8.97	94.8	16.72	4.55	20.03	1991	Fleetwood	car	97124	7			
84488	27.07	8.93	-9.96	8.58	20.17	1.63	1.57	2.58	1995	Lesabre	car	126036	7			
84490	53.4	9.08	-17.05	9.67	26.61	2.62	2.02	3.84	1991	Fleetwood	car	97144	7	84485		
84499	24.79	13.28	4.96	13.3	18.16	3.92	3.73	4.66	1995	Integra	car	80579	7			
84505	19.91	16.03	6.03	15.52	11.45	8.99	1.89	8.62	1993	Intrepid	car	210298	7			
84508	19.13	13.71	2.31	13.22	14.36	2.11	1.34	2.69	1992	Civic	car	124705	7			
84518	31.9	8.07	1.06	8.83	22.39	1.42	3.93	2.69	1994	Skylark	car	200811	7			
84526	108.49	55.15	45.99	57.32	55.35	53.61	31.08	52.13	1991	Towncar	car	188033	7			
84528	48.5	148.6	53.36	136.84	54.86	143.3	60.5	133	1994	Grand Marc	car	130521	7			
84529									1993	Sundance	car	84652	7		VG1	
84534	45.17	13.99	6.47	15.13	37.95	29.1	8.23	28.11	1993	Legacy	car	114227	7			
84547	22.28	6.68	10.49	7.76	40.24	17.2	6.38	17.66	1995	Corolla	car	103068	7			
84548	12.4	5.34	1.71	5.46	9.45	2.5	2.04	2.84	1995	Intrepid	car	138989	7		FQ	
84567	99.78	18.32	26.07	23.17	245	33.14	30.51	44.19	1992	Sedan De-\	car	155895	7			
84569	24.16	10.5	7.97	11.05	20.17	2.6	0.15	3.36	1995	Taurus	car	203067	7			
84572	47.17	23.48	-8.4	22.53	12.09	3.25	2.07	3.63	1994	Topaz	car	41482	7			
84573	39.47	8.84	5.53	10.25	38.68	3.04	4.21	5.02	1993	Park Avenu	car	74444	7		FPA	TTL
84574	9.84	7.47	11.55	7.88	4.65	0.87	0.58	1.05	1993	Taurus	car	39476	7		FPA	POST
84575	48.65	16.87	17.22	18.57	58.44	2.93	1.97	5.78	1994	Lumina	car	126825	7		FPA	TTL
84581	12.29	8.65	6.84	8.72	5.68	0.66	2.94	1.09	1995	Corsica	car	78767	7			
84585	10.05	9.92	-1.89	9.11	7.24	3.29	0.15	3.28	1993	Escort Sw	car	99988	7			
84597	18.79	11.72	-0.69	11.23	17.73	3.68	0	4.16	1994	Sunbird	car	145869	7			
84639	11.2	1.86	-0.32	2.19	7.96	1.44	1.75	1.8	1995	Cavalier	car	140500	7			
84645	29.97	16.32	2.92	16.13	23.96	5.65	1.74	6.36	1993	960	car	197094	7			
84668	10.38	4.96	-9.38	4.26	14.89	1.75	1.98	2.44	1991	Delta 88	car	139412	7			
84675	3.42	4.15	1.21	3.91	8.21	4.11	0.94	4.11	1993	Tempo	car	25053	7			
84681									1993	Tempo	car	25073	7		VG	
84688	8.47	8.45	9.27	8.51	14.49	10.55	4.65	10.34	1993	Taurus	car	92978	7			
84714	41.04	5.3	1.37	6.9	82.09	6.69	3.84	10.44	1994	Sw	car	132333	7			
84723	72.74	22.44	24.11	25.21	40.6	9.86	3.54	11.04	1991	Cavalier	car	182349	7			
Ave.	42.20023	15.99727	7.665227	16.79841	46.25614	16.27568	6.714318	17.18614								
Std Dev.	34.69293	22.58593	12.73659	20.98195	52.89274	28.34227	11.07675	26.52929								

84393	24.98	-0.23	1.2	1.18	22.64	1.2	3.6	2.48	1999	300M	car	90240	8	VPA,FG1	POWER FAILURE, Dup Rnd 1
84398	40.55	9.34	8.56	10.92	34.24	3.69	5.51	5.42	2001	Accord	car	62350	8		PA POWER RESTORED
84399									1997	Accord	car	82926	8	VG1,2	
84408	57.61	15.68	-3.28	16.54	100.25	11.41	25.13	16.89	2002	Sable	car	29501	8		
84409	27.35	13.01	5.38	13.28	27.67	3.25	3.41	4.54	1999	Malibu	car	79925	8		
84411	86.28	23.54	-0.54	24.98	206.2	81.41	18.28	83.25	1996	Sc	car	78346	8		
84412	47.73	12.12	9.91	13.8	0.69	2.96	6.57	3.09	1996	Civic	car	140479	8		
84414									2003	Impala	car	11340	8	VQ	Auto Valve off
84416	20.83	4.87	11.7	6.16	8.68	3.41	5.59	3.83	1998	Civic	car	118218	8		
84418	33.83	8	0.88	8.85	26.37	11.05	0	11.07	1997	Grand Am	car	58100	8	FQ	CONPRESSED AIR SHUT DOWN
84419	26.22	9.36	13.76	10.55	19.07	3.33	5.03	4.28	1998	Lumina	car	79187	8		
84420	50.98	10.67	1.74	12.2	80.81	13.84	8.57	17.03	2000	Accord	car	84180	8		
84421	35.8	13.62	-3.75	13.59	36.54	2.42	2.79	4.22	2000	Sedan	car	51721	8		
84426	23.46	9.84	-3.62	9.61	26.97	5.68	7.4	6.91	2001	Sedan	car	44251	8	VG3	
84427	9.74	10.45	-2.28	9.52	8.49	1.03	1.34	1.45	2001	Galant	car	51764	8	FPA	TTL SIGNAL MISSING
84428	40.77	9.33	-2.01	10.21	60.97	15.17	6.58	17	1998	Malibu	car	107047	8		
84432	40.59	2.85	2.89	4.86	47.76	4.26	3.71	6.53	1999	Sedan	car	98565	8		
84438	-1.64	8.96	-1.97	7.63	5.05	2.55	2.4	2.68	2001	Century	car	33749	8		
84445	37.62	16.15	4.58	16.45	31.16	1.68	2.45	3.24	2001	Sedan	car	67290	8		
84483	22.58	7.2	1.56	7.6	27.03	4.06	0.4	5	1996	Neon	car	79848	8		
84502	24.61	18.43	-8.38	16.89	16.06	2.96	3.72	3.7	1996	Concorde	car	111502	8		
84503	18.84	15.32	6.12	14.88	7.37	2.6	1.87	2.8	2002	Taurus	car	26406	8	RDM	
84504	17.23	7.83	-0.02	7.78	17.25	1.79	-0.08	2.45	2000	Concorde	car	65330	8		
84514	41.5	6.59	-5.26	7.6	14.73	3.32	2.41	3.85	2002	Concorde	car	34231	8	RDM	
84515	38.39	3.92	13.8	6.43	38.48	3.76	1.42	5.43	1999	Stratus	car	108838	8		
84520	25.94	10.62	6.12	11.11	15.21	2.13	0.09	2.68	2001	Taurus	car	47479	8	RDM	
84521	19.69	10.02	10.98	10.59	14.38	2	1.38	2.59	1997	Accord	car	101888	8		
84557	18.12	13.07	13.8	13.38	19.74	1.8	1.27	2.69	2000	Park Avenu	car	67099	8		
84589	18.37	5.25	12.32	6.43	599.46	1.77	0.42	32.84	2001	Sedan	car	56662	8		
84593	20.25	3.48	6.19	4.55	22.15	2.37	1.99	3.38	1998	Accord	car	75067	8		
84596	1.16	20.79	12.47	19.17	1.67	1.88	0.76	1.8	1997	Taurus	car	97601	8		
84599	72.36	2.6	0.73	6.06	87.64	8.61	2.2	12.22	1998	Avalon	car	29575	8		
84622	53.26	15.7	1.66	16.66	71.38	3.99	6.43	7.61	1999	Camry	car	64134	8	VDP	
84629	39.98	4.02	3.51	5.67	21.36	4.56	1.93	5.16	1996	Tl2.5	car	117642	8		
84729	14.59	3.27	4.29	3.91	6.96	1.89	1.63	2.13	2001	Camry	car	46869	8		
84733	16.81	3.72	6.44	4.58	5.85	1.19	1.34	1.44	1998	Skylark	car	65464	8		
84739									1998	Protoge	car	88569	8	VQ1,2,HS	
84743	15.61	3.05	4.13	3.77	11.43	0.58	1.2	1.18	1999	Protoge	car	122968	8		
84751	10.56	8.72	8.04	8.77	0.73	3.23	0.56	2.92	1998	Escort	car	55309	8		
84759	5.23	3.4	3.25	3.48	2.82	0.71	0.3	0.79	2005	Focus	car	6701	8		
Ave.	29.66973	9.312432	3.916216	9.99027	47.16919	6.041622	3.772973	8.015405							
Std Dev.	18.75004	5.539727	5.857385	5.129218	100.9203	13.21436	4.972171	14.17063							

Year	Emission Rates from the QCM Bag 1 mg/mile	Bag 2 mg/mile	Bag 3 mg/mile	FTP Composite mg/mile	Emission Rates from the Gravimetric Filter Bag 1 mg/mile	Bag 2 mg/mile	Bag 3 mg/mile	FTP Composite mg/mile
TRUCKS								
1970-1980	139.04	39.79	22.27	43.94	172.99	54.04	20.16	58.11
1981-1990	104.91	20.83	21.37	25.25	160.34	32.16	18.70	37.92
1991-1995	38.25	16.28	10.95	17.06	42.39	13.60	4.87	14.51
1996-2005	33.33	8.38	7.51	9.62	41.08	5.75	2.66	7.38
CARS								
1970-1980	74.95	9.71	9.52	13.08	151.10	26.69	9.08	31.79
1981-1990	71.68	16.01	14.07	18.58	123.09	26.06	15.35	30.04
1991-1995	42.20	16.00	7.67	16.80	46.26	16.28	6.71	17.19
1996-2005	29.67	9.31	3.92	9.99	47.17	6.04	3.77	8.02

Composite Check	Nom. Dst. mi.	Emissions mg/mi.	FTP mg/mi.
Bag 1	1.19	29.28	
Bag 2	8.64	9.33	
Bag 3	1.19	3.63	0.0099772

Bin	QCM Bag 1 mg/mile	QCM Bag 2 mg/mile	QCM Bag 3 mg/mile	QCM FTP Comp mg/mile	Grav Bag 1 mg/mile	Grav Bag 2 mg/mile	Grav Bag 3 mg/mile	Gravimetric FTP Composite mg/mile
1/Average	139.04	39.79	22.27	43.94	172.99	54.04	20.16	58.11
Std. Dev.	159.43	48.19	19.01	44.71	203.19	52.82	31.32	50.54
2/Average	104.91	20.83	21.37	25.25	160.34	32.16	18.70	37.92
Std. Dev.	137.71	27.84	28.31	30.93	189.01	49.57	36.77	51.26
3/Average	38.25	16.28	10.95	17.06	42.39	13.60	4.87	14.51
Std. Dev.	26.56	10.31	9.23	9.89	40.84	10.97	6.08	10.96
4/Average	33.33	8.38	7.51	9.62	41.08	5.75	2.66	7.38
Std. Dev.	35.01	5.32	6.68	5.30	86.19	6.64	2.32	8.09
5/Average	74.95	9.71	9.52	13.08	151.10	26.69	9.08	31.79
Std. Dev.	35.83	14.64	5.95	12.34	94.69	24.81	6.99	24.92
6/Average	71.68	16.01	14.07	18.58	123.09	26.06	15.35	30.04
Std. Dev.	112.12	22.78	18.66	25.52	213.25	38.44	27.09	42.85
7/Average	42.20	16.00	7.67	16.80	46.26	16.28	6.71	17.19
Std. Dev.	34.69	22.59	12.74	20.98	52.89	28.34	11.08	26.53
8/Average	29.67	9.31	3.92	9.99	47.17	6.04	3.77	8.02
Std. Dev.	18.75	5.54	5.86	5.13	100.92	13.21	4.97	14.17

Kansas City PM Characterization Study

Final Report

Appendix II
Quality Management Plan

Assessment and Standards Division
Office of Transportation and Air Quality
U.S. Environmental Protection Agency

Sponsors:

National Renewable Energy Laboratory, U.S. Department of Energy
Federal Highway Administration, U.S. Department of Transportation
STAPPA-ALAPCO Emission Inventory Improvement Program
Coordinating Research Council Inc. (Project No. E-69)

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United States
Environmental Protection
Agency

EPA420-R-08-009
April 2008

Quality Management Plan

Eastern Research Group, Inc.
110 Hartwell Avenue
Lexington, MA 02421

April 2004

QMP REVISION HISTORY

Revision 1: April 15, 2004

QUALITY MANAGEMENT PLAN

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EASTERN RESEARCH GROUP, INC.
QUALITY MANAGEMENT PLAN

INTRODUCTION

This Quality Management Plan (QMP) describes ERG's quality assurance/quality control (QA/QC) program in terms of the company's organizational structure, the functional responsibilities of management and staff, and the cooperative interaction among those staff planning, implementing, and assessing the activities conducted under a specific project. Quality management is the component within the overall corporate management structure that determines and implements the quality policy, which includes strategic planning, allocation of resources, and other systematic activities. ERG is committed to maintaining a corporate quality management program that is responsive to the requirements of the diverse work it performs, which ranges from field testing and laboratory analysis to education, training, and outreach. This company-wide commitment to provide services of consistent, high quality directs all QA activities.

The components of ERG's QA/QC program include:

- A statement of ERG's quality policy;
- A description of ERG's corporate and project organizational structures, and the relationship of the QA/QC function to these organizational structures;
- A description of the authority and responsibilities of the QA/QC function at both the corporate and project level; and
- A discussion of ERG's general approach for planning and implementing activities affecting quality in the Science and Engineering technical services areas.

The QMP includes the following sections:

1. Management and Organization;
2. Quality System Components;
3. Personnel Qualification and Training;
4. Procurement of Items and Services;
5. Documentation and Records;
6. Computer Hardware and Software;
7. Planning;
8. Implementation of Work Processes;
9. Assessment and Response; and
10. Quality Improvement.

SECTION 1

MANAGEMENT AND ORGANIZATION

ERG's quality system reflects the company's mission: **ERG provides quality technical services to meet the needs of our clients in a responsive and responsible manner**. The quality system provides the necessary elements to plan, implement, document, and assess the effectiveness of quality assurance and QC. QC is a system of routine technical activities implemented by the project personnel to measure and control the quality of data as they are collected and manipulated. QC activities include technical reviews, accuracy checks, and the use of standard procedures for data collection, analysis, and reporting. Quality assurance (QA) includes those activities that provide an independent assessment of a project or project tasks, including QC functions.

Responsibility for quality at ERG lies with management and depends on the cooperation of all employees. Specific responsibility for the quality of a given project lies with the Project management team (Project Manager and Task Leaders) who oversees the quality of all ERG services. All scientific and technical services provided by ERG must meet appropriate quality objectives that satisfy the client's needs and expectations, with the understanding that costs of QA/QC activities must be proportional to the needs of the program. In addition, ERG routinely incorporates technical and editorial reviews of documents to ensure that the client's needs and expectations are adequately met with documents that are technically correct and well-written and with data that are complete, accurate, precise, representative, and reproducible.

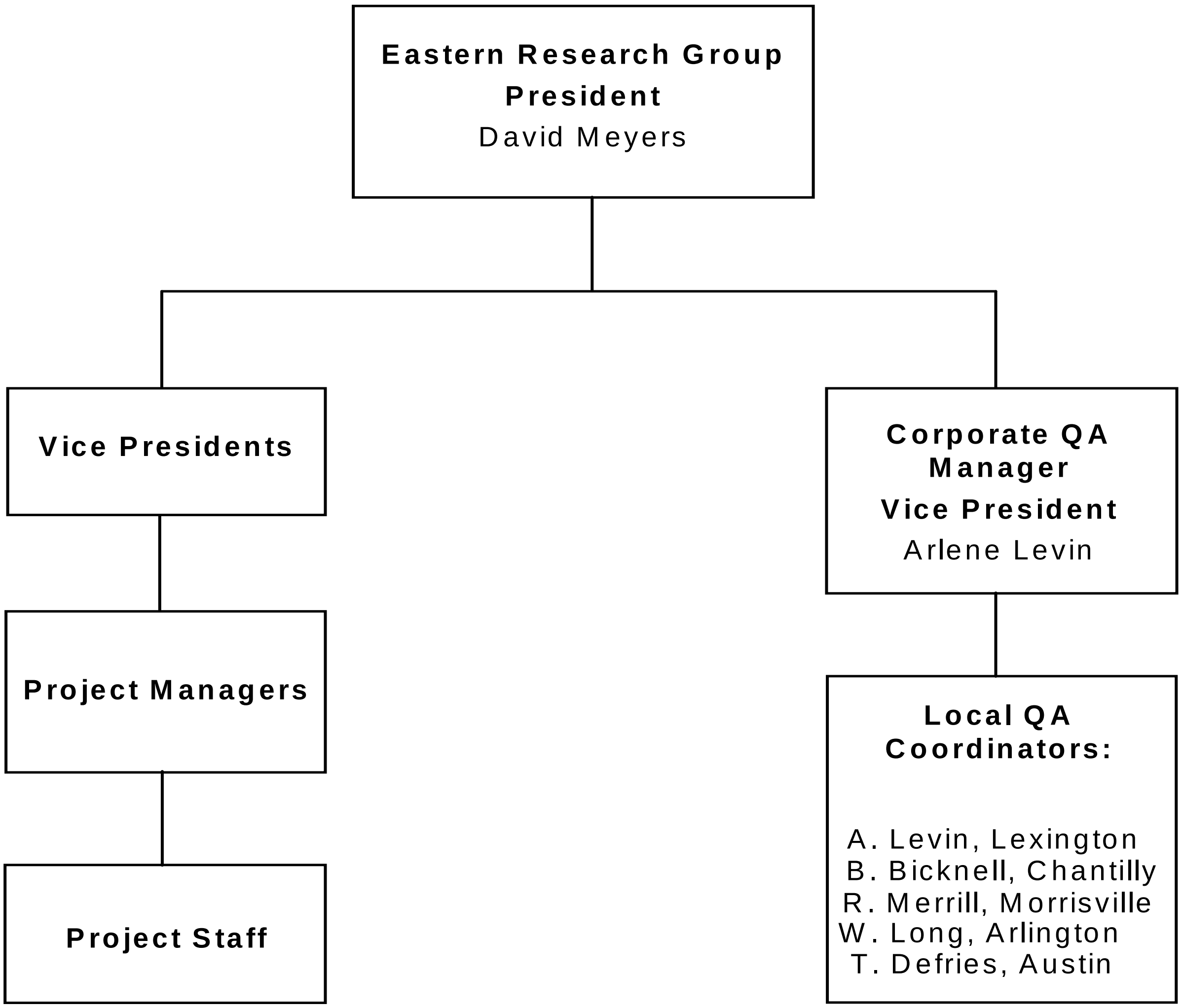
This Quality Management Plan (QMP) describes ERG's quality system, which is the structured and documented management system for the policies, objectives, principles, organizational authority, responsibilities, accountability, and implementation that ensure quality in work processes, products, and services. The quality system provides a framework for planning, implementing, and assessing work performed by the organization and for executing required QA/QC.

1.1 ERG QUALITY POLICY

ERG provides quality technical services to meet or exceed the needs of our clients in an effective and responsible manner. We measure our success as a company by our customers' satisfaction. It is our policy to maintain a corporate quality management program in order to be responsive to our clients' requirements for the diverse work we perform, which ranges from field testing and laboratory analysis to education, training, and outreach. ERG is committed to allocating the necessary resources for implementing, maintaining, and improving our quality management program, as well as preventing problems before they occur. Our company-wide pledge to provide services of consistently high quality drives all ERG quality assurance activities.

1.2 ORGANIZATION, RESPONSIBILITIES, AND AUTHORITY OF QUALITY ASSURANCE STAFF

The organization of the QA structure within ERG enables complete independence in program review. The Corporate QA Manager, ERG Vice President Arlene Levin, reports directly to ERG's President David Meyers, as indicated in the corporate organizational chart shown in Figure 1-1. She interacts with the Local QA Coordinators to assure that project-specific QA/QC programs are commensurate with project objectives and with ERG's quality system. The Local QA Coordinators, Mr. Andrew Burnette and Dr. Timothy DeFries (Austin, TX) report directly to Ms. Levin.



1-1. Corporate Organization

The independence of quality assurance is maintained at the project level (Figure 1-2). A project-specific QA coordinator is assigned to each project and given responsibility for coordinating the development and execution of QA/QC activities in all phases of the project. The Project QA Coordinator, directly responsible to the Local QA Coordinator, is responsible for ensuring the preparation of Quality Assurance Project Plans (QAPPs), which document project-specific policies, organization, objectives, functional activities, and specific QA/QC procedures; providing an independent review of the project approach, methods, experimental design, and QC activities; and conducting independent systems, performance, and data quality assessments through quality assurance audits. He/she verifies through continual evaluation that the overall quality management system is performing effectively and implements corrective measures, if necessary. Finally, he/she documents the results of all QA/QC activities in reports to ERG management. If the Project QA Coordinator is not the Local QA Coordinator, then he/she reports findings to the latter.

The independent authority of the QA staff is extremely important to ERG and to our clients. To this end, ERG confers sufficient authority on its QA staff to ensure that projects meet their defined data quality objectives and that data generated by ERG are of known quality. ERG has more than 23 years of experience supporting QA/QC activities on programs for EPA and other government clients. This experience gives us an understanding of the different levels of QA/QC activities necessary to cover the spectrum of quality objectives in ERG's scientific and technical programs, and it allows us to configure our QA staff and approach to best meet client needs. We are committed to meeting the QA/QC objectives of all our programs and our approach has proven effective for the broad range of our project work.

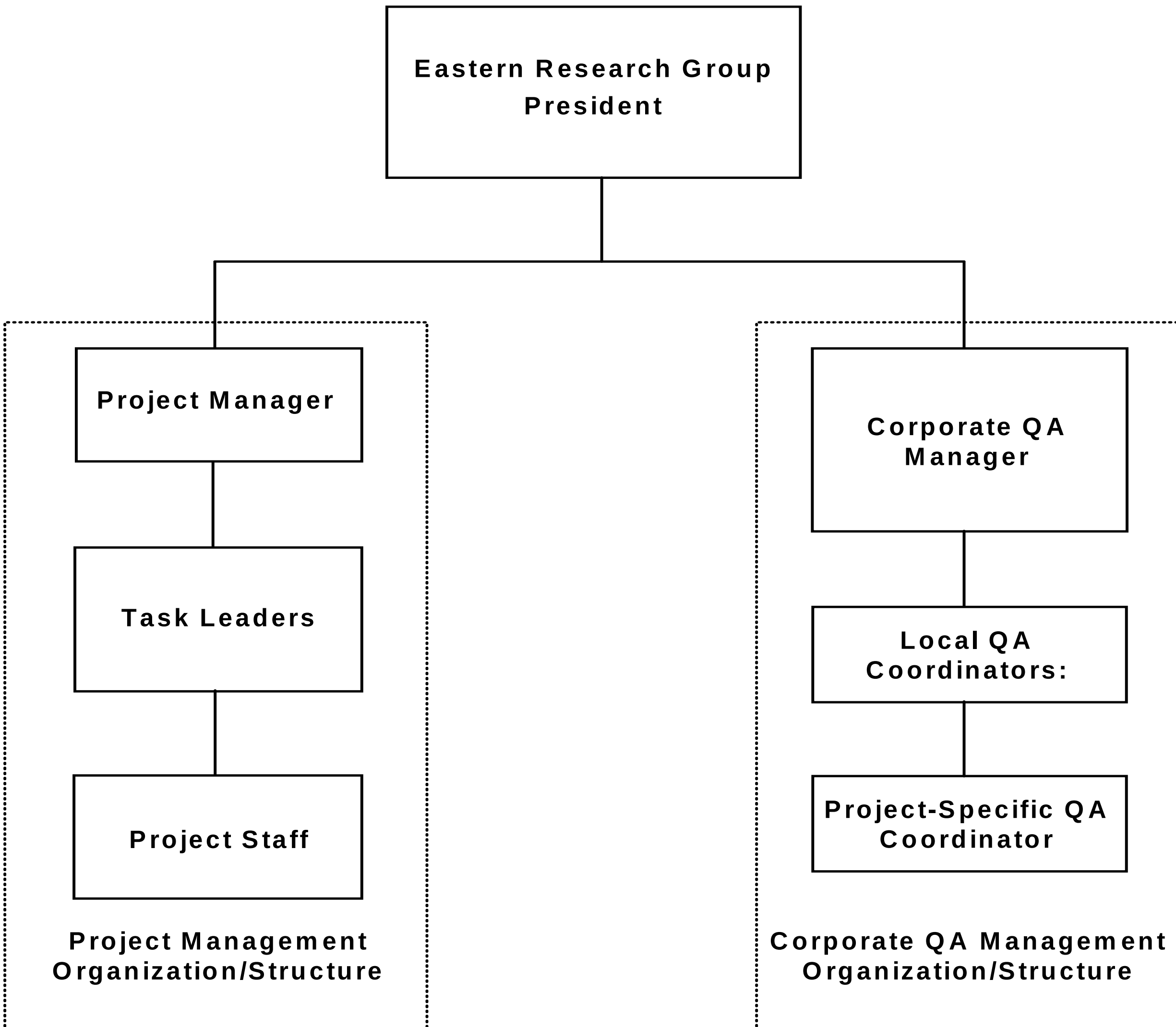


Figure 1-2. ERG's Corporate QA Structure Functions Independently of the Project Management Structure

The responsibilities, authority, and independence of ERG's corporate QA staff are outlined below.

1.2.1 Responsibilities, Authority, and Independence of the Corporate QA Manager

The Corporate QA Manager, Ms. Arlene Levin, plans, assesses, and improves ERG's quality system. She is organizationally independent, reporting directly to the ERG president. She is also responsible for:

- Developing QA policy for ERG in accordance with EPA and other client QA policies and direction from ERG management;
- Developing the corporate QMP, reviewing it annually, and revising it as necessary;
- Reviewing quality-related documents that are part of an ERG procurement, to determine if they are adequate to meet ERG's client's needs;
- Ensuring that all ERG project personnel understand the ERG quality system, through training and access to QA policy and procedure documents;
- Interacting with the Local QA Coordinators to assure that project-specific QA/QC programs are commensurate with project objectives and with ERG's quality system;
- Ensuring that independent audits are conducted to determine the effectiveness of the ERG QA/QC program;
- Working with Local QA Coordinators in conducting management systems reviews, described in Section 9.2.1 of this QMP;
- Implementing corrective actions for quality problems raised by Local and Project QA Coordinators;

- Recommending required management level corrective actions; and
- Stopping work of inadequate quality until identified deficiencies are resolved.

1.2.2 Responsibilities, Authority, and Independence of the Local QA Coordinators

Local QA Coordinators are designated for all ERG offices. They are organizationally independent, reporting to the Corporate QA Manager, Arlene Levin, who reports directly to the ERG president. (Ms. Levin also functions as the Local QA Coordinator for the Lexington office.) Local QA Coordinators are responsible for:

- Assisting the Corporate QA Manager in developing QA policies and procedures;
- Working with the Project Management Team to assure that project-specific QA/QC programs are commensurate with project objectives and with ERG's quality system;
- Assisting the Project Manager, and ERG Task Leaders in identifying and assigning appropriate project-specific QA coordinators and peer reviewers;
- Reviewing and approving QAPPs prepared by project staff;
- Reviewing reports from Project QA Coordinators of QA/QC procedures developed and executed for each project;
- Conducting independent audits to determine the effectiveness of the ERG QA/QC program, conducting management systems reviews, and independent technical assessments;
- Maintaining records of internal QA audits;
- Designating an appropriate individual to create needed standard operating procedures (SOPs), reviewing the draft procedure or designating an appropriate technical reviewer, and circulating the approved SOP to technical staff members;

- Maintaining copies of SOPs pertaining to the ERG location in a central filing system;
- Ensuring that all ERG personnel performing work covered by the QMP are notified of any changes and are informed of current requirements; and
- Submitting a summary of all unresolved or in-progress Requests for Corrective Action to ERG senior management (described in Section 10.2 of this QMP).

1.2.3 Authority to Stop Work for Quality Considerations

As discussed in Section 9 of ERG's Corporate QMP, the Project QA Coordinator audits the QA/QC performance of the project team. If the Project QA Coordinator finds deficiencies in project team performance, he/she notifies the ERG Task Leader, the Project Manager and Local QA Coordinator. If the deficiencies are not resolved, the Project QA Coordinator recommends that the ERG Task Leader stop work, replace personnel, or make other necessary changes so that the deficiencies are resolved. If deficiencies are still not resolved, the Project QA Coordinator notifies the Local QA Coordinator and Corporate QA Manager who ensure that the quality system outlined in this QMP is implemented and maintained. If the ERG Task Leader is unavailable, the Project Manager serves in his place.

1.2.4 Access of QA Staff to Management

ERG's QA/QC program is implemented at three staff levels, the Corporate QA Manager and Local QA Coordinators, described above, and the Project QA Coordinators, described in Section 1.3, below. The Project QA Coordinators serve as internal consultants to the Project Manager, and Task Leaders in developing project-specific QC systems. The Local QA Coordinators report to the Corporate QA Manager, Arlene Levin, who reports directly to the ERG president. This structure ensures that QA personnel have access to the appropriate levels of management in order to plan, assess, and improve ERG's QA/QC program.

> **"If you don't get a reasonable response to an issue or problem in a reasonable amount of time, contact me directly. Please don't feel that you're bothering me, or that I'm too busy. If something is of concern to you, I'd like to know about it and get a chance to do something about it."**
>
> **ERG President, David Meyers**
> **From President's Message on ERG Intranet**

In addition, QA staff, like all ERG staff, can contact the ERG president directly about concerns they feel have not been resolved at a lower management level.

1.3 PROJECT ORGANIZATION AND STAFF RESPONSIBILITIES

This section describes the organizational structure ERG uses to manage projects including the integration of QA/QC activities. For all work assignments, staff responsibilities, authority, and lines of communication are delineated in project-specific work plans and in the QAPPs. These plans are reviewed and approved by participants before work begins. The plans are disseminated using document control procedures to ensure that any changes made to the original plans are implemented by all project staff. Figure 1-3 presents a typical project-level QA organization.

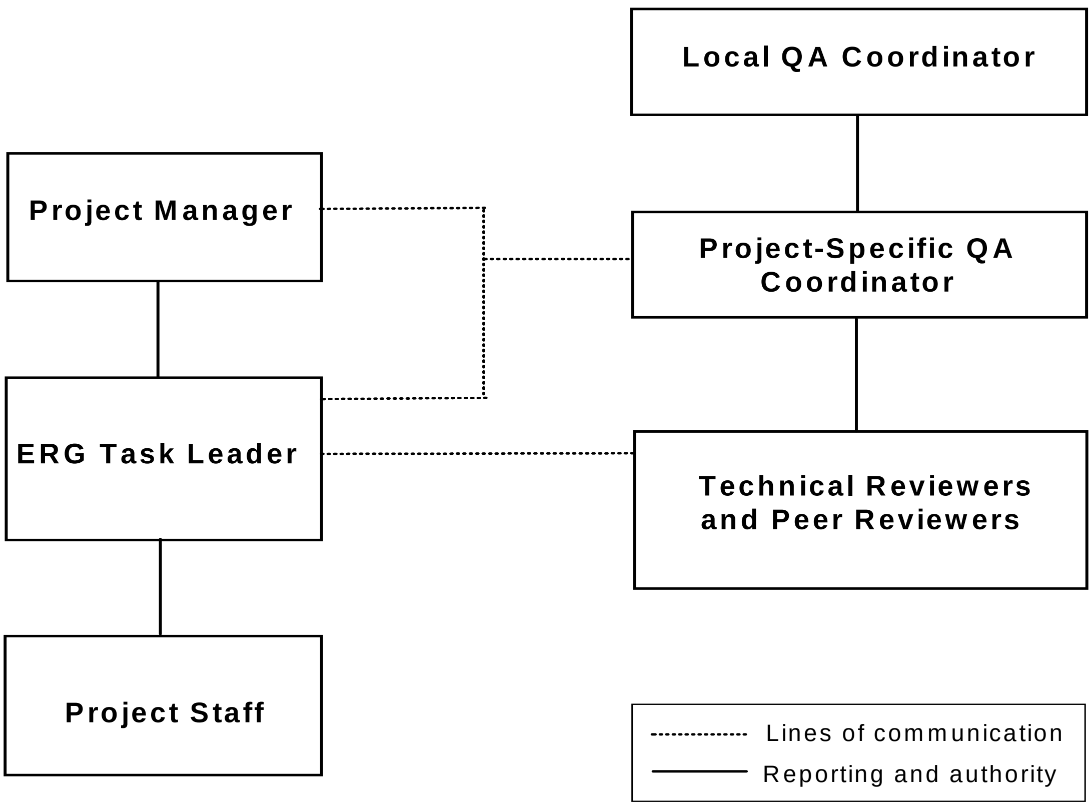


Figure 1-3. Typical Project-Level QA Organization

1.3.1 Project Manager

Project Managers (sometimes called Principal Investigators) at ERG have overall responsibility for individual work assignments. They organize and direct the technical activities and functions as the primary liaison between the client, management, and the project team. The duties of an ERG Project Manager include:

- Responding quickly to client requests and inquiries;
- Communicating with the client on technical matters and the and ERG Contract Manager on contractual matters;
- Informing project staff of contract requirements and ensuring the staff follow the requirements;
- Reviewing contract modifications;
- Reviewing all work assignments, work plans, and cost estimates;
- Ensuring that the project receives the appropriate staffing levels and technical expertise;
- Initiating and reviewing subcontractor work assignments;
- Managing and reviewing technical and financial progress reports and invoices;
- Implementing ERG's Security Plan for Handling Confidential Business Information;
- Implementing ERG's QMP;
- Assuring ERG remains free of conflict-of-interest;
- Working with the Project QA Coordinator and the ERG Task Leader to resolve any quality problems that arise; and

- Serving as the point-of-contact with ERG management on all matters relating to the contract.
- Coordinating the technical components (including personnel, facilities, and equipment) required under the contract;
- Assisting with the selection of project personnel;
- Monitoring the technical activities on each work assignment to ensure the technical objectives, budget, and schedule are met;
- Managing preparation and implementation of work plans, test plans, quality assurance project plans and cost estimates in accordance with EPA directions and format; and
- Reviewing performance of ERG Task Leaders; and
- Maintaining an awareness of new client policies and technical issues and communicating these to all work assignment staff.

1.3.2 ERG Task Leaders

ERG Task Leaders (sometimes called ERG Work Assignment Managers) coordinate the activities of the individual tasks required for completion of a given work assignment. In executing these duties, ERG Task Leaders:

- Are available to the client for action on any problem related to specific work assignments;
- Prepare and implement work plans, test plans, health and safety plans, and quality assurance project plans and associated project instructions in response to work assignments;
- Provide the client with periodic status briefings or reports;

- Implement ERG's cost and performance tracking and control system;
- Complete project on-time, within-budget, and in accordance with work order or assignment technical and regulatory objectives;
- Maintain and document all work assignment-related records, files, calculations, assumptions, and professional engineering judgments;
- Follow ERG's QMP and ensure the technical quality of reports, memoranda, and other communications from inception to delivery;
- Monitor the technical activities of each ERG project staff member to ensure that they are meeting the highest technical standards and adhering to the budget and schedule;
- Review the performance of ERG staff;
- Keep the ERG Project Manager informed on all aspects of each task, including expenditures, technical progress, problems, and recommended solutions;
- Monitor subcontractor performance and provide performance data to the ERG Project Manager;
- Ensure compliance with all QC acceptance criteria as specified in any QAPP or other project-specific supplement to the QMP; and
- Keep the Project QA Coordinator and the Project Manager advised of any quality problems that arise.

1.3.3 Project QA Coordinators

Project QA Coordinators are responsible for the development and execution of QA activities throughout the course of a project, including work plan, test plan, health and safety plan, and quality assurance project plan development and execution, data analysis, and reporting. ERG identifies a Project QA Coordinator for each work assignment or group of related work assignments on this contract. In this capacity, the Project QA Coordinators:

- As required by the work order or assignment, ensure preparation of a QAPP that documents the project-specific policies, organization, objectives, functional activities, and specific QA/QC procedures designed to achieve quality goals or requirements. (e.g., QAPPs prepared for EPA projects will comply with *EPA Requirements for Quality Assurance Project Plans*, EPA/240/B-01/003 March 2001 (QA/R-5), and/or NRMRL QMP Appendix C: *Quality Assurance Planning Requirements*, as specified by the client).

- Verify that the requirements of the approved QAPP and other ERG QA/QC procedures are communicated to the project team;

- Serve as internal consultants to the Project Manager, and ERG Task Leaders in defining quality goals or requirements and in developing a project-specific QC system that is responsive to them;

- In consultation with the Local QA Coordinator, verify that subcontractors' quality related procedures are adequate and executed;

- Provide an independent review of the project approach, methods, and sampling design;

- Provide the mechanism for bringing quality problems to the immediate attention of the Project Manager or, if warranted, to the attention of the Local QA Coordinator or Corporate QA Manager for implementation of corrective action;

- Provide an independent assessment of performance through QA audits;

- Oversee any external QA audit activities requested by the client if required by work assignment; and

- Document the results of all QA/QC activities in reports to ERG management and, if required by the work assignment, to the client(s).

1.3.4 Project Staff

Project staff are responsible for executing the project QA/QC requirements specified in the QAPP and other project plans. They are responsible for documenting the results of their

QA/QC activities and communicating with the Project QA Coordinator, who is responsible for reporting to the ERG Local QA Coordinator.

1.4 ERG TECHNICAL ACTIVITIES AND PROGRAMS SUPPORTED BY THE QA/QC PROGRAM

ERG's QA/QC program, described in this QMP, is designed to ensure the quality of services provided to clients in a wide variety of scientific, technical, and informational areas, including Environmental Data Operations (EDOs) involving the collection, evaluation, and use of environmental data. The QMP applies to all basic research, applied research, engineering, modeling, design construct and/or operation of technology, method development, sampling and analysis, secondary data use, database and software development, data review and validation, scientific assessment, and training activities conducted by ERG. ERG's QA/QC program does not, however, address quality-related activities for administrative areas of the company (e.g., human resources, facilities, accounting).

Not all elements of the QMP may be applicable to every project conducted by ERG. For example, QC procedures applicable to environmental sampling are not be appropriate for a project involving development of a training course or video. For work assignments involving measurement activities, environmental data generation (e.g., surveys, field sampling) or environmental data use, ERG develops a QAPP that meets requirements as defined by the client in the applicable work orders or assignments.

1.4.1 Oversight of Subcontractor Activities

Subcontract agreements are issued to firms, and occasionally individuals, who perform sections of ERG's prime contract scope of work at any dollar level. ERG demands the same high level of quality and performance from subcontractors and consultants as it does from its own employees, and subcontractors are bound by the same requirements and restrictions as ERG under the Prime Contract. These agreements contain all required flowdowns of the prime contract plus many flowdowns that pertain to the type of work to be performed, including any requirements for QAPPs included in a specific work assignment.

The ERG Corporate QA Manager is responsible for verifying that subcontractor's quality related procedures are adequate and executed. The Project Manager reviews the performance of ERG subcontractors and consultants and does not approve the payment of invoices unless subcontractor performance meets contract requirements.

1.4.2 Coordination of QA and QC Activities

The Corporate QA Manager is responsible for internal coordination of QA and QC activities among the local offices, represented by the Local QA Coordinators. She also serves as the Local QA Coordinator for the Lexington, MA, location. This coordination assures that project-specific QA/QC programs are commensurate with project objectives and with ERG's QA policy. The Local QA Coordinators, Mr. Andrew Burnette and Dr. Timothy DeFries (Austin, TX), work directly with the Project Manager to ensure that each project has, as appropriate, a Project QA Coordinator. Local QA Coordinators may serve as Project QA Coordinators, facilitating this coordination.

1.4.3 Management's Assurance that ERG's QA/QC System is Understood and Implemented

ERG Management assures that applicable elements of ERG's QA/QC program are understood and implemented in all programs that generate or use environmental data. Section 3, below, discusses training conducted to ensure that staff understand ERG's QA/QC program. See Section 9 for a discussion of the tools used to assess the implementation of ERG's QA/QC program.

SECTION 2

QUALITY SYSTEM COMPONENTS

2.1 INTRODUCTION

ERG is dedicated to providing quality services to our clients. Our success and growth depend on our record of providing high-quality work, which encompasses delivering on time and within budget what we promise and what our clients expect. This insistence on quality and integrity is the foundation for establishing quality objectives for every project.

This section of the QMP describes the principal components of ERG's quality system and defines who is responsible for managing and implementing each component of the system. This section also identifies the tools used to implement each component of ERG's quality system. The services ERG provides to our clients are organized as projects. Thus, ERG's quality system consists of components that are applied to ERG as a whole and components applied to each project. A project may comprise one or more related tasks or work assignments.

Components of ERG's *corporate quality system* include:

- Quality System Documentation;
- Quality System Annual Reviews and Planning;
- Quality System Management Assessments; and
- Training.

Section 2.2 contains a description of each of these components, management roles and responsibilities in their implementation, and the tools used in their implementation.

Components of ERG's *project quality system* include:

- Project Quality Planning;
- Project Quality Documentation;
- Project Data Quality Assessment; and
- Project Quality Assessment.

Section 2.3 contains a description of each of these components, management roles and responsibilities in their implementation, and the tools used in their implementation.

2.2 ERG CORPORATE QUALITY SYSTEM COMPONENTS

This section describes the *corporate quality system*, specifically, management roles and responsibilities in implementing the system and the tools used in its implementation.

2.2.1 ERG Corporate Quality System Documentation

Description: Documentation of the ERG corporate quality system is the written record of the management systems and technical activities ERG uses to ensure the quality of the work processes, products, and services we provide to our clients.

Roles and implementation responsibility: ERG's Corporate QA Manager, Arlene Levin, is responsible for developing and documenting ERG's quality system in accordance with EPA and other client QA policies and direction from ERG management. She is also responsible for developing, reviewing, and revising the corporate QMP, the major tool used to document ERG's quality system. The Local QA Coordinators are responsible for preparing new or revised Standard Operating Procedures (see below). The cognizant ERG Confidential Business

Information (CBI) Document Control Officer is responsible for developing, reviewing, and revising the statute-specific CBI plans ERG uses to manage CBI in our possession.

Tools for Implementing Corporate Quality System Documentation:

Quality Management Plan. The major tool for documenting ERG's corporate quality system is the QMP. The QMP describes how ERG structures its quality system and describes the general roles and responsibilities for staff and management. A QMP tailored to specific contract requirements is prepared at the direction of our clients (see Section 2.4, below).

ERG's QMP is based on guidelines from *American National Standard: QA Specifications and Guidelines for Quality Systems for Environmental Data Collection and Environmental Technology Programs (ANSI/ASQC-E4)* [dated 01/03/95], and *EPA Requirements for Quality Management Plans (EPA QA/R-2)* [dated 03/20/01]. The ERG Corporate QA Manager reviews this QMP at least annually and revises it as necessary. Revisions are made in order to clarify roles and responsibilities, address problem areas, and to institutionalize improvements. The QMP is also revised when existing functions that affect programs covered by the QMP are reorganized, or if audits of the QA program determine that corrective actions are necessary.

When the QMP is revised, it is re-distributed to all Local QA Coordinators. The Local QA Coordinators are responsible for ensuring that all ERG personnel performing work covered by the QMP are notified of any changes and are informed of current requirements.

Standard Operating Procedures (SOPs). SOPs are written instructions that document a routine or repeated activity. SOPs detail work processes in order to facilitate consistent conformance to technical and quality system requirements. Use of SOPs helps to ensure data quality.

ERG's SOPs follow the guidelines and requirements stated in EPA Methods for Analysis of Water and Waste, Standard Methods, SW-846, NIOSH, ASTM, and *Guidance for the Preparation of Standard Operating Procedures (QA/G-6)* [dated March 2001]. SOPs are developed for each analytical method (e.g., U. S. EPA Method 1613), engineering activity (e.g., calculations, spreadsheet data manipulation), or laboratory function (e.g., sample preparation, maintaining a laboratory notebook). When the need for a new SOP is determined, the Local QA Coordinator designates an appropriate individual to create needed SOPs, and reviews the draft procedure or designates an appropriate technical reviewer. The Local QA Coordinator approves the SOP after all peer reviewer comments are resolved, then circulates the approved SOP to technical staff members, as discussed in Section 5.2.3 of the QMP.

Appropriate SOPs are identified in each QAPP. An index of ERG SOPs (which include measurement and non-measurement related procedures) is included in Appendix A.

CBI Plans. ERG's procedures for handing CBI are documented in plans designed and prepared by ERG based on requirements established by EPA. CBI Plans are approved by the cognizant client CBI Document Control Officer. The plans are developed to meet the statutory requirements under which EPA collected the CBI from the public. ERG has approved plans for handling CBI in the Chantilly, VA; Morrisville, NC; and Lexington, MA offices.

2.2.2 ERG Corporate Quality System Annual Reviews and Planning

Description: An annual, internal review of the corporate quality system to determine if the quality system is implemented and is operating as prescribed in the QMP. Annually, plans (including schedules and resource needs) are developed for implementing corrective actions and quality system improvements identified during the quality system annual review.

Roles and implementation responsibility: The Corporate QA Manager is responsible for ensuring that independent audits are conducted to determine the effectiveness of the ERG quality system. Local QA Coordinators are responsible for reporting to the Corporate QA Manager results of independent audits they have performed to determine the effectiveness of the ERG quality system, management systems reviews, and independent project quality technical assessments.

Tools for implementing Corporate Quality System Annual Review:

Quality System Compliance Checklist. This checklist details the required elements of the management systems and technical activities specified in the QMP**.**

2.2.3 ERG Corporate Quality System Management Assessments

Description: Assessments of the ERG quality system to determine if the system (management structure, policies, practices, and procedures) is adequate for ensuring the quality of data operations conducted for our clients.

Roles and implementation responsibility: Senior management, with input from QA staff and project management, are responsible for conducting corporate quality system management assessments.

Tools for implementing Corporate Quality System Management Assessments:

Client Satisfaction Survey. ERG asks our clients directly if they are satisfied with the quality of our work. ERG President David Meyers or his designee calls Clients responsible for our prime contracts every year to obtain their feedback on our services. Additionally, each year an ERG senior manager calls each Client, Contract Officer, and Delivery Order/Work Assignment Manager. The manager who makes the call is not involved with the contract, so the clients may feel freer to assess ERG's performance from a broader perspective. We call our clients to ask for their assessment of:

- The technical quality of our work;
- Whether ERG staff have been easy to work with;
- ERG's responsiveness to the client's concerns;
- Our adherence to schedules and budgets;
- What the client might like to see us do differently (how can we improve?); and
- Any other issues that need to be addressed.

In addition, we ask our clients if our overall performance has been excellent, good, fair, or poor.

2.2.4 Training

Description: A centrally administered program of courses of broad or general applicability, supplemented by additional job- and task-specific training coordinated at the local level.

Roles and implementation responsibility: An employee's supervisor is responsible for defining the training requirements for specific jobs in each technical area. The Corporate QA Manager and Local QA Coordinator are responsible for ensuring that all ERG project personnel understand the ERG quality system, through training and access to QA policy and procedure documents. Local QA Coordinators are responsible for training staff in QA/QC procedures.

Tools for implementing Corporate Quality System Training:

See Section 3.0 for a discussion of training conducted to ensure that staff understand ERG's QA/QC program. Training tools include:

- Training in specific SOPs;
- On-the-job training;
- In-house training courses (e.g., Project Management Training and QA Training);
- Workshops;
- Classroom training programs; and
- Professional certification.

2.3 ERG PROJECT QUALITY SYSTEM COMPONENTS

Components of ERG's *project quality system* include planning, documentation, data quality assessment, and project quality assessment. This section contains a description of each of these components, management roles and responsibilities in their implementation, and the tools used in their implementation.

2.3.1 Project Quality Planning

Description: Project quality planning is the process of identifying the quality requirements of the project work, and identifying the management structures and technical activities used to ensure that products meet our clients needs and expectations.

Roles and implementation responsibilities: The Project Manager is responsible for the quality of the work performed on each project, and he/she works with the client and with the Local QA Coordinator to establish an appropriate QA/QC program for each project or work assignment. The type of QA/QC program depends on the requirements specified by the client and the intended use of the data or final report. The Project Manager and Local QA Coordinator also decide if a Project QA Coordinator is needed.

Tools for implementing Project Quality Planning:

Work Plan. The work plan translates the client's needs into specifications for producing the desired result. The work plan considers cost and schedule constraints and describes acceptance criteria for the results or measures of performance. Frequently, the Work Plan is accompanied by a QA narrative that specifies QA/QC parameters for the proposed project. For projects that involve environmental data generation or use, ERG develops a QAPP.

QA Project Plan (QAPP). A QAPP, usually prepared in conjunction with a Sampling and Analysis Plan or Laboratory Test Plan, details the QA/QC and other technical activities necessary to ensure that the results of the work will satisfy the stated performance criteria. QAPPs are always prepared for projects that involve original data gathering, generation, or measurement, such as environmental sample collection and analysis. Projects that support litigation, regulatory enforcement, human health studies and regulatory development contain the standard elements listed in the EPA guidelines (*EPA Requirements for QA Project Plans (QA/R-5)*) and address all quality issues associated with sample collection, analysis, data validation, and reporting. Many procedures are standardized, such as sample collection and analysis, instrument calibration, chain-of-custody procedures, and data validation procedures and calculations. Research and Development projects follow applicable guidelines defined by the client, ERG QA staff and scientific common sense. Project-specific QA objectives are developed, and any constraints or adaptations to standard procedures are incorporated and reviewed prior to conducting any field activities.

The Local QA Coordinator, independent of the project team, reviews and approves QAPPs. The Project QA Coordinator is responsible for ensuring that a QAPP is prepared, and that it meets the client's specifications. The Project QA Coordinator may prepare the QAPP themselves, or it may be prepared by the project team (Program Manager, ERG Task Leader, or a team member). If the project team prepares the QAPP, the Project QA Coordinator reviews it and verifies that it meets the clients needs. The Local QA Coordinator approves the plan after all peer reviewer and Project QA Coordinator reviewer comments are resolved. The Project QA

Coordinator verifies that the requirements of the approved QAPP are communicated to the project team.

Data Quality Objectives. Data Quality Objectives are statements that clarify the technical and quality objectives of a project, define the appropriate type of data, and specify tolerable levels of decision errors that will be used as the basis for establishing the quality and quantity of data needed to support decisions. The Data Quality Objectives Process is a systematic strategic planning tool, based on scientific method, that identifies and defines the type, quality, and quantity of data needed to satisfy a specified use. The key elements of the Data Quality Objectives Process are:

- Concisely defining the project objective;
- Defining the boundaries of the study;
- Identifying the decision to be made;
- Identifying the key inputs to that decision;
- Developing the decision rule;
- Specifying tolerable limits on potential decision errors; and
- Selecting the most resource-efficient data collection design

This Data Quality Objectives Process uses a graded approach, developing managerial controls that are commensurate with the importance of the work and consequences of potential decision errors (see *Guidance for the Data Quality Objectives Process*, EPA QA/G-4, EPA/600/R-96/055). Applying this process results in data quality objectives as qualitative and/or quantitative outputs. These parameters are derived in consultation with the client and are defined for the client in a Work and/or Sampling and Analysis Plan and in the QAPP. The parameters are defined internally for ERG staff through project instructions prepared for each project to communicate requirements of a technical nature and in the areas of QA/QC.

2.3.2 Project Quality Documentation

Description: An auditable trail that documents project quality planning, implementation, and assessment. Includes plans, check-lists, sign-off sheets, review memoranda, and other project-specified documentation.

Roles and implementation responsibility: The Program Manager is responsible for ensuring that project quality documentation is produced and maintained.

Tools for implementing Project Quality Documentation:

Document Review Sign-Off Sheet. Document review sign-off sheets are used to manage internal review of work assignment deliverables (memoranda, Sampling and Analysis Plans, Sampling Episode Reports, technical and engineering assessments, etc.). They provide an auditable trail of the sequence and nature of review performed for every deliverable. The Project Manager, in conjunction with the ERG Task Leader, determines the level of review a document receives based on its nature and scope. Reviewers sign off on the sheet only after they are satisfied that their comments have been addressed. If errors are discovered during the review process, corrections are made by the principal author and noted on the sign-off review sheet. An error discovered after delivery is brought to the attention of the Project Manager. He/she determines the severity of the error and its resolution, contacts the client to discuss the error and resolution, and determines the level of review necessary to check the corrected deliverable.

2.3.3 Project Data Quality Assessment

Description: Data quality assessment is used to assess the type, quantity, and quality of data in order to verify that the planning objectives, QAPP components, and sample collection procedures were satisfied and that the data are suitable for their intended purpose. Data quality assessment is a five-step procedure for determining statistically whether or not a data set is suitable for its intended purpose. This assessment is a scientific and statistical evaluation of data to determine if they are of the type, quantity, and quality needed and may be performed either during a project to check the process of data collection or at the end of a project to check if objectives were met.

Roles and implementation responsibility: A Data Quality Assessment may be performed by a project team member, by the Local QA Coordinator, or his/her designee at any point in a project in which data have been generated.

Tools for implementing Project Data Quality Assessment:

Graphical and statistical tools are used for project data quality assessment. Graphical tools include, but are not limited to:

- Histogram/frequency plots;
- Box and whisker plots;
- Ranked data plots;
- Scatter plots;
- Time series plots, including correlograms; and
- Spacial plots.

Statistical tools used for project data quality assessment include, but are not limited to:

- Hypothesis tests for a single population;
- Hypothesis tests for comparing two populations; and
- Regression analysis.

2.3.4 Project Quality Assessment

Description: A project quality assessment determines if:
1) project work meets our clients' needs and expectations and the quality requirements specified in the work plan; and
2) the management structures and technical activities specified in the work plan have been implemented.

Roles and implementation responsibility: The Project Manager has primary responsibility for assessing the quality of project work. Second assessments are made by a project's technical reviewer(s). Assessments may also be performed by the Local QA Coordinator or his/her designee.

Tools for implementing Project Quality Assessment

Technical Assessments. Technical assessments include initial (conceptual) review of project plans, ongoing (developmental) review, and review of the final product. Initial review evaluates the objectives, concepts, methods, logic, and form(s) of intermediate and final products. Ongoing developmental reviews look at the intermediate products as they evolve from draft stages into final form. ERG performs reviews in-house and also solicits intermediate or developmental review from clients.

The use of technical reviewers is an essential part of ensuring scientific and technical QC. A technical reviewer is a qualified senior staff member who is not directly involved in the work assignment. He/she typically reviews the work assignment:

- At the *work plan stage*, addressing whether the conceptual approaches are fundamentally sound to meet the project objectives;
- At *key interim milestones* to determine if the project team is still on target; and
- *Prior to submission of draft and final products* to determine if the objectives have been fulfilled in a technically sound manner.

Each work assignment product or task is assigned a technical reviewer in the work plan and his or her participation is budgeted as a line item cost. The responsibilities of a technical reviewer include an initial review of the project plan, to ensure that:

- Project goals are well-defined, realistic, and appropriate to meet the needs of the client;
- The approach proposed to meet the goals is reasonable and likely to result in a successful project; and
- The necessary resources in terms of time, dollars, and staff are dedicated to the project.

A thorough technical review is performed on all work products prior to submission of draft and final products.

In addition to on-going technical review, periodic quality reviews are conducted by senior management to assess the work being directed by their staff members. These reviews focus on continuous improvement efforts; whether a current, detailed project plan is in place; whether recent deliverables have been peer-reviewed and submitted on time and within budget; and whether the Project Management Team is soliciting and responding to client feedback. See Section 9.2.3 for additional discussion of senior technical management's formal project review.

2.4 QUALITY MANAGEMENT PLAN DEVELOPMENT

ERG's QMP is based on guidelines from *American National Standard: Specifications and Guidelines for Quality Systems for Environmental Data Collection and Environmental Technology Programs (ANSI/ASQC-E4)* [dated 01/03/95], and *EPA Requirements for Quality Management Plans (QA/R-2)* [dated 03/20/01). The ERG Corporate QA Manager reviews this QMP at least annually and revises it as necessary.

SECTION 3

PERSONNEL QUALIFICATION AND TRAINING

This section documents ERG's procedures for assuring that all our employees have the necessary skills to accomplish their work effectively. The procedures described in this section include ERG's approach to hiring and training of staff, conducting performance reviews and evaluations, and performing routine health examinations of employees who work with hazardous materials.

3.1 ERG TRAINING POLICY

It is ERG's policy to identify QA and QC training needs for all levels of management and staff, and to provide resources for this training. The goal of this training is to assure that QA and QC responsibilities and requirements are understood at every stage of project implementation. The ultimate responsibility for ensuring that training needs are identified and appropriately addressed rests with ERG senior management, specifically ERG President David Meyers and the Corporate QA Manager, Arlene Levin.

3.2 DETERMINATION OF INITIAL CAPABILITY

Technical staff managers at ERG must recruit top-quality people, know the capabilities of their staff, and match the skills of their staff to the specific needs of their projects. Senior technical staff managers work together to define future project needs in terms of both the numbers and the capabilities of people required to perform the work. Staff are selected for their qualifications for specific technical areas, as well as for their ability to function effectively as members of a project team.

ERG has well-established procedures to ensure that all newly hired employees have excellent technical skills and can function effectively as members of a project team. Procedures used to identify potential scientific and technical staff include:

- Screening potential candidates during an on-campus interview or by phone to assess their interests, background, personal characteristics, and technical and communication skills. Before ERG invites a candidate for an interview, the manager responsible for the hiring process reviews academic transcripts.

- During the interview on site, eight to ten ERG staff members at a variety of technical levels in the organization speak with the candidate. The candidate also makes a formal presentation focusing on a specific example of past technical work and provides a writing sample related to the work to allow technical managers within ERG to evaluate whether the candidate has the necessary communication skills and technical judgment to be effective in the company's project-oriented environment.

- After the interview and presentation, the technical manager in charge of hiring consults with the candidate's references about any concerns identified in the interview. No candidate receives a job offer from ERG unless the majority of the people participating in the interview feel that he/she would be a valuable member of the staff.

3.3 TRAINING

ERG ensures that personnel have the knowledge and skill necessary to complete our client's projects. Employment at ERG entails a career-long educational process, beginning with new employee training and continuing through training in project management and specific technical activities. Employees receive additional training as their job descriptions and responsibilities change and evolve and as new technology is introduced.

3.3.1 Training of New Employees

All new employees attend a general orientation and receive on-the-job training specific to their areas of responsibility. General orientation addresses the motivating principles and concepts underlying the company's approach to quality as well as technical and managerial precepts fundamental to conducting business at ERG. All employees engaged in field sampling activities receive an initial 40 hours of training in hazard identification and safe work practices, with an annual 8-hour refresher course.

3.3.2 Training Needs Identification

An employee's supervisor is responsible for defining the training requirements for specific jobs in each technical area. These requirements are communicated through technical managers, who monitor attendance at training sessions and who ensure that their staff are adequately informed about the codes and standards necessary to perform the work. Orientation activities are scheduled as required for specific programs, either as a continuing series of training seminars or under the supervision of a senior technical staff member. Training commonly provided at ERG, with the employees required to participate is listed in the table below.

Employee Responsibilities	**Related Training**
Work with CBI	Required training supported by annual refresher courses
Work managing projects	ERG Project Manager Course
Work at hazardous waste sites	OSHA-mandated 40-hour HAZWOPER instructional courses, followed by annual refresher sessions
Holding security clearances	Initial briefing followed by periodic security education and awareness programs

3.3.3 Training Courses and Programs

At ERG, our objective is to ensure that the quality of technical services is consistent regardless of who does the work or which office performs the task. This degree of standardization requires a training program that is flexible enough to meet the diverse needs of a number of different technical service areas, while ensuring that all employees receive the necessary training appropriate for their specific work area. ERG's corporate training program includes a centrally-administered program of courses of broad or general applicability, supplemented by additional job- and task-specific training coordinated at the local level.

At the corporate level, ERG offers a diversity of training courses open to all employees. Individual courses range in duration from single classes (e.g., hazard communication training, CPR training, confidential business information training) to those which meet weekly for several months (e.g., Project Management, Application of Statistics). Through these courses, ERG ensures that managers and technical personnel develop not only the technical skills to do their jobs, but also the management and communication skills required to perform their jobs with excellence.

A coordinator is assigned for each course and given responsibility for securing meeting space, for making the necessary arrangements for audio-visual aids or other special equipment, and for enlisting instructors. Announcements of upcoming classes are included as a regular agenda item in managers' meetings. While employee participation in many of the offered courses is voluntary, specific training may be required of an employee before he/she is permitted to perform certain tasks.

In addition to centrally-administered corporate training courses, each technical group defines supplemental training requirements commensurate with its specific technical activities. The Project Managers are responsible for developing and implementing training programs to meet these requirements. These training efforts typically include some combination of the following:

- Training in specific SOPs;
- On-the-job training;
- In-house training courses;
- Workshops;
- Classroom training programs; and
- Professional certification.

In addition to a formal management training program, ERG has an active technical seminar program. Topics are selected based on their relevance to ongoing project work conducted by ERG for EPA and other clients. In our Morrisville Laboratory, technical seminars focus on improving measurements performance on the Environmental Laboratory Accreditation Program (NELAP).

A second aspect of the technical seminar program is designed to give employees in various groups an opportunity to make presentations to their co-workers on the objectives, approach, and results of their work. Scheduled on a frequent basis, these seminars cover an array of topics and often incorporate briefings from employees on recent off site training that aid staff in completion of project objectives. This program enables ERG's technical staff members to refine their presentation skills in front of a group and affords managers another mechanism for reviewing work results and for promoting cross-training of staff.

3.3.4 Documentation of Training

Records of attendance and compliance with educational activities are maintained in the personnel office along with other personnel records.

3.3.5 Retraining

ERG's training program is intended to ensure that all personnel have the necessary level of experience or training to enable them to competently perform designated tasks. A new job description, the introduction of new technology, or a change in responsibilities may result in a lack of knowledge, skills, or abilities needed to perform a job successfully . When this situation arises, staff are trained in the new requirements.

3.4 FORMAL QUALIFICATIONS AND CERTIFICATIONS FOR SPECIALIZED ACTIVITIES

ERG ensures that personnel have and maintain the appropriate statutory and regulatory qualifications necessary to execute project work for our clients. Listed below is a summary of regulations pertinent to specific work areas:

- *OSHA Safety and Health Standards (29 CFR 1910).* OSHA regulations specify the general industry safety standards applicable to all workplaces. In addition, the OSHA standards contain Subpart Z, "Toxic and Hazardous Substances," which includes standards for handling specific chemicals classified as occupational carcinogens. A generic form of these standards has been developed by ERG and is the basis for all procedures for handling toxic chemicals. Recently included in Subpart Z (1900.1200) is a set of standards on communicating information involving hazards to employees. The system in place at ERG exceeds those requirements.

- *Resource Conservation and Recovery Act (RCRA).* The regulations promulgated under RCRA define the requirements for management, storage, transportation, and disposal of hazardous wastes.

- *International Air Transport Association (IATA).* The IATA regulations govern shipments of hazardous materials in international airspace. Shipments with both national and international routes must comply with U.S. Department of Transportation (DOT) and IATA regulations.

- *Nuclear Regulatory Commission (NRC).* NRC regulations are applicable to the operation and monitoring of equipment containing radioactive sources. Radioactively labeled chemicals are also regulated by NRC, DOT, and by the states.

- *Other Regulatory Requirements*. Several federal agencies have developed specific guidelines and protocols for laboratory operations involving carcinogens and other hazardous materials. These guidelines and protocols comprise a significant portion of ERG's hazardous materials safety and health program. ERG complies with or exceeds all the following:

  – National Cancer Institute (NCI), "Safety Standards for Research Involving Chemical Carcinogens," NIH 76-900,

  – National Institutes of Health (NIH), "Guidelines for the Laboratory Use of Chemical Carcinogens," NIH 81-2385,

  – Department of Health and Human Services, "Guidelines for the Laboratory Use of Chemical Substances Posing a Potential Occupational Carcinogenic Risk",

  – National Toxicology Program (NTP), "Health and Safety Minimum Requirements for Bioassay Laboratories," updated to the current "Health and Safety Minimum Requirements for Support Contractors",

  – National Institute for Occupational Safety and Health (NIOSH), "Working with Carcinogens",

  – NIOSH, "A Management Guide to Carcinogens," NIOSH 77-205,

– NIOSH, “Safety and Health Manual”, and

– “Lab Safety at the Centers for Disease Control (CDC),” CDC76-8118.

3.5 EVIDENCE OF PERSONNEL JOB PROFICIENCY

The annual performance evaluation for all employees is another important component of ERG’s quality system. Through this process, ERG recognizes the good work of employees and identifies areas that need improvement. In private discussions, staff members and their direct supervisors establish training needs and identify personal performance goals for the coming year. They also hold performance and goal-achievement evaluations throughout the year.

Objective evidence of personnel job proficiency is obtained in a variety of ways, depending on the employee’s assignment. For example, initial determination of an employee’s ability to perform specific technical procedures, such as physical or chemical measurements, typically involves repeated measurements of a reference material according to a Standard Operating Procedure. The employee must demonstrate acceptable performance, usually in terms of pre-established limits for measurement accuracy and reproducibility, in order to be certified by the technical manager to perform the test routinely. Results of these demonstrations are maintained by the technical manager.

3.6 PHYSICAL REQUIREMENTS AND EXAMINATIONS

ERG provides annual medical examinations for employees working with hazardous materials. Medical examinations are provided every three years for other employees engaged in field sampling. Medical doctors who specialize in occupational medicine perform a baseline evaluation of new employees, which includes extensive blood and urine chemistry plus cardiovascular, pulmonary, hearing, and vision tests. The initial examination provides a written assessment of the employee's physical ability to perform certain assigned tasks and identifies any limitations. Periodic follow-up examinations allow monitoring of potential physiological effects caused by exposure to workplace hazards and provide continuing assurance that an employee's physical condition is adequate to deal with the physical requirements associated with certain types of work. ERG's personnel office maintains employee medical records for a minimum of 30 years.

SECTION 4

PROCUREMENT OF ITEMS AND SERVICES

This section describes ERG's processes for reviewing and approving procurement documents for purchased items and subcontracted services, and also describes ERG's processes for reviewing and approving responses to solicitations and for ensuring that procured items and services are of acceptable quality.

4.1 INTRODUCTION: ERG's PROCUREMENT PROCEDURES

ERG has developed internal procurement procedures to standardize operations, meet government requirements, and provide day-to-day guidance in five areas:

- General procedures;
- Contracts/subcontracts;
- Purchasing;
- Receiving; and
- Government property control.

These procedures also ensure that purchased items and services are of acceptable quality. ERG's Purchasing System, detailed in the *ERG Procurement Manual*, was reviewed by Defense Contract Management Command in April 1999 during ERG's first Contractor Purchasing System Review (CPSR). ERG received U.S. governmental approval for its purchasing system in a letter dated July 9, 1999, from Cassandra B. Bain, EPA, to David Meyers, ERG.

Procurement activities at ERG are led by the corporate Procurement Officer, Craig Pilon, who oversees contract managers and contract specialists, as well as all purchasing and related operations. ERG's contract managers assist project staff in defining procurement requirements and choosing an appropriate procurement document. The ERG contract managers also generate and approve Subcontracts, Consulting Agreements, and other related agreements that may be required, such as licenses, confidentiality agreements, etc., and verify that these documents clearly describe quality requirements.

The objectives of ERG's procurement organization are to acquire supplies and services responsibly and to meet federal requirements for competitive bidding, record maintenance and justification, and small/minority business contracting.

As a government contractor, ERG is responsible for spending taxpayers' dollars wisely, promoting small, disadvantaged, woman-owned and HUBZone businesses, and maintaining records justifying its actions. These records are subject to review by three agencies: the Defense Contract Management Command, the Small Business Administration, and the Defense Contract Administration Agency, and a cognizant agency, the U.S. EPA.

4.2 PROCUREMENT PLANNING AND CONTROL

ERG's procedures for planning and controlling the procurement of items and services are addressed in detail in *The ERG Procurement Manual*. The contents of the manual are listed in Table 4-1.

Table 4-1

Contents of ERG Procurement Manual

Title
• Quick Start • Purpose • Applicability • Standards of Conduct • The Procurement Process • Flow Chart • Structure of The Procurement Organization • Defining Your Requirement • Direct v. Indirect Purchasing • Purchasing for Overhead, G&A, and Service Center Accounts • Deciding Whether to Rent, Lease, or Purchase • Blanket Purchase Agreements • Obtaining Labor Services (Temporary Agencies, Independent Contractors, Subcontractors and Consultants) • Selecting an Agreement Type • U.S. Government Sources of Supply and Rates • Selecting a Vendor, Subcontractor, or Consultant • Determining if Prices are Reasonable • Clauses for Subcontracts, Consulting Agreements, and Purchase Orders • Obtaining Travel Services • Achieving and Reporting Subcontracting Goals • Government Property • Inspection and Acceptance • Subcontract and Purchase Order Administration • Vendor Data Base • Paying Vendors • Definitions • Forms

The general steps of the procurement process are:

1. Project staff identify the need. After reviewing the client's statement of work, project staff identify what products and/or services will be required to accomplish it. They also identify long-lead items and services in order to establish a timetable for procurements.

2. The Project Manager, and Contract Manager decide whether the need can be filled by in-house resources, team subcontractors, or should be acquired from outside sources. For services, they identify the technical qualifications and expertise required. They also identify any specific quality standards that are required.

3. The Project Manager, and Contract Manager decide what method should be used to fill the need -- use of an existing vendor relationship such as a Blanket Purchase Agreement (BPA) or initiation of a new solicitation.

4. Project staff draft the solicitation. The degree of complexity of the procurement method should be directly related to the complexity, quality requirements, and dollar value of the requirement.

5. The Contract Manager reviews, approves, and issues the solicitation. With the Contract Manager's approval, project staff may solicit bids from suppliers (e.g., obtain phone quotations).

6. The Project Manager evaluates the offers. A combination of technical quality, schedule, location, price and other variables will be combined to determine which proposal will best meet ERG's needs. Negotiate, where applicable, treating offerors equally and fairly.

7. The Project Manager documents the procurement process and award decision.

8. The Contract Manager obtains necessary ERG and client authorizations, and issue the appropriate procurement document (Subcontract, Consulting Agreement, or Purchase Order).

9. The subcontractor begins work and completes performance. The ERG Project Manager manages changes to the work in the same businesslike, cost-effective, and fair manner as the initial procurement process.

10. The Project Manager closes out the procurement by inspection/acceptance of the work product, payment of final invoices, and preparation of required administrative paperwork.

4.3 PROCUREMENT TECHNICAL AND QUALITY REQUIREMENTS

This section presents procedures for ensuring that procurement documents adequately specify quality requirements.

4.3.1 Types of Procurement Documents Used By ERG

The Federal Acquisition Regulation (FAR) considers any contracts or contractual actions entered into by ERG to furnish supplies or services for performance of a prime contract a "subcontract". ERG uses three basic types of procurement documents, all of which are "subcontracts" according to the above definition:

Purchase Orders (POs): POs are used to initiate purchases of standard commercial items (and occasionally services). POs contain standard ERG terms and conditions and minimal flowdown requirements from the FAR. To initiate a PO, the ERG Requestor completes a Purchase Request, has it signed by the cognizant ERG Manager, attaches the necessary addenda, and submits it to the Contract Manager in his/her division.

Consulting Agreements: Consulting Agreements are used for individuals, and occasionally firms, who are providing advisory or review services relating to ERG's statement of work at any dollar level. Consulting Agreements contain all required prime contract flowdown clauses and the basic clauses necessary to protect ERG's and the Government's/Client's interests. Consulting Agreements are designed for work that is limited in scope or length, usually takes place at the Consultant's location, has minimal reporting required, and involves minimal risk to ERG or the Consultant. The ERG Contract Manager for each division issues or authorizes Consulting Agreements.

Subcontracts: Subcontract Agreements are issued to firms, and occasionally individuals, who perform sections of ERG's prime contract scope of work at any dollar level. Because of the need for the Subcontractor to be bound by the same requirements and restrictions as ERG under the Prime Contract, and because of the increased risk associated with extended or on-site work, these agreements contain all required flowdowns of the prime contract plus many flowdowns that pertain to the type of work to be performed. In addition, the roles and responsibilities of ERG and the Subcontractor are more carefully defined, to avoid potential misunderstanding or disputes. The ERG Contract Manager for each division issues subcontracts.

ERG has developed efficient and cost-effective procedures for placing and administering subcontracts and hiring consultants. ERG demands the same high level of quality and performance from subcontractors and consultants as it does from its own employees. Whenever a particular task requires a specialty that must be obtained (or that can be more cost-effectively obtained) from outside the company, the Project Manager selects, retains, and supervises a subcontractor or consultant. ERG's Contracts Department oversees the subcontracting process to ensure that all standards of the federal government are met.

ERG is dedicated to delivering high quality work products that may be used without fear of challenges related to Conflict of Interest (COI). Thus, like ERG, our subcontractors and consultants have no relationships with companies, individuals, or trade associations in the areas covered under a particular work assignment that would impair their objectivity or prevent them from providing impartial assistance or that would constitute an apparent COI. In general, if we discover any real or apparent COI, we do not allow the firm or the individual to participate in the work assignment unless otherwise instructed by the government.

To monitor the compliance of our subcontractors and consultants with the COI clauses contained in our prime contract (and which are passed on to the subcontractors through flow-down clauses in their subcontract agreements), ERG requires that each subcontractor sign a work assignment COI certification, and that this certification be returned to ERG before commencing work on the work assignment. This COI certification process provides ERG with an ongoing mechanism for monitoring adherence to COI provisions. In addition, ERG requests that the subcontractor certify that it has informed its personnel of their obligation to report personal and organizational COI.

To initiate a Consulting Agreement or Subcontract Agreement, the ERG Requestor completes a Purchase Request form, attaches the necessary addenda, has it signed by the cognizant Manager, and submits it to the ERG Contract Manager for his/her division.

4.3.2 Procedures for Review, Approval, and Ensuring Adequacy of Procurement Documents

To ensure that procurement documents are accurate, complete, and clearly describe the item or service needed and the associated technical and quality requirements, ERG has developed written procurement procedures, specified in *The ERG Procurement Manual*. Authority to sign procurement documents is limited to a few specified individuals. These individuals are responsible for ensuring that all the procedures specified in *The ERG Procurement Manual* have been followed.

Procurement documents clearly describe the item or service needed. ERG's procurement procedures require the employee requesting the purchase of an item or service to establish a clear statement of work (SOW), special technical requirements, necessary reporting, quality requirements, transportation, packing and packaging requirements, and schedule. When applicable, the SOW includes a quality system consistent with EPA requirements. When required by the work assignment, the SOW includes preparation of a QAPP according to *EPA Requirements for QA Project Plans (QA/R-5)* [dated 03/20/01].

The Purchase Order or Subcontract SOW describes how ERG verifies that suppliers have conformed to ERG's requirements, with provisions for ERG to inspect and accept, within a reasonable period of time, the item or service prior to payment.

The ERG Procurement Manual includes a pre-purchase checklist to help procurement requestors clearly define their purchase requirements.

4.3.3 Review and Approval of Responses to Solicitations

The Project Managers review quotations or proposals for the procurement, and identify responses that satisfy all technical and quality requirements and select a supplier. The project staff document this selection in a written source selection analysis, using a standard format, that is signed by the Project Manager and remains in the procurement file.

4.3.4 Requirement for Suppliers to Demonstrate Capability

ERG uses the following steps to evaluate suppliers' capabilities.

Where a prime contract has been awarded to ERG, the first priority for awarding work under that prime contract goes to the team subcontractors whose qualifications and staff have been established in the initial procurement process. Team subcontractors whose proposals have led to an award under a competitive procurement are considered to have been competitively-procured, provided their rates and fee are consistent with the proposal that led to the award. If team subcontractors are able to perform the requirement and provide a reasonable cost estimate (within the constraints of their prime contract bid and team subcontract with ERG), no further competition or solicitation is necessary.

If team subcontractors are not qualified to perform the work, ERG identifies other subcontractors using our internal supplier list, then outside sources such as the SBA's Pro-Net database or referrals from the Office of Small and Disadvantaged Business Utilization at the Contracting Agency. The ERG Project Manager establishes subcontractor capabilities by reviewing ERG's Supplier Procurement History file; obtaining resumes of professional personnel; researching the technical and business reputation of a company; and, where appropriate, checking the past performance references.

Prior to award of a Subcontract or Consulting Agreement, the Contract Manager making the award checks the List of Parties Excluded from Federal Procurement and Non-Procurement Programs (**www.arnet.gov**) to ensure that the vendor that has been selected is not suspended or debarred from Government contracting.

4.4 PROCUREMENT DOCUMENT SPECIFICATION, REVIEW, AND CHANGES

As discussed in Sections 4.2 and 4.3 above, *The ERG Procurement Manual* documents the procedures that ERG uses to prepare and review procurement documents, and to ensure that they are accurate, complete, and conform to EPA's requirements. The technical requirements of a procurement document are defined by the requestor and reviewed and approved by the technical Project Manager. The Contract Manager identifies the corporate and flowdown clause requirements of the procurement and works closely with the technical Project Manager to assure that it meets the technical and administrative goals as established at the onset. Only Contract Managers, the ERG Purchasing Officer, and ERG Officers have authority to approve

Subcontracts and Consulting Agreements. Prior to approval, these individuals ensure that all the authorizations and backup required in *The ERG Procurement Manual* and by the client Prime Contract have been obtained or completed.

4.4.1 Review of Changed Procurement Documents

All ERG Subcontracts and Consulting Agreements contain general terms and conditions of sale that include, among other things, provisions for changing or stopping work. When formalized, a change is incorporated in a modification to the subcontract.

Where the scope of work changes during performance, or where factors outside the subcontractor's or ERG's control intervene, careful documentation is made as to the nature of the change, the vendor's/subcontractor's proposed price to implement the change, and the negotiation process that transpired prior to Subcontract modification. Only the Contract Manager is authorized to modify, or approve modification of, a Subcontract or Consulting Agreement.

4.5 ENSURING THAT PROCURED ITEMS AND SOURCES ARE OF ACCEPTABLE QUALITY

Procured items and services are reviewed by the requestor to ensure compliance with requirements and specifications. Approval by the ERG Project Manager or his/her designee is required before invoices are paid.

4.5.1 Inspection and Acceptance

Purchase Orders and Subcontracts for items or services to be delivered to ERG contain the quality requirements to which the items or service is to conform and provisions for ERG to inspect and accept, within a reasonable period of time, the item or service prior to payment.

Prime contracts with EPA specify quality requirements and inspection/acceptance points. Purchase Orders and Subcontracts are tailored to reflect the quality requirements and inspection/acceptance criteria of the prime contract.

In defining requirements, ERG Requestors carefully review what types of quality specifications are appropriate to a Purchase Order or Subcontract and indicate the QA requirement in the Purchase Request. ERG Requestors ensure that all products and services ordered have been inspected and accepted prior to payment of vendor invoices.

ERG requests warranties, when they are appropriate to the supply/service required; however, the cost of warranties, if priced separately, is evaluated in light of the anticipated period of use, repair costs, complexity, and other variables.

4.6 EVALUATION OF SUBCONTRACTOR AND CONSULTANT PERFORMANCE

Subcontractors and consultants are under the direct supervision of the Project Manager, who ensures that project goals are met. The Project Manager evaluates all subcontractor and consultant deliverables. ERG may also audit facilities of subcontractors or consultants that collect environmental data or measurements. The subcontractor or consultant may be subject to a performance evaluation audit by ERG project staff or by the QA Coordinator. A subcontractor or consultant producing data for ERG may be subject to a data quality audit.

4.6.1 Paying Suppliers of Items and Services

ERG pays most suppliers within the latter of: 1) 30 days from receipt of a correct invoice, or 2) 30 days from product/service acceptance. The payment terms and invoicing address appear in all ERG Purchase Orders, Subcontracts, and Consulting Agreements. For supplies/services ordered via a Purchase Order, the requestor (or designee):

- Marks invoice receipt date on invoice;
- Assures that supplies/services have been received/performed and are accepted by ERG;
- Verifies that the amount invoiced matches the amount ordered;
- Prepares an ERG Voucher, and attaches the original invoice; and
- Has the Voucher signed by the ERG manager with budgetary responsibility.

For supplies/services ordered via Subcontracts and Consulting Agreements, the Division Contracts staff (based on the location of the Project Manager, the order of these steps may vary):

- Log the invoice receipt date on Subcontractor/Consultant invoice;
- Send the invoice to the ERG Project Manager for approval that the work has been performed, hours delivered, products received, etc.;
- Check the invoice against the Subcontract/Consulting Agreement Terms using the Invoice Checklist;
- Prepare/review a Voucher form with invoice information;
- Log the invoice in the Subcontract File, and document payment in the Subcontract records (applicable only to files not maintained in Lexington office); and

- Approve the invoice by signing on the Voucher, and forward invoice plus supporting documentation to Accounts Payable for payment.

All Vouchers have the signature of the ERG manager with budgetary responsibility to authorize payment. Vouchers for Subcontracts and Consulting Agreements are also approved by ERG Contracts staff prior to payment.

SECTION 5

DOCUMENTS AND RECORDS

This section of the QMP describes ERG's controls for quality-related documents and records related to the ERG corporate quality system and describes ERG's controls for documents and records related to ERG projects.

5.1 IDENTIFICATION AND CLASSIFICATION OF RECORDS

As described below, ERG's quality-related documents are associated with the corporate quality system or individual projects.

5.1.1 Corporate Quality System Documents and Records

Documents and records related to the ERG quality system include the documentation described in Section 2.2.1, and the output of quality system assessments described in Section 9. The Corporate QA Manager is responsible for identifying quality system documents that require control. These documents include, but are not limited to:

- Quality Management Plan;
- Standard Operating Procedures;
- Confidential Business Information Plans; and
- Assessments of ERG's Quality Assessment, including related checklists.

5.1.2 Project Documents and Records

Technical activities generate reports, supporting documentation, and analytical data. This information is organized in project files to facilitate retrieval and to maintain security and confidentiality. The Project Manager is responsible for identifying project documents that require control. Project files are organized into the following categories:

- Work Plan;
- Sampling Plan, if applicable;
- QA Project Plan;
- Project Instructions;
- Original data and calculations;
- Technical reports;
- Project quality assessments;
- Correspondence; and
- Progress, draft, and final reports.

Project documentation can be 1) paper (hard) copies, for example, correspondence and field notes; 2) computer files, for example, databases and web applications; or 3) records that can be maintained in both forms, for example, the word processing file and the hard copy document printed from it.

5.2 GENERATION OF RECORDS

Quality-related records generated at ERG include project records and corporate quality system records (e.g., SOPs and QMPs).

5.2.1 Project Records

The Project Manager is responsible for reviewing project documents and records to verify their conformance to technical requirements and quality system requirements. This review is conducted using selected project quality assessment tools described in Section 9. The project work plan (and QAPP if required) designates the work processes and assessment tools used on the project. The Project Manager is also responsible for ensuring that records and documents accurately reflect completed work.

Project QA planning documents designating responsibilities and specifications for quality are reviewed and signed by all accountable project employees.

Records of engineering calculations document each step with supporting references, key assumptions, professional engineering judgments, equations, or engineering fundamentals. The calculations are signed or initialed by the engineer who completed them, then checked, and after discrepancies are resolved, are signed by a qualified project team member.

All records generated by measurement activities are signed or initialed by the person performing the work and are reviewed by an appropriate supervisor. Measurement results become part of a project report which is reviewed by an ERG technical reviewer. All laboratory notebook records are kept in black ink, dated and signed by the person making the entries, and routinely reviewed and approved by the appropriate supervisor, as evidenced by his/her initials and date of inspection. Laboratory notebook maintenance procedures are regulated by a SOP, which is followed by all laboratory staff.

If corrections to laboratory records are necessary, the individual making the correction must provide a reason, which is maintained with the original data. He/she signs and dates the correction in black ink and transmits it to the appropriate project staff. Corrected laboratory reports identify the original data along with the corrected data report.

5.2.2 Corporate Quality System Records (SOPs and QMP)

As discussed in Section 1.2.1, the Corporate QA Manager is responsible for developing and revising the corporate QMP. The QMP is reviewed and approved by ERG President David Meyers and the Local QA Coordinators. The Corporate QA Manager is responsible for issuing the revised document to staff and ensuring that obsolete documentation is removed from the ERG Intranet.

As discussed in Sections 1.2.2 and 2.2.1, the Local QA Coordinators are responsible for designating an appropriate individual to create SOPs, needed at their location, reviewing the draft procedure or designating an appropriate technical reviewer, circulating the approved SOP to technical staff members; and maintaining copies of SOPs pertaining to the ERG location in a central filing system.

5.2.3 Quality System Document Control

ERG has developed and instituted document control mechanisms for the review, revision, and distribution of the QMP and QAPPs. Annually, the Corporate QA Manager reviews the QMP, and the document is revised as necessary. Two versions of the QMP are then circulated, a "Distribution Copy" and an "Information Copy." Distribution copies feature a unique serial number on the cover corresponding to a distribution list maintained by the QA staff. Whenever revisions are made, everyone on the distribution list receives the latest revision with their assigned serial number. Information copies have no specific designations, and their status is not tracked or updated.

Each QAPP has a signed approval form, title page, table of contents, and EPA-approved document control format (shown below) that appears in the upper right-hand corner of each page:

Section No.
Revision No.
Date
Page No. – of –___

QAPPs also contain a distribution list, including subcontractors and consultants as applicable. During the course of the project, any revision to the QAPP is circulated to everyone on the distribution list.

Another document control mechanism addresses SOPs, CBI, contracts, correspondence, and reports. SOPs are company-confidential, prepared and filed by individual laboratories or groups and maintained in a central filing system controlled by the Local QA Coordinator. Each SOP has a signed title page and document control format, as depicted in Figure 5-1.

Internal QA audit reports are maintained by the Local QA Coordinator at the site where the audit occurs and are indexed according to date and area of the audit. QA audit reports from external agencies are indexed according to a year-based sequential numbering system that is also cross-referenced by areas audited and by auditing agency. These files are maintained by ERG's Contracts Office.

ERG
EASTERN RESEARCH GROUP, INC.

CONFIDENTIAL

STANDARD OPERATING PROCEDURES

ENGINEERING AND SCIENCE DIVISION

GROUP: Morrisville Measurements Group	Procedure No: ERG-MOR-006	5-6
TITLE Standard Operating Procedure for the Analysis of Tenax® Tubes According to EPA Method TO-1/TO-17	REVISION NO.: 0 SUPERSEDES: N/A	EFFECTIVE DATE:
REFERENCES: ERG-MOR-005, ERG-MOR-010, ERG-MOR-023		
SATELLITE FILES: Chromatography Laboratory, Mass Spectrometry Laboratory		
REASON FOR REVISION: Original		

1.0 PURPOSE

Volatile organic compounds (VOCs) are emitted into the atmosphere from a variety of sources including industrial and commercial facilities, hazardous waste storage facilities, and vehicular traffic. Many of these organic compounds are toxic. Knowledge of the levels of such toxic VOCs in the atmosphere is required in order to determine human health impacts.

Conventional air monitoring methods such as those used for workspace monitoring have relied on carbon adsorption approaches with subsequent solvent desorption. Solvent desorption techniques allow injection of only a small portion (tidally 5-7%) of the sample into the analytical system. This dilution factor is prohibitive for performing successful analysis of...

WRITER: NAME/DATE 2/23/00		
ACTIVITY MANAGER: NAME/DATE Judith McCartney 2\23\00	QUALITY ASSURANCE COORDINATOR: NAME/DATE Theresa Kemmer Woody 2/23/00	MANAGER: NAME/DATE Joan T. Bursey 2/23/00

Figure 5-1. SOP Title Page

5.3 PROJECT RECORD MAINTENANCE

This section describes ERG's procedures for managing records for active and inactive projects. Records include paper files, electronic files, and documentation of project quality assessment. Paper files (hard copies) include: letters, memoranda, reports, notes, telecons, calculation sheets, spreadsheet printouts, database printouts, and e-mail printouts. Electronic files include spreadsheets, databases, software programs, models, electronic messages, and electronic copies of text and figures.

Laboratory data are logged by date according to project. Laboratory data include analytical results and all supporting information, including calibrations, QC data for analysis of samples, and raw data. Every project conducted in the laboratory has individual files. These files contain chain-of-custody documentation (if appropriate), project instructions, project notes about the data, and copies of any final data reports.

5.3.1 Organization

A unique project charge number is assigned upon receipt of the work assignment or technical directive and is used to track all labor and material costs associated with the project. This number is also used on all project files. If laboratory analysis is required, a laboratory subtask is created using the same number, and all resulting data and analyses are indexed according to the project and task number. QC records are maintained by the Project Manager according to project number.

Central Project Files. The Project Manager is responsible for designating an appropriate individual to develop a filing system, including an outline for the file, document labeling system, file sign-out system, and filing procedures. The Project Manager is also responsible for designating a person or persons (typically a project secretary or project assistant) to use the project file system to establish and maintain the project file and to communicate the file system requirements to all project team members. The central project files may be stored in a clearly labeled area in an individual office accessible to all project team members, or in a dedicated file room.

Electronic Files. Electronic copies of project data and calculations, programs, models, databases, text, and figures are stored on identified project areas on ERG network servers that are accessible to all project team members. The Project Manager is responsible for designating an appropriate individual to develop a plan to organize the electronic files, including removal of obsolete documentation.

5.3.2 Transmittal and Distribution

Distribution lists are established at the beginning of each project to ensure timely dissemination of information to appropriate technical and administrative staff. At the end of the project, copies of all reports and other records designated by the Project Manager are maintained in ERG's project archives.

5.3.3 Control of Record Access (Confidential Business Information)

All documents released to ERG by clients under a confidentiality agreement are handled in accordance with the terms of a client-approved security plan. For our EPA clients, EPA Acquisition Regulation 1509.505-4 requires contractors to comply with the requirements of 40 CFR Part 2 and the provisions of their contracts relating to the treatment of CBI. Under 40 CFR

Part 2, Subpart B, ERG is required to protect CBI from unauthorized disclosure. This CBI may have been collected by EPA under the authority of the Toxic Substance Control Act (TSCA), Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA), Resource Conservation and Recovery Act (RCRA), the Clean Water Act (CWA), or the Clean Air Act (CAA). Any CBI in ERG's possession is handled in accordance with a set of written procedures designed and prepared by ERG and approved by the cognizant EPA CBI Document Control Officer. ERG has approved plans for handling CBI in the Morrisville, NC; Chantilly, VA; and Lexington, MA offices. Among many other requirements, access to CBI documents is limited to authorized users through a specified sign-out procedure.

Contractually established confidentiality requirements are communicated to project staff in the project instructions. A corporate SOP is available for the handling of confidential business material (*Eastern Research Group Manual for the Handling of Confidential Business Information*). A project-specific CBI plan is developed as required by the client. ERG staff who are required to handle CBI receive special training in the appropriate procedures, along with a mandatory refresher course each year.

5.3.4 Retrieval and Preservation (Protection)

Storage and Retrieval. Active project files consist of paper records and electronic files stored on ERG's computer network. Management of inactive files varies by ERG locations. At Chantilly, paper records of inactive projects are warehoused in storage rooms. Inactive electronic files (including spreadsheets and databases) are moved to tape or compact disk for long-term storage. Archive procedures for computer files are discussed in Section 6.2.4.

At ERG's Morrisville, NC, laboratory, at the completion of a project, record material that has been stored on the computer network is archived on compact disc (typically one disc per contract). These compact discs, filed by contract number, are stored in ERG's laboratory. Paper files for inactive projects are archived in clearly labeled cartons in limited access facilities at 900 Perimeter Park, Morrisville. The contents of each carton are listed on multi-carbon inventory forms that identify:

- Project identification information;
- Originator's name;
- Name of the person receiving the carton for storage;
- Date of receipt;
- Category of contents (e.g., project files, equipment); and
- Description of the contents (e.g., test reports, work plan, reference reports).

This indexing system facilitates retrieval of any carton or document on request.

Preservation. Stored records are protected from damage, loss, and deterioration. Records stored on site are located in locked climate-controlled file rooms, in a limited-access building. The buildings are equipped with smoke alarms and sprinkler systems in case of fire. Facilities are protected by perimeter alarms, automatic dry pipe sprinklers for fire protection, and an interior alarm system monitored by a manned central station. Access to the facility storage are is limited to authorized personnel.

In the event that fire or other disaster strikes leaving records damaged and unsecured, ERG will transfer the records under close supervision to another secure location (the client's location or off-site storage facility).

5.3.5 Retention and Disposition

Project files and laboratory data are maintained for a designated period of time. If there are no additional contractual requirements, project files along with laboratory and field data are maintained for 10 years. Project Managers are notified of impending disposition of information and must approve the decision.

Documents obtained from clients or other entities or created by ERG that fall under statutory (CWA, CAA, TSCA, or RCRA) CBI requirements are destroyed or returned to the appropriate person(s) in accordance to the entities' written instructions. Other classified or confidential records are destroyed by shredding or incineration.

5.4 EVIDENTIARY RECORDS (CHAIN-OF-CUSTODY AND CONFIDENTIALITY)

ERG's procedures for chain-of-custody and confidentiality procedures for evidentiary records are described in this section.

5.4.1 Chain-of-Custody Procedures

Chain-of-custody procedures provide legally defensible documentation of sample custody from collection through disposition. Chain-of-custody procedures apply to field monitoring, sample collection, and analyses of environmental media and are tailored for specific project needs specified in the QAPPs. These procedures include standard requirements for sample labeling, chain-of-custody forms, field data sheets, field and laboratory notebooks, sample control procedures, and sample handling and shipment procedures.

QA steps taken to implement chain-of-custody procedures include presenting all documentation requirements in the QAPP, training field personnel in all procedures prior to beginning field work, and having project management and staff regularly review field and laboratory notebooks and sample custody documentation during field activities. Technical systems audits may also be conducted for field activities, and these audits provide an additional level of QA checks for chain-of-custody procedures.

Chain-of-custody procedures are initiated at the time of sample collection. Information about sample location, identification, field conditions, field meter measurements (e.g., pH, conductivity), and other pertinent information is recorded in black ink on preformatted field data sheets and/or field notebooks. Notebooks and data sheets are initialed by the personnel recording the information.

Changes in recorded entries are made by crossing out the information with a single line so the original information is not obscured, dating the change, and initialing it.

Preprinted labels are placed on sample containers at the time of collection and must be completed in waterproof ink. Sample labels must contain legible information about the sample, such as date and time of collection, initials of the person collecting the sample, and preservatives used (if any). Sample control numbers, consisting of simple sequential numbers or alphanumeric codes, are commonly used to identify samples. For air sampling, an alphanumeric sequence that identifies the sampling train, component of the sampling train, sampling run, date, and initials of the person recovering the sampling train may be used. Use of alphanumeric codes allows submission of blind samples such as field blanks or audit samples for QC purposes. Use of sample identification numbers minimizes the potential for transcription errors between the field and the laboratory.

ERG's Morrisville, NC, laboratory maintains logs of samples received for preparation or analysis. The master log, kept in a secure location and completed daily, contains the sample control number or identification, sample location, date, analytical methods required, sample volume/containers, field personnel, and sample tracking information. Entering samples into the master log is the responsibility of the Project Manager, Field Task Leader, or his/her designee. All sample documentation, including data sheets, notebooks, and the master log, are subject to review by the Project QA Coordinator.

Chain-of-custody forms are completed and an original copy is kept with the samples at all times. Each time possession of the samples changes, the chain-of-custody form is initialed and dated to indicate release and acceptance of the sample. The completed forms provide sufficient information to document sample possession through all stages of the sampling and analysis process. Standard forms are used to indicate the sample identification, analyses required, project name, responsible individual(s), and comments relating to special handling precautions required or special requests.

Sample handling and shipping procedures are established for each individual project. If samples are shipped rather than hand-delivered to the laboratory, Department of Transportation procedures for labeling and packaging are followed. An airbill number or other shipment identification number is recorded on the chain-of-custody form, and the laboratory is notified of the date and time of shipment. Sample security during transport is maintained by ensuring containers (e.g., boxes, coolers) are still sealed upon arrival at the laboratory.

5.4.2 Confidentiality Procedures for Evidentiary Records

ERG develops procedures for ensuring the confidentiality of evidentiary records at the direction of our clients. For example, at the direction of our client's attorneys, correspondence with these attorneys may be marked:

- *Attorney Work Product*;
- *Privileged and Confidential*; and
- *Attorney-Client Communication*.

SECTION 6

COMPUTER HARDWARE AND SOFTWARE

Computer hardware and software are necessary to support environmental programs. ERG uses computers to manage operations, communicate with clients, research technical information, generate scientific and technical reports, organize and analyze environmental data, and store information for easy retrieval. Computers allow our staff to perform data calculations and analyses efficiently and accurately, and allow us to present the results in an easy-to-understand format using figures, tables, color, and graphics. Computer systems used to generate or analyze data must be thoroughly evaluated to ensure that they perform the required function and that the results are accurate. ERG's computer hardware and software use is consistent with the requirements outlined in *EPA Directive 2100 (EPA 1998)*. Work done by ERG on the EPA contracts adheres to all EPA Information Technology Requirements, as necessary. This section of the QMP describes ERG's QC procedures for computer hardware and software.

6.1 ENSURING QUALITY SOFTWARE

ERG ensures the quality of our computer software meets our client's requirements by implementing processes for software development, installation, testing, use, maintenance, control, and documentation. ERG's processes for addressing each of these processes are described in detail below.

6.1.1 Software Development

Software development is an integral component of ERG's expertise. Software development is the process by which user needs are translated into software requirements, software requirements are translated into design, the design is implemented into code, and the code is certified for operational use. When a project requires new software, the ERG Project Manager or an ERG Task Leader prepares a Software Development Plan. This document integrates management activities, software development tasks, and QA procedures to guide and coordinate the actions of the software development team. The Software Development Plan details the software-specific management organization, resources, schedules, and procedures that will be used during preparation of the software and describes the work effort by task, including program milestones and periodic quality checkpoints. ERG updates the Software Development Plan as necessary to reflect any technical or management changes.

The Software Development Plan specifies:

- *Functional requirements* which are specific functions or operations that a system or system component must be capable of performing;
- *Performance parameters* which are requirements specifying system component performance characteristics such as speed, accuracy, frequency, etc;
- *System interfaces* which are hardware, software, or database elements with which a system or a system component must interface, or that establishes constraints on formats, timing, or other factors caused by such an interface; and
- *Reliability goals* which are the ability of a software system to perform its expected functions for a stated period of time and set of conditions without failure.

ERG's Software Development Plan also identifies acceptance criteria which the completed software system must satisfy before it is certified for operation and specifies the basis for these requirements. ERG consults both ANSI/IEEE Standard 730.1-1995 and ERG's Software Development SOPs when preparing the Software Development Plan.

6.1.2 Software Installation

ERG establishes software installation instructions for each piece of software that we develop. The software installation instructions are reviewed by the Project Manager or ERG Task Leader. ERG distributes copies of the instructions with the software usually in the form of a ReadMe.txt file or posted on a project website on the Internet.

6.1.3 Software Testing

After the initial version of a software tool is developed, ERG initiates a verification and validation testing phase. Verification testing is defined as "finding errors through the execution of a program in a test or simulated environment" (Glenford Myers, *The Art of Software Testing*, 1979) or "the process of evaluating software to determine whether or not an object in a given phase of the software development process satisfies the requirements of the previous phases" (IEEE Standard 1012-1998). The test environment that ERG chooses is based on the specific functionality of the application. The Software Development Plan identifies the project criteria for operation of the software before verification testing is performed. ERG thoroughly documents the results of all verification tests.

Validation testing is defined as "finding errors by executing a program in a real environment" (Myers, 1979) or "the process of evaluating software at the end of the software development process to ensure compliance with requirements" (IEEE Standard 1012-1988).

Validation testing may take the form of client-directed acceptance tests, or it may be identified as deliverable acceptance criteria in the Software Development Plan. Validation testing establishes that the final product meets all the system requirements detailed in the Software Development Plan.

6.1.4 Software Use, Maintenance, and Control

ERG maintains a master copy of all software that ERG develops. Depending upon project requirements, many versions of software may be created through ERG's iterative development cycle. ERG maintains version control during the software development life cycle by organizing development files on the file server with directory structures that correspond to version number or release data.

If the software developed includes a web application, ERG will often times host and maintain the web application on ERG servers. ERG's hardware configuration is presented in Section 6.2.2.

6.1.5 Software Documentation

Documentation is the foundation of successful software development and provides guidance for software support. ERG maintains two levels of documentation for software development projects, 1) programmer's notes and software life cycle documents, and 2) user's manuals. The Project Manager or ERG Task Leader ensures that documentation is accurate and up-to-date.

Software Development Documentation. ERG's programmers' notes and software development life cycle documents provide accurate records of the development process. This documentation is consistent with the requirements outlined in *EPA Directive 2100 (EPA 1998)*. Software development life cycle documents include:

- *Software Requirements Specification* which establishes a detailed functional description, a representation of system behavior, an indication of performance requirements and design constraints, appropriate validation criteria, and other information pertinent to requirements.

- *Design Specification* which outlines the design model, data design, architectural design, and the design of required internal and external program interfaces. The Design Specification contains a requirements cross reference. The purpose of this cross reference is to establish that all requirements are satisfied by the software design and to indicate which components are critical to the implementation of specific requirements.

- *Test Specification* which includes the overall plan for testing the software.

- *User's Manuals*. Depending upon the software development project, ERG may also develop user's manuals to assist in use of the software. ERG generates User's Manuals in a variety of forms, including hard copy manuals, electronic help files integrated with the software, or on-line help.

6.1.6 Commercial Software

ERG maintains a standard set of commercial software that is accessible to each workstation. As specified by particular project requirements, ERG may install additional software. Software installation is coordinated with the local area network (LAN) administrator.

As additional software requirements arise, ERG evaluates the needs on a case-by-case basis. Our evaluation considers the impact of any implemented changes, performance issues, and costs prior to purchase. All commercial software used on the EPA projects are compatible with the EPA computer system designated in the work assignment.

6.2 ENSURING QUALITY HARDWARE

ERG ensures that the quality of computer hardware meets ERG's requirements by implementing processes that ensure a stable computer network, an optimized hardware configuration, and properly maintained hardware. Each of these processes is described in detail below.

6.2.1 ERG's Computer Network

ERG uses a network of personal computers functioning with the Windows Operating System. The computers in each of ERG's offices are joined in Local Area Networks (LANs) consisting of file servers, user computers, printers, specialty servers, and cables that connect them together. The offices and satellite locations are joined by telephone link in a Wide Area Network (WAN). At each ERG location, all areas that house computers are secure and temperature-controlled, and heating and air conditioning units maintain an acceptable humidity range. Power to computer units is conditioned to prevent spiking and surging in the power supply. ERG ensures that the automated data collection system has sufficient facility and storage to retain raw data, including archives of computer-resident data.

ERG's Management Information Systems (MIS) department oversees the network communications system hardware and software and personal computers for all of our offices and satellite locations. ERG's MIS department consists of the director, Wendy Rodriguez, a senior systems/network engineer, Joe Savastano (located in our Lexington office), and LAN administrators, one of whom is located in each office. The MIS department meets weekly via conference calls, and the director receives weekly activity reports from each office's LAN administrator.

6.2.2 Hardware Configuration

ERG's hardware configuration is shown in Figure 6-1.

System security and virus protection are an ever-increasing concern in the business world today. As illustrated in Figure 6-1, ERG ensures information protection by operating up-to-date security systems and virus protection programs. ERG's WAN is secured by a firewall, eliminating unauthorized access and maintaining system security. ERG's MIS director, Wendy Rodriguez, and ERG's Vice President of Internet Technologies, Hui Zhou, subscribe to several list servers to be notified of security patches for all operating systems. At a minimum of once a month, a member of the ERG computer staff accesses the web site of every application provider that ERG uses to ensure that all patches and updates are applied. For many web development projects, ERG has implemented 128-bit encryption via secure socket layer (SSL) and has created password-protected sites that only ERG employees and clients with proper authorization can access.

To protect data and systems from virus infection, ERG's systems are fully automated to launch virus protection software and receive daily or more frequent virus protection updates. ERG's MIS staff subscribe to e-mail list groups to receive notification of virus updates. When a new virus surfaces, the MIS director immediately notifies all MIS staff, who load the latest virus pattern updates to the servers. The updated virus patterns are copied to staff personal computers,

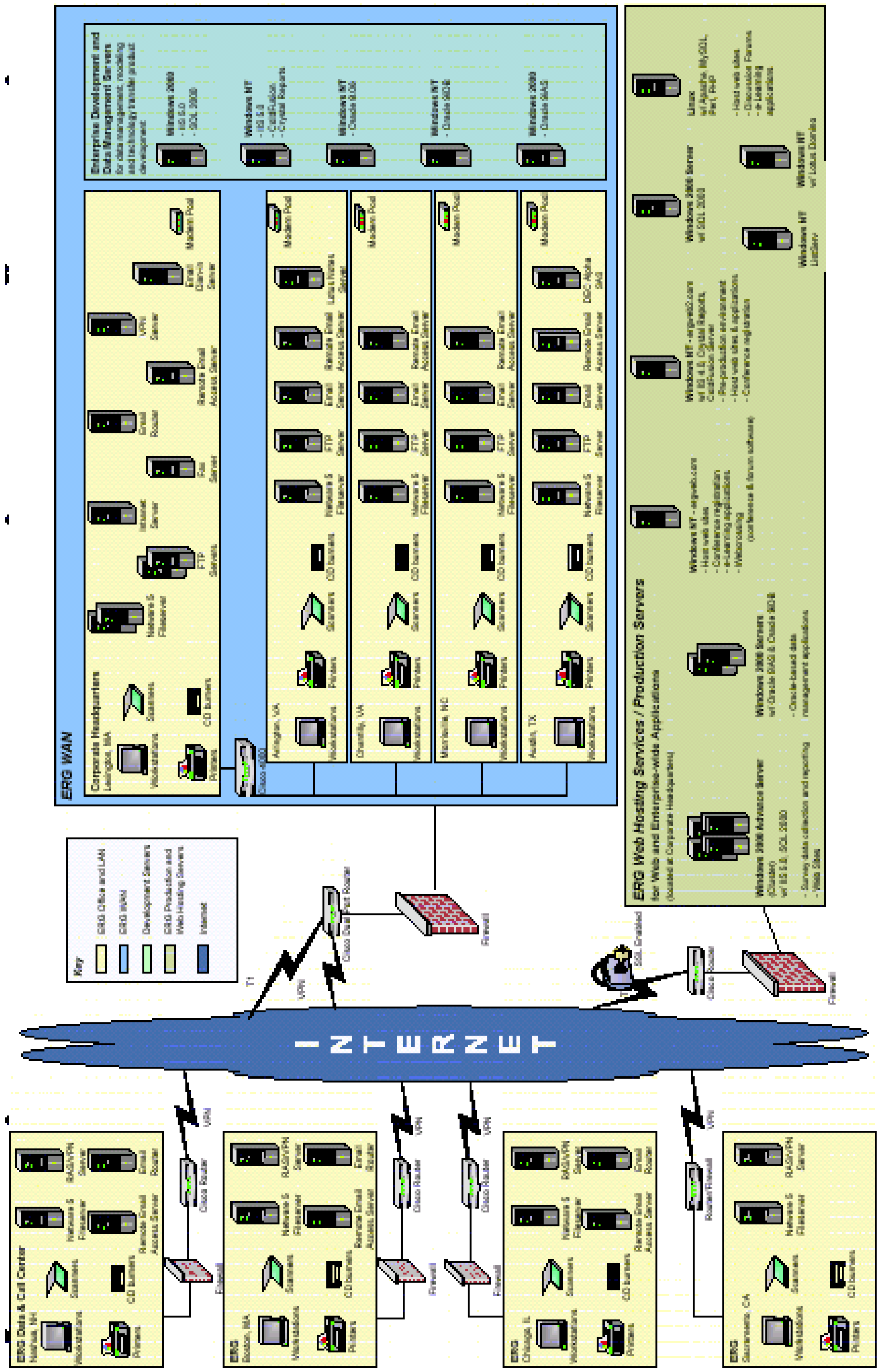


Figure 6-1. ERG Hardware and Software Infrastructure

automatically, when employees log in to the LAN. If a virus alert occurs during the course of the work day, all ERG staff are alerted via company-wide e-mail to log out of their computers and log back in to activate the virus pattern update.

ERG's MIS director is responsible for evaluating the purchase of new hardware. Due to rapid advances in technology, ERG purchases only top-of-the-line technology. ERG evaluates the need for newer technology, performance issues, and conducts a cost/benefit analysis prior to purchasing new hardware.

When new hardware is purchased, ERG implements a "trickledown system" that facilitates the introduction of new technology and the removal of obsolete technology. For example, when ERG receives a new workstation, the current workstation of the user receiving the new workstation is trickled (handed) down to another user who has an older workstation. This process allows for the oldest machines to be removed from inventory on a regular basis.

6.2.3 Hardware Testing

ERG's MIS department checks ERG's systems, network communications, and servers each morning before the normal business day begins to ensure proper operation and that no downtime is experienced by ERG's technical staff. The MIS department also checks ERG's backup systems daily to ensure that the previous evening's file systems backup was executed successfully.

When new hardware is introduced, ERG's MIS staff are responsible for ensuring a smooth transition to the new hardware. This transition includes testing in a simulated work environment during non-business hours to minimize interruptions of business operations.

Contingency plans are established, which include making a full backup tape of data potentially affected by the change in hardware.

6.2.4 Hardware Use, Maintenance, and Control

ERG LAN Administrators perform hardware maintenance and control. Our LAN Administrators perform the following to ensure the stability of ERG's hardware:

- *Tape backup*. The information on all file servers in the company is copied to magnetic tape to provide a backup for the server. Full backups are scheduled for Friday nights, and every file on the server is copied to tape. Once a month, a copy of the full backup is removed to a fire-proof safe for storage. The backup tape is stored for one year, then reused (e.g., the June 2002 backup is made over the June 2001 tape). Incremental backups are scheduled for weekday nights, and copy only files that have changed since the last backup to tape. These types of backups save wear and tear on the backup tape drives by reducing the amount of information that must be copied. Once a week, the MIS department moves a full set of the week's backup tapes off site to ensure their safety.

- *Tape archive***.** When files are no longer needed on the server, they are moved to tape for indefinite long-term storage. The space made available on the server by archiving can be used for currently active projects. ERG's archive procedures involve two identical backups of the files requested for archiving. The first backup is to an on-site tape. The second backup is to an off-site tape. After both backups are complete, ERG generates detail reports on both runs and compare the number of files backed up and their sizes. Once ERG verifies the backups, ERG removes the files from the server. The tapes are retained indefinitely.

- *Y2K compliance and other issues***.** The LAN administrators are also responsible for personal computer, file server, e-mail, user, and technical support for each of their local offices. All of ERG's systems and software applications have been tested and validated for Y2K compliance.

6.2.5 Hardware Documentation

ERG maintains records of ERG's hardware inventory on the file server. These inventory files are backed up according to the procedures outlined above. ERG's LAN administrators are responsible for maintaining and updating inventory records with the introduction of new hardware and the removal of obsolete hardware. All technical manuals for ERG hardware are maintained in the network server rooms.

6.2.6 Laboratory Automated Data Collection Systems

State-of-the-art computer software, especially in the areas of chromatography and spectroscopy, is available only from third parties. Generally, these vendors are unwilling to share the software source code or to comply with the regulatory requirements imposed by Good Laboratory Practice (GLP) Standards. Therefore, most hardware and software validation of third-party computer systems depends on evaluation of performance parameters.

Testing

Automated data collection systems are regularly tested, inspected, and maintained by ERG's MIS department with technical support from project staff. Written SOPs are available for routine maintenance operations, and the procedures identify the individual responsible for the performance of each operation. Written records are kept of all maintenance and include the date of the operation and a description of whether the operation was routine and followed the written procedure. Records of nonroutine maintenance are also kept in the system maintenance log, including whether this maintenance was the result of failure and/or malfunction. The maintenance log documents the problem, how and when the problem occurred, the remedial action taken, and acceptance criteria to ensure normal functioning of the repaired system. Each laboratory with an automated data collection system is responsible for backup and recovery procedures to guarantee that the software for the system can be recovered after a system failure. When an automated data collection system contains data that must be secured, physical and functional access to the system is limited to authorized personnel only, and the introduction of unauthorized external data and software is prohibited.

Each set of data manipulated via computer contains QC samples that indicate whether the analytical method is working properly. Routine acceptable recoveries on QC samples also indicate that the computer system is acquiring data and performing calculations correctly. For chromatography, for instance, a set of standards prepared at a minimum of five levels is injected with each set of samples. Review of the results for the standard curve (y-intercept, slope, and correlation coefficient) indicate that the instrument is calibrated and the analytical method is working properly. Area counts for the standards are monitored to determine that they are within QC limits. These indicators give the project staff a guide for performing a miniature validation on each set of data generated and analyzed.

All data generated from computer runs are evaluated by laboratory personnel and are reviewed in detail by the senior technical reviewer for any unusual occurrences that could indicate a potential problem. When the raw data are verified, the technical reviewer checks random sections of the data manually to confirm that the computer system was operating properly on that day. If data are transferred from raw form to a spreadsheet for calculations, the senior technical reviewer will verify that the data transfer was performed correctly.

Technical Management

Project Managers:

- Designate an individual with primary responsibility for the automated data collection system(s) used on their project;
- Ensure that there is a QA/QC program in place to oversee the automated data collection system(s);
- Ensure that the personnel, resources, facilities, computer, and other equipment, materials, and methodologies are available, as scheduled;
- Receive reports of QA inspections or audits of computers and/or computer-resident data and promptly take corrective actions in response to any deficiencies;
- Ensure that personnel clearly understand the functions they are to perform using automated data collection system(s); and
- Ensure that deviations from these guidelines for automated data collection system(s) are documented and reported to the designated responsible person and that corrective actions are taken and documented.

Responsible Person

ERG's MIS staff in cooperation with the local Project Managers and the local Quality Assurance Coordinator ensures that:

- There are sufficient personnel with adequate training and experience to supervise and/or conduct, design, and operate the automated data collection system, and that they maintain their skills and competence;
- There are procedures to guarantee that data are accurately recorded in the automated data collection system;

- A data security risk assessment has been made, points of vulnerability determined, and all necessary security measures implemented;

- The automated data system has written SOPs and appropriate software documentation that is complete, current, and available to staff;

- All significant changes to operating procedures and/or software are approved and signed by management;

- There are adequate acceptance procedures for software and software changes;

- Problems with automated collection systems that could affect data quality are documented when they occur and are subject to properly documented action; and

- All applicable Good Automated Laboratory Practices are followed.

Standard Operating Procedures

The local QA Coordinator for ERG's laboratory ensures that SOPs are written for:

- The security of the system, including physical security, securing access to the system and its functions, and restricting installation of external programs and software;

- Verification of manually or electronically entered data;

- Data analysis, processing, storage, and retrieval;

- Proper methods for executing data changes to include the original data element, the changed data, the date of the change, the individual responsible for the change, and the reason for the change;

- Backup and recovery of data; and

- Electronic reporting, when applicable.

ERG maintains the SOPs and other manuals that document automated data collection procedures as part of its SOP program for each office location. Published literature or vendor documentation used as a supplement to SOPs is referenced within the SOP. ERG also maintains historical file of SOPs, which includes documentation of all revisions and their dates. Through the historical record, it is possible to ascertain the software version used for the collection, analysis, processing, or maintenance of all data sets on automated data collection systems.

6.3 INFORMATION MANAGEMENT

ERG ensures the quality of the information we produce, maintain, and disseminate by adhering to specific QA/QC procedures. These procedures are consistent with the requirements outlined in *EPA Directive 2100 (EPA 1998)*.

On work assignments issued by EPA or one of its prime contractors, ERG develops and maintains information management systems that are compatible with existing or developing databases from the EPA Office issuing the work assignment. Data sets and analysis software and documentation are accessible to the EPA WAM and will be provided to EPA when the contract expires.

Prior to developing environmental information databases, ERG uses existing databases, information systems, models, and websites to the maximum extent possible. If existing products are found to be usable for fulfilling requirements for deliverables, ERG notifies the EPA WAM to facilitate coordinating use of such products.

ERG adheres to clause EPAAR 1552.211-79 “Compliance with EPA Policies for Information Resources Management (IRM),” when performing IRM-related. Table 6-1 lists EPA websites where the guidance documents articulating EPA policies may be found.

6.3.1 Data Entry

ERG ensures the integrity of the computer-resident data collected, analyzed, processed, or maintained on the system by:

- Identifying the individual responsible for direct data input at the time of its collection;
- Requiring that any change in automated data entries be made in a manner that does not obscure the original entry and that includes the reason for the change, the date, and the identity of the individual making the change; and
- Using SOPs to verify the accuracy of manually entered data and electronically transferred data collected.

Table 6-1

EPA Information Technology Requirements

Website	Name	Comments
http://www.epa.gov/irmpoli8	IRM Policies, Standards, Guidance and Planning Documents	The 2100 Series (2100-2199) of the Agency's Directive System contains the majority of the Agency's IRM policies, standards, and procedures.
http://www.epa.gov/edr	Data Standards and Environmental Data Registry	ERG adheres to Trading Partner Agreement (TPA) Data Exchange Templates (DETs) and data standards detailed in EPA Environmental Data Registry (EDR). This includes any development/enhancement of information resources (information resources for this process include systems, databases, and models/web applications that utilize information in OW systems and databases) as well as any data products flowing to or from EPA information resources.
http:// basin.rtpnc.epa.gov/ntsd/ITARoadMap.nsf	Information Technology Architecture Road Map (ITARM)	ERG adheres to all technical specifications listed in the ITARM for development/enhancement of information resources.
http://www.epa.gov/eims	Environmental Information Management System (EIMS)	When developing or enhancing an information resource ERG first conducts a thorough search of existing information resources, through means such as EIMS, to ensure development or enhancement of information resources does not duplicate existing information resources. If duplication is determined, ERG consults with the client to ensure that existing information resources are optimally utilized in conjunction with information resource being developed or enhanced. For any development or enhancement of information resources, ERG works with EPA on inserting and updating resource description information in EIMS.
http://www.epa.gov/storet	Monitoring information in STORET	Any water quality, biological, sediment, and ecological monitoring data collected as part of contract activities are entered into STORET or made available to EPA in a STORET compatible format.

6.3.2 Assuring Database Quality

ERG assures the quality of the databases ERG develops and maintains by:

- Review of database design by a team member knowledgeable in relational databases as outlined in ERG's SOPs for Database Development;
- Review of the design and output of queries by one other team member as outlined in ERG's SOPs for Database Queries;

- Review of programming code utilized in data manipulation or report generation by one other team member;
- Establishing QA/QC procedures for data entry before data entry begins by the Project Manager, or ERG Task Leader;
- Performing manual QA/QC of the results generated by programming code by a knowledgeable team member;
- Performing manual QA/QC of information presented on reports by a knowledgeable team member;
- Maintaining version control of interim databases by a responsible team member;
- Documenting database structures and maintaining documentation in project files by a responsible team member; and
- Performing integrity checks on the database prior to release by the Project Manager or Task Leader.

6.3.3 Assuring Spreadsheet Quality

ERG ensures the quality of the spreadsheets ERG develops and maintains by:

- Reviewing spreadsheet design by a knowledgeable team member;
- Reviewing the design and output of equations and formulas by one other team member as outlined in ERG's SOPs for Spreadsheet Development;
- Establishing QA/QC procedures for data entry before data entry begins;
- Maintaining version control of interim spreadsheets by the ERG Task Leader;
- Maintaining documentation in project files by a responsible team member; and
- Performing integrity checks on spreadsheets prior to release by the Project Manager, or ERG Task Leader.

6.3.4 Modeling

Computer software is routinely used to model physical processes. Common types of modeling activities include characterization of pollutant release, environmental dispersion and resulting health risks, simulation of physical processes (e.g., combustion kinetics, response of structural materials to stress, etc.), and prediction of economic impacts associated with proposed activities or regulations. Modeling activities involve determining the appropriateness of the model to the application, converting physical information to model inputs, configuring the model inputs to match the physical process, running the model, and relating the model results back to the physical process.

The objective of a modeling activity is usually to assess the impact of a proposed change in the configuration or operation of a physical process. The impact can affect the physical process itself (e.g., modeling to determine the rupture strength of a tank) or the environment surrounding the process. Typically, specific information requirements dictate the need for modeling and define the activity objective. However, the ERG Task Leader and Project QA Coordinator evaluate the modeling objectives to ensure that modeling is required to supply the needed information; in some situations, the same or better information can be generated more efficiently using physical scale models, calculations, or another approach.

Documentation within or accompanying each model should guide the user in setting up and operating the model. The ERG Task Leader and Project QA Coordinator ensure that the procedures include concise guidance for determining the appropriateness of the specific model to supply the needed information, for evaluating and selecting the proper hardware to run the model, and for establishing model parameters and inputs.

When a model or other software program is used to calculate emissions, manual verification (by hand) of each type of calculation is performed. If calculations are complex and cannot be easily reconstructed, an alternative approach ERG uses is to duplicate the results using another calculation method.

EPA modeling guidance such as *Guidance for Quality Assurance Project Plans for Modeling (QA/G-5M) Peer Review Draft* [dated 04/30/02] is consulted when developing QA/QC procedures for modeling activities.

SECTION 7

PLANNING

This section documents how ERG uses systematic planning processes, including the Data Quality Objectives Process, to ensure that data or information collected for each contract or project are of the needed and expected quality for their intended use.

7.1 SYSTEMATIC PLANNING PROCESS: WORK ASSIGNMENT REVIEW

ERG uses a systematic process to plan projects involving environmental data operations. The process of articulating the project goals, objectives, and questions and issues to be addressed begins upon receipt of a work assignment. After reviewing the work assignment, the Project Manager, identifies the staff members who will serve as the ERG Task Leader(s) and Project QA Coordinator. The Project Manager and Task Leaders(s) comprise ERG's Project Management Team, and they confer with the client, to review the work assignment requirements. Direct communication between the client and ERG's Project Management Team ensures a clear understanding by all participants of EPA's needs and expectations and of the results and products that will be provided by ERG. This initial conference between ERG and the client achieves the two objectives described below.

7.1.1 Identification of Key Information Users ('Customers') and the Organization(s) That Will Supply the Information to the Users

During the initial discussion between the client and the ERG Project Management Team, the key users of the project output are identified. ERG works with the client to ensure the these "customers" are involved in planning the project. In addition to identifying the project's "customers," ERG works with the client to understand what organization(s) are the "suppliers" responsible for meeting these customers' needs.

7.1.2 Project Goals and Objectives

During the initial work assignment discussion, the ERG Project Management Team and the client work to define the client's needs and expectations in terms of technical and quality goals by discussing the questions and issues to be addressed by ERG during the execution of the work assignment.

7.2 SYSTEMATIC PLANNING PROCESS: WORK PLAN DEVELOPMENT

After the initial conference, the ERG Task Leader prepares a Work Plan to translate the client's needs into specifications for producing the desired result.

7.2.1 Schedule, Milestones, and Budget

The ERG Task Leader develops a work breakdown structure, which identifies staff members, assigns responsibilities, and defines scopes, schedules, budgets, and performance measurement baselines or time-phased budgets. The work breakdown structure breaks the job down into the smallest, practical manageable pieces. The ERG Task Leader uses the work breakdown structure to prepare a work plan and cost estimate responding to the work assignment. The Project Manager reviews and approves the work plan before it is delivered to the client. The work plan includes:

- The person responsible for the work effort (ensuring that the proper experience level and technical discipline are represented);

- A description of the scope of work;
- The measurable milestones associated with the work effort;
- The scheduled start and completion dates; and
- A budget estimate (including labor hours, labor costs, and all necessary other direct costs, including travel, photocopying, materials, subcontracts, and shipping).

In accordance with the specifications designated in the applicable work assignment, the Work Plan is accompanied by a project-specific supplement to this QMP. This narrative may be a complete QA Project Plan following EPA requirement in QA/R-5 or it may be a subset of QA/R-5 requirements specified by the client. The narrative specifies QA/QC parameters for the proposed project and describes acceptance criteria for the results or measures of performance. ERG's design of project quality assessment is described in Section 7.3.

7.2.2 Regulatory and Contractual Requirements

The Work Plan identifies regulatory and contract requirements, such as managing CBI in accordance with ERG's approved plan, obtaining client approval of non-local travel, and use of a QAPP for each work assignment that involves measurement activities or gathering or generation of original data.

Requirements of the Paperwork Reduction Act that affect collection of data are identified. For Federal Government programs, the ERG Task Leader works with the client to identify that all data collection activities requiring Information Collection Requests are approved by the Office of Management and Budget.

7.2.3 Definition of Data Needs and Use

The Work Plan presents the general outline of the program and identifies the type and quantity of data needed and how the data will be used to support the project's objectives. For projects that require field sampling and/or field monitoring, a combined site-specific Field Test Plan and QAPP is prepared to provide a detailed description of the site(s) to be sampled, sampling and analytical methods to be applied, the project management structure for field sampling, and the schedule for sampling and analytical activities. As discussed in Section 7.4, ERG prepares a QAPP for each work assignment that involves measurement activities or gathering or generation of original data. The Project QA Coordinator ensures that a QAPP is prepared as required by the work assignment.

7.2.4 How, When, and Where the Data Will Be Obtained

The Work Plan identifies how, when, and where data required for completion of the project will be obtained. The data may be collected by ERG or obtained from a secondary source. See Section 7.5 for a discussion of the procedures used for evaluating and qualifying secondary data.

7.2.5 Data Analysis, Evaluation, and Assessment (Refer to 7.3)

Data quality assessment design is discussed in detail in Section 7.3. The QAPP describes how acquired *measurements* data will be:

- Analyzed in the field and/or in the laboratory;
- Evaluated (QA review, verification and validation);
- Assessed against the quality performance criteria; and
- Assessed against their intended use.

The Work Plan or a project-specific QA/QC plan prepared in response to a work assignment, describes how other acquired data (e.g., survey data) will be:

- Analyzed statistically;
- Evaluated (QA review, verification and validation);
- Assessed against the quality performance criteria; and
- Assessed against their intended use.

7.3 DESIGN OF QUALITY ASSESSMENT

For each work assignment, ERG develops a plan for assessing if the data or information collected are of the needed and expected quality for their intended use. ERG's plan includes procedures for documenting this assessment of data quality. These plans are prepared in accordance with the specifications designated in the applicable work assignments. This quality assessment plan is a QAPP (see 7.4) or a project-specific QA/QC plan.

All data quality assessments specify:

- The quality measurements used;
- The quality *performance criteria* for those quality measurements; and
- The QC and QA activities needed to assess the quality performance criteria.

Quality *performance criteria* are based on the ultimate use of the data to be collected and QA/QC practices required to support that use. In the decision making process, these criteria allow a user to limit decision errors to a fixed level for determining whether or not an Action Level (regulatory or risk-based) has been exceeded.

The Data Quality Objectives (DQOs) Process (described in Section 7.6) is used to develop acceptance or performance criteria based on the ultimate use of the data to be collected. The DQOs Process is also used to define the quality required for the decision in terms of acceptance limits on the probabilities of committing a decision error. Each step of the Data Quality Objectives Process defines criteria that will be used to establish the final data collection design.

7.4 QAPP

ERG prepares a QAPP for each work assignment that involves field and laboratory measurement activities or gathering or generation of original data. Standard laboratory analysis methods are performed under our NELAC - approved Laboratory Quality Systems Manual. ERG prepares QAPPs in accordance with requirements designated in the applicable work assignment. ERG follows *EPA Requirements for QA Project Plans (QA/R-5)* for work that generates enforcement or regulatory data. Quality Assurance narratives that include the appropriate subset of EPA QA/R-5 requirements are prepared for research programs not directly related to regulatory or enforcement actions. ERG does not begin work involving environmental data generation or use until the client has approved the required quality documentation.

As described in Section 2.3.1, Project staff or the Project QA Coordinator prepare the QAPP, and the Project QA Coordinator ensures that this QAPP meets the appropriate requirements. The Local QA Coordinator reviews and approves QAPPs prepared by project staff before they are submitted to the client. The ERG Task Leader ensures that the procedures specified in the QAPP are implemented and that collected data comply with all acceptance criteria specified in the QAPP.

The QAPP addresses all quality issues associated with sample collection, analysis, data validation, and reporting. Many procedures, such as sample collection and analysis, instrument calibration, chain-of-custody procedures, and data validation procedures and calculations are standardized. Project-specific QA objectives are developed, and any constraints or adaptations to SOPs are incorporated and reviewed prior to conducting any field.

7.5 SECONDARY DATA

The term "secondary data" is defined as data that were collected for a different purpose than that for which they are now being used. In addition to a different purpose than the original data collection, the level of QA/QC provided at the time of data collection may be unknown. Secondary data may be used to support decision-making or to guide research. Secondary data sources include existing databases, such as EPA's PCS and TRI databases and databases from other government agencies, such as Department of Energy and Department of Agriculture; and self-sampling data submitted by industrial facilities. Evaluation of the quality of secondary data reduces the likelihood of a decision error.

7.5.1 Assuring the Quality of Secondary Data from Existing Databases

ERG's procedures for ensuring the quality of secondary data from existing databases include the following steps:

1. Identify the data and how they will be used (e.g., preliminary assessment of pollutant loadings from an industrial category, development of BAT-based limitations, demonstration of facility compliance with regulatory requirements). Develop appropriate data acceptance criteria.

2. Develop a QAPP or project-specific supplement to the QMP, detailing planned QC for acquiring, managing, and using the secondary data. This plan details:

a) How the data will be obtained.

b) File tracking procedures. If the work assignment includes receipt of data submitted from multiple entities, a central tracking system for incoming electronic and/or hardcopy data is developed.

c) The system used for storing and archiving the data.

d) The system used to check the quality of the incoming data. If data are received in multiple, small data deliveries, the checks may be done using a check list. For large existing databases, the checks will be made using automated (query) procedures. The data are checked to identify:
   - Corrupted files;
   - Data out of acceptable range; and
   - Missing data (e.g., missing values, missing units, missing identifying information).

e) Procedures used to develop surrogate data for missing or erroneous data.

f) Quality checks made after the transfer of data between database systems (e.g., checks for number of records, file completeness).

3. Ensure that the QA/QC plan is implemented.

7.5.2 Assuring the Quality of Existing Measurements Data

ERG procedures for validating existing measurements data include the following steps:

1. Use experienced reviewers for validating the data submissions.

2. Verify that the documentation provided is sufficient to assess the quality, usability, and comparability of the data to the protocol that would be used to collect new data (e.g., an EPA Sampling and Analysis Plan).

3. Verify the data meet minimum quality acceptance criteria (e.g., for detection limits, blank contamination, reproducibility, spike recovery).

4. Verify the data were collected under a well-defined, documented quality system (e.g., Standard E-4 ([ANSI/ASQC, 1994)], or Standard 9000 [(ISO, 1987)].

5. Confirm that all pertinent information, such as protocols, test plans, and primary results, are available and use them to verify that the data were collected under appropriate and clearly defined conditions.

7.6 DATA QUALITY OBJECTIVES PROCESS

Environmental data must be of sufficient quality and quantity to establish criteria for making defensible decisions. The Data Quality Objectives Process is a systematic planning tool, based on scientific method, for establishing criteria for data quality and for developing data collection strategies. The DQOs Process is a tool available to Project Managers for structuring the data collection planning process and for developing an appropriate data collection design. The DQOs Process is most appropriate for planning the collection of environmental measurements data.

The Data Quality Objectives Process incorporates seven steps.

1) State the problem.

- Define the problem completely, clearly, and concisely.
- Identify the members of the planning team, including representatives from all groups who are stakeholders in the project and specifically include statistical expertise.
- Designate a decision-maker for the planning team, and assign specific roles to planning team members.
- Identify resources and deadlines pertinent to the project.

2) Develop a decision statement.

- Define the issue(s) that the project will attempt to resolve.
- Identify possible actions that may be taken to solve the problem, including an alternative that requires no action.
- Combine the alternative actions and the principal study question into a decision statement to express a choice among alternative actions.
- If multiple decision statements are required to address the problem, list them in the sequence in which they must be resolved.

3) Identify inputs to the decision.

- Decide what types of information are needed to resolve the decision statement and define the sources for each type of information.
- Decide what information is needed to enable choosing between alternative actions.
- Determine whether there are appropriate environmental measurement methods to provide the necessary data.

4) Define the boundaries of the study.

- Identify any practical constraints that may interfere with the study.
- Determine where and when analytical samples should be taken.

5) Develop a decision rule.

- Combine the results of the previous Data Quality Objectives steps into an "If...then..." decision rule that defines the conditions that enable decision-makers to choose among alternative actions.

6) Specify tolerable limits on decision errors.

- Error in sampling design occurs when the sampling design is unable to capture the complete extent of natural variability that characterizes the true state of the environment. Measurement error relates to the combination of random and systematic error that occurs during the various steps of a measurement process, from sample collection through data handling. The possibility of making a decision error can never be totally eliminated, but there are numerous ways that the decision error can be minimized (e.g., collecting a large number of samples to minimize sampling design error, analyzing individual samples several times to minimize measurement error, etc.). Because reducing the possibility of making decision errors generally increases costs, it is critical to have an accurate definition of the needs of the decision maker to determine tolerable limits of error.

7) Optimize the design for obtaining data.

- Identify the most effective data collection design that will generate data that satisfy the defined Data Quality Objectives. The goal is to find cost-effective alternatives that balance number of samples and measurement performance, given the feasible choices for sample collection techniques and analytical methods.

SECTION 8

IMPLEMENTATION OF WORK PROCESSES

The types of scientific and technical activities conducted by ERG include collecting and evaluating available information from existing databases and other sources; collecting environmental information through surveys, site visits, and field sampling efforts; analyzing environmental information by database development, data processing, and computer modeling; and preparing written reports and other documents. This section of the QMP describes how work processes are implemented within ERG to ensure that environmental data are of the needed and expected quality for their intended use.

8.1 PROJECT MANAGEMENT: ENSURING THAT WORK IS PERFORMED ACCORDING TO APPROVED PLANS AND SOPS

Project management consists of technical and administrative activities that ensure work assignment objectives are understood and communicated to project staff and that the expected product is provided in a technically sound, cost-effective manner. Work plans, site-specific Sampling and Analysis Plans, and QAPPs communicate this information to the client and to ERG project staff. Communication within ERG also includes project and task instructions, which contain logistical and technical information used to control and coordinate project implementation. These instructions detail the project management, technical review, and QA/QC processes used to implement the work assignment. These instructions include thorough instructions for managing and executing the technical project activities. Large projects may utilize project management software to assist in planning and scheduling. Project instructions provide logistical and technical information required by project team members to conduct the work. The primary components of project instructions are:

- Project summary and objectives;
- Scope of work;
- Budget and schedule information, including internal deadlines;
- Confidentiality requirements, if any;
- Safety concerns;
- Project staff and responsibilities;
- Standard Operating Procedures (SOPs) to be used;
- Deliverables;
- Deliverable review requirements and other QC procedures;
- Internal and external communication procedures; and
- Travel and procurement requirements.

For large projects that incorporate many tasks, task instructions may be developed as part of the technical planning activities. These task instructions provide team members with the technical approach and with schedule and data quality requirements. Task instructions also assign specific responsibilities to each individual.

8.1.1 Responsibilities

The ERG Task Leader is responsible for preparing and implementing project and task instructions. The Project Manager is responsible for ensuring that adequate project and task instructions are prepared and used.

8.2 DEVELOPMENT OF WORK PROCESSES AND PROCEDURES

ERG's processes for identifying operations that require written procedures is presented in this section. Both standard operations and special (critical) operations are discussed.

8.2.1 Standard Operating Procedures

As described in Section 2.2.1, SOPs are written instructions that document a routine or repeated activity. SOPs detail work processes in order to facilitate consistent conformance to technical and quality system requirements. Use of SOPs helps to ensure data quality.

Identifying when new SOPs are needed. As discussed in Sections 1.2.2 and 2.2.1, the Local QA Coordinators are responsible for identifying when SOPs are needed at their location and for designating an appropriate individual to create the needed SOPs. The local QA Coordinators are responsible for developing a standardized form for their location's SOPs.

Use of SOPs. In developing the work plan and project instructions, the ERG Task Leader identifies the SOPs to be used in conducting the work. The Project Manager verifies that the identified SOPs are appropriate to the activity being conducted. As discussed in Section 9.2.7, the corporate quality management staff conducts occasional technical systems audit to evaluate adherence to approved QAPPs and SOPs.

Review, approval, revision, and withdrawal of SOPs. The Local QA Coordinator is responsible for reviewing the draft SOP or designating an appropriate technical reviewer; circulating the approved SOP to technical staff members; and maintaining copies of SOPs pertaining to the ERG location in a central filing system. SOPs are company-confidential. ERG SOPs are prepared and filed by individual ERG locations and maintained in a central filing system controlled by the Local QA Coordinator. Each SOP has a signed title page and document control format, as depicted in Figure 5-1 found in Section 5 of this QMP. The Local QA Coordinator is responsible for withdrawing obsolete procedures.

8.2.2 Procedures for Special or Critical Operations

Work procedures to be followed for a specific project are presented in a written format in the work plan and project instructions. The ERG Task Leader is responsible for preparing and implementing these plans. The Project Manager is responsible for reviewing the plans and for ensuring compliance with them. For projects the Project Manager considers special or critical, review procedures are developed in consultation with the Local QA Coordinator. See Section 9 of this QMP for available assessment tools.

8.3 CONTROL MEASURES

See Sections 5.2.2 Quality System Records (SOPs and QMP) and 5.2.3 Quality System Document Control for a description of the process used for controlling and documenting the release and changes of the QMP, SOPs, and QAPPs, including needed approvals and removal of obsolete documentation from work areas.

SECTION 9

ASSESSMENT AND RESPONSE

This section of the QMP documents how ERG management determines the suitability and effectiveness of the ERG quality system. This section also documents how ERG evaluates the quality of the projects involved with environmental data collection, generation, or use.

Section 9.1 describes how and when ERG assesses the effectiveness of our corporate quality system and project quality and describes the roles and responsibilities of management and staff in conducting these assessments. Section 9.2 describes available quality assessment tools. Section 9.3 describes QC measures used during the generation of environmental measurements data.

9.1 CONDUCTING ERG QUALITY SYSTEM AND PROJECT QUALITY ASSESSMENTS

Quality System Assessment. As described in Section 2.2.2 of this QMP, the ERG Corporate QA Manager conducts an annual, internal review of the corporate quality system to determine if the quality system is implemented and is operating as prescribed in the QMP. The Corporate QA Manager is responsible for ensuring that independent audits are conducted to determine the effectiveness of the ERG quality system. Local QA Coordinators are responsible for reporting to the Corporate QA Manager results of independent audits they have performed to determine the effectiveness of the ERG quality system, Management Systems Reviews, and independent project quality technical assessments.

Project Quality Assessments. Each Local QA Coordinator is responsible for planning, scheduling, and conducting independent assessments to determine the effectiveness of the ERG

QA/QC program. Local QA Coordinators report the results of these assessments to the Corporate QA Manager and ERG management. Planning of project quality assessments, selection of assessment personnel, reports to management, and responses to assessment findings are discussed in the following sections.

9.1.1 Planning

Planning for project quality assessment is part of the development of a work plan and QAPP (if applicable). The Local QA Coordinator works with the ERG Task Leader during the development of the work plan to identify the QA/QC procedures that are commensurate with the project objectives. The Local QA Coordinator and the ERG Task Leader identify the quality assessment tools that will be used (See Section 9.2 for a description of assessment tools). Quality assessments (e.g., technical reviews, peer reviews, and field sampling audits) are included in the project schedule and budget.

9.1.2 Assessment Personnel

Qualifications of Assessment Personnel. Technical review is the most commonly used tool for assessing ERG project quality. Technical reviewers are proficient in the work area of interest, but are not directly responsible for performing the work. The Project Manager works with the Local QA Coordinator to identify one or more qualified technical reviewers at the start of the project. If special expertise is required, technical reviewers may be ERG consultants or subcontractors.

The ERG staff tasked with assessing the quality of ERG projects have considerable experience in designing and conducting audits of measurement systems (based on internal, but functionally independent, audits of projects and laboratories); external audits of ERG projects conducted by other organizations; and external audits conducted by ERG staff. This experience contributes to effectiveness and efficiency in auditing performance.

Independence of Assessment Personnel. Personnel conducting assessments are technically knowledgeable but have no direct involvement or responsibility for conducting the work assessed. Thus, they have no conflict of interest (real or perceived).

Authority of Assessment Personnel. Assessment personnel are permitted to access managers, documents, and records, as needed to evaluate the quality of the project. If necessary, the assessment personnel are granted access to CBI, after complying with the provisions of the relevant ERG CBI Plan. As discussed in Section 1.2.3, Stop Work Authority, if assessment personnel find deficiencies in project team quality performance, they notify the Project Manager and Corporate QA Manager. If the deficiencies are not resolved, the assessment personnel, in conjunction with the Project Manager, have full authority to stop work and replace project staff (if necessary) so that the deficiencies are resolved.

9.1.3 Management Review and Response to Assessment Findings

As discussed in Section 1.2.1, the Corporate QA Manager is responsible for implementing corrective actions for quality problems identified by Local and Project QA Coordinators. She is also responsible for recommending required management-level corrective actions which may include stopping work of inadequate quality until identified deficiencies are resolved.

9.1.4 Corrective Actions

Audits, evaluations, and surveillance are the mechanisms used to identify and communicate conditions adverse to quality, to determine a cause for them, and to initiate corrective action. The Project Management Team and senior technical management are responsible for ensuring that when deficiencies are identified, corrective actions are implemented and verified without delay.

Communication. Assessment personnel are responsible for communicating, in writing, any detected deficiencies to the Project Manager and Local QA Coordinator in a timely fashion. The assessment personnel identify the need for corrective action and the Project Manager is responsible for ensuring appropriate action has been taken and documented.

Confirmation of Implementation and Effectiveness. The Local QA Coordinator is responsible for confirming that corrective action has been taken and that the action was effective in remedying the deficiency detected by the assessment personnel.

9.1.5 Resolution of Disputes

On the rare occasion that there is a dispute between the Project Manager and the ERG Corporate QA Manager over proper corrective action or solutions to deficiencies (see Section 1.2.3), the ERG President, David Meyers, resolves the dispute.

9.2 ASSESSMENT TOOLS

ERG executes regularly scheduled audits to verify compliance with all aspects of its quality system and to determine its effectiveness. If inadequacies are identified in the laboratory measurement system and/or in a project's products, audits provide the mechanism for implementing corrective action.

Types of assessment tools applicable to various aspects of scientific and technical activities are described in the following sections:

- 9.2.1 Management Systems Reviews;
- 9.2.2 Peer Reviews;
- 9.2.3 Technical Reviews;
- 9.2.4 Performance Evaluation Audits;
- 9.2.5 Data Quality Assessments and Data Quality Audits;
- 9.2.6 Readiness Reviews;
- 9.2.7 Technical Systems Audits; and
- 9.2.8 Surveillance.

9.2.1 Management Systems Reviews

A management systems review is a qualitative assessment of a data collection operation and/or organization to establish whether the prevailing quality management structure, policies, practices, and procedures are adequate to ensure that the type and quality of data needed are obtained. A management systems review is a qualitative review of the role of QA/QC in project management, where strengths, weaknesses, and problem areas are evaluated. This review is also used to determine the extent to which QA/QC has been established within the organization.

Among the issues addressed in a management systems review are:

- The role of QA/QC as described in management policy;
- The documentation by the program management team of the implementation of QA/QC procedures on the project; and
- The ability to trace the resources allocated to QA/QC management.

Management systems reviews are qualitative evaluations conducted on a regular basis at the corporate level. These reviews do not answer questions involving specific aspects of the QA procedures nor do they address the measurement systems and the data quality indicators.

9.2.2 Peer Reviews

Peer review is a documented critical review of work generally beyond the "state-of-the-art," or work characterized by the existence of potential uncertainty. Peer review is conducted by qualified individuals who are independent of those who performed the work, but who have equivalent technical expertise (i.e., peers). Peer reviewers assess whether the work performed is technically adequate, competently performed, properly documented, and satisfies the technical and quality requirements specified in the Work Plan and/or QAPP. Peer review is an in-depth assessment of the assumptions, calculations, extrapolations, alternate interpretations, methodology, acceptance criteria, and conclusions of a specific work and its documentation. Peer review is typically used in research and development or other activities where quantitative methods of analysis or measures of success are unavailable or undefined.

9.2.3 Technical Reviews

Technical review is a documented critical review of work that has been performed within the "state-of-the-art." Each ERG project has at least one technical reviewer, a person who is proficient in the work area of interest, but not directly responsible for performing the work. One or more technical reviewers are designated at the start of each project at ERG, and the participation of a technical reviewer in the project is budgeted as a line-item cost. The responsibilities of this reviewer include a detailed review of all significant project deliverables and an up-front review of the detailed Work Plan to ensure that:

- The project goals are well-defined, realistic, and appropriate to the needs of the client;
- The approach proposed to meet the goals is reasonable and likely to result in a successful project; and
- The necessary resources in terms of time, dollars, and competent staff are dedicated to the project.

Depending on the needs of the project, the technical reviewer may also function as a senior technical advisor, serving as a resource to project staff during the course of the project. Because of the reviewer's technical experience and proficiency in the work area, the reviewer can make an extremely valuable technical contribution to the program.

A formal project review of all technical work may also be performed by ERG senior technical management who are independent of those who performed the work. This review is done to provide a critical analysis and evaluation of documents, activities, material, data, or items that require technical verification or validation for applicability, correctness, adequacy, completeness, and assurance that requirements established in the Work Plan or QAPP are satisfied. Technical reviews of ERG projects are maintained as part of the project file.

9.2.4 Performance Evaluation Audits

The purpose of a performance evaluation audit is to quantitatively assess data quality. A performance evaluation audit is applicable to any testing program where reproducibility according to a standard is relevant, as in physical or chemical analysis laboratories, or in field measurement programs such as ambient air monitoring or source emission characterization. The performance evaluation audit provides a direct evaluation of the various measurement systems' capabilities to generate quality data. The performance evaluation audit is accomplished by challenging the measurement system with accepted reference standards, such as Standard Reference Materials supplied by the National Institute for Standards and Technology (NIST) or by commercial vendors.

Performance evaluation audits review the following:

- Precision and bias of the measurement system;
- Comparison of QC data to actual measurement data collected;
- Function of the measurement system relative to established control limits; and
- Significant deviations from the data quality objectives over time.

Although information collected during a performance evaluation audit will determine when a system is not performing adequately, the nature of appropriate corrective action is not always evident. Questions regarding qualitative issues, such as management policies, sample custody procedures, recordkeeping, and data handling systems are not addressed in a performance evaluation audit.

9.2.5 Data Quality Assessments and Data Quality Audits

Data Quality Assessments. A data quality assessment is a statistical and scientific evaluation of a data set to determine:

- The validity and performance of the data collection design;
- The validity and performance of the statistical test(s); and
- The adequacy of the data set for its intended use.

A data quality assessment can be undertaken only after data have been generated or collected, and is typically performed by a senior project team member, another designated technical reviewer, the Local QA Coordinator, or a combination of staff. A data quality assessment determines whether the project data meet the Data Quality Objectives and whether they are of the correct type, quality, and quantity to satisfy the objectives specified in the Work Plan or QAPP.

Data Quality Audits. A data quality audit is designed to assess data quality indicators and is applicable to programs in all areas where data are collected. A data quality audit provides information to characterize the data, such as:

- Adequacy of data collection, recording, and transfer;
- Precision and bias of resultant data;
- Adequacy of data calculation, generation, and processing;
- Documentation of all data-handling procedures; and
- Identification of data quality indicators to inform users of limitations and applicability.

A data quality audit will determine whether the data collection procedures need modification and whether the use and documentation of QC procedures are adequate. A data quality audit will not, however, address the overall QA management system of an organization, nor will a data quality audit answer technical questions such as the operating conditions of facilities and equipment.

9.2.6 Readiness Reviews

A readiness review is a systematic, documented review of the readiness for the start-up or continued use of a facility, process, or activity. A readiness review is typically conducted by a project peer reviewer, senior technical management, or Project QA Coordinator, and is performed before proceeding beyond project milestones and prior to initiation of a major phase of work. A readiness review addresses the following questions:

- Has project work of sufficient quality and quantity been completed to allow the project team to proceed with the next phase of work?
- Is the project on schedule and within budget?
- Are appropriate resources (i.e., supplies, materials, analytical instruments, sampling equipment) available for successful execution of the next phase of work?
- Has the project team planned for appropriate support staff (i.e., technical editors, secretarial, or clerical support) for the next phase of work?
- If subcontractors or consultants are required in the next phase of the project, have appropriate arrangements been made and is the necessary documentation available and approved?

9.2.7 Technical Systems Audits

A technical systems audit is an on site, qualitative review of the various aspects of a total sampling and/or analytical system. A technical systems audit provides an assessment of overall effectiveness and represents a subjective evaluation of a set of interactive systems with respect to strengths, deficiencies, and potential areas of concern. Typically, the audit consists of observations and documentation of all aspects of the measurement effort.

A technical systems audit at ERG serves to evaluate adherence to approved QAPPs and SOPs. A technical systems audit reviews the following:

- Sample collection and handling;
- Instrument operation, calibration procedures, and documentation of instrument operation and maintenance;
- Completeness of data forms, notebooks, and other reporting requirements;
- Data review and validation procedures;

- Data storage, filing, and recordkeeping procedures;
- Sample custody procedures, including laboratory sample tracking;
- QC procedures and documentation;
- Operating conditions of facilities and equipment;
- Documentation of maintenance activities in individual instrument maintenance logs; and
- Systems and operations overview.

Technical systems audits do not provide a quantitative measure of quality, but rather an evaluation of the effectiveness of a QC program, both in terms of design and implementation.

9.2.8 Surveillance

Surveillance refers to the continual monitoring and verification of the status of a project and the analysis of records to ensure that specified requirements are being fulfilled. Surveillance is performed by the project's technical management team, who monitor the status of the project and are responsible for the review of records such as laboratory notebooks and other documents. Review of documents and data generated may be performed by the designated technical reviewer, who has a major role in the function of surveillance on the designated program.

9.3 QC MEASURES

ERG QC measures used in field sampling, chemical and physical measurement, and for statistical control and quality calculations are described below.

9.3.1 Field Control Samples

The specific kind and number of control samples and the frequency of collection and analysis are documented in the individual QAPP. Control samples used to document the accuracy and precision of sampling are:

- *Calibration samples*: All instrumentation used for sampling must be calibrated before and after each sampling event. Measurement control for this equipment includes physical inspection for appropriate size and shape, visual inspection for structural integrity, and leak checks. Specific calibration techniques are discussed in the QAPP.

- *Blanks*: Field (equipment) blanks are collected at the start of the sampling program. For water sampling programs, analyte-free water (HPLC-grade) is passed through or over the sampling equipment, into the appropriate sampling containers, and preserved on site according to the analyte-specific preservation methods. The analytical results are used to assess the introduction of contaminants into samples from the sampling equipment. On air sampling programs, field blanks consist of sampling media that are prepared, brought to the field, and installed in the sampling equipment with *no* stationary source matrix passed through the sampling train. Field blanks are used to detect any contamination from the sampling equipment or handling of the sampling medium, cross-contamination from previously collected samples, or contamination from conditions arising during sampling. Trip blanks are samples of sampling media taken from the laboratory to the sampling site and returned unopened to the laboratory. Trip blanks are used to detect any contamination or cross-contamination that might occur during handling and transportation of samples.

- *Field duplicates*: Duplicate samples are collected at the frequency specified in the QAPP and are used to document sampling and analytical precision. This precision is a function of the variability of the sampling matrix and the variability in the performance of the sampling and analytical techniques.

- *Field spikes*: Field spikes are used to determine the loss of compounds of interest during sampling and shipment to the laboratory. For example, field spikes are designed to show field technicians' precision, possible contamination, and degradation during storage.

9.3.2 Chemical and Physical Measurement Control

Control samples are used as an internal evaluation of how the measurement system performed. Control samples are intended to check contamination, precision, and accuracy within previously established limits. The type of control samples used depends on the laboratory procedure, but frequency, acceptance criteria, and corrective action must all be considered. Requirements for control samples must be written and unambiguous corrective action procedures specified whenever a control sample does not meet acceptance criteria. Control samples typically include calibration checks, QC check samples such as second source reference materials, blanks, spiked samples, and replicates. Project-specific control samples are specified in the QAPP.

Laboratory control samples are blanks that have been spiked with the analytes of interest from an independent source to enable monitoring of the execution of the analytical method. These samples are used to verify that the analytical instrument is calibrated correctly. The two types of blanks used in chemical and physical measurements include:

- *Laboratory blanks*: A laboratory blank is an aliquot of an analyte-free matrix that is taken through the preparation steps prior to analysis. The results from laboratory blanks are used to identify any contamination from reagents, sample preparation equipment, or analysis; and

- *System blanks*: A system blank is an artificial sample designed only to monitor instrument contamination. System blanks are reagent water or pure solvent that is taken only through the analytical process.

Four types of laboratory spikes are routinely used in the analytical laboratory:

- *Laboratory control samples* are spikes of a reagent grade matrix that are taken through the preparation and analysis steps. Laboratory control samples are used to document accuracy and precision of the entire analytical process.

- *Analytical spikes* are spikes added to the samples after preparation but before analysis; analytical spikes are used to document analytical accuracy.

- *Matrix spikes* are spikes added to a sample matrix prior to extraction, digestion, or other preparative steps, and analysis. Matrix spikes are used to assess precision and bias in actual samples, as well as to identify matrix effects.

- *Surrogate spikes* are organic compounds that are similar to the analytes of interest in chemical composition, extraction behavior, and chromatographic behavior, but that are not normally found in nature. The surrogate spike compounds may be isotopically labeled analogs of the compounds of interest or homologs of the compounds of interest. Surrogate compounds are spiked into all blanks, standards, samples, and spiked samples prior to preparation and analysis. Surrogate spikes are used to assess precision and bias.

Instrumentation used for measurement must be calibrated before and after each analytical series. Measurement control for this equipment includes visual inspection for structural integrity, leak checks for vacuum equipment, checks of chromatographic properties, etc. Specific calibration procedures are specified in the QAPP.

9.3.3 Statistical Control and Quality Calculations

Statistical methods are applied to establish and monitor control in analytical processes and to calculate precision and accuracy for measurement data during data validation. The statistical procedures and calculations to be used for a specific measurement process or project are identified and presented in the QAPP or in appropriate SOPs. These statistical calculations follow EPA or other recommended procedures.

Statistical control must be demonstrated for each analytical process before the measurements can be considered reliable. Statistical control is usually determined by calculating the mean and standard deviation of a series of measurements of the same control sample or parameter, analyzed over a period of time. Warning and control limits are generally set at two or three times the standard deviation of the measurement. Control charts are maintained to provide visual demonstration of statistical control and are updated periodically to monitor the process. Corrective action must be taken if the measurement exceeds the control limits. Parameters or measurements that are monitored include method spike recoveries for organic and inorganic analytes, surrogate spike recoveries, and the relative percent difference between matrix spike/ matrix spike-duplicate sample recoveries. The frequency requirements for updating control charts and control limits, the parameters or measurements to be monitored, and corrective actions are defined in the QAPP. Statistical control calculations and control charts are reviewed as part of Technical Systems Audits and Data Quality Audits.

Data validation procedures are presented in every QAPP and follow standard statistical calculations for precision and accuracy. Specific calculations used to assess precision include the relative percent difference (RPD) and average RPD for duplicate samples or analyses, and coefficient of variation (CV) and pooled CV for measurements of three or more replicates. Confidence intervals may be established for specific parameters or analytes for use in data interpretation applications. Accuracy is evaluated by calculating the percent recovery or standard error for Performance Evaluation Audit samples, or the percent recovery of matrix, method, or analytical spike samples.

Blank sample results may also be evaluated by statistical methods, such as calculating the average blank contaminant concentration. These results are compared to field sample results to assess whether blank contamination has influenced or biased the results.

Precision and accuracy results are compared to the established control limits or project-specific Data Quality Objectives. This comparison provides the basis for assessing whether the data are valid for use in the intended applications, whether any data must be flagged to indicate limitations in their use, or whether any corrective action is warranted.

SECTION 10

QUALITY IMPROVEMENT

This section of the QMP documents how ERG works to continuously improve our corporate quality system and the systems we use to ensure the quality of our work.

10.1 MANAGEMENT COMMITMENT

ERG's goal is to meet or exceed our customers' expectations for quality products. ERG is committed to allocating the necessary resources for implementing, maintaining, and improving our quality management program, as well as preventing problems before they occur.

ERG senior management communicate these expectations to staff during employee training, project planning, review of work plans, and staff performance reviews. Technical capability, work quality, and adherence to QA/QC procedures are the most heavily weighted factors in staff performance reviews.

ERG management and project staff consider the Project QA Coordinators as team members whose goal is to help achieve the common goal of producing complete and accurate data.

10.2 IDENTIFICATION AND REMEDIATION OF CONDITIONS ADVERSE TO QUALITY

ERG uses audits, evaluations, and surveillance (described in Section 9 of this QMP) to identify and communicate conditions adverse to quality, to determine a cause for them, and to initiate corrective action. A QA/QC system functions to save time, improve procedures, communicate the need for additional support and resources to management, and to improve the overall effectiveness of systems and the quality of the data. Systematic deficiencies identified by audits are reported to the Corporate QA Manager so that she can address these deficiencies in her annual quality improvement plan.

Any project team members concerned about problems or events that affect data quality, sample integrity, or laboratory or field safety, communicate their concerns to the Project Manager or his designee. The team members identify the problem and make recommendations for solutions. As directed by the Project Manager, the team members implement the recommended solution and document the result. Timely identification is vital to solving problems and thorough documentation is vital to preventing their recurrence.

An example of ERG's quality problem identification procedures is the Request for Corrective Action system used to track quality deficiency issues in the Morrisville chemistry laboratory. Problems signaling significant and systematic deficiencies are addressed with a Request for Corrective Action. A Request for Corrective Action is issued by a member of the QA staff or by his/her designee for a particular project to the associated manager. Each Request addresses a specific problem or deficiency, usually as a result of an external or internal QA audit. These requests are designed to identify a specific problem, to recommend a course of action, to identify the person responsible for implementing the corrective action, to verify implementation, and to document the resulting corrective action taken. Each Request for Corrective Action requires a written response from the responsible party, typically the person to whom the Request was issued.

As discussed in Section 2.2.3, ERG also asks our clients directly if they are satisfied with the quality of our work. Each client, Contract Officer, and WAM is contacted by ERG President

David Meyers or another ERG senior manager every year and asked to provide an assessment of the technical quality of our work. Clients are also asked if there are areas they would like ERG to improve. Any identified systematic deficiencies are addressed in a quality improvement plan.

10.3 QUALITY IMPROVEMENT ACTIVITIES

All ERG employees are encouraged to identify opportunities to improve the quality of our work. They are encouraged to :

- Identify problems;
- Investigate the root cause;
- Develop solutions to the problems; and
- Communicate their concerns to management, including ERG President David Meyers.

10.4 ENCOURAGING STAFF PARTICIPATION

ERG management encourages staff participation in quality improvement by taking a "no-fault attitude." Through our quarterly achievement award program, management recognizes individual and group contributions to ERG's success, including contributions to quality improvement.

APPENDIX A

ERG STANDARD OPERATING PROCEDURES FOR SCIENTIFIC AND TECHNICAL ACTIVITIES

APPENDIX A

ERG STANDARD OPERATING PROCEDURES FOR SCIENTIFIC AND TECHNICAL ACTIVITIES

SOP No.	SOP Title
1	Documentation of Field Recovery Activities
2	Gravimetric Determination for Particulate Emissions Measurements
3	Field Procedure for Collecting Ambient Air Toxics and Carbonyl Compounds Samples using the ERG:AT/C Sampling System
4	SOP for Preventive Maintenance in the Gas Chromatography/Mass Spectrometry Laboratory
5	SOP for the Concurrent GC/FID/MSD Analysis of Canister Air Toxic Samples
6	SOP for the Analysis of Tenax® Tubes According to EPA Method TO-1/TO-17
7	SOP for the Preparation of Review Packages for Mass Spectrometry Data Sets
8	Procedure for Preparation of Standard Operating Procedures
9	SOP for the Operation of the Documentation System
10	SOP for the Determination of Method Detection Limits in the GC/MS Air Toxics Laboratory
11	SOP for Sample Storage and Checkout from Freezers/Refrigerators at the Laboratory
12	SOP for Basic Training Requirements for Sample Preparation Laboratory Personnel
13	Field Procedure for Collecting Ambient Air Hexavalent Chromium Samples using the ERG:CR6 Sampling System
14	SOP for Sample Preparation QC
15	SOP for Documentation Procedures for the Sample Preparation Laboratory
16	SOP for the Varian 9000 Series High Performance Liquid Chromatography (HPLC)
17	SOP for Developing, Documenting, and Evaluating the Accuracy of Spreadsheet Data

SOP No.	SOP Title
18	Maintaining and Recording Data Records
19	SOP for Transferring, Storing, and Using Confidential Business Information (CBI)
20	SOP for Conducting a Laboratory Systems Audit
21	Calibration and Operation of Analytical Balances
22	SOP for the Preparation of Standards in the ERG Organic Preparatory Laboratory
23	SOP for the Use of Significant Figures and Rounding Off Numbers When Reporting Data
24	SOP for Preparing Aldehyde Derivatizing Reagents and Extracting Derivatized Samples
25	SOP for the Operation of the Rainin High Performance Liquid Chromatography System
26	SOP for Documentation: Labeling of Samples and Standards Prepared in the Laboratory
27	SOP for the Operation of a Gas Chromatograph
28	SOP for QA/QC in the Gas Chromatography/Mass Spectrometry
29	SOP for Concentration of Sample Extracts Using the Kuderna-Danish Concentrates
30	SOP for Canister Sampling System Certification Procedures
31	SOP for Cleaning Glassware and Syringes for Organic Analysis
32	Statistical Manual Standard Operating Procedure
33	SOP for Solid and Hazardous Waste Disposal
34	Analytical Chemistry Training at PPK Laboratory
35	SOP for QA/QC
36	SOP for Laboratory Security
37	SOP for Chemical Inventory

SOP No.	SOP Title
38	SOP for Personal Protective Equipment Program
39	SOP for Maintaining Laboratory Notebooks
40	SOP for Chemical Storage Facilities
41	SOP for Tracer Gas Release and Integrated Bag Sampling for Analysis by FTIR Spectroscopy
42	SOP for the Dionex-300 Ion Chromatograph
43	SOP for the Analysis of Semivolatile Organic Compounds in Gaseous Emissions using the SemiVOST Method
44	SOP for Method 8270C - GC/MS Analysis of Semivolatile Organics
45	SOP for Sample Log-in at the ERG Chemistry Laboratory
46	Field Procedure for Collecting Speciated and/or Total Nonmethane Organic Compounds Ambient Air Samples using the ERG:S/NMOC Sampling System
47	Field Procedure for Collecting Ambient Carbonyl Compounds Samples using the ERG:C Sampling System
48	SOP for Cleaning XAD-2® with QC Measures to Assure Cleanliness
49	SOP for the Extraction and Analysis of PAH's from XAD-2® Traps
50	SOP for Separatory Funnel Liquid-Liquid Extraction by EPA SW-846 Method 3510C
51	SOP for Continuous Liquid-Liquid Extraction by EPA SW-846 Method 3520C
52	SOP for Acid-Base Partition Cleanup by EPA SW-846 Method 3650B
53	SOP for Soxhlet Extraction by EPA SW-846 Method 3540C
55	SOP for Maintenance of NANOpure-A Deionized Water System
56	SOP for Daily Maintenance of Cold Storage Units
57	SOP for Project Peer Review
58	SOP for Preparing Method 25 Audit Samples Using the Transfill System

SOP No.	SOP Title
59	SOP for High Performance Liquid Chromatography
60	SOP for PDFID Sample Analysis
61	SOP for Standard Preparation Using Dynamic Flow Dilution System
62	SOP for UATMP & NMOC Canister Cleaning
64	SOP for Shipping Method 6, 7, 8, and 26 Audit Samples
66	Cylinder Recycling
67	SOP for Producing Standard Mixtures of Organic Compounds in Air by Liquid Injection
69	SOP for Shipping Method 23 Audit Samples
70	SOP for Storing and Shipping Method 13A, 13B, and 29 Audit Samples
71	SOP for Documentation Requirements for the GC/MS Laboratory and for GC/MS Systems in the VOC Laboratory
72	SOP for Stack Sampling using FTIR Spectroscopy
73	SOP for the ECD Wipe Test
74	SOP for the Preparation of Spiked Sorbent Samples Using Liquid Spiking into Tenax-GC® Tubes
75	SOP for the Preparation of Spiked Sorbent Samples Using Liquid Spiking onto XAD-2®
76	SOP for the Preparation of Spiked Sorbent Samples Using Flash Evaporation Spiking onto XAD-2®

Kansas City PM Characterization Study

Final Report

Appendix JJ
Kansas City Rounds 1 and 2
Vehicle Information

Assessment and Standards Division
Office of Transportation and Air Quality
U.S. Environmental Protection Agency

Sponsors:

National Renewable Energy Laboratory, U.S. Department of Energy
Federal Highway Administration, U.S. Department of Transportation
STAPPA-ALAPCO Emission Inventory Improvement Program
Coordinating Research Council Inc. (Project No. E-69)

Prepared for EPA by
Eastern Research Group, Incorporated
Austin, TX

Bevilacqua-Knight Incorporated
Oakland, CA

NuStats LLC
Austin, TX

Desert Research Institute
Reno, NV

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United States
Environmental Protection
Agency

EPA420-R-08-009
April 2008

		PEMS Testing Summary					Dyne Summary		General Vehicle Info (ERG)										
Vehicle ID #	Date	Cond Run	Cond Rep	PEMS on dyne	PEMS on dyne Rep	Dway	Dyne Test	Dyne Rep	Make	Model	Model Year	Color	No of Doors	Fuel Collected (Y/N)	Oil Collected (Y/N)	Smoke Observ (N/L/M/H)	MIL during test (Y/N)	MILL Note (If MILL during test=Y)	Comments
Round 1																			
1	7/13/2004	Yes					84032		Chevrolet	Cavalier	2001	Silver	4	N	Y				Fuel Collected - could not get fuel sample
2	8/9/2004			Yes			84154		Ford	F150	1979	Red	2	Y	Y	N			
3	7/13/2004	Yes							Dodge	RAM250	1994	Green	2						PEMS only, no dyne test
4	7/13/2004	Yes					84034		Isuzu	Trooper	1999	Black	4						
5	7/13/2004	Yes					84035		GMC	Yukon XL	2001	Tan	4						
6	7/14/2004	Yes					84036		Ford	Escort LX	1995	Green	2	N	Y				
7	7/14/2004	Yes					84037		Ford	F-250	1979	Brown	2	Y	Y				
8	7/14/2004																		Reject all wheel drive
9	7/14/2004	Yes							Toyota	RAV4	2000	Purple		N	Y				Rejected 4 wheel drive will not turn off
10	7/15/2004	Yes					84040		Dodge	Spirit	1990	White	4		Y				
11	7/15/2004	Yes					84039		Ford	F-150 XLT	2001	Black	4	Y	Y				$20.00 added to tank
13	7/16/2004	Yes					84042		Honda	Civic	1996	Green	2	Y	Y				
15	7/16/2004	Yes					84043		Honda	Civic	1991	Green	2	Y	Y				
17	7/17/2004	Yes		Yes			84047		Mazda	626	2001	White	4	Y	Y				
18	7/17/2004	Yes					84048		Dodge	Caravan SE	1989	Gray	3	Y	Y				
19	7/19/2004								Jeep	Grand Cherokee	1999			N	N				Reject all wheel drive - no turn off/on button
20	7/19/2004	Yes		Yes			84051		Chevrolet	Corsica	1996	Blue	4	Y	Y	N			
21	7/19/2004	Yes		Yes			84050		Honda	Civic SI	2002	White	2	Y	Y	N			
22	7/19/2004	Yes		Yes			84054		GMC	Jimmy	1995	White	4	N	Y	N			
23	7/19/2004	Yes		Yes			84052		Oldsmobile	Cutlass Ciera	1988	Dark Red	4	Y	Y	N			
24	7/19/2004	Yes		Yes			84055		Jeep	Cherokee Sport	1998	Dark Red	4	Y	Y	L			
25	7/20/2004	Yes		Yes			84061		Chevrolet	Cavalier	1990	White	4	Y	Y	L			
26	7/19/2004	Yes		Yes			84058		Chrysler	300	1999	Red	4	Y	N	N			
27	7/20/2004	Yes		Yes			84057		GM	Saturn	2001	Blue	4	Y	Y	N			
28	7/20/2004	Yes	Yes	Yes	Yes		84060	84062	Buick	LeSabre	1998	Green	4	N	Y	N			
30	7/20/2004	Yes		Yes			84056		Nissan	Frontier	2002	Gray	4	Y	Y	N			
31	7/23/2004	Yes		Yes			84074		Nissan	Pickup	1987	Red		Y	Y	L			
32	7/21/2004	Yes		Yes			84063		GM-Saturn	Saturn	1996	Purple	2	Y	Y	N			
33	7/21/2004	Yes		Yes			84067		Dodge	Caravan	1995	Blue	3	Y	Y	L			
34																			Rejected all wheel drive
35	7/21/2004	Yes		Yes			84064		Mercury	Villager LS	1994	Green	3	N	Y	N			
36	7/21/2004	Yes		Yes		Yes	84066		Jeep	Wrangler	1995	Green	2	Y	Y	N			
37	7/22/2004	Yes		Yes			84071		GM	Pontiac Grand Am	1989	Grey	2	N	Y	N			
38	7/23/2004								Lincoln	Continental	1989	Brown	4						Envelope says too low idle, precat exhaust leak, untestable
40	7/22/2004	Yes		Yes			84068		Toyota	Solara SLE	2001	Silver	2	N	Y	N	N		
41	7/22/2004	Yes		Yes			84069		Dodge	Grand Caravan Sport	1997	Teal	4	Y	Y	N			
43	7/23/2004	Yes		Yes			84073		Chevrolet	Blazer	1995	Green	3	N	Y	N			
44	7/23/2004	Yes		Yes			84072		Chevrolet	S-10	2003	Red	2	Y	Y	N			
46	7/23/2004	Yes		Yes			84076		Ford	Mustang	1968	Green	2	Y	Y	N			
49	7/26/2004	Yes							Lincoln	Towncar	1990	White	4	N	N		N		PEMS only
50	7/24/2004	Yes		Yes			84077		Honda	Civic EX	1999	Green	2	N	Y	N	N		
51	7/24/2004	Yes		Yes			84078		Honda	Accord	1997	Green	4	Y	Y	N	N		
52	7/24/2004	Yes		Yes			84079		Honda	Accord LX	1989	Gold	4	N	Y	L	N		
56	7/26/2004	Yes		Yes			84083		Honda	Accord EX	2000	White	4	N	Y	N	N		
57	7/26/2004	Yes		Yes			84082		Ford	Taurus SES	2003	Gray	4	Y	Y	N			
58	7/26/2004	Yes		Yes			84084		Chevrolet	Malibu LS	1998	Maroon	4	N	Y	N	N		
61	7/27/2004	Yes		Yes			84086		Honda	Odyssey	2004	Grey	5	N	Y	N			
62	7/27/2004	Yes							Nissan	Pathfinder LE	2003	Silver	4	Y	Y				PEMS only
63	7/27/2004	Yes		Yes			84088		Chevrolet	Lumina	1998	Maroon	4	N	Y	N			
64	7/27/2004	Yes		Yes			84090		Ford	Mustang	1999	Blue	2	Y	Y	N			
65	7/27/2004	Yes		Yes			84087		Hyundai	Tiburon	2000	Blue	2	Y	Y	N	N		
66	7/27/2004	Yes		Yes			84091		Cadillac	Seville	1991	Silver	4	Y	Y	N			

Vehicle ID #	Date	Cond Run	Cond Rep	PEMS on dyne	PEMS on dyne Rep	Dway	Dyne Test	Dyne Rep	Make	Model	Model Year	Color	No of Doors	Fuel Collected (Y/N)	Oil Collected (Y/N)	Smoke Observ (N/L/M/H)	MIL during test (Y/N)	MILL Note (If MILL during test=Y)	Comments
		PEMS Testing Summary					Dyne Summary		General Vehicle Info (ERG)										
Round 1																			
67	7/28/2004	Yes		Yes			84092		Saturn	SL1	1999	Blue	4	Y	Y	N			
68	7/28/2004	Yes		Yes			84094		Ford	Explorer	1993	White	5	Y	Y	N	N		
69	7/28/2004	Yes		Yes			84096		Isuzu	Rodeo SL	1999	Red	5	Y	Y	N			
71	7/28/2004	Yes							Toyota	RAV4	2000	Black	5	N	N		N		PEMS only
72	7/28/2004	Yes		Yes			84093		Nissan	Sentra GXE	1997	Black	4	N	Y	N			
73	7/29/2004	Yes		Yes			84098		Ford	Ranger	1999	Gold	2	N	Y	N			
74	7/29/2004	Yes		Yes			84097		Mercury	Sable LS	2002	Gray	4	Y	Y	N			
75	7/29/2004	Yes		Yes			84101		Toyota	Camry	1994	Green	4	Y	Y	N	N		
76	8/2/2004	Yes	Yes	Yes			84120	84123	Honda	Civic	1984	Grey	2			N			
77	7/29/2004	Yes		Yes			84099		Toyota	Avalon	1999	Beige	4	N	Y	N			
78	7/30/2004	Yes		Yes			84108		Honda	Civic DX	1991	Red	4	N	Y	N			
80	8/2/2004	Yes		Yes			84119		Jeep	Grand Cherokee	1995	White	4	N	Y	N			
81	8/2/2004	Yes							Dodge	Ram LE	1991	Silver	6						PEMS only too long for dyne
82	7/30/2004	Yes		Yes			84105		Toyota	Corolla	1997	Green	4	Y	Y	N			
83	7/30/2004	Yes		Yes			84103		Nissan	Maxima	2000	White	4	Y	Y	N	N		
84	7/29/2004	Yes		Yes			84102		Honda	Civic	1999	Black	2	N	Y	N	N		
85	7/31/2004	Yes							Ford	F-150	1995	Green	2				N		PEMS only, too long for dyne
86	7/31/2004	Yes		Yes	Yes		84110	84115	Ford	Contour	1995	Green	4	N	Y	N			
88	7/31/2004	Yes		Yes	Yes		84111	84116	Chevy	S-10	1996	Green	2	N	Y		N		
90	7/31/2004	Yes		Yes			84113		Pontiac	Grand Prix	1993	Gold	4	N	Y	N			
92	8/3/2004	Yes							Ford	Explorer	2000	Navy Blue	5	Y	Y	N			PEMS only, AWD
93	8/2/2004	Yes							Chevrolet	Silverado	2002	Gray	4	N	N				PEM only too long for dyne
94	7/30/2004	Yes	Yes	Yes	Yes		84104	84109	Plymouth	Voyager	1998	Gold	5	N	Y	N			
95	7/30/2004	Yes		Yes		Yes	84107		Buick	LeSabre	1989	Blue	4	N	Y	N			
96	7/29/2004	Yes				Yes			Subaru	Outback Legacy	1996	Green	5	N	N		N		PEMS only
97	8/3/2004	Yes		Yes		Yes	84126		Ford	Thunderbird	1988	Silver	2	Y	N	N			
98	8/3/2004	Yes		Yes			84125		Ford	Explorer XLT	1995	Black	5	N	Y	N			
99	8/3/2004	Yes		Yes			84121		Volvo	S80	2001	Silver	4	Y	Y	N			
100	8/11/2004	Yes		Yes			84165		Mazda	Protégé	1991	Burgundy	4	N	Y	N			
102	8/3/2004	Yes		Yes			84122		Dodge	Grand Caravan SE	1999	Green	5	Y	Y	N			
103	8/4/2004	Yes		Yes			84127		Chrysler	Town & Country	2000	Tan	4	Y	Y	N			
104	8/4/2004	Yes		Yes			84129		Toyota	Celica	1999	Red	2	Y	Y	N			
105	8/6/2004	Yes	Yes	Yes	Yes		84132	84137	Jeep	Cherokee Sport	1993	Green	4	Y	Y	N			
107	8/4/2004	Yes		Yes			84128		Toyota	Camry LE	2000	Tan	4	Y	Y	N			
108	8/4/2004	Yes		Yes			84131		Chevrolet	Cavalier	1997	Green	4	Y	Y	N			
109	8/5/2004	Yes		Yes			84134		Mercury	Grand Marquis GS	1997	Green	4	Y	Y	N			
110	8/5/2004			Yes			84133		Buick	Century Limited	1998	Red	4	Y	Y	N			
112	8/5/2004	Yes		Yes			84135		Ford	Probe	1993	Red	2	N	Y	N			
113	8/5/2004	Yes		Yes			84138		Ford	Bronco	1995	Red	2	Y	Y	N			
114	8/5/2004	Yes							Chrysler	Concord	2000	Blue	4	N	Y				PEMS only - engine rebuilt approx. 3,000 miles
116	8/6/2004	Yes		Yes			84139		Ford	Escort ZX2	1999	Black	2	Y	Y	N			
117	8/6/2004	Yes		Yes			84140		Chevrolet	Blazer LS	2002	White	2	Y	Y	N			
118	8/6/2004	Yes							Lincoln	Towncar	1987	Black	4						PEMS only vehicle would not go into third gear. Transmission was slipping.
120	8/6/2004	Yes		Yes			84141		Honda	Accord	1990	Tan	4	Y	Y	N			
121	8/7/2004	Yes		Yes			84148		Dodge	Dynasty	1988	Gray	4	Y	Y	N			
123	8/6/2004	Yes		Yes			84145		Jeep	Cherokee	1990	White	4			N			
124	8/9/2004	Yes		Yes		Yes	84149		Ford	Escort	2002	Red	4	N	Y	N			
126	8/7/2004	Yes		Yes			84144		Plymouth	Voyager	1993	Green	3	N	Y	N			

Vehicle ID #	Date	Cond Run	Cond Rep	PEMS on dyne	PEMS on dyne Rep	Dway	Dyne Test	Dyne Rep	Make	Model	Model Year	Color	No of Doors	Fuel Collected (Y/N)	Oil Collected (Y/N)	Smoke Observ (N/L/M/H)	MIL during test (Y/N)	MILL Note (If MILL during test=Y)	Comments
		PEMS Testing Summary					Dyne Summary		General Vehicle Info (ERG)										
Round 1																			
127	8/9/2004	Yes		Yes			84150		Honda	Odyssey	2000	Green	4	N	Y	N			
128	8/9/2004	Yes		Yes	Yes		84151	84156	Honda	Accord	2000	Red	4	N	Y	N			
129	8/9/2004	Yes		Yes			84153		Ford	F150	2000	Blue	2	Y	Y	N			
132	8/7/2004	Yes		Yes			84146		Ford	Ranger XLT	1988	Blue	2	Y	Y	L			
133	8/10/2004	Yes							Honda	Accord LX	2001	Blue	4	N	Y				
134	8/10/2004	Yes		Yes		Yes	84157		Nissan	Sentra	1994	Blue	4	N	Y	N			
136	8/10/2004	Yes							Kia	Sportage	2003	Black	4						
138	8/10/2004	Yes		Yes		Yes	84162		Chrysler	LeBaron	1983	Burgundy	4	Y	Y	N			
139	8/11/2004	Yes		Yes			84161		Volvo	850	1997	Green	4	Y	Y	N			
140	8/11/2004	Yes	Yes	Yes			84166	84169	Mercury	Topaz GS	1994	White	4	N	Y	N			
141	8/11/2004	Yes		Yes			84160		Ford	Focus SE	2001	Green	4	N	Y	N			
142	8/11/2004	Yes		Yes			84164		Plymouth	Voyager	1999	Purple	4	Y	Y	N			
147	8/12/2004	Yes		Yes			84171		Honda	Civic DX	1988	Burgundy	4	N	Y	N			
148	8/12/2004	Yes		Yes			84168		Buick	Regal	1996	Gray	4	Y	Y	N			
149	8/12/2004	Yes	Yes			Yes	84172		Cadillac	Cimmaron	1986	Gray	4	Y	Y	N			
150	8/12/2004	Yes		Yes			84167		Ford	Ranger	1999	Green	2	N	Y	N			
151	8/14/2004	Yes		Yes	Yes		84175	84180	Pontiac	Bonneville	1988	Navy Blue/	4	Y	Y	L			
152	8/13/2004	Yes		Yes			84174		Mercury	Topaz	1994	Blue	4	N	Y	N			
153	8/13/2004	Yes		Yes			84173		Mercury	Sable	1996	Red	4	Y	Y	N			
154	8/14/2004	Yes		Yes			84179		Jeep	Cherokee	1998	Black	4	Y	Y	N			
159	8/14/2004	Yes					84182		Ford	Thunderbird LX	1995	Red	2	N	Y	N			
160	8/14/2004	Yes		Yes			84178		Toyota	Camry	1997	White	4	N	Y	N			
164	8/16/2004	Yes		Yes			84185		Toyota	Corolla	1996	Green	4	Y	Y	N			
165	8/16/2004	Yes		Yes			84184		Honda	Civic	2000	Gray	4	N	Y	N			
166	8/18/2004	Yes		Yes			84191		Toyota	Camry	2000	Tan	4	N	Y	N			
167	8/16/2004	Yes		Yes			84183		Toyota	Corolla	2000	White	4	N	Y	N			
169	8/17/2004	Yes		Yes			84189		Ford	F150	1984	Black	2	Y	Y	L			
171	8/17/2004	Yes							Subaru	Outback	2000	Green	4	N	N				PEMS only all wheel drive
173	8/17/2004	Yes		Yes			84188		Chevy	Monte Carlo	1977	Red	2	Y	Y				
175	8/18/2004	Yes		Yes			84193		Hyundai	Santa Fe	2001	Burgundy	4	N	Y	N			Please see enclosed receipts on EGR valve
176	8/18/2004								Mazda	Miata MX-5	2003	Red	2	Y	Y				
178	8/18/2004	Yes		Yes			84195		Chevy	Lumina	1999	Gold	4	Y	Y	N			
179	8/18/2004	Yes		Yes			84196		GMC	Safari	1993	White	2	Y	Y	N			
180	8/18/2004	Yes		Yes			84192		GMC	Sonoma SLS	2001	Red	2	N	Y	N			
181	8/19/2004	Yes		Yes	Yes		84198	84200	Saturn	SL1	1994	Lavendar	4	Y	Y	N			2 ERG packets enclosed, entered data from packet
182	8/19/2004	Yes		Yes			84197		Buick	Regal	1990	Red	2	N	Y	N			
187	8/20/2004	Yes							Chevrolet	Astro Van	1991	Blue	2	N	N				PEMS only all wheel drive
188	8/20/2004	Yes		Yes					Chevy	Caprice Classic	1986	Silver	4	Y	Y	L			
189	8/20/2004	Yes		Yes			84201		Chevy	S-10 Truck	1985	Blue	2	Y	Y	L			
193	8/21/2004	Yes							Ford	Econoline	1983	Gray	2	Y	Y				PEMS only too wide for dyne
194	8/21/2004	Yes		Yes			84208		Lincoln	Towncar	1989	White	4	Y	Y	N			
195	8/21/2004	Yes		Yes			84205		Ford	F150 Truck	1998	Beige	2	N	Y	N			
196	8/21/2004	Yes		Yes			84204		Ford	Windstar	1999	Burgundy	4	N	Y	N			Please note engine light comes on when you turn key. Participant knows this. Keri called.
197	8/21/2004	Yes		Yes			84206		Chevrolet	C 1500	1994	Red	2	N	Y	N			
199	8/23/2004	Yes		Yes			84209		Dodge	Stratus ES	1996	Black	2	N	Y	N			Third vehicle w/same plate (same as 181 & 236)
200	8/23/2004	Yes		Yes		Yes	84211		Ford	Tempo	1986	Gray	4	N	Y	N			
201	8/23/2004	Yes		Yes			84210		Mazda	MX-6	1988	Gray	2	N	Y	N			
203	8/23/2004	Yes		Yes		Yes	84213		Oldsmobile	Ninety Eight Regency	1985	White	4	Y	Y	N			
204	8/23/2004	Yes							Lincoln	Towncar	1987	Gold	4	N	N				PEMS only too wide for dyne
1012	8/24/2004	Yes	Yes	Yes		Yes	84215		Nissan	Maxima	1992	Blue	4	N	Y	N			
207	8/25/2004	Yes		Yes			84214		Pontiac	Bonneville	1994	Blue	4	N	Y	N			
208	8/25/2004	Yes					84216		Ford	F150	1990	White	2	Y	Y				Dyno Semtech - Semtech shutdown/locked up before test. No time to fix problem.

		PEMS Testing Summary					Dyne Summary		General Vehicle Info (ERG)										
Vehicle ID #	Date	Cond Run	Cond Rep	PEMS on dyne	PEMS on dyne Rep	Dway	Dyne Test	Dyne Rep	Make	Model	Model Year	Color	No of Doors	Fuel Collected (Y/N)	Oil Collected (Y/N)	Smoke Observ (N/L/M/H)	MIL during test (Y/N)	MILL Note (If MILL during test=Y)	Comments
Round 1																			
210	8/26/2004	Yes		Yes		Yes	84224		Ford	Taurus	2002	Silver	4	N	Y	N			Dway file blank, no data
212	8/25/2004	Yes		Yes			84219		Chrysler	Concord	1994	Teal	4	N	Y	N			File name corrupted
213	8/27/2004	Yes		Yes			84231		Oldsmobile	Eighty-Eight	1994	Plum	4	N	Y	N			
214	8/26/2004	Yes							Chevrolet	C10 (Truck)	1973	Yellow	2	N	N				PEMS only
215	8/26/2004	Yes		Yes			84221		Ford	Crown Victoria	1985	Light Gray	4	Y	Y	N			
216	8/25/2004	Yes		Yes			84220		Ford	Escort	1992	Red	4	N	Y	N			
219	8/26/2004	Yes		Yes			84225		Honda	Civic	2000	Beige	4	Y	Y	N			
221	8/26/2004	Yes		Yes			84227		Buick	Century	1997	Blue	4	Y	Y	N			
222	8/26/2004	Yes		Yes			84228		Pontiac	Grand Am	1992	Red	4	N	Y	N			Originally listed as dway, but none performed
223	8/26/2004	Yes		Yes			84223		Dodge	Grand Caravan	2005	Gray	4	N	Y	N			
225	8/27/2004	Yes		Yes			84233		Toyota	Corolla	1989	White	4	Y	Y	N			
226	8/27/2004	Yes		Yes			84230		Nissan	Sentra	1993	Red	2	N	Y	N			
228	8/27/2004	Yes		Yes			84229		Oldsmobile	Silhouette	2000	White	4	N	Y	N			Added oil (2 qts.)
232	8/28/2004	Yes		Yes			84234		Volkswago	Cabriolet	1991	Dark Blue	2	Y	Y	N			
233	8/28/2004	Yes		Yes			84239		Ford	Taurus	1987	Lt Blue	4	N	Y	N			
234	8/28/2004	Yes							Ford	F150 4x2	1987	Gray	2						PEMS only
235	8/28/2004	Yes		Yes			84238		Pontiac	6000	1988	White	4	N	Y	N			
236	8/28/2004	Yes		Yes			84236		Oldsmobile	Achieva	1992	Green	4	N	Y	N			Third vehicle w/same plate (same as 181 & 199)
237	8/28/2004	Yes		Yes			84235		Geo	Prism	1990	Blue	4	Y	Y	N			
239	8/30/2004	Yes		Yes			84244		Ford	Escort	1993	Burgundy	4	N	Y	N			Originally listed as dway, but none performed
240	8/30/2004	Yes		Yes			84241		Ford	Contour	1998	Lt Blue	4	N	Y	N			
241	8/30/2004	Yes							Cadillac	Sedan de Ville	1993	Red	4	N	Y				
243	8/30/2004	Yes		Yes			84245		Honda	Accord	1987	Dirty Silver	2	N	Y	N			
244	8/30/2004	Yes		Yes			84240		Infiniti	I30	1998	Gold	4	N	Y	N			
245	8/30/2004	Yes		Yes			84242		Plymouth	Voyager	1997	Blue	4	N	Y	N			
246	8/31/2004	Yes		Yes			84246		Eagle	Talon	1994	Green		Y	Y	N			
247	8/31/2004	Yes		Yes			84248		Ford	Ranger	1987	Blue	2	Y	Y	N			Fixing brakes - 2 pm pick up 9/2
248	8/31/2004	Yes		Yes			84257		Volvo	240 GL	1983	Silver	4	Y	Y	N			
249	8/31/2004	Yes		Yes			84256		Chevy	S-10	1989	Blue	2	Y	Y	N			Keeping extra day - pick up 9/2
250	8/31/2004	Yes		Yes			84250		Ford	Escort	1987	Gray	4	Y	Y	N			New windshield from Buckner's
253	9/1/2004	Yes		Yes			84254		Buick	Regal	1992	Blue	4	N	Y	N			
254	9/1/2004	Yes		Yes		Yes	84253		Mercury	Sable	1997	Gray	4	Y	Y	N			
255	9/1/2004	Yes		Yes			84252		Ford	Taurus	2001	Gray	4	Y	Y	N			
259	9/1/2004	Yes							Plymouth	Acclaim	1990	Blue	4	N	N				PEMS only, exhaust leak
282	9/8/2004	Yes		Yes	Yes	Yes	84258	84262	Oldsmobile	Delta 88	1991	White	4	N	Y	N			
290	9/8/2004			Yes			84263		Dodge	Ram 50	1989	Red	2	Y	Y	N			
293	9/8/2004	Yes		Yes			84261		Toyota	Camry	1989	Blue	4	Y	Y	N			
294	9/8/2004	Yes		Yes			84265		Buick	Century	1984	Lt Brown	4	N	Y	N			
297	9/9/2004	Yes		Yes			84266		Kia	Sephia	2000	Gold	4	Y	Y	N			
298	9/9/2004	Yes		Yes			84267		Chevy	Cavalier	1989	Gray	2	N	Y	N			
299	9/9/2004	Yes		Yes			84271		Buick	LeSabre	1979	Lt. Tan	4	Y	Y	N			
300	9/9/2004	Yes		Yes			84268		Ford	F150	1994	White	2	Y	Y	N			
301	9/9/2004	Yes		Yes			84270		Mercury	Grand Marquis	1986	White	4	Y	Y	N			
302	9/10/2004	Yes		Yes			84276		Buick	Electra Park Ave	1989	Gold	4	N	Y	N			
304	9/10/2004	Yes		Yes			84274		Ford	Aspire	1995	Red	4	N	Y	N			

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Round 1																			
305	9/10/2004	Yes		Yes			84272		Honda	Accord	2001	Blue	4	N	Y	N			
306	9/11/2004	Yes		Yes			84273		Jeep	Grand Cherokee	1995	Black	4	Y	Y	N			PEMS only
307	9/10/2004	Yes		Yes			84278		GMC	Jimmy	1990	Red & Whi	2	N	Y	N			
308	9/10/2004	Yes					84277		MG	MG	1978	Brown	2	Y	Y	N			
309	9/13/2004	Yes		Yes			84286		Oldsmobile	Silhouette	1997	White	3	N	Y	N			
312	9/14/2004	Yes		Yes			84285		Honda	Civic	2000	Gray	2	N	Y				
314	9/13/2004	Yes		Yes			84287		GMC	Sierra	1995	Red	2	N	Y				THC @ startup approx. 7000 ppm
315									Dodge	Pickup	1968								Rejected - Hazard on dyne, incapable of proper testing
316	9/14/2004	Yes		Yes			84291		Honda	Civic	1997	Black	2	N	Y	N			THC 5,000
317	9/13/2004	Yes		Yes		Yes	84289		Oldsmobile	stom Cruiser Station Wa	1984	Gold	4	Y	Y	L			THC reading over 10,000
318	9/14/2004	Yes		Yes			84293		Volvo	GL	1984	Gray	4	N	Y	N			
319	9/14/2004	Yes		Yes			84295		Chevy	Caprice	1987	Blue	4	Y	Y	N			
321	9/14/2004	Yes							Dodge	Ram	1997	White	2	N	N				PEMS only too wide for dyne
322	9/15/2004	Yes		Yes			84302		Ford	F150	1993	White	2	Y	Y	N			
323	9/14/2004	Yes		Yes			84301		Pontiac	Grand Prix	1989	Gray	2	N	Y	N			
324	9/14/2004	Yes		Yes			84300		Buick	LeSabre	1990	Silver		Y	Y	N			THC 4,000
325	9/15/2004	Yes		Yes			84297		Dodge	Stratus	1996	Blue	4	N	Y	N			
326	9/14/2004	Yes		Yes			84292		Toyota	Camry	1997	White	4	N	Y	N			
327	9/15/2004	Yes		Yes			84298		Dodge	Durango	1999	Red	4	Y	Y	N			
328	9/15/2004	Yes		Yes			84296		Honda	Civic	1998	Black	4	N	Y	N			
329	9/15/2004	Yes		Yes			84304		Honda	Civic	2001	Gray	2	N	N	N			
330	9/16/2004	Yes		Yes			84307		Honda	Accord	1992	White	4	N	Y	N			
331	9/15/2004	Yes		Yes			84308	84312	Pontiac	Grand Am	1994	Green	2	N	N	N			THC 11,572 start up engine stall
332	9/16/2004	Yes		Yes	Yes		84305		Chevrolet	Malibu	1999	Gray	4	N	Y				THC 9,000 start up
333	9/16/2004	Yes		Yes			84303		Oldsmobile	Silhouette	2002	Tan	4	N	Y	N			
335	9/16/2004	Yes			Yes		84309		Mercedes	280 SE	1973	Gray	4	Y	Y	N			
336	9/16/2004	Yes							Chevy	G-20	1993	Blue	3	N	N				PEMS only too wide for dyne
337	9/20/2004	Yes							Ford	F150	1997	Burgundy	2	Y	Y				PEMS only too long for dyne, must go on long PEMS only route
338	9/17/2004	Yes		Yes			84310		Chevy	Venture	2003	Silver	4	N	Y	N			
339	9/17/2004	Yes		Yes			84315		Plymouth	Voyager	1991	Blue	3	N	Y	N			THC 7,500 start up
341	9/17/2004	Yes		Yes			84316		Dodge	Avenger	1996	Black	2	N	Y	N			
343	9/17/2004	Yes		Yes			84311		Toyota	Corolla	1989	Gray	2	Y	Y	N			
344	9/18/2004	Yes		Yes			84318		Nissan	Sentra	1997	Red	4	N	Y	N			THC 8,800 startup
346	9/18/2004	Yes		Yes			84322		Toyota	Camry	1990	Gold	4	Y	N	N			
347	9/18/2004	Yes		Yes			84317		Nissan	Altima	2000	Green	4	Y	Y	N			THC 21.9 start up on 1,000 & 10,000
348	9/17/2004	Yes		Yes			84314		Plymouth	Sundance	1989	Red	2	N	N	N			THC 7.9 - on start
982	9/18/2004	Yes		Yes			84319		Toyota	Camry	1998	Gold	4	N	Y	N			
349	9/29/2004	Yes		Yes			84375		Ford	Windstar	2001	White	4	Y	N	N			
350	9/18/2004	Yes	Yes	Yes			84321	84328	Toyota	Avalon	1996	Tan	4	N	Y	N			THC 9,200 startup
351	9/20/2004	Yes		Yes			84325		Nissan	Maxima	1997	Green	4	N	Y	N			
352	9/20/2004	Yes		Yes			84324		Toyota	Camry	1999	Gray	4	N	Y	N			THC 3200 on start
354	9/20/2004	Yes		Yes			84327		Ford	Taurus	1998	Lt. Blue	4	N	Y	N			THC 4,000 start up
355	9/20/2004	Yes		Yes			84329		Jeep	Wrangler	1997	Red	2	Y	Y	N			THC 58,000 start up
356	9/20/2004	Yes		Yes			84323		Kia	Rio	2004	White	4	Y	Y	N			
358	9/21/2004	Yes		Yes			84334		Chevrolet	Caprice-estate	1990	Gray	4	Y	Y	N			
359	9/21/2004	Yes		Yes			84335		Mercury	Grand Marquis	1988	White	4	Y	Y	N			

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Round 1																			
360	9/20/2004	Yes		Yes			84336		Toyota	Pickup	1987	Blue	2	Y	Y	L			THC 15,000
361	9/21/2004	Yes		Yes			84330		Chevy	Cavalier	2004	Black	4	N	Y	N			THC 2,200 startup
363	9/21/2004	Yes	Yes	Yes			84332	84341	Pontiac	Grand Am SE	1997	Tan	4	N	Y	N			THC 13,000 start up
364	9/21/2004	Yes	Yes	Yes			84331	84338	Saturn	Sedan	2001	White	4	N	Y	N			
367	9/22/2004	Yes		Yes			84339		Plymouth	Voyager	1999	Green	4	Y	Y	N			Added a quart and a half of oil
368	9/22/2004	Yes		Yes			84342		Toyota	Camry	1994	Dark Green	4	Y	Y	N			THC 8,000 start up
369	9/22/2004	Yes	Yes	Yes			84337		Ford	Ranger	2003	Tan	2	Y	Y	N			
372	9/23/2004	Yes		Yes			84343		Kia	Sedona	2004	Tan	4	N	Y	N			THC 9,800 start up
373	9/23/2004	Yes		Yes			84347		Toyota	Corolla	1995	Green	4	Y	Y	N			Start THC ~ 3,300 ppm C
374	9/23/2004	Yes		Yes			84344		Toyota	Sienna	2000	Tan	4	N	Y	N			THC 11,000 start up
377	9/23/2004	Yes	Yes						Oldsmobile	Cutlass	1987	Gray	2	N	Y				Died on preconditioning route #2, never was on dyne, start THC 24,000 ppm
379	9/24/2004	Yes		Yes			84345	84350	GM/Chevy	Lumina	1997	Red	4	N	Y	N			Check oil light came on after test, added 1/2 qt. oil, THC 11,400 start up
381	9/24/2004	Yes	Yes	Yes			84351		Ford	Contour	1996	Tan	4	N	Y	N			Start THC 5,900 ppm C
383	9/24/2004	Yes	Yes	Yes			84354		Ford	F150	1989	Blue	2	Y	Y	N			Start THC ~ 10,000 ppm C
384	9/24/2004	Yes		Yes			84353		Saturn	Wagon	1993	Red	4	Y	Y	N			THC 8,500 start up, Extended route for PEMS was ran
385	9/24/2004	Yes		Yes			84349		Chevrolet	Tracker	2003	Burgundy	4	Y	Y	N			THC start up 11,000
386	9/11/2004	Yes		Yes	Yes	Yes	84284		Chevrolet	Caprice Classic Wagon	1987	Blue	4	Y	Y	N			B000038 on drive away
387	9/11/2004	Yes		Yes			84280		Ford	Escort	1999	Green	2	N	Y	N			
388	9/11/2004	Yes		Yes			84279		Toyota	Camry	2001	White	4	N	Y	N			
389	9/11/2004	Yes		Yes			84283		Dodge	Ram	1986	Red	2	Y	Y	N			Muffler on truck was broke
390	9/11/2004	Yes		Yes	Yes		84281		Chevy	Suburban	1995	Tan	4	N	Y	N			
394	9/25/2004	Yes	Yes	Yes			84359		Toyota	Corolla	1992	Blue/Gray	4	N	Y	N			Start THC ~ 4,400 ppm C, Have to fix muffler in order to test
395	9/25/2004	Yes		Yes			84356		Pontiac	Grand Am	1997	Dark Green	4	N	Y	N			THC 8,000 start up, Alignment is off
398	9/25/2004	Yes		Yes			84357		Mercury	Tracer	1995	Red	4	N	Y	N			THC 4,000 start up, Screw/bolt has been replaced from exhaust to manifold and possibly coming loose again
399	9/25/2004	Yes		Yes			84355		Chevrolet	Lumina	2001	Burgundy	4	Y	Y	N			Start THC ~ 5,000 ppm C, Added fuel
416	9/27/2004	Yes		Yes			84362		Ford	Taurus SE	1998	Tan	4	N	Y	N			THC 8,300 start up
417	9/27/2004	Yes		Yes			84363		Toyota	Corolla	1996	White	4	Y	Y	N			Start THC ~ 4,700 ppm C
419	9/27/2004	Yes		Yes			84361		Nissan	Maxima	2002	Gray	4	Y	Y	N			Start THC ~ 5,000 ppm C
420	9/27/2004	Yes	Yes	Yes			84367		Mercedes	Sel	1980	Brown	4	N	Y	N			THC 11,000
421	9/27/2004	Yes		Yes			84365		Ford	Taurus	1993	Silver	4	N	Y	N			THC 5,500 start up
424	9/28/2004	Yes	Yes	Yes			84373		Chevrolet	Astro	1990	Red		Y	Y	N			Start THC ~ 11,000 ppm C, To turn key ignition switch loose
425	9/28/2004	Yes	Yes	Yes			84369		Volvo	850 Turbo	1996	Red	4	N	Y	N			THC 7,000 start up, Do not mess with radio, Rotors?, Check engine light is on
426	9/28/2004	Yes		Yes			84372		Toyota	Camry	1994	Beige	4	N	Y	N			THC 11,000 start up
427	9/28/2004	Yes		Yes			84368		Saturn	SL1	1997	Tan	4	N	Y	N			THC 4,000 start up
428	9/28/2004	Yes		Yes			84370		Ford	Taurus	1995	Green	4	N	Y				Start THC = 9,700 ppm C
429	9/27/2004	Yes	Yes	Yes			84366		Oldsmobile	Cutlass Wagon	1989	White	4	N	Y	N			Start THC ~ 9,800 ppm C, Leak in muffler?
430	9/29/2004	Yes		Yes			84376		Honda	Odyssey	2000	Gray	4	N	Y	N			Start THC 9,700 ppm C, Check engine light, Vehicle License - Shown as VEM 439 and VEM 432

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		PEMS Testing Summary					Dyne Summary		General Vehicle Info (ERG)										
Round 1																			
432	9/29/2004	Yes		Yes			84380		Lincoln	Continental	1995	Green	4	Y	Y	N			Start THC ~ 5,500 ppm 1
433	9/29/2004	Yes							Ford	F-150	1989	Red	2	N	N				PEMS only, Gas gauge does not work, Start THC = 9,000 ppm C
434	9/29/2004	Yes		Yes			84381		Mercury	Marquis	1994	Blue		Y	Y	N			Start THC ~ 5,400 ppm C
436	9/29/2004	Yes		Yes			84379		Pontiac	Grand Am GT	1998	Red	2	Y	Y	N			Start THC ~ 5,500 ppm C
437	9/30/2004	Yes		Yes			84383		Toyota	Camry	1996	Gray	4	Y	Y	N			
438	9/30/2004	Yes							Chevrolet	Avalanche	2002	Tan	4	N	N				Start THC ~ 4,000 ppm C, PEMS only too long for dyne
439	9/30/2004	Yes		Yes			84384		GEO	Prism	1996	Green	4	Y	Y				Missing gas cap
440	9/30/2004	Yes							Ford	Bronco	1990	Green	2	N	N				PEMS only too wide for dyne
441	9/29/2004	Yes		Yes			84377		Honda	Accord	1997	Red	4	Y	Y	N			THC 2,000
442	9/30/2004	Yes		Yes			84386		Nissan	Maxima	1990	Burgundy	4	N	Y	N			
443	9/30/2004	Yes		Yes			84382		Volkswago	Cabrio	1999	Green	2	Y	Y	N			Start THC ~ 4,100 ppm C
Round 2																			
530	1/11/2005	Yes		Yes			84396		Ford	Escort LX	1995	Green	2	N	Y	N			Flow meter J04-SE06; clean c
531	1/11/2005	Yes		Yes			84397		Chevrolet	Silverado	1976	Yellow & W	2	N	Y	H			Flow meter K04-5E03; 3 qt of
532	1/11/2005	Yes		Yes			84393		Chrysler	300M	1999	Burgundy	4	N	Y	N		Coolant temp 55.40 deg	Oil dirty, J04-SE05.
533	1/11/2005	Yes		Yes			84394		Honda	Odyssey	2000	Dark Green	4	Y	Y	N		Engine coolant 44.6 deg	Clean oil, flow meter J04-SE0
534	1/12/2005	Yes		Yes			84399		Honda	Accord	1997	Dark Green	4	N	Y	N		Engine coolant 39.2 deg	Oil clean, flow meter J04-SE0
537	1/12/2005	Yes		Yes			84401		Plymouth	Voyager	1998	Gold	4	Y	Y	N		Engine coolant 30.2 deg	Flow meter J04-SE05 (flow m
538	1/12/2005	Yes		Yes			84398		Honda	Accord	2001	Black	4	N	Y	N		Engine coolant 44.60 de	Oil clean, J04-SE05, 18.8 mpg
539	1/12/2005	Yes		Yes			84402		Honda	Civic	1991	Red	4	N	Y	N			Oil dirty, FM# J04-SE06, 19.0
540	1/13/2005	Yes					84406		Toyota	Corolla	1995	Turquoise	4	Y					Oil clean, FM J04 SE06, 19.8
541	1/13/2005	Yes					84404		Dodge	Caravan	1997	Green	4	N	Y	N			Flow meter H04-SE02, oil clea
542	1/13/2005	Yes		Yes			84407		Pontiac	Grand AM	1989	Gray	2	N		N			Flow meter J04-SE05, oil clea
543	1/13/2005	Yes		Yes			84403		Dodge	Caravan	2000	White	2	N	Y	N		Engine coolant 28.4 deg	9.628 mpg
544	1/14/2005	Yes					84408		Mercury	Sable	2002	Grey	4	N	Y				Oil clean, FM #J04-SE05
545	1/14/2005	Yes		Yes			84413		Ford	F250	1979	Dark Brown	2	N	Y				Oil dirty, FM #K04-SE03.
546	1/14/2005	Yes		Yes			84409		Chevrolet	Malibu	1999	Gray	4	N	Y				Oil dirty.
547	1/14/2005	Yes		Yes			84412		Honda	Civic	1996	Dark Green	2	N	Y				Oil clean, flow meter J04-SE0
548	1/14/2005	Yes		Yes			84411		Saturn		1996	Purple	2	N	Y				Model - nothing recorded here
549	1/15/2005	Yes		Yes			84419		Chevrolet	Lumina	1998	Maroon	4	N	Y	N		Engine coolant 32 deg F	Oil moderate, flow meter H04-
550	1/15/2005	Yes		Yes			84418		Pontiac	Grand Am	1997	Gold	4	N	Y	N			Oil clean.
551	1/15/2005	Yes		Yes			84414		Chevrolet	Impala	2003	Silver	4	N	Y			Engine coolant 39.2 deg	Oil clean, flow meter H04-SE0
552	1/15/2005	Yes		Yes			84415		Dodge	Durango	1999	Red	4	Y	Y	N		Engine coolant 32 deg F	Oil clean, flow meter K04-SE0
553	1/15/2005	Yes		Yes			84416		Honda	Civic	1998	Black	4	N	Y	N		Engine coolant 32 deg F	Oil clean, flow meter #J04-SE
559	1/17/2005	Yes		Yes	Yes		84422		Jeep	Cherokee	1998	Burgundy	4	Y	Y			Coolant temp 35.6 deg	Oil dirty, flow meter K04-SE03
555	1/17/2005	Yes		Yes			84425		Jeep	Grand Cherokee	1995	White	4	N	Y	N			Oil moderate, fuel economy 8.
556	1/16/2005	Yes		Yes			84420		Honda	Accord	2000	Red	4	Y	Y	N		Coolant temp 39.2 deg	Flow meter J04-SE05, oil clea
557	1/17/2005	Yes		Yes			84424		Ford	Explorer	1995	Black	4	Y	Y	N			Oil dirty, K04-SE03, mileage 8
558	1/16/2005	Yes		Yes			84421		Saturn	LS1	2000	Gray	4	Y	Y	N		Engine coolant 37.4 deg	Flow meter J04-SE05, 25.0 m
562	1/18/2005	Yes		Yes			84428		Chevy	Malibu	1998	Burgundy	4	N	Y	N	N		Oil clean, J04-SE05, fuel econ
563	1/18/2005	Yes		Yes			84430		Dodge	Spirit	1990	White	4	Y	Y	N			Flow J04-SE06, oil dirty, milea
564	1/18/2005	Yes		Yes			84426		Saturn	SC2	2001	Burgundy	4	Y	Y	N		Engine coolant 44.6 deg	Flowmeter J04-SE05, oil clean
565	1/18/2005	Yes		Yes			84427		Mitsubishi	Galant	2001	Cream	4	N	N	N			Flow J04-SE05, mileage 22.3
566	1/18/2005	Yes		Yes			84431		Mercury	Grand Marquis Station W	1991	Burgundy	4	Y	Y	N	N		Oil clean, mileage 9.9
567	1/18/2005	Yes	Yes	Yes			84433		Jeep	Wrangler	1997	Red	2	Y	Y	N			Oil clean, flow K04-SE03, 9.1
568	1/19/2005	Yes		Yes			84437		Toyota	Camry	1994	Green	4	Y	N	N			Flow meter J04-SE05; oil clea
1013	1/19/2005	Yes	Yes		Yes		84442		Toyota	Camry	1994	Green	4	Y	N	N			Oil medium; mpg 22.194. Dup
569	1/19/2005	Yes		Yes			84436		Chevrolet	S-10	1995	White	2	Y	N	N			Flow meter K04-SE03; 10.2 m
570	1/19/2005	Yes		Yes			84432		Saturn	Sedan	1999	Burgundy	4	Y	N		N	Fuel economy 27.32; en	Oil medium; flow J04-SE06

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Vehicle ID #	Date	Cond Run	Cond Rep	PEMS on dyne	PEMS on dyne Rep	Dway	Dyne Test	Dyne Rep	Make	Model	Model Year	Color	No of Doors	Fuel Collected (Y/N)	Oil Collected (Y/N)	Smoke Observ (N/L/M/H)	MIL during test (Y/N)	MILL Note (If MILL during test=Y)	Comments
Round 1																			
571	1/18/2005	Yes		Yes			84434	84440	Buick	Park Avenue	1995	Blue	4	N	N	N			Oil dirty; flow meter K04-SE03
572	1/20/2005	Yes							Chevy	Silverado	2002	Grey	2	Y					Oil clean; flow K04-SE03; mile
574	1/20/2005	Yes		Yes			84438		Buick	Century	2001	Dark Blue	4	N	N	N			Oil clean; flow meter K04-SG0
575	1/20/2005	Yes							Ford	F150	2001	White	4	Y	N				Oil clean; flow meter K04-SE0
576	1/20/2005	Yes		Yes			84443		Geo	Prizm	1991	Burgundy	4	Y	N	N			FM J04-SE06; oil dirty; mileag
577	1/19/2005	Yes		Yes			84439		Pontiac	Bonneville	1995	Green	4	Y	N				Oil medium; flow K04-SE03; n
579	1/21/2005	Yes		Yes			84446		Toyota	Sienna	2000	Silver	4	Y	N		N		Oil clean; flow K04-SE03; mile
580	1/21/2005	Yes		Yes			84448		Plymouth	Voyager	1999	Green	4	Y	N				Oil clean; flow meter K04-SE0
581	1/21/2005	Yes		Yes			84445		Saturn	Sedan	2001	White	4	N	N				Oil dirty; flow J04-SE06; milea
582	1/21/2005	Yes		Yes			84444		Chevrolet	Tracker	2003	Burgundy	4	Y	N	N			Oil dirty; flow J04-SE06; milea
583	1/21/2005	Yes	Yes		Yes		84449	84451	Buick	Regal	1994	Purple	4	Y	N	N			Oil clean; flow K04-SE03; mile
584	1/22/2005	Yes		Yes			84453		Nissan	Maxima	1995	Black	4	N	N	H			Oil dirty; flow J04-SE03; milea
585	1/22/2005	Yes		Yes			84452		Ford	Taurus	1995	White	4	N	N	N			Oil medium; mileage 19.2
586	1/22/2005	Yes		Yes			84456		Pontiac	Grand Prix Le	1993	Champagn	4	N	N	M			Oil dirty; flow J04-SE06; milea
587	1/25/2005			Yes			84455		Ford	Mustang	1995	Crismon	Coupe Conv	Y	N	N			This vehicle was not PEMED.
593	1/25/2005	Yes		Yes			84458		Ford	Aerostar	1993	Burgundy	2 + hatchba	Y	Y	L			Oil clean; flow K04-SE03; mp
594	1/25/2005	Yes		Yes			84462		Plymouth	Voyager	1989	Blue	2 + hatch	Y	Y	M			Oil dirty; flow K04-SE03; mpg
595	1/26/2005	Yes		Yes			84467		Ford	Ranger	1988	Dark Blue	2	N	Y	M			Oil clean; F.M. #I04-SE08; mp
596	1/25/2005	Yes		Yes			84457		Ford	Crown Victoria	1995	Black	4	Y	Y	L			Oil clean; flow K04-SE03; mp
597	1/25/2005	Yes		Yes			84459		Ford	Aerostar	1992	Burgundy	4	N	N				Oil dirty; flow J04-SE06; mpg
599	1/26/2005	Yes	Yes	Yes	Yes		84465	84468	Chevy	Lumina LS	1994	Light Blue	2 + hatch	N	Y	M			Oil dirty; flow I04-SE03; mpg 1
600	1/26/2005	Yes		Yes			84463		Ford	Contour	1995	Green	4	Y	Y	N			Oil dirty; flow I04-SE08; mpg 2
602	1/26/2005	Yes		Yes			84464		Dodge	Intrepid	1994	Burgundy	4	N	Y	L			Oil medium/dirty; flow K04-SE
605	1/27/2005	Yes		Yes			84469		Dodge	Caravan	1989	Grey	2 + hatch	Y	Y	M			Oil dirty; mpg 21.389
606	1/27/2005	Yes							Chevrolet	Silverado 1500	1996	Black	2	Y	Y				Oil medium; flow K04-SE03; n
607	1/28/2005	Yes		Yes			84475		Ford	Tempo	1986	Gray	4	N	Y				Oil clean; 15.2 mpg; flow mete
608	1/27/2005	Yes		Yes			84470		Mercedes	280 SE	1973	Silver	4	Y	Y	L			Oil medium; mpg 7.2; flow I04
609	1/27/2005	Yes		Yes			84472		Chevrolet	Monte Carlo	1977	Red	2	Y	Y	M			Oil dirty; flow I04-SE03; mpg 1
611	1/28/2005	Yes		Yes			84473		Ford	Explorer	1996	Blue	4	Y	Y				Oil dirty; flow meter K04-SE03
612	1/28/2005	Yes		Yes			84477		Dodge	Ram	1989	Red	2	N	Y				Oil dirty; flow meter L04-SE13
614	1/28/2005	Yes		Yes			84474		Honda	Civic	1988	Burgundy	4	N	Y				Flow meter L04-SE13; mpg 20
616	1/29/2005	Yes							Jeep	Cherokee	1998	White	4 + hatch	Y	N				Oil clean; flow K04-SE04; mp
617	1/29/2005	Yes		Yes			84478	84483	Dodge	Neon	1996	Blue	4	N	Y	N			Oil clean; flow L04-SE13; mp
618	1/29/2005	Yes		Yes	Yes	Yes	84482	84484	Buick	Lasabre	1979	Yellow	4	Y	Y	M			Flow meter K04-SE03; oil dirty
619	1/29/2005	Yes		Yes			84479		Dodge	Caravan	1996	Green	4 + hatch	Y	Y	N			Oil dirty; flow K04-SE03; mpg
622	1/31/2005	Yes		Yes			84487		Mazda	B2200	1992	Green	2	Y	Y	N			Oil dirty; flow meter I04-SE08;
623	1/31/2005	Yes	Yes	Yes	Yes		84485	84490	Cadillac	Fleetwood	1991	White	4	Y	Y	N			1/31/05 - flow meter I04-SE03
624	1/31/2005	Yes							Ford	Ranger	1990	Grey	2	N	Y				Oil dirty; flow meter J04-SE06
625	2/2/2005	Yes							Buick	Rainer	2004	White	4 + hatch	Y					Oil clean; flow K04-SE03; mp
626	2/1/2005	Yes		Yes			84489		Toyota	Truck	1987	Blue	2	Y	Y	L			Date - Actual test 2/2/05. Oil c
627	2/1/2005	Yes	Yes	Yes			84488		Buick	Lesabre	1995	Dark Blue	4	N	Y	L			Oil dirty; FM# K04-SE03; mpg
628	2/1/2005	Yes		Yes			84492		Chevy	C10 Silverado	1984	Tan	2	Y	Y	L			Oil dirty; flow meter K04-SE03
631	2/2/2005	Yes		Yes			84494		Ford	Ranger XLT	1997	White	2 + hatch	Y	Y	N			Oil dirty; flow J04-SE06; mpg
632	2/2/2005	Yes		Yes			84495		GMC	Sonoma	1996	Red	2	Y	Y	N			Oil medium; flow J04-SE06; m
633	2/2/2005	Yes		Yes			84493		Ford	Freestar SEL	2004	Light Gree	4 + hatch	Y	Y	N			Oil medium; flow I04-SE03; m
634	2/2/2005	Yes		Yes			84497		Toyota	4Runner SR5	1995	Black	4 + hatch	Y	Y	N			Oil clean; flow K04-SE03; mp
635	2/2/2005	Yes							Chevy	Suburban	1995	White	4	Y	Y				Oil clean; flow meter I04-SE03
638	2/3/2005	Yes		Yes			84498		Toyota	Sienna XLE	2001	Champagn	4 + hatch	Y	Y	N			Oil clean; flow K04-SE03; mp
639	2/3/2005	Yes		Yes			84499		Acura	Integra	1995	Dark Gree	2	N	Y	N			Oil clean; flow L04-SE13; mp
640	2/3/2005	Yes		Yes			84500		Nissan	Frontier	1998	White	2	Y	Y	N			Oil medium; flow I04-SE08; m
641	2/3/2005	Yes		Yes			84502		Chrysler	Concord	1996	Burgundy	4	N	Y	N			Oil dirty; mileage 18.701; FM#
642	2/4/2005	Yes		Yes			84503		Ford	Taurus	2002	Grey	4	N	Y	N			Oil clean; flow I04-SE03; mpg
643	2/4/2005	Yes		Yes			84504		Chrysler	Concord LXI	2000	Silver	4	N	Y				Oil clean; flow K04-SE03; mp

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Round 1																			
644	2/4/2005	Yes		Yes			84505		Dodge	Intrepid	1993	Brown/Gre	4	N	Y	N			Oil clean; flow I04-SE03; mpg
645	2/4/2005	Yes							Ford	F150	1989	Tan/Brown	2	Y	Y				Oil dirty; mpg 11.0125; flow m
646	2/5/2005	Yes		Yes			84509		Chevrolet	Astrovan	1992	White	2 + back	Y	Y	N			Oil medium; flow K04-SE03; r
647	2/5/2005	Yes		Yes			84510		Chevy	Suburban	1994	White	4	Y	Y	N			Oil clean; flow I04-SE03; mpg
648	2/5/2005	Yes							Ford	F150	2001	White	4	Y					Mpg 16.26; FM #I04-SE03. PI
649	2/5/2005	Yes		Yes			84508		Honda	Civic	1992	Dark Grey	4	Y	Y	N			Oil dirty; flow meter L04-SE13
651	2/6/2005	Yes		Yes			84512		Chevy	Caprice	1982	Blue	4	Y	Y	H			Oil dirty; flow H04-SE08; mpg
521	2/8/2005	Yes		Yes			84513		Mitsubishi	Montero	2003	Black	4	N	Y	L			Mpg 8.26; flow meter K04-SE
984	2/7/2005	Yes		Yes			84515		Dodge	Stratus	1999	Beige	4	N	Y	N			Oil medium; flow K04-SE01; r
653	2/7/2005	Yes		Yes			84514		Chrysler	Concorde	2002	Champagn	4	N	Y	N			Oil dirty; flow H04-SE08; mpg
654	2/7/2005	Yes		Yes			84518		Buick	Skylark	1994	Red	4	N	Y				Oil clean; flow H04-SE08; mp
655	2/8/2005	Yes					84525		Chevrolet	Astro Van	1993	Blue	2 + hatch	Y	Y				Oil dirty; flow H04-SE08; mpg
656	2/8/2005	Yes		Yes			84519		Dodge	Caravan	1992	White	4	N	Y	N			Oil dirty; flow meter K04-SE03
660	2/8/2005	Yes		Yes			84517		Dodge	Grand Caravan	1998	White	4	Y	Y	N			Oil clean; fm #H04-SE08; mp
661	2/9/2005	Yes		Yes			84526		Lincoln	Towncar	1991	Blue Navy	4	Y	Y	N			Oil dirty; flow I04-SE03; mpg r
662	2/8/2005	Yes		Yes			84524		Isuzu	Pickup	1995	Red	2	Y	Y	N			Flow meter I04-SE08; oil clea
663	2/8/2005	Yes		Yes			84520		Ford	Taurus	2001	Grey/Silver	4	N	Y	N			Oil medium; flow H04-SE08; r
664	2/9/2005	Yes		Yes			84521		Honda	Accord	1997	White	4	N	Y	N			Oil medium; flow K04-SE01; r
667	2/8/2005	Yes		Yes			84522		Chevy	C1500	1996	Red	2	Y	Y	N			Oil dirty; flow I04-SE03; mpg 1
1014	2/9/2005	Yes		Yes			84528		Mercury	Grand Marquis	1994	Dark Blue	4	Y	Y	N			Oil moderate; FM #I04-SE03;
668	2/9/2005	Yes		Yes			84527		Dodge	Ram PU	1995	Burgundy	2	Y	Y	N			Oil clean; flow H04-SE08; mp
670	2/9/2005	Yes		Yes			84531		Geo	Tracker	1992	Yellow	2	Y	Y	N			Mpg 20.762; oil dirty
671	2/9/2005	Yes		Yes			84529		Plymouth	Sundance	1992	Green	4	Y	Y	N			Oil dirty; flow K04-SE01; mpg
674	2/10/2005	Yes							Honda	CRV	1998	Red	4	N	N				Oil clean; flow L04-SE13; mp
675	2/10/2005	Yes		Yes			84533		Chevy	Suburban	1999	Grey	4	Y	Y	N			Flow meter H04-SE08; oil dirt
676	2/10/2005	Yes		Yes			84534		Subaru	Legacy Wagon	1993	Burgundy	4	N	Y	N			Oil medium; flow K04-SE01; r
677	2/10/2005	Yes		Yes		Yes	84532		Pontiac	Montana	2003	White	4	N	Y	N			Oil clean; flow H04-SE08; mp
679	2/11/2005	Yes		Yes		Yes	84538		Ford	Ranger	1998	Red	2	Y	Y	N			Oil clean; flow meter I04-SE0
680	2/11/2005	Yes		Yes			84539		Chevy	Tahoe	1996	Burgundy	4	N	Y	N			Oil clean; flow I04-SE03; mpg
681	2/11/2005	Yes	Yes	Yes	Yes		84541	84542	Dodge	Grand Caravan	1996	White	4	N	Y	N			Oil dirty; flow K04-SE01 (2 in
682	2/11/2005	Yes	Yes	Yes	Yes		84537	84543	Jeep	Cherokee Sport	2000	Gray	4	Y	Y	N			Oil clean; flow meter H04-SE
685	2/14/2005	Yes		Yes			84546		Dodge	Dakota	1999	Blue	2	Y	Y	N			Oil clean; mpg 17.098
686	2/14/2005	Yes		Yes			84547		Toyota	Corolla	1995	Green	4	Y	Y	N			Oil dirty; flow meter K04-SE01
985	2/14/2005	Yes		Yes			84548		Dodge	Intrepid	1995	Burgundy	4	N	Y	N			Oil dirty; flow H04-SE08; mpg
689	2/14/2005	Yes		Yes		Yes	84550		Lincoln	Town Car	1988	Black	4	N	Y				Oil clean; flow H04-SE08; mp
693	2/15/2005	Yes		Yes			84551		Isuzu	Axiom	2002	Beige	4	N	Y	N			Mpg 15.899; flow meter H04-S
694	2/15/2005	Yes		Yes			84552		Olds	Silhoutte	2002	Beige	4	N	Y				Oil clean; mpg 19.282; flow m
695	2/15/2005	Yes		Yes			84554		Ford	F150	1992	White	2	Y	Y	N			Oil medium; flow I04-SE03; m
696	2/15/2005	Yes					84553		Dodge	Durango RT	2002	Black	4	N	Y				Oil clean; flow H04-SE08; mp
698	2/16/2005	Yes		Yes		Yes	84556		Chrysler	Town & Country LX	2001	Silver	4	Y	Y	N			Oil dirty; flow H04-SE08; mpg
700	2/16/2005	Yes		Yes			84557		Buick	Park Avenue	2000	Blue/Grey	4	Y	Y				Oil clean; flow H04-SE08; mp
701	2/16/2005	Yes		Yes			84560		Dodge	Dakota	1998	Green	2	Y	Y	N			Oil medium; flow K04-SE01; r
702	2/16/2005	Yes		Yes			84558		Chevy	S-10	2001	Black	2	N	Y	N			Oil clean; flow H04-SE08; mp
703	2/16/2005	Yes		Yes		Yes	84561		Ford	Country Squire	1986	Brown & G	4	N	Y	M			Oil dirty; flow meter I04-SE03;
704	2/17/2005	Yes		Yes		Yes	84567		Cadillac	Sedan Deville	1992	Blue	4	N	Y				Oil clean; flow meter H04-SE
705	2/17/2005	Yes		Yes		Yes	84562		Dodge	Dakota	2004	Grey	2	Y	Y	N			Oil medium; flow I04-SE03; m
706	2/17/2005	Yes		Yes			84566		Honda	Odyssey	1995	Silver	4	N	Y	N			Oil dirty; flow L04-SE13; mpg
707	2/17/2005	Yes		Yes			84564		Dodge	Grand Caravan	1998	Burgundy	4	Y	Y	N			Oil medium; flow H04-SE08; r
709	2/17/2005	Yes		Yes			84563		Ford	Ranger	2002	White	4	N	Y	N			Oil clean; mpg 14.81; Flow me
711	2/18/2005	Yes		Yes		Yes	84572		Mercury	Topaz	1994	White	4	N	Y	N			Oil dirty; flow K04-SE01. Mod

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Round 1																			
712	2/18/2005	Yes		Yes			84568		Ford	Ranger	1996	Black	2	Y	Y	N			Oil clean; flow K04-SE01; mp
713	2/18/2005	Yes		Yes			84569		Ford	Taurus	1995	Green	4	N	Y	N			Oil dirty; flow L04-SE13; mpg
714	2/19/2005			Yes			84570		Chevrolet	S-10 Pick up	1994	Burgundy	2	N	Y	N			Dyned only vehicle. Give to R
715	2/19/2005	Yes							Chevy	Silverado	1994	Blue	2	Y	Y				Oil clean; mpg 12.84; FM #H0
716	2/19/2005	Yes		Yes			84574		Ford	Taurus	1993	Burgundy	4	N	Y	L			Oil dirty; mpg 21.35; flow mete
718	2/19/2005	Yes		Yes			84573		Buick	Park Avenue	1993	Dark Blue	4	N	Y				Oil clean; mpg 17.01; FM #H0
719	2/19/2005	Yes		Yes			84575		Chevrolet	Lumina	1994	Gray		N	Y				Oil dirty; flow meter I04-SE03;
721	2/21/2005	Yes	Yes	Yes			84577		Ford	Windstar	1998	Dark Green	3	Y	Y	N			Oil dirty; mpg 18.586; flow me
722	3/11/2005	Yes		Yes		Yes	84645		Volvo	960	1993	Blue	4	N	Y	L			Oil clean; flow L04-SE13; mp
723	2/21/2005	Yes	Yes	Yes	Yes	Yes	84675	84681	Ford	Tempo	1993	Red	2	N	Y	N			Oil dirty; flow L04-SE13; mpg
724	2/21/2005	Yes		Yes		Yes	84713		Chevrolet	Blazer	1996	Black	4	N	Y	L			
725	2/22/2005	Yes		Yes			84580		Chrysler	Town & Country	2002	Blue	4	Y	Y	N			Oil medium; flow H04-SE08; r
726	2/22/2005	Yes				Yes	84730		Chevrolet	S-10 LS	1995	Black	2	Y	Y				Oil medium; flow meter H04-S
727	2/22/2005	Yes		Yes			84582		BMW	528e	1988	Black	4	Y	Y	N			Oil dirty; flow L04-SE13; mpg
728	2/22/2005	Yes		Yes			84581		Chevy	Corsica	1995	Red	4	Y	Y	N			Oil dirty; flow H04-SE08; mpg
729	2/22/2005	Yes		Yes		Yes	84638		Chrysler	Town & Country	1996	White	4	N	Y	N			Oil clean; flow meter I04-SE0
730	2/23/2005	Yes				Yes			Ford	Ranger	1994	Green	2	Y	Y				Oil dirty; flow I04-SE03; mpg
731	2/23/2005	Yes		Yes			84585		Ford	Escort	1993	Gray	4	N	Y	L			Oil clean; flow meter K04-SE
733	2/23/2005	Yes		Yes			84584		Nissan	Pickup XE	1995	Black	2	N	Y	L			Oil medium; flow K04-SE01; r
734	2/23/2005	Yes				Yes	84734		Plymouth	Voyager	1993	Green	4	Y	Y				Oil medium; flow H04-SE08
735	2/23/2005	Yes				Yes			Dodge	Caravan SE	1995	White	4	Y	Y				Oil dirty; flow L04-SE13; mpg
736	2/25/2005	Yes		Yes			84587		Mercury	Villager	1997	Navy	4	Y	Y	N			Oil dirty; mpg 20.61; fm #H04-
737	2/25/2004	Yes		Yes			84588		Buick	Lesabre	1978	White	4	Y	Y	M			Oil dirty; flow I04-SE03; mpg
738	2/24/2005	Yes		Yes			84589		Saturn	SL 2	2001	Silver	4	Y	Y	N			Oil medium; flow I04-SE08; m
739	2/24/2005	Yes		Yes		Yes	84688		Ford	Taurus	1993	Green	4	Y	Y	N			
740	2/24/2004	Yes							Ford	Escape	2002	Navy	4	Y	Y				Oil mildly dirty: Flow K04SE0
743	2/26/2005	Yes		Yes			84592		Ford	LTD	1979	Dark Blue	2	N	Y	H			No Muffler. Need key to trunk.
744	2/25/2005	Yes		Yes			84593		Honda	Accord EX	1998	Green	4	N	Y	H			Oil clean; flow J04-SE06; mp
745	2/25/2005	Yes				Yes			Ford	Econoline E 150	2001	Dark Blue	2	N	Y				Oil clean; flow I04-SE03; mpg
747	2/25/2005	Yes		Yes			84591		Toyota	4 Runner	1993	Burgundy	4	N	Y	L			Oil clean; mpg 16.84; flow H0
749	2/26/2005	Yes		Yes			84597		Pontiac	Sunbird	1994	White	4	N	Y				Oil dirty; mpg 10.20; flow L04-
750	2/26/2005	Yes		Yes			84595		Ford	Escort SE	1998	White	4	N	Y	N			Oil medium; flow J04-SE06; n
751	2/26/2005	Yes		Yes			84596		Ford	Taurus GL	1997	Blue	4	N	Y	N			Oil dirty; flow L04-SE13; mpg
753	2/26/2005	Yes		Yes		Yes	84718	84722	Ford	Windstar	1998	Purple	2	Y	Y	L	Y	P1450/P0302	Oil dirty; fm #I04-SE03. Hit loc
986	2/28/2005	Yes		Yes			84599		Toyota	Avalon	1998	Cream	4	N	Y	N			Oil clean; flow I04-SE03; mpg
987	2/28/2005	Yes					84600		Ford	Explorer	1993	Black	4	N	N				Oil dirty; mpg 16.31; fm #H04-
757	2/28/2005	Yes		Yes			84601		Buick	Regal	1979	Green	2	Y	Y	N			Oil dirty; flow H04-SE08; mpg
759	2/28/2005	Yes				Yes			Jeep	Cherokee	1988	Gold	4	N	Y				Oil dirty; mpg 17.291; flow I04
760	2/28/2005	Yes		Yes		Yes	84739		Mazda	Protégé	1998	Silver	4	Y	Y	L			
761	3/1/2005	Yes	Yes	Yes			84603		Datsun	210 Wagon	1979	Tan	4	N	Y	M			Oil dirty; flow J04-SE06; mpg
764	3/1/2005	Yes		Yes		Yes	84733		Buick	Skylark	1998	Green	4	Y	Y	L			Oil dirty; flow I04-SE03; mpg 22.8
766	3/1/2005	Yes				Yes			Jeep	Grand Cherokee	1993	Green	4	N	Y				Oil medium; flow H04-SE08; r
767	3/2/2005	Yes		Yes			84605		Datsun	280Z	1977	Rust	2	N	Y	L			Oil dirty; flow L04-SE13; mpg
769	3/2/2005	Yes				Yes			Honda	Civic	1999	Green	4	N	Y				Oil medium; flowmeter J04-SE
770	3/3/2005	Yes		Yes		Yes	84611		Toyota	Camry	1989	Burgundy	4	N	Y	N			Oil medium; mpg 32.972; FM
772	3/3/2005	Yes		Yes			84609		Buick	Regal	1978	Burgundy	2	Y	Y	M			Oil dirty; flow meter H04-SE08
773	3/3/2005	Yes				Yes			Ford	E-150	1991	White	2	Y	Y				Flowmeter I04-SE03. PEMS &
774	3/4/2005	Yes	Yes	Yes		Yes	84608		Nissan	Quest	1996	Burgundy	4	N	Y	N			Oil clean; flow I04-SE03; mpg
775	3/4/2005	Yes		Yes			84613		Oldsmobile	Delta 88	1990	White	4	N	Y				Oil dirty; flow I04-SE03; mpg
776	3/4/2005	Yes		Yes	Yes		84627	84632	Ford	F-150	1987	Red	2	Y	Y				Oil clean; flow H04-SE08; mp
777	3/4/2005	Yes		Yes			84612		Ford	Ranger XLT	2000	Burgundy	2	N	Y				Oil medium; flow I04-SE03.
778	3/4/2005	Yes							Ford	F-250	1989	Blue	2	Y	Y				Oil dirty; flow H04-SE08; mpg
779	3/4/2005	Yes		Yes			84614		Oldsmobile	Delta 88	1978	Beige	4	Y	Y				Oil dirty; flow H04-SE08; mpg

		PEMS Testing Summary					Dyne Summary		General Vehicle Info (ERG)										
Vehicle ID #	Date	Cond Run	Cond Rep	PEMS on dyne	PEMS on dyne Rep	Dway	Dyne Test	Dyne Rep	Make	Model	Model Year	Color	No of Doors	Fuel Collected (Y/N)	Oil Collected (Y/N)	Smoke Observ (N/L/M/H)	MIL during test (Y/N)	MILL Note (If MILL during test=Y)	Comments
Round 1																			
780	3/5/2005	Yes		Yes			84617		Chevy	Suburban	1997	Blue	4	Y	Y	N			Oil clean; flow H04-SE08; mp
782	3/5/2005	Yes	Yes	Yes			84616		Plymouth	Voyager	1999	Burgundy	4	Y	Y	N			Oil clean; flowmeter H04-SE0
783	3/5/2005	Yes		Yes		Yes	84618		Plymouth	Voyager	1992	White	4	N	Y	L			Oil dirty; flow J04-SE06; mpg
784	3/5/2005	Yes		Yes			84620		Ford	Ranger XLT	1992	Green	2	N	Y	L			Oil clean; flow L04-SE13; mp
785	3/4/2005	Yes		Yes			84621		Ford	Ranger	1992	Burgundy	2	N	Y				Oil dirty; flow meter L04-SE13
786	3/7/2005	Yes				Yes			Ford	Econoline	1996	White	3	Y	Y				FM H04-SE08; oil dirty. PEMS
787	3/7/2005	Yes							Volkswago	Beetle	1973	Black	2	N	N				Oil dirty; fm #K04-SE01; mpg
788	3/7/2005	Yes	Yes	Yes		Yes	84623		Plymouth	Acclaim	1989	Gray	4	Y	Y				Oil clean; flow meter #J04-SE
789	3/7/2005	Yes		Yes			84626		Dodge	Ram Pickup	1987	Gray	2	Y	Y				Oil clean; flowmeter H04-SE0
791	3/7/2005	Yes		Yes		Yes	84622		Toyota	Camry	1999	Pewter	4	N	Y				Oil dirty; mpg 22.29; flow mete
792	3/8/2005	Yes		Yes		Yes	84628		Chevy	Trail Blazer	2002	White	4	Y	Y	N			Oil clean; flow K04-SE03; mp
795	3/9/2005	Yes		Yes		Yes	84635		Ford	Crown Victoria LTD	1989	Silver	4	Y	Y	M			Oil medium; flow H04-SE08; r
796	3/8/2005	Yes		Yes			84630		Honda	Accord SEi	1989	Tan	4	N	Y	N			Oil dirty; flow J04-SE06; mpg
797	3/8/2005	Yes		Yes			84629		Acura	2.5 TL	1996	White	4	N	Y	N			Oil dirty; flow K04-SE03; mpg
799										Econoline	1986								No tests done. No PEMS don
453	4/4/2005	Yes		Yes			84755		Honda	Odyssey	2002	Beige	4	N	N	N			Oil dirty; flow H04-SE08; mpg
462	4/5/2005	Yes		Yes			84761		Kia	Sedona	2004	Beige	4	Y	Y	N			Oil clean; flowmeter K04-SE0
484	4/5/2005	Yes					84764		Chrysler	Town & Country	2002	Blue	4	Y	Y	N			Oil clean; flowmeter H04-SE0
491	4/5/2005	Yes		Yes			84763		Honda	Odyssey	2003	Silver	4	Y	Y	N			Oil clean; flow H04-SE08; mp
495	4/4/2005	Yes		Yes			84757		Jeep	Cherokee 4x4	2001	Blue	4	Y	Y	L			Oil dirty; flow H04-SE08; mpg
506	4/4/2005	Yes		Yes			84754		Plymouth	Voyager	2003	Red	4	Y	Y	L			Oil medium; flow H04-SE08; r
511	4/2/2005	Yes		Yes			84749		Toyota	Sienna LE	2001	Silver	4	Y	Y	N			Oil clean; flow I04-SE03; mpg
518	4/2/2005	Yes		Yes			84748		Dodge	Grand Caravan	2002	Gold	4	N	N	N			Oil clean; FM H04SE08; mpg
665	4/2/2005	Yes		Yes			84747		Dodge	Grand Caravan	2003	Champagn	4	N	Y				Oil dirty; flow I04-SE03; mpg 1
800	3/14/2005	Yes		Yes			84654		Oldsmobile	Cutlass	1990	Gray	4	Y	Y				Oil clean; flowmeter I04-SE03
801	3/9/2005	Yes		Yes		Yes	84634		Plymouth	Voyager SE	1988	Silver	3	Y	Y	N			Oil clean; flow I04-SE03; mpg
802	3/9/2005	Yes		Yes			84633		Volvo	740 Turbo	1987	Gold	4	N	N	N			Oil dirty; flowmeter L04-SE13;
804	3/9/2005						84637		Oldsmobile	Cutlass	Supreme	Green	4	N	N				Dyne test done only. No PEM
805	3/10/2005	Yes		Yes		Yes	84639		Chevy	Cavalier	1995	Burgundy	4	Y	Y	N			Oil medium; flow K04-SE01.
806	3/10/2005	Yes		Yes			84642		Dodge	Spirit	1989	Burgundy	4	Y	Y				Oil clean; flowmeter L04-SE1
807	3/10/2005	Yes		Yes			84643		Ford	Escort	1987	Blue	2	N	Y	L			Flowmeter L04-SE13
808	3/10/2005	Yes		Yes		Yes	84640		Ford	Explorer	1994	Green	4	Y	Y				Oil dirty; flow K04-SE03; mpg
809	3/11/2005	Yes		Yes			84644		Nissan	Pathfinder	2001	Green	4	N	Y				Oil clean; flowmeter H04-SE0
811	3/11/2005	Yes		Yes			84648		Dodge	SE Dakota	1987	Gray	2	N	Y	L			Oil dirty; flowmeter H04-SE08
813	3/11/2005	Yes		Yes		Yes	84646		Honda	Accord LXI	1988	Black	4	N	Y	L			Flow H04-SE02; mpg 18.23
815	3/12/2005	Yes		Yes			84649		GMC	Sonoma	1995	Red	2	Y	Y	L			Oil clean; flow I04-SE03; mpg
816	3/14/2005	Yes							Nissan	Pickup	1988	Red	2	N	Y				Oil clean; flow H04-SE02; mp
818	3/12/2005	Yes		Yes		Yes	84650		Chevy	Lumina APV	1990	Grey	3	N	Y	L			Oil clean; flow I04-SE03; mpg
819	3/12/2005	Yes		Yes			84653		Chevrolet	C20 Pickup	1977	Yellow	2	Y	Y	N			Oil clean; flowmeter H04-SE0
820	3/14/2005	Yes		Yes		Yes	84655		Buick	Park Avenue Electra	1990	White	4	N	Y	L			Oil clean; flow K04-SE03; mp
821	3/15/2005	Yes		Yes			84659		Chrysler	LeBaron	1988	Red	2	N	Y				Oil dirty (added quart); flowme
822	3/15/2005	Yes		Yes			84662		Cadillac	Eldorado	1990	Blue	4	N	Y	L			Oil dirty; flowmeter I04-SE03;
823	3/14/2005	Yes		Yes			84656		Chevy	Lumina	1990	Burgundy	3	N	Y	L			Oil clean; flowmeter K04-SE0
824	3/14/2005	Yes		Yes		Yes	84658		Chevy	Astrovan	1989	Blue two to	3	Y	Y	L			Oil medium; flow H04-SE08; r
825	3/14/2005	Yes		Yes		Yes	84660		Dodge	Caravan SE	1988	Burgundy	3	N	Y	L			Oil clean; flow I04-SE03; mpg
826	3/15/2005	Yes		Yes			84667		Ford	F250 Pickup	1982	Grey	2	Y	Y	L			Oil dirty; flow H04-SE08; mpg
827	3/15/2005	Yes		Yes			84661		Buick	Century	1990	White	4	N	Y	L			Oil dirty; flow I04-SE03; mpg 1
828	3/15/2005	Yes		Yes			84666		Ford	F-150	1988	Blue	2	Y	Y	L			Oil clean; flowmeter H04-SE0
829	3/15/2005	Yes		Yes			84665		Toyota	Pickup	1989	Red	2	Y	Y	L			Flowmeter K04-SE03; mpg 15
830	3/15/2005	Yes		Yes		Yes	84663		Chevrolet	Corsica	1989	Blue	4	Y	Y	L			Flowmeter K04-SE01; mpg 20
833	3/16/2005	Yes		Yes			84670		Mercury	Topaz	1989	Burgundy	4	Y	Y	N			Oil dirty; flowmeter K04-SE01

Vehicle ID #	Date	Cond Run	Cond Rep	PEMS on dyne	PEMS on dyne Rep	Dway	Dyne Test	Dyne Rep	Make	Model	Model Year	Color	No of Doors	Fuel Collected (Y/N)	Oil Collected (Y/N)	Smoke Observ (N/L/M/H)	MIL during test (Y/N)	MILL Note (If MILL during test=Y)	Comments
		PEMS Testing Summary					Dyne Summary		General Vehicle Info (ERG)										
Round 1																			
834	3/16/2005	Yes		Yes			84672		Toyota	Tercel SR5	1983	Red	2	N	Y				Oil clean; flow H04-SE02; mp
835	3/16/2005	Yes		Yes		Yes	84669		Dodge	Spirit	1990	Silver/Blue	4	Y	Y	L			Oil clean; flowmeter L04-SE1
836	3/29/2005	Yes		Yes		Yes	84735		Honda	Accord	1988	Gray	4	N	Y	L			Driveaway mpg 22.144
837	3/16/2005	Yes		Yes			84674		Pontiac	Firebird	1979	Blue	2	Y	N	L			Oil dirty; flowmeter H04-SE08
838	3/17/2005	Yes		Yes			84668		Oldsmobile	Delta 88	1991	Silver	4	N	N	L			Flowmeter K04-SE03; mpg 1
839	3/16/2005	Yes		Yes			84673		GMC	Vandura	1983	Gray	3	Y	Y	M			Oil dirty; flowmeter H04-SE03
840	3/17/2005	Yes		Yes			84676		Ford	Bronco	1990	Burgundy	2	Y	Y	L			Oil dirty; flow H04-SE08; mpg
842	3/17/2005	Yes		Yes			84679		Toyota	Pickup	1983	White	2	Y	Y	L			Oil dirty; flow K04-SE01; mpg
844	3/17/2005	Yes							Cadillac	Fleetwood	1989	Blue	4	N	Y	H			Oil dirty; flowmeter K04-SE03
845	3/18/2005			Yes			84677		Buick	Park Avenue	1989	Burgundy	4	N	N	N			Precon. after dyne not able to
846	3/17/2005	Yes		Yes			84680		Chevrolet	Cheyenne Pickup	1973	Black	2	N	Y	H			Oil dirty; flowmeter H04-SE08
847	3/18/2005	Yes				Yes			GMC	1500 SLE Sierra	1988	White/Gre	2	N	Y				Oil dirty; flow K04-SE03; mpg
848	3/18/2005	Yes		Yes			84687		Chevy	El Camino	1976	Silver	2	N	Y	M			Oil clean; flow K04-SE03; mp
849	3/18/2005	Yes		Yes			84686		Ford	F-150	1986	Rust	2	Y	Y	M			Oil dirty; flow H04-SE08; 13.8
850	3/19/2005	Yes		Yes			84683		Ford	Ranger	1990	Blue	2	N	N	M			Oil dirty; flow H04-SE02; mpg
851	3/18/2005	Yes		Yes			84685		Ford	F-150	1988	Red	2	N	Y				Oil clean; flowmeter H04-SE0
855	3/18/2005	Yes		Yes			84682		Toyota	Camry	1990	Light Blue	4	N	Y				Oil clean; flow K04-SE01; mp
856	3/19/2005	Yes	Yes	Yes	Yes		84690	84695	Oldsmobile	Cutlass	1989	Brown	4	N	Y	M			Oil dirty; flowmeter K04-SE01
857	3/19/2005	Yes		Yes			84694		Chevrolet	C-10	1983	White	2	N	Y	H			Oil dirty; flowmeter H04-SE08
858	3/19/2005	Yes		Yes			84693		Ford	F-150	1988	Red	2	Y	Y	L			Oil clean; flowmeter H04-SE0
859	3/19/2005	Yes		Yes		Yes	84692		Buick	Century	1988	Gray	4	N	Y				Flowmeter H04-SE02; mpg 1
862	3/19/2005	Yes		Yes			84689		GMC	Jimmy	1992	Black	4	Y	Y	L			Oil clean; flowmeter K04-SE0
866	3/21/2005	Yes		Yes			84699		Chevrolet	Caprice	1985	Burgundy	4	N	Y	M			Oil clean; flowmeter I04-SE03
867	3/21/2005	Yes		Yes			84700		Ford	F-150	1978	White	2	N	Y	L			Flowmeter K04-SE03; mpg 7.
868	3/21/2005	Yes		Yes			84696		Toyota	Pickup 4x4 Turbo	1987	Black	2	Y	Y				Oil dirty; flow H04-SE02; mpg
870	4/7/2005	Yes		Yes			84777		Oldsmobile	Cutlass Supreme	1987	White	4	Y	Y	L			Flowmeter H04-SE08; mpg 1
871	3/22/2005	Yes		Yes	Yes		84706	84712	Chevrolet	Nova	1976	Burgundy	4	N	Y	L			Oil dirty; flow K04-SE03; mpg
872	3/22/2005	Yes		Yes			84707		Chevy	Impala	1973	Yellow	4	Y	Y	L			Oil dirty; flow K04-SE03; mpg
873	3/23/2005	Yes					84701		Ford	F-150	1990	Brown	2	Y	Y				Oil dirty; flow I04-SE03; mpg
875	3/22/2005	Yes		Yes			84705		Chevy	Malibu	1980	Blue	4	Y	Y	L			Oil dirty; flow I04-SE03; mpg
876	3/22/2005	Yes		Yes			84702		Chevy	G20 Van	1989	Blue	Van	N	Y	L			Oil clean; flow I04-SE03; mpg
877	3/22/2005	Yes		Yes			84703		Chevy	Blazer 4x4	1987	Brown	2	Y	Y	L			Oil dirty; flow K04-SE01; mpg
878	3/23/2005	Yes	Yes	Yes			84708		Dodge	Caravan ES	2003	Red	4	Y	Y				Oil clean; flow I04-SE03; mpg
881	3/23/2005	Yes		Yes			84709		Ford	Ranger XLT	1989	Burgundy	2	Y	Y				Oil clean; flow H04-SE02; mp
883	3/23/2005	Yes		Yes			84710		Chevy	Monte Carlo	1984	White	2	Y	Y				Oil clean; flow I04-SE03; mpg
885	3/24/2005	Yes		Yes			84714		Saturn	Station Wagon	1994	Green	4	N	N	L			Oil dirty; flow I04-SE08; mpg
887	3/24/2005	Yes		Yes			84717		Ford	Mustang	1979	Silver w/or	2	N	N	L			Oil clean; flow H04-SE02; mp
888	3/24/2005	Yes							VW	Thing	1974	Beige	4	N	N				Oil dirty (air cooled), flow I04-
889	3/24/2005	Yes		Yes			84715		Mazda	B2200	1988	Grey	2	N	Y	M			Oil dirty; flow H04-SE02; mpg
891	4/1/2005	Yes		Yes			84743		Mazda	Protégé	1999	Tan	4	N	N	N			Oil clean; flow H04-SE02; mp
894	3/25/2005	Yes	Yes	Yes			84720		Chevy	Silverado 1500	1989	Burgundy	2	N	Y	L			Oil dirty; flow K04-SE03; mpg
895	3/25/2005	Yes		Yes			84719		Oldsmobile	Cutlass	1990	Blue	4	N	Y	L			Oil - low on oil; flowmeter K04
897	3/28/2005	Yes		Yes			84732		Jeep	CJ-7	1979	Black	2	N	Y	L			Oil dirty; flowmeter I04-SE03;
898	3/26/2005	Yes		Yes			84723		Chevy	Cavalier	1991	Red	2	N	Y	N			Oil clean; flow H04-SE03; mp
901	3/26/2005	Yes		Yes			84724		Oldsmobile	Cutlass Cierra	1990	Burgundy	4	Y	Y	M			Oil dirty; flow K04-SE03; mpg
902	3/26/2005	Yes		Yes			84727		Ford	Granada	1982	Beige	4	N	Y	L			Oil dirty; flow K04-SE03; mpg
903	3/26/2005	Yes		Yes			84726		Ford	Aerostar	1990	Burgundy	3	Y	Y	N			Oil clean; flow I04-SE03; mpg
904	3/28/2005	Yes				Yes			Subaru	Forester	2001	White	4	N					Oil clean; flowmeter I04-SE08
905	3/28/2005	Yes		Yes			84729		Toyota	Camry	2001	Gray	4	N	Y	N			Oil clean; mpg 19.18. PAMS!?
906	3/28/2005	Yes		Yes			84728		Ford	Escape	2002	Red	4	N	Y				Oil clean; flowmeter I04-SE03
910	3/29/2005	Yes		Yes		Yes	84738		Pontiac	Grand Prix	1976	Red	2	Y	N	M			Oil clean; flowmeter H04-SE0
911	3/29/2005	Yes		Yes			84737		Chevrolet	Celebrity	1984	Blue	4	N	Y	L			Flowmeter H04-SE02; mpg 21
913	3/31/2005	Yes		Yes		Yes	84740		Buick	LeSabre	1990	Burgundy	4	N	Y	N			Oil medium; flow I04-SE03; m
915	4/1/2005	Yes		Yes			84745		Honda	Civic	1990	Burgundy	2	N	Y	L			Oil dirty; flow I04-SE08; mpg
916	4/1/2005	Yes							Chevy	Van 20	1986	Black	3	N	N				Oil dirty; flow I04-SE03; mpg

		PEMS Testing Summary					Dyne Summary		General Vehicle Info (ERG)										
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Round 1																			
917	4/2/2005	Yes		Yes			84752		Ford	F 100 Ranger	1978	Green	2	Y	Y	H			Flow meter K04-SE03; mpg 3
918	4/2/2005	Yes		Yes			84751		Ford	Escort	1998	Black	4	N	Y	N			Engine oil clean; semtech C0
921	4/4/2005			Yes			84765		Chev	Impala	1985	Green	4	Y	Y	H			Oil dirty
922	4/4/2005	Yes		Yes			84758		Chevy	Beauville 10	1979	Silver/Blue	4	Y	Y	M			Oil clean; flow H04-SE08; mp
923	4/5/2005	Yes		Yes			84760		Ford	Escape	2005	Gray	4	Y	Y	N			Oil clean; flowmeter H04-SE0
924	4/5/2005	Yes		Yes			84759		Ford	Focus	2005	Gray	4			N			Flowmeter I04-SE08; mpg 21.
989	4/4/2005	Yes		Yes			84753		Dodge	Grand Caravan	2003	Silver	4	N	Y	N			Oil clean; flow H04-SE08; mp
925	4/6/2005	Yes		Yes			84772		Dodge	Caravan SE	1992	Burgundy	3	Y	Y	N			Oil clean; flowmeter I04-SE03
926	4/6/2005	Yes		Yes			84768		Ford	F-150 XL	1995	Blue	2	Y	Y	N			Oil clean; flowmeter H04-SE0
927	4/6/2005	Yes		Yes			84771		Chev	Astro Van	1994	Maroon	4	Y	Y	L			Oil dirty; flow H04-SE08; mpg
928	4/6/2005	Yes		Yes			84766		Dodge	Grand Caravan Sport	2000	Red	4	Y	Y	N			Oil medium; flowmeter K04SE
929	4/7/2005	Yes		Yes			84775		Chevrolet	Suburban	1997	Red	4	Y	Y	N			Oil clean; flow meter H04-SE
930	4/6/2005	Yes		Yes			84773		Toyota	Forerunner	1998	White	4	N	N	N			Oil clean; flow H04-SE08; mp
931	4/6/2005	Yes		Yes			84767		Nissan	Frontier	1998	Green	2	Y	Y	N			Oil medium; flowmeter K04SE
935	4/6/2005	Yes		Yes			84770		Ford	F-250	1995	Grey	2	Y	Y	L			Oil clean; flow H04-SE08; mp
937	4/7/2005	Yes		Yes			84774		Dodge	Caravan	1995	Burgundy	3	Y	Y	L			Oil medium; flowmeter I04-SE
939	4/9/2005	Yes							Chevy	Astrovan	1992	Blue	3						Oil clean; flow K04-SE03; mp
941	4/8/2005	Yes							Plymouth	Voyager	1992	Black	4						Oil dirty; flowmeter I04-SE03;
944	4/8/2005	Yes							Chevy	Blazer 4x4	1993	Green	2						Oil medium; flow K04-SE03; r
945	4/8/2005	Yes							Chrysler	Voyager	2002	White	4						Oil clean; flowmeter I04-SE03
946	4/8/2005	Yes							Jeep	Cherokee	1996	Green	4						Oil dirty; flow H04-SE02; mpg
950	4/9/2005	Yes							Ford	Club Wagon E150	1989	Burgundy &	3						Oil clean; flowmeter I04-SE03
EPA Correlation Vehicle																			
1015	07/26/2004						84081		Ford	Taurus	1988	Red	4						Study Correlation Vehicle
1015	8/02/2004						84114		Ford	Taurus	1988	Red	4						Study Correlation Vehicle
1015	08/07/2004						84143		Ford	Taurus	1988	Red	4						Study Correlation Vehicle
1015	08/14/2004						84177		Ford	Taurus	1988	Red	4						Study Correlation Vehicle
1015	08/18/2004						84187		Ford	Taurus	1988	Red	4						Study Correlation Vehicle
1015	08/25/2004						84218		Ford	Taurus	1988	Red	4						Study Correlation Vehicle
1015	09/08/2004						84259		Ford	Taurus	1988	Red	4						Study Correlation Vehicle
1015	09/14/2004						84290		Ford	Taurus	1988	Red	4						Study Correlation Vehicle
1015	09/24/2004						84348		Ford	Taurus	1988	Red	4						Study Correlation Vehicle
1015	09/27/2004						84360		Ford	Taurus	1988	Red	4						Study Correlation Vehicle
1015	09/29/2004						84374		Ford	Taurus	1988	Red	4						Study Correlation Vehicle
1015	10/01/2004						84387		Ford	Taurus	1988	Red	4						Study Correlation Vehicle
1015	01/22/2005						84450		Ford	Taurus	1988	Red	4						Study Correlation Vehicle
1015	01/26/2005						84461		Ford	Taurus	1988	Red	4						Study Correlation Vehicle
1015	01/31/2005						84480		Ford	Taurus	1988	Red	4						Study Correlation Vehicle
1015	02/05/2005						84507		Ford	Taurus	1988	Red	4						Study Correlation Vehicle
1015	02/11/2005						84536		Ford	Taurus	1988	Red	4						Study Correlation Vehicle
1015	02/14/2005						84544		Ford	Taurus	1988	Red	4						Study Correlation Vehicle
1015	02/22/2005						84578		Ford	Taurus	1988	Red	4						Study Correlation Vehicle
1015	03/03/2005						84606		Ford	Taurus	1988	Red	4						Study Correlation Vehicle
1015	03/08/2005						84624		Ford	Taurus	1988	Red	4						Study Correlation Vehicle
1015	03/14/2005						84651		Ford	Taurus	1988	Red	4						Study Correlation Vehicle
1015	03/22/2005						84697		Ford	Taurus	1988	Red	4						Study Correlation Vehicle
1015	03/31/2005						84741		Ford	Taurus	1988	Red	4						Study Correlation Vehicle

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OBD Comm Protocol	Vehicle on MIL on? (Y/N)	Download MIL status (On/Off)	"Not Rdy" monitors	Confirmed Codes	Pending Codes	Comments	Odometer Reading	Odo units (mi/km)	A/C? (Y/N)	VIN	Veh Type	Mfr Date	Total GVWR	GVWR Units	Drive Type	Trans Type	Trans Details	Comments
		Off	None	None	None		57,052		Y		Car	May-01	3601	Lbs	FWD	Auto	4	
							53,493		Y		Truck	Feb-79	6300				5	
							111,131	Miles	Y		Van	3/31/1994	6400		RWD	Auto	4	Mfr Date - 4/21/94 c
	N	Off	None	None	None		63,377	Miles	Y		SUV	Sep-98	5510	Lbs	On-demand 4WD	Auto	4	
	N	Off		N/A	N/A		75,364				SUV	Mar-01	7200	Lbs	RWD			
							102,654		Y		Car	Feb-95	3457		FWD	Auto	5	
							102,281		Y		Truck	Jul-79	6900		RWD	Auto		
	N	On					68,213		Y		SUV	Jun-00	3948	Manual Lbs	Full-time 4WD	Auto	5	
							92,692		Y		Car	Dec-89	4057	Lbs	FWD	Auto	5	
	N	On					48,823.50		Y		Truck	Aug-01	6750	Lbs		Auto		
	N	Off	EGR/2nd Air/Heated Catalyst	N/A	N/A		131,484	Miles	Y		Car	Oct-95	3440	Lbs	FWD	Manual	5	
							216,571		Y		Car	Aug-91	3165	Lbs	FWD	Manual	5	
	N	Off	Heated Catalst/2nd Air	N/A	N/A		26,606	Miles	Y		Car	Jul-00	4028	Lbs	FWD	Auto	5	
							161,025		Y		Van	Apr-89	4870	Lbs	FWD	Auto	Unk	
	N	Off	None	None	None		111,475	Miles	Y		Car	Dec-95	3681		FWD	Auto		
	N	Off	None	None	None		50,388		Y		Car	May-02	3660		FWD	Manual	5	
	N					"Not Rdy" mo	102,916		Y		SUV	Jan-95	5300	Lbs	RWD	Auto W/OD		
	N						81,537	Miles	Y		Car	Jun-88	4114	Lbs	FWD	Auto	3 W/OD	
	N	Off	None	0138, P046	None	Note: Downlo	131,876		Y		SUV	Apr-98	4900	Lbs	On-demand 4WD	Manual	5	
						N/A - 1990 ve	81,289	Miles	Y		Car	Apr-90	3414	Lbs	FWD	Manual	5	
	N	Off	None	None	None		73,238		Y		Car	May-99	4535	Lbs	FWD	Auto	Unk	
	N		None	None	None		51,533	Miles	Y		Car	Nov-00	3284	Lbs	FWD	Manual	5	
	N	Off	None	None	None		45,445	Miles	Y		Car	Sep-97	4565		FWD	Auto W/OD		
			None	None	None		38,137	Miles	N		Truck	May-02	5420	Lbs	On-demand 4WD	Auto		
							138,629		N		Truck	Nov-86	4400	Lbs	RWD	Auto	3	
	N	Off	None	None	None		74,621	Miles	Y		Car	Nov-95	3090	Lbs	FWD	Auto		
							138,899	Miles	Y		Van	Jan-95	5040	Lbs	FWD	Auto W/OD		
							131,386	Miles	Y		Van	Dec-93	5445	Lbs	FWD	Auto		
							74,158	Miles	Y		SUV	Sep-95	4300		On-demand 4WD	Manual	5	
							116,807		Y		Car	Jun-89	3605	Lbs	FWD	Auto		
							70,497	Miles			Car	Mar-89	5480	Lbs	RWD	Auto W/OD		
		Off	None	None	None		48,082	Miles	Y		Car				FWD	Auto	3	
	N	Off	None	None	P0301		90,062		Y		Van	Feb-97	5380	Lbs		Auto		
							100,758	Miles	Y		SUV	Feb-95	4850	Lbs	RWD	Auto	4	
	N	Off	None	None	None		19,366		Y		Truck	Sep-02	4600	Lbs		Auto	4	
							98,852	Miles	N		Car	Aug-68				Auto	3	
	N						185,061		Y		Car	Mar-90	5442		RWD	Auto W/OD		
	N	Off		None	None		76,476		Y		Car	Jan-99	3440		FWD	Auto	3	
	N						79,576		Y		Car	May-97	3915	Lbs	FWD	Auto	4	
							209,974	Miles	Y		Car	May-89	3495	Lbs	FWD	Auto	3	
	Y	Off	None		None		77,944		Y		Car	Nov-99	4035	Lbs	FWD	Auto	4	
	Y	Off	None	None	None		25,279		Y		Car	Mar-03	4684	Lbs	FWD	Auto		
	N	Off	None	None	None		99,428		Y		Car	Jul-97	3992		FWD	Auto	4	
	N	Off					21,015		Y		Van	Oct-03	2570	kg	FWD	Auto	Unk	
	Y	Off	None	None	1456, P0456		12,463	Miles	Y		SUV	Nov-02	5300	Lbs	On-demand 4WD	Auto	3	
	N	Off					70,732	Miles	Y		Car				FWD	Auto	Unk	Mfr Date, Total GVV
	N	Off					39,497.60	Miles	Y		Car	Nov-98	4490	Lbs	RWD	Auto	Unk	
	N	Off	None	None	None		89,219	Miles	Y		Car	Feb-00	3530	Lbs	FWD	Auto		
	N					Vehicle on MI	70,494	Miles	Y		Car	Feb-91	4468	Lbs	FWD	Auto	Unk	

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OBD Comm Protocol	Vehicle on MIL on? (Y/N)	Download MIL status (On/Off)	"Not Rdy" monitors	Confirmed Codes	Pending Codes	Comments	Odometer Reading	Odo units (mi/km)	A/C? (Y/N)	VIN	Veh Type	Mfr Date	Total GVWR	GVWR Units	Drive Type	Trans Type	Trans Details	Comments
	N		None	None	None		53,419	Miles			Car	Sep-98	3274	Lbs	FWD	Manual	5	
							120,272	Miles	Y		SUV	Apr-93	5280	Lbs	On-demand 4WD	Auto	4	
	N	Off	None	None	None		114,929	Miles	Y		SUV	Oct-98	4700	Lbs	RWD	Manual	5	
	N	Off	None	None	None		62,760		Y		SUV	Nov-99	3948		Full-time 4WD		3	
ISO9141 A	N		Evap System	P0400, P1	P0450, P1105		119,192	Miles			Car				FWD	Auto w/o OD		
SAE PWM	N	Off					91,037	Miles	Y		Truck	Jan-99			RWD	Auto W/OD		
SAE-PWM	N	Off					24,581	Miles	Y		Car	Feb-02	4684	Lbs	FWD	Auto		
							169,034	Miles	Y		Car	May-94	4150	Lbs	FWD	Auto W/OD		
							87,562	Miles	Y		Car	Jul-84	2850		FWD	Manual	5	
ISO 9141	N	Off					114,751	Miles	Y		Car	Apr-99	4550	Lbs	FWD	Auto W/OD		
							214,123	Miles	Y		Car				FWD	Auto		
							171,701	Miles	Y			Sep-94	5300	Lbs	On-demand 4WD	Auto W/OD		
							90,008		Y		Van	Aug-90	6400	Lbs	RWD	Auto W/OD		
SAE VPW	N	Off					146,463	Miles	Y		Car	Jul-97	3545	Lbs	FWD	Manual	5	
ISO-9141-2	N	Off	None	None	None		74,265	Miles	Y		Car	Mar-00	4333	Lbs	FWD	Auto		
ISO-9141-2	N	Off	None	None	None		149,656	Miles	Y		Car	Dec-97	3440	Lbs	FWD	Auto	3	
							184,842	Miles			Truck	Jun-95	6050	Lbs	RWD	Auto		
							102,067	Miles	Y		Car	Jan-95	4079	Lbs		Auto w/o OD		
SAE J1850	N	Off	None	None	None		112,247	Miles	Y		Truck	Apr-96	4400	Lbs	RWD	Manual	5	
							172,169	Miles	Y		Car	Feb-93	4449	Lbs	FWD	Auto W/OD		
	N	Off	Heated Catalyst, 2nd Air	N/A	N/A		86,262	Miles	Y		SUV	Sep-99	5340		On-demand 4WD	Auto W/OD		
SAE VPW	N	Off					40,718	Miles	Y		Truck	Nov-01	6200	Lbs	RWD	Auto W/OD		
ISO 9141	N	Off					163,230	Miles	Y		Van	May-98	5350	Lbs	FWD	Auto w/o OD		
							108,545	Miles	Y		Car	Feb-89	4459	Lbs	FWD	Auto W/OD		
	N	Off	Catalyst	None	None		124,047	Miles	Y		Car	Nov-95	4245	Lbs	Full-time 4WD	Manual	5	
							178,221	Miles	y		Car	Jun-88	4309	Lbs	FWD	Auto w/o OD		
							160,610	Miles	Y		SUV	Mar-95	5280	Lbs	On-demand 4WD	Auto W/OD		
ISO 914	N	Off	EGR, Heated Catalyst, 2nd Air	N/A	N/A		55,515				Car				FWD			
							185,568		Y		Car	Aug-90	3530	Lbs	RWD	Manual	5	
ISO 9141	N	Off		N/A	N/A		104,199	Miles	Y		Van	Mar-99	5360	Lbs	FWD	Auto w/o OD		
ISO 9141-2	N	Off	Evap system, Heated Catalyst,	None	None		85,423	Miles	Y		Van	Apr-00	5410	Lbs	FWD	Auto w/o OD		
SAE PVW	N	Off	N/A	N/A			72,225	Miles	Y		Car	Dec-98	3495	Lbs	FWD	Manual	5	
							172,401		Y		SUV	Aug-92	4900	Lbs	RWD, On-demand	Manual	5	
ISO9141-2		Off	Heated Catlyst, 2nd Air	N/A	N/A		48,457		Y		Car	Nov-99	4180	Lbs		Auto W/OD		
SAE-J1850	N	Off	Heated Catlyst, 2nd Air	None	None		128,164	Miles	Y		Car	Dec-96	3650	Lbs	FWD	Auto w/o OD		
SAE 1850	Y	On	Heated Catlyst, 2nd Air	P0174	P0174		74,497				Car	Oct-97	5427	Lbs	FWD	Auto W/OD		
SAE1850-V	N	Off	Heated Catlyst, 2nd Air	None	None		71,187		Y		Car	Apr-98	4468	Lbs	FWD	Auto w/o OD		
							129,123		Y		Car	Aug-93	3630	Lbs	FWD	Auto W/OD		
							198,045		Y		Truck	Jun-96	6300		RWD	Auto w/o OD		
SAE 1850	N	Off	Evap system, Heated Catalyst,	None	None		93,660	Miles	Y		Car	Dec-99	4598	Lbs	FWD	Auto w/o OD		
SAE1850 F	N	Off	EGR, Heated Catalyst, 2nd Air	None	None		66,812		Y		Car	Dec-89	3375	Lbs	FWD	Manual	5	
SAE1850 V	N	Off	EGR, Heated Catalyst, 2nd Air	None	None		135,076		Y		SUV	Oct-01	4450	Lbs	RWD	Auto w/o OD		
	N		Catalyst				129,019		Y		Car				RWD	Auto w/o OD		
							170,424		Y		Car	Mar-90	3815	Lbs	FWD	Manual	5	
							91,307	Miles	Y		Car	Feb-88	4309	Lbs	FWD	Auto w/o OD		
							261,823	Miles	Y		SUV	Sep-89	4900	Lbs	RWD	Auto W/OD		
SAE1850 F	N	Off	Heated Catalyst, 2nd Air	None	None		26,740		Y		Car	Nov-01	3485	Lbs	FWD	Auto W/OD		
							170,009		Y		Van	Feb-93	5040	Lbs	RWD	Auto w/o OD		

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OBD Comm Protocol	Vehicle on MIL on? (Y/N)	Download MIL status (On/Off)	"Not Rdy" monitors	Confirmed Codes	Pending Codes	Comments	Odometer Reading	Odo units (mi/km)	A/C? (Y/N)	VIN	Veh Type	Mfr Date	Total GVWR	GVWR Units	Drive Type	Trans Type	Trans Details	Comments
ISO 9141	N	Off	Heated Catalyst, 2nd Air Systen	None	None		168,970		Y		Van	Sep-99	5565		RWD	Auto w/o OD		
ISO 9141	N	Off	Heated Catalyst, 2nd Air	P1456	None		76,170	Miles	Y		Car	Apr-00	3990	Lbs	FWD	Auto w/o OD		
SAE 1850	Y	On	Heated Catalyst, 2nd Air	P0133	None		61,032		Y		Truck	Nov-94	5600	Lbs	RWD	Manual	5	
							74,728	Miles	Y		Truck	Jul-88	3940	Lbs	RWD	Manual	5	
ISO-9141-2	N	Off	Heated Catalyst, 2nd Air	None	None		56,183		Y		Car	Jul-00	4035	Lbs	FWD	Auto W/OD		
							127,045		Y		Car	Sep-93	3318		RWD	Manual	5	
ISO 9141	N	Off	Evap system, EGR, Catalyst, O	None	None		20,651		Y		SUV	Jan-02	4288		Full-time 4WD	Auto W/OD		
							143,271		Y		Car	Aug-82	3855		RWD	Auto w/o OD		
ISO 9141	N	Off	2nd Air, Heated Catalyst	None	None		165,084		Y		Car	Aug-96	4180		FWD	Auto W/OD		
							99,431		Y		Car	Oct-93	3825		RWD	Auto W/OD		
SAE PWM	N	Off	2nd Air System, Heater Catalys	None	None		52,245		Y		Car	Feb-01	3620			Auto w/o OD		
ISO 9141	N	Off	Evap system, EGR, Catalyst, H	None	None		74,695		Y		Van	Jul-98	2432		RWD	Auto w/o OD		
							205,819		Y		Car	Jun-88	3090		RWD	Manual	5	
SAE PVW	N	Off	Heated Catalyst, 2nd Air Systen	None	None		139,853		Y		Car	Oct-95	4421		RWD	Auto w/o OD		
							117,601		Y		Car	Oct-86	3631		RWD	Auto w/o OD		
SAE PWM	N		Heated Catalyst, 2nd Air Suppo	None	None		92,918		Y		Truck	Oct-98	5120		RWD	Manual	5	
							236,782	Miles	Y		Car	Apr-88	2011	kg		Auto w/o OD		1G2HX5404JW27124
							132,686	Miles	Y		Car	Aug-93	3825	Lbs	FWD	Auto w/o OD		
SAE PWM	Y	On	2nd Air System, Heated Catalys	P0141, P0	None		110,403		Y		Car	Oct-95	4707	Lbs	RWD	Auto w/o OD		
	N	Off	Evap system, EGR, Heated cata	P0700	None		82,858		Y		SUV	Oct-97	2223		Full-time 4WD	Auto W/OD		
							135,033	Miles	Y		Car	Mar-95	4837	Lbs	RWD	Auto w/o OD		
ISO 9141	N	Off	2nd Air System, Heated Catalys	None	None		129,416		Y		Car	Nov-96	4075	Lbs		Auto w/o OD		
SAE VPW	N	Off	Evap system, 2nd Air System, H	None	None		148,857		Y		Car	Feb-96	3503		RWD	Manual	5	
ISO 9141	N	Off	EGR, Heated Catalyst, 2nd Air S	None	None		140,402	Miles	Y		Car	Apr-02	3330		RWD	Auto w/o OD		
ISO 9141	N	Off		None	None		47,772	Miles	Y		Car	Feb-00	4180	Lbs	RWD	Auto w/o OD		
ISO 9141	N	Off	EGR, 2nd Air System, Heated C	None	None		170,118		Y		Car	Apr-00	3515		RWD	Auto w/o OD		
							172,311		N		Truck	Jun-84	6100	Lbs	On-demand 4WD	Manual	4	
ISO 9141	N	Off	Heated Catalyst, 2nd Air Systen	None	None		75,802		Y		SUV	Feb-00	4555		Full-time 4WD	Manual	5	
							235,545	Miles	N		Car	Jul-77	2577	Lbs	RWD	Auto w/o OD		
ISO 9141	N	Off		None	None		70,613	Miles	Y		SUV	Oct-00	4950	Lbs	RWD	Auto W/OD		
ISO 9141	N	Off	None		P0442 (EVAP)		7,556	Miles	Y		Car	Nov-02	2943	Lbs	FWD	Manual	6	
SAE-1850	N	Off	None	None	None		142,997		Y		Car	Mar-99	4454	Lbs	RWD	Auto W/OD		
						N/A, 1993	283,222		Y		Van	Oct-92	5600		FWD	Auto W/OD		
SAE-J1850	N	Off	None	None	None		60,051		Y		Truck	Apr-01	4600	Lbs	RWD	Auto		
							116,783	Miles	Y		Car	Dec-93	3415	Lbs	FWD	Auto w/o OD		
							103,889	Miles	Y		Car	Oct-89	4294	Lbs	RWD	Auto w/o OD		
							147,282		Y		Van	Feb-91	6100		RWD, Full-time 4W	Auto w/o OD		
							303,803		Y		Car	Sep-85	4780		RWD	Auto w/o OD		
							30,297.10	Miles	Y		Truck	Oct-85	4498	Lbs	RWD	Auto w/o OD		
						N/A - 1983	88,692		Y		Van	Jan-83	6300	Lbs	RWD	Auto		
							82,496.30	Miles	Y		Car	Apr-89	5480	Lbs	RWD	Auto w/o OD		
SAE-PWM	Y	Off		None	None		98,654		Y		Truck	Mar-98	6000	Lbs	RWD	Auto w/o OD		
SAE-J185-	Y	On		P0171	None		102,212		Y		Van	Apr-99	2458	Lbs	RWD	Auto w/o OD		
						N/A - 1994	99,209		Y		Truck	May-94	6200	Lbs	RWD	Auto W/OD		
ISO9141	Y	Off	Evap system, EGR, Catalyst	P0134	None		126,725		Y		Car	May-96			FWD	Auto w/o OD		
						1986	160,023		Y		Car	Aug-86	3660	Lbs	RWD	Auto w/o OD		
							222,707		Y		Car	Not listed	Not listed		FWD	Manual	5	
							188,049	Miles	Y		Car	Jun-84	Unreadable	Lbs	FWD	Auto w/o OD		
							179,840		Y		Car	Jan-87	5475			Auto w/o OD		
						No OBD II 199	153,979	Miles	Y		Car	Mar-92	4167			Auto w/o OD		
						No OBD # 199	125,218		Y		Car				RWD	Auto w/o OD		Mfr Date - No label
						No OBDII 199	171,169		Y		Truck	Oct-89	5450	Lbs	RWD	Manual	5	

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SAE-PWM	N	Off		None	None		72,460		Y		Car	Sep-01	4684	Lbs	FWD	Auto w/o OD		
							169,010		Y		Car	Mar-94	2582	Lbs		Auto w/o OD		
						No OBD II	128,006		Y		Car				RWD	Auto w/o OD		Mfr Date & GVWR -
						No OBD II	?		Y		Truck	Nov-72	4900	Lbs	RWD	Auto w/o OD		
							100,274	Miles	Y		Car	Oct-84	5320	Lbs	RWD	Auto		
						No OBD II 19	127,686	Miles	Y		Car	Jul-91	3466	Lbs	RWD	Auto w/o OD		
ISO9141	N	Off		None	None		135,757	Miles	Y		Car	Feb-00	3330		RWD	Auto w/o OD		
SAE VPW	N	Off		None	None		1,200.40		Y		Car	May-97	4471	Lbs	FWD	Auto w/o OD		
							140,183	Miles	Y		Car	Oct-91	3680		RWD	Manuarl	5	
SAE VPW	N	Off	EGR	None	None		18,148		Y		Van	Feb-04	2586		FWD	Auto w/o OD		
							181,867	Miles	Y		Car	May-89	3315	Lbs	FWD			
							87,064		Y		Car	Jan-93	3318		FWD	Auto w/o OD		
SAE VPW	Y	On		None	None	Vehicle on MI	85,284		Y		Van	Dec-99	2430		RWD	Auto w/o OD		
							63,817	Miles	N		Car	Oct-90	3029	Lbs	FWD	Manuarl	5	
							33,594	Miles	Y		Car	Oct-86	4595			Auto w/o OD		
							37,848	Miles	Y		Truck	Jun-86	6100	Lbs	RWD		4	
							133,718		Y		Car	Nov-87	4297	Lbs		Auto		
						No OBD II 19	177,088		Y		Car	Apr-92	3819		RWD	Auto w/o OD		
							176,696		Y		Car	Feb-89	3420	Lbs	FWD	Auto w/o OD		
						No OBD II 19	113,379	Miles	Y		Car	Nov-92	3461	Lbs	RWD	Manuarl	5	
SAE PWM	N	Off		P0133	None		118,527	Miles	Y		Car	Dec-97	2290		FWD	Auto w/o OD		
							173,075	Miles	Y		Car	Unknown	Unknown		FWD	Auto W/OD		
							190,259	Miles	Y		Car	Mar-87	3470	Lbs	FWD	Manuarl	5	
ISO9141	N	Off		None	None		149,987	Miles	Y		Car	May-98	4273			Auto w/o OD		
ISO9141	N	Off		None	None		70,129	Miles	Y		Van	May-97	2427		RWD	Auto w/o OD		
						No OBD II	109,738	Miles	Y		Car	Mar-94	3494	Lbs	RWD	Auto W/OD		
						No OBD II	116,971		Y		Truck	Jun-87	4480		RWD, On-demand	Manual	5	
							184,415		Y		Car	Dec-82	4030	Lbs	RWD	Auto W/OD		
							174,031	Miles	Y		Truck	Jun-89	4795			Auto W/OD		
						No OBD II	178,212		Y		Car	Jun-87	3165		RWD	Manual	4	
						No OBDII 199	166,820	Miles	Y		Car	Nov-91	4348		RWD	Auto w/o OD		
SAE PWM	N	Off					104,323		Y		Car	Feb-97	5161		RWD	Auto w/o OD		
SAE PWM			None	None	None		130,898	Miles	Y		Car	Feb-01	2124		FWD	Auto w/o OD		
							159,311		Y		Car	Oct-89	4047		FWD	Auto w/o OD		
	Y					"Service engi	227,290		Y		Car	Not availabl	N/A		FWD	Auto W/OD		
						N/A	132,325	Miles	Y		Truck	Jun-89	4165	Lbs	RWD	Auto w/o OD		
							269,003	Miles	Y		Car	Aug-89	3800	Lbs	FWD		5	
							1,870	Miles	Y		Car	Unreadable	Unreadable		FWD	Auto w/o OD		
ISO9141	N	Off	None	None	None		58,652		Y		Car	Nov-99	3549		FWD	Auto		
							58,429	Miles	Y		Car	Unreadable	Unreadable		FWD	Auto w/o OD		
							137,590.30	Miles	Y		Car	Apr-79	5108		RWD	Auto w/o OD		
						N/A - Light off	169,741				Truck	Oct-93	6100	Lbs	RWD	Auto W/OD		
N/A	No						36,269		Y		Car	Feb-86	5375	Lbs	RWD	Auto W/OD		
							128,599		Y		Car	Oct-88	4466		FWD	Auto w/o OD		
							188,068	Miles	Y		Car	Dec-94	2952	Lbs	FWD	Auto w/o OD		

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Pre-Testing OBDII Check (ERG)							General Vehicle Info (ERG)											
OBD Comm Protocol	Vehicle on MIL on? (Y/N)	Download MIL status (On/Off)	"Not Rdy" monitors	Confirmed Codes	Pending Codes	Comments	Odometer Reading	Odo units (mi/km)	A/C? (Y/N)	VIN	Veh Type	Mfr Date	Total GVWR	GVWR Units	Drive Type	Trans Type	Trans Details	Comments
ISO9141	No	Off	None	None	None				Y		Car				RWD	Auto w/o OD		Mfr Date & Total GV
							104,268	Miles	Y		Truck	Dec-95	5300	Lbs	On-demand 4WD	Auto w/o OD		
						No OBD II	130,255		Y		Truck	Sep-89	4700		Full-time 4WD	Auto W/OD		
							42,913	Km	N		Car	Oct-77	1335	Lbs	RWD		4	
VPW	No	Off	None	None	None		111,018		Y		Van	Feb-97	5357	Lbs	FWD	Auto w/o OD		
ISO9141	No	Off	None	None	None		104,699	Miles	Y		Car	Jan-00	3440	Lbs	FWD	Auto w/o OD		
							171,362		Y		Truck	Nov-94	6100		RWD	Manual	5	
ISO-9141	No	Off	None	None	None		75,775	Miles	Y		Car	Mar-97	3440		FWD	Manual	5	
							8975	Miles	Y		Car	Mar-84	5490		RWD	Auto w/o OD		
						No OBD 1984	299,695	Miles	Y		Car	Apr-84	4300	Lbs	RWD	Manual	4	
							85,907.40	Miles	Y		Car	?-87	Unreadable		RWD	Auto W/OD		
ISO9141	Yes	Off	None	None	None		152,029	Miles	Y		Truck	May-97	6400	Lbs	RWD	Auto		
						No OBD II 19	184,963	Miles	Y		Truck	Aug-93	6250	Lbs	RWD	Auto w/o OD		
							92,817	Miles	Y		Car	Apr-89	4210	Lbs	FWD	Auto W/OD		
							59,404	Miles	Y		Car	Unreadable	Unreadable		FWD	Auto W/OD		
ISO9141	No	Off	None	None	None		146,571	Miles	Y		Car	May-96	4036		FWD	Auto w/o OD		
ISO9141	No	Off	None	None	None		127,406	Miles	Y		Car	Mar-97	4075	Lbs		Auto W/OD		
ISO9141	No		None	None	None		92,673		Y		SUV	Jun-99	6400		RWD			
ISO9141	No		None	None	None		115,362		Y		Car	Jan-98	3330	Lbs	RWD	Manual	5	
ISO9141	No	Off	None	None	None		49,723	Miles	Y		Car	Oct-00	3460		RWD	Auto W/OD		
						No OBD II 19	75,574	Miles	Y		Car	Unknown	Unknown		RWD	Auto w/o OD		
							101,517		Y		Car	Nov-93	3785	Lbs	FWD	Auto w/o OD		
SAE-VPW	No	Off	None	None	None		76,611	Miles	Y		Car	Apr-99	3983		RWD	Auto w/o OD		
SAE PWM	No	Off	None	None	None		40,263		Y		Van	Dec-01	2430		FWD	Auto w/o OD		
						No OBD II 19	81,571		Y		Car	Jul-72	4720		RWD	Auto w/o OD		Odometer Reading
						No OBD II 19	121,435		Y		Van	Jun-93	6600	Lbs	RWD	Auto w/o OD		
SAE 1850	No	Off	Heated Catalyst, 2nd Air	None	None		115,367		Y		Truck	Feb-97	6000	Lbs	RWD	Auto W/OD		
SAEVP	No	Off	None	None	None		24,907		Y		Van	Oct-02	2430			Auto w/o OD		
						No OBD II 19	158,762	Miles	Y		Van	Oct-90	5040		RWD	Auto w/o OD		
ISO9141	No	Off	None	None	None		124,721	Miles	Y		Car	May-96	4034		FWD	Manual	5	
						No OBD II	80,740	Miles	Y		Car	Jul-89	3315	Lbs	FWD	Auto W/OD		
ISO 9141	Yes	On	None	P0105 mar	P0105 manifold		154,236				Car	Nov-96	3413		FWD	Auto W/OD		
						No OBD II	202,788	Miles	Y		Car	Nov-89	3880	Lbs	RWD	Manual	5	
ISO9141	No	Off	None	None	None		95,297	Miles	Y		Car	Mar-00	3990		FWD	Auto W/OD		
							144,664		Y		Car	Feb-89	3696			Auto w/o OD		
ISO9141	No	Off	None	None	None		127,647		Y		Car	Apr-98	4180		RWD	Auto W/OD		
PWM	No	Off	Heat Catalyst, 2nd Air	None	None		37,914	Miles	Y		Van	Jan-01	5560	Lbs	FWD	Auto W/OD		
SAE VPW	No	Off		None	None		108,173		Y		Car	Jan-96	4520	Lbs	FWD	Auto w/o OD		
ISO 9141	No	Off	Heated Catalyst, 2nd Air	None	None		11,647		Y		Car	Aug-96	4273	Lbs	FWD	Auto W/OD		
ISO 9141	No	Off	None	None	None		60,272	Miles	Y		Car	Jul-99	4108	Lbs	FWD	Auto w/o OD		
SAE PWM	No	Off	None	None	None		77,796	Miles	Y		Car	Dec-97	2125	Lbs	FWD	Auto W/OD		
ISO 9141	No	Off	None	None	None		94,823	Miles	Y		SUV	Mar-97	4360	Lbs	RWD	Manual	5	
ISO 9141	No	Off	EGR, Heated Catalyst, 2nd Air	None	None		6,248	Miles	Y		Car	Sep-03	3370	Lbs	FWD	Manual	5	
							72,455	Miles	Y		Car	Aug-89	6005	Lbs	RWD	Auto W/OD		
							87,701	Miles	Y		Car	Feb-88	5361	Lbs	RWD	Auto W/OD		

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Pre-Testing OBDII Check (ERG)							General Vehicle Info (ERG)											
OBD Comm Protocol	Vehicle on MIL on? (Y/N)	Download MIL status (On/Off)	"Not Rdy" monitors	Confirmed Codes	Pending Codes	Comments	Odometer Reading	Odo units (mi/km)	A/C? (Y/N)	VIN	Veh Type	Mfr Date	Total GVWR	GVWR Units	Drive Type	Trans Type	Trans Details	Comments
							225,160		Y		Truck	Mar-87	4400	Lbs	RWD	Manual	5	
SAE VPW	No	Off	EGR, 2nd Air, Heated Catalyst	None	None		8,412		Y		Car	Aug-03	3701	Lbs		Auto w/o OD		
SAE VPW	No	Off	Heat Catalyst, 2nd Air	None	None		57,229	Miles	Y		Car	Aug-96	3890	Lbs	FWD	Auto W/OD		
SAE VPW	No	Off	EGR, Heat Catalyst, 2nd Air	None	None		63,143	Miles			Car	Mar-01	3981	Lbs	FWD	Auto w/o OD		
ISO 9141	No	Off	Evap System, Heated Catalyst,	None	None		75,475		Y		Van	Oct-98	5410	Lbs	FWD	Auto w/o OD		
							128,220	Miles	Y		Car	Jul-94	4310	Lbs	FWD	Auto w/o OD		
SAE PWM	No	Off	EGR, Heated Cat, 2nd Air	None	None		11,662	Miles	Y		Truck	Jul-03	4740	Lbs	RWD	Auto W/OD		
9141	No	Off	Heat Catalyst, 2nd Air	None	None		6,337		Y			Feb-04	2730	Lbs	FWD	Auto w/o OD		
							106,185		Y		Car	May-95	3505	Lbs	FWD	Auto w/o OD		
ISO 9141	No	Off	EGR, Heated Catalyst, 2nd Air	None	None		131,762	Miles	Y		Van	May-00	5250	Lbs	FWD	Auto W/OD		
							178,757	Miles	Y		Car	Feb-87	3528	Lbs	FWD	Auto w/o OD		
VPW	No	On	2nd Air	P1870 tran	P1870 transmission		133,428	Miles	Y		Car	Jan-97	4489		FWD	Auto W/OD		
SAEPWM	No	Off	Evap System, Heated Catalyst,	None	None		98,555	Miles	Y		Car	Nov-95	4079	Lbs	FWD	Auto W/OD		
							61,498	Miles	Y		Truck	Jun-89	6250	Lbs	RWD	Manual	4	
							220,817				Car	Apr-93	3301		FWD		5	
KW2000	No	Off	Heated Catalyst, 2nd Air	None	None		22,357	Miles	Y		SUV	Nov-02	4123	Lbs	RWD	Auto W/OD		
							Unable to read		Y		Car	Jul-86	Unable to read		RWD	Auto w/o OD		
SAE PWM	No	Off	None	None	None		107,408		Y		Car	Aug-99	3375		FWD	Manual	5	
	No	Off	None	None	None		61,399	Miles	Y		Car	Oct-00	4275		FWD	Auto w/o OD		
							147,558	Miles	Y		Truck	Nov-85	4950		RWD	Manual	4	
							73,824	Miles			Truck	Unreadable	Unreadable		RWD, On-demand	Auto W/OD		
							84,899	Miles	Y		Car	Dec-91	3415	Lbs	FWD	Auto w/o OD		
VPW	No	Off	Heat Catalyst, 2nd Air	None	None		120,904	Miles	Y		Car	Jun-97	3892	Lbs	FWD	Auto w/o OD		
							146,953	Miles	Y		Car	Sep-94	3481	Lbs	FWD	Auto W/OD		
SAE VPW	No	Off	Heated Catalyst	None	None		57,813		Y		Car	Apr-01	4452	Lbs	FWD	Auto W/OD		
SAE PWM	No	Off	Heated Catalyst, 2nd Air	None	None		91,846		Y		Car	May-98	4687	Lbs	FWD	Auto W/OD		
SAE VPW	Yes	On	Evap System, Heated Catalyst,	P0130, P4	None		288,775		Y		Car	Nov-95	3505	Lbs	FWD	Auto W/OD		
ISO 9141	No	Off	EGR, Heated Catalyst, 2nd Air	None	None		80,342	Miles	Y		Car	Dec-01	4295	Lbs	FWD	Auto w/o OD		
							185,872		Y		Car	?	4995	Lbs	RWD	Auto w/o OD		
							69,357	Miles	Y		Car	No sticker	No sticker		FWD	Auto W/OD		
							235,460		Y		Van	Mar-90	5850	Lbs	RWD	Auto W/OD		
ISO 9141	Yes	On	Heated Catalyst, 2nd Air	P0133			81,768	Miles	Y		Car	Feb-96	4340		FWD	Auto w/o OD		
							88,207	Miles	Y		Car	Sep-93	4310	Lbs	FWD	Auto W/OD		
SAE VPW	No	Off	Evap System, Heat Catalyst	P0341 cam	None		170,219	Miles	Y		Car	Oct-96	3354		FWD	Auto w/o OD		
							70,386		Y		Car	Apr-95	4635	Lbs	FWD	Auto W/OD		
							118,171	Miles	Y		Car	Dec-88	4915	Lbs	FWD	Auto W/OD		VIN - Blank
ISO 9141	Yes	On	Heated Catalyst, 2nd Air	P0172, P1	P1491		117,932	Miles	Y		Van	Jan-00	5565	Lbs	FWD	Auto W/OD		

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	Pre-Testing OBDII Check (ERG)							General Vehicle Info (ERG)											
	OBD Comm Protocol	Vehicle on MIL on? (Y/N)	Download MIL status (On/Off)	"Not Rdy" monitors	Confirmed Codes	Pending Codes	Comments	Odometer Reading	Odo units (mi/km)	A/C? (Y/N)	VIN	Veh Type	Mfr Date	Total GVWR	GVWR Units	Drive Type	Trans Type	Trans Details	Comments
	SAE PWM	No	Off	Evap System, Heated Catalyst,	None	None		100,945	Miles	Y		Car	Sep-94	5417	Lbs	RWD	Auto W/OD		
								24,712		Y		Truck	Aug-88	6250	Lbs	RWD	Manual	5	
								127,776		Y		Car	Jun-94	5438	Lbs	RWD	Auto W/OD		
	SAE VPW	No	Off	Heated Catalyst, 2nd Air	P1621	None		75,714	Miles	Y		Car	Oct-97	3856	Lbs	FWD	Manual	5	
	SAE VPW	No	Off	Heated Catalyst, 2nd Air, O2 Se	None	None		164,867	Miles	Y		Car	Mar-96	4150	Lbs	FWD	Auto W/OD		
	SAE VPW	No	Off	EGR, Heated Catalyst, 2nd Air	None	None		30,880	Miles	Y		Truck	Oct-01	7000	Lbs	RWD	Auto w/o OD		
	VPW	No	Off	None	None	None		169,526	Miles	Y		Car	Mar-96	3510	Lbs	FWD	Auto w/o OD		
								49,549	Miles	Y		SUV	Feb-90	6050	Lbs	RWD	Auto W/OD		
	ISO 9141	No	Off	Heated Catalyst, 2nd Air	None	None		77,793		Y		Car	Sep-96	3915	Lbs	FWD	Auto W/OD		
								258,730		Y		Car	May-90	4167	Lbs	FWD	Auto W/OD		
	ISO 9141	No	On	Evap System, EGR, Ox Sensor	P0411, P1	None		38,308		Y		Car	Jul-99	3616	Lbs	FWD	Manual	5	
oil, no V1.							No OBD II	106,984		Y		Car	Feb-95	3457	Lbs	FWD	Auto w/o OD		
oil added.							No OBD	128,817	mi	Y		Truck	Oct-75	7500	Lbs	FWD	Auto w/o OD		
	SAE VPW	N	Off	None	None	None		90,219	mi	Y		Car	May-99	4535		FWD	Auto w/OD		
6.	ISO 9141	N	Off	None	None	None		74,582	mi	Y		Van	Oct-99	5565	Lbs	FWD	Auto w/OD		
6,	ISO 9141	N	Off	None	None	None		82,918		Y		Car	May-97	3915	Lbs	FWD	Auto w/OD		
et	ISO 9141	N	Off	None	None	None		168,860	mi	Y		Van	May-98	5350	Lbs	FWD	Auto w/OD		
g.	ISO 9141	N	Off	None	None	None		62,342	mi	Y		Car	Jul-00	4035	Lbs	FWD	Auto w/OD		
8 mpg.							No OBD	220,013		Y		Car	1990	Unknown		FWD	Auto w/OD		
fuel mileage.								107,975	mi	Y		Car	May-95	3505		FWD	Auto w/o OD		
an	ISO 9141	N	Off	None	None	None		96,428		Y		Van	Feb-97	5380	Lbs	FWD	Auto w/o OD		
an, 16.7 mpg.							No OBD	123,567	mi	Y		Car	Jun-89	3605		FWD	Auto w/o OD		
	ISO 9141		Off	None	None	None		85,178				Van	Aug-99	5100	Lbs	FWD	Auto		
	SAE PWM	N	Off	None	None			29,493	mi	Y		Car	Feb-02	4684		FWD	Auto w/OD		
								XX5778		Y		Truck	1979	6900	Lbs		Auto w/o OD		
	VPW	N	Off	None	None	None		79,917	mi	Y		Car	Apr-99	3983	Lbs	FWD	Auto w/OD		
5,	ISO 9141	N	Off	None	None	None		140,462	mi	Y		Car	Oct-95	3440		FWD	Manual	5	
e,	SAE VPW	N	Off	None	None	None		178,387		Y		Car	Nov-95	3090		FWD	Auto w/o OD		
-S	VPW	N	Off	None	None	None		79,171	mi	Y		Car	1998			FWD	Auto w/OD		
	SAE VPW	N	Off	None	None	None		58,079		Y		Car	Aug-96	3890		FWD			
02.	VPW	N	Off	None	None	None		11,323	mi	Y		Car	Mar-03	4453		FWD	Auto w/OD		
03,	ISO 9141	N	Off	None	None	None		95,983	mi	Y		SUV	Jun-99	6400	Lbs		Auto w/OD		
05	ISO 9141	Y	On	None	P0304	None		118,202	mi	Y		Car	Jan-99	3330	Lbs	FWD	Manual	5	
3,	ISO 9141	N	Off	None	P0320, P0306			137,044		Y		SUV	Apr-98	4900	Lbs	RWD	Manual	5	
.294.								179,113	mi	Y		SUV	Sep-94	5300	Lbs	On-demand 4WD	Auto w/OD		
an,	ISO 9141	N	Off	None	P1456	None		84,167		Y		Car	Apr-00	3990	Lbs	FWD	Auto w/o OD		
3.805.								162,618	mi	Y		SUV	Mar-95	5280		On-demand 4WD	Auto w/OD		
mpg	SAE VPW	N	Off	None	None	None		51,713	mi	Y		Car	Aug-00			FWD	Auto w/o OD		
no	SAE VPW	N	Off	None	None	None		107,039	mi	Y		Car	Jul-97	3992	Lbs	FWD	Auto w/OD		
age 17.365.							No OBD II	93,661	mi	Y		Car	Dec-89	4057		FWD	Auto w/o OD		
n,	SAE VPW	N	Off	None	None	None		44,243	mi	Y		Car	Apr-01	3326		FWD	Auto w/o OD		
	ISO 9141	N	Off	None	None	None	Pending Code	51,756	mi	Y		Car	Jan-01	3990		FWD	Auto w/o OD		
								109,284	mi	Y		Car	Aug-90	5547	Lbs	RWD	Auto w/o OD		Odometer - 109,284
9	ISO 9141	N	Off	None	P0138		Confirmed Co	97,507	mi	Y		SUV	Mar-97	4360	Lbs	RWD	Manual	5	
an; 27.6 mpg. Duplicate test see 568A below.							No OBD II	131,858	mi	Y		Car	Jul-94	4310		FWD	Auto w/o OD		
plicate test see 568 above.									mi	Y		Car	Jul-94	4310	Lbs	FWD	Auto w/o OD		Odometer - nothing
npg; oil dirty.							No OBD II	124,968		Y		Truck	Mar-95	4900		FWD	Auto w/o OD		
	SAE VPW	N	Off	None	P0731	None		98,556		Y		Car	Feb-99	3403		FWD	Auto		

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	OBD Comm Protocol	Vehicle on MIL on? (Y/N)	Download MIL status (On/Off)	"Not Rdy" monitors	Confirmed Codes	Pending Codes	Comments		Odometer Reading	Odo units (mi/km)	A/C? (Y/N)	VIN	Veh Type	Mfr Date	Total GVWR	GVWR Units	Drive Type	Trans Type	Trans Details	Comments
3; 11.194 mpg							No OBD II		144,926		Y		Car	May-95	4669		FWD	Auto w/OD		
ea	SAE VPW	N	Off	None	None	None			48,135	mi	Y		Truck	Nov-01	6200	Lbs	RWD	Auto w/OD		
03	SAE VPW	N	Off	None	None	None			33,740	mi	Y		Car	Apr-01	4470	Lbs	RWD	Auto w/OD		
03;	PWM	N	Off		None	None			93,625	mi	Y		Truck	Jun-00	6350	Lbs	RWD	Auto w/o OD		
ge 21.7									132,317	mi	Y		Car	Nov-90	3455	Lbs	FWD	Auto w/o OD		
mileage: 10.051							None		168,134	mi	Y		Car	May-95	4545	Lbs	FWD	Auto w/o OD		
ea	9141	N	Off	None	None	None			137,485	mi	Y		Van	May-00	5250			Auto		
03;	ISO 9141	N	Off	None	None	None			79,222	mi	Y		Van	Oct-98	5410	Lbs	FWD	Auto w/o OD		
age	VPW	N	Off	None	None	None			67,283	mi	Y		Car	Mar-01	3981	Lbs	FWD	Auto w/OD		
age	2000 KW	N	Off	None	None	None			29,510		Y		SUV	Nov-02	4123	Lbs	On-demand 4WD	Auto w/o OD		
eage: 10.369							None		92,169		Y		Car	Apr-94	4407	Lbs	FWD	Auto		
age: 21.617									181,369	mi	Y		Car	Apr-94	4273	Lbs	FWD	Auto w/o OD		
							No OBD II		139,293	mi	Y		Car	Aug-94	4899	Lbs	FWD	Auto w/OD		
age 7.781							None		177,915	mi	Y		Car	Feb-93	4449	Lbs	FWD	Auto w/OD		
No paper work filled out. Seems to have OBDII but no code supplied. Dyne only vehicle. Con							Not Available		146,289		Y		Car	Jun-95	4521		RWD	Auto w/OD		
g 18.13							None		147,310		Y		Van	Apr-93	5140	Lbs	FWD	Auto w/OD		
9.97							None		145,299		Y		Van	Nov-88	4940	Lbs	FWD	Auto w/OD		
og 16.45. Gas gauge does not work but it is full, trip can go to 290 before it runs out.							None		77,513	mi	Y		Truck	Jul-88	3940	Lbs	RWD			
g 8.922; filename MO_319EXL_PRECOND2.xml							None		179,723	mi	Y		Car	Aug-94	5194	Lbs	FWD	Auto w/o OD		
17.19							None		164,552	mi	Y		Van	Sep-91	5260	Lbs	RWD	Auto w/OD		
10.8							None		124,169	mi	Y		Van	Feb-94	5126	Lbs		Auto w/OD		
23.890							None		104,073	mi	Y		Car	Jan-95	4079	Lbs	FWD	Auto		
E03; mpg 11.55							None		145,942	mi	Y		Car	Dec-93	4486	Lbs	FWD	Auto w/o OD		
							None		162,870	mi			Van	Apr-89	4870	Lbs	FWD	Auto		
mp	SAE VPW	N		None		P1100/P07	Pending Code		124,539	mi	Y		Truck	Dec-95	6200	Lbs	Full-time 4WD	Auto w/OD		
er J04-SE06							No OBD II		70,388	mi	Y		Car	Aug-86	3660		FWD	Auto w/o OD		
-SE03							None		86,123	mi	Y		Car	Jul-72	4720		RWD	Auto w/o OD		
11.515							None		36,991	mi	Y		Car	Jul-77	5369	Lbs	RWD	Auto		
3; mpg 8.752							No OBD - cou		109,585	mi	Y		SUV	Jun-96	5420	Lbs	Full-time 4WD - Co	Auto w/o OD		
3; mpg 20.9							No OBD II		133,974		Y		Truck	Jun-89	4165		FWD	Auto w/o OD		
0.083							No OBD II		207,257	mi	Y		Car	Jun-88	3090		FWD	Manual	5	
g 1	ISO 9141	Y		None	None	None			103,057	mi	Y		SUV	Sep-97	5300	Lbs	On-demand 4WD	Auto w/o OD		
g 2	9141	N		None	None	None			79,822	mi	Y		Car	May-96	3449	Lbs	FWD	Auto w/o OD		
y; mpg 7.5							No OBD II		?		Y		Car	Apr-79	5108		FWD	Auto w/o OD		
9.	9141	N		None	None	None			118,345		Y		Van	Jul-96	5430	Lbs		Auto w/o OD		
; mpg 18.1							No OBD II		101,082		Y		Truck	Jan-92	4460		FWD	Auto w/o OD		
3; oil dirty; mpg 13.78. 2/1/05 - flow meter K04-SE03; oil dirty; mpg 7.85.							No OBD II		97,116		Y		Car	Aug-90	4740		FWD	Auto w/o OD		
5; mpg 16.2. PEMS only - was dyne testable but he did not want to leave it for both.									73,983	mi	Y		Truck	Sep-89	4140		RWD			
g 1	SAE VPW	N		None	None	None			4,522	mi	Y		SUV	Oct-03	5750	Lbs	Full-time 4WD	Auto w/o OD		
clean; flow meter I04-SE08; mpg 17.716.							No OBD II		232,090	mi	Y		Truck	Mar-87	4400	Lbs	FWD	Manual	5	
g 10.26									126,028	mi	Y		Car				FWD	Auto w/OD		
3; mpg 8.13									82,250	mi	Y		Truck	Nov-83	5600	Lbs	RWD	Auto w/OD		
19	SAE PWM	N		None	None	P0171	Pending Code		118,462	mi	Y		Truck	May-97	4680	Lbs		Manual	5	
mp	SAE VPW	N		None	None	None			51,855	mi	Y		Truck	Nov-95	4200	Lbs	FWD	Manual	5	
mpg	SAE PWM	N		None	None	None			14,705	mi	Y		Van	Sep-03	5660	Lbs	FWD	Auto w/o OD		
g 8.514							None		85,899	mi	Y		SUV	Sep-94	5400	Lbs	On-demand 4WD	Auto w/o OD		
3; mpg 15.40. PEMS only - too long for dyne.							No OBD II		139,565	mi	Y		Truck	Jun-94	6800		FWD	Auto w/o OD		
g 1	ISO-9141	N		None	None	P0300	Pending code		59,726		Y		Van	Jan-01	5250	Lbs	FWD	Auto w/OD		
g 25.642									80,566	mi	Y		Car	Aug-94	3680	Lbs	FWD	Auto w/o OD		
mpg	ISO 9141	N		None	None	None			112,513	mi	Y		Truck	Sep-97	4700	Lbs	Full-time 4WD	Auto		
# I0	9141	N	Off	None	None	None			111,485	mi	Y		Car	Jun-96	4703		FWD	Auto w/OD		
1	SAE PWM	N		None	None	None	Could not con		26,398	mi	Y		Car	May-02	4684	Lbs		Auto w/OD		
g 1	SAE VPW	N		None	None	None			65,322	mi	Y		Car	2000	4635	Lbs	FWD	Auto w/OD		

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	Pre-Testing OBDII Check (ERG)							General Vehicle Info (ERG)											
	OBD Comm Protocol	Vehicle on MIL on? (Y/N)	Download MIL status (On/Off)	"Not Rdy" monitors	Confirmed Codes	Pending Codes	Comments	Odometer Reading	Odo units (mi/km)	A/C? (Y/N)	VIN	Veh Type	Mfr Date	Total GVWR	GVWR Units	Drive Type	Trans Type	Trans Details	Comments
21.748							None	210,281	mi	Y		Car	Jun-93	4405	Lbs	FWD/RWD	Auto w/OD		
eter H04-SE08. PEMS only too long for dyne.								6,060	mi			Truck	Sep-88	5450	Lbs	RWD	Auto w/OD		
npg 8.685								17,149	mi	Y		Van	Jul-92	5400	Lbs		Auto w/o OD		
12.09							None	187,394	mi	Y		SUV				Full-time 4WD	Auto w/OD		No door jamb sticke
EN	PWM	N	Off	Evap System/None	None	None	Evap not com	107,196	mi	Y		Truck	Sep-00	6500	Lbs		Auto w/OD		
3; mpg 9.050								124,688	mi	Y		Car	Mar-92	3315	Lbs	FWD	Auto w/OD		
7.52							None	88,587	mi	Y		Car	Oct-81	5013	Lbs	RWD	Auto		
03	9141	N	Off	None	None	None		19,453	mi	Y		SUV	Sep-02	6085	Lbs	On-demand 4WD	Auto w/OD		
np	9141	N		None	None	None		108,830	mi	Y		Car	Jul-98	4020	Lbs	FWD	Auto w/o OD		
1	SAE VPW	N		None	None	None		34,223	mi	Y		Car	Nov-01	4628	Lbs	FWD	Auto w/o OD		
g 21.92. License number different from folder (folder says 487 GPK).							None	200,807	mi	Y		Car		3897	Lbs	FWD	Auto w/o OD		
10.76. Make - nothing listed. PEMS only - would not shift out of park when not running - could							None	205,876	mi	Y		Van	Feb-93	5950			Auto w/OD		
3; mpg 9.506.								213,485	mi	Y		Van	Dec-91	4940	Lbs	FWD	Auto w/o OD		
g 8	9141	N	Off	None	None	None		80,570	mi	Y		Van	May-98	5410	Lbs	FWD	Auto w/OD		
mpg 16.17								188,044	mi	Y		Car	Sep-90	5478	Lbs	FWD	Auto w/OD		
r; mpg 17.34								87,208	mi	Y		Truck	Nov-94	4300	Lbs	RWD	Manual	5	
np	SAE PWM	N		None	None	None		47,470	mi	Y		Car	Oct-00	4684		FWD	Auto w/OD		
np	9141	N	On	None	P1456	None	Confirmed Co	101,901	mi	Y		Car	Nov-96	3915		FWD	Auto w/o OD		
15	SAE VPW	N		None	None	P0700/P11	Pending Code	46,702		Y		Truck	Jul-96	6100	Lbs	Full-time 4WD	Auto w/OD		
mpg 15.45								130,513	mi	Y		Car	Jun-94	5438	Lbs	RWD	Auto w/OD		
g 9.917							None	93,417	mi	Y		Truck	Aug-94	6400	Lbs	Full-time 4WD	Auto w/o OD		
								48,696	mi	N		SUV	Jun-92			RWD	Manual	5	
20.505							None	84,644	mi	Y		Car	Apr-92	3657	Lbs	FWD	Auto w/o OD		
g 1	9141	N	Off	None	None	None		76,197	mi	Y		SUV	Dec-97	4165	Lbs	On-demand AWD	Auto		
y;	VPW	N	Off	None	None	None		88,892	mi	Y		SUV	Sep-99	7300	Lbs	RWD/On-demand	Auto w/OD		
mpg 18.507							None	114,219	mi	Y		Car	Jul-92	4130		On-demand AWD	Auto w/o OD		
g 2	SAE VPW	N	Off	None	None	None		49,320	mi	Y		Van	Aug-02	5357	Lbs		Auto w/o OD		
3;	SAE-PWM	N	Off	None	None	None		48,200	mi	Y		Truck	Jul-98	2222		FWD	Auto w/o OD		
1	VPW	N	Off	None	P0306		Confirmed co	69,002	mi	Y		SUV	Jun-96	6800	Lbs	Full-time 4WD	Auto w/OD		
ch	9141	N	Off	None	None	None		161,263	mi	Y		Van	May-95	5350		FWD	Auto w/o OD		
08	ISO 9141	Y	On		P0455	None		88,505	mi	Y		Truck	Aug-99	2223			Auto w/OD		
	ISO 9141	N	Off	None	None	None		64,146		Y		Car	Jul-98	2182		FWD	Manual	5	
1; mpg 28.33							No OBD II	103,059	mi	Y		Car	Sep-94	3555	Lbs		Auto w/o OD		
20.311							None	138,981	mi	Y		Car	Oct-94	4472	Lbs	FWD	Auto w/OD		
g 16.235. No HC reading in road test screen upon returning from precond run.							None	131,660		Y		Car	Sep-87	5475	Lbs	RWD	Auto w/OD		
SE	VPW							46,354	mi	Y		SUV	Apr-01	4950	Lbs	RWD	Auto w/OD		
et	VPW	N	Off	None	None	None		61,160	mi	Y		Van	Nov-01	5357	Lbs	FWD	Auto w/OD		
pg 13.11							No OBD II	134,775	mi	Y		Truck	Mar-92	6250	Lbs	Full-time 4WD	Auto w/o OD		
g 1	9141	N	Off	None	None	None		28,700	mi	Y		SUV	Feb-02	6400	Lbs	Full-time 4WD	Auto w/o OD		Drive Type - AWD 4
1	VPW	N	Off	None	None	None		75,537	mi	Y		Van	Mar-01	5600	Lbs		Auto w/o OD		
g 2	VPW	N	Off	None	None	None		67,091	mi	Y		Car	Jun-00	4714	Lbs	FWD	Auto w/OD		
np	9141	N	Off	None	None	None		49,767		Y		Truck	Dec-97	4570	Lbs	RWD	Manual	5	
g 1	VPW	Y	On	None	P0101/P04	P0401	Confirmed co	106,227	mi	Y		Truck	Feb-01	4900	Lbs	On-demand 4WD	Auto w/o OD		Drive Type - 2Hi 4H
; mpg 15.71. Dyne test voided - car was steaming, safety issue. Oil leak.							No OBD II	?		Y		Car	Feb-86	5550		FWD	Auto w/o OD		Odometer Reading
08; mpg 9.6							No OBD II	155,898	mi	Y		Car	Not listed	Not listed		FWD	Auto w/o OD		
pg	VPW	N	Off	None	None	None				Y		Truck	Sep-03	5000	Lbs	Full-time 4WD	Manual	5	Odometer Reading
9.6							None	109,036	mi	Y		Van	Apr-95	4740	Lbs	FWD	Auto w/OD		
np	9141	N	Off	None	None	None		122,222	mi	Y		Van	Sep-97	5410	Lbs		Auto w/o OD		
ete	PWM	N	Off	None	None	None		18	mi	Y		Truck	Aug-01	5080		RWD/On-demand	Auto w/OD		
el year - No year listed.							None	41,466	mi	Y		Car	Jan-94	3825	Lbs	FWD	Auto w/o OD		Odometer Reading

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g 1	PWM	N	Off	None	None	None		126,843	mi	Y		Truck	Dec-95	4700	Lbs	RWD	Manual	5	
7.749							None	203,058	mi	Y		Car	Nov-94	4635	Lbs	FWD	Auto w/OD		
odney & Marc. Needs to be run on PEMS after dyne 2/19 also pics fuel & oil samples. No PEM							None	63,903		Y		Truck	Sep-93	4200/1905		RWD	Auto w/OD		
04-SE08. PEMS only too long for dyne.								104,721	mi	Y		Truck	Aug-93	6200	Lbs	RWD	Auto w/OD		
er #I04-SE03								39,452	mi	Y		Car	Mar-93	4692	Lbs	FWD	Auto w/OD		
04-SE08								74,419	mi	Y		Car	Nov-92	4777	Lbs	FWD	Auto w/OD		
; mpg 18							No OBD II	126,807		Y		Car	nable to Rea	Unable to Read		FWD	Auto w/o OD		
te	PWM	N	On	None	P1537/P1538/P0301/F		Confirmed co	146,235	mi	Y		Van	Apr-97	5220	Lbs		Auto w/OD		
g 19.396. Dyne 3/11/05.							None	197,078	mi	Y		Car	Dec-92	4440	Lbs	FWD	Auto w/o OD		
14.84. Round 2 driveaway only. Dyne test 3/17/05 mpg 25,045							None	24,583	mi	Y		Car	Jun-93	3825	Lbs	FWD	Auto w/o OD		Odometer Reading
	VPW	N	Off	None	P0146 (3/240, P0700 (2/21)			94,342	mi	Y		Truck	Nov-95	5300	Lbs	On-demand 4WD	Auto w/o OD		
np	VPW	N	Off	None	None	None		30,315	mi	Y		Van	May-02	5600	Lbs	FWD	Auto w/o OD		
SE	SAE VPW	N	Off	None	None	None		74,703		Y		Truck	Jul-95	4600			Auto w/o OD		
16.44							None	287,798	mi	Y		Car	Jul-07	4115	Lbs	FWD	Manual	5	
23.627							None	78,736	mi	Y		Car	Apr-95	3808	Lbs	FWD	Auto w/OD		
3;	ISO 9141	N	Off	None	P0720	None		212,969		Y		Van	Aug-95	2746		FWD	Auto w/o OD		
25. Driveaway only.							None	122,875	mi	Y		Truck	Sep-94	4740	Lbs	RWD	Auto w/OD		
01; mpg 24.0							No OBD II	199,269		Y		Car	No sticker	No sticker		FWD	Auto w/o OD		
npg 15.70							None	86,697		Y		Truck	Jun-95	4400	Lbs		Manual	5	
							None	166,354	mi	Y		Van	May-93	5040	Lbs	FWD	Auto w/o OD		
22.216. (No 2.5" flow meters available.)							None	131,298	mi	Y		Van	Oct-94	5040	Lbs	FWD	Auto w/OD		
-S	9141	N	Off	None	None	None		166,799		Y		Van				FWD	Auto w/OD		
12.111								81,364	mi	Y		Car	Jun-78	5150	Lbs	RWD	Auto w/o OD		
npg	VPW	N	Off	None	None	None		56,622	mi	Y		Car	Aug-00	3370	Lbs	FWD	Auto w/o OD		
								92,185	mi	Y		Car	Jan-93	4692	Lbs	FWD	Auto w/o OD		
1	J1850PWM	N	Off	None	None	None		44042	mi	Y		Truck	Mar-02	4528	Lbs	Full-time 4WD	Auto w/ OD		
. Have to fix muffler when done with dyne & pems. Oil dirty; mpg 15.715; fm #H04-SE08.								65,854	mi	Y		Car	Jul-79	5297		RWD	Auto w/o OD		
g 2	9141	N	Off	None	None	None		75,052	mi	Y		Car	Dec-97	4035	Lbs	FWD	Auto		
1	PWM	N	Off	None	None	None		41,183	mi	Y		Van	Jul-01	7000	Lbs	RWD	Auto w/OD		
4-SE08								178,447	mi	Y		SUV	Feb-93			RWD		5	
-SE13								145,852	mi	Y		Car	Dec-93	3513	Lbs	FWD	Auto		
np	PWM	N		None	None	None		133,068	mi	Y		Car	Sep-97	3485	Lbs	FWD	Auto w/OD		
12	PWM	N	Off	None	None	None		97,585	mi	Y		Car	Jul-97	4687	Lbs	FWD	Auto w/OD		
ck	PWM	Y	On	None	P1450/P0302		Confirmed Co	99,271	mi	Y		Van	Jun-97	5220	Lbs	FWD	Auto w/OD		
2	9141	N	Off	None	None	None		29,580	mi	Y		Car	Feb-98	4550	Lbs	FWD	Auto w/o OD		
-SE08								47,917	mi	Y		SUV	Jun-93	5120	Lbs	RWD	Auto w/OD		
13.2 6							None	5,856	mi			Car	Feb-79	4313	Lbs	RWD	Auto w/o OD		A/C? - ?
-SE03. Driveaway.								163,807	mi	Y		SUV	Nov-87	Unable to read		RWD	Auto w/OD		
	ISO 9141	Y	On	Catalyst	1794/P0505			85,890	mi	Y		Car	Oct-97	3485	Lbs	FWD	Auto w/o OD		
32.224. New tailpipe & muffler installed 2/28/05. Gas leak.							None	47,098	mi	Y		Car	Mar-79	2855	Lbs	RWD	Manual	5	
39	VPW	N	Off	None	None	None		65,043	mi	Y		Car	Sep-97	3926	Lbs	FWD	Auto w/OD		
npg 17.398.							None	116,429	mi	Y		SUV	Feb-93	5500	Lbs	Full-time 4WD	Auto w/OD		
12.5							None	94,772	mi	Y		Car	Jan-77	3203	Lbs	RWD	Manual	5	
E0	ISO 9141	N	Off	None	None	None		100,072	mi	Y		Car	Nov-98	3330	Lbs	FWD	Auto w/o OD		
#J04-SE06.								168,083	mi	Y		Car	Aug-88	4122	Lbs	FWD	Auto w/OD		
3; mpg 18.719.							No OBD II	64,563		Y		Car	Mar-78	4528		FWD	Auto w/o OD		
& driveaway vehicle only - too long for dyne!							No OBD II	165,710	mi	Y		Van	Mar-91	7200		FWD	Auto w/o OD		
1	9141-2	N	Off	None	None	None		125,651		Y		Van	May-96	5445	Lbs	FWD	Auto w/OD		
14.699.							None	18,567	mi	Y		Car	May-90	4458	Lbs	FWD	Auto w/OD		
g 13.785.							None	394	mi	Y		Truck	Aug-87	5450	Lbs	Full-time 4WD	Manual	4	
	PWM	N	Off	None	None	None		33,672	mi	Y		Truck	Feb-00	4800	Lbs		Auto w/OD		
11.317. PEMS only. Too long for Dyne ·							None	70,610	mi	Y		Truck	Apr-89	8800	Lbs	On-demand 4WD	Auto w/o OD		
15.407.							None	73,721	mi	Y		Car	Feb-78	5080	Lbs	RWD	Auto w/o OD		

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g 1	VPW	N	Off	None	None	None		145,130		Y		SUV	Dec-96	7300	Lbs	RWD	Auto w/OD		
3;	ISO 9141	N	Off	None	None	None		113,364		Y		Van	Jun-99	2432		FWD	Auto w/o OD		
20.09; mpg driveaway 21.767							None	154,224	mi	Y		Van	Aug-91	5040	Lbs		Auto w/o OD		
g 16.067							None	19,742	mi	Y		Truck	No sticker	No sticker		RWD	Manual	5	
3; mpg 12.492.							No OBD II	135,705		Y		Truck	Apr-92	4440		RWD	Manual	4	
S d	PWM	Y	On	None	P0133	P0420	Confirmed Co	203,335	mi	Y		Van	Oct-95	8550	Lbs		Auto w/OD		
22.5. PEMS only. No radiator - will overheat on dyne.								18,484	mi	N		Car	Nov-77	2844	Lbs	RWD	Manual	4	
06; mpg 39.23.							No OBD II	164,184	mi	Y		Car	Feb-89	4047		FWD	Auto w/o OD		
8; mpg 15.16.							No OBD II	23,191	mi	Y		Truck	May-87	5000		FWD	Auto w/o OD		
er	9141	N	Off	None	None	None		64,126	mi	Y		Car	Jul-99	4180	Lbs	FWD	Auto w/OD		
g 1	VPW	N	Off	None	None	None		77,750	mi	Y		SUV	Sep-01	5750	Lbs	On-demand 4WD	Auto w/o OD		
mpg 18.15							None	62,838	mi	Y		Car	Jan-89	5566	Lbs	RWD	Auto w/OD		
22.516							None	139,955	mi	Y		Car	No sticker	No sticker		FWD	Auto w/o OD		
19	9141	N	Off	None	None	None		117,634	mi	Y		Car	Jun-96	4820	Lbs	FWD	Auto w/o OD		
e safety issues.																			
15	9141	N	Off	None	None	None		60743	mi	Y		Van	Nov-01	5665	Lbs	FWD	Auto w/o OD		
3;	ISO 9141	N	Off	None	None	None		16,601	mi	Y		Van	Feb-04	5959	Lbs	FWD	Auto w/o OD		
8;	SAE-VPW	N	Off	None	None	None		31712		Y		Van	May-02	5600		FWD	Auto w/o OD		
g 1	9141	N	Off	None	None	None		44,743	mi	Y		SUV	Sep-02	5665	Lbs	FWD	Auto		
13	9141	Y	On	None	P1491/P03	None	Confirmed Co	90,003	mi	Y		SUV	Aug-00	5400		On-demand 4WD	Auto w/OD		
mp	VPW	N	Off	None	None	None		20,779	mi	Y		Van	Jul-02	5400	Lbs	FWD	Auto w/o OD		
2	9141	N	Off	None	None	None		80,211	mi	Y		Van	Nov-00	5250	Lbs	FWD	Auto		
19	VPW	N	Off	None	None	None		60,774		Y		Van	Mar-02	5500	Lbs	FWD	Auto		
18	VPW	N	Off	None	None	None		46,866	mi	Y		Van	Dec-02	5500	Lbs	FWD	Auto w/o OD		
; mpg 19.869							No OBD II	97,513		Y		Car	Feb-90	4045		FWD	Auto w/o OD		
21.2							None	162,866	mi	Y		Van	May-89	4870	Lbs	FWD	Auto		
; mpg 8.776. Very stop & go & turbo.							No OBD II	248,169	mi	Y		Car	Sep-86	4230		RWD	Auto w/o OD		
S precon.																			
							None	140,492	mi	Y		Car	Jun-95	3592	Lbs	FWD	Manual	5	
3; mpg 12.05							No OBD II	148,000		Y		Car	Mar-89	4060		FWD	Auto w/o OD		
							No OBD II	128,352		Y		Car	Jan-86	3165		FWD	Auto w/o OD		
14.201								98,966		Y		SUV	May-94	5360	Lbs	Full-time 4WD	Auto w/OD		
8;	ISO 9141	N		None	None	None		66,276	mi	Y		SUV	Jul-00	5300	Lbs	On-demand 4WD	Auto w/OD		
; mpg 13.95							No OBD II	112,830	mi	Y		Truck	Nov-86	5930		FWD	Auto w/o OD		
							None	209,194	mi	Y		Car	No sticker	No sticker		FWD	Auto w/o OD		
17.46							None	56,562	mi	Y		Truck	Dec-94	4200		RWD	Manual	5	
g 25.22. Speedometer not accurate. PEMS only, exhaust leaks.							None	220,628	mi	Y		Truck	Oct-87	5100	Lbs	On-demand 4WD	Manual	5	
19.260. Window - drivers side front hard to put down & up. Hood - have to open with pliers.							None	136,296	mi	Y		Van	Apr-90	4592	Lbs	FWD	Auto w/o OD		
8; mpg 9.69. Front left tire needs air in it.							No OBD II	376,819	mi	Y		Truck	Jul-77	6400	Lbs	FWD	Auto w/o OD		
g 17.09							None	169,851	mi	Y		Car	Sep-89	4488	Lbs	FWD	Auto w/o OD		
eter H04-SE02; mpg 21.889. PEM after Dyne.							No OBD II	117,015	mi	Y		Car	Could not rea	Cound not read		FWD	Auto w/o OD		
mpg 16.129. Linkage in steering column is worn out.							No OBD II	185,376	mi	Y		Car	Mar-90	4416	Lbs	FWD	Auto w/o OD		
3; mpg 18.011							No OBD II	123,624		Y		Van	Not listed	Not listed		FWD	Auto w/o OD		
mpg 17.897. Have to start with a screwdriver with the lights on.							None	215,899	mi	Y		Van	Nov-88	5600	Lbs	FWD	Auto w/OD		
16.933							None	61,431	mi	Y		Van	Nov-87	4930	Lbs	FWD	Auto w/o OD		
10.570. Do not set emergency brake!							None	85,487	mi	Y		Truck	Jun-82	6500	Lbs	Full-time 4WD	Manual	5	
18.72							None	148,951	mi	Y		Car	Jul-90	4119	Lbs	FWD	Auto w/OD		
8; mpg 12.631. Gas gauge does not work has $10 of gas in it. Only drive in circle D. When rev							No OBD II	140,670		Y		Truck	Jun-88	5450		FWD	Auto w/o OD		
5.46							No OBD II	262,300		Y		Truck	May-89	5350		On-demand 4WD	Auto w/o OD		
0.30							No OBD II	98,988		Y		Car	Nov-88	3621		FWD	Auto w/o OD		
; mpg 19.359							No OBD II	161,373		Y		Car	Dec-88	3682			Auto w/o OD		

	Page 2							Page 3											
	Pre-Testing OBDII Check (ERG)							General Vehicle Info (ERG)											
	OBD Comm Protocol	Vehicle on MIL on? (Y/N)	Download MIL status (On/Off)	"Not Rdy" monitors	Confirmed Codes	Pending Codes	Comments	Odometer Reading	Odo units (mi/km)	A/C? (Y/N)	VIN	Veh Type	Mfr Date	Total GVWR	GVWR Units	Drive Type	Trans Type	Trans Details	Comments
g 26.085							None	87,893	mi	Y		Car	Oct-82	2980	Lbs	FWD	Manual	5	
3; mpg 22.38							No OBD II	109,922		Y		Car	Oct-89	4057		FWD	Auto w/o OD		
							None	209,384		Y		Car	Aug-88	3959		FWD	Auto w/o OD		
; mpg 13.295. Passenger window roll down when opening door. Cold start pump gas first othe							No OBD II	45,370	mi	Y		Car	Aug-79	4568	Lbs	RWD	Auto w/o OD		
7.181. Needs to be PEMed when done on dyne.							No OBD II	139,424	mi	Y		Car	Nov-90	4429		FWD	Auto w/o OD		
; mpg 8.028. Fuel collected - sheet says no and envelope says yes. Do not roll windows down							No OBD II	327,203	mi	Y		Van	No sticker	No sticker			Auto w/o OD		
12.7							None	4,994	mi	Y		SUV	Aug-89	6050	Lbs		Auto w/OD		
20.308							None	97,627	mi	Y		Truck	Oct-82	4250	Lbs	RWD	Manual	5	
; 33.98 mpg							No OBD II	187,050		Y		Car	Oct-88	5386		FWD	Auto w/o OD		
- participant needs vehicle.								146,845	mi			Car				FWD			
; 11.85 mpg. New muffler and tail pipe last Monday. Fuel Collected? Sheet says yes and enve							No OBD II	574,687		Y		Truck	Not listed	6400	Lbs		Manual	4	
14.234. PEMS only too long for dyne. Did driveaway too.							None	30,666		Y		Truck	Not readable	6000	Lbs		Auto w/OD		
g 12.757							None	61,800	mi	Y		Car	No sticker	No sticker			Auto w/o OD		
63 mpg							None	94,729		Y		Truck	Nov-85	4900		Full-time 4WD	Manual	5	
15.261. Need to take pictures of vehicle. Needs to be PEMED after Dyne. Needs to be taken							None	72,987	mi	Y		Truck	Mar-90	4420		RWD	Manual	5	
8; 13.70 mpg. Fuel gauge does not work only fuel tank (front) works.							No OBD II	62,939		Y		Truck	Sep-87	6250		Full-time 4WD	Manual	5	
g 19.376							None	138,226	mi	Y		Car	Nov-89	4122	Lbs	FWD	Auto		
; 19 mpg							No OBD II	220,953	mi	Y		Car	Unable to rea	Unable to read		FWD	Auto w/o OD		
; mpg 12.227							No OBD II	98,784		Y		Truck	Apr-83	5200		FWD	Manual	3	
8; mpg 16.75							No OBD II	97,153		Y		Truck	May-88	6250		FWD	Auto w/OD		
5.553							No OBD II	94,539		Y		Car	Mar-88	4030		FWD	Auto w/o OD		
3; mpg 26.146. Vehicle license different from envelope.							No OBD II	90,855	mi	Y		SUV	Dec-91	5100		On-demand 4WD			
; mpg 11.37							No OBD II	58,223	mi	Y		Car	Unable to rea	Unable to read		FWD	Auto w/o OD		
431. Take to B&H.							No OBD II	73,439	mi	Y		Truck	Jun-78	6150		RWD	Auto w/o OD		
15.211							None	169,285	mi	Y		Truck	Mar-87	5080		On-demand 4WD	Manual	5	
7.181							No OBD II	87,003	mi	Y		Car	Oct-86	4705		FWD	Auto w/o OD		
15.874							None	86,086	mi	Y			No sticker	No sticker		RWD	Auto w/o OD		
7.689							None	94,171	mi	Y		Car	Jul-73	5570	Lbs	RWD	Auto		
18.923. Rebuilt transmission 2 months ago. Timothy Tankard picked up 1990 F150 that we tes							None	38,815	mi	Y		Truck	Jun-90	6250	Lbs	RWD	Auto w/OD		
15.169							None	31,245		Y		Car	Jun-80	4405	Lbs	RWD	Auto w/o OD		
12.613							None	27,420	mi	Y		Van	Sep-88	6600	Lbs	RWD	Auto w/OD		
16.8							None	153,390	mi	Y		SUV	Unknown ca	4724	Lbs	On-demand 4WD	Auto w/OD		
1	VPW	Y	On	None	None	None		10,184	mi	Y		Van	Oct-02	5600	Lbs		Auto w/o OD		
g 18.114							None	28,857	mi	Y		Truck	Jan-89	4080	Lbs		Manual	5	
20.7							None	68,802	mi	Y		Car	Not legible	Not legible		RWD	Auto w/o OD		
23.698							None	32,325	mi	Y		Car	Nov-93	3331	Lbs	FWD	Auto w/o OD		
g 11.710							None	45,542	mi	Y		Car	Apr-79	3745		RWD	Manual	5	
SE08, mpg 22.358. Warning: leaking fuel out of carburator. PEMS only air cooled engine.							None	81,747	mi	N		Car	Unknown	1340	Lbs	RWD	Manual	4	VIN - chassis numb
18.270							None	220,309	mi	Y		Truck	Jun-88	4460	Lbs	RWD	Manual	5	
g 2	9141-2	N	Off	None	None	None		122,979		Y		Car	Apr-99	3472		FWD	Manual	5	
13.352							None	140,662	mi	Y		Truck	Feb-89	5600	Lbs	RWD	Auto		
-SE03; mpg 20.16							No OBD II	85,441	mi	Y		Car	Oct-89	4453		FWD	Auto w/o OD		
mpg 11.18							No OBD II	85,092	mi	N		Truck	Not listed	Not listed			Manual	4	
g 18.692. Needs oil.							None	182,333	mi	Y		Car	Sep-90	3481	Lbs	FWD	Auto w/o OD		
18.567. Brake light stays on. Gas gauge does not work but does have gas in it. Drivers door s							None	71,459	mi	Y		Car	Dec-89	4034	Lbs	RWD	Auto w/o OD		
16.113							None	64,627	mi	Y		Car	Sep-81	4300	Lbs	RWD	Auto w/o OD		
16.117							None	19,631	mi	Y		Van	Nov-89	4880	Lbs	RWD	Auto w/OD		
3. D	ISO9141	N		None	None	None		62,848		Y		SUV	Jul-00	4175		Full-time 4WD	Auto w/OD		
?	ISO9141	N		None	None	None		46,861		Y		Car	Nov-00	4180		FWD	Auto w/o OD		
; r	SAE-PWM	N	Off	None	None	None		36,201		Y		SUV	Feb-02	4376		FWD	Auto w/o OD		
8; mpg 9.174							No OBD II	60,900		Y		Car	Aug-76	5694		FWD	Auto w/o OD		
1.113							No OBD II	64,075		Y		Car	Jun-84	3994		FWD	Auto w/o OD		
pg 21.170. Off dyne @ 10:30 am - precond & then … 3:45 driveaway.							None	107,890	mi	Y		Car	Aug-89	4382	Lbs	FWD	Auto w/OD		
23.600							None	133,958	mi	Y		Car	Jan-90	3165	Lbs	FWD	Auto w/o OD		
3.339. Oil below add line. Semtech C03SG02. PEMS only too wide for Dyne.							None	33,238	mi	Y		Van	Jul-86	6600	Lbs	RWD	Auto w/o OD		

	Page 2								Page 3												
	Pre-Testing OBDII Check (ERG)								General Vehicle Info (ERG)												
	OBD Comm Protocol	Vehicle on MIL on? (Y/N)	Download MIL status (On/Off)	"Not Rdy" monitors	Confirmed Codes	Pending Codes	Comments		Odometer Reading	Odo units (mi/km)	A/C? (Y/N)	VIN	Veh Type	Mfr Date	Total GVWR	GVWR Units	Drive Type	Trans Type	Trans Details	Comments
1.8 (wrong) (truck has major exhaust problems).									58,882		N		Truck	Nov-77	4900		RWD	Auto w/o OD		
3S	PWM	N	Off	None	None	None			55,293		Y		Car	Jan-98	3485		FWD	Auto w/OD		
									75,915		N		Car	Unk - Door v	Unk		RWD	Auto w/o OD		A/C? - OEM AC rem
g 11.091							None		84,006	mi	Y		Van	Jul-79	6000	Lbs	RWD	Auto w/o OD		
8;	CAN	N		None	None	None			10,511		Y		SUV	Jan-04	4380			Auto w/o OD		
.47	CAN	N		None	None	None			6,693		Y		SUV	Jul-04	3800		FWD	Manual	5	
g 1	VPW	N	Off	None	None	None			47,640	mi	Y		Van	Feb-03	5550	Lbs	FWD	Auto w/o OD		
; mpg 16.224							No OBD II		143,971		Y		Van	Jul-92	5200	Lbs	FWD	Auto w/OD		
8; mpg 15.881							No OBD II		147,334		Y		Truck	Feb-95	5450			Manual	5	
14.296							No OBD II		133,309		Y		Van	Jun-94	5950		FWD	Auto w/o OD		
E03	ISO9141	N	Off	None	None	None			93,154	mi	Y		Van	May-00	5410	Lbs	FWD	Auto w/OD		
08	SAE-VPW	N	Off	None	None	None			137,614		Y		SUV	Oct-96	7300		On-demand 4WD	Auto w/o OD		
g 1	9141	N	Off	None	None	None			115,751	mi	Y		SUV	Oct-97	5250	Lbs	On-demand 4WD			
E03	ISO9141	Y	On	EGR	P0440/P1448				107,607		Y		Truck	Oct-97	5200		On-demand 4WD	Manual	5	
g 13.64							None		52,565	mi	Y		Truck	Apr-95	6600	Lbs	RWD	Auto w/OD		
E03; mpg 18.836							None		136,808		Y		Van	Mar-95	5040		FWD	Auto w/o OD		
g 16.238. PEMS only.							None		195,068	mi	Y		Van	Nov-91	5950	Lbs	RWD			
mpg 16.83. PEMS only.							No OBD II		235,513	mi	Y		Van	Dec-91	5200		FWD	Auto w/o OD		
mpg 17.271. PEMS only.							None		64,970	mi	Y		Truck	Apr-93	4700	Lbs	Full-time 4WD	Auto w/OD		
; r	SAE-VPW	N	Off	None	None	None			25,981	mi	Y		Van	Apr-02	5400		FWD	Auto w/o OD		
1	9141	N	Off	None	None	None			56,429	mi	Y		SUV	Jul-96	4600	Lbs		Manual	5	
; mpg 28.6. PEMS only. 28.6 F seems way too high - insufficient time to do another run - will e							No OBD II		33,795		Y		Van	Jun-88	6600			Auto w/o OD		
									13139	mi	Y		Car	Jun-88	4615	Lbs	FWD	Auto		
									13158	mi	Y		Car	Jun-88	4615	Lbs	FWD	Auto		
									113170	mi	Y		Car	Jun-88	4615	Lbs	FWD	Auto		
									113189	mi	Y		Car	Jun-88	4615	Lbs	FWD	Auto		
									113208	mi	Y		Car	Jun-88	4615	Lbs	FWD	Auto		
									13239	mi	Y		Car	Jun-88	4615	Lbs	FWD	Auto		
									xxx	mi	Y		Car	Jun-88	4615	Lbs	FWD	Auto		
									13266	mi	Y		Car	Jun-88	4615	Lbs	FWD	Auto		
									13303	mi	Y		Car	Jun-88	4615	Lbs	FWD	Auto		
									13323	mi	Y		Car	Jun-88	4615	Lbs	FWD	Auto		
									13352	mi	Y		Car	Jun-88	4615	Lbs	FWD	Auto		
									13370	mi	Y		Car	Jun-88	4615	Lbs	FWD	Auto		
									84450	mi	Y		Car	Jun-88	4615	Lbs	FWD	Auto		
									84461	mi	Y		Car	Jun-88	4615	Lbs	FWD	Auto		
									84480	mi	Y		Car	Jun-88	4615	Lbs	FWD	Auto		
									84507	mi	Y		Car	Jun-88	4615	Lbs	FWD	Auto		
									84536	mi	Y		Car	Jun-88	4615	Lbs	FWD	Auto		
									84544	mi	Y		Car	Jun-88	4615	Lbs	FWD	Auto		
									84578	mi	Y		Car	Jun-88	4615	Lbs	FWD	Auto		
									84606	mi	Y		Car	Jun-88	4615	Lbs	FWD	Auto		
									84624	mi	Y		Car	Jun-88	4615	Lbs	FWD	Auto		
									84651	mi	Y		Car	Jun-88	4615	Lbs	FWD	Auto		
									84697	mi	Y		Car	Jun-88	4615	Lbs	FWD	Auto		
									84741	mi	Y		Car	Jun-88	4615	Lbs	FWD	Auto		

General Veh Info (ERG)

No of Cyls	Disp	Disp Units	Engine Cert Year	OBD Type	Emiss Cert Type (s)	Emiss Cert Details	PCV	TAC	AIS	EGR	Evap	Cat	FIR	Ox	Engine Family #	Evaporative Family #	Fuel Delivery Type	Air Intake
4	2.2	L	2001		USEPA	LEV	N	N	N	N	Y	Y	Y	Y	1GMXV02,4022	1GMXR0124919	Port Fuel-Injected	Normal
6													N	N				
8	5.2	L	1994		USEPA		Y	N	N	Y	Y	Y	Y	Y	RCR5.988GAEA	RCR1065AYP0A	Unknown	
6	3.5	L	1999		USEPA	NLEV	Y	N	N	Y	Y	Y	Y	Y			Port Fuel-Injected	Normal
8	5.3	L	2001	OBD II	USEPA	None	Y	N	N	Y	Y	Y		Y	1GMXT05.3182	1GMXE011920	Port Fuel-Injected	
4			1995	No OBD	USEPA		N	N	N	Y	Y	Y	Y	Y	1.9 SEF1		Port Fuel-Injected	Normal
8	351	In^3	1979	No OBD	California		Y	Y	Y	Y	Y	Y	Y	N	5.8M/6.8"B" (1x128)		Carb	Normal
4	2	L	2000	OBD II	USEPA, California, Canada		Y	N	N	Y	Y	Y	Y	Y			Port Fuel-Injected	Normal
4	2.5	L	1990	OBD I	USEPA		Y			Y	Y	Y					Port Fuel-Injected	
	5.4	L			USEPA, California		Y			Y	Y							
4	1590	cm^3	1996	OBD II	USEPA		N	N	N	N	Y	Y	Y	Y			Port Fuel-Injected	Normal
4	91	CID	1991		USEPA		Y	N	N	N	Y	Y	Y	Y			Port Fuel-Injected	Normal
6	2.5	L	2001	OBD II	USEPA, California	TLEV	Y	N	N	Y	Y	Y	Y	Y	1TKXV02.515MA	1TKXL0125PMC	Port Fuel-Injected	Normal
6	3	L	1989	No OBD	USEPA		N	N	N	N	Y	Y	Y	Y	KCR3.OT5FBLG	KCRTC	Port Fuel-Injected	
4	2.2	L	1996	OBD II	USEPA		Y	N	N	Y	Y	Y	N	Y	TGM2.2V86KEK	TGM1046AYMAA	Port Fuel-Injected	Normal
4	2	L	2002	OBD II	USEPA, California	LEVII LEV	N	N	N	N	Y	Y	Y	Y	2HNXV02.0VBP	2HNXR0099AAH	Port Fuel-Injected	Normal
6	4.3	L	1995	OBD I	USEPA		N	N	N	Y	Y	Y		Y	S3G4.329GFGJ	S3G1089AYMON	Port Fuel-Injected	Normal
6	3.8	L	1988	No OBD	USEPA	N/A	Y	N	N	Y	Y	Y	Y	N	J2G3.8V8XEB0	JB0-2D	Port Fuel-Injected	Normal
6	4	L	1998		USEPA		Y	N	N	N	Y	Y		Y	WCRXT04.02B0	WCRXE01O1GCS	Port Fuel-Injected	Normal
4	2.2	L	1990		USEPA		Y	N	N	Y	Y	Y	Y	Y	L1G2.2V5JFG2	LAO-1E	Throttle-body	Normal
6	3.5	L	1999	OBD II	USEPA, California	TLEV	Y	N	N	Y	Y	Y	Y	Y	XCRXV0215V20	XCRXR0101G1D	Port Fuel-Injected	Normal
4	1.9	L	2001	OBD II	USEPA, California	NLEV	Y	N	Y	Y	Y	Y	Y	Y	1GMXV01.9002	1GMXR0080902	Throttle-body	Normal
6	3.8	L	1998	OBD II	USEPA			N	N	Y	Y	Y	Y	Y	WGMXV03.8047	WGMXE0086903	Port Fuel-Injected	Normal
6	3.3	L	2002		USEPA, California	NLEV	Y	N	N	N	Y	Y	Y	Y	2NSXT03.3C5A	2NSXR0120RCA	Port Fuel-Injected	Normal
8			1986	OBD I			Unk	Unk	Unk	Unk	Unk	Y	Y	Unk			Carb	
4	1.9	L	1996	OBD II	USEPA	1996	Y	N	Y	Y	Y	Y	Y	Y	TGM1.9V8GKEK	TGM1035AYPAA	Port Fuel-Injected	Normal
6	3.3	L	1995		USEPA		Y	N	N	N	Y	Y	Y	N	SCR3.328GFEA	SCR1095AYMOA	Port Fuel-Injected	Normal
6	3	L	1994		USEPA		Unk	N	N	Y	Y	Y	Y	Y	RFM3.028GDEA	RFM1057BYM0B	Port Fuel-Injected	Normal
4	2.5	L	1995		USEPA		Y	N	N	N	Y	Y	Y	Y	SCR2.578GAEA	SCR1058AYMON, SC	Port Fuel-Injected	Normal
	2.3	L	1989		USEPA						Y		Y		K2G2.3V8XEW0	KAO-2G	Throttle-body	
8	5	L	Not listed		Not listed		N	N		Y	Y	Y	Y		N/A, no sticker	N/A, no sticker	Port Fuel-Injected	Normal
6	3	L	2001	OBD II	California					Y		Y	Y	Y		1TYXR0135AK1		
6	3.3	L	1997		USEPA					N	Y							
6	4.3	L	1995	OBD II	USEPA		Y	Y			Y	Y	Y				Throttle-body	
6	4.3	L	2003	OBD II	USEPA, California	NLEV	Y	N	N	N	Y	Y	Y	Y	3GMXT04.3187	3GMXR0175922	Port Fuel-Injected	Normal
4	289	In^3					Y	Y	Y	N	Unk	N	N	N	N/A	N/A	Carb	Normal
8	5	L	1990		USEPA		Y	N	Y	Y	Y	Y	Y	Y	5.0L-OHM	LFM5.OV5HBG6	Port Fuel-Injected	Normal
4			1999	OBD II	USEPA		Unk	Unk	Unk	Unk	Y		Y	Y			Port Fuel-Injected	Normal
4	2.2		1997	No OBD	USEPA		N	Unk	Unk	Y	Y	Y	Y	Y	VHN22VJGKFK	VHN1090AYMEA	Port Fuel-Injected	Normal
4	2	L	1989	No OBD			Unk	Unk	Unk	Y	Y	Y	Y	Unk	KHN20V2F4F6	89FB	Port Fuel-Injected	Normal
4	2.2	L	1999	OBD II	USEPA		Y	Unk	Unk	Y	Y	Y	Y	Y				Normal
6	3	L	2003	OBD II	USEPA			Unk	Unk	Y		Y	Y	Y	2V-Group:3FMXV03	3FMXR011SBAE	Port Fuel-Injected	Normal
6	3.1	L	1998	OBD II	USEPA		Y	Unk	Unk	Y	Y	Y	Y	Y			Port Fuel-Injected	Normal
6	3.5	L	2004	OBD II	California	ULEV LDT	Y	Unk	Unk	Y	Y	Y	Y	Y	4HNXT03.51AT	4HNXR0160AAB	Port Fuel-Injected	Normal
6	3.5	L		OBD II							Y	Y	Y	Y		3NSXR0130MAC	Port Fuel-Injected	Normal
6	3.1	L	1998	OBD II	USEPA		Y	Unk	Unk	Y	Y	Y	Y	Y	WGMXV03.1041	WGMXE0095904	Port Fuel-Injected	Normal
8	4.6	L	1999	OBD II	USEPA		Y	Unk	Unk	Y	Y	Y	Y	Y	4.6LXFMXR0105BAE	XFMXV04.6VBE, XU7	Port Fuel-Injected	Normal
4				OBD II			Unk	Unk	Unk	N		Y	Y	Y			Port Fuel-Injected	Normal
8	4.9	L	1991	OBD I	USEPA		Unk	Unk	Unk	Y	Y	Y	Unk	Y	MCD, M2G4.9V8X6A7, MBO-2B 4.9 Liter		Port Fuel-Injected	Normal

General Veh Info (ERG)

No of Cyls	Disp	Disp Units	Engine Cert Year	OBD Type	Emiss Cert Type (s)	Emiss Cert Details	PCV	TAC	AIS	EGR	Evap	Cat	FIR	Ox	Engine Family #	Evaporative Family #	Fuel Delivery Type	Air Intake
4	1.9	L		OBD II	USEPA		Y	Unk	Unk	Y	Y	Y	Y	Y	XGMXV01.9001	XGMXR0080902	Port Fuel-Injected	Normal
6	4	L		No OBD	USEPA		Y	Unk	Unk	Unk	Unk	Y	Y	Y	PFM4.0T5FYYX		Port Fuel-Injected	Normal
6	3.2	L	1999	OBD II	USEPA	Tier 1	Y	Unk	Unk	Y	Y	Y	Y	Y	XSZXT03.52EK	XSZXT0095MEO	Port Fuel-Injected	Normal
4	2		1999	OBD II	USEPA		Unk	Unk	Unk	Y	Y	Y	Y	Y	YTYXT02.0XBH	YTYXE0095AE1	Port Fuel-Injected	Normal
4	1.6	L	1997	OBD II	USEPA		Unk	Unk	Unk	Y	Y	Y	Y	Y	VNS1.6VJGKEK	VNS107SAYMEA	Port Fuel-Injected	Normal
6	3	L			USEPA		Y			Y	Y	Y	Y	Y	XFMXT03.02BB		Port Fuel-Injected	Normal
6	3	L	2002	OBD II	USEPA		Y			Y	Y	Y	Y	Y	2FMXV03.0VF4		Port Fuel-Injected	Normal
6				No OBD									Y					
6	91	CID	1984	No OBD	USEPA		Unk	Unk	Unk	Y	Y	Unk	Unk	Unk	EHN1.SU3FCF0	84 FA		Normal
6	3	L			USEPA					Y	Y	Y	Y	Y	XTYXV03.0BBA	XTYXR0135AK1	Port Fuel-Injected	Normal
4	1.5	L	1991	No OBD	USEPA		Unk	Unk	Unk	Unk	Unk	Y	Y	Unk	LHN1.5V5F1F2	90FD	Port Fuel-Injected	Normal
8	4	L	1995		USEPA		Unk	Unk	Unk	Unk	Y	Unk	Unk	Unk	SCR4.028GFEA	SCR7058AYPON		Normal
	5.2	L	1991	No OBD	USEPA		Y			Y	Y				MCR5.9TSHGF9	MCRTE		Normal
4	1.6	L	1997		USEPA					Y	Y	Y	Y	Y	VTY1.8UJGFFK	VTY1047DYMAO	Port Fuel-Injected	Normal
6	3	L	2000	OBD II	USEPA		Unk	Unk	Unk	Y	Y	Y	Y	Y	YNSXV03.0A6A	YNSXR0110RCC		
4				OBD II			Unk	Unk	Unk	N	Y	Y	Y	Y			Port Fuel-Injected	Normal
8	5	L	1995	No OBD	USEPA		Unk	Unk	Unk	Y	Unk	Y	Y	Unk	SFM1045AYM0A		Port Fuel-Injected	Normal
4	2	L					Y			Y	Y		Y					Normal
6	4.3	L	1996	OBD II	USEPA		Unk	Unk	Unk	Y	Y	Y	Y	Y	TGM4.31PGFEK	TGM1089AYMEA	Port Fuel-Injected	Normal
6	3.1	L	1993	No OBD	USEPA		Y			Y	Y	Y	Y	Y	P1G3.4V8XGZS	PBO-1K		Normal
6	4	L	2000	OBD II	USEPA					Y	Y	Y		Y	4.0L-YFMXE0120BAE	YFMXT04.02F3	Port Fuel-Injected	Normal
8	5.3	L	2002		USEPA		Y	N	N	Unk	Y	Y	Y	Y	2GMYT05.3181	2GMXE0111911	Port Fuel-Injected	Normal
6	3.3	L	1998	OBD II	USEPA		Y	Unk	Unk	Y	Unk	N	Y	Y	WCRXT03.32BP	WCRXE0101XAA		Normal
6	3.8	L	1989	No OBD	USEPA		Y			Y	Y	Y	Y		K2G3.8U8XEB1		Port Fuel-Injected	Normal
4				OBD II			Unk	Unk	Unk	Y	Unk	Y	Y	Y				
6	3.8	L	1988	No OBD	USEPA		Y	N	Y	Y	Unk	Y	Y	N	JFM3.8U5HHF3			
6	4	L	1995	OBD I	USEPA		Y	N	N	Y	Y	Y	Y	Y	4.0L-SFM1120AYM0E	SFM4.028GFEA	Carb	Normal
6	178	In^3		OBD II	California		Y				Y	Y	Y	Y	YVUXV 2.93 BU3	YVUXRO 133X48	Carb	Normal
4	112.3	In^3	1991	No OBD	USEPA		N	N	N	N	N	Y	Y	N	MTK1.8V3FFD7	E	Port Fuel-Injected	Normal
6	3.3	L	1999		USEPA		Y	Unk	Unk	Y	Y	Unk	Unk	Unk	XCRXT03.328P	XCRXE 0101XAA		Normal
6	3.3	L	2000	OBD II	USEPA		Y	N	N	Y	N	Y	Y	Y	YCRXT03.32BP	YCRXE0101XAA	Port Fuel-Injected	Normal
4	2.2	L	1999	OBD II	USEPA		N	N	N	Y	Unk	Y	Y	Y	XTYXV02.2XBC	XTYXE01 35AEO	Port Fuel-Injected	Normal
6	4	L	1993	No OBD	USEPA		N	N	N	N	Y	Y	Y	Y	PCR4.0T5FGA5	PTAPR or PTASS	Port Fuel-Injected	Normal
4	2.2			OBD II	USEPA		N	N	N	Y	Y	Y	Y	Y	YTYXV02.2XBA	YTYXR0135AKI	Port Fuel-Injected	Normal
4	2.2	L	1997	OBD II	USEPA		Y	N	N	Y	Y	Y	Y	Y	VGM2.2V8GKEK	VGM1095AYMEA	Port Fuel-Injected	Normal
8	4.6	L	1997	OBD II	USEPA		Y	N	N	Y	Y	Y	Y	Y	VFM4.6V8GKFL	VFM1090AYMED	Port Fuel-Injected	Normal
6	3.1	L	1998	OBD II	USEPA		Y	N	N	Y	Y	Y	Y	Y	WGMXV3.1041	WGMXR0133918	Port Fuel-Injected	Normal
6	152.4	In^3	1993	No OBD	USEPA		Y	N	N	Y	Y	Y	Y	Y	PFM2.5V5F2F1	Couldn't find	Port Fuel-Injected	Normal
8	5.8	L	1995	No OBD	USEPA		Unk	N	Y	Y	N	Y	Y	Y	SFM5.888GBJA	SFM1045AYMOA	Port Fuel-Injected	Normal
6	2.7	L	2000	OBD II	USEPA		Unk	N	N	Y	N	Y	Y	Y	YCRXV02.7VB0	YCRXR0101GBD	Port Fuel-Injected	Normal
4	2	L	1999	OBD II	USEPA		Y	N	N	N	Y	Y	Y	Y	XFMXV020VBB	XFMXE0080BAE	Port Fuel-Injected	Normal
6	4.3	L	2002	OBD II	USEPA, California	NLEV	Y				Y	Y		Y	2GMXT04.3187	2GMXE0095904	Port Fuel-Injected	Normal
8	5	In^3	1987 EPA	No OBD	USEPA		Y				N	Y	Y	N	HFM5.0V5HBFX	FIEGRE05AIP		Normal
4	2.2	L	1990	No OBD	USEPA		N	N	Unk	Y	Y	Y	Y	Y	LHN22V5FNF0	90FG	Port Fuel-Injected	Normal
6	3.3	L	1991		USEPA		Y	N	N	N	Y	Y	Y	Y	MCR3.8V5FBH5	MCRVC	Port Fuel-Injected	Normal
6	4	L	1990	No OBD	USEPA		N	N	N	Y	Y	Y	Y	Y	LAM4.0T5LND3	LT-4.0H-15	Port Fuel-Injected	Normal
4	2	L	2002	OBD II	USEPA, California	NLEV	Y	N	N	Y	Y	Y	Y	Y	2FMXV02.0VF3	2FMXR0080BAE	Port Fuel-Injected	Normal
6	3	L	1993	No OBD	USEPA		Y	N	N	Y	Y	Y	Y	N	PCR3.0T5FFXI	PTASC	Port Fuel-Injected	Normal

General Veh Info (ERG)

No of Cyls	Disp	Disp Units	Engine Cert Year	OBD Type	Emiss Cert Type (s)	Emiss Cert Details	PCV	TAC	AIS	EGR	Evap	Cat	FIR	Ox	Engine Family #	Evaporative Family #	Fuel Delivery Type	Air Intake
6	3.5	L	1999	OBD II	USEPA, California	NLEV	N	N	N	Y	Y	Y	Y	Y	YHNXT03.5EA3	YHNXE0130AA3	Port Fuel-Injected	Normal
4	2.3	L	2000	OBD II	USEPA, California	NLEV, Cle	N	N	N	Y	Y	Y	Y	Y	YHNXV02.3PF3	YHNXR0130AAA	Port Fuel-Injected	Normal
6	4.2	L	2000	OBD II	USEPA		N	N	N	Y	Y	Y	Y	Y	YFMXT04.22BF	YFMXE0155BAE	Port Fuel-Injected	Normal
6	2.3	L	1988	No OBD	USEPA, California		N	N	N	Y	N	Y	Y	Y	JFM2.3T5FFG1	8HM	Port Fuel-Injected	Normal
4	2.3	L	2001	OBD II	USEPA	NLEV, Cle	N	N	N	Y	Y	Y		Y	1HNXV02.32J1	1HNXR0130AAF	Port Fuel-Injected	Normal
4	1.6	L	1994	No OBD	USEPA		N	N	N	Y	Y	Y		Y	RNS16VJGFEA	RNS1030BYMOA	Port Fuel-Injected	Normal
4	2	L	2002	OBD II	USEPA	NLEV	N	N	N	N	Y	Y	Y	Y	2KMXT02.0B05	2KMXR0160B05	Port Fuel-Injected	Normal
4	2.6		EPA 1983	No OBD	USEPA		Y	N	N	Y	N	N	Y	N	DCR2.6V2BAP2	DCRKB	Port Fuel-Injected	Normal
6	2.4		1997	OBD II	USEPA, California	TLEV	Y	N	Y	N	Y	Y	Y	Y	VVV2.4VJGKEL	VVV143AYPEA	Port Fuel-Injected	Normal
4	2.3	L	1992	No OBD	USEPA		Y	N	N	Y	Y	Y	Y	Unk			Port Fuel-Injected	Normal
4	2	L	2001	OBD II	USEPA	NLEV	N	N	N	Y	Y	Y	Y	Y	2.0L-YFMXV0.2.0VF2	2.0LFMXR00B0BBE	Port Fuel-Injected	Normal
6	3.3	L	1999	OBD II	USEPA		N	N	N	Y	Y	Y	Y	N	VCRXT03.328P	XCRXE0101XAA	Port Fuel-Injected	Normal
4	91 CID 1.5		1988		USEPA		N	N	N	N	Y	Y	Y	N	JHN1.5V5FCF4	88FD	Port Fuel-Injected	Normal
6	3.8	L	1996	OBD II	USEPA, California	Tier 1	Y	N	N	N	Y	Y			TGM3.8V8GKEK	TGM1058AYMMA	Port Fuel-Injected	Normal
V6	2.8		1986		USEPA		N	N	N	Y	N	Y	Y	N	G162.8V8XG2X	6B0-1E	Port Fuel-Injected	Normal
6	3	L	1999	OBD II	USEPA		N	N	N	Y	Y	Y	Y	Y	XFMXT03.02BB	3.0LXFMXE0155FBE	Port Fuel-Injected	Normal
6	3.8	L	1988	No OBD	USEPA		Y	N	N	Y	Y			Y	J2G3.8V8XEB0	JB0-2D	Port Fuel-Injected	Normal
4	2.3	L	1994	No OBD	USEPA		Y	N	N	Y	Y	Y	Y	Y	RFM2.3V8GAJA	RFM1045AYM0A	Port Fuel-Injected	Normal
6	3		1996	OBD II	USEPA		N	N	Y	Y	Y	Y	Y	Y	TFM3.0VJGFEK	TFM1115AYMEB	Port Fuel-Injected	Normal
6	4		1988	OBD II	USEPA		N	N	N		Y	Y	Y	N	WCRXT04.02B0	WCRXE0101GCS	Port Fuel-Injected	Normal
8	4.6	L	1995	No OBD	USEPA		Y	N	N	Y	Y	Y	Y	Y	SFM4.6V8GAEB	SFM1045AYPOA	Port Fuel-Injected	Normal
4	2.2		1997	OBD II	USEPA		N	N	N	Y	Y	Y	Y	Y	VTY2.2VJGKFK	VT41095AYME1	Port Fuel-Injected	Normal
4	1.8		1996	OBD II	USEPA		N	N	N	Y	Y	Y		Y	TTY1.8VJGFFK	TTY1041DYMA0	Port Fuel-Injected	Normal
4	1.6		2000	OBD II	USEPA, California	NLEV	N	N	N	N	Y	Y	N	Y	YHNXV01.6CA3	YHNXR0099AAD	Port Fuel-Injected	Normal
4	2.2	L	2000	OBD II	USEPA		N	N	N	Y	Y	Y	N	Y	YTYXV02.2XBA	YTYXR0135AKI	Port Fuel-Injected	Normal
4	1.8		2000	OBD II	USEPA	NLEV	N	N	Y			Y		Y	YT4XV01.8	YT4XR011SAK1	Port Fuel-Injected	Normal
6	4.9	L	1984		USEPA		Y	N - Disable	N - Disable	N - Disable	Y	N - Remov	Y	N	EFM4.9TIHGG5	E4AE-9C485-AKM	Carb	Normal
4	2.5		2000	OBD II	USEPA, California	LEV	N	N	N	N	Y	Y	Y	Y	YFJXV02.5JEH	YFJXR01251CC	Port Fuel-Injected	Normal
8	305	In^3	1977	No OBD	USEPA		Unk	N- Disable	Unk	Y	Unk	N - Remov	N	N	Unlisted	710Y2	Carb	Normal
4	2.4	L	2001	OBD II	USEPA, California	NLEV	N	N	N	Y	Y	Y	Y	Y	1HYXT02.4S3S	1HYXR0175PES	Port Fuel-Injected	Normal
4	1.8	L	2003	OBD II	USEPA, California	LEV	Y	N	N	Y	Y	Y	Y	Y	3TKXV01.8CJA	3TKXR0120PMA	Port Fuel-Injected	Normal
6	3.1		1999	OBD II	USEPA		Y	N	N	N		Y	Y	Y	XGMXV03.4041	XGMXE0095904	Port Fuel-Injected	Normal
6	4.3	L	1993		USEPA		Y	N	N	Y	Y	Y	Y	Y	P3G4.3T5TAA6	PF0-3A	Throttle-body	Normal
6	4.3	L	2001	OBD II	USEPA, California	LEV	Y	N	Y	Y	Y	Y	Y	Y	1GMXT04.3187	1GMXE0095904	Port Fuel-Injected	Normal
4	1.9	L	1994	No OBD	USEPA		Y	N	N	Y	Y	Y	Y	Y	R4G1.9VHGBEA	R4G1035AYPOC		Normal
4	3.1	L	1990	No OBD	USEPA		Y	N	N	Y	Y	Y	Y	Y	LIG3.1V8XG25	LB0-1K		Normal
	4.3		1991	No OBD	USEPA		Y	N	N	Y	N	Y	Y	Y	M3G4.3T5TAA3	MF0-3B		
8	5	L	1986	No OBD	USEPA		Y	Y	N	Y	Y	Y	Y	N	non readable	non readable		N
6	2.8	L	1986	No OBD	USEPA		Y	N	N	Y	Y	Y	Y	N	FLG2812H1X1	S86-8	Carb	N
8	5.8	L	83		USEPA		Y	N	Unk	Y	Y	Y	Y	N	DFM5.8T2AAF9	3DQ?	Throttle-body	N
8	5	L	1989		USEPA		Y	N	Y	Y	Y	Y		N	5.0L-9HM	KFM5.0V5HBF4	Port Fuel-Injected	N
6	4.2	L	1998		USEPA		N	N	N	Y	Y	Y	Y	Y	WFMXT04.2BAA	WFMXE0160BAE	Port Fuel-Injected	N
6	Unknown		Unknown	OBD II			Unk	N	Unk	Y	Y	Y	Y	Y	N/A, no sticker	N/A, no sticker	Port Fuel-Injected	N
8	5.7	L	1994		USEPA		Y	Y	N	Y	Y	Y		Y	R3G5.785GAEB	R3G1085AYMOA	Throttle-body	N
4	2.4	L	1996	OBD II	USEPA		Y	Y		N	N	Y		N	TCR2.4VJGFEK	TCR1098A4PE0		N
4	2.5	L	1986	No OBD	USEPA		Y	N	N	Y	N	Y	Y	N	GFM2.5V5HCFS		Port Fuel-Injected	N
4	2.2	L	1988	No OBD	USEPA		N	N	N	Y		Y			JTK2.2V5FFG1	JB0-2D	Port Fuel-Injected	N
6	3.8	L	1985	No OBD			Y	N	N	Y	Y	Y	Y	N	F4G3.8V8XEB3	580-AA	Port Fuel-Injected	N
8	5						Unk	Unk	Unk	Unk	Unk	Unk	Y	Unk				N
6	3	L	1992	No OBD	USEPA		N	N	N	Y	Y	Y	Y	Y	NNS3.0V5FHAB	F16-1	Port Fuel-Injected	N
6	3.8		1994	OBD I	USEPA, California		N	N	N	Y	Y	Y	Y	Y	R1G3.8V8FEA	R1G1058AYM0J	Port Fuel-Injected	N
6	4.9		1990	No OBD	USEPA		Y	N	Y	Y	Y	Y		Y	IFM4.9T5HGF7		Port Fuel-Injected	N

General Veh Info (ERG)

No of Cyls	Disp	Disp Units	Engine Cert Year	OBD Type	Emiss Cert Type (s)	Emiss Cert Details	PCV	TAC	AIS	EGR	Evap	Cat	FIR	Ox	Engine Family #	Evaporative Family #	Fuel Delivery Type	Air Intake
6	3	L	2001	OBD II			Y	N	N	Y	Y	Y	Y	Y	2FMXV03.0VF3-2	2FMXR0115BAE	Port Fuel-Injected	
6	3.5	L	1994	No OBD	USEPA		N	N	N	N	Y	Y	Y	N	RCR3.5VJGAEA	RCR1095AYP01	Port Fuel-Injected	N
6	3.8		1994		USEPA, California		N	N	N	Y		Y	Y	Y	R1G3.8V8GFEA	R1G1058AYMOJ	Port Fuel-Injected	N
8	?		?	No OBD			Unk	Unk	Unk	Unk	Unk	Unk	N	Unk	?	?		N
8	5	L	1984	No OBD	USEPA		Y	N	N	Y	N	Y	Y	N	ASF-525.0L-5FM	FFM5.0V5HBF8	Carb	N
4	1.9		1992	No OBD	USEPA						Y	Y		Y	NFM1.9V5FCF3	F2AE-9C485 HGS ?	Port Fuel-Injected	N
4	1.6		2000	OBD II	USEPA, California		N	N	N	N	Y	Y	Y	Y	YHNXV01.6CA3	YHNXR0099AAD	Port Fuel-Injected	N
6	3.1	L	1997	OBD II	USEPA		Y	N	N	Y	Y	Y	Y	Y	VGM3.1V8GKEK	VGM1095AYMEA	Port Fuel-Injected	N
4	2.3	L	1992		USEPA		N	N	N	N	Y	Y	Y	Y	N2G2.3V8XRM9	NA0-2A	Port Fuel-Injected	N
6	3.8		2005	OBD II	USEPA	ULEV	Y	N	N	N		Y	Y	Y	5CRXT03.82N0	5CRXR0177GHA	Port Fuel-Injected	N
4	96.8	In^3	1989	No OBD	USEPA		Y	N	N	Y	Y	Y		Y	KTY16V2HFD8	(unknown)	Carb	N
4	1.33	L	1993	No OBD	USEPA		Y	N	N	Y	Unk	Y		N	Unknown		Port Fuel-Injected	N
6	3.4	L	2000	OBD II	USEPA		N	N	N	Y	Y	Y	Y	Y	YGMXT03.4141	YGMXE0095905	Port Fuel-Injected	N
4	1.8	L	1991		USEPA		Y	Unk	N	Unk	Unk	Y	Y	Y	MVW1.8V5FWD8	Unknown	Port Fuel-Injected	N
6	3	L	1987	No OBD	USEPA		Y	N	N	Unk	Y	Y	Y	N	BUJJIASAWSF-323.(	HFM3.0V5FEGG	Port Fuel-Injected	N
6	4.9	L	1986		USEPA		Y	N	N	Y	N	Y		N	4.9-6GM	GFM4.9T1HGG7	Carb	N
4	2.8	L	1987	No OBD	USEPA		Y	N	N	Y	N	Y	Y	N	JIG2.8V8XRZ8	JB0-1K	Port Fuel-Injected	N
4	2.3	L	1992	No OBD	USEPA		N	N	N	N	Y	Y		Y	N2G2.3V8XRM9	NA0-2A	Port Fuel-Injected	N
4	96.8 CiD	In^3	1989		USEPA		Y	N	N	N	Y	Y	Y	Y	LNT1.6V5FFD1	EV-E	Port Fuel-Injected	N
4	1.8		1993	No OBD	USEPA		Y	N	N	N	Y	Y	Y	Y	PFM1.8V5FXF7	BW0GF	Port Fuel-Injected	N
6	2.5	L	1997	OBD II	USEPA		Y	Unk	Unk	Y		Y	Y	Y	2.5WFMXE0115BBE	WFMXV02.5AA	Port Fuel-Injected	N
8	4.9	L	1992		USEPA		Y	N	N	Y	Unk	Y	Y	N	P1G4.9WBXGA0	PRO-IT 4.9	Port Fuel-Injected	N
4	2	L	1987		USEPA		Y	N	N	Y	Y	Y	Y	N	HHN2.0V5FNF4	87FG	Port Fuel-Injected	N
6	3		1998	OBD II	USEPA		N	N	N	Y	Y	Y	Y	Y	WNSXV03.0A6A	WNSXE0110MBA	Port Fuel-Injected	N
6	3.3		1997	OBD II	USEPA		N	N	N	N	Y	Y	Y	N	VCR3.828GFEK	VCR1098AYPEA	Port Fuel-Injected	N
6	1.8	L	1994	No OBD	USEPA		Unk	Unk	Unk	Unk	Y	Y	Y	Unk	RDS1.8GAEA	RDS1037BYM0G	Port Fuel-Injected	N
8	2.9	L	1987		USEPA		Y	N	N	Y	Y	Y	Y	N	HFM2.9T5FME6	E7AE-9C485-CCE	Port Fuel-Injected	N
4	141 CI		1983		USEPA, California		Y	N	N	N	N	Y	Y	Y	DVV141V5FSN4	E2	Port Fuel-Injected	N
6	4.3	L	1989		USEPA		Y	N	N	Y	N	Y	Y	N	K3G4.3T5XEB0	KB0-3E	Carb	N
4	1.9		1987	No OBD	USEPA		N	N	N	Y	Y	Y	Y	N	HFM1.9V5FFF1	E7AE-9C485	Port Fuel-Injected	N
6	3.8	L	1992	No OBD	USEPA		Y	N	N	N	N	Y	Y	Y	N2G3.8V8JAW4	NB0-2F	Port Fuel-Injected	N
6	3	L	1997	OBD II	USEPA		Y	N	N	Y	N	Y	Y	Y	VFM3.0V8GKEK	VFM1115AYMEP	Port Fuel-Injected	N
6	3	L	2001		USEPA		Y	N	N	Y	Y	Y	Y	Y	1FMXV03.0VF3	1W7E-9C485-HFP	Port Fuel-Injected	N
4			1990		USEPA		Y	Unk	Unk	Y	Unk	Y	Y	Y			Throttle-body	N
6	3.8	L	1991		USEPA		Y	N	N	Y	Y	Y	Y	Y	M2G3.8V8XEB3	MBOP-2D	Port Fuel-Injected	N
4	Unk - No label		UNK		UNK		Unk	Y	N	Y	Y	Y	Y	Unk	K02TUESL2 (model tag says), 663B, EXT P		Carb	N
4	121.9 Cid (2.0 L)		1989		USEPA		Y	Unk	N	Y	Y	Y	Y	Y	KTY2.0V5FFFX	EV-E	Port Fuel-Injected	N
6	3	L	1984		USEPA		Y	N	N	Y	N	Y		Y	E4G3.8V2NEY0	483-40	Carb	N
4	1.8	L	2000	OBD II	California	LEV	Y	N	N	N	Y	Y	Y	Y	YKMXV01.8A03	YKMXR0100A03	Port Fuel-Injected	N
4	2	L	1989	No OBD	USEPA		Y	N	N	Y	Y	Y	Y	N	K1G2.0V5IG0	KA0-1E	Carb	N
8	4.9	L	1979		USEPA		Y	N	N		Y	Y	Y	N	920S2E	983-2	Carb	N
8	5	L	1994	No OBD	USEPA	N/A	N	N	Y	Y	Y	Y		Y	RFM1045AYM0A	RFM5.888GBJ8-OC	Port Fuel-Injected	N
8	5	L	1986		USEPA	N/A	Y	N	Y	Y	Y	Y	Y	N	5.0L-6HM	GFM5.0V5HBF9	Port Fuel-Injected	N
6	3.8		1989	No OBD	USEPA		Y	N	N	Y	Y	Y	Y	N	K2G3.8V8XEB1	KB0-2D	Port Fuel-Injected	N
4	1.3	L	1994		USEPA, California		Y	N	N	Y	Y	Y		Y	SFM1065BYMDA	SFM1.3V8G1EA	Port Fuel-Injected	N

General Veh Info (ERG)

No of Cyls	Disp	Disp Units	Engine Cert Year	OBD Type	Emiss Cert Type (s)	Emiss Cert Details	PCV	TAC	AIS	EGR	Evap	Cat	FIR	Ox	Engine Family #	Evaporative Family #	Fuel Delivery Type	Air Intake
4				OBD II									Y					N
6	4	L	1995		USEPA		Y	N	N	N	Y	Y	Y	N	SCR4.028GFEA	SCR1058AYPON	Port Fuel-Injected	N
8	4.3	L	1990	No OBD	USEPA					Y		Y	Y	Y	L3G4.3T5XE	LB0-3E	Port Fuel-Injected	N
4	110 cu in		1978		USEPA		N	N	N	N	Y	N	N	N	B/50	L CAN-1	Carb	N
4	3.4	L	1997	OBD II	USEPA		Y	N	N	Y	Unk	Y	Y	Y			Port Fuel-Injected	N
4	1.6		2000	OBD II	USEPA	NLEV	N	N	N	N	Y	Y	N	Y	YHNXV01.6TA3	YHNXR0099AAD	Port Fuel-Injected	N
6	4.3		1995		USEPA		Y	N	N	Y	Y	Y	Y	Y	S3G4.385GAEA	S3G1085WYMOA	Carb	N
4	1.6	L	1997	OBD II	USEPA, California		N	N	N	Y	Y	Y	Y	Y	VHN1.6JGKEK	VHN106SAYMED	Port Fuel-Injected	N
8	5		1984	No OBD	USEPA		N	N	Y	Y	Y	N	Y	N	E3G5.0V4NLAX	434-3A	Carb	N
4	2.3	L	1984	No OBD	USEPA, California		N	N	N	N	Y	Y	Y	N	EVV2.3V5FEL8	E2	Port Fuel-Injected	N
8					USEPA		Y	Y	Y	Unk	Y	Y	Y	N	Unknown	Unknown	Carb	N
8	5.9		1997	OBD II	USEPA		Y	N	N	N	Y	Y	Y	N	VCR5.968GFEK	VCR1073AYPBB	Port Fuel-Injected	N
6	4.9	L	1993	No OBD	USEPA		Y		Y	Y	Unk	Y		Y	PFM4.9T5HGM9-OC	F3AE9C48S-J1AJ	Port Fuel-Injected	N
6	3.1	L	1989		USEPA		Y	N	N	Y	Y	Y		Unk	K1G3.1V8XGZ4	KB0-1K	Port Fuel-Injected	N
6	3.8	L	1990		USEPA		Y	Unk	Unk	Y	Y	Y	Y	Y	L2G3.8V8XEBL	LB0-2D	Port Fuel-Injected	N
4	2.4		1996	OBD II	USEPA		Y	Y	N	N	Y	Y	Y	N	TCR2.4VJGFEK	TCR1098AYPE0	Port Fuel-Injected	N
4	2.5	No Label	No Label	OBD II			N	N	N	Y	Y	Y	Y	Y	No Label	No Label	Port Fuel-Injected	N
8	5.9		1999	OBD II	USEPA		Y	N	N	N	Y	Y	Y		XCRXT05.95B2	XCRXE0133GDH	Port Fuel-Injected	N
4	1.6	L	1998	OBD II	USEPA, California	Tier 1, LEV	N	N	N		Y	Y	Y	Y	WHNXV01.6CA3	WHNXE0065AAD	Port Fuel-Injected	N
4	1.7	L	2001	OBD II	USEPA	NLEV	N	N	N	N	Y	Y	N	Y	1HNXV01.7YJD	1HNXR0099AAH	Port Fuel-Injected	N
4	2.2		1992	No OBD	USEPA		N	N	N	N	Y	Y			NHN2.ZV5FEY4	92FG	Port Fuel-Injected	N
4	2.3		1994	No OBD	USEPA		Y	N	N	Y	Y	Y	Y	Y	R1G2.3V7GFEA	R1G1046AYM0G	Port Fuel-Injected	N
6	3.1		1999	OBD II	USEPA		N	N	N	Y	Y	Y	Y	Y	XGMXV03.4041	XGMYR0124912	Port Fuel-Injected	N
6	3.4		2002	OBD II	USEPA	NLEV	Y	N	N	Y	Y	Y	Y	Y	2GMXT03.4141	2GMXR0212923	Port Fuel-Injected	N
8	4.5		1973	No OBD	USEPA, California		N	N	N	N	Unk	N		N	Unknown	Unknown	Port Fuel-Injected	N
8	5.7		1993	No OBD	USEPA		Y	N	N	Y	N	Y	Y	Y	P3G5.7T5TYA8	PP0-3C	Port Fuel-Injected	N
8	4.6	L	1997	OBD II	USEPA	light duty tr	Y	N	N	Y	Y	Y	Y	Y	VFM4628GKEK	VFM1160AYMED	Port Fuel-Injected	N
6	3.4	L	2002	OBD II	USEPA		Y	N	N	Y	Y	Y	Y	Y			Port Fuel-Injected	N
6	3	L	1991	No OBD	USEPA		Y	N	N	Unk	N	Y	Y	N	MCR3.0T5FBL8	MCRTH	Port Fuel-Injected	N
4	2	L	1996	OBD II	USEPA		Y	N	N	Unk	Y	Y	Y	Unk	TDS2.0VJGFEK	TDS1130AYMEL	Port Fuel-Injected	N
4	1.6		1989	No OBD	USEPA					Y	Y	Y	Y	Y	KTY1.6V2HFFX	EV-A	Carb	N
4	1.6	L	1996	OBD II	USEPA		Y	N	Unk	Y	Y	Y	Y	Y	VNS1.6VJGKEK	VNS1075AYMEA	Port Fuel-Injected	N
4	2	L	1990	No OBD	USEPA		N	N	N	Y	Y	Y	Y	Y	LTY2.0V5FFF0	EV-E	Port Fuel-Injected	N
4	2.4	L	2000	OBD II	USEPA		Y	N	N	Y	Y	Y	Y	Y	YNSXV02.4A3A	YNSXR0110RCB	Port Fuel-Injected	N
4	2.2	L	1989		USEPA, California		Y	N	N	Y	Y	Y	Y	Y	KCR2.5V5VBE7	KCRVB	Throttle-body	N
4	2.2	L	1999	OBD II	USEPA					Y	Y	Y	Y	Y	WTYXV02.2XBA	WTYXR0135AK1	Port Fuel-Injected	N
6	3.8	L	2001	OBD II	USEPA, California		Y	N	N	Y	Y	Y	Y	Y	1FMXR0230BBE	1FMXT03.82JS	Port Fuel-Injected	N
6	3	L	1996		USEPA		Y	N	Unk	Y	Y	Y	Y	Y	TTY3.0VJGFFK	TTY1095AYME0	Port Fuel-Injected	N
6	3	L	1997	OBD II	USEPA	N/A	Y	N	N	Y	Y	Y	Y	Y	VNS3.0VJGFEK	VNS1110AYMEA	Port Fuel-Injected	N
4	2.2	L	1999		USEPA		Y	Unk	Unk	Y	Y	Y	Y	Y	XTYXV02.2XBA	XTYXR0135AK1	Port Fuel-Injected	N
6	3	L	1998	OBD II	USEPA		Y	N	N	Y	Y	Y	Y	Y	WFMXV03.0DAA	WFMXE0115BAE	Port Fuel-Injected	N
6	4	L	1997		USEPA	Light duty t	Y	N	Unk	Y	Y	Y	Y	Y	VCR4.028GFEK	VCR1049AYPBN	Port Fuel-Injected	N
4	1.6	L	2004		USEPA, California	On Tier 2-E	N	N	N	N	Y	Y	Y	Y	4KMXV01.6102	4KMXR0100C02	Port Fuel-Injected	N
8	5	L	1990	No OBD	USEPA	NA	Unk	N	Y	Y	Y	Y	Y	Y	L2G5.0V4NLA9	L134-2A	Carb	N
8	5	L	1988	No OBD	USEPA		Y	N	N	Y	N	Y	Y	N	JFM5.0V5HBF3	Unknown	Throttle-body	N

General Veh Info (ERG)

No of Cyls	Disp	Disp Units	Engine Cert Year	OBD Type	Emiss Cert Type (s)	Emiss Cert Details	PCV	TAC	AIS	EGR	Evap	Cat	FIR	Ox	Engine Family #	Evaporative Family #	Fuel Delivery Type	Air Intake
4	2.4	L	1987	No OBD	USEPA	Light duty t	N	N	Y	Y	N	Y	Y	Y	HTY2.4T2AFF3	EV-R	Carb	N
4	2.2	L	2003		USEPA		Y	N	N	N	Y	Y	Y	Y	4GMXV02.2025	4GMXR0124919	Port Fuel-Injected	N
4	2.4	L	1997	OBD II	USEPA		N	N	N	Y	Y	Y		Y	VGM2.4VJGKEK	VGM1095AYMEA	Port Fuel-Injected	N
4	2.4	L	2001	OBD II	USEPA		Y	N	N	Y	Y	Y	Y	Y	VGM2.4JGKEK	VGM1095AYMEA	Port Fuel-Injected	N
6	3.8	L	1999		USEPA, Canada		Y	N	N	Y	N	Y	Y	Y	XCRXT03.8281	XCRXE0101GCA	Port Fuel-Injected	N
6	3	L	1994	No OBD	USEPA		Y	N	N	Y	Unk	Y	Y	Y	RTY3.0VJGFEK	RTY1073DYM00	Port Fuel-Injected	N
6	4	L	2003	OBD II	USEPA, California	SFTP, CFF	Y	N	N	N		Y		Y	3FMXT04.02FA	3FMXR0155BBE	Port Fuel-Injected	N
	3.5	L	2004	OBD II	USEPA, California		Y	N	N	N	N	Y	Y	Y	4KMXT03.5F03	4KMXR0160F03	Port Fuel-Injected	N
4	1.6	L	1995		USEPA	not Califorr	N	N	N	N	Y	Y	Y	Y	STY1.6VHGBFA	STY1047DYM00	Port Fuel-Injected	N
6	3	L	2000	OBD II	USEPA	not Califorr	N	N	N	N	Y	Y	Y	Y	YTYXT03.0XBP	YTYXE011SAE1	Port Fuel-Injected	N
4	2.5	L	1987	No OBD	USEPA		Y	N	Unk	Y	N	Y	Y	Unk	H1G2.5V5TPG0	7A0-1C	Carb	N
6	3.1	L	1997	OBD II	USEPA		Y	N	N	Y	Y	Y	Y	Y	VGM3.1V8GKEK	VGM1095AYMEA	Port Fuel-Injected	N
4	2	L	1996		USEPA		Y	N	N	Y	N	Y	Y	Y	TFMZ.0VJGFEK	TFM1045AYPAB	Port Fuel-Injected	N
6	4.9	L	1989	No OBD	USEPA		Y	N	Y	Y	Y	Y	Y	Unk	KFM4.9T5HGE5	9HM	Port Fuel-Injected	N
4	1.9	L	1993	No OBD	USEPA		Y	N	N	Y	Y	Y	Y	Y	P4G1.9V5J8H9	PA0-4C	Port Fuel-Injected	N
6	2.5	L	2003	OBD II	USEPA, California	LEV light d	N	N	N	Y	Y	Y		Y	3SKXT2.49LC1	3SKXR0120164	Port Fuel-Injected	N
8	5	L	1987	No OBD	USEPA		N	N	Y	Y	Y	Y		N	H2G5.0V4NLA3	7134-2A	Carb	N
4	2		1999	OBD II	USEPA						Y	Y	Y	Y	XFMXV02.0VBB	XFMR0080BAE	Port Fuel-Injected	N
6	3	L	2001	OBD II	USEPA, California	NLEV, LEV	N	N	N	Y	Y	Y	Y	Y	ITYXV03.0FEB	ITYXR0135AK1	Port Fuel-Injected	N
6	3.7		1986	No OBD	USEPA		N	N	N	Y	Y	Y	Y	N	GCR3.7T1BBA1	GCRTD, GCRTE	Port Fuel-Injected	N
8	5.7	L	1997		USEPA		Y	N	N	Y	Y	Y		N	S3G5.785GBEB	S3G1085AYMOA	Carb	N
4	1.6	L	1992	No OBD	USEPA		Y	N	N	N	Y	Y	Y	Y	NTY1.6V5FFD6	EV-E	Port Fuel-Injected	N
4	2.4	L	1997	OBD II			Y	N	N	Y	Y	Y	Y	Y	VGM2.4VJG2EK	VGM1095AYMEA	Port Fuel-Injected	N
4	1.9	L	1995	No OBD	USEPA		Y	N	N	Y	Y	Y	Y	Y	1.9F-SFM1045AYPO	SFM1.9V8GFEA	Port Fuel-Injected	N
6	3.1	L	2001	OBD II	USEPA, California	LEV	Y	N	Y	Y	Y	Y	Y	Y	1GMXV03.8043	1GMXR0133918	Port Fuel-Injected	N
6	3	L	1998	OBD II	USEPA		Y	N	N	Y	Y	Y	Y	Y	WFMXV03.0DAA	WFMXR0115BAE	Port Fuel-Injected	N
4	1.8	L	1996	OBD II	USEPA		N	N	N	Y	Y	Y	Y	Y	TTY1.8VJGFFK	TTY1047DYMAO	Port Fuel-Injected	N
6	3.5	L	2002	OBD II	USEPA, California	LEV	N	N	N	N	Y	Y	Y	Y	2NSXV03.5C6A	2NSXR0110RCB	Port Fuel-Injected	N
8	4520	Cm^3	1980	No OBD	USEPA		Y	N	N	Unk	Unk	Y	Y	Y	80202845	Unknown	Carb	N
6	3.8	L	1993	No OBD	USEPA		Y	N	N	Y	N	Y	Y	Y	PFM3.8V5FJF0	HM	Port Fuel-Injected	N
6	4.3	L	1990	No OBD	USEPA		Y	N	N	Y	Y	Y		Y	L3G4.3T5TAA2	LF0-3B	Carb	N
4	2.3	L	1996	OBD II	USEPA		Y	N	N	Y	Y	Y	Y	Y	TVV2.3VJGKEK	TVV1058AYPAA	Port Fuel-Injected	N
6	3	L	1994	No OBD	USEPA		N	N	N	Y	Y	Y	Y	Y	RTY3.0VJGFEK	RTY1073DYM00	Port Fuel-Injected	N
4	1.9	L	1996	OBD II	USEPA		Y	N	N	Y	Y	Y	Y	Y	VGM1.9VJGKEK	VGM1035AYPAA	Port Fuel-Injected	N
6	3	L	1995	No OBD	USEPA		Y	N	N	Y	Y	Y	Y	Y	SFM3.0V8GFEA	SFM1045AYM0A	Port Fuel-Injected	N
6	3.3	L	1989	No OBD	USEPA		Y	N	N	N	Y	Y		Y	K2G3.3V8JAW4	KB0 20	Port Fuel-Injected	N
6	3.5	L	2000		USEPA, California	NLEV, Clea	N	N	N	Y	Y	Y	Y	Y	YHNXT03.5EA3	YHNXE0130AAE	Port Fuel-Injected	N

General Veh Info (ERG)

No of Cyls	Disp	Disp Units	Engine Cert Year	OBD Type	Emiss Cert Type (s)	Emiss Cert Details	PCV	TAC	AIS	EGR	Evap	Cat	FIR	Ox	Engine Family #	Evaporative Family #	Fuel Delivery Type	Air Intake
8	4.6		1995	OBD II	USEPA		Y	N	N	Y	N	Y	Y	Y	SFM4.6V8GFEA	SFM1120AYM1B	Port Fuel-Injected	N
6	4.9	L	1989	No OBD	USEPA		Y	N	Y	Y	Y	Y	Y	Unk	KFM4.9T5GHE5	9HM	Port Fuel-Injected	N
8	4.6	L	1994		USEPA		Y	N	N	Y	Y	Y	Y	Y	RFM4.6V8GAEA	RFM1045YFP0A	Port Fuel-Injected	N
4	2.4	L	1998	OBD II	USEPA		N	N	N	Y	Y	Y	Y	Y	WGMXV02.4024	WGMXE0095904	Port Fuel-Injected	N
4	2.2	L	1996	OBD II	USEPA, California	TLEV	N	N	N	Y	Y	Y	Y	Y	TTY2.2VJG2GK	TTY1095AYME0	Port Fuel-Injected	N
8	5.3	L	2002	OBD II	USEPA	Light duty t	Y	N	N	N	Y	Y	Y	Y	2GMXT05.3182	2GMXE0111920	Port Fuel-Injected	N
				OBD II			Y	N	N	Y	Y	Y	Y	Y	Unknown	Unknown	Port Fuel-Injected	N
8	5	L	1990	No OBD	USEPA		Y	N	N	N	Unk	Y	Y	Unk	Unknown	Unknown	Port Fuel-Injected	N
4	2156	Cm^3	1997	OBD II	USEPA, California		N	N	N	Y	Y	Y	Y	Y	VHN2.2VJGKFK	VHN1090AYMEA	Port Fuel-Injected	N
6	3	L	1990	No OBD	USEPA		Unk	Unk	Unk	Y	Unk	Y	Y	Y	LNS3.0V5FCF1	FI6-1	Port Fuel-Injected	
4	2	L	1999	OBD II	USEPA, California			N	Y	Y	Y	Y	Y	Y	XVWXV02.0223	XVWXE0090233	Port Fuel-Injected	
4	1.9		1995	No OBD	USEPA		N	N	N	Y	Y	Y	Y	Y	SFM1.9VBGFEA	SFM1045AYPOA	Port Fuel-Injected	Normal
8	Unknown 350		Unknown	No OBD	USEPA		Y	N	N	N	Unk	N	N	N	Unknown	Unknown	Carb	Normal
6	3.5	L	1999	OBD II	USEPA		Y	N	N	N	Y	Y	Y	Y	XCRXV0215V20	XCRXR0101GID	Port Fuel-Injected	Normal
6	3.5	L	2000	OBD II	USEPA		Y	N	N	N	Y	Y	N	Y	4HNXT03.5EA3	4HNXE0130AAE	Port Fuel-Injected	Normal
4	2.2	L	1997		USEPA/California		Y	N	N	Y	Y	Y	Y	Y	VHN22VJGKFK	VHN1090A4MEA	Port Fuel-Injected	Normal
6	3.3	L	1998		USEPA		Y	N	N	N	Y	Y	Y	Y	WCRXT03.32BP	WCRXE0101XAA	Port Fuel-Injected	Normal
4	2.3	L	2001	OBD II	USEPA		Y	N	N	N	Y	Y	N	Y	1HNXV02.32J1	1HNXR0130AAF	Port Fuel-Injected	Normal
4	1.5	L	90	N/A	USEPA		Y	N	N	N	Y	Y	Y	Y	LHV15V5F1F2	90 FD	Throttle-body	Normal
4	1.6	L	1995	OBD I	USEPA		Y	N	N	N	Y	Y	Y	Y	ST41.6VH6BFA	ST41047D4MOO	Port Fuel-Injected	Normal
6	3.3		1997	OBD II	USEPA		N	N	N	N	Y	Y	Y	N	VCR3.828GFEK	VCR1098AYPEA	Port Fuel-Injected	Normal
4	2.3		1989	No OBD	USEPA						Y	Y	Y	N	K2G2.3V8XEW0	KA0-2G	Port Fuel-Injected	Normal
6	3	L	2000		USEPA		Y	N	N	N	Y	Y		Y	YCRXT03.02B0	YCRXE0101GCA	Port Fuel-Injected	Normal
6	3	L	2002	OBD II	USEPA/California		Y	N	N	Y	Y	Y		Y	2FMXV03.0VF4-2TW(	2FMXR0115BAE	Port Fuel-Injected	Normal
8	351	In^3	1979	No OBD	USEPA/California		Y	Y	N	Y	Y	Y	Y	N	5.8M16.6"B"(1X128)		Carb	Normal
6	3.1	L	1999		USEPA		Y	N	N	Y	Y	Y	Y	Y	XGMXV03.4041	XGMXR0124912	Port Fuel-Injected	Normal
4	1.6	L	1996	OBD II	USEPA/California		Y	N	N	N	Y	Y	Y	Y	THN1.6VJGKEK	THN1065A4MED	Port Fuel-Injected	Normal
4	1.9		1996	OBD II	USEPA		Y	N	N	Y	Y	Y	Y	Y	TGM1.9V8GKEK	TGM1035AYPAA	Port Fuel-Injected	Normal
6	3.1	L	1998	OBD II	USEPA		Y	N	N	Y	Y	Y	Y	Y	WGMXV03.1041	WGMXE0095904	Port Fuel-Injected	Normal
6	2.4	L	1997	OBD II	USEPA		N	N	N	Y	Y	Y	Y	Y	VGM2.4VJGKEK	VGM1095AYMEA	Port Fuel-Injected	Normal
6	3.8	L	2003	OBD II	USEPA		Y	N	N	Y	Y	Y	Y	Y			Port Fuel-Injected	Normal
8	5.9		1999	OBD II	USEPA		Y	N	N	N	Y	Y	Y	Y	XCRXT05.9582	XCRXE0133GDH	Port Fuel-Injected	Normal
4	1.6		1999	OBD II	USEPA/California		Y	N	N	Y	Y	Y	Y	Y	WHNXV01.6CA3	WHNXE0065AAD	Port Fuel-Injected	Normal
6	4	L	1998	OBD II	USEPA		Y	N	N	N	Y	Y	Y	Y	WCRXT04.02B0	WCRXE0101GCS	Port Fuel-Injected	Normal
6	4	L	1995	OBD II	USEPA		Y	N	N	N	Y	Y	Y	Y	SCR4.028GFEA	SCR1058AYPON	Port Fuel-Injected	Normal
4	2.3		2000	OBD II	USEPA/California	NLEV	N	N	N	N	Y	Y	N	Y	YHNXV2.3PPG	YHNXROT30AAA	Port Fuel-Injected	Normal
6	4.0	L	1995	No OBD	USEPA		Y	N	N	Y	Y	Y		Y	SFM1120AYMOB	SFM4.0286FEA	Port Fuel-Injected	Normal
4	2.2		2000	OBD II	USEPA		N	N	N	N	Y	Y	Y	Y	YGMXX02.4021	YGMXR0124919	Port Fuel-Injected	Normal
6	3.1	L	1998	OBD II	USEPA		Y	N	N	Y	Y	Y	N	Y	WGMXV03.1041	WGMXR0124912	Port Fuel-Injected	Normal
4	2.5	L	1990	No OBD	USEPA		Y	N	N	Y	Y	Y		N	LCR2.5V5FBD7	LCRVB	Port Fuel-Injected	Normal
4	1.9	L	2001	OBD II	USEPA	NLEV	Y	N	Y	N	Y	Y	Y	Y	1GMXV01.9002	1GMXR0080902	Port Fuel-Injected	Normal
6	2.4	L	2001	OBD II	USEPA		Y	N	N	Y	Y	Y	N	Y	1DSXV02.4NG	1DSXR0165A1F	Port Fuel-Injected	Normal
8	5	L	1991	No OBD	USEPA		Y	N	N	N	Y	Y	Y	N	MFM5.0V5H1367	Not listed	Port Fuel-Injected	Normal
6	4	L	1997	OBD II	USEPA		Y	N	N	N	Y	Y	Y	Y	VCR4.028GFEK	VCR1049A4PBN	Port Fuel-Injected	Normal
6	3	L	1994	No OBD	USEPA/California/Canada		N	N	N	Y	Y	Y	Y	Y	RTY3.0VJGFEK	RTY1073DYM00	Port Fuel-Injected	Normal
6	3	L	1994	No OBD	USEPA		N	N	N	Y	Y	Y	Y	Y	RT43.0VJGFEK	RY41073D4M00	Port Fuel-Injected	Normal
8	4.3	L	1995		USEPA/California		Y	N	N	Y	Y	N	Y	Y	S3G4.31SGEEA	S3G1089AYMON-Fed	Carb	Normal
4	1.9	L	1999	OBD II	USEPA		Y	Y	N	Y	Y	Y	Y	Y	XGMXV01.9003	XGMXR0080902	Port Fuel-Injected	Normal

General Veh Info (ERG)

No of Cyls	Disp	Disp Units	Engine Cert Year	OBD Type	Emiss Cert Type (s)	Emiss Cert Details	PCV	TAC	AIS	EGR	Evap	Cat	FIR	Ox	Engine Family #	Evaporative Family #	Fuel Delivery Type	Air Intake
6	3.8	L	1995	OBD II	USEPA		Y	N	N	Y	Y	Y	Y	Y	S1G3.8V8GFEC	S1G1058AYMOD	Port Fuel-Injected	Normal
8	5.3	L	2002	OBD II	USEPA		Y	N	N	Y	Y	Y	Y	Y	2GMXT05.3181	2GMXE0111911	Port Fuel-Injected	Normal
6	3.1	L	2001	OBD II	USEPA/California		Y	N	N	Y	Y	Y	Y	Y	1GMXV03.8043	1GMXR0133910	Port Fuel-Injected	Normal
8	4.6	L	2001	OBD II	USEPA		Y	N	N	Y	Y	Y	Y	Y	1FMXT04.6PF5	1FMXE0155BAF	Port Fuel-Injected	Normal
4	1.6	L	1991		USEPA		Y	N	N	N	N	Y	Y	Y	MNT1.6V5FFD2	EV-E	Port Fuel-Injected	Normal
6	3.8	L	1995	No OBD	California		Y	Y	N	Y	Y	Y		Y	S1G3.8V8GFEC	S1G105GAYMOD	Port Fuel-Injected	Supercharge
6	3	L	2000		USEPA		Y	N	N	N	Y	Y	Y	Y	YTYXT03.0XBP	YTYXE0115AE1	Port Fuel-Injected	Normal
6	3.8	L	1999	OBD II	USEPA/Canada		Y	N	Y	N	Y	Y	Y	Y	XCRXT03.8281	XCRXE0101GCA	Port Fuel-Injected	Normal
4	2.2	L	2001	OBD II	USEPA		Y	N	N	N	Y	Y	Y	Y	1GMXV02.4022S	1GMXR0124919	Port Fuel-Injected	Normal
6	2.5	L	2003	OBD II	USEPA		Y	N	N	Y	Y	Y	Y	Y	3SKXT2.49LC7	3SKXR0120164	Port Fuel-Injected	Normal
6	3.1	L	1994		California		Y	Y	N	Y	Y	Y	Y	Y	R1G3.1V8GFEA	R1G1058AYMOA	Port Fuel-Injected	Normal
6	3	L	Unknown	OBD 1	USEPA		Y	N	N	N	Y	Y	Y	Y	No sticker	No sticker	Port Fuel-Injected	Normal
6	3	L	1995	No OBD	USEPA		Y	Unk	Unk	Y	Y	Y	Y	Y	SFM3.0V8GFEA	SFM1045AYMOA	Port Fuel-Injected	Normal
6	3.1	L	1993	No OBD	USEPA		Y	N	N	Y	Y	Y	Y	Y	P1G3.4V8XG25	PB0-1K	Port Fuel-Injected	Normal
6	3.8	L	Jun-95	OBD II	USEPA							Y			SFM3.8V8G1BK	SFM1045AYMOA	Port Fuel-Injected	Normal
6	3	L	1993	No OBD	USEPA		Y	N	N	Y	Y	Y	Y	Y	PFM3.OT5FZZ5	None Listed	Port Fuel-Injected	Normal
6	3	L	1989	No OBD	USEPA		Y	Y	N	N	N	Y		N	KCR3.OT5FBL6	KCRTC (?)	Port Fuel-Injected	Normal
4	2.3	L	1988	OBD II	USEPA		Y	N	N	Y	Y	Y	Y	N	JMF2.3T5FFG1	2.3L 8HM E8AE-9648!	Throttle-body	Normal
8	4.6	L	1995	No OBD	USEPA		Y	N	N	Y	Y	Y	Y	Y	SFM1120AYM1B	SFM4.6V8GFEA	Port Fuel-Injected	Normal
6	3	L	1992	OBD I	USEPA		Y	N	N	N	Y	Y	Y	Y	NFM3.0TFZK7	N	Port Fuel-Injected	Normal
6	3.8	L	1994	No OBD	California		Y	N	N	Y	Y	Y	Y	Y	R3G3.828GFEA	R3G1058AYPOA	Port Fuel-Injected	Normal
4	2	L	1995	No OBD	USEPA		Y	N	N	Y	Y	Y	Y	N	None Listed	None Listed	Port Fuel-Injected	Normal
6	3.3	L	1994	No OBD	USEPA		Y	N	N	Y	Y	Y	Y	Y	Not Listed	Not Listed	Port Fuel-Injected	Normal
6	3	L	1989		USEPA		Y	N	N	N	Y	Y	N	N	KCR3.0T5FBL6	KCRTC	Port Fuel-Injected	Normal
8	5	L	1996	OBD II	USEPA		Y	N	N	Y	Y	Y	Y	Y	TGM5.08PGBEK	TGM1098AYMBA	Port Fuel-Injected	Normal
4	2.3		1986	No OBD	USEPA		N	N	N	Y	N	Y	Y	Unk	GFM2.5V5HCFS	E6AE-9C485-ANM	Carb	Normal
8	4.5	L	1973	No OBD	USEPA/California		Y	N	N	N	Y	Y	N	N	None Listed	None Listed	Carb	Normal
8	305	In^3	1977	No OBD	USEPA		Y	N	N	N	N	Y	N	N	None Listed	None Listed	Carb	Normal
6	4	L	1996	No OBD	USEPA		Y	N	N	Y	Y	Y	Y	Y	TFM4.028GKFK		Port Fuel-Injected	Normal
4			1989	No OBD	USEPA								Y		No sticker model K0Z	No sticker model K0ZT	Carb	Normal
4	1.5		1988	No OBD	USEPA		N	N	N	N	Y	Y	Y	Unk	1JHN1.5V5FCF4	88FD	Carb	Normal
6	4	L	1998	OBD II	USEPA		N	N	N	Y	Y	Y	Y	Y	WCRXT04.02B0	WCRXE0101TGCS	Port Fuel-Injected	Normal
4	2	L	1996	OBD II	USEPA		Y	N	N	Y	Y	Y	Y	Y	TCR2.0VJGKEK	TCR1049AYPAO	Port Fuel-Injected	Normal
8	4.9		1979	No OBD	USEPA		Y	N	N	Y	Y	Y	Y		Not Listed	Not listed	Carb	Normal
6	3.3	L	1996	OBD II	USEPA		Y	N	N	Y	Y	Y	Y	N	TCR3.328GKEK	TCR1098AYPEA	Port Fuel-Injected	Normal
4	2.1			No OBD	USEPA		Unk	Unk	Unk	Unk	Unk	Unk	Y/Unk	Unk	No sticker	No sticker	Carb	Normal
8	4.9		1990	No OBD	USEPA		N	N	N	Y	Y	Y	Y	Y			Port Fuel-Injected	Normal
4	2.3	L	1990	OBD 1	USEPA		Y	N	N	N	Y	Y	Y	Y	LFM2.3T5FNF0	FOAE 9C485DGE	Throttle-body	Normal
6	4.2	L	2004	OBD II	USEPA		N	N	Y	N	Y	Y	Y	Y	4GMXT04.2185	4GMXR0175922	Port Fuel-Injected	Normal
4	2.4	L	1987	No OBD	USEPA		N	N	N	Y					HTY2.4T2AFF3	EV-R	Carb	Normal
6	3.8	L	1995	OBD I	USEPA		Y	N	N	Y	Y	Y	Y	Y	S1G3.8V8GFEC	S1G1058AYMOD	Port Fuel-Injected	Normal
8	5	L	1984	No OBD	USEPA		Y	Y	Y	Y	Y	Y	Unk	N	E1G5.7T4HHCX	4D4-8	Carb	Normal
4	2.3	L	1997	OBD II	USEPA		Y	N	N	Y	Y	Y	Y	Y	VFM1045AYPBA	VFM2.318GFEK	Port Fuel-Injected	Normal
4	2.2	L	1996	OBD II	California		Y	N	N	Y	Y	Y	Y	Y	TGM2.218GFEK	TGM1089AYMEA	Port Fuel-Injected	Normal
6	4.2	L	2004	OBD II	USEPA		N	N	N	Y	Y	Y	Y	Y	4FMXT04.22HB	4FMXR0200BBE	Port Fuel-Injected	Normal
6	3	L	1995	No OBD	USEPA		N	N	N	Y	Y	Y	Y	Y	STY3.087GAFA	STY1047DYM00	Port Fuel-Injected	Normal
8	5.7	L	1995	No OBD	USEPA		Y	N	N	Y		Y	Y	Y	S3G5.785GAEA	S3G1085AYMOA	Carb	Normal
6	3	L	2001		USEPA	NLEV	Y	N	N	N	Y	Y	N	Y	1TYXT0T3.0FFP	1TYXR0150AK1	Port Fuel-Injected	Normal
4	1.8	L	1995	OBD I	California		N	N	N	N	Y	Y	Y	Y	SHN1.8VJGEFA	SHN1077BYMOC	Port Fuel-Injected	Normal
4	2.4	L	1998	OBD II	USEPA		N	N	N	Y	Y	Y	Y	Y	WNSXT02.4A3A	WNSXE0110MBA	Port Fuel-Injected	Normal
6	3.5	L	1996		USEPA		Y	N	N	N	Y	Y	Y	Y	TCR3.5VJGFEK	TCR1073AYPAO	Port Fuel-Injected	Normal
6	3	L	2002	OBD II	California		Y	N	N	Y	Y	Y	Y	Y	2FMXR0115BAE	2FMXV03.0VF4	Port Fuel-Injected	Normal
6	3.2	L	2000	OBD II	USEPA		Y	N	N	N	Y	Y	Y	Y	4CRXV03.5VBO	4CRXR0101GBD	Port Fuel-Injected	Normal

General Veh Info (ERG)

No of Cyls	Disp	Disp Units	Engine Cert Year	OBD Type	Emiss Cert Type (s)	Emiss Cert Details	PCV	TAC	AIS	EGR	Evap	Cat	FIR	Ox	Engine Family #	Evaporative Family #	Fuel Delivery Type	Air Intake
6	3.3	L	1993	OBD I	USEPA		Y	N	N	N	Y	Y	Y	Y	PCR3.3U5FKGX		Port Fuel-Injected	Normal
8	5	L	1989	OBD I	USEPA		Y	N	N	Y	Y	Y	Y	Y	KFM5.8T5HZB8		Port Fuel-Injected	Normal
8	4.3	L	1992	No OBD	USEPA		Y	N	N	Y	Y	Y	Y	Y	N3G4.3TBTAA3		Port Fuel-Injected	Normal
8	5.7	L	1994	No OBD	USEPA		Y	N	N	Y	Y	Y	Y	Y	R3G5.785GAEB	R3G1085AVMOA	Carb	Normal
8	5.4	L	2001	OBD II	USEPA		Y	N	N	Y	Y	Y	Y	Y	1FMXE0155BAG	1FMXT05.4RF8	Port Fuel-Injected	Normal
4	1.5	L	1992	OBD I	USEPA		Y	N	N	N	Y	Y	Y	Y	NHN1.5V5FLF8	92FL	Port Fuel-Injected	Normal
8	4.4	L	1982	No OBD			Y	Y	Y	Y	Y	Y	Y	N	CIG4.4V2ACA6	238-1B	Carb	Normal
6	3.8	L	2003	OBD II	USEPA		Y	N	N	N	Y	Y	Y	Y	3MTXT03.8GNS	3MTXR0200AIA	Port Fuel-Injected/T	Normal
4	2.4	L	1999		USEPA		Y	N	N	Y	Y	Y	Y	Y	XCRXV02.4VBO	XCRXR0101GBC	Port Fuel-Injected	Normal
6	3.5	L	2002	OBD II	California		Y	N	N	N	Y	Y	Y	Y	2CRXV03.5VD1	2CRXR0130GBA	Port Fuel-Injected	Normal
6	3.1	L	1994	No OBD	USEPA		Y	N	N	Y	Y	Y	Y	N	Unknown	Unknown	Port Fuel-Injected	Normal
8	4.3	L	1993	No OBD	USEPA		Y	N	N	Y	Y	Y	Y	Y	P3G4.3T5TAA6	PF0-3A	Port Fuel-Injected	Normal
6	3	L	1992	No OBD	USEPA		Y	N	N	N	Y	Y	Y	Y	NCR3.0T5FFXX	NCRTC	Throttle-body	Normal
6	3.3	L	1998	OBD II	USEPA		Y	N	N	Y	Y	Y	Y	Y	WCRXT03.32BP	WCRXE0101XAA	Port Fuel-Injected	Normal
8	4.6	L	1991	No OBD	USEPA		Y	N	N	Y	Y	Y	Y	Y	MFM4.6V5FDFX		Port Fuel-Injected	Normal
4	2.3	L	1995				Y	N	N	Y	Y	Y		Y	SSZ2.318GFEA	SSZ1046B4M00	Throttle-body	Normal
6	3	L	2001	OBD II	California	LEV	Y	N	N	Y	Y	Y	Y	Y	1FMXR0115BAE	1FMXV03.0VF3	Port Fuel-Injected	Normal
4	2.2	L	1997		California		N	N	N	Y	Y	Y	Y	Y	VHN2.2VJGKFK	VHN1090AYMEA	Port Fuel-Injected	Normal
8	4.3	L	1996		California		Y	N	N	Y	Y	Y	Y	Y	TGM4.35PGFEK	TGM1098QYMBA	Port Fuel-Injected	Normal
8	4.6	L	1994	OBD I			Y	N	N	Y	Y	Y	Y	Y	RFM1045AYPOA	RFM4.6V8GAEA	Port Fuel-Injected	Normal
8	5.9	L	1995	OBD I	USEPA		Y	N	N	Y	Y	Y	Y	N	SCR5.988GAEA	SCR1065AYPOA	Port Fuel-Injected	Normal
4	1.6	L	1992	No OBD			Y	N	N	Y	Y	Y	Y	Y	NSK1.6T5FFC8		Throttle-body	Normal
4	2.5	L	1992	No OBD	USEPA		Y	N	N	N	Y	Y	Y	N	PCR2.5V5FBDO	PVASB	Carb	Normal
4	2	L	1998	OBD II	USEPA		N	N	N	N	Y	Y	Y	Y	WHNXT02.0UF1	WHNXE0080AAB	Port Fuel-Injected	Normal
8	5.7	L	1999	OBD II	USEPA		Y	N	N	Y	Y	Y	Y	Y	XGMXT05.7183	XGMXE0133913	Port Fuel-Injected	Normal
4	2.2	L	1993	No OBD	USEPA		Y	N	N	N	Y	Y	Y	Y	PFJ2.2V5FFE4	HU	Port Fuel-Injected	Normal
6	3.4	L	2003		California	NLEV	Y	N	N	Y	Y	Y	Y	Y	3GMXT034141	3GMXR0212923	Port Fuel-Injected	Normal
6	4		1998	OBD II	USEPA		N	N	N	N	Y	Y	Y	Y	WFMXT04.0GAA	WFMXE0105BBE	Port Fuel-Injected	Normal
8	5.7	L	1996	OBD II	California		Y	N	N	Y	Y	Y	Y	Y	TGM5.76PGFEK	TGM1098AYPBA	Port Fuel-Injected	Normal
6	3.3	L	1996	OBD II	USEPA		N	N	N	Y	Y	Y	Y	Y	TCR3.38GKEK	TCR1098QYPBA	Port Fuel-Injected	Normal
8	4	L	2000	OBD II	USEPA	LEV	N	N	N	N	Y	Y	Y	Y	YCRXT0242230	YCRXE0101G2S	Port Fuel-Injected	Normal
6	3.9	L	1999	OBD II			Y	N	N	N	Y	Y	Y	Y	XCRXT03.92B1	XCRXE0101GCH	Port Fuel-Injected	Normal
4	1.8		1995	No OBD	USEPA		N	N	N	Y	Y	Y	Y	Y	STY1.8VJGFFA	STY1047DYM00	Port Fuel-Injected	Normal
6	3.3	L	1995	OBD I	California		Y	N	N	Y	Y	Y	Y	Y	SCR3.3V8GFEA	SCR1095AXP01	Port Fuel-Injected	Normal
8	5	L	1988	No OBD	USEPA		Y	N	Y	Y	Y	Y	?	N	JFM5.0V5HBF3		Port Fuel-Injected	Normal
6	3.5	L	2002	OBD II	USEPA		Y	N	N	Y	Y	Y	Y	Y	2SZXT03.52KK	2SZXR0175PE0	Port Fuel-Injected	Normal
6	3.4	L	2002	OBD II			Y	N	N	Y	Y	Y	Y	Y	Missing sticker	Missing sticker	Port Fuel-Injected	Normal
8	4.9	L	1992		USEPA		Y	N	Y	Y	Y	Y		Y	NFM4.9T5HGJ4		Port Fuel-Injected	Normal
8	5.9	L	2002	OBD II	USEPA		Y	N	N	Y	Y	Y	Y	Y	2CRXT05.9582	2CRXE0101GDH	Port Fuel-Injected	Normal
6	3.3	L	2001	OBD II			Y	N	N	Y	Y	Y	Y	Y	1CRXT03.32DT	1CRXR0165XAA	Port Fuel-Injected	Normal
6	3.8	L	2000	OBD II			N	N	N	Y	Y	Y	Y	Y	YGMXV3.8042	YGMXR0133910	Port Fuel-Injected	Normal
4	2.5	L	1998	OBD II	USEPA		N	N	N		Y	Y	Y		WCRXT02.51B0	WCRXE0101GCS	Port Fuel-Injected	Normal
6	4.3	L	2001	OBD II	California	LEV	Y	N	Y	Y	Y	Y	Y	Y	1GMXT04.3187	1GMXE0095904	Port Fuel-Injected	Normal
8	5		1986	No OBD	USEPA		N	N	N	Y	Y	Y	Y	Y	GFM5.0V5HBF9	?	Port Fuel-Injected	Normal
8	4.9		1992	No OBD	USEPA		N	N	N	Y	Y	Y	Y	Y	N2G4.9V8X6A8	NB0-2B	Port Fuel-Injected	Normal
6	3.7	L	2004	OBD II	California	Non tier 2	Y	N	N	N	Y	Y	Y	Y	4CRXT03.72N0	4CRXR0155GCH	Port Fuel-Injected	Normal
4	2.2			OBD II	No sticker												Port Fuel-Injected	Normal
6	3.3	L	1998	OBD II	USEPA		Y	N	N	Y	Y	Y	Y	Y	WCRXT03.32BP	WCRXE0101XAA	Port Fuel-Injected	Normal
6	4	L	2002	OBD II	USEPA/California		Y	N	N	Y	Y	Y	Y	Y	2FMXR0155BBE	2FMXT0402F3	Port Fuel-Injected	Normal
4	2.3	L	1994	No OBD	Unknown		Y	N	N	N	Y	Y	Y	N	Unknown no sticker	Unknown no sticker	Port Fuel-Injected	Normal

General Veh Info (ERG)

No of Cyls	Disp	Disp Units	Engine Cert Year	OBD Type	Emiss Cert Type (s)	Emiss Cert Details	PCV	TAC	AIS	EGR	Evap	Cat	FIR	Ox	Engine Family #	Evaporative Family #	Fuel Delivery Type	Air Intake
4	2.3	L	1996	OBD II	USEPA		Y	N	N	Y	N	Y	Y	Y	TFM1045AYPBA	TFM2.318GFEK	Port Fuel-Injected	Normal
6	3	L	1995	OBD II	USEPA		Y	N	N	Y	Y	Y	Y	Y	SFM1045AYMOA	SFM3.0V8GFEA	Port Fuel-Injected	Normal
4	2.2	L																
8	5.7	L	1994		USEPA		Y	N	N	Y	Y	Y	Y	Y	R365.785GAEB	R361085A4MOA	Throttle-body	Normal
6	3.8	L	1993		USEPA		Y	N	N	Y	Y	Y	Y	Y	PFM3.8V5FJFO		Throttle-body	Normal
6	3.8		1993	OBD I	USEPA		Y	N	N	Y	Y	Y	Y	Y	P163.8V8JGB4	PB0-1R	Port Fuel-Injected	Normal
6	3.1		1994		USEPA		Y	N	N	Y	Y	Y	Y	Y	R1G3.1V7GAEA	R1G1058AYMOA		
6	3.8	L	1998	OBD II	USEPA		Y	N	N	Y	Y	Y	Y	Y	WFMXE0140BBE	WFMXT03.8ABA	Port Fuel-Injected	Normal
6	2.9	L	1993	No OBD	USEPA		Y	N	N	N	Y	Y	Y	Y	PVV2.9V5F951	E3	Port Fuel-Injected	Normal
4	2.3	L	1993	No OBD	USEPA		Y	N	N	Y	Y	Y	Y	Y	RFM2.3V5HWFO		Port Fuel-Injected	Normal
6	4.3	L	1996	OBD II	California		Y	N	N	Y	Y	Y	Y	Y	TGM4.32PGKEK	TGM1089AYMEA	Port Fuel-Injected	Normal
6	3.8	L	2002	OBD II	California	NLEV, LEV	Y	N	N	Y	Y	Y	Y	Y	2CRXT03.8D1	2CRX0165GCA	Port Fuel-Injected	Normal
6	4.3	L	1996	OBD II						Y	Y	Y	Y	Y	No sticker	No sticker		Normal
6	2.7	L	1988		California		Y	N	N	N	Y	Y	Y	Y	EV40	JBM2.7V5F359	Port Fuel-Injected	Normal
6	3.1	L	1995	No OBD	California		Y	N	N	Y	Y	Y	Y	Y	S1G3.1V8GFA	S1G1058QYMOA	Port Fuel-Injected	Normal
6	3.8		1996	OBD II	USEPA		N	N	N	Y	Y	Y	Y	Y	TCR3.82BGFEK	TCR109BAYPBA	Port Fuel-Injected	Normal
6	3	L	1994		USEPA		Y	N	N	Y	Y	Y	Y	Y	RFM1045AYPOA	RFM3.078GAFA	Port Fuel-Injected	Normal
4	1.9			No OBD			N	N	N	N	Y	Y	Y	Y			Port Fuel-Injected	Normal
6	2.4	L	1995	No OBD	USEPA		N	N	N	Y	Y	Y	Y	Y	SNS2.41JGFEA	SNS1030BYMOB	Port Fuel-Injected	Normal
6	3	L	1993	No OBD	USEPA		Y	N	N	Y	Y	Y	Y	Y	PCR3.0T5FFX1	PTASC	Port Fuel-Injected	Normal
6	3.3	L	1995	No OBD	USEPA		Y	N	N	Y	Y	Y	Y	Y	SCR3.328GFEA	SCR1095AYMOA	Port Fuel-Injected	Normal
	3	L		OBD II											TFM3.028G1HK	TFM1057BYMBB	Port Fuel-Injected	Normal
8	5.7	L	1978	No OBD	USEPA		Y	Y	N	N	Y	N	N	N	840J4U	8BFV	Carb	Normal
4	1.9	L	2001	OBD II	California	NLEV	Y	N	Y	Y	Y	Y	Y	Y	1GMXV01.9002	1GMXR0080902	Port Fuel-Injected	Normal
6	3	L	Unk	No OBD	USEPA		Y	N	N	Y	Y	Y	Y	Y	No Sticker	No Sticker	Port Fuel-Injected	Normal
6	3	L	2002	OBDII	USEPA		Y	N	N	Y	Y	Y		Y	2FMXT03.01F7	2FMXR0115BBE	Port Fuel-Injected	Normal
8	5	L	1979	No OBD			Y	Y	N	N	Y	N	N	N	45.0 (2X124)		Carb	Normal
4	2.3	L	1998	OBD II	California	LEV	N	N	N	Y	Y	Y	Y	Y	WHNXV02.3PA3	WHNXR0130AAA	Port Fuel-Injected	Normal
8	5.4	L	2001	OBD II	California	LEV	N	N	N	Y	Y	Y	Y	Y	5.4L - 1FMXE0155BA	1FMXT05.4RF7	Port Fuel-Injected	Normal
6	3	L	1993	OBD I	USEPA		Y	N	N	Y	Y	Y	Y	Y	PT43.0T5FBE4	EV-E	Port Fuel-Injected	Normal
4	2	L	1994	OBD I	USEPA		Y	N	N		Y	Y	Y	Y	R162.0U76FEA	R161046AYMOA	Port Fuel-Injected	Normal
4	2	L	1998	OBD II	USEPA		Y	N	N	Y	Y	Y	Y	Y	2.0L - WFMXR0080B	WFMXV02.0BFA	Port Fuel-Injected	Normal
6	3	L	1997	OBD II	USEPA		Y	N	N	Y	Y	Y	Y	Y	3.0L VFM1115AYME	VFM3.0V8GKEK	Port Fuel-Injected	Normal
6	3.8	L	1998	OBD II	USEPA		Y	N	N	Y	Y	Y	Y	Y	3.8L - WFMXE0140B	WFMXT038ABA	Port Fuel-Injected	Normal
6	3	L	1998	OBD II	California	LEV	N	N	N	Y	Y	Y	Y	Y	WTYXV03.0GXB	WTYXE0095AE1	Port Fuel-Injected	Normal
6	4	L		OBD I	USEPA		Y	N	N	N	Y	Y	N	Y	PFM4.0T5F44X	F3AE9L485JBL	Port Fuel-Injected	Normal
6	3.8	L	1979	No OBD	USEPA		Y	Y	N	Y	Y	Y	N	N	3.8L 940B2	9B3-4	Carb	Normal
6	5.7	L	1988				Y	N	N	N	Y	Y	Y	Unk	JAM4.0T5LN01	JT-4.OH-1S	Port Fuel-Injected	Normal
4	1.5	L	1998	OBD II	USEPA		Y	N	N	Y	Y	Y	Y	Y	WTKXV01.5VBA	WTKXE0104BFA	Port Fuel-Injected	Normal
4	85.2 CID		1979	No OBD	USEPA		Y	Y	N	Y	Y	N	N	N	A140F	EVP-CARB-2	Carb	Normal
6	3.1	L		OBD II	USEPA		Y	N	N	Y	Y	Y	Y	Y	WGMXV03.1041	WGMXE0095904	Port Fuel-Injected	Normal
8	5.2	L	1993	OBD II	USEPA		Y	N	N	Y	Y	Y	Y		PCR5.9TSFEY4	PTAPH	Port Fuel-Injected	Normal
6	2.8	L	1977	No OBD	USEPA		Y	N	N	Y	Y	Y	Y	N	LZ80C		Port Fuel-Injected	Normal
4	1.8	L	1999	OBD II	USEPA/California		N	N	N	N	Y	Y		Y	XHNXV01.8CA3	XHNXR009AAD	Port Fuel-Injected	Normal
6	2.5	L	1989	OBD I	USEPA		Y	N	N	Y	Y	Y	Y	Y	KT42.5V5FFF7	EV-E	Port Fuel-Injected	Normal
6	305	In^3	1978	No OBD	USEPA		Y	Y	N	Y	Y	Y	Y	N	310L4	BBFV	Carb	Normal
6	4.9	L		No OBD	USEPA		N	N	N	Y	Y	Y	Y	Y	No Label	No Label	Port Fuel-Injected	Normal
6	3	L	1996	OBD II	USEPA					Y	Y	Y			TNS3.028GKEK	TNS1057BYUBB	Port Fuel-Injected	Normal
6	3.8	L	1990	No OBD	USEPA		Y	N	N	Y	Y	Y	Y	Y	L2G3.8V8XEB2	LBO-2D	Port Fuel-Injected	Normal
6	4.9	L	1987	No OBD	USEPA		Y	N	N	Y	N	Y	Y	N	HFM4.9T5HGFI	7HM	Port Fuel-Injected	Normal
6	4	L	2000	OBD II	USEPA		Y	N	N	Y	Y	Y	Y	Y	4.0L-YFMXE0105BBI	YFMXT04.02BD	Port Fuel-Injected	Normal
8	7.5	L	1989	No OBD	USEPA		Y	N	N	Y	Y	Y	Y	N	KFM07.5BTAX	9HN	Port Fuel-Injected	Normal
	350	In^3	1978		USEPA		Y	N	N	Y	Unk	Y		N	830M4U	8BFU	Carb	Normal

General Veh Info (ERG)

No of Cyls	Disp	Disp Units	Engine Cert Year	OBD Type	Emiss Cert Type (s)	Emiss Cert Details	PCV	TAC	AIS	EGR	Evap	Cat	FIR	Ox	Engine Family #	Evaporative Family #	Fuel Delivery Type	Air Intake
8	5.7	L	1997	OBD II	USEPA		Y	N	N	Y	Y	Y	Y	Y	VGM5.76P6FEK	VGM1098AYMBA	Port Fuel-Injected	Normal
6	3.3	L	1999	OBD II	USEPA		Y	N	N	Y	Y	Y	Y	Y	XCRXT03.32BP	XCRXE0101XAA	Port Fuel-Injected	Normal
4	2.5	L	1992	No OBD	USEPA		Y	N	N	N	Y	Y	Y	N	NCR2.5T5FGF0	NCRTA	Port Fuel-Injected	Normal
4	2.3	L	1992	OBD I	USEPA		N	N	N	Y	N	Y	Y	Y	NFM2.3T5FMG1	9HM	Port Fuel-Injected	Normal
6	3		1992	No OBD	USEPA		N	N	N		Y	Y	Y	Y	NFM3.0T5FZF0		Port Fuel-Injected	Normal
6	4.9	L	1996	OBD II			Y	N	N	Y	Y	Y	Y	Y	TFM1045AYMBB	TFM4.968GFUK	Port Fuel-Injected	Normal
4	1300 CC		1973				Y	Y	N	N	N	N	N	N			Carb	Normal
4	2.5		Not listed	No OBD	USEPA		N	N	N	Y	Y	Y	Y	Y	No Label	No Label	Port Fuel-Injected	Normal
6	3.7		1987	No OBD	USEPA		Y	Y	Y	Y	Y	Y	Y	N	No Label	No Label	Carb	Normal
4	2.2	L	1999	OBD II	USEPA		Y	N	N	Y	Y	Y	Y	Y	No Sticker	No Sticker	Port Fuel-Injected	Normal
8	4.2	L	2002	OBD II	California	NLEV	N	N	N	Y	Y	Y	Y	Y	2GMXT04.2185	2GMXR0175922	Port Fuel-Injected	Normal
8	5	L	1989	No OBD	USEPA		Y	N	N	Y	Y	Y	Y	N	KFM5.0V5HBF4	9HM	Port Fuel-Injected	Normal
4	2	L	1989	No OBD	USEPA		N	N	N	Y	Y	Y	Y	Y	KHN2.0V5FNF9	89FG	Port Fuel-Injected	Normal
5	2.5	L	1996	OBD II	California		N	N	N	Y	Y	Y	Y	Y	THN2.5VJGKEK	THN100BYMAR	Port Fuel-Injected	Normal
6	3.5	L	2002	OBD II	USEPA/California	LEV	N	N	N	Y	Y	Y	Y	Y	2HNXT03.51AP	2HNXR0160AAA	Port Fuel-Injected	Normal
6	3.5		2004	OBD II	USEPA		N	N	N	Y	Y	Y	Y	Y	4KMXT03.5F03	4KMXR0160F03	Port Fuel-Injected	Normal
6	3.8	L	2002	OBD II	USEPA		N	N	N	Y	Y	Y	Y	Y	2CRXT03.82D1	2CRXR0165GCA	Port Fuel-Injected	Normal
6	3.5	L	2003	OBD II	California		Y	N	N	Y	Y	Y	Y	Y	3HNXT03.5ZAP	3HNXR0160AAA	Port Fuel-Injected	Normal
6	4	L	2001	OBD II	USEPA		N	N	N	Y	Y	Y	Y	Y	1CRXT04.02D1	1CRXE0101GCS	Port Fuel-Injected	Normal
6	3.3	L	2003	OBD II		LEV	Y	N	N	N	N	Y	Y	Y	3CRXT03.3DP	3CRXR0177XAA	Port Fuel-Injected	Normal
6	3	L	2001	OBD II	California	LEV	N	N	N	N	Y	Y	Y	Y	1TYXT03.0FFP	1TXXR0150AK1	Port Fuel-Injected	Normal
6	3.3	L	2002	OBD II	USEPA/California	EPA NLEV	Y	N	N	N	Y	Y	Y	Y	2CRXT03.32DP	2CRXR0165XAA	Port Fuel-Injected	Normal
6	3.3	L	2003	OBD II	USEPA/California	LEV	Y	N	N	N	N	Y	Y		3CRXT03.3DP	3CRXR0177XAA	Port Fuel-Injected	Normal
6	3.3	L	1990	No OBD	USEPA		Y	N	N	Y	Y	Y	Y	Y	L2G3.3V8JAWJ	LB0-2F	Port Fuel-Injected	Normal
6	3	L	1988	No OBD	USEPA		Y	N	N	Y	Y	Y	Y	N	JCR3.0T5FBHX	JCRTC	Port Fuel-Injected	Normal
4	14.1	In^3	1987	No OBD	USEPA/California		Y	N	N	N	Y	Y		Y	HVV2.3V5FFT2	E3	Port Fuel-Injected	Turbocharge
4	2.2	L	1995	No OBD	USEPA		Y	N	N	Y	Y	Y		Y	S1G2.2V7GFEA	S1G1089AYMOA	Port Fuel-Injected	Normal
	2.5		1989	No OBD	USEPA		Y	N	N		Y	Y	Y		KCR2.5V5FB06	KCRVB	Port Fuel-Injected	Normal
4	1.9		1987	No OBD	USEPA		Y	Y	N	Y	Y	Y		Y	HFM1.9V5FFF1	Unknown	Carb	Normal
6	4	L	1994	No OBD	USEPA		Y	N	N	Y	Y	Y	Y	Y	RFM1045AXPOA	RFM4.028GFEA	Port Fuel-Injected	Normal
6	3.5		2001	OBD II	USEPA						Y	Y	Y	Y	INSXT03.5C7A	INSXE0110MBA	Port Fuel-Injected	Normal
6	3.9		1987	No OBD	USEPA		Y	Unk	Unk	Y	Y	Y	Y	Unk	HCR3.9T2HGC4	HCRT1	Carb	Normal
4	2	L	1988	No OBD	USEPA		N	N	N	N	Y	Y	Y	Y	JHN2.0V5FNF8	88FG	Port Fuel-Injected	Normal
6	4.3	L	1995		USEPA		Y	N	N	Y	Y	Y	Y	Y	53G4.375GAEA	53G1089AYMOA	Carb	Normal
4	145.8	In^3	1988	No OBD	USEPA		Y	Y	N	Y	Y	Y		N	JNS2.4T5HDF2	TBI-7	Carb	Normal
6	3.1	L	1990	No OBD	USEPA		Y	Y	N	Y	Y	Y	Y	Y	L3G3.1T5XAT7	LB0-3D	Carb	Normal
8	350	In^3	Not listed	No OBD	USEPA		Y	N	N	N	N	N	N	N	Not listed	Not listed	Carb	Normal
6	3.8	L	1990	No OBD	USEPA		N	N	N	Y	Y	Y	Y	Y	Not listed	Not listed	Port Fuel-Injected	Normal
4	2.5	L	1988	No OBD	USEPA		Y	N	N	Y	Y	Y	Y	Y	JCR2.5V5FBE6	JCRVB	Port Fuel-Injected	Normal
8	4.5		1990	No OBD	USEPA		N	N	Y	Y	Y	Y	Y	Y	L2G4.5V8NKA1	L130-213	Port Fuel-Injected	Normal
6	3.1		1990	No OBD	USEPA					Y	Y	Y	Y	Y	LG3.1T5XAT7	LB0-3D	Carb	Normal
6	4.3	L	1989	No OBD	USEPA		Y	N	N	Y	Y	Y	Y	N	K3G4.3T5TAA1	KF0-3B	Port Fuel-Injected	Normal
6	3	L	1988	No OBD	USEPA		Y	N	N	Y	Y	Y	Y	Y	JCR3.0T5FBHX	JCRTC	Port Fuel-Injected	Normal
8	5.8	L	1982	No OBD	USEPA		Y	Y	N	Y	Y	Y	Y	N	CFM5.8T2HBF9	2EQ	Carb	Normal
6	3.3	L	1990	No OBD	USEPA		Y	N	N	Y	Y	Y	Y	Y	L2G3.3V8JAW5	LB0-2F	Port Fuel-Injected	Normal
8	5	L	1988	No OBD	USEPA		N	N	N	Y	Y	Y	Y	Y	JFM5.8T5HZB7	5.0L-8HM	Port Fuel-Injected	Normal
6	3	L	1989	No OBD	USEPA		N	N	N	Y	Y	Y	Y	Y	KTY3.0T5FBEX	EV-E	Port Fuel-Injected	Normal
6	2		1989	No OBD	USEPA		Y	N	N	Y	Y	Y	Y	N	K1G2.0V5JFG0	KAO-1E	Port Fuel-Injected	Normal
4	2.3		1989	No OBD	USEPA		Y	N	N	Y	Y	Y	Y	Unk	Not provided/torn	Not provided/torn	Port Fuel-Injected	Normal

General Veh Info (ERG)

No of Cyls	Disp	Disp Units	Engine Cert Year	OBD Type	Emiss Cert Type (s)	Emiss Cert Details	PCV	TAC	AIS	EGR	Evap	Cat	FIR	Ox	Engine Family #	Evaporative Family #	Fuel Delivery Type	Air Intake
4	1.6	L	1983	No OBD	USEPA		N	Y	N	Y	Y	Y	Y	Y	DTY1.6V2HFF1	EV-A	Carb	Normal
4	2.5		1990	No OBD	USEPA		Y	N	N	Y	Y	Y	Y	Y	LCR2.5V5FB07	LCRVB	Port Fuel-Injected	Normal
4	2		1988	No OBD	USEPA		N	N	N	Y	Y	Y	Y	Y	JHN2.0V5FNF8	88FG	Port Fuel-Injected	Normal
8	6.6		1979	No OBD	USEPA		Y	Y	N	Y	Y	Y	Y	N	S30M4U	9134-3	Carb	Normal
6	3.8		1991	No OBD	USEPA		Y	N	N	Y	Y	Y	Y	Y	M2G3.8V8XEB3	MBOP-20	Port Fuel-Injected	Normal
8	5	L	1983	No OBD	USEPA		Y	N	N	Y	Y	Y	Y	N	DIG5.7T4HAC6	3D45-B	Port Fuel-Injected	Normal
8	5	L	1990	No OBD	USEPA		N	N	Y	Y	N	Y	Y	Y	LFM5.8T5HZ89	9HM	Port Fuel-Injected	Normal
4	2.2	L	1983	No OBD	USEPA		N	Y	N	Unk	Y	Y	Y	Unk	No sticker	No sticker	Carb	Normal
8	5		1989	No OBD	USEPA		Y	Unk	Y	Y	Y	Y	Y	Unk	K2G5.0V4NLAB	KB4-2A	Carb	Normal
6	3.8	L					Y	N	N	Y	Y	Y	Y	Y	K2G3.8V8XEB1	KBO-2D	SFI	Normal
8	5		Unknown/r	No OBD	USEPA		Y	Y	Unk	N	N	N	N	N	No sticker	No sticker	Carb	Normal
8	5.7	L	1988	No OBD	USEPA		Y	N	Y	Y	Y	Y	Y	N	J3G5.7T5TYA2	JF0-3C	Carb	Normal
8	350	In^3	1976	No OBD	USEPA		Y	Y	N	Y	Y	Y		N	10J2		Carb	Normal
6	4.9	L	1986	No OBD	USEPA		Y	Y	N	Y	Y	Y		N	GFM4.9T1HGG7	GGM	Carb	Normal
4	2.9	L	1990	No OBD	USEPA		Y	N	N	N	Y	Y	Y	Y	LFM2.9T5FMF1	9HM	Port Fuel-Injected	Normal
8	4.9		1988	No OBD	USEPA		Y	N	N	Y	Y	Y	Y	Y	JFM4.9T5HGE4	E8AE-9C48S-AFB	Port Fuel-Injected	Normal
6	2.5	L	1990	No OBD	USEPA		N	N	N	Y	Y	Y	Y	Y	LTY2.5V5FFF8	EV-E	Port Fuel-Injected	Normal
6	2.8		1989	No OBD	USEPA		Y	N	N	Y	Y	Y	Y	Y	K1G3.1V8XG24	KB0-1K	Port Fuel-Injected	Normal
6	4.1	L	1983	No OBD	USEPA		Y	N	N	Y	Y	Y	Y	Unk	DTG4.1T2HHS0	3D68	Carb	Normal
8	5		No label	No OBD	No label	No label	Y	Unk	Unk	Y	Y	Y	Y	Unk	No label	No label	Port Fuel-Injected	Normal
4	2.8	L	1988	No OBD	USEPA		Y	N	N	Y	Y	Y	Y	Unk	J1G2.8WBXRZ2	JB0-12	Port Fuel-Injected	Normal
6	4.3		1992	No OBD	USEPA		Y	N	N	Y	Y	Y	Y	Y	N3G4.3TBXEB2	NB0-3E	Carb	Normal
6	5		1985	No OBD	USEPA		Y	N	Y	Y	Y	Y		N	F1G5.7V4NEA4	584-1A	Carb	Normal
8	6.5		1978	No OBD	USEPA		Y	Y	N	Y	Y	N	N	N	351M/400EGR		Carb	Normal
4	2.4	L	1987	No OBD	USEPA		N	N	N	Y	Y	Y	Y	Y	HTY2.415FBT8	EV-E	Port Fuel-Injected	Turbocharge
8	5	L	1987	No OBD	USEPA		Y		N	Y	Y	Y	Y	Y	H2G5.0V4NLA3	7B4-2A	Carb	Normal
6	250	In^3	1976	No OBD	USEPA		Y	Y	N	Y	Y	N	Y	N	10F1		Carb	Normal
8	350	In^3	1973	No OBD	USEPA/California		Y	Y	Unk	Unk	Y	N	N	N	GM104	None listed	Carb	Normal
6	4.9	L	1990	No OBD	USEPA		Y	N	Y	Y	Y	Y	Y		LFM4.9T5HGF7	9HM	Port Fuel-Injected	Normal
8	3.8	L	1980	No OBD	USEPA		Y	Y	N	Y	Y	Y	Y	N	01E2F	OB3-1	Carb	Normal
8	5.7	L	1989	No OBD	USEPA		Y	N	N	Y	Y	Y	Y	N	K305.7T5TYA3	KDO-3C	Carb/Throttle-body	Normal
4	2.8	L	1987		USEPA		Y	Y	Y	Y	Y	Y		N	Not readable	Not readable	Carb/Throttle-body	Normal
6	3.8	L	2003	OBD II	California	LEV	Y	N	N	N	N	Y	Y	Y	3CRXT03.82D0	3CRXR0177GCA	Port Fuel-Injected	Normal
4	2.3	L	1989	No OBD	USEPA		Y	N	N	Y	Y	Y	Y	N	KFM2.3T5FNFX	9HM	Port Fuel-Injected	Normal
8	5	L	1984	No OBD	USEPA		Y	Y	Y	Y	Y	Y		N	E1G5.7V4NEA3	4B4-1A	Carb	Normal
4	1.9	L	1994	No OBD	USEPA/California		Y	N	N	Y	Y	Y	Y	Y	R4G1.9V5GEEA	R41035AYPOA	Port Fuel-Injected	Normal
4	2.3	L	1979	No OBD	USEPA		Y	N	Y	Y	Y	Y	Y	N	2.3(T)'F'1XL2	B	Carb	Turbocharge
4	1.6	L	1974	No OBD	USEPA		N	N	N	N	Y	N	N	N			Carb	Normal
4	2.2	L	1988		USEPA		Y	N	N	Y	Y	Y	Y	N	JTK2.2T2HFG7	G	Carb	Normal
4	1.6	L	1999	OBD II	USEPA		Y	N	N	N	Y	Y	Y	Y	XTKXV01.6VBB	XTKXR0125BFB	Port Fuel-Injected	Normal
8	5	L	1989		USEPA		Y	N	N	Unk	Y	Y	Y	Unk	K3G5.7T5TYA3	KF0-3C	Carb/Throttle-body	Normal
6	3.1		1990		USEPA		Y	N	N	Y	Y	Y	Y	Y	L1G3.1V8XG.25	LB0-1K	Carb	Normal
6	4.2	L		No OBD	USEPA		Y	Y	Y	N	N	N	Y	N	No Sticker	No sticker	Carb	Normal
4	2.2	L	1991	No OBD	USEPA		Y	N	N	Y	Y	Y	Unk	Y	M1G2.2V5JFG3	MAOP-1E	Carb	Normal
6	3.3	L	1990	No OBD	USEPA		Y	N	N	N	Y	Y	Y	Y	L2G3.3V8JAW5	LBO-2F	Port Fuel-Injected	Normal
6	3.3	L	1982	No OBD			Y	Y	N	Y	Y	Y			CFM3.3V1GXF9	2AM	Carb	Normal
6	3	L	1990	No OBD	USEPA		Y	N	N	N	Y	Y	Y	Y	LFM3.0T5FYK3	9HM	Port Fuel-Injected	Normal
4	2.5		2001	OBD II	USEPA/California		N	N	N	Y	Y	Y	Y	Y	1FJXV02.SJEH	1FJXR01251BB	Port Fuel-Injected	Normal
4	2.2		2001	OBD II	USEPA		Y	N	N	Y	Y	Y	N	Y	1TYXV02.2JJA	1TYXR0135AK1	Port Fuel-Injected	Normal
6	3		2002	OBD II	USEPA		N	N	N	Y	Y	Y	Y	Y	2FMXT03.01F7	2FMXR0115BBE	Port Fuel-Injected	Normal
8	350	In^3	1976	No OBD	USEPA		Y	Unk	Unk	Y	N	Y	N	Unk	GM20KL		Carb	Normal
4	2.5	L	1984	No OBD	USEPA		Y	N	N	Y	Y	Y	Y	Y	E2G2.5VSTPG7	4AO-2A	Carb	Normal
6	3.8	L	1990	No OBD	USEPA		Y	N	N	Y	Y	Y	Y	Y	L2G3.8V8XEB2	LBO-2D	Port Fuel-Injected	Normal
4	Unk	L	1990	No OBD			Unk	N	N	Y	Y	Y	Y	Y	No sticker	No sticker	Port Fuel-Injected	Normal
8	5	L	1986	No OBD	USEPA		Y	Y	Y	Y	Y	Y	Y	N	G1G5.7T4HHC1	6D4S-8	Carb	Normal

General Veh Info (ERG)

No of Cyls	Disp	Disp Units	Engine Cert Year	OBD Type	Emiss Cert Type (s)	Emiss Cert Details	PCV	TAC	AIS	EGR	Evap	Cat	FIR	Ox	Engine Family #	Evaporative Family #	Fuel Delivery Type	Air Intake
	4.9	L	1978	No OBD	No sticker	No sticker						Y			No sticker	No sticker	Carb	
4	2	L	Unk			Unk	N	N	N	Y	Y	Y	Y	Y	Unk	Unk	Port Fuel-Injected	Normal
6	4.3	L	1985	No OBD	USEPA		N - OEM re	N - OEM re	N	Y	Y	Y	Y	N	FIG4.3V5NDA7	580-1C	Throttle-body	Normal
8	5.7	L	1979	No OBD	USEPA		Y	Y	N	Y	Y	Y	Y	N	912K48	9B4-T	Carb	Normal
6	3		2004	OBD II	USEPA/California	ULEV	N	N	N	Y	Y	Y	Y	Y	SFMXT03.01FE	SFMXR0150GAL	Port Fuel-Injected	Normal
4	2		2005	OBD II	USEPA		Y	N	N	Y	Y	Y	Y	Y	5FMXV0231D4	5FMXR0120GAK	Port Fuel-Injected	Normal
6	3.3	L	2003	OBD II	California	LEV	Y	N	N	N	N	Y	Y	Y	3CRXT03.32DR	3CRXR0177XAA	Port Fuel-Injected	Normal
6	3.3		1992	No OBD	USEPA		N	N	N	Y	Y	Y	Y	Y	NCR3.31SFGF7	NCRTD.NCRTE	Port Fuel-Injected	Normal
6	4.9	L	1995	No OBD	USEPA		Y	N	Y	Y	Y	Y	Y	Y	SFM4.9880AJA	SFM1045AYAM0A	Port Fuel-Injected	Normal
6	4.3	L	1994	No OBD	USEPA		N	N	N	Y	Y	Y	Y	Y	R3G4.389GAEA	R3G1085AYM08	Port Fuel-Injected	Normal
6	3.3	L	2000		USEPA		Y	N	N	Y	Y	Y	Y	Y	YCRXT03.32BP	YCRXE010XAA	Port Fuel-Injected	Normal
8	5.7		1997	OBD II	USEPA					Y	Y	Y	Y	Y	VGM5.76PGFEK	VGM1098AYMBA	Port Fuel-Injected	Normal
6	3.4	L	1998	OBD II	USEPA		N	N	N	N	Y	Y	Y	Y	WTYXT03.4DBP	WTYXE0095AEO	Port Fuel-Injected	Normal
4	2.4		1998	OBD II	USEPA		N	N	N	Y	Y	Y		Y	WNSXT02.4A3C	WNSXE0110MBA	Port Fuel-Injected	Normal
8	4.9	L	1995	No OBD	USEPA		Y	N	Y	Y	Y	Y	Y	Y	SFM1045AYMOC	SFM4.988GAJA	Port Fuel-Injected	Normal
6	3	L	1995	No OBD	USEPA		Y	N	N	Y	Y	Y	Y	Y	SCR3.02BOGFEA	SCR1095AYMOA	Port Fuel-Injected	Normal
Unknown	Unknown		1992	No OBD			Unk	N	N	Unk	Y	Y	Y	Y	No sticker	No sticker	Carb	Normal
6	3.3		No sticker	No OBD			N	N	N	Y	Y	Y	Y	Y	No label	No label	Port Fuel-Injected	Normal
6	4.3	L	1993	No OBD	USEPA		Y	N	N	Y	Y	Y	Y	Y	P3G4.3TBXEB4	PBO-3H	Port Fuel-Injected	Normal
6	3.3		2002	OBD II	USEPA	LEV	N	N	N	Y		Y	Y	Y	2CRXT03.3DP	2CRXR0165XAA	Port Fuel-Injected	Normal
4	2.5	L	1996	OBD II	USEPA		N	N	N	Y	Y	Y	Y	Y	TCR2.518GFEK	TCR1049AYMBN	Port Fuel-Injected	Normal
8	5		1989	No OBD	USEPA		Unk	Unk	Y	Y	Y	Y	Y	Unk	KFM5.8T5HZZ4	9HM	Port Fuel-Injected	Normal
6	3	L	1988	No OBD			Y	N	N	Unk	Y	N	Y	Y			Port Fuel-Injected	Normal
6	3	L	1988	No OBD			Y	N	N	Unk	Y	N	Y	Y			Port Fuel-Injected	Normal
6	3	L	1988	No OBD			Y	N	N	Unk	Y	N	Y	Y			Port Fuel-Injected	Normal
6	3	L	1988	No OBD			Y	N	N	Unk	Y	N	Y	Y			Port Fuel-Injected	Normal
6	3	L	1988	No OBD			Y	N	N	Unk	Y	N	Y	Y			Port Fuel-Injected	Normal
6	3	L	1988	No OBD			Y	N	N	Unk	Y	N	Y	Y			Port Fuel-Injected	Normal
6	3	L	1988	No OBD			Y	N	N	Unk	Y	N	Y	Y			Port Fuel-Injected	Normal
6	3	L	1988	No OBD			Y	N	N	Unk	Y	N	Y	Y			Port Fuel-Injected	Normal
6	3	L	1988	No OBD			Y	N	N	Unk	Y	N	Y	Y			Port Fuel-Injected	Normal
6	3	L	1988	No OBD			Y	N	N	Unk	Y	N	Y	Y			Port Fuel-Injected	Normal
6	3	L	1988	No OBD			Y	N	N	Unk	Y	N	Y	Y			Port Fuel-Injected	Normal
6	3	L	1988	No OBD			Y	N	N	Unk	Y	N	Y	Y			Port Fuel-Injected	Normal
6	3	L	1988	No OBD			Y	N	N	Unk	Y	N	Y	Y			Port Fuel-Injected	Normal
6	3	L	1988	No OBD			Y	N	N	Unk	Y	N	Y	Y			Port Fuel-Injected	Normal
6	3	L	1988	No OBD			Y	N	N	Unk	Y	N	Y	Y			Port Fuel-Injected	Normal
6	3	L	1988	No OBD			Y	N	N	Unk	Y	N	Y	Y			Port Fuel-Injected	Normal
6	3	L	1988	No OBD			Y	N	N	Unk	Y	N	Y	Y			Port Fuel-Injected	Normal
6	3	L	1988	No OBD			Y	N	N	Unk	Y	N	Y	Y			Port Fuel-Injected	Normal
6	3	L	1988	No OBD			Y	N	N	Unk	Y	N	Y	Y			Port Fuel-Injected	Normal
6	3	L	1988	No OBD			Y	N	N	Unk	Y	N	Y	Y			Port Fuel-Injected	Normal
6	3	L	1988	No OBD			Y	N	N	Unk	Y	N	Y	Y			Port Fuel-Injected	Normal
6	3	L	1988	No OBD			Y	N	N	Unk	Y	N	Y	Y			Port Fuel-Injected	Normal
6	3	L	1988	No OBD			Y	N	N	Unk	Y	N	Y	Y			Port Fuel-Injected	Normal
6	3	L	1988	No OBD			Y	N	N	Unk	Y	N	Y	Y			Port Fuel-Injected	Normal

BKI Dyne Test Information, First Dyne Run										BKI Dyne Test Information, Second Dyne Run									
Dyne Run Number	BKI Vehicle Info	Dyne Test Date	BKI Odo	Test Inertia (Lbs)	Test HP (@ 50 MPH)	Ambient Temp (F)	Pbaro (mmHg)	RH (%)	Test Comments	Dyne Run Number	BKI Vehicle Info	Dyne Test Date	BKI Odo	Test Inertia (Lbs)	Test HP (@ 50 MPH)	Ambient Temp (F)	Pbaro (mmHg)	RH (%)	Test Comments
84032	2001 Chevrolet Cavalier	07/14/2004	57066	3000	6.4	82.3	743.98	55.9	Traction Control (TCS) engaged 100 sec PH1 & 3,										
84154	1979 Ford F150 PU	08/10/2004	53503	3500	11.7	78.4	746.42	33.7	6Cyl. Runs very rough. Leaking multiple fluids. Difficulty maintaining trace. Tailpipe came off during the soak and the first 90 seconds of bag three was lost. Bag1 HC realtime off scale..using ba										
									No dyne test										
84034	1999 IsuzuTrooper	07/14/2004	63387	4500	14.8	84.1	743.95	59.4	0										
84035	2001 GMC Yukon	07/14/2004	75374	5500	18.8	85.6	743.69	58.1	0										
84036	1995 Ford Escort	07/15/2004	102663	2750	5.6	80.5	744.40	65.7	0										
84037	1979 Ford F250	07/15/2004	02285	3500	10.5	83.2	744.24	58.5	0										
									No dyne test										
									No dyne test										
84040	1990 Dodge Spirit	07/16/2004	109270	3000	8.7	81.0	742.12	75.6	0										
84039	2001 Ford F150	07/16/2004	48831	5500	16.2	79.5	741.88	79.7	0										
84042	1996 Honda Civic	07/17/2004	131492	2500	6.9	76.0	744.70	75.6	Engine stalled several times.										
84043	1991 Honda Civic	07/17/2004	216571	2500	6.9	77.5	744.79	70.5	0										
84047	1996 Mazda 626	07/19/2004	26614	3000	7.7	79.9	742.88	66.2	0										
84048	1989 Dodge Caravan	07/19/2004	161033	3500	7.6	83.2	742.61	63.9	0										
									No dyne test										
84051	1995 Chevy Corsica	07/20/2004	111484	3000	5.9	84.0	741.71	71.8	0										
84050	2002 Honda Civic	07/20/2004	50405	3000	5.3	82.0	741.60	80.3	Coolant on dyno after testing										
84054	1995 GMC Jimmy	07/20/2004	102924	3500	10.7	94.1	741.80	47.5	0										
84052	1988 Olds Cutlass	07/20/2004	81545	3000	6.4	89.1	741.77	60.0	AC on/switch broken										
84055	1998 Jeep Cherokee	07/20/2004	131884	3500	11.8	95.8	741.76	50.1	Rattling catalyst possibly bad.										
84061	1990 Chevy Cavalier	07/21/2004	81297	2750	5.6	91.5	742.43	57.7	0										
84058	1999 Chysler 300M	07/21/2004	73246	3500	5.8	87.3	741.73	65.2	0										
84057	2001 Saturn SL1	07/21/2004	51541	2500	6.1	85.9	742.52	69.2	0										
84060	1998 Buick LeSabre	07/21/2004	45455	3500	5.9	90.3	742.64	63.8	0	84062	1998 Buick Lesabre	07/22/2004	45483	3500	5.9	83.9	743.49	80.3	Dups.
84056	2002 Nissan Frontier P/U	07/21/2004	38153	4500	16.5	85.4	742.31	70.3	0										
84074	1986 Nissan P/U	07/24/2004	138620	3500	11.4	60.2	748.73	88.5	0										
84063	1998 Saturn SC	07/22/2004	74642	2500	6.0	85.3	743.69	72.5	0										
84067	1995 Dodge Caravan	07/22/2004	138912	4000	7.0	87.8	743.77	65.0	0										
									No dyne test										
84064	1994 Mercury Villager	07/22/2004	131405	4000	8.4	84.7	743.87	72.3	0										
84066	1995 Jeep Wrangler	07/22/2004	71165	3000	15.7	87.4	743.77	66.1	No Tunnel Heater-Hard shift from M4 to M5.										
84071	1989 Pontiac Grand Am	07/23/2004	116827	3000	5.9	77.2	746.61	84.5	0										
84068	2001 Toyota Solara	07/23/2004	48090	3500	7.0	76.7	746.18	88.6	0										
84069	1997 Dodge Caravan Sport	07/23/2004	90070	3500	7.2	76.8	746.27	84.1	0										
84073	1995 Chevy Blazer	07/24/2004	100766	3500	10.7	62.4	748.49	84.5	0										
84072	2003 Chevy S-10 P/U	07/24/2004	19374	3500	12.0	64.7	748.17	92.0	Zero Drift on Torque Readout.										
84076	1968 FordMustang	07/24/2004	98864	3000	8.0	61.1	748.68	92.3	0										
									No dyne test										
84077	1999 Honda Civic	07/26/2004	76504	2500	5.1	66.6	749.59	85.0	Exhaust Leaks										
84078	1997 Honda Accord	07/26/2004	79593	3000	4.9	70.4	749.53	70.3	0										
84079	1989 Honda Accord	07/26/2004	209991	2750	6.0	74.1	749.31	61.9	0										
84083	2000 Honda Accord	07/27/2004	77962	3000	7.8	76.1	747.42	42.5	0										
84082	2003 Ford Taurus	07/27/2004	25287	3500	6.8	71.9	747.39	53.0	0										
84084	1998 Chevy Malibu	07/27/2004	99436	3000	5.8	78.0	747.19	38.4	0										
84086	2004 Honda Odyssey	07/28/2004	21035	4500	12.0	73.7	745.09	49.4	(1) Traction control was engaged during first minute of bag 1.										
									No dyne test										
84088	1998 Chevrolet Lumina	07/28/2004	70740	3500	5.5	80.1	745.05	40.8	0										
84090	1999 Ford Mustang	07/28/2004	39505	3500	9.7	83.1	744.42	40.5	0										
84087	2000 Hyundai Tiburon	07/28/2004	89226	3000	5.9	77.4	745.04	44.1	0										
84091	1991 Cadillac Seville	07/28/2004	70502	3500	6.2	82.9	744.40	43.9	0										

BKI Dyne Test Information, First Dyne Run										BKI Dyne Test Information, Second Dyne Run									
Dyne Run Number	BKI Vehicle Info	Dyne Test Date	BKI Odo	Test Inertia (Lbs)	Test HP (@ 50 MPH)	Ambient Temp (F)	Pbaro (mmHg)	RH (%)	Test Comments	Dyne Run Number	BKI Vehicle Info	Dyne Test Date	BKI Odo	Test Inertia (Lbs)	Test HP (@ 50 MPH)	Ambient Temp (F)	Pbaro (mmHg)	RH (%)	Test Comments
84092	1999 Saturn	07/29/2004	53427	2500	5.5	73.9	744.65	58.1	0										
84094	1993 Ford Explorer	07/29/2004	120280	4000	10.2	78.0	744.49	47.1	0										
84096	1999 Isuzu Rodeo	07/29/2004	114937	4000	14.0	78.6	744.05	45.7	0										
									No dyne test										
84093	1997 Nissan Sentra	07/29/2004	119201	2750	7.0	75.7	744.62	51.1	0										
84098	1999 Ford Ranger	07/30/2004	91045	3500	12.1	70.8	742.44	63.5	0										
84097	2002 Mercury Sable	07/30/2004	24589	3500	6.8	69.9	742.90	65.0	0										
84101	2004 Toyota Camry	07/30/2004	169043	3500	7.2	77.4	742.87	49.9	0										
84120	1984 Honda Civic	08/03/2004	87570	2250	7.2	93.6	742.25	44.4	original miles. Engine temp. was elevat	84123	1984 Honda Civic	08/04/2004	87590	2250	7.2	85.1	741.52	56.2	duplicate
84099	1999 Toyota Avalon	07/30/2004	114759	3500	5.9	73.4	742.63	57.6	0										
84108	1990 Honda Civic	07/31/2004	214131	2500	6.5	87.6	744.40	38.7	0										
84119	1995 Jeep Cherokee	08/03/2004	171701	4000	13.1	91.9	742.48	44.5	0										
									No dyne test										
84105	1997 Toyota Corolla	07/31/2004	146471	2750	7.8	81.1	744.92	51.7	0										
84103	2000 Nissan Maxima	07/31/2004	74273	3500	7.4	74.6	744.72	60.7	0										
84102	1998 Honda Civic	07/30/2004	149665	2500	5.1	80.8	742.67	44.5	0										
									No dyne test										
84110	1995 Ford Contour	08/02/2004	102084	3000	5.0	84.7	743.32	56.8	0	84115	1995 Ford Contour	08/03/2004	102096	3000	5.0	84.0	742.82	57.1	duplicate
84111	1996 Chevrolet S-10 P/U	08/02/2004	112263	3500	9.3	88.4	743.39	51.6	0	84116	996 Chevrolet S-10 P	08/03/2004	112276	3500	9.3	87.6	742.80	49.5	duplicate run. braking violations
84113	1993 Pontiac Grand Prix	08/02/2004	172185	3500	5.0	91.0	743.34	47.8	0										
									No dyne test										
									No dyne test										
84104	1998 Plymouth Voyager	07/31/2004	163238	4000	7.0	78.1	744.89	55.7	0	84109	998 Plymouth Voyag	08/02/2004	163258	4000	7.0	83.0	743.24	59.1	duplicate. hp read 3.4 after test
84107	1989 Buick LeSabre	07/31/2004	108562	3500	7.0	86.0	744.76	39.4	0										
									No dyne test										
84126	1988 Ford Thunderbird	08/04/2004	178221	3500	9.1	80.5	743.05	61.7	Braking Violations										
84125	1995 Ford Explorer	08/04/2004	160621	4500	11.5	80.9	742.41	59.9	Small exhaust leak between catalyst and muffler										
84121	2001 Volvo S80	08/04/2004	55523	4000	4.0	82.9	741.29	60.0	0										
84165	1991 Mazda Protege	08/12/2004	185576	2750	7.9	71.6	747.42	37.5	0										
84122	1999 Dodge Caravan	08/04/2004	104207	4000	7.3	83.3	741.39	57.5	0										
84127	00 Chrysler Town and Coun	08/05/2004	85431	4500	9.3	70.3	747.95	57.0	Bags were being evacuated for the first 30 seconds of bag 1										
84129	1999 Toyota Celica GT	08/05/2004	72233	3000	6.5	75.4	748.46	45.2	Throttle sticking. Violation @ the start of bag 3 due to a monitor power failure										
84132	1993 Cherokee Sport	08/05/2004	172409	3500	15.6	80.3	747.88	38.3	braking violations RWD	84137	1993 Jeep Cherokee	08/06/2004	172421	3500	15.6	76.9	748.46	34.9	Duplicate. The rear straps were too ti
84128	2000 Toyota Camry	08/05/2004	48465	3500	7.3	73.5	748.40	47.6	car was hard to start. Had to be cranked over several times before it started.										
84131	1997 Chevy Cavalier	08`/05/2004	128172	3000	5.4	79.4	748.14	38.8	0										
84134	1997 Mercury Grand Marqui	8/06/2004	74497	4000	9.5	72.9	749.21	43.6	car was hard to start. Had to be cranked over several times before it started.										
84133	1998 Buick Century	08/6/2004	71195	3500	5.9	68.8	749.13	53.0	0										
84135	1993 Ford Probe	08/06/2004	129131	3000	8.1	75.2	749.31	38.3	0										
84138	1995 Ford Bronco	08/06/2004	198053	5000	10.7	79.0	748.04	32.0	Braking Violations. RWD										
									No dyne test										
84139	1999 Ford Escort	08/07/2004	66820	2750	5.6	69.7	746.93	53.2	5 speed Slipping on the rolls in the beginning										
84140	2002 Chevy Blazer	08/07/2004	35072	3500	11.3	75.1	746.75	44.9	0										
									No dyne test										
84141	1990 Honda Accord	08/07/2004	170433	3000	5.9	77.9	746.54	42.4	5 speed										
84148	1991 Dodge Dynasty	08/09/2004	91324	3000	6.8	83.8	747.29	43.5	Front lower engine spport broken. Wired the engine down with a peice of wire to help stabalize the engine for testing.										
84145	1990 Jeep Cherokee	08/09/2004	261848	3500	10.8	79.2	747.61	49.2	Stalled @ start of bag 1.Lots of small holes in muffler. Exhaust leaks										
84149	2002 Ford Escort SE	08/10/2004	26748	3000	7.3	69.6	748.16	49.4	2fmxr0080bae										
84144	1993 Plymouth Voyager	08/09/2004	170027	4000	7.3	75.7	747.59	54.0	0										

BKI Dyne Test Information, First Dyne Run										BKI Dyne Test Information, Second Dyne Run									
Dyne Run Number	BKI Vehicle Info	Dyne Test Date	BKI Odo	Test Inertia (Lbs)	Test HP (@ 50 MPH)	Ambient Temp (F)	Pbaro (mmHg)	RH (%)	Test Comments	Dyne Run Number	BKI Vehicle Info	Dyne Test Date	BKI Odo	Test Inertia (Lbs)	Test HP (@ 50 MPH)	Ambient Temp (F)	Pbaro (mmHg)	RH (%)	Test Comments
84150	2000 Honda Odyssey	08/10/2004	68979	4500	9.6	68.3	748.16	48.5	Traction control Disabled Clean Start										
84151	2000 Honda Accord	08/10/2004	76178	3500	7.5	69.4	748.08	46.8	YHNXV02.3PF3	84156	2000 Honda Accord	08/11/2004	76191	3500	7.5	65.4	747.56	59.4	Sample bags for bags one and two we
84153	2000 Ford F150 PU	08/10/2004	61040	4500	16.9	76.0	746.76	38.1	5Spd manual. Check engine light is on. Sliding on rolls @ start of bag 1.										
84146	1988 Ford Ranger	08/09/2004	74743	3500	10.2	82.4	747.54	46.6	5Spd. Torque meter read 4.6 After loading the vehicle. Reset to zero before start of test.										
	void																		
84157	1994 Nissan Sentra	08/11/2004	127063	2750	7.1	65.9	747.90	54.5	5Spd. Repaired video cable before start of test. Noticed that the video signal was a little noisy afterward										
									No dyne test										
84162	1983 Chrysler Lebaron	08/12/2004	43291	2750	5.5	67.3	747.99	41.7	Muffler removed for testing. Actual mileage 100K+										
84161	1997 Volvo 850	08/12/2004	65093	3500	6.0	65.4	748.07	52.9	traction control disabled. Used an orange silicone boot which began smoking @ the end of bag 2.										
84166	1994 Mercury Topaz	08/12/2004	9950	3000	6.1	71.5	747.45	39.2	odometer has turned over. rattling from	84169	1994 Mercury Topaz	08/13/2004	9961	3000	6.1	70.7	749.47	44.0	Dupe Mileage is in excess of 100K
84160	2001 Ford Focus	08/12/2004	52253	3000	7.3	62.0	748.22	56.0	0										
84164	1999 Plymouth Voyager	08/12/2004	74703	4000	6.6	70.8	747.49	36.6	JB's first time driving. tunnel heater set point changed from 109 to 108 degrees										
84171	1988 Honda Civic DX	08/13/2004	205828	2250	6.4	70.8	749.21	44.8	5 Speed. Stalled twice in Bag 2. 1.5L										
84168	996 Buick Regal Grand Spo	08/13/2004	139861	3500	5.6	70.1	749.47	46.7	3.8 L										
84172	1986 Cadillac Cimmaron	08/13/2004	17610	3000	5.9	73.0	748.85	39.6	2.8L Vehicle mileage is in excess of 100k										
84167	1999 Ford Ranger P/U	08/13/2004	92926	3500	11.4	68.5	749.25	50.6	5 speed 3.0L										
84175	1988 Pontiac Bonneville	08/14/2004	236760	3500	8.5	70.1	750.37	47.8	3.8 liter	84180	988 Pontiac Bonnevil	08/16/2004	236790	3500	8.5	74.6	748.74	44.4	Duplicate. 3.8L. Stalled @ start of test
84174	1994 Mercury Topaz	08/14/2004	32694	3000	6.1	66.9	750.27	54.6	Car infested with fleas. Driver switched @ 700 sec. into bag 2. JFsr took over for JFjr. Mileage stated is in excess of 100K										
84173	1996 Mercury Sable	08/14/2004	110411	3500	6.9	65.2	750.12	57.5	check engine light on										
84179	1998 Jeep Cherokee	08/16/2004	82874	3500	11.8	72.9	749.00	43.5	4.0L RWD. Braking Violations										
84182	1995 Ford Thunderbird	08/16/2004	135049	4000	10.6	76.7	747.84	45.1	4.6L RWD. Braking Violations.										
84178	1997 Toyota Camry	08/16/2004	129432	3500	7.3	68.7	748.92	54.4	2.2L										
84185	1996 Toyota Corolla	08/17/2004	148865	2750	6.6	80.5	745.47	50.6	5Spd.										
84184	2000 Honda Civic	08/17/2004	40410	2750	7.0	77.6	745.64	53.1	YHNXV01.6CA3										
84191	2000 Toyota Camry	08/19/2004	47780	3500	7.3	68.4	746.92	45.9	YTYXV02.2XBA										
84183	2000 Toyota Corolla	08/17/2004	70126	2750	7.5	74.8	745.75	58.9	ytyxr0115ak1										
84189	1984 Ford F150 Pickup	08/18/2004	72318	3500	12.9	84.4	743.17	41.4	3spd W/OD. Runs very rough. Exhaust leaks. Stalled Bag 2 approx 770 secs. HC was off scale for 95% of the test. Using Bag values for HC instead of Real time.4.9 L 6cyl.										
									No dyne test										
84188	1977 Chevy Monte Carlo	08/18/2004	5553?3555	4000	11.6	80.2	743.17	45.7	Stalled @ start of test. Added brake fluid Brakes faded after heating up. Braking violoations.										
84193	2001 Hyundai Sante Fe	08/19/2004	70621	4000	8.7	68.9	746.67	45.0	1HYXT02.4S3S										
									No dyne test										
84195	1999 Chevy Lumina	08/19/2004	42985	3500	5.4	70.2	746.60	44.1	3.1 L										
84196	1993 GMC Safari	08/19/2004	283231	4000	12.5	68.0	746.31	51.4	4.3L RWD. Braking violations										
84192	2001 GMC Sonoma	08/19/2004	60059	3500	11.3	68.7	747.06	45.6	1GMXT04.3187 Eng. code called for 4500# inertia. Ran @ S-10 load of 3500# S-10 engine code1GMXT04.3186										
84198	1994 Saturn SL1	08/20/2004	116791	2500	4.7	65.8	745.82	63.2	0	84200	1994 Saturn SL1	08/21/2004	116822	2500	4.7	65.2	747.51	68.8	Duplicate
84197	1990 Buick Regal	08/20/2004	103881	3000	6.8	64.3	745.70	66.6	hard cold start										
									No dyne test										
									No dyne test										
84201	1985 Chev S10	08/21/2004	30305	3000	10.4	65.0	747.59	67.6	No bag info for phase 1 & 2 RWD poor braking										
									No dyne test										
84208	1989 Lincoln Towncar	08/23/2004	82512	4000	12.7	75.7	742.36	66.8	0										
84205	1998 Ford F150	08/23/2004	98670	4500	13.3	75.1	742.67	68.8	0										
84204									No dyne test										
84206	1994 Chevy P/U	08/23/2004	99225	4000	12.2	75.2	742.87	67.1	Some engine skipping on accels										
84209	1996 Dodge Stratus	08/24/2004	126733	3000	7.5	71.7	743.54	71.1	Check Engine light is on.										
84211	1986 Ford Tempo	08/24/2004	60031	2500	6.9	71.9	741.86	69.1	0										
84210	1988 Mazda MX6	08/24/2004	222715	3000	6.8	71.3	743.27	69.7	0										
84213	1985 Olds Regency 98	08/24/2004	188058	3500	7.9	75.7	740.94	54.3	0										
									No dyne test										
84215	1992 Nissan Maxima	08/25/2004	53987	3500	8.5	79.8	740.84	58.5	Low Mileage vehicle.										
84214	1994 Pontiac Bonneville	08/25/2004	125226	3500	5.3	78.6	740.53	61.5	Late crank, ~ 20 seconds into Ph1										
84216	1990 Ford F150 P/U	08/25/2004	7131	4000	15.5	81.0	741.13	54.2	0										

BKI Dyne Test Information, First Dyne Run										BKI Dyne Test Information, Second Dyne Run									
Dyne Run Number	BKI Vehicle Info	Dyne Test Date	BKI Odo	Test Inertia (Lbs)	Test HP (@ 50 MPH)	Ambient Temp (F)	Pbaro (mmHg)	RH (%)	Test Comments	Dyne Run Number	BKI Vehicle Info	Dyne Test Date	BKI Odo	Test Inertia (Lbs)	Test HP (@ 50 MPH)	Ambient Temp (F)	Pbaro (mmHg)	RH (%)	Test Comments
84224	2002 Ford Taurus	08/27/2004	72468	3500	6.5	83.1	743.18	52.9	0										
84219	1994 Chrysler Concorde	08/26/2004	169018	3500	7.8	78.6	741.31	64.8	0										
84231	1994 Olds Eighty Eight	08/28/2004	128014	3500	6.5	75.5	746.31	50.4	0										
									No dyne test										
84221	985 Ford LTD Crown Victori	08/26/2004	100260	3500	9.3	82.2	741.60	54.3	new muffler and tailpipe										
84220	1992 Ford Escort	08/26/2004	12788	2750	6.4	80.0	741.53	60.0	0										
84225	2000 Honda Civic LX	08/27/2004	35766	2750	7.0	83.8	743.29	49.6	0										
84227	1997 Buick Century	08/27/2004	86430	3500	5.9	85.8	743.32	46.2	0										
84228	1992 Pontiac Grand Am	08/27/2004	140191	3000	4.7	86.7	742.99	44.8	Manual Transmission Stalled once in bag 2										
84223	2005 Dodge Caravan	08/27/2004	18159	4000	8.0	82.2	743.01	56.8	0										
84233	1989 Toyota Corolla	08/28/2004	181875	2500	5.9	76.5	745.80	44.7	0										
84230	1993 Nissan Sentra	08/28/2004	87073	2500	6.2	75.5	745.71	53.8	0										
84229	2000 Olds Silhouette	08/28/2004	85292	4000	11.5	77.6	745.36	55.2	Change oil light on.										
84234	1991 VW Cabriolet	08/30/2004	63829	2750	8.0	71.0	747.73	74.0	0										
84239	1987 Ford Taurus	08/30/2004	33610	3000	6.9	79.8	747.95	31.5	Losing coolant (oil mix ?)..but not overheating..stopped Ph2 @ 1300 sec.										
									No dyne test										
84238	1988 Pontiac 6000 Wagon	08/30/2004	133737	3500	6.8	78.6	747.89	37.4	Shut off twice during initial idle..possible exhaust leak.										
84236	1992 Olds Achieva	08/30/2004	177104	3000	4.9	75.1	748.17	59.1	0										
84235	1990 Geo Prizm	08/30/2004	176712	2500	6.9	73.0	747.94	63.6	Bag 1 did not fill..Realtime ok..Engine cut off at 10 sec.										
84244	1992 Ford Escort	08/31/2004	11345	2750	7.4	80.8	749.36	45.4	0										
84241	1998 Ford Contour	08/31/2004	118535	3000	4.8	77.0	749.88	12.8	0										
									No dyne test										
84245	1987 Honda Accord	08/31/2004	19268	2750	6.0	81.8	748.95	24.3	0										
84240	1998 Infiniti I30	08/31/2004	50005	3500	6.4	74.7	749.62	40.4	0										
84242	1997 Plymouth Voyager	08/31/2004	70430	3500	6.7	79.2	749.90	10.4	0										
84246	1994 Eagle Talon	09/01/2004	109747	3500	10.6	74.7	749.13	49.7	Cut off during first 10 seconds of Ph 1										
84248	1987 Ford Ranger	09/01/2004	1705	3000	10.4	79.3	749.91	48.9	No rear brakes, brake lines leaking profusely.										
84257	1983 Volvo GL	09/02/2004	184224	3000	10.5	82.1	746.06	37.1	0										
84256	1989 Chevy S10 P/U	09/02/2004	174034	3000	10.4	81.7	746.47	36.9	Roll/tire slippage on Ph1										
84250	1987 Ford Escort	09/01/2004	78217	2500	7.4	81.1	749.43	46.2	Vehicle ran hot, coolant added.										
84254									No dyne test										
84253	1997 Mercury Sable	09/02/2004	104330	3500	8.0	77.7	747.38	35.8	0										
84252	2001 Ford Taurus	09/02/2004	30917	3500	6.8	75.1	747.28	34.4	0										
									No dyne test										
84258	1991 Olds Delta 88	09/08/2004	226269	3500	7.0	70.8	749.36	1.5	0	84262	1991 Olds Delta 88	09/09/2004	227290	3500	7.0	71.8	748.36	50.2	Dup. First 700 seconds @3000 #s ine
84263	1989 Dodge Ram P/U	09/09/2004	132325	3500	15.0	74.5	748.57	41.8	0										
84261	1989 Toyota Camry	09/09/2004	269020	3500	7.7	66.0	747.79	65.7	Clutch slips, Massive exhaust leak.										
84265	1984 Buick Century	09/09/2004	1878	3000	7.3	78.4	747.60	37.2	Runs poorly, "Check Engine" lamp illuminates sporatically, used HC bag values.										
84266	2000 Kia Sephia	09/10/2004	58660	2750	6.3	72.3	748.57	54.8	0										
84267	1989 Chevrolet Cavalier	09/10/2004	58439	2750	6.7	74.3	748.70	47.5	0										
84271	1979 Buick LeSabre	09/10/2004	37608	3500	10.5	81.5	747.41	30.2	Ignition switch stuck at start of Ph3.										
84268	1994 Ford F150 P/U	09/10/2004	169749	4500	12.9	76.7	748.64	39.8	0										
84270	1986 Mercury Grand Marqui	09/10/2004	36277	4000	10.7	79.6	747.87	30.6	0										
84276	1989 Buick Park Avenue	09/11/2004	128607	3500	6.0	78.7	747.57	33.8	0										
84274	1995 Ford Aspire	09/11/2004	188078	2250	6.1	74.4	748.19	49.6	0										

BKI Dyne Test Information, First Dyne Run										BKI Dyne Test Information, Second Dyne Run									
Dyne Run Number	BKI Vehicle Info	Dyne Test Date	BKI Odo	Test Inertia (Lbs)	Test HP (@ 50 MPH)	Ambient Temp (F)	Pbaro (mmHg)	RH (%)	Test Comments	Dyne Run Number	BKI Vehicle Info	Dyne Test Date	BKI Odo	Test Inertia (Lbs)	Test HP (@ 50 MPH)	Ambient Temp (F)	Pbaro (mmHg)	RH (%)	Test Comments
84272	2001 Honda Accord	09/11/2004	39702	3500	7.8	72.3	748.03	65.2	0										
84273									No dyne test - dyne test voided										
84278	1990 GMC Jimmy	09/11/2004	130254	3500	14.5	79.9	747.05	33.7	No Bag Data										
84277	1978 MG MGB	09/11/2004	42926	2750	6.1	79.3	747.54	30.4	0										
84286	1997 Olds. Silhouette	09/14/2004	111026	4000	10.1	80.7	743.51	53.0	Traction control began to work @ the start of bag 3. disabled it by restarting the engine Violations @ the start of bag 3										
84285	2000 Honda Civic	09/14/2004	46677	2750	7.0	79.2	743.39	56.1	YHNXV01.6TA3										
84287	!995 GMC Sierra P/U	09/14/2004	171370	4000	12.2	83.5	743.31	49.8	Tailpipe Missing.Ran 6' of silicone tubing to get the exhaust to the back of the vehicle.										
									No dyne test										
84291	1997 Honda Civic	09/15/2004	75783	2500	5.0	80.4	741.40	56.4	1.6L										
84289	34 Olds Custom Cruiser Wag	09/14/2004	8983	4500	11.6	86.7	742.44	41.2	Mileage stated is in excess of 100K. Stalled repeatedly in bag 1. Exhaust leak @ manifoldHooked up a new sensors flow meter down stream from our normal meter. Background HC reading were										
84293	1984 Volvo GL Wagon	09/15/2004	299703	3000	10.7	79.7	742.17	61.8	Stalled in bag 1										
84295	1987 Chevy Caprice Classic	09/15/2004	85915	4000	9.7	79.5	742.41	59.8	Stalled in bag 1. Exhayst leaks.										
									No dyne test										
84302	1993 Ford F150 P/U	09/16/2004	184984	4500	12.8	79.1	745.06	32.1	RWD. Braking Violations										
84301	1989 Pontiac Grand Prix	09/16/2004	149395	3500	4.5	78.1	745.57	31.3	3.1L. Real time Bag 1 HC off-scale..using bag value.										
84300	1990 Buick Lesabre	09/16/2004	59413	3500	6.8	77.1	746.18	33.1	Mileage stated is actual miles										
84297	1996 Dodge Stratus	09/16/2004	146579	3000	7.5	70.9	747.08	50.9	Nox Air supply was interupted @ some point during the run. Glitch in the regulator or the cylinder valve or the bench operator? The gauges on the regulator read zero. As soon As I touched the (										
84292	1997 Toyota Camry	09/15/2004	127414	3500	7.3	80.8	741.83	56.9	2.2L										
84298	1999 Dodge Durango	09/16/2004	92681	5000	16.9	74.0	746.92	44.2	5.9L										
84296	1998 Honda Civic	09/16/2004	115370	2500	5.1	68.1	746.88	64.6	Stalled in bag 1 200 seconds+-. A large truck parked out back of the building during the run which may account for the increased CO2 background.										
84304	2001 Honda Civic	09/17/2004	49751	2750	8.0	71.2	746.55	47.3	1HNXV01.7YJ9 No HP settings were listed in the database. Ran @ 6.0										
84307	1992 Honda Accord	09/17/2004	74582	3000	5.7	76.8	745.98	41.1	0										
84308	1994 Pontiac Grand Am	09/17/2004	101526	3000	5.4	77.4	745.47	42.3	0	84312	994 Pontiac Grand A	09/18/2004	101538	3000	5.4	74.3	747.25	61.1	Duplicate run
84305	1999 Chevy Malibu	09/17/2004	76627	3500	5.8	74.2	746.44	42.5	3.1L										
84303	2002 Olds Silhouette	09/17/2004	40271	4500	16.2	65.1	746.51	63.6	Traction control engaged 1st 40 seconds of bag 1.										
84309	1973 Mercedes 280 SE	09/17/2004	81588	4000	11.4	78.2	744.24	42.1	RWD poor braking performance. Braking Violations. It is unknown whether the mileage stated is actual miles.										
									No dyne test										
									No dyne test										
84310	2003 Chevy Venture	09/18/2004	24915	4500	16.2	73.6	747.61	63.3	3.4L 3GMXT03.4141 There was noHP listed in the load tables for this year model. Used the load listing for 2GMXT03.4141.										
84315	1991 Plymouth Voyager	09/18/2004	158771	3500	7.6	83.4	746.37	46.4	exhaust leaks										
84316	1996 Dodge Avenger	09/18/2004	124729	3000	4.4	84.6	746.05	46.3	5spd. Car was smoking heavily @ startup and @ the beginning of the PEMs run.										
84311	1989 Toyota Corolla	09/18/2004	80749	2500	5.9	74.0	747.14	62.2	1.6L										
84318	1997 Nissan Sentra	08/21/2004	154255	2750	7.0	75.3	747.99	36.7	CHECK ENGINE AND BRAKELIGHT CAME ON 280 SECONDS INTO TEST										
84322	1990 Toyota Camry	09/21/2004	202804	3000	5.9	81.4	746.39	31.5	0										
84317	2000 Nissan Altima	08/21/2004	95313	3500	7.9	73.8	747.89	41.7	0										
84314	1989 Plymouth Sundance	09/18/2004	144672	2750	6.9	80.6	746.46	48.3	0										
84319	1998 Toyota Camry	08/21/2004	127663	3500	6.4	77.5	747.82	35.3	0										
84375	2001 Ford Windstar	09/30/2004	37923	4500	10.1	64.5	746.50	12.0	0										
84321	1996 Toyota Avalon	08/21/2004	108189	3500	6.2	80.5	746.86	33.3	0	84328	1996 Toyota Avalon	09/21/2004	108210	3500	6.2	82.0	747.32	40.7	0
84325	1998 Nissan Maxima	09/21/2004	111655	3000	6.1	77.6	747.83	43.7	0										
84324	1999 Toyota Camry	09/21/2004	60286	3500	6.4	75.4	747.84	45.1	0										
84327	1998 Ford Taurus	09/21/2004	77804	3500	5.0	80.8	747.54	41.5	0										
84329	1997 Jeep Wrangler	09/21/2004	94832	3500	16.1	83.2	747.14	38.3	0										
84323	2004 Kia Rio Cinco	09/21/2004	6260	2750	6.7	74.0	747.59	46.8	0										
84334	Chevrolet Caprice Estate W	09/22/2004	72464	4500	9.6	80.2	748.60	37.5	OIL SMOKE FROM UNDER HOOD FILLED ROOM										
84335	1988 Mercury Grand Marqui	09/22/2004	87717	4000	12.5	82.3	748.07	36.7	0										

BKI Dyne Test Information, First Dyne Run										BKI Dyne Test Information, Second Dyne Run									
Dyne Run Number	BKI Vehicle Info	Dyne Test Date	BKI Odo	Test Inertia (Lbs)	Test HP (@ 50 MPH)	Ambient Temp (F)	Pbaro (mmHg)	RH (%)	Test Comments	Dyne Run Number	BKI Vehicle Info	Dyne Test Date	BKI Odo	Test Inertia (Lbs)	Test HP (@ 50 MPH)	Ambient Temp (F)	Pbaro (mmHg)	RH (%)	Test Comments
84336	1987 Toyota P/U	09/22/2004	225176	2750	9.6	82.2	747.54	33.4	BRAKE PROBLEMS(NONE AT TIMES)BORDERLINE OVERHEATING										
84330	2004 Chevrolet Cavalier	09/22/2004	8420	3000	3.9	73.3	748.85	44.6	TRACTION CONTROL DISABLED										
84332	1997 Pontiac Grand Am	09/22/2004	57230	3000	3.8	76.8	749.25	39.7	HC2 NOT RESPONDING	84341	997 Pontiac Grand A	09/23/2004	57260	3000	3.8	76.0	747.59	54.3	DUPLICATE RUN
84331									No dyne test	84338	2001 Saturn	09/23/2004	63172	3000	6.4	77.2	746.83	46.7	DUPLICATE RUN
84339	999 Plymouth Grand Voyag	09/23/2004	75489	4000	6.6	78.0	747.10	46.6	0										
84342	1994 Toyota Camry	09/23/2004	128229	3500	7.2	77.5	747.29	46.0	0										
84337	2003 Ford Ranger P/U	09/23/2004	11678	3500	4.1	75.4	746.41	47.2	0										
84343	2004 Kia Sedona	09/24/2004	6344	4000	6.8	67.6	749.27	58.3	NOX 03 AIR CHANGED/LOST O3 AFTER SPAN/NOT READING DURING TEST										
84347	1995 Toyota Corolla	09/24/2004	106201	2500	6.0	77.8	749.08	31.4	0										
84344	2000 Toyota Sienna	09/24/2004	131771	4000	6.5	71.3	749.60	49.3	0										
									No dyne test										
84345	1997 Chevrolet Lumina	09/24/2004	133436	3500	5.3	74.1	749.54	42.5	0	84350	997 Chevrolet Lumin	09/25/2004	133465	3500	5.3	70.7	750.62	49.5	DUPLICATE RUN
84351	1996 Ford Contour	09/25/2004	98572	3000	5.6	73.7	750.62	44.1	0										
84354	1989 Ford F150	09/25/2004	61510	4000	15.3	79.9	749.66	27.6	0										
84353	1993 Saturn Wagon	09/25/2004	220839	3000	4.8	78.4	750.19	31.6	0										
84349	2003 Chevrolet Tracker	09/25/2004	22365	3000	12.7	66.8	750.40	60.0	0										
84284	1987 Chevy Caprice Wagon	09/13/2004	29828	4500	9.6	83.9	743.26	35.6	mileage stated is in Excess of 100K. Exhaust leaks.										
84280	1999 Ford Escort	09/13/2004	74102	2750	4.9	78.9	744.70	44.4	Stalled @ 230 seconds in bag 1										
84279	2001 Toyota Camry 3.0L	09/13/2004	61415	4000	7.0	77.1	744.89	47.2	Torque zero board was dislodged @ the end of the test. Not sure when this occured.										
84283	1986 Dodge P/U	09/13/2004	47582	3500	12.8	82.8	743.74	37.2	mileage stated is in excess of 100K. Runs rough. Bag 1 HC off-scale..using bag HC value for Bag1.										
84281	1995 Chevy Suburban	09/13/2004	73848	5000	10.8	80.5	744.53	38.7	Rear wheel drive. Braking Violations										
84359	1992 Toyota Corolla	09/27/2004	84923	2750	8.6	76.0	747.63	51.8	0										
84356	1997 Pontiac Grand Am	09/27/2004	120921	3000	3.8	69.1	748.45	54.6	0										
84357	1995 Mercury Tracer	09/27/2004	146970	2750	4.5	72.4	748.32	51.9	EXHAUST LEAK AT MOTOR/700 SECONDS STARTED SKIPPING/WORSE AT END OF BAGII/RECONNECTED 2 PLUG WIRES AT FIRST IDLE OF BAG III										
84355	2001 Chevrolet Lumina	09/27/2004	57829	3500	7.0	65.4	748.19	55.0	0										
84362	1998 Ford Taurus	09/28/2004	91855	3500	5.0	68.0	749.80	28.9	0										
84363	1996 Toyota Corolla	09/28/2004	288784	2750	6.6	67.4	750.24	27.4	0										
84361	2002 Nissan Maxima	09/28/2004	80356	3500	5.0	68.3	749.34	30.9	0										
84367	1980Mercedes 450 SEL	09/28/2004	185888	4000	8.3	73.6	749.22	20.0	0										
84365	1993 Ford Taurus	09/28/2004	69365	3500	5.5	72.1	749.80	20.6	0										
84373	1990 Chevrolet Astrovan	09/29/2004	235476	4000	12.0	71.6	747.30	17.7	0										
84369	1996 Volvo 850 Wagon	09/29/2004	81784	3500	7.3	63.2	749.46	12.3	0										
84372	1994 Toyota Camry	09/29/2004	88215	3500	7.2	71.0	748.04	16.0	0										
84368	1997 Saturn SL	09/29/2004	170227	2500	6.7	58.8	749.19	11.9	0										
84370	1995 Ford Taurus	09/29/2004	70394	3500	5.4	67.0	749.26	14.8	0										
84366	1989 Olds Cutlass Wagon	09/28/2004	118187	3000	5.7	73.1	749.40	20.2	0										
84376	2000 Honda Odyssey	09/30/2004	117948	4500	9.6	67.0	746.65	12.5	0										

BKI Dyne Test Information, First Dyne Run									
Dyne Run Number	BKI Vehicle Info	Dyne Test Date	BKI Odo	Test Inertia (Lbs)	Test HP (@ 50 MPH)	Ambient Temp (F)	Pbaro (mmHg)	RH (%)	Test Comments
84380	1995 Lincoln Continental	09/30/2004	100959	4000	5.7	75.9	744.68	17.1	0
									No dyne test
84381	1994 Mercury Marquis	09/30/2004	127784	4000	10.7	76.7	744.43	17.8	0
84379	1998 Pontiac Grand Am	09/30/2004	75722	3000	4.4	73.8	745.52	16.0	0
84383	1996 Toyota Camry	10/01/2004	164875	3500	6.9	70.4	744.05	13.7	0
									No dyne test
84384	1996 Geo Prizm	10/01/2004	169535	2750	7.0	70.4	744.22	15.0	0
									No dyne test
84377	1997 Honda Accord	09/30/2004	77801	3000	4.9	69.9	746.53	13.6	0
84386	1990 Nissan Maxima	10/01/2004	258738	2750	5.8	71.6	743.85	15.1	Vehicle would not go into gear for first 2 minutes.
84382	1999 VW Cabrio	10/01/2004	38317	3000	6.9	71.3	743.88	13.6	0
84396	1995 Ford Escort	01/12/2005	106996	2750	5.6	39.1	735.36	65.5	0
84397	975 Chevrolet Silverado 20 F	01/12/2005	2893	4000	13.9	39.3	735.39	65.8	0
84393	1999 Chrysler 300M	01/12/2005	90240	3500	5.8	37.9	735.51	70.6	Coolant Temp = 55.4 F (semtech data)
84394	2000 Honda Odyssey	01/12/2005	74601	4500	9.6	39.2	735.81	69.1	Initial coolant temp = 43 F (semtech data)
84399	1997 Honda Accord	01/13/2005	82926	3000	4.9	32.7	746.99	43.4	Initial coolant temperature = 39 F.
84401	1998 Plymouth Voyager	01/13/2005	168876	4000	7.0	30.1	747.74	41.3	0
84398	2001 Honda Accord	01/13/2005	62350	3500	7.8	32.8	745.88	45.7	Initial coolant temperature = 44 F
84402	1991 Honda Civic	01/13/2005	220022	2500	6.5	29.4	749.29	39.2	0
84406	1995 Toyota Corolla	01/14/2005	107983	2500	6.0	20.9	757.05	36.0	0
84404	1997 Dodge Caravan	01/14/2005	96455	3500	7.2	14.5	758.07	43.0	0
84407	1989 Pontiac GrandAm	01/14/2005	123575	3000	5.9	23.9	756.85	32.5	Service engine soon light is on.
84403	2000 Dodge Caravan	01/14/2005	85198	3500	7.2	12.2	756.88	41.7	Initial engine coolant temperature = 28 F.
84408	2002 Mercury Sable	01/15/2005	29501	3500	6.8	15.9	760.07	45.3	Tunnel heater off on Phase 3.
84413	1979 Ford F250 PU	01/15/2005	5797	3500	10.5	18.4	758.93	47.0	0
84409	1999 Chevrolet Malibu	01/15/2005	79925	3500	5.8	17.9	760.61	43.5	0
84412	1996 Honda Civic	01/15/2005	140479	2500	6.9	17.8	759.17	44.8	0
84411	1996 Saturn SC	01/15/2005	78346	2500	6.0	18.4	759.53	43.9	0
84419	1998 Chevrolet Lumina	01/17/2005	79187	3500	5.5	34.1	758.24	30.8	TUNNEL WARMED 40 MINUTES/20 GAL. DIESEL FUEL ADDED TO GENERATOR]
84418	1997 Pontiac Grand Am	01/17/2005	58100	3000	3.8	31.4	758.31	33.5	GENERATOR RAN OUT OF FUEL AT START OF PHASE III TUNNEL HEATER STOPPPED/SEMTECH HAS BURN SMELL AT VI
84414	2003 Chevrolet Impala	01/17/2005	11340	3500	2.9	27.2	759.38	40.1	TRUCKS NEXT DOOR STARTED FIRST MINUTE OF TEST
84415	1999 Dodge Durango	01/17/2005	95999	5000	16.9	28.4	760.06	33.7	* LICENSE# QGD396 FOR SUMMER STUDY
84416	1998 Honda Civic	01/17/2005	118218	2500	5.1	28.2	759.52	36.0	0
84422	1998 Jeep Cherokee	01/18/2005	137053	3500	11.8	37.4	754.57	38.5	5 SPEED/BKG HIGHER/TRUCKS
84425	5 Jeep Grand Cherokee Lar	01/18/2005	179121	4000	13.1	43.9	750.62	39.3	LOWERED"NOT CLOSED" DOORS DUE TO WIND
84420	2000 Honda Accord	01/18/2005	84180	3500	7.5	30.4	755.93	39.4	0
84424	1995 Ford Explorer	01/18/2005	162634	4500	11.5	41.3	751.65	41.5	0
84421	2000 Saturn Sedan	01/18/2005	51721	2750	4.0	34.9	755.56	36.4	0
84428	1998 Chevrolet Malibu	01/19/2005	107047	3500	5.9	46.3	751.20	56.5	0
84430	1990 Dodge Spirit	01/19/2005	93661	3000	8.2	46.7	749.92	56.0	LICENSE # WAS REPORTED AS SKJ248 FOR SUMMER STUDY
84426	2001 Saturn Sedan	01/19/2005	44251	2750	3.7	39.4	749.92	61.8	0
84427	2001 Mitsubishi Galant	01/19/2005	51764	2750	3.7	45.2	751.03	58.3	2DRI REPLACED COMPRESSOR BEFORE RUN
84431	91 Mercury Grand Marquis S	01/19/2005	19292	4000	10.3	47.1	749.48	54.9	JUMP STARTED/OIL LEAKING ON CROSSOVER PIPE-PRE-CATALYST/SMOKED BUILDING/SECOND BUILDING EXHAUST FAN TURNED ON
84433	1997 Jeep Wrangler	01/20/2005	97532	3500	16.1	48.3	744.43	57.4	0
84437	1994 Toyota Camry	01/20/2005	131874	3500	7.2	60.1	742.95	47.0	0
84442	1994 Toyota Camry	01/21/2005	131894	3500	7.2	40.7	743.97	59.6	DUPLICATE RUN/ COLDER DAY
84436	1995 Chevrolet S10 PU	01/20/2005	124976	3500	10.8	56.3	743.27	50.5	HY-HE CHANGED AT 11:40/BAD REAR BRAKES ON TRUCK
84432	1999 Saturn Sedan	01/20/2005	98565	2500	5.5	44.7	744.21	60.5	0

BKI Dyne Test Information, Second Dyne Run									
Dyne Run Number	BKI Vehicle Info	Dyne Test Date	BKI Odo	Test Inertia (Lbs)	Test HP (@ 50 MPH)	Ambient Temp (F)	Pbaro (mmHg)	RH (%)	Test Comments

BKI Dyne Test Information, First Dyne Run										BKI Dyne Test Information, Second Dyne Run									
Dyne Run Number	BKI Vehicle Info	Dyne Test Date	BKI Odo	Test Inertia (Lbs)	Test HP (@ 50 MPH)	Ambient Temp (F)	Pbaro (mmHg)	RH (%)	Test Comments	Dyne Run Number	BKI Vehicle Info	Dyne Test Date	BKI Odo	Test Inertia (Lbs)	Test HP (@ 50 MPH)	Ambient Temp (F)	Pbaro (mmHg)	RH (%)	Test Comments
84434	QAZ044	01/20/2005	0	Void	0.0	29.3	750.53	50.1	FID FILTER CHANGED/REAL-TIME C	84440	995 Buick Park Aven	01/21/2005	144956	4000	7.2	40.3	745.92	58.0	VOID PREVIOUS DAY/VALVE COVE
									No dyne test										
84438	2001 Buick Century	01/21/2005	33749	3500	5.3	40.3	746.74	60.9	LOW TRACTION LIGHT ON 30 SECONDS/SERVICE ENGINE SOON AND BRAKE LIGHT ON										
									No dyne test										
84443	1991 Geo Prizm	01/21/2005	132326	2500	7.4	41.5	743.38	61.0	0										
84439	1995 Pontiac Bonneville	01/21/2005	168145	3500	5.3	40.6	746.22	60.1	SMOKE FROM LEAKING VALVE COVER GASKET										
84446	2000 Toyota Sienna	01/22/2005	137493	4000	6.5	23.6	754.06	35.8	0										
84448	1999 Plymouth Voyager	01/22/2005	79230	4000	6.4	24.7	754.75	38.9	Exhaust leak										
84445	2001 Saturn Sedan	01/22/2005	67290	3000	6.4	24.1	753.20	33.4	0										
84444	2003 Chevrolet Tracker	01/22/2005	29519	3000	12.7	25.0	752.03	32.6	0										
84449	1994 Buick Regal	01/22/2005	92177	3500	5.6	25.8	755.24	39.0	dyno began to make an unusual noise a	84451	1994 Buick Regal	01/25/2005	92214	3500	5.6	37.6	742.76	61.3	Dupe. Nox span drifted between spa
84453	1995 Nissan Maxima	01/25/2005	181395	3500	6.5	50.1	742.60	47.8	3.0L										
84452	1995 Ford Taurus	01/25/2005	139316	3500	6.5	46.3	742.85	49.6	Station Wagon 3.0L										
84456	1993 Pontiac Grand Prix	01/25/2005	177931	3500	5.0	55.4	740.60	44.1	engine runs very rough										
84455	1995 Ford Mustang	01/25/2005	146289	3500	7.5	54.9	740.70	42.7	RWD. Braking Violations										
84458	1993 Ford Aerostar	01/26/2005	147319	3500	11.1	45.0	749.44	52.6	RWD 3.0L Braking Violations										
84462	1989 Plymouth Voyager	01/26/2005	145307	3500	7.6	42.9	749.87	50.9	3.0L										
84467	1988 Ford Ranger PU	01/27/2005	77528	3500	10.2	37.2	753.33	55.0	RETEST Manual 2.3L Exhaust Terminates in front of the axle. Attatched 6' of Silicone hosing to the pipe to get the exhaust to the back of the vehicle. Unable to keep up with the hard accels. Br a										
84457	1995 Ford Crown Vic	01/26/2005	179731	4000	8.5	42.2	748.24	59.8	RWD 4.6L Braking Violations										
84459	1992 Ford Aerostar	01/26/2005	164560	3500	11.4	45.4	749.77	51.6	RWD 3.0L Braking Violations										
84465	1994 Chevrolet Lumina APV	01/27/2005	124172	4000	8.9	37.9	754.67	56.0	3.8L	84468	4 Chevrolet Lumina A	01/28/2005	124200	4000	8.9	36.6	751.71	46.3	Duplicate
84463	1995 Ford Contour	01/27/2005	104083	3000	5.0	34.7	753.96	62.5	Retest from the summer study										
84464	1994 Dodge Intrepid	01/27/2005	145950	3500	5.1	37.2	754.53	61.2	No Nox data for bag three. Wrote the wrong value on the run sheet										
84469	1989 Dodge Caravan	01/28/2005	162878	3500	7.6	37.6	751.66	43.0	Retest. Major oil leak. Leaked enough to form a puddle 24" across on the concrete under the dyno trailer. L front tire had a broken belt. Rotated back to front to get a good tire on the rolls. Car s										
									No dyne test										
84475	1986 Ford Tempo	01/29/2005	70396	2500	6.9	36.8	749.75	65.2	Retest. Car Stalled @ 500 seconds into Bag 2. Restarted car and continued without incident										
84470	1973 Mercedes 280 SE	01/28/2005	86134	4000	11.4	38.0	751.05	42.9	Retest. BKG HC readings were meaninless because the sample cell was saturated. Instruments pegged and stayed that way for the duration of the run. Ambient HC behaved strangely while tryi										
84472	1977 Chevrolet Monte Carlo	01/28/2005	36999	4000	11.6	40.0	749.43	40.9	RETEST Car runs very rough. Brake fluid was added during bag 1. Poor Braking performance. Checked the Zero on the ambient HC instrument @ 400 seconds into the Soak. Car is tag is incor										
84473	1996 Ford Explorer	01/29/2005	109593	4500	11.8	33.3	749.31	72.6	RWD 4.0L Braking Violations										
84477	1989 Dodge Ram 50	01/29/2005	133981	3500	15.0	39.4	748.86	59.8	Restest. Low power hard to keep up with trace. Brake light on. Braking Violations										
84474	1988 Honda Civic	01/29/2005	207265	2250	6.4	35.9	749.43	67.1	RETEST 5speed manual.										
									No dyne test										
84478	1996 Dodge Neon	01/31/2005	79839	2500	7.2	37.3	751.61	73.9	Run Aborted due to a Realtime compute	84483	1996 Dodge Neon	02/01/2005	79848	2500	7.2	41.1	753.51	58.3	2.0L
84482	1979 Buick Lasabre	01/31/2005	40364	3500	10.5	39.0	751.60	70.1	Retest	84484	1979 Buick Lesabre	02/01/2005	40385	3500	10.5	40.7	753.52	56.8	Retest. Dupe. The EPA people are h
84479	1996 Dodge Caravan	01/31/2005	118369	4000	7.2	35.0	752.01	78.3	3.3L										
84487	1992 Mazda B2200 PU	02/01/2005	101090	3000	10.7	44.1	752.57	46.8	2.2L										
84485	1991 Cadillac Fleetwood	02/01/2005	97124	4000	6.9	38.9	753.71	59.2	4.9L Chain popped on the front on bag	84490	991 Cadillac Fleetwo	02/02/2005	97144	4000	6.9	36.9	752.63	55.0	Duplicate
									No dyne test										
									No dyne test										
84489	1987 Toyota PU	02/02/2005	232098	2750	9.6	34.9	752.70	63.0	Tailpipe is missing and the pipe going into the muffler on the upstream side is loose. Used a variety of boots and silcone tubes to get the exhaust out to the back of the vehicle. Exhaust leaks. 5 S										
84488	1995 Buick Lesabre	02/02/2005	126036	3500	7.1	35.4	752.80	65.4	Did not evacuate the bages this AM before the start of the test. May be a little diluted if the bags leaked overnight.										
84492	1984 Chevy C-10 Silverado	02/02/2005	82259	4000	15.2	41.4	751.72	39.7	5.0L Unknown if mileage stated is in excess of 100K										
84494	1997 Ford Ranger PU	02/03/2005	118470	3500	10.9	42.9	753.76	52.4	2.3L 5speed. Braking Violations. Stalled @ 1000 sec in bag 2.										
84495	1996 GMC Sonoma PU	02/03/2005	51863	3000	9.2	47.9	753.68	49.4	2.2L 5Spd Braking Violations										
84493	2004 Ford Freestar Minivan	02/03/2005	14714	4500	10.0	34.5	753.54	58.9	4.2L No HP data in the database. Ran with best guess.										
84497	1995 Toyota 4 Runner	02/03/2005	85898	4000	12.9	53.8	752.75	43.3	Hard to Shift. Does not go into gears easily. Stalled 550 sec in bag 2.										
									No dyne test										
84498	2001 Toyota Sienna	02/04/2005	59734	4000	10.0	43.7	752.82	55.8	ITYXT03.0FFP										
84499	1995 Acura Integra	02/04/2005	80579	2750	7.2	49.7	752.68	51.9	1.8L										
84500	1998 Nissan Frontier PU	02/04/2005	112521	3500	11.0	55.1	752.38	46.1	RWD Braking Violations										
84502	1996 Chrysler Concorde	02/04/2005	111502	3500	7.7	60.6	751.02	34.2	3.5L Gas light is on.										
84503	2002 Ford Taurus	02/05/2005	26406	4000	8.0	49.2	749.80	45.0	No HP load data in the tables.										
84504	2000 Chrysler Concorde	02/05/2005	65330	3000	11.3	51.3	749.60	43.9	0										

BKI Dyne Test Information, First Dyne Run										BKI Dyne Test Information, Second Dyne Run									
Dyne Run Number	BKI Vehicle Info	Dyne Test Date	BKI Odo	Test Inertia (Lbs)	Test HP (@ 50 MPH)	Ambient Temp (F)	Pbaro (mmHg)	RH (%)	Test Comments	Dyne Run Number	BKI Vehicle Info	Dyne Test Date	BKI Odo	Test Inertia (Lbs)	Test HP (@ 50 MPH)	Ambient Temp (F)	Pbaro (mmHg)	RH (%)	Test Comments
84505	1993 Dodge Intrepid	02/05/2005	210298	3500	6.8	54.3	749.22	40.1	0										
									No dyne test										
84509	1992 Chevrolet Astrovan	02/07/2005	217165	4000	12.5	34.0	749.18	60.4	0										
84510	1994 Chevrolet Suburban	02/07/2005	187410	5500	10.8	34.9	749.35	55.5	4 X 4										
									No dyne test										
84508	1992 Honda Civic	02/07/2005	124705	2250	4.6	34.6	748.52	63.0	0										
84512	1982 Chevrolet Caprice	02/07/2005	88587	4000	4.6	31.0	748.59	57.6	SMOKED UP ROOM/OTHER DOOR OPENED /HC-CO INSTRUMENTS PEGGED/CATALYST REMOVED PREVIOUSLY-HEADER WRAP APPLIED/										
84513	0.00	02/08/2005	VOID	0	0.0	29.3	750.53	50.1	traction control turned off at shifter but car would not get over 5 mph./void run										
84515	1999 Dodge Stratus	02/08/2005	108838	3000	5.5	28.2	750.41	58.1	0										
84514	2002 Chrysler Concorde	02/08/2005	34231	3500	7.8	27.0	750.19	56.1	DIESEL TRUCK STARTED NEXT DOOR										
84518	1994 Buick Skylark	02/08/2005	200811	3000	5.4	28.7	748.58	62.8	0										
84525	CHEVROLET ASTRO, VUI	02/09/2005	0	0	0.0	29.3	750.53	50.1	VOIDED RUN / NOT ABLE TO GET OUT OF PARK/BLANK(84523) COPIED AS 84525 TO FILL DATA BASE										
84519	1992 Dodge Caravan	02/08/2005	213493	3500	8.0	29.6	748.54	61.7	0										
84517	1998 Dodge Caravan	02/08/2005	80989	4000	7.9	27.7	748.85	62.7	0										
84526	1991 Lincoln Towncar	02/09/2005	188033	4000	7.1	35.7	750.42	86.6	0										
84524	1995 Isuzu PU	02/09/2005	87225	3000	12.0	33.8	750.57	94.9	0										
84520	2001 Ford Taurus	02/09/2005	47479	3500	6.8	26.8	751.16	52.3	0										
84521	1997 Honda Accord	02/09/2005	101888	3000	4.9	28.2	751.31	85.1	0										
84522	1996 Chevrolet 1500 PU	02/09/2005	46711	4000	12.2	29.3	751.43	103.1	0										
84528	1994 Mercury Grand Marqui	02/10/2005	130521	4000	10.7	31.4	754.13	24.0	REPEAT FROM SUMMER										
84527	1995 Dodge Ram 1500 PU	02/10/2005	93425	4000	15.0	24.3	753.63	35.3	TAG # WAS USED ON 97 HONDA ACCORD IN SUMMER STUDY										
84531	1992 Geo Tracker	02/10/2005	48704	2750	14.5	40.3	752.84	17.3	34.4 OIL TEMP/										
84529	1993 Plymouth Sundance	02/10/2005	84652	2750	6.3	35.2	753.75	20.7	OIL TEMP 31.7 / ENGINE SKIPPING										
									No dyne test										
84533	1999 Chevrolet Suburban	02/11/2005	88900	5000	12.5	39.8	752.54	1.3	OIL TEMP 41.4										
84534	1993 Subaru Legacy	02/11/2005	114227	3500	9.0	44.1	752.57	5.1	OILT EMP 39.1/ Til pipe became disconnected at 1000 seconds for about 30-40 seconds										
84532	2003 Pontiac Montana	02/11/2005	49337	4500	10.1	34.9	752.64	2.4	OIL TEMP 43.0/										
84538	1998 Ford Ranger PU	02/12/2005	48208	3500	11.7	45.6	745.93	58.5	OIL TEMP 41.4										
84539	1996 Chevrolet Tahoe	02/12/2005	69010	4500	12.5	47.9	745.80	57.4	OIL TEMP 41.9/										
84541	1996 Dodge Caravan	02/12/2005	161280	4000	7.2	49.8	743.88	68.3	OIL TEMP 44.4	84542	1996 Dodge Caravan	02/14/2005	161308	4000	7.2	44.6	743.87	61.3	DUPLICATE / OIL TEMP 44.1
84537	2000 Jeep Cherokee	02/12/2005	88513	3500	12.5	40.9	745.98	63.8	OIL TEMP 40.5/ CHECK ENGINE LIGH	84543	2000 Jeep Cherokee	02/14/2005	88541	3500	12.5	49.5	744.38	52.5	DUPLICATE /CHECK ENGINE LIGHT
84546	1999 Dodge Dakota PU	02/15/2005	64155	3500	9.6	47.0	742.63	63.1	OIL TEMP 49.7 /										
84547	1995 Toyota Corolla	02/15/2005	103068	2750	6.0	48.6	743.43	59.8	OIL TEMP 50.0										
84548	1995 Dodge Intrepid	02/15/2005	138989	3500	5.9	50.5	743.44	53.6	OIL TEMP 50.1										
84550	1988 Lincoln Continental	02/15/2005	31667	4000	8.3	53.3	743.44	42.2	OILTEMP 50.3										
84551	2002 Isuzu Axiom	02/16/2005	46363	4000	13.4	37.9	752.18	56.4	OIL TEMP 42.0										
84552	2002 Oldsmobile Silouette	02/16/2005	61168	4000	9.2	39.5	752.56	51.8	OIL TEMP 42.4										
84554	1992 Ford F50 PU	02/16/2005	134791	4500	14.6	44.3	752.37	38.0	OIL TEMP 39.8 / LEFT REAR WHEEL SMOKED										
84553	2002 Dodge Durango	02/16/2005	VOID	0	0.0	29.3	750.53	50.1	69915:VOID / RUN NUMBER USED BY DRI / VOIDED AWD										
84556	001 Chrysler Town & Count	02/17/2005	75545	4500	8.4	35.8	752.84	54.9	OIL TEMP 39.4										
84557	2000 Buick Park Avenue	02/17/2005	67099	4000	6.6	40.7	752.60	42.4	OIL TEMP 40.0										
84560	1998 Dodge Dakota Sport	02/17/2005	49775	3500	11.2	48.8	750.82	36.1	PNV789>>NO PHASE 3 DATA>>'OIL TEMP 42.2/ AFTER SEMTECH RAN OBVIOUS EXHAUST LEAK AT MANIFOLD /TWO BOLTS MISSING / A NEW BOLT INSTALLED AT (INTAKE-EXHAU										
84558	2001 Chevrolet S-10 PU	02/17/2005	106236	4000	9.8	43.5	752.13	36.3	2OIL TEMP 39.9 / BATTERY DEAD / ENGINE HAD CORRODED + BATTERY TERMINAL DID NOT IDLE VERY WELL , NUMEROUS RESTARTS / DRIVER KEPT GAS PEDAL ON TO STOP										
84561	86 Ford Crown Victoria SW	02/17/2005	54310	3500	9.0	51.6	750.46	32.7	VQJ544, VOIDED RUN DUE TO COOLANT LEAK AND OVER HEATING AT 1000 SECONDS INTO TEST										
84567	1992 Cadillac Sedan De-Vill	02/18/2005	155895	4000	6.9	46.6	752.20	30.4	OIL TEMP 39.1 / MOTOR MISSING ON ONE CYLINDER/										
84562	2004 Dodge Dakota PU	02/18/2005	8627	4000	12.6	33.3	753.71	47.8	OIL TEMP 39.8										
84566	1995 Honda Odyssey	02/18/2005	109044	3500	9.8	44.8	753.08	32.7	OIL TEMP 38.7										
84564	1998 Dodge Caravan	02/18/2005	127230	4000	7.9	40.1	753.63	36.7	OIL TEMP 41.7										
84563	2003 Ford Ranger 4X4 PU	02/18/2005	18757	3500	11.5	38.5	753.67	39.6	2OIL TEMP 41.7										
84572	1994 Mercury Topaz	02/19/2005	41482	2750	7.0	46.6	747.60	65.6	OIL TEMP 44.8										

BKI Dyne Test Information, First Dyne Run										BKI Dyne Test Information, Second Dyne Run									
Dyne Run Number	BKI Vehicle Info	Dyne Test Date	BKI Odo	Test Inertia (Lbs)	Test HP (@ 50 MPH)	Ambient Temp (F)	Pbaro (mmHg)	RH (%)	Test Comments	Dyne Run Number	BKI Vehicle Info	Dyne Test Date	BKI Odo	Test Inertia (Lbs)	Test HP (@ 50 MPH)	Ambient Temp (F)	Pbaro (mmHg)	RH (%)	Test Comments
84568	1999 Ford Ranger PU	02/19/2005	126851	3500	9.0	45.0	749.58	61.8	OIL TEMP 49.1										
84569	1995 Ford Taurus	02/19/2005	203067	3500	5.4	45.1	749.09	62.4	OIL TEMP 44.1										
84570	1994 Chevrolet S10 PU	02/19/2005	63902	3000	9.8	45.4	748.99	64.5	OIL TEMP 44.8										
									No dyne test										
84574	1993 Ford Taurus	02/21/2005	39476	3500	5.5	37.7	747.95	67.3	Oil Temp = 43.0 F										
84573	1993 Buick Park Avenue	02/21/2005	74444	4000	6.1	36.5	747.36	71.8	Oil Temp not taken										
84575	1994 Chevrolet Lumina	02/21/2005	126825	3500	5.4	39.0	748.02	65.5	Oil Temp = 40.7 F										
84577	1998 Ford Aerostar	02/22/2005	0	4000	7.9	42.0	751.46	62.2	Oil Temp= 48.8 F; Coolant Temp = 44.6 F										
84645	1993 Volvo 960	03/12/2005	197094	3500	10.3	56.5	737.31	34.2	2.9L oil temp 50.5F. Minor exhaust leak										
84675	1993 Ford Tempo	03/18/2005	25053	2750	6.1	52.9	740.59	28.9	OIL TEMP 54.4/ SERVICE ENGINE SO	84681	1993 Ford Tempo	03/19/2005	25073	2750	6.1	41.3	747.03	68.7	DUPLICATE / OIL TEMP 50.7 /SERV
84713	1996 Chevrolet Blazer	03/25/2005	94350	4000	10.7	44.1	745.38	74.1	OIL TEMP 51.0 / KEVIN BACK										
84580	002 Chrysler Town & Count	02/23/2005	84580	4500	11.1	45.3	751.07	45.8	Traction control problem @ 180 sec of Ph1..Coolant temp = 50F										
84730	1995 Chevrolet S10 PU	03/29/2005	75640	3500	9.8	66.6	737.58	39.6	4.3L oil temp 63.2										
84582	1988 BMW 528e	02/23/2005	287806	3500	10.7	47.2	750.78	40.4	Oil temp = 46.1 F										
84581	1995 Chevrolet Corsica	02/23/2005	78767	3000	5.9	45.5	750.72	45.8	Oil Temp = 49.1 F										
84638	996 Chrysler Town & Count	03/11/2005	213656	4000	8.5	42.5	746.25	36.3	oil Temp44.6. 3.8L. Service engine light is illuminated.										
									No dyne test										
84585	1993 Ford Escort SW	02/24/2005	99988	2750	6.6	45.5	749.31	48.8	0										
84584	1995 Nissan PU	02/24/2005	86705	3500	12.0	42.5	749.13	53.9	Oil Temp = 46.0 F										
84734	1993 Plymouth Voyager	03/30/2005	166916	4000	7.3	63.0	733.73	42.9	3.0L Oil Temp 63.0. Adjusted BKG HC Vacuum pressure from 7 to 10.										
									No dyne test										
84587	1996 Mercury Villager	02/25/2005	166799	4000	7.9	43.9	748.25	45.7	0										
84588	1978 Buick Regal	02/25/2005	81379	4000	9.9	48.3	748.38	40.6	Oil Temp = 39.0 F										
84589	2001 Saturn	02/25/2005	56662	2750	6.1	52.6	748.40	36.0	0										
84688	1993 Ford Taurus	03/21/2005	92978	3500	9.5	52.1	744.13	38.9	OIL TEMP 54.4										
									No dyne test										
84592	1979 Ford LTD	02/26/2005	65850	4000	10.7	45.5	749.42	46.2	Oil Temp = 45.9,,Absolutely NO brakes!!!!										
84593	1998 Honda Accord	02/26/2005	75067	3000	4.0	49.5	749.32	43.0	45.1										
									No dyne test										
84591	1993 Toyota 4Runner	02/26/2005	178462	4000	12.9	41.4	749.66	51.6	48.1										
84597	1994 Pontiac Sunbird	02/28/2005	145869	2750	5.2	38.4	746.40	40.9	oil temp 36 ambient temp 36.6										
84595	1988 Ford Escort	02/28/2005	133085	2750	6.0	36.7	746.17	43.7	Nox warmed up only 20-25 minutes before start of test. Cyl regulator was turned all the way down. O3 generator was not working.										
84596	1997 Ford Taurus	02/28/2005	97601	3500	6.7	37.4	746.08	41.9	oil temp 41.1										
84718	QBI692	03/26/2005	0	0	0.0	41.1	748.36	65.5	vOID WOULD NOT START	84722	1998 Ford Windstar	03/28/2005	99476	4000	7.9	50.5	742.54	47.4	OIl Temp 50.1 3.3L Service engine an
84599	1998 Toyota Avalon	03/01/2005	29575	3500	5.8	29.1	749.21	43.9	3.0L Origanal mileage										
84600	1993 Ford Explorer	03/01/2005	47980	4000	10.2	32.3	749.84	37.6	4.0L										
84601	1979 Buick Regal	03/01/2005	5864	3500	11.8	35.8	749.85	31.4	3.8L This car used for inreel testing. Oil temp28.9F										
									No dyne test										
84739	1998 Mazda Protoge	03/31/2005	88569	2750	6.8	50.1	746.56	52.1	Check Engine LIght is on										
84603	79 Nissan Datsun 210 Wag	03/02/2005	47114	2500	9.8	39.4	747.78	42.0	Fuel Pump Leaking. Mechanical pump was not available Locally. Bypassed the mecchanical pump with an electric pump for the purposes of testing. Stalled 30 seconds into bag 1.										
84733	1998 Buick Skylark	03/30/2005	65464	3500	5.9	63.4	733.25	42.7	3.1L Oil Temp 66.2 BKG HC failed to reachthe span #.										
									No dyne test										
84605	1977 Nissan 280Z	03/03/2005	94782	3000	9.9	45.9	747.04	44.8	Oil Temp 42.6F										
									No dyne test										
84611	1989 Toyota Camry	03/04/2005	168091	3500	8.4	59.2	745.48	41.0	oil temp 48.6										
84609	1978 Buick Regal	03/04/2005	64571	3500	10.8	48.8	745.94	65.2	Tailpipe and muffler removed in front of the axle because of holes. Used silicone boots to get the exhaust to the back of the car. Stalled several times @ start of test.										
									No dyne test										
84608	1996 Nissan Quest	03/04/2005	125651	4000	10.0	41.3	745.70	67.3	oil Temp 42.9										
84613	1990 Oldsmobile Delta 88	03/05/2005	185694	3500	6.8	44.9	751.80	52.2	runs rough										
84627	1987 Ford F150 PU	03/08/2005	410	4000	10.4	47.0	746.42	34.9	4.9L RWD braking Violations.	84632	1987 Ford F150 PU	03/09/2005	428	4000	13.9	45.0	747.69	30.4	Duplicate. RWD, Braking Violations
84612	2000 Ford Ranger PU	03/05/2005	33680	3500	12.0	42.1	751.22	55.2	used 1999 Load table because 2000 tables seemed unrealistic										
									No dyne test										
84614	1978 Oldsmobile Delta 88	03/05/2005	73729	4000	8.7	47.6	752.11	47.6	Torgue board vibrated out during bag 2 and was re-inserted during the soak, before the start of bag 3										

BKI Dyne Test Information, First Dyne Run										BKI Dyne Test Information, Second Dyne Run									
Dyne Run Number	BKI Vehicle Info	Dyne Test Date	BKI Odo	Test Inertia (Lbs)	Test HP (@ 50 MPH)	Ambient Temp (F)	Pbaro (mmHg)	RH (%)	Test Comments	Dyne Run Number	BKI Vehicle Info	Dyne Test Date	BKI Odo	Test Inertia (Lbs)	Test HP (@ 50 MPH)	Ambient Temp (F)	Pbaro (mmHg)	RH (%)	Test Comments
84617	1997 Chevrolet Suburban	03/07/2005	145147	5500	11.2	53.1	741.51	46.5	5.7L										
84616	1999 Plymouth Voyager	03/07/2005	113389	4000	7.2	52.9	740.73	47.8	oil temp 55.6F										
84618	1992 Plymouth Voyager	03/07/2005	154297	4000	7.5	50.6	742.10	47.7	LA92 cold start linked to the Nreel tests, 47618, 20618 and 21618										
84620	1992 Ford Ranger PU	03/07/2005	19758	3500	11.3	51.8	742.13	42.1	oil temp 49.7. Cracked exhaust manifold. Stalled several times @ start of test.										
84621	1992 Ford Ranger PU	03/07/2005	13586	3500	11.1	52.8	742.04	35.1	3.0L 5 speed										
									No dyne test										
									No dyne test										
84623	1989 Plymouth Acclaim	03/08/2005	164203	3000	6.9	41.1	746.94	39.1	Front tire had a knot and a bent rim. Rotated the tire to the fear of the car.2.2L										
84626	!987 Dodge D100 PU	03/08/2005	23200	3500	13.2	46.2	746.51	35.5	42.4 Oil temp. RWD braking violations										
84622	1999 Toyota Camry	03/08/2005	64134	3500	6.4	37.4	746.91	45.9	oil Temp 40.9										
84628	2002 Chevrolet Trailblazer	03/09/2005	77758	4500	10.0	37.9	748.31	44.0	oil temp. 40.7 The 2002 tables listed this vehicle at 5500 pounds with no hp value. This seemed like a very heavy inertia for a Trailblazer on our dyno.										
84635	1989 Ford Crown Vic	03/10/2005	62847	3500	11.0	56.5	742.90	33.1	5.0L oil temp 49.1 RWD braking Violations										
84630	1989 Honda Accord	03/09/2005	139963	2750	6.0	40.4	749.17	36.1	2.0L oil temp 39.5										
84629	1996 Acura TL2.5	03/09/2005	117642	3500	8.1	38.9	748.78	38.6	oil temp 42F 2.5L										
									No dyne test										
84755	2002 Honda Odyssey	04/05/2005	60753	4500	12.7	69.1	740.09	54.7	OIL TEMP=67.1										
84761	2004 Kia Sedona	04/06/2005	16609	5000	10.7	62.9	742.53	62.5	OIL TEMP= 64.9 Realtime filter heater off										
84764	202GMB	04/06/2005	0	0	0.0	29.3	750.53	50.1	Previously tested on 2/23/05.										
84763	2003 Honda Odyssey	04/06/2005	44752	4500	12.4	65.4	742.93	56.1	Oil Temp = 64.4										
84757	2001 Jeep Grand Cherokee	04/05/2005	90011	4000	11.7	68.2	740.38	50.0	OIL TEMP=67.4										
84754	003 Chrysler Town & Counti	04/05/2005	20787	4500	8.9	67.0	739.87	58.3	OIL TEMP=66.1										
84749	2001 Toyota Sienna	04/04/2005	80227	4000	9.4	68.0	742.13	37.3	Oil Temp = 63 F										
84748	2002 Dodge Caravan	04/04/2005	60790	4500	9.3	66.1	742.14	36.9	Oil Temp = 63F										
84747	2003 Dodge Caravan	04/04/2005	0	0	0.0	63.6	742.20	36.9	QIO211, Wrong driving trace used.										
84654	990 Oldsmobile Cutlass Cier	03/15/2005	97522	3000	5.4	45.6	750.83	28.7	OIL TEMP 47.1/REAL TIME COMPUTER HAD INTERNAL ERROR AT 10 MINUTE SOAK, 684wfs										
84634	1988 Plymouth Voyager	03/10/2005	162874	4000	7.8	51.9	743.07	43.8	3.0L oil temp 44.2										
84633	1987 Volvo 740 Turbo	03/10/2005	248178	3000	9.9	47.8	742.83	46.9	oil temp 44.6. 2.3L										
84637	30 Oldsmobile Cutlass Supre	03/10/2005	79420	3500	10.5	59.7	742.03	23.7	RWD Braking Violations.										
84639	1995 Cheverolet Cavalier	03/11/2005	140500	2750	4.8	45.6	746.05	33.5	oil temp 44.7 2.2L 5spd.										
84642	1989 Dodge Spirit	03/11/2005	139488	3000	8.4	55.0	743.18	29.7	2.5L oil temp = ambient										
84643	1987 Ford Escort	03/11/2005	12845	2500	7.4	58.5	741.78	24.2	1.9L.										
84640	1994 Ford Explorer	03/11/2005	98974	4000	10.6	48.7	745.64	32.4	oil temp 44.8. 4.0L										
84644	2001 Nissan Pathfinder	03/12/2005	66284	4000	15.3	49.7	737.03	42.3	oil Temp 49.5										
84648	1987 Dodge Dakota PU	03/12/2005	112838	3500	10.6	65.7	737.65	24.2	3.9L oil temp is ambient. Stalled several times @ start up.										
84646	1988 Honda Accord	03/12/2005	209194	2750	6.4	60.7	737.26	31.4	2.0L 53.7F oil temp. BKG HC instrument is drifting.										
84649	1995 GMC Sonoma PU	03/14/2005	56578	3500	9.8	40.2	750.38	43.9	OIL TEMP 41.1										
									No dyne test										
84650	1990 Chevrolet Lumina APV	03/14/2005	136313	3500	8.1	42.5	750.33	38.7	OIL TEMP 41.4										
84653	1977 Chevrolet C-20 PU	03/14/2005	37697	4000	13.9	50.2	749.00	27.1	OIL TEMP 41.9/ADDED 1 QUART OIL/ DEAD BATTERY JUMP STARTED										
84655	990 Buick Electra Park Aveni	03/15/2005	169860	3500	6.3	49.4	750.83	26.0	OIL TEMP 47.4										
84659	1988 Chrysler Le Baron	03/15/2005	117003	3000	8.3	55.5	749.31	23.7	OIL TEMP 51.3/IDLES HIGH										
84662	1990 Cadillac Eldorado	03/16/2005	185384	3500	6.2	47.8	749.61	48.7	OIL TEMP 47.4/SERVICE ENGINE SOON LIGHT/EXHAUST LEAK-SMELL ONLY										
84656	1990 Chevrolet Lumina APV	03/15/2005	123632	3500	8.1	52.0	750.75	25.2	OIL TEMP 47.8										
84658	1989 Chevrolet Astrovan	03/15/2005	215908	3500	12.0	54.8	749.67	24.0	OIL TEMP 49.0/IDLES HIGH/ WILL NOT STOP /EXHAUST SMELL-LEAKS										
84660	1988 Dodge Caravan	03/15/2005	61439	3500	8.0	55.6	749.00	23.6	OIL TEMP 50.2										
84667	1982 Ford F250 PU	03/16/2005	85513	3500	11.9	57.8	746.60	22.8	OIL TEMP 50.0/ ENGINE STALLS AT IDLE/ RESTARTED NUMEROUS TIMES/SMELLED EXHAUST IN BUILDING										
84661	1990 Buick Century	03/16/2005	148959	3000	6.8	44.3	749.69	50.7	OIL TEMP 47.1										
84666	1988 Ford F150 PU	03/16/2005	14075	4000	14.6	56.4	747.24	28.3	OIL TEMP 49.7										
84665	1989 Toyota 4X4 PU	03/16/2005	262316	3500	10.9	54.9	747.72	34.2	OIL TEMP 49.4										
84663	1989 Chevrolet Corsica	03/16/2005	98999	3000	5.3	51.4	749.05	42.8	OIL TEMP 46.4/EXHAUST PIPE OIL COVERED-SMOKED BUILDING FOR FIRST 600 SECONDS										
84670	1989 Mercury Topaz	03/17/2005	6137	2750	6.6	55.9	744.46	27.3	OIL TEMP=51.8 DEAD BATTERY ODOMETER DEAD										

BKI Dyne Test Information, First Dyne Run										BKI Dyne Test Information, Second Dyne Run									
Dyne Run Number	BKI Vehicle Info	Dyne Test Date	BKI Odo	Test Inertia (Lbs)	Test HP (@ 50 MPH)	Ambient Temp (F)	Pbaro (mmHg)	RH (%)	Test Comments	Dyne Run Number	BKI Vehicle Info	Dyne Test Date	BKI Odo	Test Inertia (Lbs)	Test HP (@ 50 MPH)	Ambient Temp (F)	Pbaro (mmHg)	RH (%)	Test Comments
84672	1983 Toyota Tercel	03/17/2005	87900	2250	6.7	58.3	743.46	24.1	OLIL TEMP=51.9 EXHAUST LEAKS										
84669	1990 Dodge Spirit	03/17/2005	109931	3000	8.7	53.0	745.06	30.7	OIL TEMP=49.0 ANOTHER VEHICLE STARTED IN BUILDING										
84735	1988 Honda Accord	03/30/2005	209393	2750	6.4	63.1	734.47	47.4	2.0L Oil Temp Ambient										
84674	1979 Pontiac Firebird	03/17/2005	45370	4000	10.8	60.7	742.27	20.1	OIL TEMP=51.8										
84668	1991 Oldsmobile Delta 88	03/17/2005	139412	3500	7.0	48.9	745.21	37.3	OIL TEMP=48.9										
84673	1983 GMC Vandura	03/17/2005	52728	4500	16.2	60.5	742.25	21.4	OIL TEMP=52.0 WILL NOT EXCEED 50 MPH										
84676	1990 Ford Bronco	03/18/2005	25202	4500	13.3	54.8	740.59	25.6	OIL TEMP 54.8/ POOR BRAKING!!!!										
84679	1983 Toyota PU	03/18/2005	97635	3000	9.9	60.5	739.42	25.4	OIL TEMP=56.6 4 SPEED MAUNAL										
									No dyne test										
84677	1988 Buick Park Avenue	03/18/2005	146833	3500	6.3	57.9	740.38	24.1	OIL TEMP=56.4										
84680	1973 Chevrolet PU	03/18/2005	57484	4000	12.6	62.1	739.03	24.2	OIL TEMP=58.9 EXHAUST LEAKS NEW MUFFLER										
									No dyne test										
84687	1976 Chevrolet El Camino	03/19/2005	61809	4000	12.1	49.9	747.29	3.2	OIL TEMP 44.3 / RH BATTERY DEAD										
84686	1986 Ford F150 PU	03/19/2005	94737	3500	12.5	49.3	747.12	14.1	OIL TEMP 44.6 / EXHAUST LEAKS / POOR BRAKING										
84683	1990 Ford Ranger PU	03/19/2005	72976	3500	11.1	45.5	747.52	39.4	OIL TEMP 46.9 / MUFFLER ERMOVED / EXHAUST LEAK AT TRANSFER TUBE PORT ON TUNNEL "BRAIDED LINE"										
84685	1988 Ford F150 PU	03/19/2005	62947	4000	13.5	46.9	747.88	22.6	OIL TEMP 46.9										
84682	1990 Toyota Camry	03/19/2005	138235	3500	9.0	43.1	747.45	33.1	OIL TEMP 47.9										
84690	989 Oldsmobile Cutlass Cier	03/21/2005	220970	3000	5.4	55.2	744.56	38.3	NOT ABLE TO OPEN HOOD /NO OIL T	84695	Oldsmobile Cutlass	03/22/2005	220989	3000	5.4	42.4	742.73	67.6	OIL TEMP=52.0 DUPLICATE
84694	1983 Chevrolet C10 PU	03/21/2005	98799	3500	14.0	52.1	742.69	51.9	OIL TEMP 54.3 / COOLANT LIGHT CAME ON AT 1200 SECONDS										
84693	1988 Ford F150 PU	03/21/2005	97172	4000	14.6	54.7	743.13	43.3	OIL TEMP 54.3/EXHAUST LEAKS/ENGINE SKIPS INTERMITTENTLY,STARTED @1300 SECONDS										
84692	1988 Buick Century	03/21/2005	94555	3000	6.4	55.8	743.01	35.3	NOT ABLE TO OPEN HOOD/ EXHAUST SMELL										
84689	1992 GMC Jimmy	03/21/2005	90871	3500	9.5	54.2	744.37	38.2	OIL TEMP 54.4 / EXHAUST LEAKS UNDER VEHICLE										
84699	1985 Chevrolet Caprice	03/22/2005	58223	3500	8.7	42.6	742.84	71.1	OIL TEMP=44.4/NO BAG DATA/HAD TO BE RESTARTED MANY TIMES/VIN# DOESN'T MATCH/POOR BRAKING										
84700	1978 Ford PU	03/22/2005	73447	4000	11.7	40.8	742.76	72.9	OIL TEMP=41.5/PIPE CUTOFF AND STILL LEAKS/ DEAD BATTERY/ JUMP STARTED										
84696	1987 Toyota PU	03/22/2005	169293	2750	9.6	42.2	742.84	67.7	OIL TEMP= 46.2 EXHAUST LEAKS/ DEAD BATTERY/ JUMP STARTED										
84777	1987 Oldsmobile Cutlass	04/08/2005	87020	3500	9.6	63.8	745.59	29.3	Exhaust Leaks										
84706	776 Chevrolet Nova/ 144MG	03/23/2005	86094	3500	9.6	48.6	745.29	52.7	VOID RUN/ CAR OVERHEATED AT 40	84712	1979 Chevrolet Nova	03/24/2005	86117	3500	9.6	48.8	742.79	61.3	OIL TEMP 49.0/ EXHAUST LEAKS / S
84707	1973 Chevrolet Impala	03/23/2005	94178	4000	11.4	48.6	745.22	52.8	OIL TEMP=48.6 REPEATED STARTS/WON'T RUN COLD										
84701	1990 Ford F150 PU	03/23/2005	38803	4000	13.5	40.2	745.58	66.9	OIL TEMP=49.4 POOR BRAKING										
84705	1980 Chevrolet Malibu	03/23/2005	31253	3500	9.5	48.1	745.03	54.2	OIL TEMP=46.8 IDLES HIGH										
84702	1989 Chevrolet G20 Van	03/23/2005	27435	4000	16.2	41.2	746.52	64.8	OIL TEMP=46.4										
84703	1987 Chevrolet Blazer	03/23/2005	153398	3500	9.8	43.7	746.69	60.9	OIL TEMP=49.4 POOR BRAKING/EXHAUST LEAKS										
84708	2003 Dodge Caravan	03/24/2005	10200	4000	7.2	46.0	745.06	60.0	VEHICLE LICENSED AS 94 MERCURY VILLAGER PREVIOUSLY/OIL TEMP 50.4/TRACTION CONTROL TURNED OFF/KEVIN SICK-CARD AND ANDREW RUNNING SEMTECH										
84709	1989 Ford Ranger PU	03/24/2005	28864	3000	11.1	47.0	744.44	60.4	OIL TEMP 48.6										
84710	1984 Chevrolet Monte Carlo	03/24/2005	68810	3500	10.6	48.2	743.97	59.3	OIL TEMP 48.4 / AT BAG I STRONG EXHAUST SMELL / HIGH HC &CO BACKGROUNDS										
84714	1994 Saturn SW	03/25/2005	132333	2500	6.1	43.2	746.36	71.4	OILT EMP 49.4										
84717	1979 Ford Mustang	03/25/2005	45551	3000	9.7	42.8	746.15	71.0	OIL TEMP 46.4 / COMPUTER ERRORED DURING BAGI-SOLENOIDS STILL WORKED, BAG DATA ONLY, 109ajw										
									No dyne test										
84715	1988 Mazda B2200 PU	03/25/2005	220307	3000	10.6	43.2	746.83	72.6	OIL TEMP 45.9 / MASSIVE EXHAUST LEAK AT CATALYST, ANDREW KNEW /CHECK ENGINE LIGHT ON										
84743	1999 Mazda Protoge	04/01/2005	122968	2750	6.9	52.4	749.92	42.3	1.6L 5Spd Oil Temp 56										
84720	1989 Chevrolet 1500 PU	03/26/2005	140678	4000	12.8	43.6	749.84	59.9	OIL TEMP 46.6 / POOR REAR BRAKING										
84719	0 Oldsmobile Cutlass Supre	03/26/2005	85449	3500	4.5	42.7	749.79	62.0	OIL TEMP 46.7										
84732	1979 Jeep CJ76	03/29/2005	8518	3000	10.6	70.6	736.57	37.1	RWD 4.2L oil temp Ambient . Manual trans										
84723	1991 Chevrolet Cavalier	03/28/2005	182349	2750	5.8	54.7	742.79	43.2	2.2L Oil temp not available. The dipstick could not be removed easily.										
84724	990 Oldsmobile Cutlass Cie	03/28/2005	171475	3000	5.4	58.8	742.41	35.3	3.3L Oil Temp 53.9										
84727	1982 Ford Grenada	03/28/2005	64654	3500	10.6	66.5	740.90	26.5	3.3L Oil temp 60.8 RWD poor braking performance										
84726	1990 Ford Aerostar	03/28/2005	19648	3500	10.3	64.4	741.52	29.1	3.0L Oil Temp 58.5. RWD poor braking performance										
									No dyne test										
84729	2001 Toyota Camry	03/29/2005	46869	3500	6.7	64.6	737.61	41.5	2.2L Oil Temp 62.2 eng code 1TYXV02.2JJA										
84728	2002 Ford Escape 2wd	03/29/2005	36209	3500	7.5	62.5	737.41	43.4	3.0L oil temp 60.9. Load tables did not list a 2wd Escape. Used best guess for load and inertia settings. eng code 2FMXT03.01F7										
84738	1976 Pontiac Gran Prix	03/30/2005	60909	4500	10.7	58.2	736.55	50.7	5.7L Oil Temp 58.9 same as ambient RWD poor braking										
84737	1984 Chevrolet Celebrity	03/30/2005	64091	3000	6.7	59.5	735.84	49.5	2.5L Oil Temp 60.7 Engine temp light came on 1125 sec. in bag two. Moved the fan up and placed a squirrel cage fan on the bumper to direct more air through the radiator. Light went off. Electr										
84740	1990 Buick Lesabre	03/31/2005	107876	3500	6.8	51.6	747.48	48.7	3.8L Oil Temp 52										
84745	1990 Honda Civic	04/02/2005	133966	2250	4.6	50.2	750.04	38.5	1.5L Oil Temp 49										
									No dyne test										

BKI Dyne Test Information, First Dyne Run

Dyne Run Number	BKI Vehicle Info	Dyne Test Date	BKI Odo	Test Inertia (Lbs)	Test HP (@ 50 MPH)	Ambient Temp (F)	Pbaro (mmHg)	RH (%)	Test Comments
84752	1978 Ford F100 PU	04/04/2005	58917	3500	12.2	74.1	740.46	33.5	0
84751	1998 Ford Escort	04/04/2005	55309	2750	6.0	72.3	741.07	35.9	Oil Temp = 67 F
84765	1985 Chevrolet Impala	04/06/2005	75914	4000	11.1	66.2	742.96	53.9	OIL TEMP=64.2 Exhaust manifold repaired before testing Poor braking Exhaust leaks Service engine soon light on
84758	1979 Chevrolet C10 Beauvill	04/05/2005	84025	4000	14.6	68.9	740.45	49.1	OIL TEMP= could not get
84760	2004 Ford Escape	04/06/2005	10519	3500	10.4	61.8	742.50	68.6	OIL TEMP= 65.7 Realtime filter heater off
84759	2005 Ford Focus	04/06/2005	6701	3000	11.7	60.2	742.14	73.3	OIL TEMP=65.4 Realtime filter heater off
84753	2003 Dodge Caravan	04/05/2005	47649	4500	7.9	66.0	739.62	59.6	OIL TEMP=66.1
84772	1992 Dodge Caravan	04/07/2005	143971	4000	7.0	56.7	747.26	64.1	Fluids (coolant and trans fluid) topped off.
84768	1995 Ford F150 PU	04/07/2005	147342	4500	11.6	56.2	747.25	63.7	Oil Temp = 57.4
84771	1994 Chevrolet Astrovan	04/07/2005	133318	4000	12.3	56.4	747.71	64.5	0
84766	2000 Dodge Caravan	04/07/2005	93162	4000	10.0	56.8	746.02	64.8	0
84775	1997 Chevrolet Suburban	04/08/2005	137630	5000	10.8	60.0	746.61	40.1	0
84773	1998 Toyota 4Runner	04/08/2005	115768	4000	11.7	50.0	746.91	72.9	Oil Temp = 55.2
84767	1998 Nissan Frontier PU	04/07/2005	107615	3500	11.0	56.5	746.97	64.2	Oil Temp = 58.3
84770	1995 Ford F250 PU	04/07/2005	52586	4500	11.6	56.9	747.56	63.4	No Brakes, Oil Temp = 56.8
84774	1995 Dodge Caravan	04/08/2005	136837	4000	7.6	55.6	747.01	60.3	0
									No dyne test
									No dyne test
									No dyne test
									No dyne test
									No dyne test
									No dyne test
84081	1988 Ford Taurus	07/26/2004	13139	3500	4.0	76.4	748.47	40.6	Control Vehicle
84114	1988 Ford Taurus	8/02/2004	13158	3500	4.0	93.5	743.15	45.0	Control Vehicle
84143	1988 Ford Taurus	08/07/2004	13170	3500	4.0	81.5	745.40	38.2	Control Vehicle
84177	1988 Ford Taurus	08/14/2004	13189	3500	4.0	74.1	749.96	35.0	Control Vehicle
84187	1988 Ford Taurus	08/18/2004	13208	3500	4.0	77.4	743.43	54.2	Control vehicle. vorque Zero drifting. Video failure @950 sec into bag 2. Vviolation while repairing cable.
84218	1988 Ford Taurus	08/25/2004	13239	3500	4.0	81.0	741.43	60.8	Control vehicle
84259	1988 Ford Taurus	09/08/2004	13250	3500	4.0	72.0	749.29	47.9	Control Vehicle
84290	!988 Ford Taurus	09/14/2004	13266	3500	4.0	87.7	741.85	39.0	Control Vehicle. Ran a second flow meter behind our normal flow meter. Two of the Semtech devices were sampling from the exhaust before it went into the transfer tube.
84348	1988 Ford Taurus	09/24/2004	13303	3500	4.0	79.6	748.58	26.8	Control Vehicle
84360	1988 Ford Taurus	09/27/2004	13323	3500	4.0	77.6	747.21	51.5	Control Vehicle
84374	1988 Ford Taurus	09/29/2004	13352	3500	4.0	73.7	746.84	17.5	Control Vehicle
84387	1988 Ford Taurus	10/01/2004	13370	3500	4.0	72.0	743.77	14.1	Control Vehicle
84450	1988 Ford Taurus	01/22/2005	13729	3500	4.0	24.9	756.08	41.1	Control vehicle. Dyno noise continues @ a certian roll speed.
84461	1988 Ford Taurus	01/26/2005	13748	3500	4.0	43.9	749.90	50.6	Control Vehicle
84480	1988 Ford Taurus	01/31/2005	13768	3500	4.0	40.2	752.20	69.6	Corellation Vehicle. The fan that exhausts the building and the tunnel gases was not on this morning. This probably accounts for the higher backgrounds in bag 2.
84507	1988 Ford Taurus	02/05/2005	13788	3500	4.0	58.9	747.32	27.1	Correlation Vehicle
84536	1988 Ford Taurus	02/11/2005	13809	3500	4.0	51.7	750.85	1.2	OIL TEMP 41.9 / CO-RELATION VEHICLE/ BAGS LEFT ON EVACUATE FOR BAG I & II
84544	1988 Ford Taurus	02/14/2005	13828	3500	4.0	54.0	744.13	49.7	Correlation VEHICLE/OIL TEMP 44.2 / GAS SMELL FROM VEHICLE
84578	1988 Ford Taurus	02/22/2005	13871	3500	4.0	43.8	752.08	55.9	No oil temp.
84606	1988 Ford Taurus	03/03/2005	13936	3500	4.0	51.9	746.87	40.9	Correlation Vehicle
84624	1988 Ford Taurus	03/08/2005	14013	3500	4.0	44.6	747.22	35.0	Correlation vehicle. 'Oil temp 42.4. The CO2 value for bag 3 was curiously not recorded. Don't know why. Simple omission.
84651	1988 Ford Taurus	03/14/2005	14033	3500	4.0	46.1	750.16	34.2	CORRELATION VEHICLE/OIL TEMP 41.0
84697	1988 Ford Taurus	03/22/2005	14052	3500	4.0	42.6	742.97	69.4	OIL TEMP=49.6
84741	1988 Ford Taurus	03/31/2005	14072	3500	4.0	53.9	748.14	43.0	Correlation Vehicle

BKI Dyne Test Information, Second Dyne Run

Dyne Run Number	BKI Vehicle Info	Dyne Test Date	BKI Odo	Test Inertia (Lbs)	Test HP (@ 50 MPH)	Ambient Temp (F)	Pbaro (mmHg)	RH (%)	Test Comments

Page 5 (Installation for Precoditioning Drive)																
		SEMTECH System Information (ERG)										OBDII	Cylinder Numbers			
Date	PEM Serial #	FID Pres (psig)	Battery Voltage (V)	Ambient Temp (C)	RH (%)	FID Oven Temp(C)	Chiller Temp (C)	Amb. P	P1 (mbar)	P2 (mbar)	P3 (mbar)	OBDII protocol	Zero Gas #	Audit Gas #	Span Gas #	Comments
7/13/2004		760	10.7	99.3 F	44	191	5	997	865	940	940		ALM035327	ALM066169	ALM060855	
g value																
7/13/2004	H03-SG04	667	11.8	96.6	45	193	5	976	904	938	931		ALM035327	ALM066169	ALM060855	
7/13/2004	C03-SG01	316	13.1	82.9	69	195	5	989	900	935	933	SAE-J1850 VPW	ALM035327	ALM066169	ALMO60885	Span gas # correct?
7/13/2004		781	11.9	98.4	41	196	4	986	853	934	939		ALM035327	ALM066169	ALM060855	
7/14/2004		307	12	79.5	61		4	991	914	949	937		ALM035327	ALM066169	ALM060855	
7/14/2004		1773	11.8	84.4	50	195	3	988	860	950	879		ALM035327	ALM066169	ALM060855	
7/14/2004	H03-SG02	1845	12.8	82.2	51	193	4	980	910	936	923	ISO-9141-2	ALM035327	ALM066169	ALM060855	
7/15/2004	H03-SG02	1687	12.8	27.3	58	193	5	979	876	935	932	Will not communicate	ALM035327	ALM066169	ALM060855	
7/15/2004	H03-SG06	1804	13.4	27.3	60	193	5	985	859	940	935	SAE-J1850 PWM	ALM035327	ALM066169	ALM060855	
7/16/2004	H03-SG02	601	12.4	24.9	78	193	4	975	905	932	928	ISO-9141-2	ALM035327	ALM066169	ALM060855	
7/16/2004	H03-SG01	1661	12.7	31.4	60	195	4	974	902	936	932	Will not communicate	ALM035327	ALM066169		
7/17/2004	H03-SG02	1750	12.2	26	62	193	4	989	897	933	927	SAE-J1850 PWM	ALM035327	ALM066169	ALM060855	
7/17/2004	H03-SG02	315	12.8	25.4	64	193	5	980	910	935	933	Will not communicate	ALM035327	ALM066169	ALM060855	
7/19/2004	H03-SG02	510	11.1	33	48	193	5		875	930	917	SAE-J1850 VPW	ALM035327	ALM066169	ALM060855	
7/19/2004	H03-SG02	1804	12.7	25	62	192	5		874	935	931	ISO-9141-2	ALM035327	ALM066169	ALM060855	
7/19/2004	C03-SG01	1682	11.7	32	53	196	5		856	935	934		ALM035327	ALM066169		
7/19/2004	H03-SG02	849	11.5	31	53	192	6		874	930	923		ALM035327	ALM066169	ALM060855	
7/19/2004	H03-SG06	1861	13	32	52	194	4	980	856	938	93	ISO-9141-2	ALM035327	ALM066169	ALM060855	FID Pres - bottle rplcd
7/20/2004	H03-SG01	1418	12.2	36.5	45	195	6		861	939	935	Will not communicate	ALM035327	ALM066169	ALM060855	
7/19/2004	C03-SG01	724	13.2	28	75	197	4		899	927	931	SAE-J1850 VPW	ALM035327	ALM066169	ALM060855	OBDII protocol - try VPW
7/20/2004	C03-SG01	1765	11.9	34.6	43	196	5		846	929	930	SAE-J1850 VPW	ALM035327	ALM066169	ALM060855	OBDII protocol - try VPW
7/20/2004	H03-SG06	1600	13.5	27	75	103	1		894	941	932	SAE-J1850 VPW	ALM035327	ALM066169	ALM060855	OBDII protocol - try VPW
7/20/2004	H03-SG02	1943	12.7	36.5	47	193	0		867	929	925	ISO-9141-2				Vehicle would disconnec
7/23/2004	C03-SG01	1865	13.1	27.1	61	196	4		856	931	937	Will not communicate	ALM035327	ALM066169	ALM060855	
7/21/2004	H03-SG06	1057	13.4	31.6	55	194	5		854	941	930	SAE-J1850 VPW	ALM035327	ALM066169	ALM060855	OBDII protocol - try VPW
7/21/2004	H03-SG06	592	13.2	34.4	52	194	6		856	919	931	Will not communicate	ALM035327	ALM066169	ALM060855	
7/21/2004	H03-SG02	503	11.3	32.9	56	193	5		882	939	940	Will not communicate	ALM035327	ALM066169	ALM060855	
7/21/2004	H03-SG02	909	11.7	32	58	193	6		874	929	927	Will not communicate	ALM035327	ALM066169	ALM060855	
7/22/2004	C03-SG01	1691	12	29.8	65	196	5		855	936	936	Will not communicate				
7/24/2004																Untestable
7/22/2004	H03-SG01	857	12.1	32.3	53	195	7		864	943	940	ISO-9141-2	ALM035327	ALM066169	ALM060855	
7/22/2004	H03-SG01	1805	13.5	29.6	69	195	6		860	938	935	ISO-9141-2	ALM035327	ALM066169	ALM060855	OBDII protocol - change
7/23/2004	C03-SG01	494	12	26.9	67	196	4		863	941	942					
7/23/2004	H03-SG02	1608	11.5	27	69	193	5		883	942	941	SAE-J1850 VPW	ALM035327	ALM066169		
7/23/2004	H03-SG02	786	11.5	27.1	64	193	5		882	937	921	Will not communicate	ALM035327	ALM066169		
7/26/2004	H03-SG01	1749	12.1	24.4	52	195	5		851	932	935	Will not communicate	ALM035327	ALM066169	ALM060855	
7/24/2004		1800	11.4	18.4	75	192	5		890	962	922	ISO-9141-2	ALM035327	ALM066169	ALM060855	
7/24/2004	H03-SG02	216	11.6	18.9	75	192	4		888	949	946	Will not communicate	ALM035327	ALM066169	ALM060855	
7/24/2004	H03-SG01	401	12.6	29.7	75	195	3		872	949	873	Will not communicate	ALM035327	ALM066169	ALM060855	
7/26/2004	H03-SG02	974	11.6	27	40	192	5		885	946	947	ISO-9141-2	ALM035327	ALM066169	ALM060855	
7/26/2004	H03-SG02	603	11.2	28.1	40	192	5		886	939	891	SAE-J1850 PWM	ALM035327	ALM066169	ALM060855	
7/26/2004	H03-SG01	1302	11.7	26.1	45	195	4		877	950	905	SAE-J1850 VPW	ALM035327	ALM066169	ALM060855	
7/27/2004	H03-SG01	310	13.2	27.9	41	195	3		864	940	1017	ISO-9141-2	ALM035327	ALM035327	ALM060855	
7/27/2004	H03-SG02	1355	11	25.3	46	192	5		886	942	907	ISO-9141-2	ALM035327	ALM066169	ALM060855	
7/27/2004	H03-SG02	374	12.3	27.9	41	193	5		875	903	896					
7/27/2004	H03-SG01	525	12.9	27.9	41	195	4		866	942	997	SAE-J1850 PWM	ALM035327	ALM066169	ALM060855	
7/27/2004	H03-SG02	215	11.6	23.8	57	192	6		884	940	939	ISO-9141-2	ALM035327	ALM066169	ALM060855	
7/27/2004	H03-SG02	320	12.5	27.8	41	195	3		940	921	987	Will not communicate	ALM035327	ALM066169	ALM060855	

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		SEMTECH System Information (ERG)										OBDII	Cylinder Numbers			
Date	PEM Serial #	FID Pres (psig)	Battery Voltage (V)	Ambient Temp (C)	RH (%)	FID Oven Temp(C)	Chiller Temp (C)	Amb. P	P1 (mbar)	P2 (mbar)	P3 (mbar)	OBDII protocol	Zero Gas #	Audit Gas #	Span Gas #	Comments
7/28/2004	H03-SG02	399	12.5	27.1	55	193	5		873	933	883	SAE-J1850 VPW	ALM042257	ALM066169	ALM060855	
7/28/2004	H03-SG02	1068	12.6	26.8	51	193	5		874	926	889	Will not communicate	ALM035327	ALM066169	ALM060855	
7/28/2004	H03-SG02	1848	13.2	24.4	56	195	5		880	937	928	SAE-J1850 VPW	ALM035327	ALM066169	ALM060855	
7/28/2004	H03-SG02	1390	12.6	25.9	51	193	5		875	930	872	ISO-9141-2	ALM035327	ALM066169	ALM060855	
7/28/2004	H03-SG02	524	12.1	27	54	193	5		887	921	931	ISO-9141-2	ALM042257	ALM066169	ALM060855	
7/29/2004	H03-SG01	1526	13.3	25.6	68	196	2		832	925	919	SAE-J1850 PWM	ALM042257	ALM066169	ALM060855	
7/29/2004	H03-SG02	1393	12.6	25.9	56	193	5	979	1026	929	904	SAE-J1850 PWM	ALM042257	ALM066169	ALM060855	
7/29/2004	H03-SG03	691	12.1	25.9	65	193	6	25.8	891	521	932	Will not communicate	ALM042257	ALM066169	ALM060855	
8/2/2004	H03-SG01	1919	12.5	34.6	55	196	3	975	901	939	934	Will not communicate	ALM042257	ALM066169		
7/29/2004	H03-SG02	1697	11.6	23.9	61	193	6	978	1021	868	870	ISO-9141-2	ALM042257	ALM066169	ALM060855	
7/30/2004	H03-SG02	1502	12.5			193	5		870	928	900	Will not communicate	ALM042257	ALM066169	ALM060855	
8/2/2004	H03-SG01	1671	12.5	35.4	54	196	3	974	856	929	901	Will not communicate	ALM042257	ALM066169	ALM060855	
8/2/2004	H03-SG02	355	12.3	32.9	57	193	5	983	916	923	929	Will not communicate	ALM042257	ALM066169		
7/30/2004	H03-SG02	845	12.9	28.1	53	196	8		858	933	1010	SAE-J1850 VPW	ALM042257	ALM066169	ALM060855	
7/30/2004	H03-SG02	1745	12.5	26.6	56	193	5		890	910	931	ISO-9141-2	ALM042257	ALM066169	ALM060855	
7/29/2004	H03-SG02	730	12.8	25.4	59	193	7		879	904	881	ISO-9141-2	ALM042257	ALM066169	ALM060855	
7/31/2004	H03-SG02	1758	12.1	28.1	64	193	5		876	934	932	Will not communicate	ALM042257	ALM066169	ALM060855	
7/31/2004	H03-SG02	472	11.9	28	63.7	192	5		878	934	932	Will not communicate	ALM042257	ALM066169	ALM060855	
7/31/2004	H03-SG02	1293	12.7	31.3	43	193	5		871	930	1014	SAE-J1850 VPW	ALM042257	ALM066169	ALM060855	
7/31/2004	H03-SG01	638	12	28	63	195	3		867	946	942	Will not communicate	ALM042257	ALM066169	ALM060855	
8/2/2004	H03-SG02	1693	11.7	34.8	54	193	5	975	870	926	925	SAE-J1850 PWM	ALM042257	ALM066169	ALM060855	
8/2/2004	SG02	9.8	12.9	28	74	193	5	976	926	870	922	SAE-J1850 VPW	ALM042257	ALM066169	ALM060855	
7/30/2004	H03-SG02	1206	11.2	27.6	55	192	5		876	928	890	ISO-9141-2	ALM042257	ALM066169	ALM060855	
7/30/2004	H03-SG01	1169	12.9	26.7	51	195	8		859	934	929	Will not communicate				
7/29/2004	H03-SG05	885	12.6	23.9	61	193	7		882	931	932	ISO-9141-2	ALM042257	ALM066169	ALM060855	
8/3/2004	H03-SG03	314	13.1	36.5	52	194	6		862	908	845		ALM042257	ALM066169		
8/3/2004		1065	12.5	32.4	55	196	3	974	901	945	950	Will not communicate				
8/3/2004	C03-SG01	1660	12.9	35.8	52	196	6		846	924	926	ISO-9141-2	ALM042257	ALM066169	ALM060855	
8/11/2004	H03-SG02	269	12.4	23.1	42	193	5	982	878	935	896	Will not communicate				
8/3/2004	H03-SG02	1398	12.2	29.9	68	193	5	975	869	931	927	ISO-9141-2				
8/4/2004	H03-SG01	1501	13.2	28	73	195	2		856	928	870	ISO-9141-2				
8/4/2004	H03-SG01	1219	13.1	28.8	76	195	3	972	857	903	872	SAE-J1850 PWM				
8/4/2004	H03-SG07	1008	13.3	28	73	195	3	973	859	939	947	Will not communicate				
8/4/2004	H03-SG01	1737	13.4	27.6	75	195	3	971	856	930	948	ISO-9141-2				
8/4/2004	H03-SG05	779	11.6	29.9	69	193	7	978	93	925	926	SAE-J1850 VPW				
8/5/2004	H03-SG01	802	12.2	25.4	49	195	3	983	913	951	962	SAE-J1850 PWM				
		1319	121			195	3	982	868	945	911	SAE-J1850 VPW				
8/5/2004	H03-SG01	1840	12.5	29.3	41	196	3	983	910	944	913	Will not communicate				
8/5/2004		1542	12.5			196	4	994	909	940	942	Will not communicate				
8/5/2004	C03-SG01	1071	12.3	28.5	42	196	4	993	860	936	932	SAE-J1850 VPW				
8/6/2004	H03-SG02	1787	12.4			190	5	994	913	960	936	SAE-J1850 PWM				
8/6/2004	H03-SG05	1714	12	24.3	45	193	7	991	925	940	937	SAE-J1850 VPW				
8/6/2004	H03-SG05	1286	12.9	26.8	37	193	6	989	923	927	930	Will not communicate				
8/6/2004	C03-SG01	626	12.6	25.3	43	196	4	996	909	939	943	Will not communicate				
8/7/2004	H03-SG01	640	13.5	26.6	44	196	3	979	906	941	934	Will not communicate				
8/7/2004	H03-SG02	1149	11.7	23.6	56	193	5	982	882	934	936	Will not communicate				
8/9/2004	H03-SG03	944	12.4	31.9	46	193	5	981	871	948	942	SAE-J1850 PWM				
8/7/2004	H03-SG03	353	13.2	24.6	53	194	5	981	907	953	918	Will not communicate				

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		SEMTECH System Information (ERG)										OBDII	Cylinder Numbers			
Date	PEM Serial #	FID Pres (psig)	Battery Voltage (V)	Ambient Temp (C)	RH (%)	FID Oven Temp(C)	Chiller Temp (C)	Amb. P	P1 (mbar)	P2 (mbar)	P3 (mbar)	OBDII protocol	Zero Gas #	Audit Gas #	Span Gas #	Comments
8/9/2004	H03-SG03	1350	13	24.6	64	178	5	982	909	919	945	ISO-9141-2				
8/9/2004	H03-SG02	1896	11.8	29	56	193	5	983	913	937	935	ISO-9141-2				
8/9/2004	H03-SG05	688	12.9	28.8	55	193	6	988	922	1016	701	SAE-J1850 PWM				
8/7/2004	H03-SG02	603	12	27.9	48	193	5	979	911	937	934	Will not communicate				
8/10/2004	C03-SG01	247	13.1	24.8	46	196	3	993	906	937	937	ISO-9141-2				
8/11/2004	H03-SG03	1887	131			194	5	981				Will not communicate				
8/10/2004	H03-SG03	701	12.1	22.1	51	194	5	983	913	936	893	ISO-9141-2				
8/10/2004	103-SG01	1003	11.6	27.4	40	196	4	991	856	871	876	Will not communicate				
8/11/2004	H03-SG02	1203	12.8			193	5	984	850	868	888	ISO-9141-2				
8/11/2004	H03-SG03	490	11.7	20.9	59	193	5	983	911	935	893	Will not communicate				
8/11/2004		583	11.6	23.4	41	191	5	983	881	936	929	SAE-J1850 PWM				
8/11/2004	H03-SG02	866				193	4	984	870	889	886	ISO-9141-2				
8/12/2004	H03-SG05	1413	12.5	21.9	42	193	6					Will not communicate				
8/12/2004	H03-SG05	1725	11.7	18.8	65	193	5	988	926	942	935	SAE-J1850 VPW				
8/12/2004	H03-SG02	955	12.5	20.6	46	193	4	984	881	948	896	Will not communicate				
8/12/2004	H03-SG02	1242	11.7	19.6	64	187	5	984	876	893	905	SAE-J1850 PWM				
8/14/2004	H03-SG05	1862	12.7	26.4	37	193	7	992	927	936	917	Will not communicate				
8/13/2004	H03-SG02	347	11.8	23.9	47	193	5	986	883	940	885	Will not communicate				
8/12/2004	H03-SG02	692	12.7	19.4	64	193	5	986	917	931	936	SAE-J1850 PWM				
8/14/2004	H03-SG02	1432	12	24.8	40	193	6	988	883	938	916	ISO-9141-2				
8/14/2004	H03-SG05	630	11.4	23.9	49	191	6	992	886	963	943	Will not communicate				
8/14/2004	H03-SG02	1766	12.7	22.6	53	193	5	988	918	1023	942	ISO-9141-2				
8/16/2004	H03-SG05	792	12.2	22.8	65	193	4	985	880	937	889	SAE-J1850 VPW				
8/16/2004	H03-SG05	1603	12.5	22.8	5	193	6	990	928	939	928	ISO-9141-2				
8/18/2004	H03-SG02	1853	12.7	34.3	36	186	5	974	974	972	957	ISO-9141-2	ALM042257	ALM066169		
8/16/2004	H03-SG02	1027	12	22.4	52	193	5	985	915	255	553	ISO-9141-2				
8/17/2004	H03-SG02	646	12.2	25.4	65	192	5	980	875	938	946	Will not communicate				
8/17/2004	H03-SG05	1764	12.6	25.4	65	193	6	984	921	943	949	ISO-9141-2				
8/17/2004	H03-SG03	335	12.6	26.9	63	193	5	979	904	931	942	Will not communicate				
8/14/2004	H03-SG03	1019	12.3	31.6	45	193	6	974	864	920	927	ISO-9141-2	ALM042257	ALM066169		
																Could not SEMTECH te
8/18/2004	H03-SG02											SAE-J1850 VPW				
8/18/2004	H03-SG03	717	12.7	35	32	194	6	972	898	923	871					
8/18/2004	H03-SG03	323	12.1	28.9	53	193	5	975	904	930	927	SAE-J1850 VPW				
8/19/2004	H03-SG03	1797	12.6	22.6	44	193	4	981	908	930	885	Will not communicate				
8/19/2004	H03-SG03	417	12.3	20.9	46	193	5	982	908	932	892	Will not communicate				
8/20/2004	H03-SG04	1173	12.7	22.1	57	193	5	980	910	936	929	Will not communicate				PEMS-only (all-wheel dr
8/20/2004	H03-SG03	1371	11.7	19.4	74	193	5	-32	877	908	847	Will not communicate				
8/20/2004	H03-SG03	1766	12.5	18.4	78	193	5	979	906	946	934	Will not communicate				
8/21/2004	H03-SG03	575	12.8	18.6	88	193	5	983	910	940	926	Will not communicate				
8/21/2004	H03-SG02	453	12.7	23.9	65	193	5	982	910	931	906	Will not communicate				
8/21/2004	H03-SG01	948	12.8	22.9	66	196	4	980	911	944	938	SAE-J1850 PWM				
8/21/2004	H03-SG01	675	13.1			195	3	979	866	945	916	SAE-J1850 PWM				
8/21/2004	H03-SG02	841	12.3	19.1	86	193	5	984	914	940	949	Will not communicate				
8/23/2004	H03-SG01	1740	13.2	24.5		195	4	973	904	910	918	ISO-9141-2				RH(%) - Out of range Hi
8/23/2004	H03-SG01	1301	13	24.9	89	195	4	972	860	935	894	Will not communicate				
8/23/2004	H03-SG02	1782	12.1	24.9	89	193	5	975	904	924	904	Will not communicate				
8/23/2004		1356	12.1	25.5	89	180	5	974	903	928	873	Will not communicate				
8/23/2004	C03-SG01	496	13.2	24.1	87	197	3	983	898	922	896	Will not communicate				
8/24/2004	H03-SG06	1718	12.4	23.9	70	193	4	977	903	909	925	Will not communicate				
8/25/2004	H03-SG02	1690	12.1	29	73	190	7	971	839	856	835	Will not communicate				
8/25/2004		834	12.5	30.9	68	194	5	978	864	929	925	Will not communicate				

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		SEMTECH System Information (ERG)										OBDII	Cylinder Numbers			
Date	PEM Serial #	FID Pres (psig)	Battery Voltage (V)	Ambient Temp (C)	RH (%)	FID Oven Temp(C)	Chiller Temp (C)	Amb. P	P1 (mbar)	P2 (mbar)	P3 (mbar)	OBDII protocol	Zero Gas #	Audit Gas #	Span Gas #	Comments
8/26/2004	H03-SG02	1572	12.8	27.8	77	193	5	972	866	936	900	SAE-J1850 PWM				
8/25/2004		1595	11.8	30.3	72	193	5	972	900	921	915	Will not communicate				
8/27/2004	H03-SG02	289	11.9	27.6	77	193	5	975	869	940	921	Will not communicate				
8/26/2004	HC3-SG02	1799	12.2	25.9	87	193	5	972	901	936	926	Will not communicate				
8/26/2004	H03-SG06	1442	12.6	34.5	54	194	6	976	889	895	901	Will not communicate				
8/25/2004		1196	11.7	26.4	83	193	5	977	904	930	942	Will not communicate				
8/26/2004	H03-SG02	411	12.3	34.6	55	193	5	970	862	906	887	ISO-9141-2				
8/26/2004	C03-SG01	475	12.3	27.5	77	193	4	978	894	910	926	SAE-J1850 VPW				
8/26/2004	H03-SG02	1219	12.2	30.8	64	193	5	972	864	923	879	Will not communicate				
8/26/2004	H03-SG02	738	12.2	34.1	56	193	5	970	863	921	878	SAE-J1850 VPW				
8/27/2004	H0C-SG06	1829	12.7	30.6	62	194	5	982	854	907	883	Will not communicate				
8/27/2004	H03-SG06	498	12.3	27.6	77	193	4		859	937	932	Will not communicate				
8/27/2004	H03-SG02	1389	12.4	31.9	59	193	5	975	868	916	895	SAE-J1850 VPW				
8/28/2004																No PEM
8/28/2004	H03-SG06	865	12.3	23.9	73	194	5	986	901	929	934					
8/28/2004	H03-SG04	905	12.8	24.9	65	193	4	979	857	919	920	Will not communicate				
8/28/2004	H03-SG04	1472	12.7	22	84	188	5	978	902	941	925	Will not communicate				
8/28/2004	H03-SG01	430	13.4	27.4	57	193	5	979	858	925	923	Will not communicate				
8/28/2004	H03-SG04	1168	12.9	73	23	193	5	979	859	935	919	Will not communicate				
8/30/2004	H03-SG04	1265	12.4	20.6	74	193	4	982	868	947	931	Will not communicate				
8/30/2004	H03-SG04	364	12.7	27.3	51	193	5	982	861	926	927	SAE-J1850 PWM				
8/30/2004	H03-SG06	1658	12.4	21.1	70	193	4	989	902	939	937					
8/30/2004	H03-SG06	1216	12.7	24.1	59	194	5	990	903	943	845	Will not communicate				
8/30/2004	H03-SG04	570	12.6	25.6	57	193	5	982	863	926	926	ISO-9141-2				
8/30/2004	H03-SG04	790	12.8	23.6	61	193	5	983	863	928	923	ISO-9141-2				
8/31/2004	H03-SG06	772	12.7	29.6	50	194	6	993	864	941	932	Will not communicate				
8/31/2004	H03-SG04	1773	12.9	23.9	67	193	5	985	907	935	937	Will not communicate				
8/31/2004	H03-SG06	590	12.6	31	44	193	6	992	954	968	987	Will not communicate				
8/31/2004	H03-SG06	1776	12.4	22.8	80	194	4	992	906	949	940					
8/31/2004	H03-SG04	1334	13	27.4	60	193	6	986	862	939	927	Will not communicate				
9/1/2004	H03-SG05	1145	13	24.1	64	193	7	991	916	937	930	Will not communicate				
9/1/2004	H03-SG04	1804	13.5	27	54	193	5	986	906	933	931	SAE-J1850 PWM				
9/1/2004	H03-SG06	1779	12.7	26.5	57	194	5	993	865	947	941	SAE-J1850 PWM				
9/1/2004	H03-SG02	1849	12.8	26.8	56	193	5	987	920	947	943	Will not communicate				
9/8/2004																Info not collected by Mik
9/8/2004	H03-SG02	1828	12.1	26	36	193	5	986	915	943	939	Will not communicate				
9/8/2004	H03-SG06	1010	12.9	23.3	46	194	4	992	904	947	936	Will not communicate				
9/9/2004	H03-SG05	680	12.5	23.4	49	194	6	989	914	925	906	ISO-9141-2				
9/9/2004	H03-SG05	242	12.8	22.4	52	194	4	991	863	886	899	Will not communicate				
9/9/2004	H03-SG06	509	12.9	18.9	73	194	4	990	903	905	934	Will not communicate				
9/9/2004	H03-SG05	502	12.5	26.9	43	194	6	987	915	910	883	Will not communicate				
9/9/2004	H03-SG06	1805	13	28	41	194	5	988	900	944	911	Will not communicate				
9/10/2004	H03-SG06	737	13	28.9	37	194	6	990	860	892	936	Will not communicate				
9/10/2004	H03-SG06	1494	13.6	19.9	69	19		990	903	891	916	Will not communicate				

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			SEMTECH System Information (ERG)										OBDII	Cylinder Numbers			
	Date	PEM Serial #	FID Pres (psig)	Battery Voltage (V)	Ambient Temp (C)	RH (%)	FID Oven Temp(C)	Chiller Temp (C)	Amb. P	P1 (mbar)	P2 (mbar)	P3 (mbar)	OBDII protocol	Zero Gas #	Audit Gas #	Span Gas #	Comments
	9/10/2004	H03-SG06	549	12.1	30.1	37	193	6	969	866	923	918	ISO-9141-2				
	9/11/2004	H03-SG03	1079	12.3	27.3	44	193	5	984	881	944	941	Will not communicate				
	9/10/2004	H03-SG05	1447	13	25.1	51	194	6	989	915	942	929	Will not communicate				
	9/10/2004	H03-SG05	1056	12.5	29.6	36	194	7	988	867	914	844	Will not communicate				
	9/13/2004	H03-SG02	1705	12	29.8	49	193	5	967	867	930	927	SAE-J1850 VPW				
	9/14/2004	H03-SG03	1807	12.5	26.9	66	194	6	975	899	911	910	ISO-9141-2				
	9/13/2004	H03-SG02	315	11.8	23.9	58	193	5	978	907	934	931	Will not communicate				
	9/14/2004	H03-SG05	801	12.6	31.9	44	194	7	976	900	895	871	ISO-9141-2				
e r	9/13/2004	H03-SG05	1648	12.4	25.9	55	194	6	982	909	915	907	Will not communicate				
	9/14/2004	H03-SG05	1063	12.7	31.6	48	194	6	977	902	928	902	Will not communicate				
	9/14/2004	H03-SG05	1467	12.3	25.4	70			979	856	911	904					
	9/14/2004	H03-SG04	281	13	31	52	193	5	972	893	952	917	ISO-9141-2				
	9/15/2004	H03-SG05	917	12	27.9	57	193	7	978	909	862	814	Will not communicate				
	9/14/2004		1534	12.9	23.9	High	196	2	983	846	887	871	Will not communicate				
	9/14/2004	H03-SG04	1785	12.1	24.9	74	193	4	971	893	929	917	Will not communicate				
cy	9/15/2004	H03-SG05	353	12.7	24.9	75	194	6	976	901	862	895	ISO-9141-2				
	9/14/2004	H03-SG03	1511	13	29.9	60	194	6	974	898	260	524	ISO-9141-2				
	9/15/2004	H03-SG05	429		25.9	76	194	6	975	904	848	826	ISO-9141-2				
	9/15/2004	H03-SG05	797	12.2	24.5	88	193	6	978	907	878	848	ISO-9141-2				
	9/15/2004	H03-SG02	1052	12	23.6	High	193	6	975	867	933	894	ISO-9141-2				
	9/16/2004	H03-SG05	1740	13	27.6	33	194	7	984	900	924	902					
	9/15/2004	H03-SG03	1730	13.4	20	66	194	5	981	906	927	911	Will not communicate				
	9/16/2004	H03-SG03	796	12.3	27.9	32	193	6	978	866	921	920	SAE-J1850 VPW				
	9/16/2004	H03-SG05	1287	13	27.9	33	194	7	983	862	928	895	SAE-J1850 PWM				
	9/16/2004	H03-SG03	1426	12.6	24.4	49	194	5	981	905	938	876	Will not communicate				
	9/16/2004	H03-SG05	1575	13	25.6	42	194	6	966	912	865	892	Will not communicate				
	9/20/2004	H03-SG02	593	11.9	27.9	40	113	5	982	908	934	932	SAE-J1850 PWM				Start THC ~ 5,000
	9/17/2004																
	9/17/2004	H03-SG05	644	12.5	23.1	50	193	6	985	865	867	828	Will not communicate				
	9/17/2004	H03-SG02	625	11.9	24.5	47	193	6	961	910	965	934	ISO-9141-2				
	9/17/2004	H03-SG03	1314	12.8	22.4	49	193	6	980	936	935	873	Will not communicate				
	9/18/2004	H03-SG05	1600	12.7	20	86	193	6	986	913	938	908	ISO-9141-2				
	9/18/2004	H03-SG03	965	13	22.8	73	194	6	981	903	923	911	Will not communicate				
	9/18/2004	H03-SG02	1375	12.2	31.1	47	193	5	981	872	949	928	ISO-9141-2				
	9/17/2004	H03-SG03	1715	12.4	17.1	77	193	5	980	905	949	868	Will not communicate				
	9/18/2004	H03-SG02	525	12.7	20.1	31	193	6	983	912	940	934	ISO-9141-2				
	9/29/2004	H03-SG02	1174	11.8	15.3	61	193	5	987	918	942	940	SAE-J1850 PWM				
	9/18/2004	H03-SG05	1259	12.9	26.1	65	193	7	986	865	817	761	Will not communicate				
	9/20/2004	H03-SG02	1010	11.8	22	46	192	5	985	878	935	929					Beginning THC ~ 3000,
	9/20/2004	H03-SG05	959	12.7	231	43	194	6	987	910	896	872	ISO-9141-2				
	9/20/2004	H03-SG05	429	12.8	37.1	24.5	194	6	985	883	857	865	SAE-J1850 PWM				
	9/20/2004	H03-SG05	722	12.8	31	25	194	7	987	866	842	800	ISO-9141-2				
	9/20/2004	H03-SG02	787	12	25	40	193	5	984	913	930	920	ISO-9141-2				Start THC ~ 2,500
	9/21/2004	H03-SG05	1406	12.5	24.5	53	194	7	987	913	846	884	Will not communicate				Start THC ~ 11,500
	9/21/2004	H03-SG05	873	12.9	34.5	38.4	194	7	986	911	863	898	Will not communicate				

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		SEMTECH System Information (ERG)										OBDII	Cylinder Numbers			
Date	PEM Serial #	FID Pres (psig)	Battery Voltage (V)	Ambient Temp (C)	RH (%)	FID Oven Temp(C)	Chiller Temp (C)	Amb. P	P1 (mbar)	P2 (mbar)	P3 (mbar)	OBDII protocol	Zero Gas #	Audit Gas #	Span Gas #	Comments
9/20/2004	H03-SG02	1590	11.9	28.9	34	193	5	980	872	932	909	Will not communicate				
9/21/2004	H03-SG02	1050	11.5	20.8	58	193	5	984	912	937	934	SAE-J1850 VPW				
9/21/2004	H03-SG02	259	11.9	26.1	55.1	193	5	984	876	945	927	SAE-J1850 VPW				
9/21/2004	H03-SG03	697	12.2	27.9	50	194	6	981	909	925	912	SAE-J1850 VPW				Start THC ~ 3,300
9/22/2004	H03-SG05	1049	12.6			194	7	989	868	794	783	ISO-9141-2				Start THC ~ 1,500
9/22/2004		1559	12.8	29.4	41	193	5	982	908	934	931	Will not communicate				
9/22/2004	H03-SG05	1644	12.5	22.4	50	193	6	989	915	907	890	SAE-J1850 PWM				
9/23/2004	H03-SG05	411	12.6	21.5	63	194	7	984	912	922	924	ISO-9141-2				
9/23/2004	H03-SG02	1314	11.6			193	5	982	909	931	925	Will not communicate				
9/23/2004		1640	12.7	24.1	59	194	7	985	867	936	883					
9/23/2004	H03-SG02	939	11.8	21.4	75	193	5	984	878	952	927	Will not communicate				
9/24/2004	H03-SG05	1235	12.5	27.9	32	193	7	989	868	902	913	SAE-J1850 VPW				
9/24/2004	H03-SG05	1711	12.4	22.6	54	193	7	990	918	906	925	SAE-J1850 PWM				
9/24/2004	H03-SG02	1085	11.9	27.4	32	193	5	985	877	934	911	Will not communicate				
9/24/2004	H03-SG02	311	11.8	17.4	71	193	5	987	916	938	944	Will not communicate				
9/24/2004	H05-SG02	1657		25.6	54.5	193	5	987	879	940	915	Will not communicate				
9/11/2004	H03-SG05	709	13	29.6	40	194	7	986	863	936	911	Will not communicate				
9/11/2004	H03-SG05	956	13	28.1	41	194	7	987	866	917	902	SAE-J1850 PWM				
9/11/2004	H03-SG02	829	12.9	29.1	40	193	5	983	909	937	931	ISO-9141-2				
9/11/2004	H03-SG05	1655	12.8	19.9	78	193	6	988	916	941	920	Will not communicate				
9/11/2004	H03-SG06			19.1	76	193	6	990	870	929	937	Will not communicate				
9/25/2004	H03-SG05	411	12.6	29.9	32	194	7	991	920	912	931	Will not communicate				
9/25/2004	H03-SG02	739	11.9	18.9	80	193	5	988	917	942	939	SAE-J1850 VPW				
9/25/2004	H03-SG02	471	11.9	23.5	51	193	5	988	880	940	926	Will not communicate				
9/25/2004	H03-SG05	650	12.3	21.6	54	193	6	992	876	957	932	SAE-J1850 VPW				
9/27/2004	H03-SG05	1605	12.5	29.4	34	194	7	986	856	900	831	SAE-J1850 PWM				
9/27/2004	H03-SG02	1691	11.7			193	5	985	913	934	928	SAE-J1850 VPW				
9/27/2004	H03-SG02	1418	11.6	29.4	34	192	6	984	875	931	929	ISO-9141-2				
9/27/2004		952	12.5	19 C	73	193	5	968	917	938	927	Will not communicate				
9/27/2004	H03-SG05	338	12.5	26.2	51	194	8	987	914	899	808	Will not communicate				
9/28/2004	H03-SG02	531	11.6	20.4	58	193	5	987	867	895	896	Will not communicate				
9/28/2004	H03-SG05	1041	12.1	20.1	60	193	6	991	872	875	844	ISO-9141-2				
9/28/2004	H03-SG05	421	12.6	27	40	194	7	991	871	919	851	Will not communicate				
9/28/2004	H03-SG05	1318	12.9	22.4	63	193	6	990	918	953	916	SAE-J1850 VPW				
9/28/2004	H03-SG02	1715	11.9	24.9	40	193	6	988	860	884	882	Will not communicate				
9/27/2004	H03-SG02	955	12.2	29.8	82	193	6	982	873	932	915	Will not communicate				
9/29/2004	H03-SG05	1657	13.1	21.6	30	194	6	988	915	940	913	ISO-9141-2				

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		SEMTECH System Information (ERG)										OBDII	Cylinder Numbers			
Date	PEM Serial #	FID Pres (psig)	Battery Voltage (V)	Ambient Temp (C)	RH (%)	FID Oven Temp(C)	Chiller Temp (C)	Amb. P	P1 (mbar)	P2 (mbar)	P3 (mbar)	OBDII protocol	Zero Gas #	Audit Gas #	Span Gas #	Comments
9/29/2004	H03-SG02	546		23.9	28	193	5	983	864	885	891					
9/29/2004	H03-SG02	306	12	24.1	27	193	5	982	874	930	907	Will not communicate				
9/29/2004	H03-SG02	732	12	20.5	39	193	6	986	880	938	893	Will not communicate				
9/29/2004	H03-SG03	1707	11.9	19.4	45	194	5	985	879	896	903	SAE-J1850 VPW				
9/30/2004	H03-SG05	655	12.5	21.1	44	194	7	985	912	930	836	SAE-J1850 VPW				
9/30/2004	H03-SG05	307	12.8	23.9	44.4	193	7	983	909	931	833	SAE-J1850 VPW				
9/30/2004		949	12.9	19.2	54.2	193	5	985	869	936	925	SAE-J1850 VPW				
9/30/2004	H03-SG02	1322	12.1	25.9	39.1	193	5	978	904	931	911	Will not communicate				
9/29/2004	H03-SG03	1530	12.8	24.1	29	194	5	981	865	929	938	ISO-9141-2				
9/30/2004	H03-SG02	1689	11.6	20.1	51	193	5	982	862	879	887	Will not communicate				Start THC ~ 8,700 ppm
9/30/2004	H03-SG02	1529	12			193	5	980	863	882	892	ISO-9141-2				
1/11/2005	H03-SG06	1284	13.1	11.6	41	194	4	984	901	936	941	Vehicle will not commur	ALM050011	ALM041307		
1/11/2005	H03-SG05	1447	13.2	11.9	47	193	5	980	912	927	906	Vehicle will not commur	ALM050011	ALM041307		
1/11/2005	H03-SG06	1685	12.9	13.5	44	194	4	981	897	927	1009	SAE-J1850 VPW	ALM050011	ALM041307		
1/11/2005	H03-SG05	1701	13.8	11.1	45	193	6	984	913	930	923	ISO-9141-2	ALM050011	ALM041307		
1/12/2005	H03-SE05	996	13.5	5.9	61	193	5	970	903	909	871	ISO-9141-2	ALM050011	ALM041307		
1/12/2005	H03-SG03	1030	12.6	6.9	53	193	4	964	860	921	852	ISO-9141-2	ALM050011	ALM041307		
1/12/2005	H03-SG03	346	12.5	7.6	68	153	4	102	892	880	838	ISO-9141-2	ALM050011	ALM041307		
1/12/2005	H03-SG05	773	12.6	8.3	68	193	5	968	904	910	847	Vehicle will not commur	ALM050011	ALM041307		
1/13/2005	H03-SG06	643	12.5	2.1	43	193	3	908	1013	939	909		ALM050011	ALM041307		
1/13/2005	H03-SG05	1349	13.5	1.9	45	193	4	984	921	952	877	ISO-9141-2	ALM050011	ALM041307		
1/13/2005	H03-SG03	1631	12.6	4.8	40	193	3	983	919	925	908	Vehicle will not commur	ALM050011	ALM041307		
1/13/2005	C03-SG01	769		4.6	31	195	3	1002	943	951	921	ISO-9141-2				
1/14/2005	H03-SG03	1474	12.9	3.6	26	194	3	1003	905	993	828	SAE-J1850 VPW	ALM050011	ALM041307		
1/15/2005	H03-SG05	853	12.4	5	24	193	5	1008	937	919	900		ALM050011	ALM041307		
1/14/2005	H03-SG05	1310	12	7.9	25	193	2	1030	893	950	934	SAE-J1850 VPW	ALM050011	ALM041307		
1/14/2005	H03-S003	968	11.9	6.8	25	193	3	10000	939	938	919	ISO-9141-2	ALM050011	ALM041307		
1/14/2005	H03-SG06	1667	12.8	-0.1	24	193	2	1008	932	957	934	SAE-J1850 VPW	ALM050011	ALM041307		
1/15/2005	H03-SG06	1700	12.5	15.6	20	1700	4	1042	884	961	945	SAE-J1850 VPW	ALM050011	ALM041307		
1/15/2005	H03-SG03	990	13.4	12.9	22	193	2	1009	938	876	930	SAE-J1850 VPW	ALM050011	ALM041307		
1/15/2005	H03-SG06	1212	12.7	12.1	22	193	4	1036	883	965	954	SAE-J1850 VPW	ALM050011	ALM041307		
1/15/2005	H03-SG05	555	12.8	14.6	20	193	6	1010	940	957	958	ISO-9141-2	ALM050011	ALM041307		
1/15/2005	H03-SG03	1705	13.4	16	20	193	4	1006	934	902	881	ISO-9141-2	ALM050011	ALM041307		
1/17/2005	H03-SG05	1543	12	14.6	42	193	5	1038	935	945	931	ISO-9141-2	ALM050011	ALM041307		
1/17/2005	H03-SG05	1855	12.7	18.6	20	193	6	1041	936	949	927	Vehicle will not commur	ALM050011	ALM041307		
1/16/2005	H03-SG03	1795	13.4	18.9	20	194	4	1004	932	904	885	ISO-9141-2	ALM050011	ALM041307		
1/17/2005	C03-SG01	1667	13	13.4	22	191	5	1013	969	953	946	Vehicle will not commur	ALM050011	ALM041307		
1/16/2005	H03-SG03	1473	12.2	22.6	20	193	4	1002	936	916	907	SAE-J1850 VPW	ALM050011	ALM041307		
1/18/2005	H03-SG06	888	12.6	14.3	23	193	5	1029	885	952	929	SAE-J1850 VPW	ALM050011	ALM041307		
1/18/2005	H03-SG06	575	13	22.1	22	194	5	993	910	942	935	Vehicle will not commur	ALM050011	ALM041307		
1/18/2005	H03-SG03	1669	13	20.4	21	193	5	1008	931	914	920	SAE-J1850 VPW	ALM050011	ALM041307		
1/18/2005	H03-SG03	1482	12.5	20.1	24	193	4	1025	920	890	936	ISO-9141-2	ALM050011	ALM041307		
1/18/2005	C03-SG01	1736	12.4	18.1	24	195	5	1017	982	945	949	Vehicle will not commur	ALM050011	ALM041307		
1/18/2005	H03-SG03	1135	12.4	20	27	193	4	1025	915	885	889	ISO-9141-2	ALM050011	ALM041307		
1/19/2005	C03-SG01	331	12.4	11.9	41	195	5	1012	976	937	909	Vehicle will not commur	ALM050011	ALM041307		
1/19/2005	C03-SE01	1529	12.4	13.5	45	195	6	1009	920	917	882	Vehicle will not communicate using any of the above communication protocols.				
1/19/2005	H03-SG06	1731	13.6	12.1	40	193	4	935	979	987	936	Vehicle will not commur	ALM050011	ALM041307		
1/19/2005	C03-SG01	647	12.2	17.4	25	195	5	1019	886	942	972	SAE-J1850 VPW	ALM050011	ALM041307		

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			SEMTECH System Information (ERG)											OBDII	Cylinder Numbers			
	Date	PEM Serial #	FID Pres (psig)	Battery Voltage (V)	Ambient Temp (C)	RH (%)	FID Oven Temp(C)	Chiller Temp (C)	Amb. P	P1 (mbar)	P2 (mbar)	P3 (mbar)	OBDII protocol	Zero Gas #	Audit Gas #	Span Gas #	Comments
ER	1/18/2005	H03-SG03	879	12.5	14.6	35	193	4	989	918	925	911	Vehicle will not commu	ALM050011	ALM041307		
	1/20/2005	H03-SG06	1719	13	9	56	193	4	1005	850	878	873	SAE-J1850 VPW	ALM050011	ALM041307		
	1/20/2005	H03-SG02	1025	12.7	19.8	34	193	5	976	908	930	915	SAE-J1850 VPW	ALM050011	ALM041307		
	1/20/2005	H03-SG06	1388	12.3	13.9	51	193	4	963	908	921	847	SAE-J1850 PWM	ALM050011	ALM041307		
	1/20/2005	H03-SG02	880	12.3	12.3	53	192	6	1012	880	739	926		ALM050011	ALM041307		
	1/19/2005	H03-SG06	861	12.9	21.1	32	193	4	1006	860	924	905	Vehicle will not commu	ALM050011	ALM041307		
	1/21/2005	H03-SG06	1694	13.6	45.4	25	194	4	1013	902	935	923	ISO-9141-2	ALM06117	ALM041307		
	1/21/2005	H03-SG06	1308	12.6	13.5	31	193	5	1008	846	874	878	ISO-9141-2	ALM006117	ALM041307		
	1/21/2005	C03-SG07	1621	12.6	13.5	39	195	6	997	915	930	933	SAE-J1850 VPW	ALM006117	ALM041307		
	1/21/2005	H03-SG03	1645	12.6	12.4	40	193	5	1018	873	932	923	Vehicle will not commu	ALM006117	ALM041307		
ns	1/21/2005	H03-SG06	867	12.8	22.9	25	194	4	1008	896	918	920	Vehicle will not commu	ALM006117	ALM041307		
	1/22/2005	H03-SG02	1581	12	16.4	23	191	6	993	875	891	896	Vehicle will not commu	ALM006117	ALM041307		
	1/22/2005	C03-SG01	1294	12.5	15.6	23	195	3	1000	966	943	940		ALM006117	ALM041307		
	1/22/2005	C03-SG01	1031	12.4	6.5	22	195	5	1012	988	944	917	Vehicle will not commu	ALM006117	ALM041307		
	1/25/2005	H03-SG02	1628	12.8	12.6	40	193	3	991	938	949	969		ALM006117	ALM041307		
	1/25/2005	H03-SG02	769	12.8	13.4	41	193	5	1006	875	936	892	Vehicle will not commu	ALM006117	ALM041307		
ak	1/26/2005		1736	12.5	20.9	28	195	5	1012	903	933	934	Vehicle will not commu	ALM006117	ALM041307		
	1/25/2005	H03-SG02	1127	12.8	15.6	34	193	5	1008	909	935	923	Vehicle will not commu	ALM006117	ALM041307		
	1/25/2005	H03-SG06	1213	12.9	14.8	41	193	4	1001	857	886	917	Vehicle will not commu	ALM006117	ALM041307		
	1/26/2005	H03-SG02	1797	12.5	20.9	28	192	5	1021	887	939	928	Vehicle will not commu	ALM006117	ALM041307		
	1/26/2005	H03-SG02	1404	12.6	23.1	22	192	5	1023	920	940	911	Vehicle will not commu	ALM006117	ALM041307		
	1/26/2005	H03-SG06	559	12.5	16.9	36	191	5	1014	867	881	904	Vehicle will not commu	ALM006117	ALM041307		
sn	1/27/2005	L04-SE13	1227	13.5	17.3	30	195	3	995	925	941	895	Vehicle will not commu	ALM006117	ALM041307		
	1/27/2005	H03-SG03	1697	12.2	17.9	24	192	6	1232	907	961	963	SAE-J1850 VPW	ALM006117	ALM041307		
	1/28/2005	H03-SG02	1744	12.8	17.3	29	191	6	990	888	943	934	Vehicle will not commu	ALM06117	ALM041307		
in	1/27/2005		1117	12.5	16.9	30	192	5	1029	894	952	943	Vehicle will not commu	ALM006117	ALM041307		
re	1/27/2005	H03-SG02	777	12.5	18.9	29	193	5	993	933	943	935	Vehicle will not commu	ALM006117	ALM041307		
	1/28/2005	H03-SG06	975	12	19.1	22	194	5	1022	906	935	926	Vehicle will not commu	ALM006117	ALM041307		
	1/28/2005	H03-SG02	1129	12.8	19.8	27	193	5	988	922	944	921	Vehicle will not commu	ALM06117	ALM041307		
	1/28/2005	H03-SG02	456	13	21.8	21			986	858	875	882	Vehicle will not commu	ALM006117	ALM041307		
	1/29/2005	H03-SG03	1752	12.6	19.1	28	193	5	1023	912	930	931	ISO-9141-2	ALM006117	ALM041307		
	1/29/2005	H03-SG02	583	12.6	20.5	30	193	5	1021	917	933	914	ISO-9141-2	ALM006117	ALM041307		
er	1/29/2005	H03-SG06	1740	12.5	20.8	30	193	4	992	864	945	926		ALM006117	ALM041307		
	1/29/2005	H03-SG06	1392	13	21	28	194	4	1022	900	942	922	ISO-9141-2	ALM006117	ALM041307		
	1/31/2005	H03-SG02	1737		13.8	50			999	891	940	936		ALM061111	ALM041307		
	1/31/2005	K03-SG01	1706	13	19.6	42	195	4	987	920	941	943	Vehicle will not commu	ALM006117	ALM041307		
	1/31/2005	H03-SG03	1414	13.1	13.4	51	193	4	990	920	942	932	Vehicle will not commu	ALM06111	ALM041307		
	2/2/2005	H03-SG02	973	12.5	15	37	193	5	1025	924	935	915	SAE-J1850 VPW	ALM006117	ALM041307		
Sp	2/1/2005	H03-SG02	1712	13	18.5	37	193	5	996	903	930	886	Vehicle will not commu	ALM006117	ALM041307		
	2/1/2005	H03-SG02	338	12.5	9.9	42	193		991	841	854	860	Vehicle will not commu	ALM006117	ALM041307		
	2/1/2005	H03-SG03	768	12.1	16.4	25			992	884	956	940	Vehicle will not commu	ALM006117	ALM041307		
	2/2/2005	C03-SG02	1468	12.3	15.9	37	193	4	1004	873	980	940	SAE-J1850 PWM	ALM006117	ALM041307		
	2/2/2005	C03-SG02	971	12.6	8.4	33	192	3	1018	885	940	856	SAE-J1850 VPW	ALM006117	ALM041307		
	2/2/2005	H03-SG02	1260	12.5	8.6	29	191	6	988	1022	921	887	SAE-J1850 PWM	ALM006117	ALM041307		
	2/2/2005	H03-SG01	521	12.6	14.1	30	195	4	1020	880	953	967	Vehicle will not commu	ALM006117	ALM041307		
	2/2/2005	H03-SG02	566	12.1	10.5	43			991	891	920	894	Vehicle will not commu	ALM006117	ALM041307		
	2/3/2005	H03-SG01	564	12.6	22.9	23	195	4	1028	921	954	951	ISO-9141-2	ALM006117	ALM041307		
	2/3/2005	H03-SG06	920	12.3	22.8	23	191	6	1000	1026	937	931	Vehicle will not commu	ALM006117	ALM041307		
	2/3/2005	H03-SG03	290	12.6	193	5	16.6	35	990	881	871	925	ISO-9141-2	ALM006117	ALM041307		
	2/3/2005	H03-SG02	830	12.5	15.6	39	193	6	992	889	944	938	ISO-9141-2	ALM006117	ALM041307		
	2/4/2005	H03-SG02	287	12.5	22.1	31	193	5	990	886	938	929	SAE-J1850 PWM	ALM006117	ALM041307		OBDII - Could not comm
	2/4/2005	C03-SG02	1527	12.6			193	4	1025	922	928	945	SAE-J1850 VPW	ALM006117	ALM041307		

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		SEMTECH System Information (ERG)										OBDII	Cylinder Numbers			
Date	PEM Serial #	FID Pres (psig)	Battery Voltage (V)	Ambient Temp (C)	RH (%)	FID Oven Temp(C)	Chiller Temp (C)	Amb. P	P1 (mbar)	P2 (mbar)	P3 (mbar)	OBDII protocol	Zero Gas #	Audit Gas #	Span Gas #	Comments
2/4/2005	H03-SG02	1746	12.5	22.9	23	193	6	987	885	920	869	Vehicle will not commu	ALM006117	ALM041307		
2/4/2005	C03-SG01	412	12.2	25.9	23	195	5	999	1012	941	937	Vehicle will not commu	ALM006117	ALM041307		
2/5/2005	C03-SG02	577	12.3	190	35	191	5	998	866	941	934	Vehicle will not commu	ALM006117	ALM041307		
2/5/2005	H03-SG02	1250	12.4	10.6	45	193	6	985	886	916	911	Vehicle will not commu	ALM006117	ALM041307		
2/5/2005	H03-SG02	924	12.7	18.6	32	193	5	985	785	799	804	SAE-J1850 PWM	ALM006117	ALM041307		
2/5/2005	H03-SG06	1780	12.3	16.8	32	193	5	988	888	938	929	Vehicle will not commu	ALM006117	ALM041307		
2/6/2005	H03-SG06	1280	12.5	16.3	53	193	4	987	857	934	921	Vehicle will not commu	ALM006117	ALM041307		
2/8/2005	H03-SG03	1688	12.4	19.6	28	193	4	985	876	945	937	ISO-9141-2	ALM006117	ALM041307		
2/7/2005	C03-SG01	1771	12.2	18.5	31	195	4	1017	921	940	939	ISO-9141-2	ALM006117	ALM041307		
2/7/2005	C03-SG01	1206	12.4	16.1	30	193	5	995	876	929	872		ALM006117	ALM041307		OBD II - ?
2/7/2005	C03-SG01	1557	12.5	18.1	30	195	4	1004	917	932	881	Vehicle will not commu	ALM006117	ALM041307		
2/8/2005	C03-SG01	852	12.6	17	30	195	4	1019	875	957	878	Vehicle will not commu	ALM006117	ALM041307		
2/8/2005	H03-SG03	1224	12.8	13.9	31	194	4	1022	912	976	979	Vehicle will not commu	ALM006117	ALM041307		
2/8/2005	H03-SG06	793	12.6	18.4	31	193	5	990	866	885	930	ISO-9141-2	ALM006117	ALM041307		
2/10/2005	C03-SG01	826	12.2	12.8	31	195	4	1003	876	943	891	Vehicle will not commu	ALM006117	ALM041307		
2/8/2005	H03-SG02	285	12.5	18	30	193	5	986	858	872	887	Vehicle will not commu	ALM006117	ALM041307		
2/8/2005	H03-SG02	447	12.2	18.1	30	145	4	1004	990	933	872	SAE-J1850 PWM	ALM006117	ALM041307		
2/9/2005	H03-SG01	546	12.4	17.5	30	195	4	986	877	945	933	ISO-9141-2	ALM006117	ALM041307		
2/8/2005												SAE-J1850 VPW	ALM006117	ALM041307		
2/9/2005	C03-SG01	1231	12.6	15.4	30	195	4	1012	901	928	875	Vehicle will not commu	ALM006117	ALM041307		
2/9/2005	H03-SG02	538	12.7	18.3	23	193	4	1022	884	933	925	Vehicle will not commu	ALM006117	ALM041307		
2/9/2005	C03-SG01	1694	12.4	17.9	29	195	5	999	900	937	938	Vehicle will not commu	ALM006117	ALM041307		
2/9/2005	H03-SG01	859	12.3	19.4	25	195	3	1023	919	947	944	Vehicle will not commu	ALM006117	ALM041307		
2/10/2005	C03-SG02	1389	12.4	19.6	22	192	5	1029	870	946	940	ISO-9141-2	ALM006117	ALM041307		
2/10/2005	H03-SG06	1401	12.2			193	5	997	876	968	941	SAE-J1850 VPW	ALM006117	ALM041307		
2/10/2005	H03-SG03	342	12.4	13.9	27	193	5	1029	918	955	919	Vehicle will not commu	ALM006117	ALM041307		
2/10/2005	H03-SG06	608	12.6	18.9	25	194	5	1010	853	886	811	SAE-J1850 VPW	ALM006117	ALM041307		
2/11/2005	C03-SG01	488	12.2	10.1	30	195	5	1001	946	935	876	SAE-J1850 PWM	ALM006117	ALM041307		
2/11/2005	C03-SG01	484	12.1	17.1	32	196	6	1001	875	940	935	SAE-J1850 VPW	ALM006117	ALM041307		
2/11/2005	H03-SG08	1523	12.9	10.4	30	193	3	995	905	941	873	ISO-9141-2	ALM006117	ALM041307		
2/11/2005	H03-SG06	445	12.4	21.3	25	193	4	1023	865	955	860	ISO-9141-2	ALM006117	ALM041307		
2/14/2005	H03-SG01	954		15.1	41	195	3	973	875	911	886	ISO-9141-2	ALM006117	ALM049099		
2/14/2005	H03-SG01	893	13.3	22.1	32	196	4	972	905	897	900	Vehicle will not commu	ALM006117	ALM049099		
2/14/2005	C03-SG01	1066	12.5	15	44	193	5	1008	916	872	867	Vehicle will not commu	ALM006117	ALM049099		
2/14/2005	C03-SG01	1462	12.4	14.1	31	195	4	1001	943	868	883	Vehicle will not commu	ALM006117	ALM049099		
2/15/2005	H03-SE08	931	13	17.8	42	194	6	982	817	826	791	SAE-J1850 VPW	ALM006117	ALM049099		
2/15/2005	C03-SG01			16.5	45	195	4	985	914	912	892	SAE-J1850 VPW	ALM006117	ALM049099		
2/15/2005	C03-SG01	748	12.4	15	50	196	4	985	914	931	924	Vehicle will not commu	ALM006117	ALM049099		
2/15/2005	H03-SG06	1515	12.6	15	50	193	3	980	930	927	919	ISO-9141-2	ALM006117	ALM049099		
2/16/2005	H03-SG06	1223	12.7	17.4	27	194	3	1020	864	902	875	SAE-J1850 VPW	ALM006117	ALM049099		
2/16/2005	H03-SG06	995	12.6	15.4	25	193	5	997	824	814	838	SAE-J1850 VPW	ALM006117	ALM049099		
2/16/2005	H03-SG01	712	13	24	25	195	4	987	876	940	942	ISO-9141-2	ALM006117	ALM049099		
2/16/2005	H03-SG06	537	12.7	21.3	28	193	7	996	899	903	903	SAE-J1850 VPW	ALM006117	ALM049099		
2/16/2005	C03-SG01	1123	12.3	11	35	195	4	1002	946	949	949	Vehicle will not commu	ALM006117	ALM049099		
2/17/2005	H03-SG06	1642	12.3	18.1	31	193	5	997	706	870	951	Vehicle will not commu	ALM006117	ALM049099		H04-SE08
2/17/2005	C03-SG01	484	12.9	17.1	32	195	4	1001	875	940	943	SAE-J1850 VPW	ALM006117	ALM049099		
2/17/2005	H03-SG06	1078	13.2	9.4	32	194	3	996	903	885	845	Vehicle will not commu	ALM006117	ALM049099		
2/17/2005	H03-SG02	409	12.5	18	31	193	4	986	885	936	927	ISO-9141-2	ALM006117	ALM049099		
2/17/2005	H03-SG02	834	12.8			193	3	985	916	932	869	SAE-J1850 PWM	ALM010867	ALM049099		
2/18/2005	H03-SG02	380	12.7	10.9	25	193	5	991	891	927	861	Vehicle will not commu	ALM010867	ALM049099		

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	Date	PEM Serial #	FID Pres (psig)	Battery Voltage (V)	Ambient Temp (C)	RH (%)	FID Oven Temp(C)	Chiller Temp (C)	Amb. P	P1 (mbar)	P2 (mbar)	P3 (mbar)	OBDII protocol	Zero Gas #	Audit Gas #	Span Gas #	Comments
			SEMTECH System Information (ERG)										OBDII	Cylinder Numbers			
	2/18/2005	H03-SG02	641	12.2	20.6	23	193	5	991	886	938	877	SAE-J1850 PWM	ALM010867	ALM049099		
	2/18/2005	H03-SG06	1520	12.6	18.4	21	194	6	1026	900	918	925	Vehicle will not commu	ALM010867	ALM049099		
	2/19/2005	H03-SG01	1801	12.3	20.9	34	195	4	982	872	943	937	Vehicle will not commu	ALM049099	ALM010867		
	2/19/2005	C03-SG01	1706	12.1	21.1	32	195	4	996	917	938	933		ALM049099	ALM010867		
	2/19/2005	H03-SG01	1586	12.4	21.6	35	195	4	981	869	936	872	Vehicle will not commu	ALM010867	ALM049099		
	2/19/2005	C03-SG01	1031	12.5	23	37	195	5	994	873	932	915	Vehicle will not commu	ALM049099	ALM010867		
	2/21/2005	H03-SG01	1107	12.3	21.9	28	196	4	980	845	871	891	SAE-J1850 PWM	ALM010867	ALM049099		
	3/11/2005	H03-SG03	1813	12.7	19	22	193	5	1017	868	878	909	Vehicle will not commu	ALM010867	ALM049099		
IC	3/17/2005	H03-SG02	1123	12.8	15.1	36	194	5	977	909	913	864	Vehicle will not commu	ALM010867	ALM049099		Flowmeter K04-SE01; m
	3/24/2005	H03-SG01	1003	12.3	23.6	30	195	4	1012	865	925	917	SAE-J1850 VPW	ALM010867	ALM049099		Flowmeter I04-SE03
	2/22/2005	H03-SG01	238	12.5	17.4	34	195	4	987	878	937	887	SAE-J1850 VPW	ALM010867	ALM049099		
	2/22/2005	C03-SG01	1711	12.6	18.9	27	194	4	1027	942	924	917	SAE-J1850 VPW	ALM049099	ALM010867		I04-SE03
	2/22/2005	H03-SG06	1427		15.6	40	194	4	996	903	943	930	Vehicle will not commu	ALM010867	ALM049099		
	2/22/2005	H03-SG01	388	12.4	27.3	25	195	4	1026	918	950	914	Vehicle will not commu	ALM010867	ALM049099		
	3/10/2005	H03-SG01	279	12.4	19.1	33	195	3	1008	904	934	926	ISO-9141-2	ALM010867	ALM049099		Flow I04-SE03; mpg 17.
	2/23/2005	C03-SG01	1651	12.6	16.4	33	195	5	1021	887	938	934	Vehicle will not commu	ALM010867	ALM049099		
	2/23/2005	H03-SG06	1326	12.7	21.8	27	194	-4	995	901	937	961	Vehicle will not commu	ALM010867	ALM049099		
	2/23/2005	H03-SG06	780	12.3	23.9	22	193	4	992	861	929	908	Vehicle will not commu	ALM010867	ALM049099		
	2/23/2005	H03-SG01	1749	12.2	18	30	195	4	1021	876	935	941	Vehicle will not commu	ALM010867	ALM049099		
	2/23/2005	H03-SG02			19.8	22							Vehicle will not commu	ALM010867	ALM049099		
	2/25/2005	H03-SG06											ISO-9141-2				
	2/25/2005	C03-SG01	1503	12.5	15.3	31	195	4	1019	863	936	930	Vehicle will not commu	ALM010867	ALM049099		
	2/24/2005	H03-SG03	409	12.6	20.9	30	193	5	1023	907	935	918	SAE-J1850 VPW	ALM010867	ALM049099		
	3/19/2005	C03SG01	810		12.1	25	195	5	1016	906	934	934	te using any of the abov	ALM010867	ALM049099		Flow I04-SE03; mpg 20.198
	3/21/2005	C03SG02	727	12.8	20.3	28	193	5	989	901	927	858	SAE-J1850 PWM	ALM010867	ALM049099		
	2/26/2005	H03-SG06	388	12.6	25.4	21	193	5	1012	853	889	888	Vehicle will not commu	ALM010867	ALM049099		
	2/25/2005	H04-SG03	986	12.5	17.6	30	193	5	983	871	972	945	ISO-9141-2	ALM010867	ALM049099		
	2/25/2005	C03-SG01	1692	12.7	18.9	30	195	4	1018	864	953	934	SAE-J1850 PWM	ALM010867	ALM049099		
	2/25/2005	H03-SG01	506	12.5			191	6	990	859	918	917	Vehicle will not commu	ALM010867	ALM049099		
	2/26/2005	H03-SG02	1306	12.3	16.6	32	192	5	983	876	918	854	Vehicle will not commu	ALM018067	ALM049099		
	2/26/2005	H03-SG03	1613	12.3	14.9	32	193	5	985	875	976	978	SAE-J1850 PWM	ALM010867	ALM049099		
	2/26/2005	H03-SG02	263	12.5	17.8	30	193	4	1020	913	931	911	SAE-J1850 PWM	ALM010867	ALM049099		
nd	3/25/2005	H03-SG02	1519	12.3	20.3	34	195	4	1015	912	933	929	SAE-J1850 PWM	ALM042613	ALM049099		Flow I04-SE03; mpg 17.
	2/28/2005	H03-SG03	950	12.4	22.9	22	193	4	1016	869	971	939	ISO-9141-2	ALM010867	ALM049099		
	2/28/2005	H03-SG06	872	12.8			193	5	986	934	968	968	Vehicle will not communicate using any of the above communication protocols.				
	2/28/2005	H03-SG06	586	128	70.3	21	193	5	985	852	909	862	Vehicle will not commu	ALM010867	ALM049099		
	2/28/2005	H03-SG03	1604	12.5	18.1	23	193	4	979	869	927	912	Vehicle will not communicate using any of the above communication protocols.				
	3/30/2005	H03-SG06	722	12.5	19.3	47	193	4	990	830	914	902	ISO 9141	ALM042613	ALM049099		Flow I04-SE08; mpg 27.63
	3/1/2005	C03-SG01	764	12.5	19.4	23	195	4	996	874	940	939	Vehicle will not commu	ALM010867	ALM049099		
	3/29/2005	C03SG02	1720	12.3	25	35	193	5	973	844	922	916	J1850VPW	ALM041623	ALM049099		Flowmeter I04-SE03, mpg 20.
	3/1/2005	H03-SG06	1754	13.1	21.6	20	193	6	1016	856	927	915	Vehicle will not commu	ALM010867	ALM049099		
	3/2/2005	H03-SG02	558	12.4	149	26	193	5	977	842	859	880	Vehicle will not commu	ALM010867	ALM049099		
	3/2/2005	C03-SG01	1812	12.7	23.9	21	195	4	989	902	933	931	ISO-9141-2	ALM010867	ALM049099		J04-SE06
	3/3/2005	C03-SG01	1774	12.8	16.4	56	195	3	988	980	932	929	Vehicle will not commu	ALM010867	ALM049099		
	2/3/2005	H03-SG01	845	12.5	22.4	24	195	4	779	870	943	936	Vehicle will not commu	ALM010867	ALM049099		
	3/3/2005	H03-SG02	1741	12.7	18.6	32	193	4	1014	909	926	920	Vehicle will not commu	ALM010867	ALM049099		
	3/4/2005	H03-SG02	192	12.4	22	23	193	5	975	870	933	881	ISO-9141-2	ALM010867	ALM049099		
	3/4/2005	H03-SG02	1390	12.7	20.8	32	193	5	977	871	926	857	Vehicle will not commu	ALM010867	ALM049099		
	3/4/2005	H03-SG06	1804		65	9.6	194	5	985	887	925	914	Vehicle will not commu	ALM010867	ALM049099		
	3/4/2005	H03-SG02	1702	12.2	12.1	62	195	5	1011	911	941	881	SAE-J1850 PWM	ALM010867	ALM049099		
	3/4/2005	H03-SG06	1087	12.8	21.9	23	194	5	983	852	905	854		ALM010867	ALM049099		
	3/4/2005	H03-SG06	1312	12.5	19.4	38	193	5	1011	888	901	847	Vehicle will not commu	ALM010867	ALM049099		

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		SEMTECH System Information (ERG)										OBDII	Cylinder Numbers			
Date	PEM Serial #	FID Pres (psig)	Battery Voltage (V)	Ambient Temp (C)	RH (%)	FID Oven Temp(C)	Chiller Temp (C)	Amb. P	P1 (mbar)	P2 (mbar)	P3 (mbar)	OBDII protocol	Zero Gas #	Audit Gas #	Span Gas #	Comments
3/5/2005	H03-SG03	366	12.5	21.7	27	193	4	989	881	857	913	SAE-J1850 PWM	ALM010867	ALM049099		
3/5/2005	H03-SG03	734		19.8	31	193	4	987	876	866	913	ISO-9141-2	ALM010867	ALM049099		Flowmeter H04-SE03
3/5/2005	C03-SG01	1467	12.6			195	3	1000	876	943	938	Vehicle will not commu	ALM010867	ALM049099		
3/5/2005	H03-SG06	706	12.8	17.9	33	193	3	995	895	919	919	Vehicle will not commu	ALM010867	ALM049099		
3/4/2005	H03-SG03	347	12.7	14.3	37	194	5	995	897	905	843	Vehicle will not commu	ALM010867	ALM049099		
3/7/2005	H03-SG03	1609		13.3	30	193	4	973	864	925	916	SAE-J1850 PWM	ALM010867	ALM049099		
3/7/2005	H03-SG01	911	12.5	20.6	25	196	4	969	829	856	868	Vehicle will not commu	ALM010867	ALM049099		
3/7/2005	C03-SG01	1050	12.5	13.9	40	195	4	983	849	924	926	Vehicle will not commu	ALM010867	ALM049099		
3/7/2005	H03-SG03	297		18.6	35	193	4	971	898	837	892	Vehicle will not commu	ALM010867	ALM049099		
3/7/2005	H03-SG01	1164	12.4	16.9	41	191	4	969	864	935	931	ISO-9141-2	ALM010867	ALM049099		
3/8/2005	H03-SG06	422		25	22	194	5	967	887	928	918	SAE-J1850 VPW	ALM010867	ALM049099		
3/9/2005	H03-SG03	1011				194	4	984	912	869	933	Vehicle will not commu	ALM010867	ALM049099		
3/8/2005	H03-SG02	1756	12.5	22.6	22	193	5	980	846	865	901	Vehicle will not commu	ALM010867	ALM049099		
3/8/2005	H03-SG02	1743	13			193	6	986	850	921	907	ISO-9141-2	ALM010867	ALM049099		
4/4/2005	H03-SG02	1144	12.8	25	36	193	4	970	865	899	900	ISO-9141-2	ALM042613	ALM049099		
4/5/2005	H03-SG01	1415	12.4	19.9	68	194	3	966	856	927	921	ISO-9141-2	ALM042613	ALM049099		Flow K04-SE03
4/5/2005	H03-SG02	300	12.8	21.8	58	193	5	1002	862	884	892	SAE-J1850 VPW	ALM042613	ALM049099		
4/5/2005	H03-SG02	576	12.7	19.9	70	193	4	968	897	882	894	ISO-9141-2	ALM042613	ALM049099		
4/4/2005	H03-SG02	952	12.8	25.6	34	193	5	1002	864	884	891	ISO-9141-2	ALM042613	ALM04299		
4/4/2005	H03-SG02	1508	12.7	22.3	37	193	5	971	864	915	893	SAE-J1850 VPW	ALM042613	ALM049099		
4/2/2005	C03-SG02	1529	12.7	27.3	23	193	5	1021	909	939	928	ISO-9141-2	ALM042613	ALM049099		
4/2/2005	C03-SG01	970	12.5	15	24	195	3	997	862	934	932	SAE-J1850 VPW	ALM0402613	ALM049099		
4/2/2005	C03-SG02	1285	12.8	16	24	193	4	1026	911	931	881	SAE-J1850 VPW	ALM042613	ALM049099		
3/14/2005	H03-SG01	563/194	12.4	13.1	29	194	3		880	936	934	Vehicle will not commu	ALM010867	ALM049099		FID Fuel Pressure - 563
3/9/2005	H03-SG01	524	12.3	21.4	22	195	4	1018	772	946	940	Vehicle will not commu	ALM010867	ALM049099		
3/9/2005	H03-SG06	389	12.9	12.8	24	194	4	1016	886	918	902	Vehicle will not commu	ALM010867	ALM049099		
3/10/2005	H03-SG02	700	12.4	18.1	28	194	4	1007	901	932	893	Vehicle will not commu	ALM010867	ALM049099		Flow K04-SE01; mpg 27
3/10/2005	H03-SG06	1757	13	20.6	30	193	4	980	849	910	883	Vehicle will not commu	ALM010867	ALM049099		L04-SE13
3/10/2005	H03-SG06	596	12.6	17.4	25	194	6	977	797	833	849	Vehicle will not commu	ALM010867	ALM049099		
3/10/2005	C03-SG01	1744		17.4	25	195	4	1005	896	922	917	Vehicle will not commu	ALM010867	ALM049099		
3/11/2005	H03-SG06	1728	12.7	16.9	31	194	5	981	891	900	887	ISO-9141-2	ALM010867	ALM049099		H04-SE08
3/11/2005	H03-SG06	287	12.8	22	22	194	5	986	897	926	919	Vehicle will not commu	ALM010867	ALM049099		
3/11/2005	H03-SG03	1166	12.4	16.9	31	193	5	1011	864	837	884	Vehicle will not commu	ALM010867	ALM049099		
3/12/2005	H03-SG01	1452	12.3	19.3	32	195	4	998	896	924	917	Vehicle will not commu	ALM010867	ALM049099		
3/14/2005	H03-SG03	777	12.2	13.1	29	193	5	1019	874	988	976	Vehicle will not commu	ALM010867	ALM049099		
3/12/2005	H03-SG01	1167	12.6	22.4	24	195	4	998	852	926	916	Vehicle will not commu	ALM010867	ALM049099		
3/12/2005	H03-SG06	1518	12.8	17.8	32	194	4	970	876	890	872	Vehicle will not commu	ALM010867	ALM049099		
3/14/2005	C03-SG01	1819	12.3	23.9	22	195	4	997	916	947	935	Vehicle will not commu	ALM010867	ALM049099		
3/15/2005	H03-SG03	987	12.6	15.9	27	193	5	964	909	974	941	Vehicle will not commu	ALM010867	ALM049099		
3/15/2005	H03-SG01	1791	12.5	18.1	30	195	3	984	876	902	920	Vehicle will not commu	ALM010867	ALM049099		
3/14/2005	C03-SG01	1437	12.5	10.9	31	195	4	997	867	922	883	Vehicle will not commu	ALM010867	ALM049099		
3/14/2005	H03-SG06	1119	12.3	12.9	32	193	4	1018	903	920	907	Vehicle will not commu	ALM010867	ALM049099		
3/14/2005	H03-SG01	818	12.2	24.1	22	195	4	1021	873	926	936	Vehicle will not commu	ALM010867	ALM049099		
3/15/2005	C03-SG01	852	12.3	12.9	25	195	5	1023	913	904	895	Vehicle will not commu	ALM010867	ALM049099		
3/15/2005	H03-SG03	474		16.4	26	194	5	985	910	953	961	Vehicle will not commu	ALM010867	ALM049099		I04 SE03
3/15/2005	H03-SG01	1460	12.3	15.5	26	195	3	1020	920	918	919	Vehicle will not commu	ALM010867	ALM049099		Flowmeter H04-SE08
3/15/2005	H03-SG06	1756	12.8	11.9	24	194	5	1023	858	911	903	Vehicle will not commu	ALM010867	ALM049099		
3/15/2005	H03-SG02	1135	12.4	14.4	26	193	4	986	915	931	93	Vehicle will not commu	ALM010867	ALM049099		Flowmeter K04-SE01
3/16/2005	H03-SG02	1821	12.3	19.1	33		4	983	910	929	930	Vehicle will not commu	ALM010867	ALM049099		

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			SEMTECH System Information (ERG)										OBDII	Cylinder Numbers			
	Date	PEM Serial #	FID Pres (psig)	Battery Voltage (V)	Ambient Temp (C)	RH (%)	FID Oven Temp(C)	Chiller Temp (C)	Amb. P	P1 (mbar)	P2 (mbar)	P3 (mbar)	OBDII protocol	Zero Gas #	Audit Gas #	Span Gas #	Comments
	3/16/2005	H03-SG03	443	12.3	21.1	23	193	4	1016	868	860	928	Vehicle will not commu	ALM010867	ALM049099		
	3/16/2005	H03-SG02	1306		19.8	22	192	5	979	876	927	924	Vehicle will not commu	ALM010867	ALM049099		
	3/29/2005	C03-SG01	1704	12.4	19.4	47	195	4	975	838	893	906	Vehicle will not commu	ALM042613	ALM049099		
	3/16/2005	C03-SG02	1427	12.3	18.1	26	193	4	992	909	934	927	Vehicle will not commu	ALM010867	ALM049099		H04-SE08
	3/17/2005	C03-SG01	1823		18.4	31	195	4	987	903	928	928		ALM010867	ALM049099		
	3/16/2005	C03-SG02	1741	12.6	20	24	193	4	994	942	1017	933	Vehicle will not commu	ALM010867	ALM049099		H04-SE03
	3/17/2005	H03-SG02	811	12.3	17.1	26	193	5	971	863	874	905	Vehicle will not commu	ALM010867	ALM049099		
	3/17/2005	H03-SG06	1721	12.4	16.4	31	194	4	1010	882	934	915	Vehicle will not commu	ALM010867	ALM049099		
	3/17/2005	C03-SG01	1156		17.1	30	193	4	983	865	925	916	Vehicle will not commu	ALM010867	ALM049099		
	3/17/2005	C03-SG02	906		20.8	32	193	4	989	905	904	907	Vehicle will not commu	ALM010867	ALM049099		
	3/18/2005	H03-SG02	1782	12.8	17.4	33	193	5	1000	892	878	871	Vehicle will not commu	ALM010867	ALM049099		
	3/18/2005	H03-SG02	630	12.6	13.9	33	193	4	1002	895	875	905	Vehicle will not commu	ALM010867	ALM049099		
	3/18/2005	C03-SG02	186		17.1	33	193	4	981	849	929	913	Vehicle will not commu	ALM010867	ALM049099		
	3/19/2005	H03-SG03	1420	12.3	17.8	28	193	5	1019	907	950	928	Vehicle will not commu	ALM010867	ALM049099		
	3/18/2005	C03-SG02	608	12.6	23.8	23	192	4	982	856	928	933	Vehicle will not commu	ALM010867	ALM049099		
	3/18/2005	H03-SG06	759	12.6	19.4	31	194	4	1001	875	921	910	Vehicle will not commu	ALM010867	ALM049099		
	3/19/2005	H03-SG06	557		18.6	27	194	3	988	893	940	931	Vehicle will not commu	ALM010867	ALM049099		
	3/19/2005	C03-SG02	1312		16.9	28	193	4	994	916	945	940	Vehicle will not commu	ALM010867	ALM049099		H04-SE08
	3/19/2005	C03-SG02	1566		13.9	26	193	4	994	915	938	934	Vehicle will not commu	ALM010867	ALM049099		
	3/19/2005	H03-SG03	1804		16.6	29	193	5	981	906	944	909	Vehicle will not commu	ALM010867	ALM049099		
	3/19/2005	H03-SG02	1752	12.5	19.3	27	193	5	980	872	930	925	Vehicle will not commu	ALM010867	ALM049099		
	3/21/2005	C03-SG02	973	12.7	16.3	32	193	4	989	903	935	898	Vehicle will not commu	ALM010867	ALM049099		
	3/21/2005	C03-SG02	501	12.3	16	44	193	3	985	899	900	888	Vehicle will not commu	ALM010867	ALM049099		
	3/21/2005	C03-SG01	423	12.4	14.8	38	195	4	1018	898	813	870	Vehicle will not commu	ALM010867	ALM049099		
	4/7/2005	H03-SG01	1410	12.3	17.4	51	195	4	1012	868	902	871	Vehicle will not commu	ALM041623	ALM049099		
ST	3/22/2005	C03-SG01	1471	12.6	20.1	33	195	5	1002	801	823	802	Vehicle will not commu	ALM042613	ALM049099		
	3/22/2005	C03-SG02	804	12.8	14	44	194	3	1008	881	913	895	Vehicle will not commu	ALM042613	ALM049099		
	3/23/2005	H03-SG01	274	12.6	14.6	36	195	4	1014	865	925	930	Vehicle will not commu	ALM042613	ALM049099		
	3/22/2005	H03-SG01	1147	12.5	16.6	31	195	3	1008	863	936	927	Vehicle will not commu	ALM042613	ALM049099		
	3/22/2005	H03-SG01	754	12.7	23.3	27	196	4	1005	850	878	885	Vehicle will not commu	ALM042613	ALM049099		
	3/22/2005	H03-SG06	1059	12.6	20.4	31	193	5	1007	884	917	894	Vehicle will not commu	ALM042613	ALM049099		
	3/23/2005	H03-SG01	1494	12.8	18.5	34	196	3	1012	909	895	895	SAE-J1850 VPW	ALM042613	ALM049099		
	3/23/2005	H03-SG02	1759	12.8	23.9	25	193	4	1015	870	924	915	Vehicle will not commu	ALM042613	ALM049099		
	3/23/2005	H03-SG01	1692	12.5	23.4	30	195	4	1013	865	919	908	Vehicle will not commu	ALM042613	ALM049099		
	3/24/2005	H03-SG06	1535	12.7	25.3	31	194	5	1006	847	925	914	Vehicle will not commu	ALM042613	ALM049099		
	3/24/2005	H03-SG01	687		24	27	195	3	1018	865	903	932	Vehicle will not commu	ALM042613	ALM049099		
	3/24/2005	H03-SG06	270	13	16.9	46	193	4	1006	884	933	928	Vehicle will not commu	ALM042613	ALM049099		
	3/24/2005	H03-SG01	482	13	18.4	49	196	4	970	900	911	923	Vehicle will not commu	ALM042613	ALM049099		
	4/1/2005	C03-SG01	1192	12.2	15.8	39	195	3	1020	871	968	932	ISO-9141-2	ALM042613	ALM049099		
	3/25/2005	C03-SG01	891	12.4	20.4	34	195	6	1014	851	920	857	Vehicle will not commu	ALM042613	ALM049099		
	3/25/2005	C03-SG01	1276	12.1	20.1	34	195	4	991	903	933	934	Vehicle will not commu	ALM042613	ALM049099		K04-SE03
	3/28/2005		1215		20	28	193	5	971	870	893	889	Vehicle will not communicate using ar		ALM049099		PEM Serial Number - Bl
	3/26/2005	H03-SG01	274	12.7	25.6	27	196	4	1021	911	943	935	Vehicle will not commu	ALM042613	ALM049099		
	3/26/2005	C03-SG01	285	12.6	21.4	31	195	4	1021	912	881	873	Vehicle will not commu	ALM042613	ALM049099		
	3/26/2005	C03-SG01	1162	12.6	17.6	25	195	4	996	859	898	887	Vehicle will not commu	ALM042613	ALM049099		
	3/26/2005	H03-SG02	1162	12.7	20.4	32	193	4	1019	916	936	936	Vehicle will not commu	ALM042613	ALM049099		
	3/28/2005	H03-SG06	1380		19.1	35	193	5	979	879	929	920	ISO-9141-2	ALM04263	ALM049099		
	3/28/2005		471	12.4	21.3	30	195	6	981	862	900	883		ALM042613	ALM049099		PEM Serial Number - Bl
	3/28/2005	H03-SG02	1735	12.6	19.5	33	193	4	972	838	855	882	SAE-J1850 PWM	ALM042613	ALM049099		
	3/29/2005	C03-SG01	1081	12.3	23.9	33	195	4	972	883	866	904	Vehicle will not commu	ALM041263	ALM049099		
ic	3/29/2005	H03-SG02	1814	12.8	22.9	36	193	5	962	893	894	911	Vehicle will not commu	ALM042613	ALM049099		
	3/31/2005	C03-SG02	1826	12.6	16.1	40	193	5	1016	906	937	925	Vehicle will not commu	ALM042613	ALM049099		
	4/1/2005	H03-SG06	559	12.9	17.1	35	193	4	1019	902	958	950	Vehicle will not commu	ALM042613	ALM049099		
	4/1/2005	C03-SG02	1820	12.6	18.6	28	193	4	1016	863	937	929	Vehicle will not commu	ALM042613	ALM049099		

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		SEMTECH System Information (ERG)										OBDII	Cylinder Numbers			
Date	PEM Serial #	FID Pres (psig)	Battery Voltage (V)	Ambient Temp (C)	RH (%)	FID Oven Temp(C)	Chiller Temp (C)	Amb. P	P1 (mbar)	P2 (mbar)	P3 (mbar)	OBDII protocol	Zero Gas #	Audit Gas #	Span Gas #	Comments
4/2/2005	H03-SG01	1704	12.9	16	16	195	3	983	875	945	939	Vehicle will not commu	ALM042613	ALM049099		
4/2/2005	C03-SG01	630	12.5	18	23	194	5	994	859	931	918	SAE-J1850 PWM	ALM042613	ALM049099		
4/4/2005	H03-SG02	739	12.6	27	33	193	4	968	862	879	868	Vehicle will not commu	ALM042613	ALM049099		
4/5/2005	H03-SG02	1354		22.1	52		4	968	897	876	886	ISO-15765	ALM041623	ALM049099		
4/5/2005	C03-SG01	1758	12.4	21.9	56	195	4	980	899	929	926	ISO-15765	ALM042613	ALM049099		OBDII protocol - CAN. F
4/4/2005	H03-SG02	1794	13.1	19.4	42	193	4	1006	900	925	921	SAE-J1850 VPW	ALM042613	ALM049099		
4/6/2005	C03-SG02	1004	12.4	22.8	48	193	5	985	851	930	923	Vehicle will not commu	ALM041263	ALM049099		
4/6/2005	H03-SG02	896	12.5	18.9	70	192	5	972	867	885	867	Vehicle will not commu	ALM042163	ALM049099		
4/6/2005	H03-SG01	1118	12.9	22.3	51	195	4	971	858	935	929	Vehicle will not commu	ALM042163	ALM049099		
4/6/2005	H03-SG02	375	12.5	22	50	192	5	972	868	884	909	ISO-9141-2	ALM042613	ALM049099		
4/7/2005	H03-SG01	696	12.6	25.4	33	195	4	977	908	937	906	SAE-J1850 VPW	ALM042613	ALM049099		Flowmeter H03-SE08
4/6/2005	H03-SG01	948	12.3	22.3	50	195	4	1004	857	907	899	ISO-9141-2	ALM042613	ALM049099		
4/6/2005	H03-SG02	410	12.5	21.3	53	193	5	972	901	875	853	ISO-9141-2	ALM047613	ALM049099		
4/6/2005	H03-SG02	1153	12.9	18	73	193	5	972	901	879	891	Vehicle will not commu	ALM042613	ALM049099		
4/7/2005	C03-SG02	1402	12.4	19.9	43	193	4	992	905	899	926	Vehicle will not commu	ALM042163	ALM049099		
4/9/2005	H03-SG06	1030	12.8	21.6	50	194	5	1006	891	931	902	Vehicle will not commu	ALM042613	ALM049099		
4/8/2005	C03-SG02	458	12.8	22.4	30	193	4	990	854	927	913	Vehicle will not commu	ALM042613	ALM049099		
4/8/2005	H03-SG06	1757	12.6	27	30	194	5	1014	887	932	925	Vehicle will not commu	ALM042613	ALM049099		
4/8/2005	C03-SG02	1031		27.4	30	193	5	993	904	939	905	SAE-J1850 VPW	ALM042613	ALM049099		
4/8/2005	H03-SG06	1347		22.1	26	194	6	1009	851	928	913	ISO-9141-2	ALM042613	ALM049099		
4/9/2005	C03-SG02	1802	12.6	23.4	44	193	3	985	807	872	840	Vehicle will not commu	ALM042613	ALM049099		

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		SEMTECH System Information (BKI)										OBDII	Cylinder Numbers			
Date	PEM Serial #	FID Pres (psig)	Battery Voltage (V)	Ambient Temp (C)	RH (%)	FID Oven Temp(C)	Chiller Temp (C)	Amb. P	P1 (mbar)	P2 (mbar)	P3 (mbar)	OBDII protocol	Zero Gas #	Audit Gas #	Span Gas #	Comments
8/10/2004	H03-SG04	30	0	27	37	193	5	980	858	903	870	Will not communicate	ALM014633	ALM034356	CAL013942	
7/19/2004	H03-SG04	NA	NA	75 F	64	196	4	975	899	903	921	SAE-J1850 VPW	ALM014633	CAL771	CAL013942	
7/20/2004	H03-SG04	30	0	29	68	193	5		851	891	875	SAE-J1850 VPW	ALM014633	CAL771	CAL013942	
7/20/2004	H03-SG04	30	0	28	72	194	5		851	893	873	ISO-9141-2	ALM014633	CAL771	CAL013942	
7/20/2004	H03-SG04	30	0	35	38	194	5		849	872	886	SAE-J1850 VPW	ALM014633	CAL771	CAL013942	
7/20/2004	H03-SG04	30	0	32	53	193	5		841	877	841	Will not communicate	ALM014633	CAL771	CAL013942	
7/20/2004	H03-SG04	30	0	37	39	193	6		846	875	862	ISO-9141-2	ALM014633	CAL771	CAL013942	
7/20/2004	H03-SG04	30	0	34	55	193	6		852	879	878	Will not communicate	ALM014633	CAL771	CAL013942	
7/21/2004	H03-SG04	30	0	30	58	193	5		851	887	881	SAE-J1850 VPW	ALM014633	CAL771	CAL013942	
7/21/2004	H03-SG04	30	0	30	60	193	5		852	886	889	SAE-J1850 VPW	ALM014633	CAL771	CAL013942	
7/21/2004	H03-SG04	30	0	33	53	193	6		846	876	881	SAE-J1850 VPW	ALM014633	CAL771	CAL013942	
7/21/2004	H03-SG04	30	0	29	65	193	5		827	847	854	ISO-9141-2	ALM014633	CAL771	CAL013942	
7/24/2004	H03-SG04	30	0	19	74	193	4		867	910	892	Will not communicate	ALM014633	ALM066169	CAL013942	
7/22/2004	H03-SG04	30	0	30	63	193	5		853	901	889	SAE-J1850 VPW	ALM014633	CAL771	CAL013942	
7/22/2004	H03-SG04	30	0	32	55	193	5		856	883	866	Will not communicate	ALM014633	CAL771	CAL013942	
7/22/2004	H03-SG04	30	0	30	60	193	5		856	882	854	Will not communicate	ALM014633	CAL771	CAL013942	
7/22/2004	H03-SG04	30	0	32	55	193	5		856	886	887	Will not communicate	ALM014633	CAL771	CAL013942	
7/23/2004	H03-SG04	30	0	26	70	193	5		862	888	880	Will not communicate	ALM014633	CAL771	CAL013942	
7/23/2004	H03-SG04	30	0	26	74	193	4		860	928	889	ISO-9141-2	ALM014633	CAL771	CAL013942	
7/23/2004	H03-SG04	30	0	26	75	194	5		854	894	852	ISO-9141-2	ALM014633	CAL771	CAL013942	
7/23/2004	H03-SG04	30	0	21	70	193	5		858	894	862	Will not communicate	ALM014633	ALM066169	CAL013942	
7/24/2004	H03-SG04	30	0	22	73	193	4		864	904	914	SAE-J1850 VPW	ALM014633	ALM066169	CAL013942	
7/24/2004	H03-SG04	30	0	20	72	193	4		866	912	908	Will not communicate	ALM014633	ALM066169	CAL013942	
7/26/2004	H03-SG04	30	0	20	76	193	4		868	925	885	ISO-9141-2	ALM014633	ALM066169	CAL013942	
7/26/2004	H03-SG04	30	0	23	64	193	5		854	894	857	Will not communicate	ALM014633	ALM066169	CAL013942	
7/26/2004	H03-SG04	30	0	25	48	193	4		864	898	895	Will not communicate	ALM014633	ALM066169	CAL013942	
7/27/2004	H03-SG04	30	0	25	54	193	5		825	868	838	ISO-9141-2	ALM014633	ALM066169	CAL013942	
7/27/2004	H03-SG04	30	0	21	77	193	4		865	928	883	SAE-J1850 PWM	ALM014633	ALM066169	CAL013942	
7/27/2004	H03-SG04	30	0	26	44	193	5		830	871	839	SAE-J1850 VPW	ALM014633	ALM066169	CAL013942	
7/28/2004	H03-SG04	30	0	23	65	193	5		859	924	865	ISO-9141-2	ALM014633	ALM034356	CAL013942	
7/28/2004	H03-SG04	30	0	26	49	193	5		817	846	822	SAE-J1850 VPW	ALM014633	ALM034356	CAL013942	
7/28/2004	H03-SG04	30	0	29	47	193	5		778	886	900	SAE-J1850 PWM	ALM014633	ALM034356	CAL013942	
7/28/2004	H03-SG04	30	0	24	56	193	5		817	858	820	ISO-9141-2	ALM014633	ALM034356	CAL013942	
7/28/2004	H03-SG04	30	0	29	52	193	5		855	883	872	Will not communicate	ALM014633	ALM034356	CAL013942	

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		SEMTECH System Information (BKI)										OBDII	Cylinder Numbers			
Date	PEM Serial #	FID Pres (psig)	Battery Voltage (V)	Ambient Temp (C)	RH (%)	FID Oven Temp(C)	Chiller Temp (C)	Amb. P	P1 (mbar)	P2 (mbar)	P3 (mbar)	OBDII protocol	Zero Gas #	Audit Gas #	Span Gas #	Comments
7/29/2004	H03-SG04	30	0	24	69	191	4	977	858	928	862	SAE-J1850 VPW	ALM014633	ALM034356	CAL013942	
7/29/2004	H03-SG04	30	0	26	54	193	5		856	881	874	Will not communicate	ALM014633	ALM034356	CAL013942	
7/29/2004	H03-SG04	30	0	27	56	193	5		816	840	841	SAE-J1850 VPW	ALM014633	ALM034356	CAL013942	
7/29/2004	H03-SG04	30	0	25	64	193	5	977	811	852	818	ISO-9141-2	ALM014633	ALM034356	CAL013942	
7/30/2004	H03-SG04	30	0	23	70	193	5	974	794	825	805	SAE-J1850 PWM	ALM014633	ALM034356	CAL013942	
7/30/2004	H03-SG04	30	0	22	75	193	4	975	856	830	792	SAE-J1850 PWM	ALM014633	ALM034356	CAL013942	
7/30/2004	H03-SG04	30	0	25	65	193	5	975	802	821	827	Will not communicate	ALM014633	ALM034356	CAL013942	
8/4/2004	H03-SG04	30	0	30	64	193	5	972	849	838	826	Will not communicate	ALM014633	ALM034356	CAL013942	
7/30/2004	H03-SG04	30	0	23	71	193	5	974	792	834	797	ISO-9141-2	ALM014633	ALM034356	CAL013942	
7/31/2004	H03-SG04	30	0	32	39	193	5	977	853	859	830	Will not communicate	ALM014633	ALM034356	CAL013942	
8/3/2004	H03-SG04	30	0	34	50	194	6	974	849	851	837	Will not communicate	ALM014633	ALM034356	CAL013942	
7/31/2004	H03-SG04	30	0	30	54	193	5	978	854	862	845	SAE-J1850 VPW	ALM014633	ALM034356	CAL013942	
7/31/2004	H03-SG04	30	0	23	77	187	4	977	859	870	829	ISO-9141-2	ALM014633	ALM034356	CAL013942	
7/30/2004	H03-SG04	30	0	27	53	193	4	974	852	852	839	ISO-9141-2	ALM014633	ALM034356	CAL013942	
8/2/2004	H03-SG04	30	0	30	65	193	5	975	852	857	848	Will not communicate	ALM014633	ALM034356	CAL013942	
8/2/2004	H03-SG04	30	0	31	62	193	5	975	852	846	798	SAE-J1850 VPW	ALM014633	ALM034356	CAL013942	
8/2/2004	H03-SG04	30	0	34	51	193	5	975	852	847	839	Will not communicate	ALM014633	ALM034356	CAL013942	
7/31/2004	H03-SG04	30	0	25	71	193	5	978	857	863	853	ISO-9141-2	ALM014633	ALM034356	CAL013942	
7/31/2004	H03-SG04	30	0	31	50	193	5	978	854	864	854	Will not communicate	ALM014633	ALM034356	CAL013942	
8/4/2004	H03-SG04	30	0	28	68	193	5	974	852	835	805	Will not communicate	ALM014633	ALM034356	CAL013942	
8/4/2004	H03-SG04	30	0	27	73	193	5	973	851	831	823	Will not communicate	ALM014633	ALM034356	CAL013942	
8/4/2004	H03-SG04	30	0	27	81	193	4	970	850	843	808	ISO-9141-2	ALM014633	ALM034356	CAL013942	
8/12/2004	H03-SG04	30	0	24	37	193	5	982	861	901	864	Will not communicate				
8/4/2004	H03-SG04	30	0	29	67	193	4	972	850	837	829	ISO-9141-2	ALM014633	ALM034356	CAL013942	
8/5/2004	H03-SG04	30	0	22	69	189	4	982	865	854	817	ISO-9141-2	ALM014633	ALM034356	CAL013942	
8/5/2004	H03-SG04	30	0	24	52	193	4	984	862	830	817	SAE-J1850 PWM	ALM014633	ALM034356	CAL013942	
8/5/2004	H03-SG04	30	0	28	41	193	5	983	860	823	810	Will not communicate	ALM014633	ALM034356	CAL013942	
8/5/2004	H03-SG04	30	0	24	56	193	4	983	863	830	785	ISO-9141-2	ALM014633	ALM034356	CAL013942	
8/5/2004	H03-SG04	30	0	29	38	194	5	983	859	829	824	SAE-J1850 VPW	ALM014633	ALM034356	CAL013942	
8/6/2004	H03-SG04	30	0	23	51	193	5	985	865	849	819	SAE-J1850 PWM	ALM014633	ALM034356	CAL013942	
8/6/2004	H03-SG04	30	0	22	58	193	5	984	866	863	806	SAE-J1850 VPW	ALM014633	ALM034356	CAL013942	
8/6/2004	H03-SG04	30	0	25	44	193	5	985	863	843	812	Will not communicate	ALM014633	ALM034356	CAL013942	
8/6/2004	H03-SG04	30	0	26	38	194	5	983	861	836	828	Will not communicate	ALM014633	ALM034356	CAL013942	
8/7/2004	H03-SG04	30	0	19	72	193	4	981	863	841	784	SAE-J1850 PWM	ALM014633	ALM034356	CAL013942	
8/7/2004	H03-SG04	30	0	23	57	193	5	981	860	822	774	SAE-J1850 VPW	ALM014633	ALM034356	CAL013942	
8/7/2004	H03-SG04	30	0	28	42	193	5	979	856	786	775	Will not communicate	ALM014633	ALM034356	CAL013942	
8/9/2004	H03-SG04	30	0	30	47	193	5	982	858	909	889	Will not communicate	ALM014633	ALM034356	CAL013942	
8/9/2004	H03-SG04	30	0	27	58	193	4	982	860	933	927	Will not communicate	ALM014633	ALM034356	CAL013942	
8/10/2004	H03-SG04	30	0	22	56	193	4	982	863	937	894	SAE-J1850 PWM	ALM014633	ALM034356	CAL013942	
8/9/2004	H03-SG04	30	0	22	73	187	4	981	862	809	798	Will not communicate	ALM014633	ALM034356	CAL013942	

Page 7 (Installation for Dyne Sampling)																
		SEMTECH System Information (BKI)										OBDII	Cylinder Numbers			
Date	PEM Serial #	FID Pres (psig)	Battery Voltage (V)	Ambient Temp (C)	RH (%)	FID Oven Temp(C)	Chiller Temp (C)	Amb. P	P1 (mbar)	P2 (mbar)	P3 (mbar)	OBDII protocol	Zero Gas #	Audit Gas #	Span Gas #	Comments
8/10/2004	H03-SG04	30	0	22	57	193	4	983	863	903	873	ISO-9141-2	ALM014633	ALM034356	CAL013942	
8/10/2004	H03-SG04	30	0	22	56	193	4	983	863	905	879	ISO-9141-2	ALM014633	ALM034356	CAL013942	
8/10/2004	H03-SG04	30	0	25	47	193	5	981	861	913	879	SAE-J1850 PWM	ALM014633	ALM034356	CAL013942	
8/9/2004	H03-SG04	30	0	29	52	193	5	982	859	915	889	Will not communicate	ALM014633	ALM034356	CAL013942	
8/11/2004	H03-SG04	30	0	20	64	193	4	982	862	897	879	Will not communicate	ALM014633	ALM034356	CAL013942	
8/12/2004	H03-SG04	30	0	20	57	193	4	983	863	895	866	Will not communicate	ALM014633	ALM034356	CAL013942	
8/12/2004	H03-SG04	30	0	19	63	193	4	983	865	903	872	ISO-9141-2	ALM014633	ALM034356	CAL013942	
8/12/2004	H03-SG04	30	0	24	37	193	5	980	868	898	864	Will not communicate	ALM014633	ALM034356	CAL013942	
8/12/2004	H03-SG04	30	0	16	70	193	4	983	867	946	884	SAE-J1850 PWM	ALM014633	ALM034356	CAL013942	
8/12/2004	H03-SG04	30	0	24	38	193	5	982	860	894	868	ISO-9141-2	ALM014633	ALM034356	CAL013942	
8/13/2004	H03-SG04	30	0	23	49	193	5	985	864	906	859	Will not communicate	ALM014633	ALM034356	CAL013942	
8/13/2004	H03-SG04	30	0	21	59	193	4	985	865	901	856	SAE-J1850 VPW	ALM014633	ALM034356	CAL013942	
8/13/2004	H03-SG04	30	0	19	69	193	5	984	865	944	867	SAE-J1850 PWM	ALM014633	ALM034356	CAL013942	
8/14/2004	H03-SG04	30	0	23	54	193	5	986	866	904	860	Will not communicate	ALM014633	ALM034356	CAL013942	
8/14/2004	H03-SG04	30	0	20	64	193	4	986	866	905	855	Will not communicate	ALM014633	ALM034356	CAL013942	
8/14/2004	H03-SG04	30	0	20	66	193	4	986	865	904	863	SAE-J1850 PWM	ALM014633	ALM034356	CAL013942	
8/16/2004	H03-SG04	30	0	24	47	193	5	984	863	901	866	ISO-9141-2	ALM014633	ALM034356	CAL013942	
				25	54	193	5	983	860	908	864	Will not communicate	ALM014633	ALM034356	CAL013942	
8/16/2004	H03-SG04	30	0	18	74	193	4	984	867	939	868	ISO-9141-2	ALM014633	ALM034356	CAL013942	
8/17/2004	H03-SG04	30	0	28	57	193	5	978	855	888	852	SAE-J1850 VPW	ALM014633	ALM034356	CAL013942	
8/17/2004	H03-SG04	30	0	26	64	193	5	978	856	884	853	ISO-9141-2	ALM014633	ALM034356	CAL013942	
8/19/2004	H03-SG04	30	0	22	51	193	4	980	861	941	888	ISO-9141-2	ALM014633	ALM034356	CAL013942	
8/17/2004	H03-SG04	30	0	24	70	193	5	978	859	932	840	ISO-9141-2	ALM014633	ALM034356	CAL013942	
8/18/2004	H03-SG04	30	0	30	47	193	5	974	851	882	850	Will not communicate	ALM014633	ALM034356	CAL013942	
8/18/2004	H03-SG04	30	0	27	58	193	5	974	852	886	852	Will not communicate	ALM014633	ALM034356	CAL013942	
8/19/2004	H03-SG04	30	0	22	49	193	5	980	859	887	852	ISO-9141-2	ALM014633	ALM034356	CAL013942	
st vehicle - trunk & passenger compartment too small - Mike S.																
8/19/2004	H03-SG04	30	0	22	48	193	5	980	860	891	862	SAE-J1850 VPW	ALM014633	ALM034356	CAL013942	
8/19/2004	H03-SG04	30	0	22	52	193	5	979	859	895	852	Will not communicate	ALM014633	ALM034356	CAL013942	
8/19/2004	H03-SG04	30	0	21	47	193	4	981	860	899	861	SAE-J1850 VPW	ALM014633	ALM034356	CAL013942	
8/20/2004	H03-SG04	30	0	19	74	193	4	978	860	894	862	Will not communicate	ALM014633	ALM034356	CAL013942	
8/20/2004	H03-SG04	30	0	20	72	193	4	978	861	934	847	Will not communicate	ALM014633	ALM034356	CAL013942	
ive), extended precond route. Mike S.																
8/21/2004	H03-SG04	30	0	21	74	193	4	982	861	895	866	Will not communicate	ALM014633	ALM034356	CAL013942	
8/21/2004	H03-SG04	30	0	20	78	193	4	982	862	891	855	Will not communicate	ALM014633	ALM034356	CAL013942	
8/23/2004	H03-SG04	30	0	25	84	193	5	973	852	882	862	Will not communicate	ALM014633	ALM034356	CAL013942	
8/23/2004	H03-SG04	30	0	25	79	193	5	973	839	855	829	SAE-J1850 PWM	ALM014633	ALM034356	CAL013942	
8/23/2004	H03-SG04	30	0	26	74	193	5	973	854	931	868	SAE-J1850 PWM	ALM014633	ALM034356	CAL013942	
8/23/2004	H03-SG04	30	0	26	78	193	5	973	850	878	858	Will not communicate	ALM014633	ALM034356	CAL013942	
8/24/2004	H03-SG04	30	0	23	79	193	4	975	855	897	838	ISO-9141-2	ALM014633	ALM034356	CAL013942	
8/24/2004	H03-SG04	30	0	22	81	193	4	974	853	895	909	Will not communicate	ALM014633	ALM034356	CAL013942	
8/24/2004	H03-SG04	30	0	23	77	193	4	974	810	926	921	Will not communicate	ALM014633	ALM034356	CAL013942	
8/24/2004	H03-SG04	30	0	25	65	193	5	970	849	904	895	Will not communicate	ALM014633	ALM034356	CAL013942	
8/25/2004	H03-SG04	30	0	29	70	193	4	970	847	906	893	Will not communicate	ALM014633	ALM034356	CAL013942	
8/25/2004	H03-SG04	30	0	27	74	193	5	970	849	947	889	Will not communicate	ALM014633	ALM034356	CAL013942	

Page 7 (Installation for Dyne Sampling)

		SEMTECH System Information (BKI)										OBDII	Cylinder Numbers			
Date	PEM Serial #	FID Pres (psig)	Battery Voltage (V)	Ambient Temp (C)	RH (%)	FID Oven Temp(C)	Chiller Temp (C)	Amb. P	P1 (mbar)	P2 (mbar)	P3 (mbar)	OBDII protocol	Zero Gas #	Audit Gas #	Span Gas #	Comments
8/27/2004	H03-SG01	30	0	31	62	195	4	974	860	954	944	SAE-J1850 PWM	ALM014633	ALM034356	CAL013942	
8/26/2004	H03-SG01	30	0	27	76	195	4	971	858	945	941	Will not communicate	ALM014633	ALM034356	CAL013942	
8/28/2004	H03-SG01	30	0	24	74	195	4	978	868	961	938	Will not communicate	ALM014633	ALM034356	CAL013942	
8/26/2004	H03-SG01	30	0	30	65	195	4	971	855	850	942	Will not communicate	ALM014633	ALM034356	CAL013942	
8/26/2004	H03-SG01	30	0	28	70	195	4	970	858	949	942	Will not communicate	ALM014633	ALM034356	CAL013942	
8/27/2004	H03-SG01	30	0	31	60	195	4	974	860	955	945	ISO-9141-2	ALM014633	ALM034356	CAL013942	
8/27/2004	H03-SG01	30	0	33	54	195	4	974	859	948	944	SAE-J1850 VPW				
8/27/2004	H03-SG01	30	0	34	53	195	4	974	858	952	941	Will not communicate	ALM014633	ALM034356	CAL013942	
8/27/2004	H03-SG01	30	0	30	65	193	4	973	860	947	945	SAE-J1850 VPW	ALM014633	ALM034356	CAL013942	
8/28/2004	H03-SG01	30	0	26	63	195	4	978	867	953	952	Will not communicate	ALM014633	ALM034356	CAL013942	
8/28/2004	H03-SG01	30	0	24	74	195	4	978	867	958	935	Will not communicate	ALM014633	ALM034356	CAL013942	
8/28/2004	H03-SG01	30	0	24	79	195	4	977	866	951	942	SAE-J1850 VPW	ALM014633	ALM034356	CAL013942	
8/30/2004	H03-SG01	30	0	21	74	193	4	981	872	956	953	Will not communicate	ALM014633	ALM034356	CAL013942	
8/30/2004	H03-SG01	30	0	30	45	195	4	982	868	956	949	Will not communicate	ALM014633	ALM034356	CAL013942	
8/30/2004	H03-SG01	30	0	29	47	195	4	982	869	955	951	Will not communicate	ALM014633	ALM034356	CAL013942	
8/30/2004	H03-SG01	30	0	25	56	195	4	982	871	964	953	Will not communicate	ALM014633	ALM034356	CAL013942	
8/30/2004	H03-SG01	30	0	22	76	195	4	982	872	962	955	Will not communicate	ALM014633	ALM034356	CAL013942	
8/31/2004	H03-SG01	30	0	31	42	195	4	984	874	940	880	Will not communicate	ALM014633	ALM034356	CAL013942	
8/31/2004	H03-SG01	30	0	26	62	195	4	985	876	961	955	SAE-J1850 PWM	ALM014633	ALM034356	CAL013942	
8/31/2004	H03-SG01	30	0	33	42	195	4	984	871	938	881	Will not communicate	ALM014633	ALM034356	CAL013942	
8/31/2004	H03-SG01	30	0	21	82	193	4	984	877	959	956	ISO-9141-2	ALM014633	ALM034356	CAL013942	
8/31/2004	H03-SG04	30	0	27	58	195	4	985	877	947	935	ISO-9141-2	ALM014633	ALM034356	CAL013942	
9/1/2004	H03-SG01	30	0	25	63	195	4	985	880	930	859	Will not communicate	FHJ742	ALM034356	CAL013942	
9/1/2004	H03-SG01	30	0	29	46	195	4	985	876	918	862	Will not communicate	FHJ742	ALM034356	CAL013942	
9/2/2004	H03-SG01	30	0	31	39	195	4	979	868	940	879	Will not communicate	FHJ742	ALM034356	CAL013942	
9/1/2004	H03-SG01	30	0	26	60	195	4	985	878	940	864	Will not communicate	FHJ742	ALM034356	CAL013942	
9/1/2004	H03-SG01	30	0	30	43	195	4	984	874	928	894	Will not communicate				
9/2/2004	H03-SG01	30	0	28	52	195	4	981	872	934	864	Will not communicate	FHJ742	ALM034356	CAL013942	
9/2/2004	H03-SG01	30	0	25	65	195	4	981	873	931	855	SAE-J1850 PWM	FHJ742	ALM034356	CAL013942	
9/2/2004	H03-SG01	30	0	25	64	195	4	981	873	931	856	SAE-J1850 PWM	FHJ742	ALM034356	CAL013942	
9/8/2004	H03-SG01	30	0	18	69	195	4	984	883	931	906	Will not communicate	FHJ742	ALM034356	CAL013942	
9/9/2004	H03-SG01	30	0	25	47	195	4	983	875	915	873	Will not communicate	FHJ742	ALM034356	CAL013942	
9/9/2004	H03-SG01	30	0	20	70	195	4	983	877	941	876	Will not communicate	FHJ742	ALM034356	CAL013942	
9/9/2004	H03-SG01	30	0	27	42	195	4	982	873	909	870	Will not communicate	FHJ742	ALM034356	CAL013942	
9/10/2004	H03-SG01	30	0	23	53	195	4	983	872	934	861	ISO-9141-2	FHJ742	ALM034356	CAL013942	
9/10/2004	H03-SG01	30	0	24	55	195	4	983	873	938	867	Will not communicate	FHJ742	ALM034356	CAL013942	
9/10/2004	H03-SG01	30	0	31	31	195	4	982	872	924	883	Will not communicate	FHJ742	ALM034356	CAL013942	
9/10/2004	H03-SG01	30	0	26	45	195	4	983	871	936	860	Will not communicate	FHJ742	ALM034356	CAL013942	
9/10/2004	H03-SG01	30	0	30	33	195	4	982	868	912	863	Will not communicate	FHJ742	ALM034356	CAL013942	
9/11/2004	H03-SG01	30	0	29	41	195	4	982	873	912	869	Will not communicate	FHJ742	ALM034356	CAL013942	
9/11/2004	H03-SG01	30	0	24	58	195	4	982	810	838	835	Will not communicate	FHJ742	ALM034356	CAL013942	

Page 7 (Installation for Dyne Sampling)																
		SEMTECH System Information (BKI)										OBDII	Cylinder Numbers			
Date	PEM Serial #	FID Pres (psig)	Battery Voltage (V)	Ambient Temp (C)	RH (%)	FID Oven Temp(C)	Chiller Temp (C)	Amb. P	P1 (mbar)	P2 (mbar)	P3 (mbar)	OBDII protocol	Zero Gas #	Audit Gas #	Span Gas #	Comments
9/11/2004	H03-SG01	30	0	18	81	176	4	981	878	950	898	ISO-9141-2	FHJ742	ALM034356	CAL013942	
9/11/2004	H03-SG01	30	0	23	61	195	4	982	875	933	861	Will not communicate	FHJ742	ALM034356	CAL013942	
9/11/2004	H03-SG01	30	0	28	41	195	4	982	874	911	865	Will not communicate	FHJ742	ALM034356	CAL013942	
9/14/2004	H03-SG01	30	0	30	56	195	4	974	824	907	856	SAE-J1850 VPW	FHJ742	ALM034356	CAL013942	
9/14/2004	H03-SG01	30	0	28	60	195	4	974	829	910	866	ISO-9141-2	FHJ742	ALM034356	CAL013942	
9/14/2004	H03-SG01	30	0	30	57	195	4	974	829	908	859	Will not communicate	FHJ742	ALM034356	CAL013942	
9/15/2004	H03-SG01	30	0	26	67	178	3	970	864	944	933	ISO-9141-2	FHJ742	ALM034356	CAL013942	
9/14/2004	H03-SG03	1877	12.6			194	5	970	859	897	918	Will not communicate				
9/15/2004	H03-SG01	30	0	26	76	195	3	970	862	911	869	Will not communicate	FHJ742	ALM034356	CAL013942	
9/15/2004	H03-SG01	30	0	26	73	195	3	972	863	911	877	Will not communicate	FHJ742	ALM034356	CAL013942	
9/16/2004	H03-SG01	30	0	27	31	195	3	977	868	918	868	Will not communicate	FHJ742	ALM034356	CAL013942	
9/16/2004	H03-SG01	30	0	28	30	195	4	977	868	917	865	Will not communicate	FHJ742	ALM034356	CAL013942	
9/16/2004	H03-SG01	30	0	26	36	195	4	979	870	919	908	Will not communicate	FHJ742	ALM034356	CAL013942	
9/16/2004	H03-SG01	30	0	24	47	195	4	980	872	916	871	ISO-9141-2	FHJ742	ALM034356	CAL013942	
9/15/2004	H03-SG01	30	0	27	66	195	4	970	862	915	875	ISO-9141-2	FHJ742	ALM034356	CAL013942	
9/16/2004	H03-SG01	30	0	26	32	195	4	979	870	919	909	Cound not hook VI in	FHJ742	ALM034356	CAL013942	
9/16/2004	H03-SG01	30	0	21	68	195	3	979	874	929	873	ISO-9141-2	FHJ742	ALM034356	CAL013942	
9/17/2004	H03-SG01	30	0	22	55	195	4	978	872	914	877	ISO-9141-2	FHJ742	ALM034356	CAL013942	
9/17/2004	H03-SG01	30	0	26	44	195	4	979	870	920	873	Will not communicate	FHJ742	ALM034356	CAL013942	
9/17/2004	H03-SG01	30	0	27	45	195	4	978	870	918	869	Will not communicate	FHJ742	ALM034356	CAL013942	
9/16/2004	H03-SG01	30	0	25	44	195	4	979	869	914	868	SAE-J1850 VPW	FHJ742	ALM034356	CAL013942	
9/17/2004	H03-SG01	30	0	21	57	195	3	978	872	913	867	SAE-J1850 PWM	FHJ742	ALM034356	CAL013942	
9/18/2004	H03-SG01	30	0	22	80	195	3	981	874	942	897	SAE-J1850 VPW	FHJ742	ALM034356	CAL013942	
9/18/2004	H03-SG01	30	0	32	47	195	4	979	869	918	864	Will not communicate	FHJ742	ALM034356	CAL013942	
9/18/2004	H03-SG01	30	0	32	45	195	4	978	866	917	877	ISO-9141-2	FHJ742	ALM034356	CAL013942	
9/18/2004	H03-SG01	30	0	23	72	195	4	980	873	918	873	Will not communicate	FHJ742	ALM034356	CAL013942	
9/20/2004	H03-SG01	30	0	26	37	195	4	982	871	919	868	ISO-9141-2	FHJ742	ALM034356	CAL013942	
9/20/2004	H03-SG01	30	0	29	34	195	3	979	867	943	866	Will not communicate	FHJ742	ALM034356	CAL013942	
9/20/2004	H03-SG01	30	0	23	45	195	3	981	872	913	865	ISO-9141-2	FHJ742	ALM034356	CAL013942	
9/18/2004	H03-SG01	30	0	28	57	195	4	978	867	924	877	Will not communicate	FHJ742	ALM034356	CAL013942	
9/19/2004	H03-SG01	30	0	29	33	195	4	980	868	922	885	ISO-9141-2	FHJ742	ALM034356	CAL013942	
9/30/2004	H03-SG06	30	0	19	47	194	4	986	859	922	816	SAE-J1850 PWM	FHJ742	ALM034356	CAL013942	
9/20/2004	H03-SG01	30	0	27	36	195	4	980	867	922	885	ISO-9141-2	FHJ742	ALM034356	CAL013942	
9/21/2004	H03-SG01	195	0	27	48	195	3	981	870	940	862	ISO-9141-2	FHJ742	ALM034356	CAL013942	
9/21/2004	H03-SG01	30	0	25	51	195	4	981	873	943	870	ISO-9141-2	FHJ742	ALM034356	CAL013942	
9/21/2004	H03-SG01	30	0	27	46	195	3	981	871	940	866	SAE-J1850 PWM	FHJ742	ALM034356	CAL013942	
9/21/2004	H03-SG01	30	0	31	42	195	4	980	869	939	860	ISO-9141-2	FHJ742	ALM034356	CAL013942	
9/21/2004	H03-SG01	30	0	23	53	195	3	981	872	946	870	ISO-9141-2	FHJ742	ALM034356	CAL013942	
9/22/2004	H03-SG06	30	0	28	43	194	6	990	858	905	873	Will not communicate	FHJ742	ALM034356	CAL013942	
9/22/2004	H03-SG06	30	0	29	39	194	7	890	860	917	879	Will not communicate	FHJ742	ALM034356	CAL013942	

Page 7 (Installation for Dyne Sampling)

		SEMTECH System Information (BKI)										OBDII	Cylinder Numbers			
Date	PEM Serial #	FID Pres (psig)	Battery Voltage (V)	Ambient Temp (C)	RH (%)	FID Oven Temp(C)	Chiller Temp (C)	Amb. P	P1 (mbar)	P2 (mbar)	P3 (mbar)	OBDII protocol	Zero Gas #	Audit Gas #	Span Gas #	Comments
9/22/2004	H03-SG06	30	0	30	40	194	7	989	857	906	877	Will not communicate	FHJ742	ALM034356	CAL013942	
9/22/2004	H03-SG01	30	0	19	63	195	3	983	876	928	928	SAE-J1850 VPW	FHJ742	ALM034356	CAL013942	
9/22/2004	H03-SG06	30	0	25	45	194	5	991	897	908	859		FHJ742	ALM034356	CAL013942	
9/22/2004	H03-SG06	30	0	24	46	194	5	991	887	905	859	SAE-J1850 VPW	FHJ742	ALM034356	CAL013942	
9/23/2004	H03-SG06	30	0	25	57	194	5	987	858	910	871	ISO-9141-2	FHJ742	ALM034356	CAL013942	
9/23/2004	H03-SG06	30	0	25	54	194	6	987	898	914	867	Will not communicate	FHJ742	ALM034356	CAL013942	
9/23/2004	H03-SG06	30	0	23	61	174	5	986	857	944	917	SAE-J1850 PWM	FHJ742	ALM034356	CAL013942	
9/24/2004	H03-SG06	30	0	16	78	193	4	991	863	910	862	ISO-9141-2	FHJ742	ALM034356	CAL013942	
9/24/2004	H03-SG06	30	0	27	34	194	5	991	862	913	875	Will not communicate	FHJ742	ALM034356	CAL013942	
9/24/2004	H03-SG06	30	0	21	58	194	5	991	863	909	861	ISO-9141-2	FHJ742	ALM034356	CAL013942	
9/24/2004	H03-SG06	30	0	25	43	194	6	992	862	913	874	SAE-J1850 VPW	FHJ742	ALM034356	CAL013942	
9/25/2004	H03-SG06	30	0	23	55	194	5	993	864	916	875	SAE-J1850 PWM	FHJ742	ALM034356	CAL013942	
9/25/2004	H03-SG06	30	0	29	32	194	4	992	861	911	886	Will not communicate	FHJ742	ALM034356	CAL013942	
9/25/2004	H03-SG06	30	0	29	33	195	5	993				Will not communicate	FHJ742	ALM034356	CAL013942	
9/25/2004	H03-SG06	30	0	15	79	193	3	992	867	937	905	Will not communicate	FHJ742	ALM034356	CAL013942	
9/13/2004	H03-SG01	30	0	32	39	195	4	974	832	926	878					
9/13/2004	H03-SG01	30	0	27	49	195	4	976	832	914	864	SAE-J1850 PWM	FHJ742	ALM034356	CAL013942	
9/13/2004	H03-SG01	30	0	25	55	182	3	976	868	955	938	ISO-9141-2	FHJ742	ALM034356	CAL013942	
9/13/2004	H03-SG01	30	0	31	42	195	4	975	827	917	872	Will not communicate	FHJ742	ALM034356	CAL013942	
9/13/2004	H03-SG01	30	0	31	42	195	4	975	830	917	871	Will not communicate	FHJ742	ALM034356	CAL013942	
9/27/2004	H03-SG06	30	0	26	40	193	6	989	858	901	884	Will not communicate	FHJ742	ALM034356	CAL013942	
9/27/2004	H03-SG06	30	0	22	63	194	5	990	861	911	866	SAE-J1850 VPW	FHJ742	ALM034356	CAL013942	
9/27/2004	H03-SG06	30	0	22	60	193	5	990	861	911	866	Will not communicate	FHJ742	ALM034356	CAL013942	
9/27/2004	H03-SG06	30	0	16	79	193	5	989	864	907	852	SAE-J1850 VPW	FHJ742	ALM034356	CAL013942	
9/28/2004	H03-SG06	30	0	21	58	194	5	993	863	901	841	SAE-J1850 PWM	FHJ742	ALM034356	CAL013942	
9/28/2004	H03-SG06	30	0	20	59	194	5	993	864	906	858	SAE-J1850 VPW	FHJ742	ALM034356	CAL013942	
9/28/2004	H03-SG06	30	0	20	67	194	5	991	863	901	841	ISO-9141-2	FHJ742	ALM034356	CAL013942	
9/28/2004	H03-SG06	30	0	25	26	194	5	991	862	899	872	Will not communicate	FHJ742	ALM034356	CAL013942	
9/28/2004	H03-SG06	30	0	23	48	194	4	993	864	906	858	Will not communicate	FHJ742	ALM034356	CAL013942	
9/29/2004	H03-SG06	30	0	23	27	194	5	988				Will not communicate	FHJ742	ALM034356	CAL013942	
9/29/2004	H03-SG06	30	0	16	56	194	4	991	864	887	851	ISO-9141-2	FHJ742	ALM034356	CAL013942	
9/29/2004	H03-SG06	30	0	23	27	194	5	989				Will not communicate	FHJ742	ALM034356	CAL013942	
9/29/2004	H03-SG06	30	0	12	70	193	4	991	866	900	828	SAE-J1850 VPW	FHJ742	ALM034356	CAL013942	
9/29/2004	H03-SG06	30	0	19	43	193	5	991				Will not communicate	FHJ742	ALM034356	CAL013942	
9/28/2004	H03-SG06	30	0	25	28	194	6	991	861	899	873	Will not communicate	FHJ742	ALM034356	CAL013942	
9/30/2004	H03-SG06	30	0	19	48	194	4	986	859	923	833	ISO-9141-2	FHJ742	ALM034356	CAL013942	

Page 7 (Installation for Dyne Sampling)																	
		SEMTECH System Information (BKI)										OBDII	Cylinder Numbers				
Date	PEM Serial #	FID Pres (psig)	Battery Voltage (V)	Ambient Temp (C)	RH (%)	FID Oven Temp(C)	Chiller Temp (C)	Amb. P	P1 (mbar)	P2 (mbar)	P3 (mbar)	OBDII protocol	Zero Gas #	Audit Gas #	Span Gas #	Comments	
9/30/2004	H03-SG06	30	0	26	42	193	6	984	855	901	864	Will not communicate	FHJ742	ALM034356	CAL013942		
9/30/2004	H03-SG06	30	0	28	40	194	5	983	853	899	824	Will not communicate	FHJ742	ALM034356	CAL013942		
9/30/2004	H03-SG06	30	0	27	42	194	6	984	855	901	864	SAE-J1850 VPW	FHJ742	ALM034356	CAL013942		
10/1/2004	H03-SG06	30	0	20	77	194	5	982				SAE-J1850 VPW	FHJ742	ALM034356	CAL013942		
10/1/2004	H03-SG06	30	0	21	78	194	5	982				SAE-J1850 VPW	FHJ742	ALM034356	CAL013942		
9/30/2004	H03-SG06	30	0	23	44	194	5	986				ISO-9141-2	FHJ742	ALM034356	CAL013942		
10/1/2004	H03-SG06	30	0	23	69	194	5	981	853	900	844	Will not communicate	FHJ742	ALM034356	CAL013942		
10/1/2004	H03-SG06	30	0	21	66	194	5	982				ISO-9141-2	FHJ742	ALM034356	CAL013942		
1/12/2005	H03-SG01	30	N/A	4	85	195	4	960	851	918	910	Vehicle will not commur	FHJ742	ALM034356	ALM060855	Flow meter # H04 SE02	
1/12/2005	H03-SG01	30	N/A	4	81	195	4	962	853	920	891	Vehicle will not commur	FHJ742	ALM034356	ALM060855		
1/12/2005	H03-SG01	30	N/A	4	76	195	4	962	856	923	916	SAE-J1850 VPW	FHJ742	ALM034356	ALM060855	Flow meter SN: K04 SE	
1/12/2005	H03-SG01	30	N/A	4	84	196	4	962	852	915	886	ISO-9141-2	FHJ742	ALM034356	ALM060855	Flow meter SN: K04 SE	
1/13/2005	H03-SG01	30	N/A	0	59	195	4	980	874	936	907	ISO-9141-2	FHJ742	ALM034356	ALM060855		
1/13/2005	H03-SG01	30	N/A	-1	58	195	4	982	878	936	917	ISO-9141-2	FHJ742	ALM034356	ALM060855	Flo meter SN: K04-SE0	
1/13/2005	H03-SG01	30	N/A	2	58	195	4	976	872	939	934	ISO-9141-2	FHJ742	ALM034356	ALM060855		
1/13/2005	H03-SG01	30	N/A	-1	52	195	4	983	878	937	908	Vehicle will not commur	FHJ742	ALM034356	ALM060855		
		30	N/A	-6	41	192	6	1001	903							No run Semtech down.	
1/14/2005	H03-SG01	30	N/A	-3	31	195	4	987	893	756	753	Vehicle will not commur	FHJ742	ALM034356	ALM060855		
1/14/2005	H03-SG01	30	N/A	-11	56	195	4	999	896	959	954	ISO-9141-2	FHJ742	ALM034356	ALM060855		
1/15/2005	H03-SG01	1996	N/A	57 F	15	195	4	1001	896	561	567		FHJ742	ALM034356	ALM060855		
1/15/2005	H03-SG01	1986	N/A	-6	55	195	4	1004	898	972	966	SAE-J1850 VPW	FHJ742	ALM034356	ALM060855		
1/15/2005	H03-SG01	1985	N/A	56.5 F	17	195	4	1001	898	381	566	ISO-9141-2	FHJ742	ALM034356	ALM060855	P2 - Faults 1	
1/15/2005	H03-SG01	2000	N/A	57.7 F	15	195	4	1002	895	964	900	SAE-J1850 VPW	FHJ742	ALM034356	ALM060855		
1/17/2005	H03-SG05	30	N/A	2	33	193	6	1008	889	957	933	SAE-J1850 VPW	FHJ742	ALM034356	ALM060855		
1/17/2005	H03-SG01	30	N/A	1	33	195	4	1001	895	957	905	SAE-J1850 VPW	FHJ742	ALM034356	ALM060855		
1/17/2005	H03-SG01	30	N/A	-2	45	195	4	1001	892	963	958	SAE-J1850 VPW	FHJ742	ALM034356	ALM060855		
1/17/2005	H03-SG01	30	N/A	0	34	195	4	1002	896	964	919	ISO-9141-2	FHJ742	ALM034356	ALM060855		
1/17/2005	H03-SG01	30	N/A	1	30	195	4	1002	897	960	880	ISO-9141-2	FHJ742	ALM034356	ALM060855		
1/18/2005	H03-SG05	30	N/A	3	40	193	6	1003	855	906	883	ISO-9141-2	FHJ742	ALM034356	ALM060855		
1/18/2005	H03-SG05	30	N/A	3	40	193	6	1003	885	906	883	Vehicle will not commur	FHJ742	ALM034356	ALM060855		
1/18/2005	H03-SG05	30	N/A	0	45	193	6	1004	884	963	941	ISO-9141-2	FHJ742	ALM034356	ALM060855		
1/18/2005	H03-SG05	30	N/A	5	44	193	6	998	879	927	886	Vehicle will not commur	FHJ742	ALM034356	ALM060855		
1/18/2005	H03-SG05	30	N/A	2	40	193	6	1003	884	907	876	SAE-J1850 VPW	FHJ742	ALM034356	ALM060855		
1/19/2005	H03-SG05	30	N/A	11	54	193	6	995	875	924	844	SAE-J1850 VPW	FHJ742	ALM034356		OBDII Protocol - V1 wo	
1/19/2005	H03-SG05	30	N/A	10	56	194	6	993	874	916	879	Vehicle will not commur	FHJ742	ALM034356	ALM060855		
1/19/2005	H03-SG05	30	N/A	5	66	193	6	993	874	932	924	SAE-J1850 VPW	FHJ742	ALM034356	ALM060855		
1/19/2005	H03-SG05	30	N/A	7	63	193	6	994	874	921	852	ISO-9141-2	FHJ742	ALM034356	ALM060855		
1/19/2005	H03-SG05	30	N/A	10	55	193	6	993	872	913	841	Vehicle will not commur	FHJ742	ALM034356	ALM060855		
1/20/2005	H03-SG05	30	N/A	12	57	193	6	983	863	912	853	ISO-9141-2	FHJ742	ALM034356	ALM060855		
1/20/2005	H03-SG05	30	N/A	19	16	193	6	981	860	888	861	Vehicle will not commur	FHJ742	ALM034356			
1/20/2005	H03-SG05	30	N/A	14	53	194	6	982	848	851	847	Vehicle will not commur	FHJ742	ALM034356	ALM060855		
1/20/2005	H03-SG05	30	N/A	6	75	193	6	983	864	923	935	SAE-J1850 VPW	FHJ742	ALM034356	ALM060855		

Page 7 (Installation for Dyne Sampling)																
		SEMTECH System Information (BKI)										OBDII	Cylinder Numbers			
Date	PEM Serial #	FID Pres (psig)	Battery Voltage (V)	Ambient Temp (C)	RH (%)	FID Oven Temp(C)	Chiller Temp (C)	Amb. P	P1 (mbar)	P2 (mbar)	P3 (mbar)	OBDII protocol	Zero Gas #	Audit Gas #	Span Gas #	Comments
1/21/2005	H03-SG05	30	N/A	5	69	193	6	983	863	892	833	Vehicle will not commu	FHJ742	ALM034356		
1/21/2005	H03-SG05	30	N/A	5	72	193	6	987	869	918	916	SAE-J1850 VPW	FHJ742	ALM034356		OBD II Protocol - V1 no
1/21/2005	H03-SG05	30	N/A	6	66	193	6	981	863	864	827	Vehicle will not commu	FHJ742	ALM034356	ALM060855	
1/21/2005	H03-SG05	30	N/A	6	63	193	6	986	869	886	827	Vehicle will not commu	FHJ742	ALM034356		
1/22/2005	H03-SG05	30	N/A	-4	35	193	5	999	882	924	895					
1/21/2005	H03-SG05	30	N/A	-5	48	193	5	1001	884	890	830		FHJ742	ALM034356		OBD II Protocol - V1 no
1/22/2005	H03-SG05	30	N/A	-7	41	193	5	999	883	924	895	SAE-J1850 VPW	FHJ742	ALM034356		OBD II Protocol - V1 no
1/22/2005	H03-SG05	30	N/A	-5	40	193	5	996				Vehicle will not commu	FHJ742	ALM034356		
1/25/2005	H03-SG05	30	N/A	8	53	193	6	980	861	918	908	Vehicle will not commu	FHJ742	ALM034356		Semtech - changed filte
1/25/2005	H03-SG05	30	N/A	8	54	193	6	980	860	915	908	Vehicle will not commu	FHJ742	ALM034356	ALM060855	
1/25/2005	H03-SG05	30	N/A	15	39	193	6	976	855	883	826	Vehicle will not commu	FHJ742	ALM034356		
1/25/2005	H03-SG05	30	N/A	14	41	193	6	977	856	877	831	Vehicle will not commu	FHJ742	ALM034356		
1/26/2005	H03-SG05	30	N/A	8	60	193	6	990	870	885	867	Vehicle will not commu	FHJ742	ALM034356	ALM060855	
1/26/2005	H03-SG05	30	N/A	8	53	193	5	992	872	908	836	Vehicle will not commu	FHJ742	ALM034356		
1/27/2005	H03-SG05	30	N/A	5	53	193	6	999	879	934	829	Vehicle will not commu	ALM035591	ALM034356		
1/26/2005	H03-SG05	30	N/A	3	76	193	5	988	870	934	922	Vehicle will not commu	FHJ742	ALM034356	ALM060855	
1/26/2005	H03-SG05	30	N/A	8	55	193	6	992	871	873	857	Vehicle will not commu	FHJ742	ALM034356		
1/27/2005	H03-SG05	30	N/A	5	62	193	6	1000	880	893	821	Vehicle will not commu	ALM035591	ALM034356		
1/27/2005	H03-SG05	30	N/A	2	66	193	6	1000	879	942	935	Vehicle will not commu	FHJ742	ALM034356		
1/27/2005	H03-SG05	30	N/A	5	61	193	6	1000	879	892	825	Vehicle will not commu	ALM035591	ALM034356		
1/28/2005	H03-SG05	30	N/A	5	44	193	6	996	875	879	862	Vehicle will not commu	ALM035591	ALM034356		
1/29/2005	H03-SG05	30	N/A	4	70	193	6	992	871	849	812	Vehicle will not commu	ALM035591	ALM034356		
1/28/2005	H03-SG05	30	N/A	4		193	6	995	875	894	845	Vehicle will not commu	ALM035591	ALM034356		
1/28/2005	H03-SG05	30	N/A	6	42	193	6	992	872	931	884	Vehicle will not commu	ALM035591	ALM034356		
1/29/2005	H03-SG05	30	N/A	2	78	193	5	991	871	933	934	Vehicle will not commu	ALM035591	ALM034356		
1/29/2005	H03-SG05	30	N/A	7	57	193	6	991	869	828	811	Vehicle will not commu	ALM035591	ALM034356		
1/29/2005	H03-SG05	30	N/A	4	74	193	6	991	871	879	857	Vehicle will not commu	ALM035591	ALM034356		
2/1/2005	H03-SG01	30	N/A	5	69	193	6	998	878	928	922	ISO-9141-2	ALM035591	ALM034356		
1/31/2005	H03-SG05	30	N/A	7	66	193	6	995	874	912	881	Vehicle will not commu	ALM035591	ALM034356		
1/31/2005	H03-SG05	30	N/A	5	71	193	6	996	875	905	854	ISO-9141-2	ALM035591	ALM034356		
2/1/2005	H03-SG05	30	N/A	7	52	193	6	997	876	924	897	Vehicle will not commu	ALM035591	ALM034356		
2/1/2005	H03-SG05	30	N/A	5	63	194	6	998	876	933	894	Vehicle will not commu	ALM035591	ALM034356		
2/2/2005	H03-SG05	30	N/A	4	64	193	6	997	878	897	885	Vehicle will not commu	ALM035591	ALM034356		
2/2/2005	H03-SG05	30	N/A	4	63	193	6	997	877	898	883	Vehicle will not commu	ALM035591	ALM034356		
2/2/2005	H03-SG05	30	N/A	5	44	193	6	996	876	929	865	Vehicle will not commu	ALM035591	ALM034356		
2/3/2005	H03-SG05	30	N/A	11	47	193	6	998	877	928	893	SAE-J1850 PWM	ALM035591	ALM034356		OBD II Protocol - V1 no
2/3/2005	H03-SG05	30	N/A	10	48	193	6	999	877	928	892	SAE-J1850 VPW	ALM035591	ALM034356		
2/3/2005	H03-SG05	30	N/A	1	65	193	5	999	879	936	931	SAE-J1850 PWM	ALM035591	ALM034356		
2/3/2005	H03-SG05	30	N/A	15	39	193	6	996	874	926	909	Vehicle will not commu	ALM035591	ALM034356		
2/4/2005	H03-SG05	30	N/A	10	53	193	6	997	878	892	891	ISO-9141-2	ALM035591	ALM034356		OBD II Protocol - V1 no
2/4/2005	H03-SG05	30	N/A	11	53	193	6	996	878	893	894	Vehicle will not commu	ALM035591	ALM034356		
2/4/2005	H03-SG05	30	N/A	11	53	193	6	996	878	893	894	ISO-9141-2	ALM035591	ALM034356		OBD II Protocol - V1 no
2/4/2005	H03-SG05	30	N/A	17	32	193	6	994	872	910	877	Vehicle will not commu	ALM035591	ALM034356		
2/5/2005	H03-SG05	30	N/A	12	44	193	6	991	871	918	857	SAE-J1850 PWM	ALM035591	ALM034356		OBD II Protocol - V1 no
2/5/2005	H03-SG05	30	N/A	12	44	193	6	991	871	918	857		ALM035591	ALM034356		

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		SEMTECH System Information (BKI)										OBDII	Cylinder Numbers			
Date	PEM Serial #	FID Pres (psig)	Battery Voltage (V)	Ambient Temp (C)	RH (%)	FID Oven Temp(C)	Chiller Temp (C)	Amb. P	P1 (mbar)	P2 (mbar)	P3 (mbar)	OBDII protocol	Zero Gas #	Audit Gas #	Span Gas #	Comments
2/5/2005	H03-SG05	30	N/A	13	42	193	6	991	871	913	852	Vehicle will not commu	ALM035591	ALM034356		OBD II Protocol - V1 no
2/7/2005	H03-SG05	30	N/A	1	78	193	6	990	870	914	853	Vehicle will not commu	ALM035591	ALM034356		
2/7/2005	H03-SG05	30	N/A	0	76	193	5	991	872	907	849	Vehicle will not commu	ALM035591	ALM034356		
2/7/2005	H03-SG05	30	N/A	2	78	193	5	989	870	912	858		ALM035591	ALM034356		
2/7/2005	H03-SG05	30	N/A	0	74	193	5	990	872	900	864	Vehicle will not commu	ALM035591	ALM034356		
2/8/2005	H03-SG05	30	N/A	-2	66	193	5	993	875	930	923		ALM035591	ALM034356		Void test traction contro
2/8/2005	H03-SG05	30	N/A	-2	73	193	5	993	875	918	893	ISO-9141-2	ALM035591	ALM034356		
2/8/2005	H03-SG05	30	N/A	-3	78	193	5	992	875	930	924	SAE-J1850 PWM	ALM035591	ALM034356		
2/8/2005	H03-SG05	30	N/A	-1	79	193	6	990	873	902	847	Vehicle will not commu	ALM035591	ALM034356		
2/8/2005	H03-SG05	30	N/A	0	76	193	5	989	872	895	847		ALM035591	ALM034356		
2/8/2005	H03-SG05	30	N/A	-1	73	193	5	991	873	916	860	ISO-9141-2	ALM035591	ALM034356		
2/9/2005	H03-SG05	30	N/A	2	47	193	5	992	873	924	858	Vehicle will not commu	ALM035591	ALM034356		
2/9/2005	H03-SG05	30	N/A	0	49	193	6	993	874	900	857	Vehicle will not commu	ALM035591	ALM034356		
2/9/2005	H03-SG05	30	N/A	-3	57	193	5	993	877	932	940	SAE-J1850 PWM	ALM035591	ALM034356		
2/9/2005	H03-SG05	30	N/A	-1	51	193	5	994	877	918	865	ISO-9141-2	ALM035591	ALM034356		
2/9/2005	H03-SG05	30	N/A	-1	51	193	5	994	876	919	868	SAE-J1850 VPW	ALM035591	ALM034356		
2/10/2005	H03-SG05	30	N/A	0	59	193	5	998	880	921	868	Vehicle will not commu	ALM035591	ALM034356		
2/10/2005	H03-SG05	30	N/A	-5	72	193	5	998	880	935	931	Vehicle will not commu	ALM035591	ALM034356		
2/10/2005	H03-SG05	30	N/A	6	48	193	6	997	875	838	802	Vehicle will not commu	ALM035591	ALM034356		
2/10/2005	H03-SG05	30	N/A	3	53	193	5	999	880	911	841	Vehicle will not commu	ALM035591	ALM034356		
2/11/2005	H03-SG05	30	N/A	5	58	193	5	996	875	910	852	SAE-J1850 VPW	ALM035591	ALM034356		OBD II Protocol - V1 no
2/11/2005	H03-SG05	30	N/A	7	55	193	6	996	875	886	828	Vehicle will not commu	ALM035591	ALM034356		
2/11/2005	H03-SG05	30	N/A	0	72	193	5	995	876	931	924	SAE-J1850 VPW	ALM035591	ALM034356		OBD II Protocol - V1 no
2/12/2005	H03-SG05	30	N/A	7	71	193	6	984	865	846	822		ALM035591	ALM034356		
2/12/2005	H03-SG05	30	N/A	9	66	193	6	984	864	823	800	Vehicle will not commu	ALM035591	ALM034356		
2/12/2005	H03-SG05	30	N/A	11	75	193	6	982	861	821	792	ISO-9141-2	ALM035591	ALM034356		
2/12/2005	H03-SG05	30	N/A	6	73	193	6	984	864	936	912	ISO-9141-2	ALM035591	ALM034356		OBD II Protocol - V1 co
2/15/2005	H03-SG05	30	N/A	8	76	193	6	979	859	914	908	ISO-9141-2	ALM035591	ALM034356		
2/15/2005	H03-SG05	30	N/A	9	73	193	6	980	859	903	881	Vehicle will not commu	ALM035591	ALM034356		
2/15/2005	H03-SG05	30	N/A	11	65	193	6	981	860	894	877	Vehicle will not commu	ALM035591	ALM034356		
2/15/2005	H03-SG05	30	N/A	13	50	193	6	981	860	852	883	Vehicle will not commu	ALM035591	ALM034356		
2/16/2005	H03-SG05	30	N/A	4	65	193	5	995	874	930	927	SAE-J1850 VPW	ALM035591	ALM034356		
2/16/2005	H03-SG05	30	N/A	6	56	193	5	995	874	916	893	SAE-J1850 VPW	ALM035591	ALM034356		
2/16/2005	H03-SG05	30	N/A	6	52	193	6	996	874	911	888	Vehicle will not commu	ALM035591	ALM034356		
2/17/2005	H03-SG05	30	N/A	1	70	193	5	996	876	933	930	SAE-J1850 VPW	ALM035591	ALM034356		
2/17/2005	H03-SG05	30	N/A	5	53	193	5	996	876	882	888	SAE-J1850 VPW	ALM035591	ALM034356		
2/17/2005	H03-SG05	30	N/A	10	39	193	6	993	873	870	837	ISO-9141-2	ALM035591	ALM034356		
2/17/2005	H03-SG05	30	N/A	7	40	193	6	996	875	882	856	SAE-J1850 VPW	ALM035591	ALM034356		
2/17/2005	H03-SG05	30	N/A	12	33	194	6	993	870	881	834	Vehicle will not commu	ALM035591	ALM034356		
2/18/2005	H03-SG05	30	N/A	10	32	193	6	996	874	808	853	Vehicle will not commu	ALM035591	ALM034356		
2/18/2005	H03-SG05	30	N/A	0	63	193	5	997	877	931	929	SAE-J1850 VPW	ALM035591	ALM034356		
2/18/2005	H03-SG05	30	N/A	7	38	193	6	997	875	864	879	Vehicle will not commu	ALM035591	ALM034356		
2/18/2005	H03-SG05	30	N/A	5	42	193	6	997	876	875	867	ISO-9141-2	ALM035591	ALM034356		
2/18/2005	H03-SG05	30	N/A	2	52	193	5	998	878	885	884	SAE-J1850 PWM	ALM035591	ALM034356		
2/19/2005	H03-SG05	30	N/A	8	76	193	6	987	866	858	836	Vehicle will not commu	ALM035591	ALM034356		

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		SEMTECH System Information (BKI)										OBDII	Cylinder Numbers			
Date	PEM Serial #	FID Pres (psig)	Battery Voltage (V)	Ambient Temp (C)	RH (%)	FID Oven Temp(C)	Chiller Temp (C)	Amb. P	P1 (mbar)	P2 (mbar)	P3 (mbar)	OBDII protocol	Zero Gas #	Audit Gas #	Span Gas #	Comments
2/19/2005	H03-SG05	30	N/A	8	75	193	6	991	870	925	918	SAE-J1850 PWM	ALM035591	ALM034356		
2/19/2005	H03-SG05	30	N/A	8	73	193	6	991	870	888	863	Vehicle will not commu	ALM035591	ALM034356		
2/19/2005	H03-SG05	30	N/A	9	73	193	6	989	869	875	848	Vehicle will not commu	ALM035591	ALM034356		
2/21/2005	H03-SG05	30	N/A	6	69	193	6	989	867	840	812	Vehicle will not commu	ALM035591	ALM034356		
2/21/2005	H03-SG05	30	N/A	4	77	193	5	988	867	912	909	Vehicle will not commu	ALM035591	ALM034356		
2/21/2005	H03-SG05	30	N/A	4	75	193	6	989	869	921	901	Vehicle will not commu	ALM035591	ALM034356		
2/22/2005	H03-SG05	30	N/A	7	71	193	6	994	875	931	927	SAE-J1850 PWM	ALM035591	ALM034356		
3/12/2005	H03-SG05	30	N/A	13	38	193	6	969	847	892	889	Vehicle will not commu	ALM010707	ALM034356		
3/18/2005	H03-SG05	30	N/A	12	37	193	6	976	854	905	903	Vehicle will not commu	ALM010707	ALM034356		
3/25/2005	H03-SG05	30	N/A	20	35	193	6	983	862	915	912	SAE-J1850 VPW	ALM010707	ALM034356	ALM060855	
2/23/2005	H03-SG05	30	N/A	9	47	193	6	994	873	930	927	SAE-J1850 VPW	ALM035591	ALM034356		
2/23/2005	H03-SG05	30	N/A	9	48	193	6	993	870	921	883		ALM035591	ALM034356		
2/23/2005	H03-SG05	30	N/A	9	50	193	6	994	872	927	881	Vehicle will not commu	ALM035591	ALM034356		
3/11/2005	H03-SG05	30	N/A	6	42	193	6	985	865	917	913	ISO-9141-2	ALM010707	ALM034356		
2/24/2005	H03-SG05	30	N/A	8	60	193	6	991	869	880	856	Vehicle will not commu	ALM035591	ALM034356		
2/24/2005	H03-SG05	30	N/A	6	66	193	6	990	869	925	921	Vehicle will not commu	ALM035591	ALM034356		
2/25/2005	H03-SG05	30	N/A	10	44	193	6	989	868	876	847	ISO-9141-2	ALM035591	ALM034356		
2/25/2005	H03-SG05	30	N/A	10	44	194	6	988	867	885	851	Vehicle will not commu	ALM035591	ALM034356		
2/25/2005	H03-SG05	30	N/A	13	37	193	6	989	866	888	850	SAE-J1850 VPW	ALM035591	ALM034356		
3/21/2005	H03-SG05	30	N/A	12	44	192	6	981	860	810	933		ALM010707	ALM034356		
2/26/2005	H03-SG05	30	N/A	9	50	193	6	991	869	917	864	Vehicle will not commu	ALM035591	ALM034356		
2/26/2005	H03-SG05	30	N/A	10	50	193	6	990	868	860	824	ISO-9141-2	ALM035591	ALM034356		
2/26/2005	H03-SG05	30	N/A	6	58	193	5	991	870	925	925	Vehicle will not commu	ALM035591	ALM034356		
2/28/2005	H03-SG05	30	N/A	2	52	193	5	985	865	910	847	Vehicle will not commu	ALM035591	ALM034356		
2/28/2005	H03-SG05	30	N/A	3	52	194	6	984	864	921	947	SAE-J1850 PWM	ALM035591	ALM034356		
2/28/2005	H03-SG05	30	N/A	1	58	193	5	985	865	914	848	SAE-J1850 PWM	ALM035591	ALM034356		
3/26/2005	H03-SG05	30	N/A	5	77	193	5	989	867	918	909	Vehicle will not commu	ALM010707	ALM038949		
1/1/2005	H03-SG05	30	N/A	-2	55	193	5	990	871	927	923	ISO-9141-2	ALM035591	ALM034356		
				0	47	193	5	991	872	913	886					Information pulled off se
1/1/2005	H03-SG05	30	N/A	2	37	193	5	991	871	903	851	Vehicle will not commu	ALM035591	ALM034356		
3/31/2005	H03-SG05	30	N/A	11	58	194	6	986	836	871	875	ISO 9141	ALM010707	ALM038949		
3/2/2005	H03-SG05	30	N/A	2	62	193	5	987	868	920	918	Vehicle will not commu	ALM035591	ALM034356		
3/30/2005	H03-SG05	30	N/A	18	48	193	5	963	843	893	913	J1850VPW	ALM010707	ALM034949		
3/3/2005	H03-SG05	30	N/A	7	51	193	6	987	865	916	912	Vehicle will not commu	ALM035591	ALM034356		
3/4/2005	H03-SG05	30	N/A	13	65	193	6	984	862	862	816	Vehicle will not commu	ALM035591	ALM034356		
3/4/2005	H03-SG05	30	N/A	8	75	193	6	984	863	873	854	Vehicle will not commu	ALM035591	ALM034356		
3/4/2005	H03-SG05	30	N/A	5	79	193	5	984	863	910	906	ISO-9141-2	ALM035591	ALM034356		
3/5/2005	H03-SG05	2498	N/A	6	62	193	6	994	872	892	872	N/A				
3/8/2005	H03-SG05	2498	N/A	11	31	193	5	985	865	866	833		ALM035591	ALM034356	ALM060855	
3/5/2005	H03-SG05	2498	N/A	5	66	194	6	1019	818	834	860	SAE-J1850 PWM	ALM035591	ALM034356		I04SE07. Phase 1 of ru
3/5/2005	H03-SG05	2490	N/A	9	54	193	6	995	873	893	834	Vehicle will not commu	ALM035591	ALM034356		

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		SEMTECH System Information (BKI)										OBDII	Cylinder Numbers			
Date	PEM Serial #	FID Pres (psig)	Battery Voltage (V)	Ambient Temp (C)	RH (%)	FID Oven Temp(C)	Chiller Temp (C)	Amb. P	P1 (mbar)	P2 (mbar)	P3 (mbar)	OBDII protocol	Zero Gas #	Audit Gas #	Span Gas #	Comments
3/7/2005	H03-SG05	30	N/A	11	55	193	6	976	855	873	851	SAE-J1850 VPW	ALM035591	ALM034356		
3/7/2005	H03-SG05	30	N/A	12	52	193	6	976	854	900	895	ISO-9141-2	ALM035591	ALM034356		
3/7/2005	H03-SG05	30	N/A	11	53	193	5	978	856	903	881	Vehicle will not commu	ALM035591	ALM034356		
3/7/2005	H03-SG05	30	N/A	11	48	193	6	977	857	901	895	Vehicle will not commu	ALM035591	ALM034356		
3/7/2005	H03-SG05	30	N/A	11	41	193	6	977	856	901	890	Vehicle will not commu	ALM035591	ALM034356		
3/8/2005	H03-SG05	30	N/A	4	44	193	6	986	866	878	862					
3/8/2005	H03-SG05	2498	N/A	8	40	193	6	986	865	872	848		ALM035591	ALM034356	ALM060855	
3/8/2005	H03-SG05	30	N/A	3	55	193	5	986	866	925	919	ISO-9141-2	ALM035591	ALM034356		
3/9/2005	H03-SG05	30	N/A	3	53	193	5	988	867	928	917	SAE-J1850 VPW	ALM035591	ALM034356		
3/10/2005	H03-SG05	30	N/A	14	38	193	6	979	856	844	818	Vehicle will not commu	ALM035591	ALM034356		
3/9/2005	H03-SG05	30	N/A	4	45	194	5	990	868	871	843	Vehicle will not commu	ALM035591	ALM034356		
3/9/2005	H03-SG05	30	N/A	3	51	193	6	989	868	883	844	ISO-9141-2	ALM035591	ALM034356		
4/5/2005	H03-SG05	30	N/A	21	62	193	6	974	852	902	848	ISO-9141-2	ALM010707	ALM038949		
4/6/2005	H03-SG05	30	N/A	18	70	193	6	978	856	870	852	ISO-9141-2	ALM010707	ALM038949		
4/6/2005	H03-SG05	30	N/A	20	61	193	6	979	857	846	856	ISO-9141-2	ALM010707	ALM038949		
4/5/2005	H03-SG05	30	N/A	22	54	193	6	975	853	883	861	ISO-9141-2	ALM010707	ALM038949		
4/5/2005	H03-SG05	30	N/A	20	66	193	6	974	852	874	848	SAE-J1850 VPW	ALM010707	ALM038949		
4/2/2005	H03-SG05	30	N/A	21	38	193	6	978	855	898	847	ISO-9141-2	ALM010707	ALM038949		
4/4/2005	H03-SG05	30	N/A	20	40	193	6	978	855	907	847	SAE-J1850 VPW	ALM010707	ALM038949		
4/4/2005	H03-SG05	30	N/A	18	40	194	6	978	854	912	908	SAE-J1850 VPW	ALM010707	ALM038949		
3/15/2005	H03-SG05	30	N/A	7	35	194	5	993	871	926	925	Vehicle will not commu	ALM010707	ALM034356		
3/10/2005	H03-SG05	30	N/A	12	46	193	6	979	858	871	844	Vehicle will not commu	ALM035591	ALM034356		
3/10/2005	H03-SG05	30	N/A	9	54	194	5	979	858	880	908	Vehicle will not commu	ALM035591	ALM034356		
3/11/2005	H03-SG05	30	N/A	7	38	193	6	985	864	868	835	Vehicle will not commu	ALM010707	ALM034356		
3/11/2005	H03-SG05	30	N/A	13	33	193	5	980	859	855	827	Vehicle will not commu	ALM010707	ALM034356		
3/11/2005	H03-SG05	30	N/A	15	27	193	5	978	858	840	821	Vehicle will not commu	ALM010707	ALM034356		
3/11/2005	H03-SG05	30	N/A	8	38	193	6	984	863	855	819	Vehicle will not commu	ALM010707	ALM034356		
3/12/2005	H03-SG05	30	N/A	9	56	194	6	969	850	930	895	ISO-9141-2	ALM010707	ALM034356		
3/12/2005	H03-SG05	30	N/A	20	24	194	6	970	848	897	867	Vehicle will not commu	ALM010707	ALM034356		
3/12/2005	H03-SG05	30	N/A	16	32	193	6	969	848	900	852	Vehicle will not commu	ALM010707	ALM034356		
3/14/2005	H03-SG05	30	N/A	4	57	194	5	991	871	926	922	Vehicle will not commu	ALM010707	ALM034356		
3/14/2005	H03-SG05	30	N/A	7	44	193	6	992	871	905	877	Vehicle will not commu	ALM010707	ALM034356		
3/14/2005	H03-SG05	30	N/A	11	30	193	6	990	868	885	867	Vehicle will not commu	ALM010707	ALM034356		
3/15/2005	H03-SG05	30	N/A	10	28	193	6	993	871	881	883	Vehicle will not commu	ALM010707	ALM034356		
3/15/2005	H03-SG05	30	N/A	14	24	193	6	991	867	887	895	Vehicle will not commu	ALM010707	ALM034356		
3/16/2005	H03-SG05	30	N/A	9	62	193	6	991	869	882	849	Vehicle will not commu	ALM010707	ALM034356		
3/15/2005	H03-SG05	30	N/A	12	28	193	6	992	870	883	886	Vehicle will not commu	ALM010707	ALM034356		
3/15/2005	H03-SG05	30	N/A	13	26	194	6	992	869	905	900		ALM010707	ALM034356		
3/15/2005	H03-SG05	30	N/A	14	25	193	6	990	867	861	885	Vehicle will not commu	ALM010707	ALM034356		
3/16/2005	H03-SG05	30	N/A	16	25	193	6	986	864	787	802	Vehicle will not commu	ALM010707	ALM03435		
3/16/2005	H03-SG05	30	N/A	6	71	193	5	991	869	933	920	Vehicle will not commu	ALM010707	ALM034356		
3/16/2005	H03-SG05	30	N/A	15	32	193	6	987	864	790	792	Vehicle will not commu	ALM010707	ALM034356		
3/16/2005	H03-SG05	30	N/A	13	42	194	6	988	866	855	818	Vehicle will not commu	ALM010707	ALM034356		
3/16/2005	H03-SG05	30	N/A	11	57	193	6	990	867	895	855	Vehicle will not commu	ALM010707	ALM034356		
3/17/2005	H03-SG05	30	N/A	13	34	193	6	982	862	784	798	Vehicle will not commu	ALM010707	ALM034356		

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Date	PEM Serial #	FID Pres (psig)	Battery Voltage (V)	Ambient Temp (C)	RH (%)	FID Oven Temp(C)	Chiller Temp (C)	Amb. P	P1 (mbar)	P2 (mbar)	P3 (mbar)	OBDII protocol	Zero Gas #	Audit Gas #	Span Gas #	Comments
		SEMTECH System Information (BKI)										OBDII	Cylinder Numbers			
3/17/2005	H03-SG05	30	N/A	15	30	193	6	980	860	877	910	Vehicle will not commu	ALM010707	ALM034356		
3/17/2005	H03-SG05	30	N/A	11	44	193	6	983	861	875	874	Vehicle will not commu	ALM010707	ALM034356		
3/30/2005	H03-SG05	36	N/A	19	48	193	6	964	843	858	836	Vehicle will not commu	ALM010707	ALM038949		
3/17/2005	H03-SG05	30	N/A	17	23	193	6	978	856	842	847	Vehicle will not commu	ALM010707	ALM034356		
3/17/2005	H03-SG05	30	N/A	9	53	193	5	983	862	923	914	Vehicle will not commu	ALM010707	ALM034356		
3/17/2005	H03-SG05	30	N/A	16	26	193	6	978	858	870	857	Vehicle will not commu	ALM010707	ALM034356		
3/18/2005	H03-SG05	30	N/A	13	33	193	6	975	854	874	846	Vehicle will not commu	ALM010707	ALM034356		
3/18/2005	H03-SG05	30	N/A	17	32	193	6	973	852	887	848	Vehicle will not commu	ALM010707	ALM034356		
3/18/2005	H03-SG05	30	N/A	19	27	193	6	973	851	894	818	Vehicle will not commu	ALM010707	ALM034356		
3/18/2005	H03-SG05	30	N/A	14	31	193	6	975	853	870	839	Vehicle will not commu	ALM010707	ALM034356		
3/18/2005	H03-SG05	30	N/A	18	30	193	6	973	851	882	836	Vehicle will not commu	ALM010707	ALM034356		
3/19/2005	H03-SG05	30	N/A	10	35	193	6	987	865	899	915	Vehicle will not commu	ALM010707	ALM034356		
3/19/2005	H03-SG05	30	N/A	10	38	193	6	987	865	816	788	Vehicle will not commu	ALM010707	ALM034356		
3/19/2005	H03-SG05	30	N/A	6	46	193	5	987	866	842	829	Vehicle will not commu	ALM010707	ALM034356		
3/19/2005		30	N/A	7	44	194	5	988	866	842	805	Vehicle will not commu	ALM010707	ALM034356		
3/19/2005	H03-SG05	30	N/A	5	50	194	5	986	866	882	882	Vehicle will not commu	ALM010707	ALM034356		
3/21/2005	H03-SG05	30	N/A	13	43	193	6	982	860	865	883	Vehicle will not commu	ALM010707	ALM034356		
3/21/2005	H03-SG05	30	N/A	12	57	193	6	979	857	869	884	Vehicle will not commu	ALM010707	ALM034356		
3/21/2005	H03-SG05	30	N/A	13	48	194	6	979	857	870	875	Vehicle will not commu	ALM010707	ALM034356		
3/21/2005	H03-SG05	30	N/A	14	40	194	6	980	858	854	880	Vehicle will not commu	ALM010707	ALM034356		
3/21/2005	H03-SG05	30	N/A	12	42	193	6	982	860	880	891	Vehicle will not commu	ALM010707	ALM034356		
3/22/2005	H03-SG05	30	N/A	5	84	193	6	979	858	884	877	Vehicle will not commu	ALM010707	ALM034356		
3/22/2005	H03-SG05	30	N/A	4	84	193	5	979	857	902	866	Vehicle will not commu	ALM010707	ALM034356		
3/22/2005	H03-SG05	30	N/A	5	80	193	6	979	858	876	866	Vehicle will not commu	ALM010707	ALM034356		
4/8/2005	H03-SG05	30	N/A	21	29	193	6	984	861	883	866	Vehicle will not commu	ALM010707	ALM038949		
3/23/2005	H03-SG05	30	N/A	10	60	194	6	983	861	885	867	Vehicle will not commu	ALM010707	ALM034356		
3/28/2005	H03-SG05	30	N/A	10	56	193	6	983	862	860	857	Vehicle will not commu	ALM010707	ALM034356		
		30		5	74	193	5	984	863	916	915		ALM010707	ALM034356		On front of folder.
3/23/2005	H03-SG05	30	N/A	9	65	193	6	984	863	911	876	Vehicle will not commu	ALM010707	ALM034356		
3/23/2005	H03-SG05	30	N/A	5	72	193	5	985	864	885	880	Vehicle will not commu	ALM010707	ALM034356		
3/23/2005	H03-SG05	30	N/A	7	68	193	6	985	878	863	857	Vehicle will not commu	ALM010707	ALM034356		
3/24/2005	H03-SG05	2498	N/A	20.9	37.5	193	6	1011	862	917	911	SAE-J1850 VPW	ALM010707	ALM034356		
3/23/2005	H03-SG05	2498	N/A	21.5	33	194	6	1008	810	822	836		ALM010707	ALM034356		
3/23/2005	H03-SG05	2498	N/A	21.6	34.4	193	6	981	858	892	871		ALM010707	ALM034356		
3/25/2005	H03-SG05	30	N/A	7	83	194	6	984	862	850	867	Vehicle will not commu	ALM010707	ALM034356		
3/25/2005	H03-SG05	30	N/A	6	84	193	6	986	863	786	843	Vehicle will not commu	ALM010707	ALM034356		
3/25/2005	H03-SG05	30	N/A	6	82	193	6	985	863	825	841	Vehicle will not commu	ALM010707	ALM034356		
4/1/2005	H03-SG05	30	N/A	11	51	194	6	992	868	924	921	ISO-9141-2	ALM010707	ALM038949		
3/26/2005	H03-SG05	30	N/A	7	71	194	6	991	868	837	841	Vehicle will not commu	ALM010707	ALM038949		
3/26/2005	H03-SG05	30	N/A	6	75	193	6	990	868	880	910	Vehicle will not commu	ALM010707	ALM038949		
3/29/2005	H03-SG05	30	N/A	23	34	193	6	968	846	877	860	Vehicle will not commu	ALM010707	ALM038948		
3/28/2005	H03-SG05	30	N/A	14	45	194	6	978	856	905	851	Vehicle will not commu	ALM010707	ALM038949		
3/28/2005	H03-SG05	30	N/A	17	37	193	6	978	855	901	852	Vehicle will not commu	ALM010707	ALM038949		
3/28/2005	H03-SG05	30	N/A	23	22	194	6	976	852	876	866	Vehicle will not commu	ALM010707	ALM038949		
3/28/2005	H03-SG05	30	N/A	20	30	194	6	977	853	890	866	Vehicle will not commu	ALM010707	ALM038949		
3/29/2005	H03-SG05	30	N/A	19	45	193	6	970	847	867	841	ISO-9141-2	ALM010707	ALM038949		
3/29/2005	H03-SG05	30	N/A	17	48	193	6	970	847	907	899	Vehicle will not commu	ALM010707	ALM038949		
3/30/2005	H03-SG05	30	N/A	15	57	193	6	968	847	873	842	Vehicle will not commu	ALM010707	ALM038949		
3/30/2005	H03-SG05	30	N/A	16	58	193	6	966	846	859	839	Vehicle will not commu	ALM010707	ALM038949		
3/31/2005	H03-SG05	30	N/A	10	60	193	6	986	864	879	885	Vehicle will not commu	ALM010707	ALM038949		
4/2/2005	H03-SG05	30	N/A	10	42	193	6	992	868	928	924	Vehicle will not commu	ALM010707	ALM038949		

Page 7 (Installation for Dyne Sampling)

		SEMTECH System Information (BKI)										OBDII	Cylinder Numbers			
Date	PEM Serial #	FID Pres (psig)	Battery Voltage (V)	Ambient Temp (C)	RH (%)	FID Oven Temp(C)	Chiller Temp (C)	Amb. P	P1 (mbar)	P2 (mbar)	P3 (mbar)	OBDII protocol	Zero Gas #	Audit Gas #	Span Gas #	Comments
4/4/2005	H03-SG05	30	N/A	26	31	194	6	975	851	894	853	Vehicle will not commu	ALM010707	ALM038949		
4/4/2005	H03-SG05	30	N/A	24	36	193	6	976	811	847	846	SAE-J1850 PWM	ALM010707	ALM038949		
4/6/2005	H03-SG05	30	N/A	21	57	193	6	978	857	839	855	Vehicle will not commu	ALM010707	ALM038949		
4/5/2005	H03-SG05	30	N/A	23	51	193	6	975	853	891	841	Vehicle will not commu	ALM010707	ALM038949		
4/6/2005	H03-SG05	30	N/A	16	78	193	6	978	855	869	848	ISO-15765	ALM010707	ALM038949		
4/6/2005	H03-SG05	30	N/A	15	83	193	6	978	856	912	927	ISO-15765	ALM010707	ALM038949		
4/5/2005	H03-SG05	30	N/A	19	68	193	6	973	851	908	904	SAE-J1850 VPW	ALM010707	ALM038949		
4/7/2005	H03-SG05	30	N/A	13	76	193	6	987	863	897	853	Vehicle will not commu	ALM010707	ALM038949		
4/7/2005	H03-SG05	30	N/A	12	77	194	5	987	864	897	863	Vehicle will not commu	ALM010707	ALM038949		
4/7/2005	H03-SG05	30	N/A	13	74	193	6	987	864	890	857	Vehicle will not commu	ALM010707	ALM038949		
4/7/2005	H03-SG05	30	N/A	13	75	193	6	985	864	919	916	ISO-9141-2	ALM010707	ALM038949		
4/8/2005	H03-SG05	30	N/A	17	51	193	7	985	861	884	881	SAE-J1850 VPW	ALM010707	ALM038949		
4/8/2005	H03-SG05	30	N/A	8	81	193	6	986	863	921	918	ISO-9141-2	ALM010707	ALM038949		
4/7/2005	H03-SG05	30	N/A	12	78	193	6	986	864	883	855	ISO-9141-2	ALM010707	ALM038949		
4/7/2005	H03-SG01	30	N/A	13	75	193	6	987	864	900	872	Vehicle will not commu	ALM010707	ALM038949		
4/8/2005	H03-SG05	30	N/A	13	71	193	6	986	863	891	890	Vehicle will not commu	ALM010707	ALM038949		

Page 9 (Installation for Driveaways)																	
			SEMTECH System Information (ERG)										OBDII	Cylinder Numbers			
Date	Install Tech	PEM Serial #	FID Pres (psig)	Battery Voltage (V)	Ambient Temp (C)	RH (%)	FID Oven Temp(C)	Chiller Temp (C)	Amb. P	P1 (mbar)	P2 (mbar)	P3 (mbar)	OBDII protocol	Zero Gas #	Audit Gas #	Span Gas #	Comments
7/23/2004	Sean Pinder/Mark Holland	H03-SG06	1668	13.2	25.9	75	193	5		857	952	932	Will not communicate	ALM035327	ALM066169	ALM060855	

Page 9 (Installation for Driveaways)																	
			SEMTECH System Information (ERG)										OBDII	Cylinder Numbers			
Date	Install Tech	PEM Serial #	FID Pres (psig)	Battery Voltage (V)	Ambient Temp (C)	RH (%)	FID Oven Temp(C)	Chiller Temp (C)	Amb. P	P1 (mbar)	P2 (mbar)	P3 (mbar)	OBDII protocol	Zero Gas #	Audit Gas #	Span Gas #	Comments
7/29/2004	Mark Holland	H03-SG02	441	11.6	25.6	63	193	5		877	931	889	ISO-9141-2	ALM042257	ALM066169		
8/5/2004	Scott Sholar	H03-SG03	1804	12.2			194	4	984	910	935	921	Will not communicate				
8/10/2004	Scott Sholar	H03-SG05	1788	13.1	22.9	50	194	6	987	922	947	911	SAE-J1850 PWM				

Page 9 (Installation for Driveaways)

			SEMTECH System Information (ERG)										OBDII	Cylinder Numbers			
Date	Install Tech	PEM Serial #	FID Pres (psig)	Battery Voltage (V)	Ambient Temp (C)	RH (%)	FID Oven Temp(C)	Chiller Temp (C)	Amb. P	P1 (mbar)	P2 (mbar)	P3 (mbar)	OBDII protocol	Zero Gas #	Audit Gas #	Span Gas #	Comments
8/12/2004	Scott Sholar/Rodney Williams	H03-SG03	1744	11.7/12.5	24.6	43	194	43	982	876	933	925	Will not communicate				
8/24/2004	Leland May	C0G-SG01	1735	12.2	27.3	61	196	4	982	894	918	927	Will not communicate				

Page 9 (Installation for Driveaways)																		
			SEMTECH System Information (ERG)										OBDII	Cylinder Numbers				
Date	Install Tech	PEM Serial #	FID Pres (psig)	Battery Voltage (V)	Ambient Temp (C)	RH (%)	FID Oven Temp(C)	Chiller Temp (C)	Amb. P	P1 (mbar)	P2 (mbar)	P3 (mbar)	OBDII protocol	Zero Gas #	Audit Gas #	Span Gas #	Comments	
8/27/2004		H03-SG02	1837	12.1	55	33.8	193	5	974	900	919	914	SAE-J1850 PWM					
8/27/2004	Leland May	H03-SG06	1855	12.5	33.6	56			980	853	901	923	Will not communicate					
8/31/2004	Leland May	H03-SG04	1840	12.6	30.9	42	193	5	984	955	939	972	Will not communicate					
9/2/2004	Rodney Williams	H03-SG04	1817	12.7	27.3	57	193	5	981	903	943	927	SAE-J1850 PWM					
9/10/2004	Mike S	H03-SG02	1817	12	19.5	69	193	5	985	914	938	936	N/A	AAL7737	ALM066169		Battery voltage - dual batteries, t	

Page 9 (Installation for Driveaways)																	
			SEMTECH System Information (ERG)										OBDII	Cylinder Numbers			
Date	Install Tech	PEM Serial #	FID Pres (psig)	Battery Voltage (V)	Ambient Temp (C)	RH (%)	FID Oven Temp(C)	Chiller Temp (C)	Amb. P	P1 (mbar)	P2 (mbar)	P3 (mbar)	OBDII protocol	Zero Gas #	Audit Gas #	Span Gas #	Comments
9/15/2004	R. Williams/M. Sabisch	H03-SG03	1380	12.1	25	74	194	6	971	861	915	898	N/A				Battery Voltage - 2 batteries

Page 9 (Installation for Driveaways)

Date	Install Tech	PEM Serial #	FID Pres (psig)	Battery Voltage (V)	Ambient Temp (C)	RH (%)	FID Oven Temp(C)	Chiller Temp (C)	Amb. P	P1 (mbar)	P2 (mbar)	P3 (mbar)	OBDII protocol	Zero Gas #	Audit Gas #	Span Gas #	Comments
			SEMTECH System Information (ERG)										OBDII	Cylinder Numbers			
9/13/2004	Leland May	H03-SG02	1838	11.9	23.6	73	193	5	974	902	934	912	Will not communicate				Note - Ran a zero, & audit, but I

Page 9 (Installation for Driveaways)

			SEMTECH System Information (ERG)										OBDII	Cylinder Numbers			
Date	Install Tech	PEM Serial #	FID Pres (psig)	Battery Voltage (V)	Ambient Temp (C)	RH (%)	FID Oven Temp(C)	Chiller Temp (C)	Amb. P	P1 (mbar)	P2 (mbar)	P3 (mbar)	OBDII protocol	Zero Gas #	Audit Gas #	Span Gas #	Comments
2																	
03																	
06																	
3																	
1/13/2005	Kevin Hicks	H03-SG01	30		-1	53											
uld not connect, tried w/2 different connectors, might be something wrong w/board.																	

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			SEMTECH System Information (ERG)										OBDII	Cylinder Numbers			
Date	Install Tech	PEM Serial #	FID Pres (psig)	Battery Voltage (V)	Ambient Temp (C)	RH (%)	FID Oven Temp(C)	Chiller Temp (C)	Amb. P	P1 (mbar)	P2 (mbar)	P3 (mbar)	OBDII protocol	Zero Gas #	Audit Gas #	Span Gas #	Comments
t working																	
t working																	
t working																	
rs																	
2/1/2005	R. Williams	H03-SG01	1621	12.9	10.3	41	195	4	988	925	956	950	Vehicle will not commu	ALM006117	ALM041307		
t working																	
t working.																	
t working																	
t working																	

Page 9 (Installation for Driveaways)																	
			SEMTECH System Information (ERG)										OBDII	Cylinder Numbers			
Date	Install Tech	PEM Serial #	FID Pres (psig)	Battery Voltage (V)	Ambient Temp (C)	RH (%)	FID Oven Temp(C)	Chiller Temp (C)	Amb. P	P1 (mbar)	P2 (mbar)	P3 (mbar)	OBDII protocol	Zero Gas #	Audit Gas #	Span Gas #	Comments
t working																	
l would not turn off!																	
t working																	
2/11/2005	Mark/Rodney/Carl	H03-SG02	1588	12.7	20.4	24	194	5	992	900	897	849	SAE-J1850 VPW	ALM006117	ALM041307		Flow I04-SE03; mpg 21.0
2/12/2005	Mark/Carl	H03-SG06	1606	12.6	19.1	40	193	4	1010	853	948	923	SAE-J1850 PWM	ALM006117	ALM041307		Flow I04-SE03; mpg 17.101
rd not long enough																	
2/15/2005	Carl/Mark	C03-SG01	1747	12.4	19.4	32	195	4	1010	864	883	891	Vehicle will not commu	ALM006117	ALM049099		Flow I04-SE03; mpg 17. (HC not
2/17/2005	Mark	C03-SG01	1704				193	4	998	960	928	897	SAE-J1850 VPW	ALM006117	ALM049099		Flow I04-SE03; mpg 20.698
2/17/2005	Rodney	H03-SG01	1651	12.6	19.3	22	195	3	983	915	951	917	Vehicle will not commu	ALM010867	ALM049099		Flow H04-SE08; mpg 20.549
2/18/1995	Carl/Mark/Rodney	H03-SG03	1621	12.8	13.9	26	193	4	1027	917	889	920	Vehicle will not commu	ALM010867	ALM049099		Flow I04-SE08
2/18/2005	Rodney	H03-SG01	1395	12.5	15.1	27	195	3	987	923	953	949	SAE-J1850 VPW	ALM010867	ALM049099		Flow H04-SE08; mpg 20.69
2/19/2005		H03-SG06	1773		25.8	32	193	4	986	938	971	931	Vehicle will not commu	ALM010869	ALM049099		FM #I04-SE13; mpg 16.45

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			SEMTECH System Information (ERG)										OBDII	Cylinder Numbers			
Date	Install Tech	PEM Serial #	FID Pres (psig)	Battery Voltage (V)	Ambient Temp (C)	RH (%)	FID Oven Temp(C)	Chiller Temp (C)	Amb. P	P1 (mbar)	P2 (mbar)	P3 (mbar)	OBDII protocol	Zero Gas #	Audit Gas #	Span Gas #	Comments
2/21/2005	Carl/Mark	C03-SG02	1817	12.6	20.9	28	193	4	1019	909	933	923	Vehicle will not commu	ALM010867	ALM049099		Flow K04-SE01; mpg 24.813. Mi
2/21/2005	Mark Wuenstel	H03-SG06	1743	12.5	23.5	26	191	4	988	939	973	970	Vehicle will not commu	ALM010867	ALM049099		
2/21/2005	Carl Young	C03-SG01	1734	12.2	17.4	30	195	4	1009	949	935	932	SAE-J1850 VPW	ALM010867	ALM049099		Flow I04-SE03:mpg 19.61
2/22/2005	Rodney Williams	C03-SG01	1738	12.6	11.9	33	195	4	1001	920	947	938		ALM010867	ALM049099	I04-SE03	
2/24/2005	Mark Wuenstel	H03-SG02	1753	12.6	15.4	34	193	5	1019	880	933	909	N/A	ALM010867	ALM049099		
2/26/2005	M/W	C03-SG01	1750	12.6	17.4	34	195	3	995	940	937	930	SAE-J1850 PWM	ALM010867	ALM049099		
eparate sheet in packet.																	
2/28/2005	Carl Young	H03-SG02		12.8	21.4	21	193	4	978	870	925	922	ISO 9141	ALM010867	ALM049099		
3/1/2005	Carl Young	H03-SG03	1615	12.4	15.8	23	193	5	1022	909	974	956	J1850VPW	ALM010867	ALM049099		
3/4/2005	Rolwe	H03-SG01	1665	12.9	21.9	27	195	4	985	919	952	917	Vehicle will not commu	ALM010867	ALM049099		Flow #K04-SE01; mpg 24.412.
3/5/2005	Carl	H03-SG02	1685	12.8	23.4	25	193	4	1024	917	927	890	ISO-9141-2	ALM010867	ALM049099		Flow I04-SE03; mpg 21.581.
n invalid (no 84612 flow) remaining runs done before flow meter box warmed up, so flows through entire run are suspect - Mike																	

Page 9 (Installation for Driveaways)

Date	Install Tech	PEM Serial #	FID Pres (psig)	Battery Voltage (V)	Ambient Temp (C)	RH (%)	FID Oven Temp(C)	Chiller Temp (C)	Amb. P	P1 (mbar)	P2 (mbar)	P3 (mbar)	OBDII protocol	Zero Gas #	Audit Gas #	Span Gas #	Comments
		SEMTECH System Information (ERG)											OBDII	Cylinder Numbers			
3/7/2005	R. Williams	H03-SG02	1450		26.1	28	193	4	971	868	922	912	Vehicle will not commu	ALM010867	ALM049099		
3/7/2005	Rodney Williams	H03-SG02	1366		23.9	22			978	904	926	907	Vehicle will not commu	ALM010867	ALM049099		
3/8/2005	Carl/Mark	H03-SG06	1548	12.6	25.9	21	194	6	986	847	879	842	ISO-9141-2	ALM010867	ALM049099		Flow #K04-SE03; mpg 24.692.
3/9/2005	Rodney/Carl	H03-SG03	1741	12.8	15	26	193	4	1020	909	853	924	SAE-J1850 VPW	ALM010867	ALM049099		Flow H04-SE08; mpg 19.266.
3/10/2005	Rodney	H03-SG06	1715	12.4	17.5	25	194	5	1003	841	865	808	Vehicle will not commu	ALM010867	ALM049099		Flow K04-SE08
3/10/2005	R. Williams	H03-SG01	1746		18.4	27	195	3	970	903	930	893	Vehicle will not commu	ALM010867	ALM049099		Flow L04-SE03; mpg 17.948. 2 p
3/11/2005	Rodney	H03-SG02	1773	12.5	16.6	29	194	5	971	902	919	919	Vehicle will not commu	ALM010867	ALM049099		Flow K04-SE01
3/11/2005	Carl	C03-SG01	1718	12.6	15.9	29	195	4	1007	845	923	920	Vehicle will not commu	ALM010867	ALM049099		Flow K04-SE03; mpg 15.344
3/12/2005	Rodney W.	H03-SG02	1780	12.6	18.4	30	193	5	964	891	915	914	Vehicle will not commu	ALM010867	ALM049099		Flowmeter L04-SE01; mpg 23.14
3/14/2005	Rodney W.	H03-SG06	1691	12.6	12.4	29	194	5	990	896	870	858	Vehicle will not commu	ALM010867	ALM049099		Flowmeter K04-SE03; mpg 25.44
3/16/2005	Carl/Rodney	C03-SG01	1731	12.6	20.4	31	195	4	1022	911	894	899	Vehicle will not commu	ALM010867	ALM049099		Flow K04-SE03; 20.348
3/15/2005	Carl	H03-SG01	1789	12.8	15.8	25	195	4	1019	912	926	930	Vehicle will not commu	ALM010867	ALM049099		Flow H04-SE08
3/16/2005	Rodney	H03-SG06	1647	12.5	17.1	34	194	3	991	887	934	932	Vehicle will not commu	ALM010867	ALM049099		Flow I04-SE03; mpg 16.440
3/17/2005	Carl	H03-SG03	1818	12.6	16.6	35	193	5	1016	902	889	920	Vehicle will not commu	ALM010867	ALM049099		Flow H04-SE02; mpg 18.136

Page 9 (Installation for Driveaways)																	
			SEMTECH System Information (ERG)										OBDII	Cylinder Numbers			
Date	Install Tech	PEM Serial #	FID Pres (psig)	Battery Voltage (V)	Ambient Temp (C)	RH (%)	FID Oven Temp(C)	Chiller Temp (C)	Amb. P	P1 (mbar)	P2 (mbar)	P3 (mbar)	OBDII protocol	Zero Gas #	Audit Gas #	Span Gas #	Comments
3/16/2005	Carl	H03-SG06	1761	12.6	18.3	30	194	4	1005	841	911	878	Vehicle will not commu	ALM010867	ALM049099		Flow K04-SE01; mpg 25.152
3/30/2005	Carl/Holly/Rodney	H03-SG02	1774	12.8	30	23	193	5	961	889	894	905	Vehicle will not commu	ALM042613	ALM049099		
3/21/2005	Rodney Williams	H03-SG01	1761	12.8	22	25	196	3	971	904	940	932	Vehicle will not commu	ALM042613	ALM049099		Flow H04-SE02
3/30/2005	Carl/Holly/Rodney	C03-SG01	1733	12.6	27.3	32	195	4	975	846	920	916	Vehicle will not commu	ALM042613	ALM049099		Flow H04-SE08; mpg 12.641

Page 9 (Installation for Driveaways)

			SEMTECH System Information (ERG)										OBDII	Cylinder Numbers			
Date	Install Tech	PEM Serial #	FID Pres (psig)	Battery Voltage (V)	Ambient Temp (C)	RH (%)	FID Oven Temp(C)	Chiller Temp (C)	Amb. P	P1 (mbar)	P2 (mbar)	P3 (mbar)	OBDII protocol	Zero Gas #	Audit Gas #	Span Gas #	Comments

ERG Packet
Driveaway questionnaire

Did you drive differently with PEMS?	Did you feel PEMS caused you to drive differently?	Did PEMS alter your vehicle's performance?	Were you only person, or did you pick up passengers?	Passenger pickup & dropoff schedule

ERG Packet

Driveaway questionnaire

Did you drive differently with PEMS?	Did you feel PEMS caused you to drive differently?	Did PEMS alter your vehicle's performance?	Were you only person, or did you pick up passengers?	Passenger pickup & dropoff schedule

ERG Packet
Driveaway questionnaire

Did you drive differently with PEMS?	Did you feel PEMS caused you to drive differently?	Did PEMS alter your vehicle's performance?	Were you only person, or did you pick up passengers?	Passenger pickup & dropoff schedule
No	No	No	Only person in vehicle	

ERG Packet

Driveaway questionnaire

Did you drive differently with PEMS?	Did you feel PEMS caused you to drive differently?	Did PEMS alter your vehicle's performance?	Were you only person, or did you pick up passengers?	Passenger pickup & dropoff schedule
No	No	No	Only person	
No	No	No	Only person	Only person - was in rain storm
No	No	No	by myself but I picked up about 150 pounds of product at my warehouse	I picked up about 150 pounds of product at my warehouse and unloaded 100 still has 50 lbs of product in back seat
				No driveaway questionnaire available

ERG Packet
Driveaway questionnaire

Did you drive differently with PEMS?	Did you feel PEMS caused you to drive differently?	Did PEMS alter your vehicle's performance?	Were you only person, or did you pick up passengers?	Passenger pickup & dropoff schedule

ERG Packet
Driveaway questionnaire

Did you drive differently with PEMS?	Did you feel PEMS caused you to drive differently?	Did PEMS alter your vehicle's performance?	Were you only person, or did you pick up passengers?	Passenger pickup & dropoff schedule
No	No	Didn't feel same power (less power w/unit o	no passengers	N/A

ERG Packet

Driveaway questionnaire

Did you drive differently with PEMS?	Did you feel PEMS caused you to drive differently?	Did PEMS alter your vehicle's performance?	Were you only person, or did you pick up passengers?	Passenger pickup & dropoff schedule

ERG Packet

Driveaway questionnaire

Did you drive differently with PEMS?	Did you feel PEMS caused you to drive differently?	Did PEMS alter your vehicle's performance?	Were you only person, or did you pick up passengers?	Passenger pickup & dropoff schedule
				No driveaway questionnaire available

ERG Packet
Driveaway questionnaire

Did you drive differently with PEMS?	Did you feel PEMS caused you to drive differently?	Did PEMS alter your vehicle's performance?	Were you only person, or did you pick up passengers?	Passenger pickup & dropoff schedule
				No driveaway questionnaire available.
				No driveaway questionnaire available.
: recording) Semtech rebooted. New file (before driveaway) KS_SLE054_DRIVEAWAY2.XML				No driveaway questionnaire available.
				No driveaway questionnaire available.
				No driveaway questionnaire available.
				No driveaway questionnaire available.
				No driveaway questionnaire available.

ERG Packet

Driveaway questionnaire

Did you drive differently with PEMS?	Did you feel PEMS caused you to drive differently?	Did PEMS alter your vehicle's performance?	Were you only person, or did you pick up passengers?	Passenger pickup & dropoff schedule
				No driveaway questionnaire available.
leage: 195,994 miles.				No driveaway questionnaire available. 2 questionnaire forms (Rnd 2 dway done in
				No driveaway questionnaire available. 2 questionnaire forms (Rnd 2 dway done in
				No driveaway questionnaire available. 2 questionnaire forms (Rnd 2 dway done in Feb, dyne in March). Fuel and oil info pertains to March dyne test.
				No driveaway questionnaire available.
				No driveaway questionnaire available.
				No driveaway questionnaire available. 2 questionnaire forms (Rnd 2 dway done in Feb, dyne in March). Fuel and oil info pertains to March dyne test.
				No driveaway questionnaire available.
				No driveaway questionnaire available. 2 questionnaire forms (Rnd 2 dway done in
				No driveaway questionnaire available.

ERG Packet
Driveaway questionnaire

Did you drive differently with PEMS?	Did you feel PEMS caused you to drive differently?	Did PEMS alter your vehicle's performance?	Were you only person, or did you pick up passengers?	Passenger pickup & dropoff schedule
				No driveaway questionnaire available.
				No driveaway questionnaire available.
om driveaway.				
				No driveaway questionnaire available.
				No driveaway questionnaire available.
43				
47.				No driveaway questionnaire available.
				No driveaway questionnaire available.
				No driveaway questionnaire available.
				No driveaway questionnaire available.

ERG Packet
Driveaway questionnaire

Did you drive differently with PEMS?	Did you feel PEMS caused you to drive differently?	Did PEMS alter your vehicle's performance?	Were you only person, or did you pick up passengers?	Passenger pickup & dropoff schedule
				No driveaway questionnaire available.
				No driveaway questionnaire available.

ERG Packet

Driveaway questionnaire

Did you drive differently with PEMS?	Did you feel PEMS caused you to drive differently?	Did PEMS alter your vehicle's performance?	Were you only person, or did you pick up passengers?	Passenger pickup & dropoff schedule

Page 11 (Installation for Replicate Preconditioning Drive)

			SEMTECH System Information (ERG)										OBDII	Cylinder Numbers		
Date	Install Tech	PEM Serial #	FID Pres (psig)	Battery Voltage (V)	Ambient Temp (C)	RH (%)	FID Oven Temp(C)	Chiller Temp (C)	Amb. P	P1 (mbar)	P2 (mbar)	P3 (mbar)	OBDII protocol	Zero Gas #	Audit Gas #	Span Gas #
7/21/2004	Sean Pinder/Mark Holland	H03-SG06	322	11.7	32.8	61	193	4		862	910	924	SAE-J1850 VPW	ALM035327	ALM066169	ALM060855

Page 11 (Installation for Replicate Preconditioning Drive)

			SEMTECH System Information (ERG)										OBDII	Cylinder Numbers		
Date	Install Tech	PEM Serial #	FID Pres (psig)	Battery Voltage (V)	Ambient Temp (C)	RH (%)	FID Oven Temp(C)	Chiller Temp (C)	Amb. P	P1 (mbar)	P2 (mbar)	P3 (mbar)	OBDII protocol	Zero Gas #	Audit Gas #	Span Gas #
8/3/2004		H03-SG01	242	12	36.1	52	195	3	972	859	922	901	Will not communicate			
8/3/2004	Scott Sholar	H03-SG03	581	12.6	34.9	55	194	6	973	899	915	873	ISO-9141-2			
8/6/2004			926	12.5	27.3	31	187	6	987	882	935	888	Will not communicate			

Page 11 (Installation for Replicate Preconditioning Drive)

			SEMTECH System Information (ERG)										OBDII	Cylinder Numbers		
Date	Install Tech	PEM Serial #	FID Pres (psig)	Battery Voltage (V)	Ambient Temp (C)	RH (%)	FID Oven Temp(C)	Chiller Temp (C)	Amb. P	P1 (mbar)	P2 (mbar)	P3 (mbar)	OBDII protocol	Zero Gas #	Audit Gas #	Span Gas #
8/13/2004	Grooms	H03-SG05	1082	11.8	23.6	46	193	6	990	925	953	936	Will not communicate			
8/13/2004	Scott Sholar	H03-SG03	193	12.5	23.9	49	193	4	984	910	929	915	Will not communicate			
8/25/2004	Rodney Williams	C03-SG01	1775	13	30	74	196	4	961	893	922	925	Will not communicate			

Page 11 (Installation for Replicate Preconditioning Drive)

			SEMTECH System Information (ERG)										OBDII	Cylinder Numbers		
Date	Install Tech	PEM Serial #	FID Pres (psig)	Battery Voltage (V)	Ambient Temp (C)	RH (%)	FID Oven Temp(C)	Chiller Temp (C)	Amb. P	P1 (mbar)	P2 (mbar)	P3 (mbar)	OBDII protocol	Zero Gas #	Audit Gas #	Span Gas #

Page 11 (Installation for Replicate Preconditioning Drive)

			SEMTECH System Information (ERG)										OBDII	Cylinder Numbers		
Date	Install Tech	PEM Serial #	FID Pres (psig)	Battery Voltage (V)	Ambient Temp (C)	RH (%)	FID Oven Temp(C)	Chiller Temp (C)	Amb. P	P1 (mbar)	P2 (mbar)	P3 (mbar)	OBDII protocol	Zero Gas #	Audit Gas #	Span Gas #
9/20/2004	Leland May	H03-SG05	292	12.9	29.5	34.1	194	7	984	883	835	805	SAE-J1850 VPW			

Page 11 (Installation for Replicate Preconditioning Drive)

		SEMTECH System Information (ERG)											OBDII	Cylinder Numbers		
Date	Install Tech	PEM Serial #	FID Pres (psig)	Battery Voltage (V)	Ambient Temp (C)	RH (%)	FID Oven Temp(C)	Chiller Temp (C)	Amb. P	P1 (mbar)	P2 (mbar)	P3 (mbar)	OBDII protocol	Zero Gas #	Audit Gas #	Span Gas #
9/22/2004	Leland May/Scott Sholar	H03-SG02	522		27.6	44	193	5	985	910	933	928	ISO-9141-2			
9/21/2004	Scott Sholar	H03-SG03	526	12.1	28.6	48	193	6	981	867	919	86	SAE-J1850 VPW			
9/22/2004	Leland May	H03-SG06	1394	12.8	32.4	31.9	193	6	989	869	816	794				
9/23/2004	Scott Sholar/Leland May	H03-SG02	738	11.8	23.9	58	193	5	983	878	917	885	Will not communicate			
9/24/2004	Scott Sholar	H03-SG02	1503	12.4	27.9	36	194	7	989	868	925	913	SAE-J1850 PWM			
9/24/2004	Scott Sholar	H03-SG02	921	11.8	27.9	31	193	6	985	876	940	908	Will not communicate			
9/25/2004	Scott Sholar	H03-SG05	1155	12.5			194	7	990	869	927	916	Will not communicate			
9/27/2004	Leland May	H03-SG05	554	12.8	31.4	51.2	194	0	988	868	904	804	Will not communicate			
9/28/2004	Scott Sholar	H03-SG02	326	11.4			193	5	988	842	860	875	Will not communicate			
9/28/2004		H03-SG05	807	12.2	22.5	50	193	6	992	873	862	828	ISO-9141-2			
9/27/2004	Scott Sholar	H03-SG02	705	12	29.1	34	193	5	982	855	879	878	Will not communicate			

Page 11 (Installation for Replicate Preconditioning Drive)

			SEMTECH System Information (ERG)										OBDII	Cylinder Numbers		
Date	Install Tech	PEM Serial #	FID Pres (psig)	Battery Voltage (V)	Ambient Temp (C)	RH (%)	FID Oven Temp(C)	Chiller Temp (C)	Amb. P	P1 (mbar)	P2 (mbar)	P3 (mbar)	OBDII protocol	Zero Gas #	Audit Gas #	Span Gas #
1/19/2005	R. Williams	H03-SG03	663	12.3	12.8	45	191	3	987	916	926	885	Vehicle will not cor	ALM050011	ALM041307	
1/20/2005	Carl & Rodney		1692		17.8	40			975	906	941	937	Vehicle will not cor	ALM050011	ALM041307	25.3 mpg

Page 11 (Installation for Replicate Preconditioning Drive)

			SEMTECH System Information (ERG)											OBDII	Cylinder Numbers		
Date	Install Tech	PEM Serial #	FID Pres (psig)	Battery Voltage (V)	Ambient Temp (C)	RH (%)	FID Oven Temp(C)	Chiller Temp (C)	Amb. P	P1 (mbar)	P2 (mbar)	P3 (mbar)	OBDII protocol	Zero Gas #	Audit Gas #	Span Gas #
1/22/2005	Mark W.	C03-SG01	572	13.2	18.4	20	194	5	1009	958	945	942		ALM006117	ALM041307	
1/27/2005	R. Williams	C03-SG01	1700	13.1	17.4	29	195	4	1003	988	949	952				
2/1/2005	Rodney/Mark	H03-SG02	651	12.2	11.4	35	191	6	991	905	935	927	Vehicle will not cor	ALM006117	ALM041307	
2/2/2005	Mark	H03-SG02	1680	12.2	17.6	23	192	5	989	890	911	883	Vehicle will not cor	ALM006117	ALM041307	

Page 11 (Installation for Replicate Preconditioning Drive)

		SEMTECH System Information (ERG)											OBDII	Cylinder Numbers		
Date	Install Tech	PEM Serial #	FID Pres (psig)	Battery Voltage (V)	Ambient Temp (C)	RH (%)	FID Oven Temp(C)	Chiller Temp (C)	Amb. P	P1 (mbar)	P2 (mbar)	P3 (mbar)	OBDII protocol	Zero Gas #	Audit Gas #	Span Gas #
2/12/2005	Carl/Mark/Rodney	C03-SG01	1792	12.6	18.9	45	195	3	990	978	984	982	ISO-9141-2	ALM006117	ALM041307	Flow H04-SE08
2/12/2005	R. Williams	H03-SG01	1481	12.6	16.9	40	195	4	976	909	941	937	ISO-9141-2	ALM006117	ALM041307	Flow H04-SE08

Page 11 (Installation for Replicate Preconditioning Drive)

			SEMTECH System Information (ERG)											OBDII	Cylinder Numbers		
Date	Install Tech	PEM Serial #	FID Pres (psig)	Battery Voltage (V)	Ambient Temp (C)	RH (%)	FID Oven Temp(C)	Chiller Temp (C)	Amb. P	P1 (mbar)	P2 (mbar)	P3 (mbar)	OBDII protocol	Zero Gas #	Audit Gas #	Span Gas #
2/21/2005	Carl/Rodney	H03-SG01	886	12.6	23.4	24	195	4	1017	911	939	934	SAE-J1850 PWM	ALM010867	ALM049099	Flow H04-SG08;
3/18/2005	R. Williams	H03-SG03	1815	12.4	18.9	32	194	4	968	894	924	914	Vehicle will not cor	ALM010867	ALM049099	Flow meter H04-
3/1/2005	Carl/Mark	C03-SG01	337	12.4	25.2	20	195	5	1006	914	935	930	Vehicle will not cor	ALM010867	ALM049099	Flow J04-SE06;
3/4/2005	Carl	H03-SG02	565	12.4	21.9	22	193	4	1009	869	915	883		ALM010867	ALM049099	Flow I04-SE03;

Page 11 (Installation for Replicate Preconditioning Drive)

			SEMTECH System Information (ERG)										OBDII	Cylinder Numbers		
Date	Install Tech	PEM Serial #	FID Pres (psig)	Battery Voltage (V)	Ambient Temp (C)	RH (%)	FID Oven Temp(C)	Chiller Temp (C)	Amb. P	P1 (mbar)	P2 (mbar)	P3 (mbar)	OBDII protocol	Zero Gas #	Audit Gas #	Span Gas #
3/5/2005	Carl	H03-SG03	467	12.3	18.6	23	193	4	1023	878	878	845	ISO-9141-2	ALM010867	ALM049099	Flow H04-SE03;
3/7/2005	MW	C03-SG01	560	12.2			195	5	983	855	920	917	Vehicle will not communicate using any of the above communica			

Page 11 (Installation for Replicate Preconditioning Drive)

		SEMTECH System Information (ERG)											OBDII	Cylinder Numbers		
Date	Install Tech	PEM Serial #	FID Pres (psig)	Battery Voltage (V)	Ambient Temp (C)	RH (%)	FID Oven Temp(C)	Chiller Temp (C)	Amb. P	P1 (mbar)	P2 (mbar)	P3 (mbar)	OBDII protocol	Zero Gas #	Audit Gas #	Span Gas #
3/21/2005	Carl	H03-SG06	1822	13.1	28.9	23	194	5	1008	885	926	917	Vehicle will not cor	ALM042613	ALM049099	Flow K04-SE01;
3/23/2005	Carl/Holly	H03-SG01	1104	12.5	17.8	40	195	4	1008	832	834	829	SAE-J1850 VPW	ALM042613	ALM049099	Flow I04-SE03;
3/25/2005	Carl/Rodney	C03-SG01	466	12.3	21.8	29	195	6	1010	879	908	910	Vehicle will not cor	ALM042613	ALM049099	Flow K04-SE03;

Page 11 (Installation for Replicate Preconditioning Drive)																
			SEMTECH System Information (ERG)										OBDII	Cylinder Numbers		
Date	Install Tech	PEM Serial #	FID Pres (psig)	Battery Voltage (V)	Ambient Temp (C)	RH (%)	FID Oven Temp(C)	Chiller Temp (C)	Amb. P	P1 (mbar)	P2 (mbar)	P3 (mbar)	OBDII protocol	Zero Gas #	Audit Gas #	Span Gas #

Additional Installation Types (such as Replicate Dyne)

			SEMTECH System Information										OBDII	Cylinder Numbers			
Date	Type of Install (i.e., rep dyne)	PEM Serial #	FID Pres (psig)	Battery Voltage (V)	Ambient Temp (C)	RH (%)	FID Oven Temp(C)	Chiller Temp (C)	Amb. P	P1 (mbar)	P2 (mbar)	P3 (mbar)	OBDII protocol	Zero Gas #	Audit Gas #	Span Gas #	Comments
7/22/2004	Dyne Sampling Dupe	H03-SG04	30	0	29	70	193	5		853	898	909	SAE-J1850 VPW	ALM014633	CAL771		CAL013942

Additional Installation Types (such as Replicate Dyne)

			SEMTECH System Information										OBDII	Cylinder Numbers			
Date	Type of Install (i.e., rep dyne)	PEM Serial #	FID Pres (psig)	Battery Voltage (V)	Ambient Temp (C)	RH (%)	FID Oven Temp(C)	Chiller Temp (C)	Amb. P	P1 (mbar)	P2 (mbar)	P3 (mbar)	OBDII protocol	Zero Gas #	Audit Gas #	Span Gas #	Comments
8/3/2004	DUPE	H03-SG04	30	0	29	68	193	5	974	852	851	816	Vill not communicat	ALM014633	ALM034356		CAL013942
8/3/2004	Dupe Dyne	H03-SG04	30	0	32	57	193	5	974	851	840	822	SAE-J1850 VPW	ALM014633	ALM034356		CAL013942
8/2/2004	Dyne Sampling Dupes	H03-SG04	30	0	27	74	190	5	975	855	837	811	ISO-9141-2	ALM014633	ALM034356		CAL013942
8/6/2004	Dyne Dupes	H03-SG04	30	0	26	41	193	5	984	862	834	818	Will not communica	ALM014633	ALM034356		CAL013942

Additional Installation Types (such as Replicate Dyne)

			SEMTECH System Information										OBDII	Cylinder Numbers			
Date	Type of Install (i.e., rep dyne)	PEM Serial #	FID Pres (psig)	Battery Voltage (V)	Ambient Temp (C)	RH (%)	FID Oven Temp(C)	Chiller Temp (C)	Amb. P	P1 (mbar)	P2 (mbar)	P3 (mbar)	OBDII protocol	Zero Gas #	Audit Gas #	Span Gas #	Comments
8/11/2004	Dupe Dyne Sampling	H03-SG04	30	0	18	72	193	5	982	855	870	856		ALM014633	ALM034356		CAL013942
	Dupe Dyne Sampling		30	0	23	51	193	5	985	865	906	858					
8/16/2004	Dyne Sampling Dupe	H03-SG04	30	0	25	47	193	5	984	862	896	867	Vill not communicat	ALM014633	ALM034356		CAL013942
8/21/2004	Dupe Dyne Sampling	H03-SG04	30	0	18	84	193	4	981	865	935	841	Will not communica	ALM014633	ALM034356		CAL013942

Additional Installation Types (such as Replicate Dyne)

			SEMTECH System Information										OBDII	Cylinder Numbers			
Date	Type of Install (i.e., rep dyne)	PEM Serial #	FID Pres (psig)	Battery Voltage (V)	Ambient Temp (C)	RH (%)	FID Oven Temp(C)	Chiller Temp (C)	Amb. P	P1 (mbar)	P2 (mbar)	P3 (mbar)	OBDII protocol	Zero Gas #	Audit Gas #	Span Gas #	Comments
9/9/2004	DUPE SEMTECH Insta	H03-SG01	30	0	20	70	195	4	982	876	942	877	Will not communica	FHJ742	ALM034356		CAL013942

Additional Installation Types (such as Replicate Dyne)

			SEMTECH System Information										OBDII	Cylinder Numbers			
Date	Type of Install (i.e., rep dyne)	PEM Serial #	FID Pres (psig)	Battery Voltage (V)	Ambient Temp (C)	RH (%)	FID Oven Temp(C)	Chiller Temp (C)	Amb. P	P1 (mbar)	P2 (mbar)	P3 (mbar)	OBDII protocol	Zero Gas #	Audit Gas #	Span Gas #	Comments
9/16/2004	Part 1: SEMTECH Inst	H03-SG03	591	12	27.9	33	194	7	977	861	859	838	SAE-J1850 VPW				
9/16/2004	Part 1: SEMTECH Inst	H03-SG03	1117	12.3	27.3	33	194	6	980	867	922	902	Will not communicate				

Additional Installation Types (such as Replicate Dyne)

			SEMTECH System Information										OBDII	Cylinder Numbers			
Date	Type of Install (i.e., rep dyne)	PEM Serial #	FID Pres (psig)	Battery Voltage (V)	Ambient Temp (C)	RH (%)	FID Oven Temp(C)	Chiller Temp (C)	Amb. P	P1 (mbar)	P2 (mbar)	P3 (mbar)	OBDII protocol	Zero Gas #	Audit Gas #	Span Gas #	Comments
9/11/2004	SEMTECH Installatiion	H03-SG05	466	12.2			193	7	986	920	845	862	Will not communicate				Duplicate run
9/11/2004	SEMTECH Installation	H03-SC06	1810	12.2	27.6	44	193	6	990	902	896	901	Will not communicate				

Additional Installation Types (such as Replicate Dyne)																	
			SEMTECH System Information										OBDII	Cylinder Numbers			
Date	Type of Install (i.e., rep dyne)	PEM Serial #	FID Pres (psig)	Battery Voltage (V)	Ambient Temp (C)	RH (%)	FID Oven Temp(C)	Chiller Temp (C)	Amb. P	P1 (mbar)	P2 (mbar)	P3 (mbar)	OBDII protocol	Zero Gas #	Audit Gas #	Span Gas #	Comments
1/17/2005	SEMTECH Installation	H03-SG05	1543	12	14.6	42	193	5	1038	935	945	931	ISO-9141-2	ALM050011	ALM041307		
1/21/2005	Installation for Replicat	H03-SG05	30	N/A	6	69	193	6	984	864	911	847	Vehicle will not cor	FHJ742	ALM034356		

Additional Installation Types (such as Replicate Dyne)

			SEMTECH System Information										OBDII	Cylinder Numbers			
Date	Type of Install (i.e., rep dyne)	PEM Serial #	FID Pres (psig)	Battery Voltage (V)	Ambient Temp (C)	RH (%)	FID Oven Temp(C)	Chiller Temp (C)	Amb. P	P1 (mbar)	P2 (mbar)	P3 (mbar)	OBDII protocol	Zero Gas #	Audit Gas #	Span Gas #	Comments
1/25/2005	Installation for Replicat	H03-SG05	30	N/A	3	68	193	5	981	864	918	913	Vehicle will not cor	FHJ742	ALM034356		
1/28/2005	SEMTECH Installaiton	H03-SG05	30	N/A	7	40	193	5	996	877	942	953	Vehicle will not cor	ALM035591	ALM034356		
2/1/2005	SEMTECH Installation	H03-SG05	30	N/A	7	59	193	6	998	876	927	895	Vehicle will not cor	ALM035591	ALM034356		
2/2/2005	SEMTECH Installation	H03-SG05	30	N/A	4	64	193	6	997	877	907	854	Vehicle will not cor	ALM035591	ALM034356		

Additional Installation Types (such as Replicate Dyne)

			SEMTECH System Information										OBDII	Cylinder Numbers			
Date	Type of Install (i.e., rep dyne)	PEM Serial #	FID Pres (psig)	Battery Voltage (V)	Ambient Temp (C)	RH (%)	FID Oven Temp(C)	Chiller Temp (C)	Amb. P	P1 (mbar)	P2 (mbar)	P3 (mbar)	OBDII protocol	Zero Gas #	Audit Gas #	Span Gas #	Comments
2/14/2005	SEMTECH Installation	H03-SG05	30	N/A	4	85	193	6	981	862	917	911	ISO-9141-2	ALM035591	ALM034356		
2/14/2005	SEMTECH Installation	H03-SG05	30	N/A	10	63	193	6	982	862	895	857	ISO-9141-2	ALM035591	ALM034356		

Additional Installation Types (such as Replicate Dyne)

			SEMTECH System Information										OBDII	Cylinder Numbers			
Date	Type of Install (i.e., rep dyne)	PEM Serial #	FID Pres (psig)	Battery Voltage (V)	Ambient Temp (C)	RH (%)	FID Oven Temp(C)	Chiller Temp (C)	Amb. P	P1 (mbar)	P2 (mbar)	P3 (mbar)	OBDII protocol	Zero Gas #	Audit Gas #	Span Gas #	Comments
; mpg 17.41																	
3/19/2005	SEMTECH Installation	H03-SG05	30	N/A	5	49	193	5	986	866	920	925	Vehicle will not cor	ALM010707	ALM034356		
mpg 29.5.																	
mpg 20.11.																	
3/9/2005	SEMTECH Installation	H03-SG05	2498	N/A	7	34	193	6	988	867	911	862	Vehicle will not cor	ALM035591	ALM034356		

Additional Installation Types (such as Replicate Dyne)

			SEMTECH System Information										OBDII	Cylinder Numbers			
Date	Type of Install (i.e., rep dyne)	PEM Serial #	FID Pres (psig)	Battery Voltage (V)	Ambient Temp (C)	RH (%)	FID Oven Temp(C)	Chiller Temp (C)	Amb. P	P1 (mbar)	P2 (mbar)	P3 (mbar)	OBDII protocol	Zero Gas #	Audit Gas #	Span Gas #	Comments
mpg 19.727																	
ation protocols.																	

Additional Installation Types (such as Replicate Dyne)

			SEMTECH System Information										OBDII	Cylinder Numbers			
Date	Type of Install (i.e., rep dyne)	PEM Serial #	FID Pres (psig)	Battery Voltage (V)	Ambient Temp (C)	RH (%)	FID Oven Temp(C)	Chiller Temp (C)	Amb. P	P1 (mbar)	P2 (mbar)	P3 (mbar)	OBDII protocol	Zero Gas #	Audit Gas #	Span Gas #	Comments
3/22/2005	Semtech Installation fo	H03-SG05	30	N/A	6	77	193	5	979	859	914	924	Vehicle will not cor	ALM010707	ALM034356		
3/24/2005	Semtech Installation fo	H03-SG05	2498	N/A	72.5 F	32.3	193	6	980	858	857	867	N/A - too old	ALM010707	ALM034356		
mpg 16.138																	
mpg 13.443																	

Additional Installation Types (such as Replicate Dyne)																	
			SEMTECH System Information										OBDII	Cylinder Numbers			
Date	Type of Install (i.e., rep dyne)	PEM Serial #	FID Pres (psig)	Battery Voltage (V)	Ambient Temp (C)	RH (%)	FID Oven Temp(C)	Chiller Temp (C)	Amb. P	P1 (mbar)	P2 (mbar)	P3 (mbar)	OBDII protocol	Zero Gas #	Audit Gas #	Span Gas #	Comments

					Engine Rebuild Info (BKI)				Catalytic Converter (BKI)															
Make	Model	Year	Mileage	VIN	# of rebuilds	Date of Last Rebuild	Reasons for Last Rebuild	Non OEM mods	1. Original owner? (Y/N)	Mileage at purchase?	2. Cat been replaced? (Y/N)	# of cat replcmnts	Rattling?	How long?	Odo at 1st rplcmnt	Odo at 2nd rplcmnt	Odo at 3rd rplcmnt	4.Rattling reason for cat rplcmnt?	Chk eng light reason	Fail smog chk reason	Collision damage reason	Was cat under warranty?	Customer Paid	Non-dealer?
Chevrolet	Cavalier	2001	57,049		N/A			N/A	N	32,000	N													
Ford	F150	1979	53,493		0			No	N	125,000	N		N											
Dodge	Van	1994	111,129		None		N/A	None	N	60,000	N		N											
Isuzu	Trooper	1999	63,375		No	N/A	N/A	Engine	N	40,000	N		N		N/A	N/A	N/A							
GMC	Yukon	2001	75,364		No		N/A	N/A	Y		N		N		N/A	N/A	N/A							
Ford	Escort	1995	102,652		N/A			N/A	N	29,000	N		N											
Ford	F250	1979	102,264		N/A			No	N	95,000	N/A													
Subaru	Forester	1999																						
Toyota	RAV4	2000	68,202		N/A		N/A	No	Y		N		N											
Dodge	Spirit	1990	92,692		N/A			N/A	N	20,000	N													
Ford	F-150	2001	48,820.10		No			No	N	18,000	N		N											
Honda	Civic	1996	131,483		N/A			N/A	Y		N		Y	2 weeks										
Honda	Civic	1991	216,562.40		N/A			N/A	N	60-85,000	N		N											
Mazda	626	2001	26,597				N/A	N/A	Y		N													
Dodge	Caravan	1989	161,017		N/A		N/A	No	N	150,000	N		Y	Sometimes										
Jeep	and Cherok	1999	90,120		N/A			Not aware	N	60,000	N		N											
Chevrolet	Corsica	1996	111,475		N/A			New water	N	33,000	N		N											
Honda	Civic	2002	50,388		N/A		N/A	N/A	Y		N													
GMC	Jimmy	1995	102,915		N/A			New radiat	Y		N		N											
Oldsmobile	eight Cutlas	1988	81,536		N/A			Not sure	N	70,000	N		N											
Jeep	Cherokee	1998	131,875		N/A			N/A	N	118,000	N		Y	2 months										
Chevrolet	Cavalier	1990	81,282		N/A			Engine rep	N	120,000	Y		N/A											
Chrysler	300	1999	73,237		N/A			Not aware	N	48,000	N		N											
Saturn	Sedan	2001	51,532		N/A			Not aware	Y		N		N											
Buick	LeSabre	1998	45,444		N/A			N/A	N	8,000	N		N											
Nissan	Frontier	2002	38,136		N/A			N/A	N	14,000	N		N											
Nissan	Pickup	1987	138,629		No			New radiat	N	Not sure	N		Y	3 years										
Saturn	SCI	1996	74,620						Y		N		N											
Dodge	Caravan	1995	113,889.80		N/A			Not aware	N	130,000	N		N											
Honda	CRV	1998																						
Mercury	Villager	1994	131,386		N/A		N/A	No	N	21,000	N		N											
Jeep	Wrangler	1995	74,158		N/A			New air co	N	61,000	N		N											
Pontiac	Grand Am	1989	116,806		1	2001	Not known	None know	N	72,000	N		Y	6 months										
Lincoln	Continental	1989	170,427		No			Radiator, w	N	100,000	N		Y											
Toyota	Solara	2001	40,081		N/A			No	Y		N		N											
Dodge	Caravan	1997	90,061		N/A			No knowle	N	84,000	N		N											
Chevrolet	Blazer	1995	100,757		No			Not aware	N	47,700	N		N											
Chevrolet	S-10	2003	19,365		N/A			No	N	3,000	N		N											
Ford	Mustang	1968	98,851.50		N/A			No	Y		N		N											
Lincoln	Continental	1990	185,060		No		N/A	Water pum	Y		N		N											
Honda	Civic	1999	76,475		No			No	Y		N		N											
Honda	Accord	1997	79,575		N/A			No	Y		N		N											
Honda	Accord	1989	209,974		No			New altern	Y				N											
Honda	Accord	2000	77,943		No			No	Y		N		N											
Ford	Taurus	2003	25,279		N/A			No	N	20,000	N		N											
Chevrolet	Malibu	1998	99,428		No			No	Y		N		N											
Honda	Odyssey	2004	21,015		No			New transr	Y		N		N											
Nissan	Pathfinder	2003	12,463		No			No	Y		N		N											
Chevrolet	Lumina	1998	70,731		No			New intake	N	59,000	N		N											
Ford	Mustang	1999	39,497.60		No			Recall on s	Y		N		N											
Hyundai	Tiburon	2000	89,219		No			New struts	Y		N		N											
Cadillac	Seville	1991	70,493		No			No	N	5,000	N		N											

					Engine Rebuild Info (BKI)				Catalytic Converter (BKI)															
Make	Model	Year	Mileage	VIN	# of rebuilds	Date of Last Rebuild	Reasons for Last Rebuild	Non OEM mods	1. Original owner? (Y/N)	Mileage at purchase?	2. Cat been replaced? (Y/N)	# of cat replcmnts	Rattling?	How long?	Odo at 1st rplcmnt	Odo at 2nd rplcmnt	Odo at 3rd rplcmnt	4.Rattling reason for cat rplcmnt?	Chk eng light reason	Fail smog chk reason	Collision damage reason	Was cat under warranty?	Customer Paid	Non-dealer?
Saturn	SL1	1999	53,419		No			No	Y		N		N											
Ford	Explorer	1993	120,271.40		No			Odometer,	N	100,000	N		N		100,000 - really 160,000									
Isuzu	Rodeo	1999	114,929		No			No	N	75,000	N		N											
Toyota	RAV4	2000	62,759		No			N	N	49,000	N		N											
Nissan	Sentra	1997	119,192		No			No	Y		N		Y	6 months										
Ford	Ranger	1999	91,037		None			No	Y		N		N											
Mercury	Sable	2002	24,580		No			No	Y		N		N											
Toyota	Camry	1994	169,031		No			New radiat	Y		N		Y	6 months										
Honda	Civic	1984	87,562		No			New fuel p	Y		N		N											
Toyota	Avalon	1999	114,750		No			No	Y		N		N											
Honda	Civic	1991	214,123		No			New brake	N	125,000	N		N											
Jeep	Cherokee	1995	171,693		No			No	Y		N		N											
Dodge	Ram	1991	90,008		No			New altern	Y		N		Y											
Toyota	Corolla	1997	146,463		No			No	Y		N		N											
Nissan	Maxima	2000	74,265		No			No	N	10,000	N		N											
Honda	Civic	1999	149,656		No			No	N	136,000	N		N											
Ford	F150	1995	184,842		No			No	N	73,000	N		N											
Ford	Contour	1995	102,066		No			New belt o	N	63,000	N		Y (belt on engine)											
Chevrolet	S10	1996	112,247		No			No	Y		N		N											
Pontiac	Grand Prix	1992	172,169		No			No	Y		N		N											
Ford	Explorer	2000	86,262		No			No	Y		N		N											
Chevrolet	Silverado	2002	40,718		No			No	Y		N		N											
Plymouth	Voyager	1998	163,230		No			New transr	Y		N		N											
Buick	LeSabre	1989	108,545		No			New altern	N	80,000	N		N											
Subaru	Legacy Ou	1996	124,047		No			No	Y		N		Y											
Ford	Thunderbird	1988	178,211		No			New therm	N	170,000	N		N											
Ford	Explorer	1995	160,608		No			New transr	N	75,000	N		N											
Volvo	S80	2001	55,515		No			No	Y		N		N											
Mazda	Protégé	1991	185,565		0			Head gask	N	60,000	N		N											
Dodge	Caravan	1999	104,197		N/A			New brake	N	26,000	N		N											
Chrysler	Town & Co	2000	85,423		No			N/A	Y		N		N											
Toyota	Celica	1999	72,222		No			No	Y		N		N											
Jeep	Cherokee	1993	172,400		No			No	N	150,000	N		Y	1 year										
Toyota	Camry	2000	48,457		No			Brakes	N	19,000	N		N											
Chevrolet	Cavalier	1997	128,162		No			No	Y		N		N											
Mercury	Grand Mar	1997	74,489		No			No	Y		N		N											
Buick	Century	1998	71,187		0			Replace ga	N	Not sure	N		N											
Ford	Probe	1993	129,123		0			Not sure; n	Y	40,000	N		Y	2 months										
Ford	Bronco	1995	198,044.90		0			Belt tensio	N	88,000	N		N											
Chrysler	Concorde	2000	93,660		1	2004	Oil pump q	Entire engi	Y		N		N											
Ford	Escort ZX2	1999	66,812		0			None	N	Not known	N		N											
Chevrolet	Blazer	2002	35,068		0			No	Y		N		N											
Lincoln	Towncar	1987	129,019		0			No	N	75,000	N	Y												
Honda	Accord	1990	170,424		0			No	Y		N		N											
Dodge	Dynasty	1988	91,307		0			No	Y		N		N											
Jeep	Cherokee	1990	261,821		0			Water pum	N	99,000	N	Y												
Ford	Escort	2002	26,740		0			No	N	19,000	N		Y	5 months										
Plymouth	Voyager	1993	170,009		0			Transmissi	Y		N		Y											

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Honda	Odyssey	2000	68,967		0			12/3 engin	Y		N		N											
Honda	Accord	2000	76,169		No			No	Y		N		N											
Ford	F150	2000	61,031		0			No	Y		N		N											
Ford	Ranger	1987	74,727		0			No	N	?	N		N											
Honda	Accord	2001	56,182		0			Transmissi	Y		N		N											
Nissan	Sentra	1994	127,045		0			No	N	14,000	N		N											
Kia	Sportage	2003	20,651		0			No	Y		N		N											
Chrysler	Lebaron	1983	43,270		0			Has only h	Y		N		Y											
Volvo	850	1997	65,084		0			This week	Y		N		N											
Mercury	Topaz	1994	9,942		0			Replaced v	Y		N		Y											
Ford	Focus	2001	52,245		0			New brake	N	25,000	N		N											
Plymouth	Voyager	1999	74,695		0			New radiat	N	20,000	N		N											
Honda	Civic	1988	205,819		0			New muffle	N	Not sure	N		N											
Buick	Regal	1996	139,853		0			New altern	Y		N		N											
Cadillac	Cimmeron	1986	17,601		No			No	N	98,000	N		N											
Ford	Ranger	1999	92,917		0			No	N	10,000	N		Y											
Pontiac	Bonneville	1985	236,759		0			No	N	Questional	N		N											
Mercury	Topaz	1994	32,686		0			New brake	Y		N		N											
Mercury	Sable	1996	110,402		0			None	N	Not sure -	N		Y											
Jeep	Cherokee	1998	82,858		0			No	N	40,000	N		Y											
Ford	Thunderbir	1995	135,032		0			Transmisis	N	24,000	N		N											
Toyota	Camry	1997	129,415		0			No	Y		N		N											
Toyota	Corolla	1996	148,857		0			None	N	Not known	N		N											
Honda	Civic	2000	40,402		0			No	Y		N		N											
Toyota	Camry	2000	47,771		0			No	Y		N		N											
Toyota	Corolla	2000	70,118		0			No	N	35,000	N		N											
Ford	F150	1984	172,311		0			None	N	Exempt	N		Y	2 yrs										
Subaru	Outback	2000	75,802		0			Radiator	N	24,000	N		N											
Chevrolet	Monte Car	1977	135,545		0			Catalytic co	N	119,000	Unsure		N									Y		
Hyundai	Santa Fe	2001	70,613		0			Check eng	Y		N		N											
Mazda	Miata	2003	75,556		0			No	N	45,010	N		N											
Chevrolet	Lumina	1999	42,977		0			No	Y		N		N											
GMC	Safari	1993	283,221		1	5 yrs ago	Original ow	Transmissi	N	Not sure	N		N											
GMC	Sonoma	2001	60,051		0			Not known	N	50,000	N		N											
Saturn	SL1	1994	116,783		No			No	Y		N		N											
Buick	Regal	1990	103,889		0			No	N	95,000	N		Y	Forever										
GMC	Astro Van	1990	147,282		0			None	N	Not known	N		N											
Chevrolet	Caprice	1986	303,803		0			New cataly	N	Not known	Y	1 - one year ago						Y					Y	
Chevrolet	S10	1985	30,295		Yes	Previous o	Not known	None since	N	75,000	N		Y	?										
Ford	Econoline	1983	88,692		0			Transmissi	Y		N		N											
Lincoln	Towncar	1989	82,496		0			None	Y		N		N											
Ford	F150	1998	98,654		0			None	Y		N		N											
Ford	Windstar	1999	102,212		0			None	Y		N		N											
Chevrolet	C 1500	1994	99,209		0			None	N	2,000	N		N											
Dodge	Stratus	1996	126,725		No			None	Y		N		N											
Ford	Tempo	1986	60,022		0			New muffle	N	30,000	N		Y											
Mazda	MX6	1988	222,707		0			Not known	N	191,000	N		N											
Oldsmobile	98	1985	188,049		0			Water pum	Y		N		N											
Lincoln	Towncar	1987	79,840		0			None	Y		N		N											
Nissan	Maxima	1992	53,979		0			None	N	26,000	N		N											
Pontiac	Bonneville	1994	125,218		0			None	N	25,000	N		N											
Ford	F150	1990	7,116		0			Not known	N	105,000														

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Ford	Taurus	2002	72,460		0			None	Y		N		N											
Chrysler	Concorde	1994	169,010		No				N		N		N											
Oldsmobile	88	1994	128,005		0			March - Ox	N	50,000	N		N											
Chevrolet	C-10	1973	36,791		No				N		N		N											
Ford	Crown Vict	1985	265		No				Y		N													
Ford	Escort Wag	1992	12,768		0			Tire rods	N	92,000	N		N											
Honda	Civic	2000	35,757		0			None	Y		N		N											
Buick	Century	1997	86,421		0			None	N	21,000	N		N											
Pontiac	Grand Am	1992	140,183		Not known			Not known	N	35,000	N		N											
Dodge	Caravan	2005	18,148		0			None	Y		N		N											
Toyota	Corolla	1989	181,867		0			Timing belt	N	140,000	N		N											
Nissan	Sentra	1993	87,064		0			None	N	Not known	N		N											
Oldsmobile	Silhouette	2000	85,283		0			None	N	69,000	N		N											
Volkswagon	Cabriolet	1991	63,817		0			None	N	12,000	N		N											
Ford	Taurus	1987	33,594		0			None	N	100,000	N		N											
Ford	F150	1986	37,843		0			New exhau	N	97,000	N		Y	1 yr										
Pontiac	6000	1988	133,718		0			None	N	37,000	N		N											
Oldsmobile	Achieva	1992	177,088		0			None	N	Not known	N		N											
Geo	Prism	1990	176,696		0			None	N	120,000	N		N											
Ford	Escort	1993	11,337		0			None	N	Not known	N		N											
Ford	Contour	1998	118,527		0			None	N	103,000	N		N											
Cadillac	Deville	1993	173,073		Yes	5,000 miles ago		New engin	N	45,000	N		N											
Honda	Accord	1987	190,529		0			None	N	186,000	N		N											
Infinite	I30	1998	49,997		0			None	N	30,000	N		N											
Plymouth	Grand Voy	1997	70,127		0			None	N	7,000	N		N											
Eagle	Talon	1994	109,739		0			None	N	108,500	N		N											
Ford	Ranger	1987	1,697		0			None	N	Not known	N		Y	Forever										
Volvo	240 GL	1983	184,215		0			New valve job			Y	once about 100,000 miles ago								Y			Y	
Chevy	S10	1989	174,031		1	25,000 miles ago		None	N	120,000	N		N											
Ford	Escort	1987	78,212		0			None	Y		N		N											
Buick	Regal	1992	166,826		0			None	Y		N		N											
Mercury	Sable	1997	104,323		No			None	N	Not known	N		N											
Ford	Taurus	2001	30,898		0			None	N	Not known	N		N											
Plymouth	Acclaim	1990	159,311		0			None	N	15,000	N		Y											
Oldsmobile	88	1991	227,260.90		0			None	N	194,000	N		N											
Dodge	Ram 50	1989	132,317		0			None	N	90,000	N		N											
Toyota	Camry	1989	269,003		0			New brake	N	Not known	N		N											
Buick	Century	1984	1,870		0			None	N	No	N		N											
Kia	Sefia	2000	58,652		0			None	Y		N		N											
Chevrolet	Cavalier	1989	58,429		0			None	Y		N		N											
Buick	LeSabre	1979	37,590		0			None	N	55,000	N		N											
Ford	F150	1994	169,741		0			None	N	128,000	N		Y											
Mercury	Marquie	1986	36,269		No			None	Y		N		Y											
Buick	ectra Park A	1989	128,599		0			New starte	Y		N		N											
Ford	Aspire	1995	188,068		0			None	Y		N		N											

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Honda	Accord	2001	39,000		0			None	Y		N		N											
Jeep	Cherokee	1995	104,260		0			None	Y		N		N											
GMC	Jimmy	1990	130,255		0			None	N	36,000	N		N											
MG	MG	1978	42,913		0			None	N	41-42,000	N		N											
Oldsmobile	Silhouette	1997	111,018		0			None	N	60,000	N		N											
Honda	Civic	2000	46,669		0			None	Y		N		N											
GMC	Sierra	1995	171,362		0			None	Y		N		N											
Dodge	Pickup	1968			0			None	Y		N		N											
Honda	Civic	1997	75,775		0			None	N	72,000	N		N											
Olds	Custom Cr	1984	8,975		0			None	y		N		N											
Volvo	GL	1984	299,695		0			None	Y		N		N											
Chevrolet	Caprice	1987	85,907		0			Within last	Y		Y													
Dodge	Ram	1997	152,029		0			None	N	75,000	N		N											
Ford	F150	1993	184,963		0			None	N	181,000	N		Y	May										
Pontiac	Grand Prix	1989	92,817		1	4 yrs. ago		None	N	Not known	N		Y	4yrs										
Buick	LeSabre	1990	59,404		0			None	N	21,000	N		N											
Dodge	Stratus	1996	146,571		0			None	Y		N		N											
Toyota	Camry	1997	127,406		0			Muffler rep	N	73,000	N		N											
Dodge	Durango	1999	92,673		0			None	Y		N		?											
Honda	Civic	1998	115,362		0			None	N	Not known	N		N											
Honda	Civic	2001	49,723		0			None	N	34,000	N		N											
Honda	Accord	1992	75,574		0			None	N	42,000	N		N											
Pontiac	Grand Am	1994	101,517		0			None	Y		N		N											
Chevrolet	Malibu	1999	76,611		0			None	N	74,000	N		N											
Oldsmobile	Silhouette	2002	40,260		0			None	Y		N		N											
Mercedes	280 SE	1973	81,517		0			None	N	95,000	N/A		N											
Chevrolet	G20	1993	121,435		0			None	N	19,000	Y	1											Y	
Ford	F150	1997	115,366		0			None	N	46,000	N		N											
Chevrolet	Venture	2003	24,907		No			N/A	Y		N		N											
Plymouth	Voyager	1991	158,762		No			N/A	Y		N		N											
Dodge	Avenger	1996	124,720		No			N/A	Y		N													
Toyota	Corolla	1989	80,740		No			N/A	Y		N													
Nissan	Sentra	1997	154,236		0			None	N	50,000	N		N											
Toyota	Camry	1990	202,788		0			None	Y		Y		N											
Nissan	Altima	2000	95,296		0			None	Y		N		N											
Plymouth	Sundance	1989	144,664		0			None	N	46,000	N		Y	1 yr.										
Toyota	Camry	1998	127,647		0			None	Y		N		N											
Ford	Winstar	2001	37,914		0			None	Y		N		N											
Toyota	Avalon	1996	108,173		0			None	Y		N		N											
Nissan	Maxima	1997	111,644		0			None	N	101,000	N		N											
Toyota	Camry	1999	60,271		0			None	Y		N		N											
Ford	Taurus	1998	77,795		0			None	Y		N		N											
Jeep	Wrangler	1997	94,822		0			None	N	94,000	N		N											
Kia	Rio	2004	6,248		0			None	Y		N		N											
Chevrolet	Caprice	1990	72,455		0			None	N	90,000	N		N											
Mercury	Grand Mar	1988	87,701		0			None	Y		N		N											

					Engine Rebuild Info (BKI)				Catalytic Converter (BKI)															
Make	Model	Year	Mileage	VIN	# of rebuilds	Date of Last Rebuild	Reasons for Last Rebuild	Non OEM mods	1. Original owner? (Y/N)	Mileage at purchase?	2. Cat been replaced? (Y/N)	# of cat replcmnts	Rattling?	How long?	Odo at 1st rplcmnt	Odo at 2nd rplcmnt	Odo at 3rd rplcmnt	4.Rattling reason for cat rplcmnt?	Chk eng light reason	Fail smog chk reason	Collision damage reason	Was cat under warranty?	Customer Paid	Non-dealer?
Toyota	Pickup	1987	225,160		0			Rebuilt Ca	Y		N		N											
Chevrolet	Cavalier	2004	8,412		0			None	Y		N		N											
Pontiac	Grand Am	1997	57,229		0			Oxygen se	Y		N		N											
Saturn	Sedan	2001	63,143		0			None	N	21,000	N		N											
Plymouth	Voyager	1999	75,474		0			None	Y		N		N											
Toyota	Camry	1994	128,219		0			None	N	38,000	N		N											
Ford	Ranger	2003	11,661		0			None	N	10,000	N		N											
Kia	Sedona	2004	6,336		0			None	Y		N		N											
Toyota	Corolla	1995	106,184		0			None	N	97,000	N		N											
Toyota	Sienna	2000	131,762		0			None	Y		N		N											
Oldsmobile	Cutlass	1987	178,755		0			None	N	Not known	N		N											
Chevrolet	Lumina	1997	133,428		0			N/A	N	125,137	N		N											
Ford	Contour	1996	98,554		0			Air flow me	Y		N		N											
Ford	F150	1989	61,498		0			N/A	N	160,000	N		N											
Saturn	Wagon	1993	220,816		1			5,000 plus	N	200,000	N		N											
Chevrolet	Tracker	2003	22,356		0			None	Y		N		N											
Chevrolet	Caprice Cl	1987	29,804		0			New water	N	Not known	N		N											
Ford	Escort	1999	74,087		0			None	Y		N		N											
Toyota	Camry	2001	61,399		0			None	N	59,000	N		N											
Dodge	Pickup	1986	47,558		2	Over 5,000 miles ago		Engine reb	Y		N		N											
Chevrolet	Suburban	1995	73,823		0			None	N	50,000	N		N											
Toyota	Corolla	1992	84,898		0			None	N	82,000	N		N											
Pontiac	Grand Am	1997	120,904		0			Transmissi	Y		N		N											
Mercury	Tracer	1995	146,952		1		Drop lifters	Screw/bolt	N	100,000	N		N											
Chevrolet	Lumina	2001	57,812		0			None	Y		N		N											
Ford	Taurus	1998	91,846		0			None	Y		N		N											
Toyota	Corolla	1996	288,774		0			None	Y		N		N											
Nissan	Maxima	2002	80,341		0			None	N	20,000	N		N											
Mercedes	SEL	1980	185,871		0				N	Not known	N		N											
Ford	Taurus	1993	69,356		0			None, New	N	Not known	N		N											
Chevrolet	Astrovan	1990	235,459		0			9 months a	N	160,000	N		N											
Volvo	850 Turbo	1996	81,768		0			None	N	30,000	N		Y											
Toyota	Camry	1994	88,207		0			None	N	50,000	N		N											
Saturn	SL1	1997	170,219		0			None	Y		N		N											
Ford	Taurus	1995	70,386		0			None	N	Not known	N		N											
Oldsmobile	Cutlass	1989	118,171		0			None	Y		N		N											
Honda	Odyssey	2000	117,932		0			None	N	Not known	N		N											

					Engine Rebuild Info (BKI)				Catalytic Converter (BKI)															
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Lincoln	Continental	1995	100,945		1	2002	Light came	None other	Y		N		Y											
Ford	F150	1989	24,712 ?		0			None	N	100,000	N		N											
Mercury	Grand Mar	1994	127,716		0			None	N	23,000	N		N											
Pontiac	Grand Am	1998	75,714		0			None	N	60,000	N		N											
Toyota	Camry	1996	164,867		0			None	N	Not known	N		N											
Chevrolet	Avalanche	2002	30,880		0			None	Y		N		N											
GEO	Prism	1996	169,526		0			None	N	42,000	?		N											
Ford	Bronco	1990	49,548		0			None	N	Not sure	N		N											
Honda	Accord	1997	77,793		0			None	N	31,000	N		N											
Nissan	Maxima	1990	258,730		0			None	N	Not known	N		Y	3 months										
Volkswagon	Cabriolet	1999	38,308		0			Not known	Y		N		N											
Ford	Escort	1995	106,984		0			Valve seat	Y		N		N											
Chevrolet	Silverado	1976	2,878		0			?, Regular	N	95,000	N		Y/N											
Chrysler	300M	1999	90,213		0			None	N	Not known	N		N											
Honda	Odyssey	2000	74,582		0			None	Y		N		N											
Honda	Accord	1997	82,918		0			None	Y		N		N											
Plymouth	Voyager	1998	168,860		0			None	Y		N		N											
Honda	Accord	2001	62,342		0			None	Y		N		N											
Honda	Civic	1991	220,013		0			None	Y		N		N											
Toyota	Corolla	1995	107,975		0			None	Y		N		N											
Dodge	Caravan	1997	96,428		0			None	Y		N		N											
Pontiac	Grand Am	1989	123,567		1			1991 engin	Y		N		N											
Dodge	Caravan	2000	85,178		0			None	Y		N		N											
Mercury	Sable	2002	29,493		0			None	Y		N		N											
Ford	F250	1979	5,778		0			None	N		?		Y											
Chevrolet	Malibu	1999	79,917		0			None	Y		N		N											
Honda	Civic	1996	140,462		0			None	Y		N		N											
Saturn	SC1	1996	78,337		0			None	Y		N		N											
Chevrolet	Lumina	1998	79,171		0			None	Y		N		N											
Pontiac	Grand Am	1997	58,079		0			None	Y		N		N											
Chevrolet	Impala	2003	11,323		0			None	Y		N		N											
Dodge	Durango	1999	95,983		0			None	Y		N		N											
Honda	Civic	1998	118,202		0			None	N	68,000	N		N											
Jeep	Cherokee	1998	137,044		0			None	N	118,000	N		Y											
Jeep	Cherokee	1995	179,113		0			None	N	Not known	N		N											
Honda	Accord	2000	84,167		0			None	Y		N		N											
Ford	Explorer	1995	162,618		0			None	Y		N		N											
Saturn	LS1	2000	51,713		0			None	N	?	N		N											
Chevrolet	Malibu	1998	107,039		0			None	Y		N		N											
Dodge	Spirit	1990	9,366		0			None	N	20,000	N		N											
Saturn	Sedan	2001	44,243		0			None	Y		N		N											
Mitsubishi	Galant	2001	51,756		0			None	Y		N		N											
Mercury	Grand Mar	1991	9,284		0			Leak in the	N	66,000	N		N											
Jeep	Wrangler	1997	97,507		0			None	N	14,510	N		N											
Toyota	Camry	1994	131,858		0			None	N	38,000	N		N											
Toyota	Camry	1994	131,858		0			None	N	38,000	N		N											
Chevrolet	S-10	1995	124,968		0			None	N	19,000	N		N											
Saturn	Sedan	1999	98,556		0			None	N	42,000	N		N											

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Buick	Park Aven	1995	144,926		0			None	N	40,000	N		N											
Chevrolet	Silverado	2002	48,135		0			None	Y		N		N											
Buick	Century	2001	33,740		0			None	N	22,000	N		N											
Ford	F150	2001	93,614		0			None	N	70,000	N		N											
Geo	Prism	1991	132,317		1	9 months a	?	Bought w/r	N	110,000	N		N											
Pontiac	Bonneville	1995	168,126		0			None	Y		N		Y											
Toyota	Sienna	2000	137,485		0			None	Y		N		N											
Plymouth	Voyager	1999	79,222		0			None - Fac	N	9,780	N		N											
Saturn	Sedan	2001	67,283		0			?	Y		N		N											
Chevrolet	Tracker	2003	29,510		0			None	Y		N		N											
Buick	Regal	1994	92,169		0			None	N	40,000	N		N											
Nissan	Maxima	1995	181,369		0			None	N	160,000	N		N											
Ford	Taurus	1995	139,293		0			None - spe	N	Not known	N		N											
Pontiac	Grand Prix	1994	177,915		0			None	Y		N		N											
Ford	Mustang	1995	146,273		0			None	N	18,698	N		N											
Ford	Aerostar	1993	147,310		0			None	Y		N		Y											
Plymouth	Voyager	1989	145,299		0			None	N	104,000	N		N											
Ford	Ranger	1988	77,513						N	?	Not Known		N											
Ford	Crown Vict	1995	179,723		0			None	N	40,000	N													
Ford	Aerostar	1992	164,552		0			None	N	35,000	N		N											
Chevrolet	Lumina	1994	124,169		0			None	N	Not known	N		Y											
Ford	Contour	1995	104,023		0			New timing	N	Not known	N		N											
Dodge	Intrepid	1994	145,942		0			None	N	40,000	Y	11/22/04 -	N					Rattling					Y	
Dodge	Caravan	1989	162,870		N/A			No	N	150,000	N		Y											
Chevrolet	1500 Pick	1996	124,539		0			None	N	60,000	N		N											
Ford	Tempo	1996	70,388		0			None	N	30,000	N		N											
Mercedes	280	1973	86,123		0			None	N	95,000	N/A	N												
Chevrolet	Monte Carlo	1977	36,991		0			Catalytic co	N	119,000	Unsure		N											
Ford	Explorer	1996	109,585		0			Transmissi	Y		N		N											
Dodge	Ram Pick U	1989	133,974		0			None	N	Not known	N		Y											
Honda	Civic	1988	207,257		0			None	N	?	N		N											
Jeep	Cherokee	1998	103,057		0			N/A	N	43,000	N		N											
Dodge	Neon	1996	79,812		0			None	N	69,000	N		N											
Buick	LeSabre	1979	40,349		?			? - Old veh	N	?	?		Y											
DOdge	Caravan	1996	118,345		0			New transr	N	85,000	N		N											
Mazda	B-2200	1992	101,082		0			None	N	87,000	N		N											
Cadillac	Fleetwood	1991	97,116		0			None	N	85,000	Y		N					Rattling					Y	
Ford	Ranger	1990	73,983		1			None	Y		N		Y	70,000										
Buick	Rainer	2004	4,522		0			None	Y		N		N											
Toyota	Pickup	1987	232,090		0			New carbo	N		N		N											
Buick	LeSabre	1995	126,028		0			None	N	120,000	N		N											
Chevy	10 Silverad	1984	82,250		0			None	N	78,786	N		Y											
Ford	Ranger	1997	118,462		0			None	N	57,000	N		N											
GMC	Sonoma	1996	51,855		0			Clutch @ 1	Y		N		N											
Ford	Freestar	2004	14,705		0			None	Y		N		Y											
Toyota	Runner SR	1995	85,889		0			None	N	40,000	N		N											
Chevrolet	Suburban	1994	139,565		0			None	Y		N		N											
Toyota	Sienna	2001	59,726		0			None	N	30,000	N		N											
Acura	Integra	1995	80,569		0			None	N	17,000	N		N											
Nissan	Frontier	1998	112,513		0			None	Y		N		N											
Chrysler	Concorde	1996	111,485		0			None	Y		N		N											
Ford	Taurus	2002	26,398		0			None	Y		N		N											
Chrysler	Concorde	2000	65,322		0			None	Y		N		N											

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Dodge	Intrepid	1993	210,281		0			None	N	201,000	N		N											
Ford	F150	1989	160,598		0			Transmissi	N	90,000	N		Y											
Chevrolet	Astrovan	1992	217,149		0			None	N	140,000	N		N											
Chevrolet	Suburban	1994	187,394		0			Rebuilt trar	N	60,000	N		Y											
Ford	F150	2001	107,196		0			None	Y		N		N											
Honda	Civic	1992	124,688		0			1998 Trans	Y		N		N											
Chevrolet	Caprice	1982	88,587		0			None	N	Not known	N		Y											
Mitsubishi	Montero	2003	19,453		0			None	Y		N		N											
Dodge	Stratus	1999	108,830		0			None	N	106,000	N		N											
Chrysler	Concorde	2002	34,223		0			None	Y		N		N											
Buick	Skylark	1994	200,807		1	1999		Replaced t	N	68,000	N		N											
Chevrolet	Astro Van	1993	205,876		0			None	N	Not known	N		Y											
Dodge	Caravan	1992	213,485		0			Head gask	N	200,000	N		N											
Dodge	Caravan	1998	80,570		0			None	Y		N		N											
Lincoln	Towncar	1991	188,025		0			None	N	82,000	N		N											
Isuzu	Pickup	1995	87,207		0			Cat replace	Y		Y	Once						Rattling					Y	
Ford	Taurus	2001	47,470		0			None	N	33,000	N		N											
Honda	Accord	1997	101,877		0			None	N	Not known	N		N											
Chevy	C1500	1996	46,702		0			None	Y		N		N											
Mercury	Marquis	1994	130,513		0			None	N	Not known	N		N											
Dodge	Ram	1995	93,417		0			None	N	90,000	N		N											
Geo	Tracker	1992	48,696		0			None	N	47,000	N		N											
Plymouth	Sundance	1992	84,644		0			Door	Y		N		N											
Honda	CRV	1998	76,197		0			None	N	72,000	N		N											
Chevrolet	Suburban	1999	88,892		0			None	N		N		N											
Subaru	Legacy Wa	1993	114,219		0			None	Y	60,000	N		N											
Pontiac	Montanna	2003	49,320		0			None	N	Not known	N		N											
Ford	Ranger	1998	48,200		No			None	Y		N		N											
Chevrolet	Tahoe	1996	69,002		0			New brake	N	46,500	N		N											
Dodge	Caravan	1996	161,262		0			None	Y		N		Y											
Jeep	Cherokee S	2000	88,505		0			None	N	69,000	N		Y											
Dodge	Dakota	1999	64,146		0			None	N	33,000	N		N											
Toyota	Corolla	1995	103,059		0			None	N	33,000	N		N											
Dodge	Intrepid	1995	113,898		0			None	Y		N		Y											
Lincoln	Town Car	1988	131,660		0			None	Y		N		N											
Isuzu	Axiom	2002	46,354		0			None	Y		N		N											
Oldsmobile	Silhouette	2002	61,160		0			None	Y		N		N											
Ford	F150	1992	134,776		1	Last year about 30,00		New starte	N		N		N											
Dodge	Durango	2002	28,700		0			None	N	17,000	N		N											
Chrysler	Town & Co	2001	75,537		0			None	N	42,000	N		N											
Buick	Park Aven	2000	67,091		0			None	N	66,400	N		N											
Dodge	Dakota	1998	49,767		0			None	N	28,000	N		N											
Chevrolet	S-10	2001	106,227		0			0	Y		N		N											
Ford	Country Sq	1986	154,302		0			None	Y		N		N											
Cadillac	Deville	1992	155,888		0			None	Y		N		N											
Dodge	Dakota	2004	8,619		0			None	Y		N		N											
Honda	Odyssey	1995	109,036		0			None	N	15,000	N		Y											
Dodge	Caravan	1998	122,222		?			None	N	Not known	N		N											
Ford	Ranger	2002	18,741		0			None	Y		N		N											
Mercury	Topaz	1994	141,466		0			None	N	100,000	N		N											

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Ford	Ranger	1996	126,843		0			None	N	Not known	N		N											
Ford	Taurus	1995	203,058		0			None	N	60,000	N		N											
Chevrolet	S-10	1994	63,894		0			None	N	15,000	N		N											
Chevy	Silverado	1994	104,721		1	38,000 mil	Rod went d	None	Y		Y	1	N					Rattling					Y	
Ford	Taurus	1993	119,452		0			New transr	Y		N		N											
Buick	Park Aven	1993	74,419		0			None	Y		N		N											
Chevrolet	Lumina	1994	126,807		0			None	N	85,000	N		N											
Ford	Windstar	1998	146,235		0			Under warr	N	12,000	N		N											
Volvo	960	1993	195,994		0			Transmissi	N	13,000	N		N											
Ford	Tempo	1993	124,583		0			None	N	82,000	N		Y	Last month										
Chevrolet	Blazer	1996	93,877		0			None	N	35,000	N		N											
Chrysler	Town & Co	2002	30,315		0			None	Y		N		N											
Chevrolet	S10	1995	74,703		0			None	N	54,000	N		N											
BMW	528E	1988	287,798		0			None	N	Not known	N		N											
Chevrolet	Corsica	1995	78,735		0			Replaced c	N	75,000	N		N											
Chrysler	Town & Co	1996	212,969		0			Transmissi	N	69,000	N		N											
Ford	Ranger	1994	122,875		0			Transmissi	N	80,000	N		N											
Ford	Escort	1993	199,926		0			None	N	50,000	N		Refer to questionare											
Nissan	Pickup XE	1995	86,697		0			None	N	5,000	N		N											
Plymouth	Voyager	1993	166,354		1	40,000 miles ago			Y		N		N											
Dodge	Caravan	1995	131,298		0			None	N	85,000	N		N											
Mercury	Villager	1997	166,799		0			None	N	39,000	N		N											
Buick	LeSabre	1978	81,364		0			None	N	26,000	N/A		N											
Saturn	L-Series	2001	56,662		0			None	Y		N		N											
Ford	Taurus	1993	192,185		0				N	170,000	N		Y											
Ford	Escape	2002	44,042		0			None	Y		N		N											
Ford	LTD	1979	65,818		0			None	N	Not known	N/A		Y	?										
Honda	Accord	1998	75,052		0			None	Y		N		N											
Ford	Econoline	2001	41,183		0			None	Y		N		N											
Toyota	4 Runner	1993	178,447		0			None	Y		N		N											
Pontiac	Sunbird	1994	145,852		0			None	N	100,000	N		N											
Ford	Escort	1998	133,068		0			None	N	60,000	N		N											
Ford	Taurus	1997	97,585		0			None	Y		N		N											
Ford	Winstar	1998	99,271		1	15,000 mil	Not sure	None	Y		N		Y											
Toyota	Avalon	1998	29,580		0			None	Y		N		N											
Ford	Explorer	1993	47,971		0			None	Y		N		Y/N											
Buick	Regal	1979	58,560		No			None	N		Y	Once												
Jeep	Cherokee	1988	163,807		0			None	Y		N		N											
Mazda	Protégé	1998	85,890		0			None	N	79,000	N		N											
Datsun	210 Wagon	1979	47,098		0			None	Y		N/A		Y											
Buick	Skylark	1998	65,043		0			None	N	27,000	N		N											
Jeep	Cherokee	1993	116,429		0			None	Y		N		N											
Datsun	280Z	1977	94,772		0			None	N	92,000	N/A		Y											
Honda	Civic	1999	100,072		0			None	N	31,000	N		N											
Toyota	Camry	1989	168,083		1	2002	Drove car	None	N	127,000	N		N											
Buick	Regal	1978	64,563		0			Valve job 4	N	Not sure	N/A		N											
Ford	E150	1991	65,710		0			None	N	133,000	N		N											
Nissan	Quest	1996	125,664		1	1997	Drove with no oil.		Y		N		Y	1-2 weeks										
Oldsmobile	88	1990	185,678		0			None	N	149,000	N		N											
Ford	F150	1987	103,949		0			Not that is	N	99,000	N		N											
Ford	Ranger	2000	33,672		0			None	Y		N		N											
Ford	F250	1989	70,610		0			None	N	Not known	N		N											
Oldsmobile	Delta 88	1978	73,721		0			New transr	N				N											

					Engine Rebuild Info (BKI)				Catalytic Converter (BKI)															
Make	Model	Year	Mileage	VIN	# of rebuilds	Date of Last Rebuild	Reasons for Last Rebuild	Non OEM mods	1. Original owner? (Y/N)	Mileage at purchase?	2. Cat been replaced? (Y/N)	# of cat replcmnts	Rattling?	How long?	Odo at 1st rplcmnt	Odo at 2nd rplcmnt	Odo at 3rd rplcmnt	4.Rattling reason for cat rplcmnt?	Chk eng light reason	Fail smog chk reason	Collision damage reason	Was cat under warranty?	Customer Paid	Non-dealer?
Chevrolet	Suburban	1997	145,130		0			None	Y		N		N											
Plymouth	Voyager	1999	113,364		0			None	Y		N		N											
Plymouth	Voyager	1992	154,223		0			None	N	66,000	N		N											
Ford	Ranger	1992	197,429		0			Transmissi	N	98,000	N		N											
Ford	Ranger	1992	135,705		0			None	N	Not known	N		N											
Ford	Econoline	1996	203,336		0			None	N	86,000	N		Y	Ever										
Volkswagon	Beetle	1973	18,484		1	er 3,000 mi	Needed it	None	N	110,000	N/A		N											
Plymouth	Acclaim	1989	164,184		0			None	N	Not known	N		N											
Dodge	Ram Pickup	1987	23,190		0			None	N	115,000	Y		N											
Toyota	Camry	1999	64,126		0	N/A	N/A	None	N	29,000	N		N											
Chevrolet	Trailblazer	2002	77,750		0			None	Y		N		N											
Ford	Crown Vict	1989	62,838		0			Questionab	N	Not known	N		N											
Honda	Accord	1989	139,955		No			None	N	42,000	N		N											
Acura	TL	1996	117,634		0			None	N	90,000	N		N											
Ford	Econoline	1986	87,042		No			None	N	150,000	N		N											
Honda	Odyssey	2002	55160		0			None	Y		N		N											
Kia	Sedona	2004	16,601		No				Y															
Chrysler	Town & Co	2002	31,712		No				Y															
Honda	Odyssey	2003	44,743		No				Y															
Jeep	Cherokee	2001	85,959		0			None	Y		N		N											
Plymouth	Voyager	2003	20,779		No			None	Y		N													
Toyota	Sienna	2001	80,211		0			None	Y		N		N											
Dodge	Caravan	2002	60,774		0			None	Y		N		N											
Dodge	Caravan	2003	46,866		0			None	N	14,000	N		N											
Oldsmobile	Cutlass	1990	97,513		0			None	N	78,000	N		N											
Plymouth	Voyager	1988	162,866		0			None	Y		N		N											
Volvo	740	1987	248,169		1	4 years ago		None	N	Over 100,0	N		N											
Oldsmobile	Cutlass	1980	79,411		?			None	Y		N		N											
Chevrolet	Cavalier	1995	140,492		0			None	N	100,000 pl	N		N											
Dodge	Spirit	1989	139,488		0			None	Y		N		N											
Ford	Escort	1987	128,352		No			Fuel pump	Y		N		N											
Ford	Explorer	1994	98,966		No			None	N	90,000	N		N											
Nissan	Pathfinder	2001	66,276		0			None	Y		N		N											
Dodge	Dakota	1987	112,830		0			None	N	94,000	N		Y	Within the last year										
Honda	Accord	1988	209,194		1	2 yrs ago		Muffler rep	N	180,000	N		N											
GMC	Sonoma	1995	56,562		No			None	N	16,000	N		N											
Nissan	Pickup	1988	220,628		0			Head gask	Y		Y	Once 3,000+ miles ago						Rattling					Y	
Chevrolet	Lumina	1990	136,296		0			None	N	57,000	N		N											
Chevrolet	C20 Pickup	1977	37,681		0			See attach	Y		N/A		N											
Buick	Electra Pa	1990	169,851		0			None	N	20,000	N		N											
Chrysler	LeBaron	1988	117,003		0			None	N	97,000	N		N											
Cadillac	Eldorado	1990	185,376		0			None	N	?	N		N											
Chevrolet	Lumina	1990	123,624		0			None	N	45,000	N		Y	2 years										
Chevrolet	Astrovan	1989	215,900		No			None	Y		N		N											
Dodge	Caravan	1988	61,431		0			Wheelchai	N	59,000	N		N											
Ford	F250	1982	85,487		1	80,000 miles		None	N	140,000	N		N											
Buick	Century	1990	148,951		No			None	Y	129,245	N		N											
Ford	F150	1988	14,067		0			None	N	Not known	N		N											
Toyota	Pickup	1989	262,300		0			None	N	170,000	N		N											
Chevrolet	Corsica	1989	98,988		No			None	N		N		N											
Mercury	Topaz	1989	106,137		0			New muffe	N	Not known	N		N											

					Engine Rebuild Info (BKI)				Catalytic Converter (BKI)															
Make	Model	Year	Mileage	VIN	# of rebuilds	Date of Last Rebuild	Reasons for Last Rebuild	Non OEM mods	1. Original owner? (Y/N)	Mileage at purchase?	2. Cat been replaced? (Y/N)	# of cat replcmnts	Rattling?	How long?	Odo at 1st rplcmnt	Odo at 2nd rplcmnt	Odo at 3rd rplcmnt	4.Rattling reason for cat rplcmnt?	Chk eng light reason	Fail smog chk reason	Collision damage reason	Was cat under warranty?	Customer Paid	Non-dealer?
Toyota	Tercel	1983	87,893		0			None	Y		Y	Once										Y		
Dodge	Spirit	1990	109,922		1	less than 20,000 miles		New muffle	N	20,000	N		N											
Honda	Accord	1988	209,384		No			None	N	109,000	N		N											
Pontiac	Firebird	1979	45,360		0			Carborator	N	Not known	N		N											
Oldsmobile	Delta 88	1991	139,412		0			None	N	96,000	N		N											
GMC	Vandura	1983	52,720		0			Rebuilt trar	N	Not known	N		N											
Ford	Bronco	1990	104,994		0			None	N	Not known	N		N											
Toyota	Pickup	1983	97,627		No			None	N	85,000	N		N											
Cadillac	Fleetwood	1989	118,705		0			None	Y		It is totally removed		Y	Sunday of this week										
Buick	Park Avenu	1989	146,845		0				N	140,000	N		Y											
Chevrolet	eyenne Pic	1973	57,468		No			Not origina	N		N		N											
GMC	1500	1988	130,666		1	30,000 miles ago		Transmissi	N	45,000	N		N											
Chevy	El Camino	1976	61,800		0			None	Y		N/A		N											
Ford	F150	1986	94,729		0			None	N	93,000	N		N											
Ford	Ranger	1990	72,968		0			New valve	N	150,000	N		N											
Ford	F-150	1988	62,939		0			None	N	158,000	N		Y	Occasionally										
Toyota	Camry	1990	138,226		0			None	N	115,000	N		N											
Oldsmobile	Cutlass	1989	220,953		1	Many yrs ago		None	N	212,000	N													
Chevrolet	C-10	1983	98,784		0			None		80,000	N		N											
Ford	F150	1988	97,153		1	3,000 plus miles ago		New transr	Y		Y	Once (a wh	N											
Buick	Century	1988	94,539		0			None	N	83,000	N		N											
GMC	Jimmy	1992	90,855		No			None	N	60,000	N		N											
Chevrolet	Carpice	1985	58,223		0			New transr	Y		N/A		N											
Ford	F150	1978	73,439		0			None	N	Not known	N/A	Y												
Toyota	4x4	1987	169,285		0			None	N	Not known	N		N											
Oldsmobile	Cutlass	1987	87,003		No				N	42,000														
Chevrolet	Nova	1976	86,086		0			New carbo	N	65,000	N/A		N											
Chevy	Impala	1973	94,171		0			None	Y		N/A													
Ford	F150	1990	38,797		0			New transr	N	85,000	N		N											
Chevrolet	Malibu	1980	31,245		No			No	N	70,000	N		N											
Chevrolet	G20 Van	1989	27,420		No			No	N	70,000	N		N											
Chevrolet	S-10 Blaze	1987	153,390		0			New motor	N	Not known	N		N											
Dodge	Caravan	2003	10,184		No				N	5,000	N		N											
Ford	Ranger	1989	20,857		0			None	N	99,000	N		N											
Chevrolet	Monte Carl	1984	68,802					None	y		N		N											
Saturn	Wagon	1994	32,325		0			None	Y		N		N											
Ford	Mustang	1979	45,542		0			None	Y		N/A													
Volkswagon	Thing	1974	81,747		0			None	N		N/A		Y											
Mazda	B2200	1988	220,309		0			None	Y		N		N											
Mazda	Protégé	1999	122,960		No				N		N		N											
Chevrolet	1500	1989	140,662		0			New exhau	N	6,000	N		N											
Oldsmobile	Cutlass	1990	85,441						Y		N		N											
Jeep	CJ7	1979	8,509		0			None	N	Not known	N/A		Y											
Chevrolet	Cavalier	1991	182,333		0			None	N	182,000	N		N											
Oldsmobile	Cutlass	1990	71,459		0			None	Y		N		N											
Ford	Granada	1982	64,627		0			None	N	53,000	N		Y											
Ford	Aerostar	1990	19,631		0			None	N	Not known	N		N											
Subaru	Forester	2001	62,848		0			None	Y		N		N											
Toyota	Camry	2001	46,861		0			None	N	15,000	N		N											
Ford	Escape	2002	36,201		0			None	Y		N		N											
Pontiac	Grand Prix	1976	60,900		1	2 years ago		Transmissi	Y		N/A		N											
Chevrolet	Celebrity	1984	64,075		No			None	N	45,000	N		N											
Buick	LeSabre	1990	107,868		0			None	Y		N		N											
Honda	Civic	1990	133,958		0			None	Y		N		Y	Last few months										
Chevrolet	Conversion	1986	33,238		1	30,000 miles ago		Transmissi	N	95,000	N		N											

					Engine Rebuild Info (BKI)				Catalytic Converter (BKI)															
Make	Model	Year	Mileage	VIN	# of rebuilds	Date of Last Rebuild	Reasons for Last Rebuild	Non OEM mods	1. Original owner? (Y/N)	Mileage at purchase?	2. Cat been replaced? (Y/N)	# of cat replcmnts	Rattling?	How long?	Odo at 1st rplcmnt	Odo at 2nd rplcmnt	Odo at 3rd rplcmnt	4.Rattling reason for cat rplcmnt?	Chk eng light reason	Fail smog chk reason	Collision damage reason	Was cat under warranty?	Customer Paid	Non-dealer?
Ford	100 Range	1978	58,882		Yes	1997	Had 200,000 miles		N	130,000	N		N											
Ford	Escort	1998	55,293		0			None	N	38,000	N		N											
Chevrolet	Impala	1985	75,903		No				N															
Chevrolet	Beauville 1	1979	84,006		No				Y															
Ford	Escape	2005	10,511		No				Y															
Ford	Focus	2005	6,693		No				Y															
Dodge	G.C.	2003	47,640						Y															
Dodge	Caravan	1992	143,963		No				N	95,000														
Ford	F-150	1995	147,334		No				N	80,000														
Chevy	Astro	1994	133,309		No				N	30,000														
Dodge	Grand Car	2000	93,154		No				Y															
Chevy	Suburban	1997	137,613		No				N	27,000														
Toyota	4 runner	1998	115,751		No				N	100,000														
Nissan	Frontier	1998	107,607		No				N	45,000														
Ford	F-250	1995	52,565		No				N	30,000														
Dodge	Caravan	1995	136,808		No				N	42,000														
Chevy	Astro	1992	195,068		No				N	155,000														
Plymouth	Voyager	1992	235,513		No				Y															
Chevy	Blazer	1993	164,970		No				N	130,000														
Chrysler	Voyager	2002	25,981		No				Y															
Jeep	Cherokee	1996	56,429		No				N	35,000														
Ford	Club Wago	1989	13,379		No				N															
Ford	Taurus	1988	13139																					
Ford	Taurus	1988	13158																					
Ford	Taurus	1988	113170																					
Ford	Taurus	1988	113189																					
Ford	Taurus	1988	113208																					
Ford	Taurus	1988	13239																					
Ford	Taurus	1988	xxx																					
Ford	Taurus	1988	13266																					
Ford	Taurus	1988	13303																					
Ford	Taurus	1988	13323																					
Ford	Taurus	1988	13352																					
Ford	Taurus	1988	13370																					
Ford	Taurus	1988	84450																					
Ford	Taurus	1988	84461																					
Ford	Taurus	1988	84480																					
Ford	Taurus	1988	84507																					
Ford	Taurus	1988	84536																					
Ford	Taurus	1988	84544																					
Ford	Taurus	1988	84578																					
Ford	Taurus	1988	84606																					
Ford	Taurus	1988	84624																					
Ford	Taurus	1988	84651																					
Ford	Taurus	1988	84697																					
Ford	Taurus	1988	84741																					

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Owner-provided Fuel and Oil Information, associated with dyne testing

Comments	Last Fuel Purchased	Fuel Grade	Date of Last Oil Change	Oil Brand at Last Change	Oil Viscosity at Last Change	Oil Additives	Major repairs within last year	Description of Vehicle or Engine Driveability problems
	Unknown	Regular	7/12/03	Penzoil	10W-30	None	None	None
	Quick Trip	Regular	3 months	Penzoil	10W-40	None	None	None
	BP	Regular	3000 mi	Walmart Tech 2000	10W-40	None	Replaced Radiator	None
Non OEM Mods - Engine replaced 4/7/04 59,008 miles factory replacement un	Quick Trip	Regular	7/7/04	Penzoil	5W-30	None	Engine replaced 4/7/04 at 40,000 miles	None
	Phillips 66	Regular	7/12/04	Penzoil	10W-30	None	None	None
Rattling? - Rear	Quick Trip	Regular	5/1/04	Penzoil	10W-30	None	Ground head and replaced 2 valve seats	None
	Phillips 66	Premium	3 months, 2200 miles	Quaker State	10W-30	None	None	None
Reject all wheel drive	Quick Trip	Regular	3/20/04, 5000 miles	Valvoline	10W-30	None	None	None
Rejected 4 wheel drive will not turn off	Citgo	Regular	3000 miles	Walmart Tech 2000	10W-30	None	None	None
	Quick Trip	Regular	4/26/04	Castrol	10W-30	None	None	None
Had to fill $20 worth of gas to test vehicle	Quick Trip	Regular	7/14/04	Penzoil	5W-20	None	None	None
How long? - Squeak in brake	Unknown	Regular	5/22/04	Unknown	5W-30	None	None	None
	Quick Trip	Regular	7/9/04	Valvoline	10W-30	None	None	None
	Phillips 66	Premium	5/14/04	Unknown	Unknown	None	None	None
	Chevron	Regular	4 months	Quaker State high mileage	10W-40	None	None	Oil leaks, engine makes noise
Reject wheel drive - no turn off/on button	Unknown	Regular	7/12/04	MOPAR	10W-30	None	None	None
	Unknown	Regular	6/18/04	Unknown	Unknown	None	None	None
	Quick Trip	Regular	7/1/04	Castrol	5W-20	Unknown	None	None
	Sam's Club	Regular	90 days	General Motors	10W-30	None	None	None
	Phillips 66	Regular	7/13/04	Unknown	Unknown	None	None	None
	Quick Trip	Regular	128172	Unknown	10W-40	None	None	None
Rattling? - Some jerking	Shell	Regular	1 year	Blank	10W-30	None	Catalyst converter replaced	exhaust was clogged - leakage of coolant
	Conoco	Regular	12000 miles	Unknown	10W-30	None	None	None
Non OEM mods - New spark plugs								
	Sam's Club	Regular	90 days	Valvoline	10W-30	None	None	None
	Phillips 66	Regular	14 weeks	Unknown	10W-30	None	None	None
	Shell	Regular	Unknown	Quaker State	10W-30	None	None	No speedometer and no rear view mirror
	BP	Regular	3400 miles	Castrol	5W-30	None	Cracked head, replaced upper 1/2 of engine	None
	Shell	Regular	not since March	Quaker State	10W-30	None	None	front driver's side tire is bad and we're getitng ready to change it Friday
Rejected all wheel drive	Quick Trip	Regular	7/16/2004	GTX	5W-30	None	None	None
	BP	Regular	1 month	Pennzoil	5W-30	None	None	Blank
	Flying J	Regular	3 months	Valvoline	10W-30	None	Replaced 5th gear in transmission	Blank
	Conoco	Regular	2500 miles ago	Valvoline	5W-30	None	None	When first started there is a rattling noice possibly from the catalytic converter
Rattling? - Getting exhaust done; Mileage # - Different from ERG info	Texaco	Regular	6 months	Quaker State	40W	None	Transmission	None
	Quick Trip	Regular	One month	Castrol	10W-30	None	None	None
	Unknown	Regular	7/14/2004	Penzoil	10W-30	None	None	None
	Quick Trip	Regular	7/20/2004	Penzoil	5W-30	None	None	Blank
	Quick Trip	Regular	6 weeks ago	Valvoline	5W-30	None	None	Blank
	Conoco	Regular	7/22/2004	Valvoline	10W-40	None	None	None
	Unknown	Regular	5/11/2004	Penzoil	5W-30	None	None	Blank
	Quick Trip	Regular	300 miles	Unknown	10W-30	None	None	None
	Quick Trip	Regular	3000 miles	Super Tech	10W-30	Restore	None	rough idle cold start then high idle to throttle to idle down
	Quick Trip	Regular	2 weeks ago	Castrol	5W-30	Unknown	None	None
	Unknown	Regular	2000 miles ago	Unknown	10W-30	None	None	None
	Caseys	Regular	3500 miles ago	Honda made by Mobil	10W-30	None	transmission replaced in winter 03	None
	Phillips 66	Regular	2 months	Unknown	10W-30	None	None	None
	Citco	Regular	7/25/2004	Valvoline	5W-30	None	Chaned intake manifold gaskets 3 months ago	None
	Conoco	Regular	5/18/2004	Unknown	5W-30	None	None	Blank
Rattling ? - Some squeaking	Phillips 66	Regular	about June 20th	SuperTech	10W-30	None	None	Blank
	Conoco	Premium	2000	Quaker State	10W-30	None	None	None

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Owner-provided Fuel and Oil Information, associated with dyne testing

Comments	Last Fuel Purchased	Fuel Grade	Date of Last Oil Change	Oil Brand at Last Change	Oil Viscosity at Last Change	Oil Additives	Major repairs within last year	Description of Vehicle or Engine Driveability problems
	Phillips 66	Regular	7/23/2004	Blank	5W-30	None	None	None
	Phillips 66	Regular	5 months ago	Unknown	10W-30	None	Radiator replaced front wheels replaced	None
	Murphys	Regular	7/25/2004	Penzoil	10W-30	None	None	None
	Quick Trip	Regular	1000	Unknown	10W-30	None	None	None
	Conoco	Premium	6 months	WalMart Brand	10W-30	None	None	No engine problems. Noise in drivers from wheel when turn
	Quick Trip	Regular	5/7/2004	Unknown	5W-30	None	None	I think the fuel injectors get clogged. It doesn't seem to have the get up & go that it used to.
	Conoco	Regular	May-04	Motorcraft	5W-20	None	None	None
	Shell	Regular	1 year	Valvoline	10W-40	None	None	Oil leaking from engine, need front end alignment
	Quick Trip	Regular	7/26/2004	Penzoil	Unknown	None	None	Usually dies on first attempt to start
	Conoco	Regular	3 months	Castrol	5W-30	None	Timing Belt	None
	Texaco	Regular	May-04	Riley	5W-30	None	None	None
	Unknown	Regular	3-4 months	Unknown	10W-30	None	replace radiator; replace power steering mechanism	None
	Quick Trip	Regular	3 months	Firestone	10W-30	None	brakes, califers, A/C	None
	Unknown	Regular	5/20/2004	Riley	5W-30	None	None	None
	Quick Trip	Super	4 months	Unknown	Unknown	None	Front Bumper/hood	None
	Texaco	Regular	6/2/2004	Riley	5W-30	None	None	None
	Quick Trip	Regular	7/30/2004	Quaker State	10W-40	None	None	None
	Shell	Premium	6 months	Quaker State	10W-30	None	None	None
	BP	Regular	Unknown	Unknown	10W-30	Unknown	Unknown	None
	Quick Trip	Regular	5/25/2004	Havoline	10W-30	None	None	Cutting out a little
	Conoco	Regular	7/12/2004	Unknown	5W-30	Unknown	Thermostat replaced	Blank
	Unknown	Regular	2000 miles ago	Quaker State	10W-30	None	None	None
	Conoco	Regular	2 weeks ago	Unknown	10W-30	None	None	None but A/C doesn't work
	Quick Trip	Regular	2 months	Firestone	10W-30	None	brakes	None
Rattling ? - Muffler loose	Citco	Regular	2 months	Mobil One Synthetic	5W-30	None	None	None
	BP	Regular	Jun-04	Penzoil	10W-30	None	None	Reflective material gone from drivers side headlight - won't
	Phillips 66	Premium	Mar-04	Penzoil	10W-30	None	Transmission replaced	Blank
Service light turned on	BP	Regular	Blank	Blank	Blank	None	None	Blank
	Quick Trip	Regular	3200 miles ago	Quaker State	10W-30	None	Replaced head gasket	None
	Conoco	Regular	2000 miles ago	Mobil One Synthetic	5W-30	None	None	Blank
	Quick Trip	Regular	19-Apr	Penzoil	10W-30	None	None	Sometimes gas pedal sticks
Rattling ? - Frond end - b/c 4 wheel drive has loose parts	Quick Trip	Regular	One month	Penzoil	10W-40	None	None	Blank
	Quick Trip	Regular	3 months	Firestone	10W-30	None	Driver's door replaced, brakes	None
	Conoco	Regular	5 days ago	Valvoline Maxlife	5W-30	Blank	None	Blank
Rattling? - Engine light comes on; Mileage - Different from ERG info	Conoco	Regular	71890	Exxon	10W-30	None	None	First start of day not as rapid as when new
	BP	Regular	2/21/2004	Firestone	10W-30	Blank	Blank	
	BP	Regular	Blank	Advanced Auto Parts	10W-30	None	rebuilt transmission	Alternator belt broke recently
Rattling? - Shock	Quick Trip	Regular	Jun-04	Troparctic	10W-30	Lucas	Fuel Pump	Blank
	Quick Trip	Regular	2 weeks	Valvoline Sun	10W-30	None	New engine	Oil pump failure with resulting seizing
	Unknown	Regular	7/22/2004	Mobil	5W-30	None	None	Blank
	Quick Trip	Regular	July	Unknown	Unknown	Unknown	None	No problems
	Quick Trip	Regular	2 months	Quaker State	10W-30	Blank	None	None
	Diamond Shamrock	Regular	4,000 miles	Blank	Blank	None	None	None
	BP	Regular	2 months	Unknown	10W-30	None	None	1 motor mont needs to be put on it
Rattling? - Muffler	Caseys	Regular	257058	Super Tech	10W-30	None	None	Have to pump accelerator peddle to start car
Rattling? - When it idles	Unknown	Regular	Jul-04	Havoline	5W-20	None	None	idles rough at stop lights
Rattling? - Fuel pump is rattling	Quick Trip	Regular	One month	Castrol	10W-30	"Sea Foam"	Replaced fuel pump	Think we have a defective fuel pump that is new needs to be taken off and replaced

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	Phillips 66	Regular	6/9/2004	Penzoil	5W-30	None	12/03 Engine light - Code P0401 - Insufficient EGR flow clean intake - install EGR kit	Blank
	Quick Trip	Regular	8/8/2004	Penzoil	10W-30	None	None	None
	Quick Trip	Regular	3 months	Dealer brand	Blank	Blank	None	Blank
	Conoco	Regular	6 months	Kendal	10W-30	Blank	None	Blank
	Phillips 66	Regular	2/25/2004	Penzoil	5W-30	None	New transmission 4/23/04	None
	Quick Trip	Regular	8/4/2004	Quaker State	10W-30	None	new brakes	None
	Phillips 66	Regular	18 months	Havoline	10W-30	None	None	None
	BP	Premium	24-Apr-04	Quaker State	Blank	Unknown	None	Blank
	Amoco	Regular	5 or 6 months	WalMart	10W-30	None	None	Harmonic Balancer is ratteling
Non OEM mods - Past due for oil change by 2 or 3,000 miles	Diamond Shamrock	Regular	3 months	Castrol	20W-50	None	None	Runs fine
	Diamond Shamrock	Regular	2-3 months	Unknown	10W-30	None	None	None
	Quick Trip	Regular	May-04	Valvoline	10W-30	None	None	Leaks oil and may run hot if idled for too long
	Shamrock	Regular	2.5 months	Penzoil	10W-30	None	None	Blank
	Quick Trip	Regular	2 months	Valvoline	10W-30	None	None	None
Rattling? - Squeak on driver side front	Phillips 66	Regular	3000 miles	Quaker State	10W-30	None	None	None
	Quick Trip	Regular	Blank	Penzoil	10W-30	None	None	Small leak (oil)
	Blank	Regular	June 1st	Havoline	10W-30	None	Speedometer gear in transmission	High RPMs
Rattling? - Some (possible shock)	Quick Trip	Regular	May	Penzoil	10W-30	None	None	None
Rattling? - cracked								
	Amoco	Regular	Apr-04	Valvoline	10W-30	Blank	Transmission overhaul	Blank
	Quick Trip	Premium	May	Penzoil	10W-30	None	None	None
	Unknown	Regular	6/1/2004	Unknown	5W-30	None	None	No problem
	Quick Trip	Regular	2,000 miles	N/A	10W-30	None	None	None
	Unknown	Regular	8/7/2004	Unknown	10W-30	None	None	None
	Amoco	Regular	4 months	WalMart	10W-30	Blank	None	The "timing" on the distributer needs adjusted
	Quick Trip	Regular	9/11/2004	Penzoil	Unknown	Unknown	Radiator replaced	works well
	BP	Regular	been quite a while	probably some generic	10W-40	None	None	carb probs & oil leak
	Unknown	Regular	8/7/2004	Super Tech	10W-30	None	None	check engine light has come on 3 times since January. Problems
	Phillips 66	Premium	May-04	Penzoil	10W-30	None	None	None
	Conoco	Regular	42,000	Quaker State	10W-30	None	None	None
	Quick Trip	Regular	3 months	Vavoline	5W-30	None	None	Unaware of any
	Conoco	Regular	5/15/2004	Penzoil	5W-30	None	None	None
	Quick Trip	Regular	60 days	WalMart	10W-30	None	None	None
	Phillips 66	Regular	2000 miles	Quaker State	10W-30	None	Rebuilt alternator	None
	Wood Oil	Regular	A month ago	Penzoil	Blank	Blank	Yes	Blank
	Phillips 66	Regular	Refer to windshield	Penzoil	Refer to sticker	None	Catalytic converter 1 yr 6 months	Run on after turning off engine
	Unknown	Regular	Unknown	Penzoil	10W-30	None	None	Flat cam, trk will not pull hills or run at highway speed long
PEMS only too wide dyne	Other	Regular	1 month	Vavoline	10W-40	None	None	Blank
	Caseys	Premium	300 miles ago	Penzoil	10W-30	None	None	None
	Caseys	Regular	2,000 miles ago	Vavoline	10W-30	None	None	None
	Quick Trip	Premium	5,000 miles ago	Penzoil	5W-30	None	None	None
	Quick Trip	Regular	6/8/2004	Penzoil	10W-30	None	None	None
Rattling? - Muffler	Conoco	Regular	1 week/30 miles	Penzoil	10W-30	None	None	CV Boots & Shafts tie rod ends
	Quick Trip	Regular	8/10/2004	Quaker State	10W-30	None	Unknown	None
	Quick Trip	Regular	8/21/2004	WalMart	10W-30	None	None	Blank
	Conoco	Regular	8/20/2004	Penzoil	10W-30	None	None	None
	Quick Trip	Regular	3 months	Penzoil	10W-30	None	None	Blank
	Texaco	Regular	3 months	Penzoil	10W-30	None	None	Blank

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	Shell	Regular	8/14/2004	Penzoil	5W-20	None	None	None
	BP	Regular	8/25/2004	Valvoline	5W-30	None	Leaking water pump replaced	Engine died on slowing down. Replaced EGR and oxygen sensor - runs ok now - March 2004
	7 Eleven	Regular	Jul-04	Exxon Super HQ	10W-40	None	Inner Tie rods	Blank
	BP	Regular	Jun-04	Amoco	10W-30	None	None	None
	Conoco	Regular	6/7/2004	Valvoline	10W-30	None	None	None
	Texaco	Regular	4 months	Quaker State	5W-30	Blank	None	Does not start in neutral
	Unknown	Regular	6,000	Valvoline	5W-30	None	None	None
	Quick Trip	Regular	2 months	Econoline	10W-30	None	timing belt & water pump & clutch ring	
	Quick Trip	Regular	80222 miles	GM Goodwrench	10W-30	None	None	None known
	Phillips 66	Regular	Jun-03	Penzoil	10W-30	None	None	None
	Citgo	Regular	10/16/2003	Penzoil	10W-30	None	None	vehicle generally driven around town - not suitable for commuting outside city limits. Vehicle may run hot, has slow antifreeze leak
	BP	Regular	3,500 miles	Valvoline	5W-30	None	None	Spark plugs are founed - need to be changed
	BP	Regular	4,000 miles	Valvoline	5W-30	None	None	None
	BP	Regular	1 year	Texaco	10W-30	Pro-Long	None	Tune-up Fuel injector needs cleaning
	Quick Trip	Regular	Unknown	Exxon	10W-40	None	None	None known
	Quick Trip	Regular	2 months	Penzoil	10W-30	None	None	Check engine light comes on but goes off after 20 minutes
	Quick Trip	Premium	3 weeks	O'Reilly	10W-30	Unknown	replace moter & transmission	wiring & computer trouble
	BP	Regular	3 months	Castrol	5W-30	None	None	None
	Shell	Premium	8/28/2004	Firestone	5W-30	None	None	None
	Quick Trip	Regular	3 weeks	Castrol	10W-30	None	None	engine/transmission control has problems with coming out of torque convertor lock up around 43-45 mph
	Phillips/ Conoco	Regular	3 weeks	Unknown	10W-30	None	head gasket replaced	None
	Phillips 66	Regular	3/17/2004	Penzoil	10W-40	None	None	Blank
	Quick Trip	Regular	6 months ?	Castrol	10W-30	None	None	None
	Quick Trip	Regular	One month	Valvoline	10W-30	None	None	Runs a little rough when first started
	Phillips 66	Regular	Mar-04	Penzoil	10W-30	None		None
	Quick Trip	Regular	17-Jul-04	Penzoil	10W-30	None	None	None - new brake pads
	Texaco	Regular	3 months	Penzoil	10W-30	None	just bought the car in August 04	None
Mileage at purchase? - Odometer does not work	BP	Regular	4 months	Quaker State	10W-40	None	None	some
	Phillips/ Conoco	Regular	8/3/2004	Penzoil	10W-30	None	None	drivers side window will fall into door (pliers in quadrant) check engine light stuck on - no problem with car
	Quick Trip	Regular	17-Jul-04	Penzoil	10W-30	None	None	None
	Shell	Regular	2 months	Quaker State	10W-30	None	None	None
	Amoco	Regular	18 months	Quaker State	10W-40	None	None	Needs tune up
	Conoco	Regular	9/8/2004	Penzoil	10W-30	Unknown	None	None
	Texaco	Regular	3,000 miles	Motor oil	10W-40	None	None	None
	BP	Super	35,252	Valvoline	10W-30	None	None	front brakes low, left blinker broken - must hold down to activate/operate
Rattling ? Stepboard	Quick Trip	Regular	Mid July	Valvoline	5W-30	None	None	engine rod is knocking
	Phillips 66	Regular	Mar-04	Jiffy Lube	Unknown	None	None	Blank
	Shell	Regular	2 months	Havoline	10W-30	None	Blank	Blank

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	Quick Trip	Regular	Aug-04	Mobile	10W-40	None	None	None
	Quick Trip	Regular	Summer 2004	Jiffy Lube	Heavy wt synthetic for high mileage cars	Bardahl no smoke	replaced starter & fuel pump	doesn't like to drive > 50/55 mph
	Phillips 66	Regular	3 months	Honda dealer brand	Unknown	None	None	None
	Woods Mini Mart	Regular	Blank	Havoline	10W-30	None	None	need to replace muffler & tail pipe
Rejected	Conoco	Regular	8 months ago	Quaker State	10W-40	STP Oil Treatment	None	None
	Conoco	Premium	2 months ago	Quaker State	10W-40	STP Oil Treatment	None	None
Cat been replaced? 1-2 years ago	Blank	Regular	One week		10W-40	None	Transmission muffler	tend to shake when stopping
	Quick Trip	Regular	3 months	Quaker State	10W-30	None	None	check engine light on because sometimes won't fire on one cylinder
	Quick Trip	Regular	Jun-04	Valvoline	10W-30	None	None	drivers door latch inside broken
Rattling? - Shocks	Woods	Regular	9	Penzoil	10W-30	None	None	Blank
	Quick Trip	Regular	6-Mar-04	Mobile 1	5W-30	None	None	
	BP	Regular	1 month ago	Penzoil	10W-30	None	tierod - right front/wheel bearings - front	at an idle when A/C is on it sputters and loses power - popping sound when turning
	Quick Trip	Regular	7/19/2004	Valvoline	5W-30	None	repair rear of car & muffler (car accident)	None
	BP	Regular	7/1/2004	Shell	5W-30	None	None	None
	Quick Trip	Regular	2.5 months	Shell	5W-30	None	None	None
	Unknown	Regular	about 2 months ago - not sure	Shell	5W-30	None	None	None
	Quick Trip	Regular	Blank	Valvoline	5W-30	None	None	Blank
	Shell	Regular	7/10/2004	Penzoil	5W-30	None	None	Blank
	Conoco	Regular	7/5/2004	Mobil	5W-30	None	None	None
	Phillips 66	Regular	3 months	Blank	20-50W	None	None	Bad gas - Diamond Shamrock caused it to miss
Cat been replaced? - over 5,000 miles ago, Rattling reason for cat rplcmnt? - e	Shell	Regular	at 120,000 miles	Valvoline	10W-30	STP	None	We think the oxygen sensor is out
	Conoco	Regular	7/27/2003	Valvoline or Castrol	10W-30	None	None	High temperature at low idle after highway driving
	BP	Regular	8/21/2004	Penzoil	10W-30	None	None	Blank
	Quick Trip	Regular	5/12/2004	Quaker State	5W-30	Noen	None	None
	Unknown	Regular	7 months?	Havoline	10W-30	None	None	the check engine light stays on and so does the brake light
Cat been replaced? - over 5,000 miles ago	Kwik Stop	Regular	about 1,600 miles ago	Unknown	Unknown	None	timing belt, wheel bearing, CV boot	burns a slight amount of oil
	BP	Regular	Jul-04	Unknown	10W-30	None	None	None
	Conoco	Regular	approx 3 months ago	Penzoil	5W-30	None	None	sluggish very little power
	Quick Trip	Regular	2-3 weeks ago	Penzoil	5W-30	None	None	None
	Conoco/ Phillips	Regular	5-Aug-04	Castrol	5W-20	None	None	None
	Phillips 66	Regular	1,740 miles	Valvoline	5W-30	None	None	None
	BP	Regular	2 months	Penzoil	10W-40	None	None	Blank
	Quick Trip	Regular	5/17/2004	Quaker State	5W-30	None	None	None
	BP	Regular	6 months	Blank	5W-30	None	None	None
	Conoco	Premium	3 months	Quaker State	10W-30	Prolong	None	None
	BP	Premium	1 month	Castrol	10W-30	Prolong	None	None
	Quick Trip	Regular	Jun-04	Quaker State	10W-40	None	None	Blank
	Conoco	Regular	6 months	Valvoline	10W-30	None	None	None

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	Casey's	Regular	2 weeks	Penzoil	10W-30	None	None	Must give a little gas until warm - watch temp gauge
	Unknown	Regular	Jun-04	Valvoline	5W-30	None	None	None
	Phillips 66	Regular	6/14/2004	Kendal	10W-30	None	None	Blank
	Quick Trip	Regular	12-Aug-04	Castrol	5W-30	None	Transmission fluid & filter change & oil change	Shocks need to be changed - working on it.
	Conoco	Regular	~6,000	Mopar	10W-30	None	None	None
	Quick Trip	Super	2 days	Kendal	10W-30	None	None	None
	Cosco	Regular	Unknown	Unknown	Unknown	Unknown	Unknown	None
	Casey's	Regular	1,500	Penzoil	10W-30	None	None	None
	Quick Trip	Regular	9/9/2004	Quaker State	10W-30	Unknown	None	None
	Phillips 66	Regular	7/4/2004	Unknown	we use pure synthetic	None	None	None
	BP	Regular	5 months	Unknown	10W-30	None	Head gasket	muffler
	Cosco	Regular	2 months	Penzoil	10W-30	None	None	Air flow meter sensor replaced 8/04
	Quick Trip	Regular	two weeks	Jiffy Lube	Blank	None	None	Blank
	Quick Trip	Regular	60 days	Havoline	5W-30	None	It has a new ?? (illegible)	?? (illegible)
	Casey's	Regular	1,500 miles	Penzoil	10W-30	None	None	None
	Quick Trip	Regular	previous week	Penzoil	10W-30	None	Fixed leaking water pump	once in a while it will hesitate when giving gas to start going
	Sinclair	Regular	31-May-04	O'Reillys Store brand	10W-30	None	None	None
	Texaco	Regular	1 month	synthetic	10W-30	None	None	None
	Quick Trip	Regular	4 months ago	Penzoil	10W-30	None	Blank	No emergency brake
	Quick Trip	Regular	18-Jul-04	Valvoline	5W-30	None	None	Blank
	Quick Trip	Regular	Aug-04	Unknown	10W-30	None	rebuilt transmission 4/2004	Unknown
	Quick Trip	Regular	4-5,000 miles	Unknown	10W-30	None	None	exhaust manifold mount (connection to block) getting loose
	Unknown	Regular	last November	Unknown	5W-30	None	None	None
	Texaco	Regular	4/1/2004	Penzoil	10W-30	Unknown	Unknown	Unknown
	Phillips 66	Regular	2-3 thousand	Trop Artic	5W-30	None	None	None
	Texaco	Premium	1,000 miles	Valvoline	5W-30	None	None	None
	Chevron	Super	2 years ago - drive only in summer	Castrol	20W-50	None	None	None
	Conoco	Regular	18-Aug-04	Kendall	10W-30	None	None	None - Runs fine
Rattling? - Rotors are warped make noise sometimes, radio works only someti	Texaco	Regular		Penzoil	10W-30	None	None	None
	Texaco	Regular	1 week	Quaker State	10W-30	Blank	None	None
	Casey's	Super	167,471	Castrol	5W-30	fuel injector additives (cleaner)	None	None
	Quick Trip	Regular	645,819	Quaker State	10W-40	None	None	Blank
	Quick Trip	Regular	Jun-03	Shell	10W-30	None	None	None
	Phillips 66	Regular	14-Aug-04	Quaker State	5W-30	None	None	Blank

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Rattling? - ??	Shell	Regular	July	Unknown	10W-30	None	rebuilding engine	Blank
	Quick Trip	Regular	Aug-04	Quick Trip	10W-40	None	None	None
	Shell	Premium	1.5 weeks	Ford	10W-30	Unknown	None	None
	Unknown	Regular	Aug-04	Unknown	5W-30	None	None	None
	Phillips 66	Regular	2-Jul-04	Texaco	10W-30	None	None	One morning the engine continued to idle after I turned off the ignition - about 1.45 weeks ago
	Casey's	Super	30,000	Castrol - Sentech	5W-30	None	None	None
	Phillips 66	Regular	2 months	Unknown	10W-30	Unknown	timing ??? Replaced	O2 sensor replaced - drove/run poorly
	BP	Regular	Sep-04	Unknown	10W-30	None	None	Power steering whines
	Phillips 66	Regular	14-Aug-04	Kendall	Blank	Blank	None	Check engine light comes on occassionally - O2 sensor problem 2.5 years ago
	Quick Trip	Regular	1.5 months ago	Penzoil	10W-30	Unknown	Valve seat broke	None
Different from ERG info; Rattling ? - Both boxes checked (Y/N).	Quick Trip	Regular	Blank	Blank	Blank	Blank	None	Blank
	Phillips 66	Regular	10/26/2004	Penzoil	5W-30	N/A	None	None
	Quick Trip	Regular	1,000 miles	Unknown	10W-30	None	None	None
	Conoco	Regular	Blank	Unknown	10W-30	None	None	None
	Philips 66	Regular	9/28/2004	Penzoil	5W-20	None	None	None
	Texaco	Regular	within 3,000 miles	O'Reiley	5W-30	None	None	None
	Quick Trip	Regular	9/9/2004	Unknown	10W-30	None	None	None
	Unknown	Regular	7/17/2004	Penzoil	10W-30	Penzoil Synthetic #10	None	Had motor tune up (95350) new platinum plugs - throttle body & fuel injection cleaned - air & fuel filter replaced
	Unknown	Regular	Blank	Valvoline	5W-30	None	Unknown	service engine light stays on
	Phillips 66	Regular	3,000	Motorcraft	10W-40	None	None	a little unstable in cross winds
	Phillips 66	Premium	800 miles	Quaker State	10W-30	None	None	Blank
	Diamond Shamrock	Regular	10/22/2004	Penzoil	5W-30	None	Unknown	None
	Conoco	Regular	1/13/2005	Valvoline	5W-30	None	None	None
	Quick Trip	Regular	12/29/2004	Castrol	5W-30	None	None	Unknown
	Texaco	Regular	2,000 miles	Valvoline	5W-30	None	None	alternator is broke lights strobe
	Shell	Regular	2 weeks	Shell	10W-30	None	None	None
	Phillips 66	Regular	Nov-04	Shell	5W-30	None	None	Blank
Cat been replaced? - Needs to be	Quick Trip	Regular				None	None	
	Blank	Regular	Blank	Unknown	10W-30	Blank	Blank	None
	Chevron	Super	3 weeks	Penzoil	10W-30	None	None	The universal belt started squeeking about 3 days ago, believe its from the extreme cold
	Texaco	Regular	3 weeks	Penzoil	10W-30	None	None	None
	Unknown	Regular	2,000 miles	Quaker State	5W-30	None	None	Blank
	Blank	Regular					None	
	Casey		2,000	Castrol	5W-30	None	None	None
	Quick Trip	Regular	10/2/2004	Valvoline	5W-30	Unknown	None	Blank
	Conoco	Regular	10-Jan-05	Unknown	10W-30	None	None	Leaky valve cover gasket
	Shell	Premium	150 miles	Quaker State	5W-30	Prolong	None	None
	Conoco	Super	3 weeks	Kendall	10W-30	None	None	None
	Quick Trip	Regular		Unknown	5W-30	None	None	runs rough when AC is on
	Quick Trip	Regular	a month ago	Dealer brand	5W-30	None	None	Needs to warm up in cold weather or problem shifting into drive can occur

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	Quick Trip	Regular	9/20/2004	2804 BFS	10W-30	Sometimes oil/gas addtive from WalMart	None	transmission flush 11/22/04; problems since but not before
	Phillips 66	Regular	11/17/2004	Kendall	10W-30	None	None	Blank
	Quick Trip	Regular	2 weeks	Penzoil	10W-30	None	None	None
	BP	Regular	11/28/2004	Quaker State	5W-30	None	None	None
Rattling - Rear shock	Quick Trip	Regular	11/6/2004	Valvoline Max Life	10W-40	None	Transmission rebuilt in october 2004	Blank
	Texaco	Regular	10/30/2005	Penzoil	Unknown	Synthetic	None	None
	Casey's	Regular	3,000 miles	Penzoil	10W-30	None	None	None
	BP	Regular	19-Nov-04	Penzoil	5W-30	Sometimes - WalMart Brand	None	Blank
	BP	Premium	2 months	Valvoline	10W-30	Unknown	None	Check engine lighe always
	Quick Trip	Regular	Blank	Quaker State	10W-30	None	None	None
	Quick Trip	Regular	Oct-04	MaxLife	10W-30	None	None	Blank
Rattling - Occasionally	Quick Trip	Regular	3 months	Quaker State	10W-30	None	None	None
Rattling - Electrical rattle	Quick Trip	Regular	27-Dec	Unknown	Blank	None	None	transmission may stick if cold when shifting into reverse
	Quick Trip	Regular	2,000 miles	Unknown	10W-30	None	None	None
	Quick Trip	Regular	12/18/2004	Advanced Auto	10W-30	None	None	None
Rattling - Some rattling accelerating uphill	Quick Trip	Regular	2 months	Unknown	Unknown	None	None	Engine ok, no problems. Needs front end work but sure what & shocks
Rattling - Not sure	Quick Trip	Regular	Nov-04	MaxLife	10W-30	None	None	None
	BP	Regular	10/31/2004	Valvoline	10W-30	None	Catalyst converter 11/22/04	None
	Differs	Regular	4 months	Quaker State	10W-30	None	None	oil leak - needs to be realigned - pulls to right
	Texaco	Premium	June	Jiffy Lube	10W-30	None	None	None
	Unknown	Regular	1 week	Penzoil	10W-30	None	None	Sputters when cold
does not have a catalytic converter.	Philips 66	Regular	2,000 miles	Blank	20-50	None	Fuel Injector	Some fuel injectors need changing
	Seven-11	Regular	awhile	cheap stuff	10W-40	None	None	oil leak and carb problems
	Quick Trip	Regular	11/14/2004	Kendall	Unknown	Unknown	None	Check engine light comes on occasionally
Rattling - Some	Quick Trip	Regular	1,500 miles ago	Penzoil	10W-30	None	None	None
	Exxon	Regular		Valvoline	10W-30	None	None	Blank
Check engine light on.	Unknown	Regular	2,200 miles	Penzoil	10W-40	None	None	Check engine light is on - all fluids topped off, transmission will slip and is going out
	Citgo	Regular	9/26/2004	Penzoil	10W-30	None	None	Good driving order
Rattling - Some	Conoco	Regular	1/14/2005	Quaker State	10W-30	None	None	None
	Quick Trip	Premium	1/20/2005	Penzoil	10W-30	None	Converter 7/20/04	None
	Unknown	Regular	5,000 miles	Penzoil	10W-40	Slick 50	None	Transmission does not engage overdrive
	Sam's	Regular	4,000	GMC	10W-30	None	None	None
Rattling - Rarely	Citgo	Super	4-Aug-04	Quaker State	10W-30	None	Carburetor rebuilt	Engine knocks badly on specified low octane fuel. Engine stalls at wide open throttle. Engine runs poorly when cold.
	Quick Trip	Regular	2 months	Quaker State	10W-30	None	Replaced alternator	Blank
	Blank	Regular	Oct-04	Unknown	10W-30	None	Replaced alternator	None
Rattling - Some								
	Phillips 66	Regular	Nov-04	Quaker State	10W-30	None	None	None
	Sinclair	Regular	3,000 miles	GM	10W-40	None	None	Blank
	Unknown	Regular	Unknown	Unknown	Blank	None	None	Blank
	Conoco	Regular	2/1/2005	Castrol GTX	Unknown	None	None	ABS system acting up - diagnosis uncertain
	Quick Trip	Premium	2 weeks	Penzoil	10W-30	None	None	None
	Quick Trip	Regular	7/22/2004	Ford Motor Co.	10W-30	None	Transmission repair 10/8/04	None that we are aware of
	Quick Trip	Regular	12/29/2004	Penzoil	10W-30	None	None	None

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Owner-provided Fuel and Oil Information, associated with dyne testing

Comments	Last Fuel Purchased	Fuel Grade	Date of Last Oil Change	Oil Brand at Last Change	Oil Viscosity at Last Change	Oil Additives	Major repairs within last year	Description of Vehicle or Engine Driveability problems
	Quick Trip	Regular	Dec-04	Havoline	5W-20	None	None	Blank
Rattling - Some	Shell	Regular	One year	Penzoil	10W-30	None	Transmission rebuilt	Check engine light comes on after `10 minutes - no noticeable performance issues
	Quick Trip	Regular	4,000 miles	Penzoil	10W-30	None	Water pump/muffler	Hood hard to open
Rattling - Last 2 months Vehicle has 2 plates	Quick Trip	Regular	3 months	Castrol	10W-40	Lucas Oil	transmission	Blank
	Quick Trip	Regular	1-Feb-05	Penzoil	5W-20	None	None	None
	Quick Trip	Regular	11/31/04	Penzoil	10W-30	None	None	None, but needs CV joint replacement
	Quick Trip	Regular	5 months	Penzoil	10W-30	None	None	Needs tune-up, timing adjustment, carbureator & engine rebuild, manifold gaskets
	Total	Regular	Sep-04	Valvoline	10W-30	None	None	Blank
	Quick Trip	Regular	Before I purchased	Unknown	5W-30	None	None	None
	BP	Premium	2/3/2005	Chrysler brand	10W-30	None	None	None
	Shell	Regular	1,000 miles	Quaker State	5W-30	None	#1 injector replaced	IAC sluggish on start up after hot soak
Rattling - Some	Casey's	Regular	6,000 miles	Penzoil	10W-30	Marvel Mystery Oil	New water pump & thermostat	Possible worn valve
	Texaco	Regular	3 months	Quaker State	10W-30	None	Head gasket replaced	None
	Conoco	Regular	2/7/2005	Castrol	5W-30	None	None	None
Cat been replaced - 3 years ago.	Quick Trip	Premium	12/11/2004	Castrol	5W-30	None	None	Needs front end alignment, brakes, catalytic converter leaks
	Quick Trip	Regular	12/11/2004	Castrol	5W-30	None	None	None
Rattling - Some not all the time	BP	Regular	Sep-04	Blank	10W-30	None	None	None
	Shell	Regular	11/17/2004	Valvoline	10W-30	None	None	None
	Fisca Oil	Regular	1,500 miles	Penn	10W-30	STP for Older Eng	I put a new clutch in	None
Non OEM Mods - Air bag light stays on.	Shell	Regular	Dec-04	Havoline	10W-50	None	None	None
	Quick Trip	Regular	Oct-04	Havoline	10W-30	None	None	None
Non OEM Mods - Transmission leak repaired last fall.	Quick Trip	Regular	1-Oct-04	Penzoil	10W-30	None	Transmission leak repaired -seals	Blank
	Quick Trip	Regular	Blank	Shell	Under the hood	None	None	Engine will stall at highway speed (60 mph) until warmed up
	Conoco	Regular	2/10/2005	Mobil	5W-30	None	None	None
	Quick Trip	Regular	12/15/2004	Ford Motor Co.	10W-30	Blank	None	None
	Walmart	Regular	2/8/2005	Penzoil	10W-30	None	None	Burns Oil
Rattling - Tail pipe loose	Quick Trip	Regular	about 2,700 miles	Quaker State	5W-30	None	None	Blank
	Casey's	Regular	less than 1,000 miles ago	Valvoline	10W-30	None	None	None
Rattling - Some	Shell	Regular	4 months	Penzoil	10W-30	None	None	Blank
	Shell	Premium	Jan-05	Havoline	20W-50	None	None	None
	Quick Trip	Regular	Unknown	Unknown	Unknown	Unknown	None	Unknown
	Conoco	Regular	1/18/2005	Kendall	10W-30	None	None	None
	Philips 66	Regular	2,400 miles	Valvoline	5W-30	None	Transmission rebuild, starter, smog pump, alternator, water pump, rings and seals	None
	Philips 66	Regular	1/2/2005	Quaker State	10W-30	None	None	Blank
	Texaco	Regular	9 months	Quaker State	10W-30	None	None	funny sound when turning
	Costco	Regular	1/15/2005	Unknown	10W-30	None	None	None
	Unknown	Super	2/15/2005	Philips	10W-30	None	None	Pinging when lower octane fuels are used
	BP	Regular	1,000 miles ago	Penzoil	10W-30	None	None	None
	Shell	Regular	Dec-04	Havoline	20W-50	None	None	Car runs fine
	Philips 66	Super	Due Now	Quaker State	10W-30	None	None	Blank
Rattling - Some when starting	Unknown	Regular	Feb-05	Shell	10W-30	None	None	None
	Quick Trip	Regular	11,9350 miles	Castrol GTX	10W-40	None	None	Blank
	Quick Trip	Regular	1800	Ford M/C	5W-20	None	None	None
	Conoco	Regular	Nov-04	Unknown	10W-30	None	None	None

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Owner-provided Fuel and Oil Information, associated with dyne testing

Comments	Last Fuel Purchased	Fuel Grade	Date of Last Oil Change	Oil Brand at Last Change	Oil Viscosity at Last Change	Oil Additives	Major repairs within last year	Description of Vehicle or Engine Driveability problems
	Quick Trip	Premium	1/22/2005	Valvoline	5W-30	None	None	None
	Citgo	Regular	5 months	Quaker State	10W-30	None	None	None
	Sinclair	Regular	7/28/2004	Unknown	10W-30	None	None	Small external coolant leak (head gasket)
Cat been replaced - over 20,000 miles ago.	Philips 66	Regular	12/12/2004	Valvoline	10W-30	None	None	Blank
	Philips 66	Regular	6 months	Unknown	Unknown	Unknown	None	Check engine light comes on if drive over 65 mph/checked out and don't know why
	Quick Trip	Regular	Nov-04	Valvoline	10W-30	None	None	Bad brakes
	Citgo	Regular	Late December	Quaker State	10W-30	None	None	None
	Quick Trip	Regular	Dec-04	Valvoline	5W-30	None	None	Squeek in steering - occasional starts rough, check engine light
	Philips 66	Premium	4,000 miles ago	Volvo One Synthetic	10W-30	None	None	exhaust leak
	Conoco	Regular	Nov-04	Mobile One Synthetic	10W-30	None	replaced alternator	engine light always on
	Philips 66	Regular	20-Jan-05	Penzoil	10W-30	None	None	None - Although the check engine soon light came on Monday 3/21/05
	Quick Trip	Regular	Dec-04	Kendall	10W-30	None	Replaced fuel injector	None
Exhaust system was worked on & repaired about one month ago not sure what was replaced ($250).								
	Quick Trip	Premium	1,500 miles	Penzoil	10W-30	None	None	None
	Wood Oil	Regular	20-Jan-05	Unknown	5W-30	None	Manifold & head gaskets replaced after engine overheated	None
	Shell	Regular	One week	Quaker State	10W-30	Zero F - Metal Conditioner	None	in the last week, it has not shifted to OD smoothly
	Casey's	Regular	Oct-04	Penzoil	10W-30	None	Rebuilt Transmission in April 2004	Engine knocking
	Blank		Nov-04	Valvoline	5W-30	None	None	dash rattles when idling
	Unknown	Regular	One Month	Unknown	Unknown	None	None	None
	Unknown	Regular	200 miles	Valvoline	10W-30	None	Replaced half shaft	None
	Philips 66	Regular	128,198	Penzoil	5W-30	None	None	None
	Shell	Regular	3,000	Quaker State	10W-30	None	None	None
	Quick Trip	Regular	2,400 miles	Unknown	10W-30	Unknown	None	Blank
	Quick Trip	Regular	8,000 miles	Valvoline	10W-30	None	Head gaskets, idle air control valve	leave transmission shift indicator in (D) (0verdrive) or it will buck a lot
	Conoco	Regular	Jan-05	Penzoil	10W-30	None	Ford recall on catalyst	None
	Pillions	Regular	2/19/2005	Kendall	5W-30	None	None	None
	Shell		Nov-04	Quaker State	Blank	Blank	None	Blank
	Costco	Regular	1,950 miles	Quaker State	10W-30	None	None	None
Mileage at purchase - 100,000 not sure								
Non OEM Mods - brakes 3,000 + miles ago. Catalytic Converter - may have so	Unknown	Regular	4 months	Havoline	10W-30	None	None	None
	Quick Trip	Regular	11/26/2004	Motorcraft	5W-30	None	None	None
Rattling? - Some	Philips 66	Regular	~1,400 miles ago	Penzoil	10W-40	None	None	Bad transmission
	Costco	Regular	1,080 miles	Quaker State	10W-30	None	None	None
Non OEM Mods - Mass airflow changed August 04, error code may still show 0	Unknown	Regular	12/6/2004	Quaker State	10W-30	None	None	None. Gas gauge out - good till 300 miles on tripometer
Cat been replaced? - 3,000+ miles ago	Texaco	Regular	2 months	Penzoil	10W-30	STP 2/27	None	None
	Kwik Shop	Regular	10/20/2004	Valvoline	10W-40	None	None	None
	Shell	Regular	October	Havoline	10W-30	None	None	None
Rattling? - Some	Philips 66	Regular	8-Jan-04	Havoline	10W-30	None	Muffler/tail pipe installed 2/28/05	If care is driven on a cold engine, severe backfiring will occur during
	Quick Trip	Regular	3 months	Valvoline	5W-30	None	None	do not put down driver's window
	Quick Trip	Regular	2 months	Conoco	10W-30	None	None	None
Rattling? - Some @ 75 mph								
	Philips 66	Regular	2,500 miles	Castrol	5W-30	None	None	Blank
	BP	Regular	6 months	Oriley	10W-30	None	None	None
	Quick Trip	Regular	Due now	Jiffy Lube	10W-30	None	None	Small oi leak in front (need to check this)
	Sinclair	Premium	26-Feb-05	Penzoil	5W-30	None	None	None
	Philips 66	Regular	2/14/2005	Havoline	5W-30	None	None	Blank
	Conoco	Regular	4/2/2004	Quaker State	10W-30	None	None	Blank
	Conoco	Regular	9/9/2004	Quaker State	10W-30	None	None	Blank

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Owner-provided Fuel and Oil Information, associated with dyne testing

Comments	Last Fuel Purchased	Fuel Grade	Date of Last Oil Change	Oil Brand at Last Change	Oil Viscosity at Last Change	Oil Additives	Major repairs within last year	Description of Vehicle or Engine Driveability problems
	Quick Trip	Regular	Blank	Penzoil	10W-40	None	None	None
	Texaco	Regular	2.5 months ago	Penzoil	5W-30	None	transmission fluid drain/replaced	None
	Quick Trip	Regular	12/18/2004	Valvoline Maxlife	5W-30	None	None	None
	Quick Trip	Super	1/5/2005	Penzoil	10W-30	None	None	None - squeaky belt
	Quick Trip	Premium	Last fall	Penzoil	10W-30	None	None	None
	HyVee Gas	Regular	5 months	Havoline	10W-30	None	None	N
	Quick Trip	Regular	2 months	Sam's Wholesale	10W-30	None	carburetor rebuilt - tune up, partial motor rebuild	Carb idles too hot right now
	Sam's	Regular	3 months	Sam's Wholesale	10W-30	None	None	Leaks oil and trans fluid, runs great except when very wet may have trouble starting
Cat been replaced? - Yes, 3,000 plus miles. Reason for cat rplcmnt - plugged.								
	Shell	Regular	4 months	Quaker State	10W-30	None	None	None
	Texaco	Regular	1,000 miles	Quaker State	10W-40	None	None	If it sputters or lags give it a little gas - open drivers side door from inside
	Shell	Regular	6-8 months	Unknown	Unknown	None	None	None - squeaky speedometer cable
	Quick Trip	Regular	2 months	Kendall	"GT-1"	None	None	None
	Sinclair	Regular	5 months	Unknown	10W-40	None	None	None
Round 2 (4/4/05) and Round 1.5 (12/2/04).	Quick Trip	Regular	9/3/2004	Castrol	5W-20	None	None	Slight hesitation occassionally when shifting from 3 - 4th gear. Dealer says there is nothing wrong.
Round 2 (4/4/05), Round 1.5 Duplicate (12/17/04), and Round 1.5 (12/14/04). Non OEM Mods - Steering does not lock up.								
	Conoco	Regular	7/16/04	Castrol	10W-30	Blank	None	Blank
Round 1.5 (1/3/05) and Round 2 (4/2/05). Round 1.5 mileage 75,916.	Costco	Regular	10/16/04	Penzoil	10W-30	None	None	None
	Seven-11	Regular	17-Sep-04	Penzoil	10W-30	None	None	None
	Shell	Regular	1,000 miles	Mobil One Synthetic	10W-30	None	None	None
	Quick Trip	Regular	3 months	Unknown	10W-30	None	Alternator replaced	None
Dyne test done only. No PEMS precon.	Quick Trip	Regular	end of January	Castrol	10W-30	Unknown	None	None
	Quick Trip	Regular	2 weeks	Valvoline	10W-30	None	fuel injector	Blank
Odometer not working, broke about 7 or 8,000 miles ago.								
	Quick Trip	Regular	3,000 miles	Penzoil	10W-30	None	None	Brakes squeak
	Quick Trip	Regular	3/9/2005	Penzoil	5W-30	None	None	None
	Quick Trip	Regular	3,000 miles	10W-40	10W-40	Blank	None	None
	Philips 66	Regular	10/10/2004	Penzoil	10W-30	None	None	Blank
	Philips 66	Regular	11/30/2004	Quaker State	10W-30	None	None	None
	Sinclair	Regular	9 months	Quaker State	5W-30	None	None	Choke/accelerator may stick and engine race - just nees a quick depression of accelerator pedal to undo
	Quick Trip	Regular	2/26/2005	Texaco	10W-30	None	None	None
	Conoco	Regular	3 months	Shell	Blank	Blank	None	None
	Conoco	Regular	3 months	Shell	10W-30	None	None	To start, turn key on, pull on top of steering wheel toward driver
	Sinclair	Regular	2 years ago	Unknown	10W-40	Blank	None	Runs rough. I was told it is in the transmission. They cleaned out
	Quick Trip	Regular	7/22/2003	Valvoline	10W-30	None	None	Steering column damaged from attempted theft, requires starting
	Seven-11	Regular	2/16/2005	Car Quest	10W-30	None	Right front axel	Serpentine belt squeak, exhaust smokes a lot when first
	Texaco	Regular	6 months	Havolin Long Life	10W-30	None	None	Low idle when starting/rear brakes lock if emergency brake is
	Quick Trip	Regular	3,000 miles	Motor Craft	10W-30	None	None	None
	Unknown	Regular	3/10/2004	Valvoline	10W-30	Marel Mystery	Timing belt, knock sensor, gaskets, plugs, etc.	I add oil 1 qt./2-3 months use oil, no leaking no smoke
Mileage at purchase? Put 3 or 4 thousand on	Quick Trip	Regular	4 months	Valvoline	10W-30	None	None	None
	Unknown	Regular	Feb-05	Quaker State	10W-30	None	Hose replacement, muffler, tail pipe	needs tune up & alignment

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Owner-provided Fuel and Oil Information, associated with dyne testing

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Rattling reason for cat rplcmnt? Engine would not run.	Conoco	Regular	12 months	Unknown	10W-30	None	None	Clutch sometimes pops - engine runs slightly rough
	Conoco	Super	5-Mar-05	Mastercare Oil	10W-30	None	None	None
	Texaco	Regular	2,800 miles	O'Reilly	10W-30	None	carb rebuilt	None
	BP	Regular	less than 1,000 miles	Quaker State	30HD	1 Pint STP	Rebuilt transmission	It needs some carburator work, probably rebuilder kit
	Philips 66	Regular	Aug-04	O'Reilly	10W-40	None	None	Blank
	Quick Trip	Regular	Unknown	Unknown	10W-30	Blank	None	Bent a-arm right front vibration while not in park and in motion
	Shell	Regular	3/16/2005	Blank	Blank	None	Rebuilt Transmission	none
	Quick Trip	Regular	August	Castrol	10W-40	None	None	Bad valve seal on #2 cylinder fouls spark plug #2 choke doesn't work on carburetor
	Costco	Regular	1,000 miles	Jiffy Lube	10W-30	None	None	None
	Philips 66	Regular	4 months	Valvoline	10W-30	None	None	oil leak under engine
	Seven-11	Regular	Jan-05	Quaker State	10W-30	None	None	Timing is slightly advanced, runs a bit rough until warm
	Philips 66	Regular	69,000	WalMart	10W-30	None	Rebuilt transmission 3/04	New joint & valve cover gasket 7/04
	Philips 66	Regular	9 months	Exxon Superflo	10W-30	None	None	Blank
	HyVee	Regular	10/26/2004	Motorcraft	10W-40	None	None	Blank
	Casey's	Regular	6/28/2004	Penzoil	10W-30	None	None	Runs rough sometimes check engine light is intermitent
	Sinclair	Regular	89,990 miles	Quaker State	5W-30	None	None	When first start, blue smoke exits exhaust - 1 short puff
	Texaco	Regular	1 year	Motorcraft	10W-30	None	None	Rough idle
	Quick Trip	Regular	6 months	Valvoline	10W-30	None	None	None
	Conoco/ Phillips	Regular	about 5,000 miles ago	Kendall GT-1	10W-30	Blank	None	Transmission slips a little sometimes
	Texaco	Regular	8 months	O'Reilly	10W-30	None	None	Needs tune up
	Costco	Regular	Aug-04	O'Reilly	10W-30	None	replaced transmission	Blank
	Unknown	Regular	3 months ago	Penzoil	10W-30	None	None	None
	Unknown	Regular	10-Mar-05	Penzoil	10W-30	None	None	None
	Quick Trip	Regular	September	Valvoline	10W-30	None	None	None
	Flying J	Regular	1 month	Valvoline	5W-30	None	None	None
	Conoco	Regular	22-Mar-05	Citco	10W-30	None	None	None
	BP	Regular	one year	Penzoil	10W-40	None	None	None
	Citgo	Regular	10 weeks	Kendall	Dealer bulk syn	None	None	Blank
	Quick Trip	Regular	2 months	Penzoil	30W	None	None	Sheered distributor pin
	Cenex	Regular	2/12/2005	Advance Auto Parts Brand	10W-30	None	None	Idles fast until gas pedal is pumped to slow it down. Gas gauge doesn't work all the time
	BP	Regular	2 months	Penzoil	10W-30	Unknown	None	Excellent
	Wood's Oil	Regular	~1,000 miles	Penzoil	10W-30	None	None	Drips/used oil
Engine Rebuilt Info - Sheet mising from packet	Quick Trip	Regular	2,000 miles	Valvoline	10W-30	None	Transmission	Blank
Gas gauge does not work but has gas in it.	Unknown	Regular	10 months	Ford	10W-30	None	None	The jeep is very seldom drove, it may set for several months
	Quick Trip	Regular	1 month	Castrol	10W-30	None	head gasket	transmission seems to slip at times
Rattling? - Minor	Casey's	Regular	9 months	Quaker State	10W-30	None	None	Blank
	Casey's	Regular	Feb-05	Penzoil	10W-30	None	None	Blank
	Unknown	Regular	2,400 miles	Quaker State	10W-30	None	None	None
	Quick Trip	Regular	2 months	Blank	Blank	None	None	None
	Casey's / Phillips 66	Regular	2,000 miles ago	Spectrum	5W-30	None	None	None
	Other	Regular	@ 106,000	Spectrum	5W-30	None	None	None
	Shell	Regular	1 month	Unknown	10W-30	None	Distributor	None

BKI Packet

Owner-provided Fuel and Oil Information, associated with dyne testing

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	Unknown	Regular	2 weeks	Penzoil	10W-30	Blank	None	Blank
	Quick Trip	Regular	November	Quaker State	10W-40	None	Muffler/brakes	Have to get in on passenger side. Car will "dence" on take off doesn't die but feels like its not getting gas
	Conoco	Regular	Aug-04	Firestone	10W-40	None	None	None
	Fuel Outlet	Regular	3/28/2005	Quaker State	5W-20	None	None	None
	Costco	Regular	1/18/2005	Motorcraft Synthetic Blend	5W-20	Unknown	None	Blank
	Unknown	Regular	Nov-04	Unknown	5W-30	None	Fuel Pump	A/C doesn't work
	Conoco	Regular	2 weeks	Penzoil	10W-30	None	None	None
	Quick Trip	Premium	500 miles	Mobile 1	5W-30	None	None	None
	Shell	Regular	27-Mar-05	Valvoline	10W-40	None	None	Minor oil leak
	Quick Trip	Regular	13-Mar-05	Penzoil	10W-30	None	None	None
	Quick Trip	Regular	6 months	Quaker State	10W-30	None	None	Blank
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Kansas City PM Characterization Study

Final Report

Appendix KK
NuStats Demographics

(For access to this information, please contact U.S. EPA personnel)

Assessment and Standards Division
Office of Transportation and Air Quality
U.S. Environmental Protection Agency

Sponsors:

National Renewable Energy Laboratory, U.S. Department of Energy
Federal Highway Administration, U.S. Department of Transportation
STAPPA-ALAPCO Emission Inventory Improvement Program
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Austin, TX

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EPA United States Environmental Protection Agency

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Kansas City PM Characterization Study
Final Report

Appendix LL
NuStats Demographics Data Dictionary

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U.S. Environmental Protection Agency

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National Renewable Energy Laboratory, U.S. Department of Energy
Federal Highway Administration, U.S. Department of Transportation
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United States
Environmental Protection
Agency

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Household File

SAMPN Household sample number
AREA Area type
1 Urban
2 Suburban
3 Remainder of Area

PHONE Household phone number
HHADDR HH Location Number (unique number for address in LOCATION file)
HCNTY Household County
HHSIZ Household size
HHWRK Employed HH Members age 16+
HHSTU Number of HH Students
HHVEH Household vehicles

UBLSM Bikes used last summer
Value Label
1 YES
2 NO
9 DK/RF

BPLSM1 Purpose of bike usage last summer
1 WORK
2 SCHOOL
7 SOME OTHER ACTIVITY
9 DK/RF

BPLSM2 Purpose of bike usage last summer
1 WORK
2 SCHOOL
7 SOME OTHER ACTIVITY
9 DK/RF

BPLSM3 Purpose of bike usage last summer
1 WORK
2 SCHOOL
7 SOME OTHER ACTIVITY
9 DK/RF

O_BPLSM If other, specify

UBTSM Plan to use Bikes this summer
Value Label
1 YES
2 NO
9 DK/RF

BPTSM1 Planned Purpose(s) for bike usage this summer
1 WORK
2 SCHOOL
7 SOME OTHER ACTIVITY
9 DK/RF

BPTSM2 Planned Purpose(s) for bike usage this summer
1 WORK
2 SCHOOL
7 SOME OTHER ACTIVITY
9 DK/RF

BPTSM3 Planned Purpose(s) for bike usage this summer
1 WORK
2 SCHOOL
7 SOME OTHER ACTIVITY
9 DK/RF

O_BPTSM If other, specify

RESTY Residence type

Value	Label
1	One-family house detached from any other house
2	One-family house attached to one or more houses (DUPLEX, ROW
3	Mobile home
4	Building with 2 or more apartments (CONDO, APARTMENT, etc.)
7	Or something else? SPECIFY
9	RF

O_RESTY Residence type, other

HTYPE Household type

Value	Label
1	House
2	Apt
3	Mobile Home
4	Other

OWN Home ownership

Value	Label
1	Owned by you or someone in this household
2	Rented for cash rent or
3	Occupied without payment of cash rent,
7	Or something else?, SPECIFY
9	RF

O_OWN Home ownership, other

LIVED Lived in residence

Value	Label
1	Less than 1 year
2	1-2 years
3	3-5 years
4	6-10 years
5	More than 10 years
9	RF

INCOM Income

Value	Label
1	$0 - $14,999
2	$15,000 - $24,999
3	$25,000 - $34,999
4	$35,000 - $49,999
5	$50,000 - $74,999
6	$75,000 or more
9	DK/RF

ASSN Travel assignment number

533	Monday, February 2
534	Tuesday, February 3
535	Wednesday, February 4
536	Thursday, February 5
537	Friday, February 6
540	Monday, February 9
541	Tuesday, February 10
542	Wednesday, February 11
543	Thursday, February 12
544	Friday, February 13
548	Tuesday, February 17
549	Wednesday, February 18
550	Thursday, February 19
551	Friday, February 20
554	Monday, February 23
555	Tuesday, February 24
556	Wednesday, February 25
557	Thursday, February 26
558	Friday, February 27
561	Monday, March 1
562	Tuesday, March 2
563	Wednesday, March 3
564	Thursday, March 4
565	Friday, March 5
568	Monday, March 8
569	Tuesday, March 9
570	Wednesday, March 10
571	Thursday, March 11
572	Friday, March 12
575	Monday, March 15
576	Tuesday, March 16
577	Wednesday, March 17
578	Thursday, March 18
579	Friday, March 19
582	Monday, March 22
583	Tuesday, March 23

DAY Travel day

Value	Label
1	Monday
2	Tuesday
3	Wednesday
4	Thursday
5	Friday

GPSINT GPS Study – indicated interest in participating

Value Label
- 1 YES
- 2 NO
- 9 NOT ELIGIBLE

GPSDATA GPS Data Available (code provided by GeoStats after GPS unit retrieved)

*For this interim delivery, just noting those hhlds that received gps units.

Value Label
- 1 Yes

HTRIPS Household trips

VP Valid Partial (if hhsize>4 and 1 person didn't complete travel log)
- 1 Yes

OUTLOOK1 Importance of Sidewalks in your neighborhood

Value Label
- 1 very unimportant
- 5 very important

OUTLOOK2 Importance of Neighborhood bike paths

Value Label
- 1 very unimportant
- 5 very important

OUTLOOK3 Importance of conveniently located bus stops

Value Label
- 1 very unimportant
- 5 very important

OUTLOOK4 Importance of uncongested roadways

Value Label
- 1 very unimportant
- 5 very important

OUTLOOK5 Importance of Timely updates about traffic tie-ups

Value Label
- 1 very unimportant
- 5 very important

OUTLOOK6 Importance of neighborhood input of road construction projects affecting neighborhood

Value Label
- 1 very unimportant
- 5 very important

OUTLOOK7 Importance of bus information in English and Spanish (bilingual only)

Value Label
- 1 very unimportant
- 5 very important

GRADE1 Rating of Sidewalks in your neighborhood

Value Label
- 1 Excellent (A)
- 5 Failing (F)

GRADE2 Rating of Neighborhood bike paths

Value	Label
1	Excellent (A)
5	Failing (F)

GRADE3 Rating of conveniently located bus stops

Value	Label
1	Excellent (A)
5	Failing (F)

GRADE4 Rating of uncongested roadways

Value	Label
1	Excellent (A)
5	Failing (F)

GRADE5 Rating of Timely updates about traffic tie-ups

Value	Label
1	Excellent (A)
5	Failing (F)

GRADE6 Rating of neighborhood input of road construction projects a

Value	Label
1	Excellent (A)
5	Failing (F)

GRADE7 Rating of bus information in English and Spanish (bilingual

Value	Label
1	Excellent (A)
5	Failing (F)

Person File

SAMPN Household sample number
PERNO Person Number
WADD Work address location number (if employed) – use to link to address info in location file
SADD School address location number (if student) – use to link to address info in location file

RELAT Relationship to main household respondent

Value	Label
0	REFERENCE/RESPONDENT /SELF
1	SPOUSE/PARTNER
2	CHILD
3	PARENT
4	GRANDPARENT
5	GRANDCHILD
6	OTHER RELATIVE
7	NOT RELATED
9	RF

GEND Gender

Value	Label
1	MALE
2	FEMALE
9	RF

AGE Age

Value	Label
98	98 years old or older
99 M	DK/RF

HISP Are you Hispanic, Latino, or Spanish? (asked only if RESP=0)

Value	Label
1	YES
2	NO
9	RF

ETHN Ethnicity (asked only if RESP=0)

Value	Label
1	White
2	African American, Black
3	Asian
4	American Indian, Alaskan Native
5	Native Hawaiian or other Pacific Islander?
6	MULTIRACIAL
7	HISPANIC/ MEXICAN
97	OTHER, SPECIFY
99	RF

O_ETHN Ethnicity,other

ACTWK Status (age 16+)

Value Label
- 1 Working
- 2 Temporarily absent from a job or business
- 3 Looking for work
- 4 A homemaker
- 5 Going to school
- 6 Retired
- 7 Or doing something else?, SPECIFY
- 8 Don't Know
- 9 Refused

O_ACTWK Status (age 16+), other

VOLUN Volunteer Status (age 16+ and ACTWK>2)
- 1 Yes
- 2 No
- 9 DK/RF

EMPLY CALCULATED - Employed (ACTWK<3 OR VOLUN=1)

Value Label
- 1 Yes
- 2 No

FTPT Full time or part time status

Value Label
- 1 FULL TIME
- 2 PART TIME
- 3 NO, DIDN'T WORK AT ALL
- 9 RF

OCCUP Occupation

Value Label
- 1 Sales or service
- 2 Clerical or administrative support
- 3 Manufacturing, construction, maintenance, or farming
- 4 Professional, managerial, or technical
- 7 OTHER, SPECIFY
- 9 RF

O_OCCUP Occupation, other

WNAME Name of employer

WLOC Work location flag

Value Label
- 1 HOME
- 2 ADDRESS GIVEN
- 8 DK
- 9 RF

WTYPE Work land use classification

Value	Label
1	Office Building
2	Retail
3	Industrial/Manufacturing Site
4	Medical
5	Educational
6	Residential
7	OTHER, SPECIFY
9	RF

O_WTYPE Work land use classification, other

PKST1 If needed to park at work, street 1
PKST2 If needed to partk at work, street 2

WMODE Mode typically used to get to work (if WLOC>1)

Value	Label
1	WALK
2	BIKE
3	AUTO / VAN/ TRUCK DRIVER
4	AUTO / VAN / TRUCK PASSENGER
5	TRANSIT
6	LOCAL PARATRANSIT OPERATORS
7	SCHOOL BUS
8	TAXI/ SHUTTLE
9	RF

WPARK Pay to park

Value	Label
1	YES
2	NO
3	EMPLOYER PROVIDED
8	DK
9	RF

PAYPK Amount paid to park (if WPARK=1)

WPPER Pay method

Value	Label
1	PER HOUR
2	PER DAY
3	PER WEEK
4	PER MONTH
5	PER YEAR
6	DK
7	RF

EDUCA Highest level of education attained

Value	Label
1	Not a high school graduate, 12 grade or less
2	High school graduate (high school diploma or GED)
3	Some college credit but no degree
4	Associate or technical school degree
5	Bachelor's or undergraduate degree
6	Graduate degree (includes professional degree like MD, DDs,
7	OTHER, SPECIFY
9	DK/RF

O_EDUC Highest level of education attained, other

STUD Student status

Value	Label
1	YES
2	NO
9	DK/RF

SCHOL Type of school attending

Value	Label
1	DAYCARE
2	NURSERY SCHOOL, PRE-SCHOOL
3	KINDERGARTEN TO GRADE 8
4	GRADE 9 TO 12
5	TECHNICAL/VOCATION SCHOOL
6	2 YEAR COLLEGE (COMMUNITY COLLEGE)
7	4-YEAR COLLEGE OR UNIVERSITY
97	OTHER, SPECIFY
99	DK/RF

O_SCHOL Type of school attending, other

SNAME School name

TRAVL Reported travel on travel day

Value	Label
1	Traveled
2	Did Not Travel
3	Out of Area

NOGO Reason for no travel (travel=2)

Value	Label
1	personally sick
2	caretaking sick kids
3	caretaking sick other
4	homebound (elderly or disabled)
5	worked at home for pay
6	worked around home (not for pay)
7	other

O_NOGO Other reason for non-travel

PTRIPS Number of person trips reported on travel day

Vehicle File

SAMPN Household sample number
VEHNO Vehicle Number

YEAR Vehicle Year

Value	Label
8888 M	DK/RF
9999 M	Refused

MAKE Vehicle Make

Value	Label
1	Acura
2	Audi
3	Bmw
4	Buick
5	Cadillac
6	Chevrolet
7	Chrysler
8	Dodge
9	Ford
10	Geo
11	Gmc
12	Harley Davidson
13	Honda
14	Hyundai
15	Infiniti
16	Isuzu
17	Jaguar
18	Jeep
19	Kawasaki
20	Kia
21	Lexus
22	Lincoln
23	Mazda
24	Mercury
25	Mercedes
26	Mitsubishi
27	Nissan
28	Oldsmobile
29	Plymouth
30	Pontiac
31	Porsche
32	Range Rover
33	Saab
34	Saturn
35	Subaru
36	Suzuki
37	Toyota
38	Volkswagen
39	Volvo
40	Yamaha
41	Daewoo
97	Other, Specify
98	Dont Know
99	Refused

O_MAKE Vehicle Make, Other

MODEL Vehicle Model

BTYPE Vehicle Body Type

Value	Label
1	Auto/Car/Station Wagon
2	Van(Minivan, Cargo, Passenger)
3	Sport Utility Vehicle/SUV
4	Pick Up Truck
5	Other truck
6	RV
7	Motorcycle
97	Other

O_BTYPE Vehicle Body Type, other

FUEL Vehicle fuel

Value	Label
1	Gas
2	Diesel
7	Other (Specify)
9	Refused

O_FUEL Vehicle fuel, other

CIGAR Cigarette lighter/power outlet

Value	Label
1	Yes
2	No
9	DK/RF

NHMD Non-HHld member drove vehicle on travel day

1	Yes
2	No

Trip File

SAMPN Household sample number
PERNO Person Number
PLANO Place number
LOCNO Location identifier (link to location file for address information)

PTYPE Place type

Value	Label
1	Home
2	Work
3	School
4	Other Place within study area, specify name of the place
5	Out of Area, specify city and state

ARR_HR Arrival hour
ARR_MN Arrival minute
DEP_HR Departure hour
DEP_MN Departure minute

LTYPE Land Use type of place

Value	Label
1	Office
2	Retail
3	Industrial Or Manufacturing
4	Medical
5	Education
6	Residential
7	Other (Specify)
9	DK/RF

O_LTYPE Land Use type of place, other

MODE Travel mode

Value	Label
1	Walk
2	Bike
3	Driver-Auto/Van/Truck
4	Passenger-Auto/Van/Truck
5	Transit
6	Links Paratransit/Dial-A-Ride
7	School Bus
8	Taxi/Shuttle
97	Other, specify
99	Refused

VEHNO If auto-driver or auto-passenger, hh vehicle number used
(note: can link on sampn/vehno to see vehicle information for hh vehicle used)

Value	Label
97	Non-Hh Veh Used

WITHP People in vehicle with you

Value	Label
1	Yes
2	No
9	DK/RF

WAHHM HH Members with you?

Value	Label
1	Yes
2	No
9	DK/RF

OTHTR Non-HH Members with you?

Value	Label
1	Yes
2	No
9	DK/RF

NUMHH Number of HH members traveling with you
NONHH Number of non-hh members in travel party
TOTTR Total in travel party (computed as NUMHH + NONHH + 1)

PERTP Person #s for hh members on Trip

TOBUS If used transit, # blocks walked to get on bus

Value	Label
99	Refused

FRBUS If used transit, # blocks walked once got off bus

Value	Label
99	Refused

TRANS If used transit, # of transfer

Value	Label
99	Refused

WHTTR If transferred, where? (corresponds to look-up list)
O_WHTTR If transferred, where? (if not on list, what was intersection?)

ACT1 Main Activity at this place

Value	Label
1	Work At Home
2	Non-Work At Home Activities
3	Work
4	Work-Related
5	Pick-Up Or Drop-Off Passenger At Work
6	School
7	School Related
8	Pick-Up Or Drop-Off Passenger At School
9	Quick Stop
10	Shopping
11	Visit
12	Personal Business
13	Eat Meal
14	Entertainment
15	Recreation Or Fitness
16	Civic Or Religious
17	Pick-Up Or Drop-Off Passenger At Other Location
18	Change Mode Of Transportation
97	Other
99	Refused

TRPDU Calculated trip duration

ACTDU Calculated activity duration

Location File

LOCNO Location number (links to HHADD, WADD, SADD, or LOCNO)

LOCTY Location type

Value	Label
1	Home
2	Work
3	School
5	Other place
6	Out of area

NAME Name of place

ADDR Place address

XSTRT Cross street nearest place

LAND Landmark

CITY City

CNTY County

STATE State

ZIP Zip code

AV_STA Geocoding status

Value	Label
C	On-Screen Matched
L	Landmark File Match
M	Matched
O	Out of Area
U	Unmatched

XCORD X coordinate

YCORD Y coordinate

FIPS County FIPS code

TRACT Census tract

TAZ Traffic analysis zone

AV_ADD Address corresponding to xcord and ycord

AV_ZONE Geocoding zone corresponding to xcord and ycord (typically zip)

Kansas City PM Characterization Study

Final Report

Appendix MM
Gas Diesel Split Study

Assessment and Standards Division
Office of Transportation and Air Quality
U.S. Environmental Protection Agency

Sponsors:

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Variations in Speciated Emissions from Spark-Ignition and Compression-Ignition Motor Vehicles in California's South Coast Air Basin

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ABSTRACT

The DOE Gasoline/Diesel PM Split Study examined the sources of uncertainties in using an organic compound-based chemical mass balance (CMB) receptor model to quantify the contributions of spark-ignition (SI) and compression-ignition (CI) engine exhaust to ambient fine particulate matter ($PM_{2.5}$). This paper presents the chemical composition profiles of SI and CI engine exhaust from the vehicle testing portion of the study. Chemical analysis of source samples consisted of gravimetric mass, elements, ions, organic and elemental carbon (OC and EC) by both the IMPROVE and STN thermal/optical methods, polycyclic aromatic hydrocarbons, hopanes, steranes, alkanes, and polar organic compounds. Over half the mass of

carbonaceous particles emitted by heavy-duty diesel trucks was EC (IMPROVE) and emissions from SI vehicles contained predominantly OC. While total carbon (TC) by the IMPROVE and STN protocols agreed well for all samples, the STN/IMPROVE ratios for EC from SI exhaust decreased with decreasing sample loading. SI vehicles, whether low or high emitters, emitted greater amounts of high molecular-weight particulate PAHs (benzo(ghi)perylene, indeno(1,2,3-cd)pyrene, and coronene) than CI vehicles. Diesel emissions contained higher abundances of 2- to 4-ring semi-volatile PAHs. Diacids were emitted by CI vehicles, but are also prevalent in secondary organic aerosols so they cannot be considered unique tracers. Hopanes and steranes were present in lubricating oil with similar composition for both gasoline and diesel vehicles and were negligible in gasoline or diesel fuels. CI vehicles emitted greater total amounts of hopanes and steranes on a mass per mile basis, but abundances were comparable to SI exhaust normalized to TC emissions within measurement uncertainty. The combustion-produced high-molecular weight PAHs were found in used gasoline motor oil but not in fresh oil and are negligible in used diesel engine oil. The contributions of lubrication oils to abundances of these PAHs in the exhaust were large in some cases and were variable with the age and consumption rate of the oil. These factors contributed to the observed variations in their abundances to total carbon or $PM_{2.5}$ among the SI composition profiles.

IMPLICATIONS

We examined several factors that contribute to variations in chemical composition of $PM_{2.5}$ emissions from in-use diesel and gasoline vehicles in California's South Coast Air Basin. These factors included model year, mileage accumulation, vehicle test cycles, composition of lubrication oils and variations in sampling and analytical methods. Distinctive differences were found in the abundances of specific chemical species in diesel and gasoline exhaust, but the variations among individual exhaust profiles were large. These variations should be considered when applying specific profiles in receptor modeling or emission inventory development and in estimating the uncertainties associated with the results.

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INTRODUCTION

Motor vehicle emissions are important sources of ambient air pollution and have been statistically associated with cancer and non-cancer health effects.[1-2] Vehicle exhaust is a complex mixtures of particulate matter (PM), gaseous pollutants and semi-volatile organic compounds (SVOC) that are in equilibrium with the particle phase. Several studies have been conducted recently to characterize the emission rates and organic speciation of PM from gasoline (or spark-ignition, SI) and diesel (or compression-ignition CI) vehicles.[3-12] The rate and chemical composition of gaseous and particulate emissions from diesel and gasoline vehicles depend upon many factors, which include vehicle age and mileage, fuel, emission control technology, state of vehicle maintenance, type and condition of lubricating oil, vehicle operating mode (e.g., cold start, hot stabilized), engine load, and ambient temperature.Data from dynamometer exhaust emission tests of properly functioning light-duty gasoline vehicles show that modern, low-mileage vehicles have low carbon monoxide, hydrocarbon, and particulate matter emission rates during hot stabilized operation and during relatively non-aggressive driving conditions.[13,14] Emission rates are higher for properly functioning vehicles during cold starts, during intermittent high engine load conditions induced by hard acceleration and grade and at low ambient temperatures.[10,13,14] The distribution of emission rates among in-use vehicles is highly skewed with a relatively small fraction of high emitters accounting for a disproportionate fraction of total emissions.[4,15,16]

Receptor models have been widely used to estimate the contributions of various sources to measured airborne particulate matter concentrations.[3, 5]. Current understanding of the uncertainties associated with receptor modeling calculations is limited by data to sufficiently characterize the variations and representativeness of source composition profiles, especially for motor vehicles. The Gasoline/Diesel PM Split Study was conducted during the summer of 2001 to assess the sources of uncertainties in using organic-compound-based chemical mass balance (BMV) receptor model to quantify the relative contributions of emissions from SI and CI engines to the ambient concentrations of fine particulate matter ($PM_{2.5}$). The impetus for the study was the disparate conclusions obtained from studies in the Los Angeles area and the Northern Front Range of Colorado regarding the relative contributions of SI and CI vehicles to ambient concentrations of fine particles.[3,5,6] Studies conducted in Denver indicated that gasoline combustion from mobile sources contributed more to ambient PM than diesel combustion. However, studies conducted in Los Angeles indicate that diesel combustion contributed more than gasoline combustion to ambient PM.

Key components of the design for the Gasoline/Diesel PM Split Study included characterization of the variations in exhaust composition within vehicle categories, the differences in determination of elemental carbon by two alternative methods, and comparability between multiple laboratories in the analysis of organic species. The study called for researchers from the Desert Research Institute (DRI) and the University of Wisconsin Madison (UWM) to work cooperatively on sample collection and quality assurance aspects of the study, but work independently, at least initially, on chemical analysis and data analysis. This current study did not necessarily seek to reconcile the results of the prior studies, but was intended to examine the range of uncertainties that may be associated with the methods and procedures for sample collection, chemical analysis, and source apportionment. This paper presents the source composition profiles derived by the DRI. It examines variations in the relative abundances of OC, EC, and potential molecular markers in SI and CI exhaust relative to the factors that may be associated with the observed variations. The ambient source apportionment results obtained by DRI and associated uncertainties are described elsewhere.[17,18]

EXPERIMENTAL METHODS

As part of this collaborative study, Bevilacqua-Knight, Inc. (BKI) with the U.S. Environmental Protection Agency (EPA) and West Virginia University (WVU) conducted dynamometer tests of light-duty gasoline-powered vehicles and heavy-duty diesel-powered vehicles, respectively. The vehicle emission tests were conducted at the Ralphs Grocery distribution center in Riverside, CA during summer of 2001 from June 2 to June 23 for light-duty vehicles, and from July 20 to September 19 for heavy-duty diesel vehicles. The vehicle selection and test protocols, vehicle characteristics, and dynamometer systems are described by EPA and BKI and WVU.[19,20] Details of the testing program that are pertinent to the development of exhaust composition profiles are summarized here.

Light-Duty Vehicle Testing

The U.S. Environmental Protection Agency (EPA) and BKI conducted dynamometer tests on their transportable Clayton Model CTE-50-0 chassis dynamometer for 57 light-duty gasoline vehicles and two light-duty diesel vehicles in the eleven combined model-year and mileage categories shown in Table 1. Table S1, located in the supplemental information section, gives the make, model, model year, mileage, and $PM_{2.5}$ emission rates for each vehicle.

Regulated emissions were determined with a constant volume sampling system (CVS) and continuous monitors for carbon monoxide (CO), carbon dioxide (CO_2), total hydrocarbons (THC), and oxides of nitrogen (NOx). BKI tested each vehicle using a modified Unified Driving Cycle (UDC) that consisted of a phase 1 plus phase 2 from a cold start, a ten minute soak, followed immediately by a repeat of the phase 1 (i.e., phase 3) plus phase 2 from a warm start. A pair of time-integrated samples was collected for each vehicle, one during phases 1 and 2 of the test cycle (“cold start” sample) and a second during the repeat of phases 1 and 2 after the ten-minute soak (“warm start” sample). The warm start test was repeated for eight vehicles to investigate the reproducibility of the emissions. In two of the replicate tests a set of parallel samples was collected from a smaller residence chamber with a volume equal to 20 percent of the main chamber (60 liters) to investigate the extent of particle coagulation and condensation.

One composite sample was collected for each model year and mileage group in categories 1 through 4 by sampling all vehicles within each category through the same sampling media ("media composite"). Samples were collected on separate media for vehicles in all remaining vehicle categories and combined in the laboratory according to the scheme shown in Table S1. Selection of samples within the composites were based on a target minimum combined mass loading of 1 mg of OC, which was estimated by subtracting the photoacoustic black carbon (BC) from gravimetric mass. The analytical composites also combined samples with similar BC/$PM_{2.5}$ ratios. Other relevant chemical characterizations included lubricating oils from each vehicle and representative fuel samples from nearby service stations. The lubrication oil samples were analyzed by DRI for organic constituents and by Gregory Poole Laboratories in Raleigh, NC for elements by inductively coupled plasma (ICP) analysis.

Heavy-Duty Diesel Vehicle Testing

West Virginia University (WVU) tested heavy-duty diesel trucks and diesel buses on their transportable heavy-duty vehicle emissions testing laboratories. Thirty trucks were selected for testing in the twelve combined vehicle weight (light-heavy, medium-heavy and heavy-heavy) and model year categories shown in Table 2. Fifteen trucks were newer model year, well-maintained fleet vehicles. The remaining fifteen trucks were a mix of vehicles in typical service. Two transit buses were also tested with one transit bus representing older engine technology and one representing newer engine technology. All 30 trucks were operated over three duty cycles for purposes of developing composition profiles, the City-Suburban Heavy Vehicle Route (CSHVR), the highway cycle (HW), and idle operation. The two buses were operated through the CSHVR, an idle period, and the Manhattan test cycle. WVU recorded continuous emissions levels of NOx, THC, CO, and CO_2. PM mass emissions were measured using two parallel filter-sampling trains. PM emissions were also continuously measured by WVU using a Tapered Element Oscillating Microbalance. An oil sample was withdrawn from each engine tested, and analyzed by DRI for organic constituents.

A set of time-integrated samples was collected in parallel by DRI and UWM for each test cycle run on each vehicle. When possible, the secondary dilution ratio was adjusted to compensate for variations in the emission rate of the vehicles. Table S2, in the supplemental information section, gives the make, model, model year, mileage, and $PM_{2.5}$ emission rates for each vehicle, and shows which samples were combined into composite samples. Analytical results for the idle tests are not shown because mass loadings were too low to yield useable data.

Sample Collection and Continuous Measurements

DRI provided a secondary dilution sampler that was capable of collecting diluted exhaust samples from the primary dilution tunnels of the EPA and WVU transportable dynamometers. The DRI dilution sampler was tested by Chang et al.[21] and is based on a similar sampler originally designed by Hildemann et al.[22] Emissions were withdrawn from the primary exhaust dilution tunnel through a heated Teflon line to the dilution sampler. In the sampler the exhaust mixed with dilution air under turbulent flow conditions, to cool and dilute the exhaust to near-ambient conditions. Ambient air filtered through a high efficiency particulate air (HEPA) filter and an activated carbon bed was used for dilution. The secondary dilution was adjusted to ratios between 20 and 50 for diesel testing. Several diesel trucks were also retested without secondary dilution as part of another project. Due to the large range of emission rates for different test cycles and vehicles, the optimal sampling rate could not always be achieved for all sampling media. For example, sample loading was excessive in some samples for TOR carbon analysis but was optimal for organic speciation. In general, the range of PM emissions for diesel trucks were lower than expected resulting in many diluted exhaust samples with near or below detection quantities for most organic species. For SI vehicles, the secondary dilution sampler was used without dilution (i.e., as a residence time chamber only) due to the low PM emission rates expected for most SI vehicles.

Sample air from the secondary dilution sampler was distributed to the various samplers from a conical aluminum plenum with 12 exit ports distributed radially around its base. From the residence chamber the samples were drawn through cyclone separators with a cut-off diameter of 2.5 μm, operating at 113 lpm, and collected using a DRI sequential filter sampler for inorganic species, and the DRI sequential fine particulate/semi-volatile organic compound (PSVOC) sampler for organic species (10). Samples were also collected by UWM in parallel with DRI from the same sampling plenum. Aerosol samples were collected by DRI on the following media: Gelman (Ann Arbor, MI) polymethylpentane ringed, 2.0 μm pore size, 47 mm diameter

PTFE Teflon-membrane filters (#RPJ047) for particle mass, elements and water soluble chloride, nitrate, sulfate, ammonium; Pallflex (Putnam, CT) 47 mm diameter pre-fired quartz-fiber filters (#2500 QAT-UP) for organic and elemental carbon; and Pallflex (Putnam, CT) T60A20 102 mm diameter Teflon-impregnated glass fiber TIGF) filters followed by a cartridge of 20-60 mesh Amberlite XAD-4 (Aldrich Chemical Company, Inc.) sandwiched between two polyurethane foam (PUF) plugs for organic speciation. A 2,4-dinitrophenylhydrazine (DNPH) cartridge (Sep-Pak) sampler for carbonyl compounds, a Tenax sampler for hydrocarbons in the range of C_8 to C_{20}, and a canister sampler for C_2-C_{12} volatile organic compound speciation were added to the sample train during light-duty passenger vehicle testing as part of the California Regional PM_{10}/$PM_{2.5}$ Air Quality Study (CRPAQS) source characterization project.[23]

$PM_{2.5}$ mass was monitored during the dynamometer tests for all SI and CI vehicles using a tapered element oscillating microbalance (TEOM), particle light scattering with a DustTrak nephelometer, and particle absorption using a photoacoustic instrument [24,25] to examine changes in emission rates and ratios of black carbon to $PM_{2.5}$ with varying operating conditions.[17] The continuous monitors also sampled from the same secondary dilution plenum connected to the primary dilution tunnel, both for gasoline and diesel vehicles. Continuous measurements of DustTrak light scattering provided immediate feedback about the nature of the emissions from vehicles and identified portions of the driving cycles where particulate emissions are greatest and least. They were also useful in determining whether the dilution tunnel had been adequately flushed between measurements. The continuous data were time-averaged and accumulated (in real-time) to provide total black carbon emissions and total particle emissions for use in comparison to the elemental carbon data from Thermal/Optical carbon analysis of the quartz filter and gravimetric mass analysis of the Teflon filters.

Periodic dynamic blank samples were collected during both phases of the vehicle testing program to characterize the dilution air used in BKI's constant volume dilution system (PDP-CVS) and in the combined WVU primary dilution system and DRI secondary dilution sampler. The blanks also characterize any sampling artifacts that may have been introduced by components of the sampling system. The methods used to collect these blanks were identical to that used for the vehicle exhaust samples except that no vehicle dynamometer test was run. The use of dynamic blanks for subtracting background contributions is not straightforward with regard to development of source composition profiles that include organic carbon and speciated organic compounds. Examination of the continuous light scattering and adsorption data for three of the SI dynamic blanks indicates that residual levels drop off rapidly and do not strongly influence the average concentration of the hour-long blank samples. Similar results were obtained for the CI dynamic blanks. We note that the primary dilution air was HEPA filtered to remove atmospheric background. Some of the organic carbon in the blanks may be an artifact of SVOCs desorbing off the walls of the sampling system and adsorbing on the quartz filter. Desorption of SVOCs is favored in the equilibrium process of passing clean dilution air through the sampling system. Furthermore, subtracting the dynamic blank concentrations of PAHs essentially eliminates the heavier PAHs from the speciation profile for many of the low–emitting, late model low mileage SI vehicles and lower emitting CI vehicles. Additionally, many of the PAHs with positive values have large relative uncertainties. Based upon these considerations, the profiles developed by DRI for study for subsequent receptor model calculations are reported here without dilution tunnel blank corrections. However, all samples were corrected for field/transport blanks. Results for the dilution tunnel blanks are provided in the supplemental information section.

Analytical Methods

Prior to use, sampling media were pre-cleaned as follows: quartz fiber filters were baked for several hours in a muffle furnace at 900ºC, and TIGF filters were cleaned by sonication for 10 minutes in dichloromethane (CH_2Cl_2) twice, with the solvent replaced and drained, and sonicated for 10 minutes in methanol twice with the solvent replaced. New XAD-4 was washed with liquinox soap and rinsed with hot water, followed with DI water and technical grade methanol (3-4 times). The XAD-4 was then extracted using a Dionex Accelerated Solvent Extractor (ASE) with dichloromethane (CH_2Cl_2) at 1500 psi and 80°C, followed by acetone. It was then dried in a vacuum oven at 50°C, and stored in clean 1L glass jars that were placed in aluminum cans with activated charcoal. PUF plugs were cleaned by first washing with distilled water, followed by Dionex ASE extraction for 15min/cell with acetone at 1500 psi and 80°C, followed by 10% diethyl ether in hexane under the same conditions. The extracted PUF plugs were dried in a vacuum oven at 50°C for approximately 3 days or until no solvent odor was detected, and stored in clean 1L glass jars with Teflon-lined lids wrapped in aluminum foil. Each batch of precleaned XAD-4 resin and ~10% of precleaned TIGF filters and PUF plugs were checked for purity by solvent extraction and GC/MS analysis of the extracts. The PUF plugs and XAD-4 resins were assembled into glass cartridges (10 g of XAD between two PUF plugs) and stored at room temperature prior to shipment to the field. All samples were shipped back to DRI in coolers at approximately 4^{o}C and stored in a freezer prior to extraction.

Weighing was performed on a Cahn 31 electro microbalance with ±0.001 mg sensitivity. Unexposed and exposed Teflon-membrane filters were equilibrated at a temperature of 20 ±5 °C and a relative humidity of 30±5% for a minimum of 24 hours prior to weighing. The charge on each filter is neutralized by exposure to a polonium source for 30 seconds prior to the filter being placed on the balance pan. X-ray fluorescence (XRF) analysis was performed on Teflon-membrane filters for elemental analysis using a Kevex Corporation Model 700/8000 energy dispersive x-ray fluorescence (EDXRF) analyzer.[26] Chloride (Cl^-), nitrate (NO_3^-), and sulfate ($SO4^=$) ions were measured with the Dionex 2020i (Sunnyvale, CA) ion chromatograph (IC). The Dionex system contains a guard column (AG4a column, Cat. No. #37042) and an anion separator column (AS4a column, Cat. No. #37041) with a strong basic anion exchange resin, and an anion micro membrane suppressor column (250´ 6 mm ID) with a strong acid ion exchange resin. The anion eluent consists of sodium carbonate (Na_2CO_3) and sodium bicarbonate ($NaHCO_3$) prepared in distilled, deionized water. A Technicon (Tarrytown, NY) TRAACS 800 Automated Colorimetric System (AC) was used to measure ammonium concentrations by the indolphenol method.

Elemental carbon (EC) and organic carbon (OC) were measured by thermal optical reflectance (TOR) method using the IMPROVE (Interagency Monitoring of Protected Visual Environments) temperature/oxygen cycle (IMPROVE TOR).[27, 28] Samples were also analyzed according to the Speciation Trends Network (STN) Protocol using a thermal/optical transmittance (TOT) instrument (29). In both methods, samples are collected on quartz filters. A section of the filter sample is placed in the carbon analyzer oven such that the optical reflectance or transmittance of He-Ne laser light (632.8 nm) can be monitored during the analysis process. The filter is first heated under oxygen-free helium purge gas. The volatilized or pyrolyzed carbonaceous gases are carried by the purge gas to the oxidizer catalyst where all carbon compounds are converted to carbon dioxide. The CO_2 is then reduced to methane, which is quantified by a flame ionization detector (FID). The carbon evolved during the oxygen-free heating stage is defined as “organic carbon”. The sample is then heated in the presence of helium gas containing 2 percent of oxygen and the carbon evolved during this stage is defined as “elemental carbon”. Some organic compounds pyrolyze when heated during the oxygen-free stage of the analysis and produce additional EC, which is defined as pyrolyzed carbon (PC). The formation of PC is monitored during the analysis by the sample reflectance or transmittance. EC and OC are thus distinguished based upon the refractory properties of EC using a thermal evolution carbon analyzer with optical (reflectance or transmittance) correction to compensate for the pyrolysis (charring) of OC. Carbon fractions in the IMPROVE method correspond to temperature steps of 120^{o}C (OC1), 250^{o}C (OC2), 450^{o}C (OC3), and 550^{o}C (OC4) in a nonoxidizing helium atmosphere, and at 550^{o}C (EC1), 700^{o}C (EC2), and 850^{o}C (EC3) in an oxidizing atmosphere. The temperature steps in the STN thermal evolution protocol are 310^{o}C, 480^{o}C, 615^{o}C, and 900^{o}C in a nonoxidizing helium atmosphere and 600^{o}C, 675^{o}C and 825^{o}C, in an oxidizing atmosphere. The STN method uses fixed hold times of 45 to 120 seconds at each heating stage and IMPROVE method uses variable hold times of 150-580 seconds so that carbon responses return to baseline values.

Thermal optical analysis of ambient samples by IMPROVE and STN protocols generally yield equivalent total carbon but STN EC is often less than IMPROVE EC.[30, 31] Because EC and OC are operationally defined by the method, the specific instrument used, details of its operation, and choice of thermal evolution protocol can influence the split between EC and OC.[32,33] Visual examination of filter darkening at different temperature stages have shown that substantial charring takes place within the filter, possibly due to adsorbed organic gases or diffusion of vaporized particles. The filter transmittance is more influenced by within-filter charring, whereas the filter reflectance is dominated by charring of the near-surface deposit. TOR and TOT corrections converge in the case of only a shallow surface deposit of EC or only a uniformly distributed pyrolyzed organic carbon (POC) through the filter and diverge when EC and POC exist concurrently at the surface and are distributed throughout the filter, respectively, especially when the surface EC evolves prior to the POC. The difference between TOR and TOT partly depends on the POC/EC ratio in the sample.[30] Thus, highly loaded source samples would yield similar EC values for TOR and TOT corrections, while lightly loaded source and ambient samples would typically yield different EC values. While EC values for TOR may tend toward higher EC due to underestimation of the POC correction, higher absorption efficiency of POC within the filter may tend toward lower EC values for TOT.

For organic compound speciation, PUF/XAD/PUF cartridges and TIGF filters were extracted and analyzed together, except for CI blanks, idle cycle tests and selected samples with low PM loadings, which were extracted and analyzed separately. Prior to extraction, the following deuterated internal standards were added to each filter and cartridge pair: naphthalene-d_8, acenaphthylene-d_8, phenanthrene-d_{10}, anthracene-d_{10}, chrysene-d_{12}, pyrene-d_{10}, benz[a]anthracene-d_{12}, benzo[a]pyrene-d_{12}, benzo[e]pyrene-d_{12}, benzo[k]fluoranthene-d-$_{12,}$ benzo[g,h,i]perylene-d_{12}, coronene-d_{12}, cholestane-d_{50}, and tetrocosane-$d_{50.}$ Filters and XAD-4 were extracted with dichloromethane, followed by acetone, using the Dionex ASE. Since PUF media degrade when extracted with dichloromethane, the PUF were extracted twice with acetone using the Dionex ASE. The extracts were then combined and concentrated by rotary evaporation at 20 °C under gentle vacuum to ~1 ml and filtered through 0.45 mm Acrodiscs (Gelman Scientific). The extract was concentrated to 1 ml and split into two fractions: (1) the first fraction was precleaned by the solid-phase extraction technique using Superclean LC-SI SPE cartridges (Supelco) with sequential elution with hexane, and hexane/benzene (1:1).[34, 35] The hexane fraction contained the non-polar aliphatic hydrocarbons, and hopanes and steranes, and the hexane/benzene fraction contained the PAH. These two fractions were combined and concentrated to ~100 µL and analyzed by GC/MS technique for hydrocarbons, hopanes, steranes, PAH and oxy-PAH. The second fraction was utilized for the polar compound analysis without precleaning. It was derivatized using a mixture of bis(trimethylsilyl)trifluoroacetamide and pyridine to convert the polar compounds into their trimethylsilyl derivatives. The second fraction was evaporated to 100 µl under moisture filtered ultra high purity nitrogen and transferred to 300 µl silanized glass inserts (National Scientific Company, Inc.). Samples were further evaporated to 50 µl, and 25 µl of pyridine (Pierce), 25 µl of internal standard mixture (succinic acid d-4, myristic acid -d27, and 1,2,4-butanetriol), and 150 µl of BSTFA with 1 % TMCS [N, O-bis (trimethylsilyl) trifluoroacetamide with 1% trimethylchlorosilane (Pierce)] were added. The glass insert containing the sample was put into a 2 ml vial and sealed. The sample was then placed into a thermal plate (custom made) containing individual vial wells at 70 ºC for 3 hours. The calibration solutions were freshly prepared and derivatized just prior to the analysis of each sample set, and then all samples were analyzed by GC/MS within 18 hours to avoid degradation. Analysis of the polar organic compounds and the internal standards added are described elsewhere.[36, 37]

Samples were analyzed by gas chromatography/mass spectrometry (GC/MS), using Varian CP-3800 GC equipped with a CP8400 autosampler and interfaced to a Varian Saturn 2000 Ion Trap operating in electron impact (EI) ionization mode (for PAH, oxy-PAH, hopanes/steranes and alkanes) or chemical ionization (CI) mode, using isobutene as an ionization gas (for polar compounds). Concentrations were quantified by comparing the response of the deuterated internal standards to the analyte of interest.[10] It should be also noted that due to the lack of authentic standards, most of the hopanes/steranes are identified tentatively (with exception of hop19, hop23 and ster45, for which standards were available), based on the available literature data.[34,35,38-40] Diesel fuel and gasoline and diesel lubrication oil samples were obtained from the vehicles immediately after emissions sampling and were analyzed for PAH and hopanes/steranes. The fuel and oils were cleaned and fractionated prior to analysis using the method described by Wang, et al.[34, 35] and detailed elsewhere.[10]

RESULTS

The 30 SI and 8 CI individual or analytical composite samples were further combined into six composite SI and four composite CI exhaust profiles as shown in Table 3. The SI composite profiles consist of low and high emitters for both “cold” (SI_LC and SI_HC, respectively) and “warm” (SI_LW and SI_HW) emission tests. Incremental cold start profiles were obtained by subtracting the warm samples from the corresponding cold samples, but the analytical uncertainties are too high for them to be useful in receptor modeling. A separate pair of composite profiles was also derived for vehicles with higher proportions of elemental carbon (SI_BC and SI_BW). MDD is the composite of all available speciation data for light-heavy and medium-heavy trucks. HCS and HW are composites exhaust profiles for heavy-heavy trucks on the City Suburban Heavy Vehicle Route and Highway Driving Cycles, respectively. HDD is the composite of the HCS and HW profiles. In several tests, secondary dilution of diesel exhaust resulted in insufficient amounts of sample for quantitative analysis of many organic species. These samples were excluded from the composite profiles. Samples collected for idle tests were all below detection. The composite profiles combine samples with similar $PM_{2.5}$ emission rates, EC/TC ratios, and abundances of hopanes, steranes and three of the high-molecular weight PAHs, benzo(ghi)perylene, indeno(1,2,3-cd)pyrene and coronene, that are potential markers for SI exhaust. The speciated emission rates are listed for the composite profiles in Table S3, located in the supplemental information section. These profiles were subsequently used in CMB receptor modeling to estimate the relative contributions of SI and CI exhaust to ambient carbonaceous particles in California's South Coast Air Basin.[18]

Fine Particle Mass, Ions and Metals

The average $PM_{2.5}$ emission rates for SI vehicles on the UDC were 27.2 mg/mile (251.9 maximum) for cold start tests and 16.9 mg/mile (207.9 maximum) for warm start tests. The distribution of $PM_{2.5}$ emissions for the 57 test SI vehicles is highly skewed with 10 percent that were the highest emitters accounting for 62 and 69 percent of the cumulative emissions for cold and warm tests, respectively. Average $PM_{2.5}$ emission rates for heavy-duty trucks were 404 mg/mile (1125 maximum) on the hot city-suburban route cycle and 187 mg/mile (520 maximum) on the highway cycle. The distribution of $PM_{2.5}$ emissions for heavy-duty trucks is less skewed than light-duty SI vehicles with 12 percent of the trucks accounting for 30 percent of the cumulative emissions for the hot CSHVR cycle.

The fractions of non-carbonaceous species to the total $PM_{2.5}$ in the composite profiles were negligible for both spark-ignition and diesel vehicles. Silicon and ammonium sulfate were dominant in the samples for light-duty vehicles in groups 1-4. Since these are major constituents of the ambient atmospheric PM, they are likely entrained through the vehicle's air filter. Zinc, calcium, and phosphorus, which are the dominant elements in lubricating oil, were present in all samples. The emission rates of these elements for SI vehicles, shown in Figure 1a, are highly variable with a range spanning nearly three orders of magnitude (maximum of 11.8 and minimum of 0.015 mg/mi). However, the relative proportions were constant, indicating that lubrication oil is likely the common source of these elements. The emissions distribution was highly skewed with most 1990 and newer SI vehicles emitting less than 0.1 mg/mile of the three elements and most pre-1990 SI vehicles showing higher emissions. The range of emission rates of these elements was not as large for CI exhaust (Figure 1b). The lower range was comparable to pre-1990 SI vehicles and the upper end was comparable to the highest emitting SI vehicles. The relative emissions of the three elements were more variable in CI exhaust with lower proportional amounts of phosphorus with increasing emissions. While there is a general tendency toward higher $PM_{2.5}$ emissions with greater emissions of zinc, calcium and phosphorus, the correlations were weak.

Carbon Composition

Over half the mass of carbonaceous particles emitted by heavy-duty diesel trucks is elemental carbon, as illustrated in Figure 2. The EC/TC ratios for the combined light and medium heavy-duty diesel trucks (MDD) and the heavy heavy-duty diesel trucks (HDD) were both 0.62 (IMPROVE TOR method) with about two-thirds of the EC in the EC2 fraction. By comparison, the EC/TC ratios among the SI composite profiles were lower and more variable. $PM_{2.5}$ emissions from SI vehicles with higher emission levels contain predominantly OC with EC/TC ratios of 0.17 and 0.12 for cold and warm start tests, respectively. The EC/TC ratios for lower emitters were 0.31 for both cold and warm start tests. SI vehicles emitted a larger fraction of EC as EC1 than CI vehicles. Table 3 shows that there were a few moderate to high-emitting SI vehicles with EC/TC ratios that were comparable to heavy-duty diesel trucks (0.56 for cold start test and 0.53 for warm start test) with higher fractions of EC in the EC2 fraction.

EC and OC are operationally defined parameters and may vary with the specific instrument and protocol used. The scatterplots in Figure 3 for TC and EC show that measurements by the IMPROVE TOR and STN TOT protocols agree well for highly loaded samples. However, the STN TOT/IMPROVE TOR ratios for EC decrease with decreasing sample loadings. The divergence between the two methods occurs for lightly loaded SI samples. Figure 4 shows scatterplots of STN versus IMPROVE EC measurements for all CI (top left) and for SI (top right) samples. The same two plots are shown for lower exhaust concentrations in the bottom panels. While the two methods agree for CI samples for the entire range of exhaust concentrations, IMPROVE TOR EC is higher relatively to STN TOT EC in SI samples at lower exhaust concentrations. The effect of variations in EC measurements by the two methods on the CMB source apportionments is discussed elsewhere.[18]

The continuous photoacoustic light absorption measurements showed that all vehicles tested, including late model spark ignition vehicles, had black carbon emissions.[17] For SI vehicles, black carbon and $PM_{2.5}$ emission rates can be two to eight times larger during the cold start phase than during hot stabilized operation. Relatively clean spark ignition vehicles have black carbon emissions that occur during the more aggressive portions of the driving cycle, with maximum emissions typical during cold start and a secondary peak during aggressive acceleration, which are both associated with fuel/air ratio enrichment. Figure 5 shows examples of the variations in light absorption during the test cycle for very clean, normal, and visibly smoking SI vehicles, and a light-duty diesel vehicle. The 'clean' and 'normal' vehicles had greatest emission concentrations in the first 5 minutes of phase 1 (cold start), and the similar driving cycle after 35 minutes in the phase 3 warm start produced much lower emissions. Virtually all of the PM emissions from "normal emitters" come from the first few minutes during a cold start and from hard accelerations with relatively higher amounts of black carbon produced during both cold starts and hard accelerations.

Distribution of Organic Compounds in Exhaust and Lubricating Oil

Figure 6 presents the emission rates (μg/mile) of higher molecular-weight polycyclic aromatic hydrocarbons (PAH) that are mostly particle-associated in the composite diesel and gasoline exhaust. Gasoline vehicle exhaust contains higher proportions of the 6-and 7-ring PAH, indeno[1,2,3-cd]pyrene, benzo[ghi]perylene and coronene in comparison with diesel exhaust. This is consistent with the comparative composition of PAH emissions that have been reported in previous studies.[10, 41] In contrast, diesel emissions are enriched in 2- to 4-ring semi-volatile PAHs, including primarily particle-associated chrysene and benz(a)anthracene. Benz(a)anthracene is relatively reactive PAH, thus it is not a suitable tracer for diesel emissions. However, chrysene is a stable PAH and is mostly particle associated at ambient conditions. Chrysene correlates well with IMPROVE TOR EC for the four composite diesel profiles (r^2= 0.97).

While several 6 and 7-ring PAH are potential markers for gasoline exhaust, their relative abundances to total carbon emissions were variable. PAHs in lubricating oils may be one possible explanation of this variability. In a previous study, we reported that these PAHs are found in used gasoline motor oil but not in fresh oil and are negligible in used diesel engine oil.[10] Combustion-produced PAH can escape from the combustion chamber past the piston rings with the blow-by gases that can absorb into the crankcase oil. We postulate that the concentration of PAH in the lubrication oil increases with mileage accumulation until the next oil change. Consequently, emissions of PAH may also depend on the rate of consumption and age of the lubrication oil as well as the vehicle operating conditions that directly produce PAHs during combustion. Figure 7 shows the concentrations of the same eight higher molecular weight PAHs in diesel fuel and diesel and gasoline vehicle lubrication oils (in µg/g). Gasoline lubrication oils contain higher concentrations of these PAH in comparison with diesel fuels or oils. This is consistent with previous results.[10] Note that while the absolute concentrations of PAHs vary in the gasoline vehicle lubricating oil, their proportions to each other are consistent.

Hopanes and steranes are compounds present in crude oil as a result of the decomposition of sterols and other biomass.[39] These compounds are present in lubricating oils, but not in the fuels.[10] They have been used as molecular markers for vehicle emissions and are higher in vehicles that emit oil.[10, 38-40] Figure 8 shows the emission rates of individual hopanes and steranes for the composite diesel and gasoline vehicle profiles. Table S3 explains the mnemonics. CI composite exhaust profiles contain higher amounts of lower molecular weight hopanes and steranes, while the SI exhaust profiles have a more even distribution by molecular weight. This result is inconsistent with previous studies that have shown similar composition of hopanes and steranes in SI and CI exhaust.[10] As noted earlier, the results for most CI vehicle samples have higher uncertainty due to the higher dilution ratios used in sample collection. Some CI samples have the expected patterns of hopanes and steranes, but were not included in the composite profile due to invalid analytical results for other species (e.g., invalid carbon data due to overloaded quartz filter).

Figure 9 shows the comparison of hopanes and steranes profiles in the lubricating oils and in the CI and SI vehicle exhaust. The composition of steranes and hopanes are similar in SI vehicle exhaust to that in lubrication oil, especially for steranes. Thus, we estimate lubricating oil emission rates for SI vehicles by assuming that all steranes present in emissions are from the lubrication oil and are not destroyed during the combustion process. The lubrication oil emission rates (Oil Em) were calculated from the following equation:

$$\text{Oil Em (g/mile)} = S_{em}\ (\mu g/mile)/S_{oil}\ (\mu g/g) \quad (1)$$

where S_{em} is total steranes emission rate from the SI vehicles and S_{oil} is the total concentration of steranes in the lubrication oil of the corresponding vehicle. The emissions of PAHs that originate from the lubrication oil can be estimated from equation (2):

$$\text{PAH emitted with oil } (\mu g/mile) = PAH_{oil}\ (\mu g/g) * \text{Oil Em (g/mile)} \quad (2)$$

The ratio of PAHs originating from the oil to total PAHs in the exhaust gives the fraction of PAH in the emissions that are associated with oil. Table 4 shows the results calculated for the same eight and three (indeno[1,2,3-cd]pyrene, benzo[ghi]perylene and coronene) higher mw PAH, for SI vehicles. The contribution of lubrication oil to emissions of PAHs ranges from 0.2% to 79% and from 0.1% to 55% for eight and three PAHs, respectively. This contribution depends upon two key factors: (1) the vehicle's oil consumption rate; and (2) time and mileage since the oil was last changed. For example, two SI vehicles from category 7 (SI_7C2 and SI_7C3) are not the highest lubrication oil emitters (67 and 96 mg/mile, respectively, as compared to over 300 mg/mile for vehicle SI_10C3), but the PAH contributions from the lubrication oil are the highest among the SI group. This suggests that these two vehicles are excessive oil emitters. Indeed, the OC/TC ratio is also the highest for these two vehicles (91 and 93%, IMPROVE method). The highest lubrication oil emitter, vehicle SI_10C3 (358 mg/mile) has only moderate contribution of heavy PAH from the lubrication oil (5% for three PAH) but its lubrication oil was only 8 days old and the concentrations of these PAH in the oil were relatively low (See Figure 7). Vehicles from category 10 are high PM emitters, but the PAHs in the exhaust are formed mostly during the combustion process with a relatively minor contribution from the lubrication oil. It should be noted that the lubrication oil emissions calculated according to the equation (1) are often higher than the $PM_{2.5}$ emissions. However, not all components of burned oil are in particulate matter as some may be too volatile to condense on the particles or may be destroyed during the combustion process.

Aliphatic and cyclic hydrocarbons were measured in vehicle emissions only. We quantified 15 n-alkanes (from C14 to C28), 5 branched alkanes: norfarnesane (2,6,10-trimethylundecane), farnesane (2,6,10-trimethyldodecane), norpristane (2,6,10-trimethylpentadecane), pristane (2,6,10,14-tetramethylpentadecane), phytane (2,6,10,14-

tetramethylhexadecane), and 14 n-alkylcyclohexanes (from C7- to C20-cyclohexane). Table S-3 lists the emission rates of these alkanes and, in addition, a sum of n-alkylcyclohexanes for composite CI and SI vehicles. It is clear from this table that the emission rates of these compounds are much higher for CI than SI vehicles. In fact, only high-emitting SI vehicles, especially in hot start mode, emit any significant amounts of branched and cyclic hydrocarbons. This is true for n-alkanes as well. For CI vehicle exhaust, n-alkanes, branched alkanes and n-alkylcyclohexanes constitute approximately 60-80%, 6-20% and 6-30%, respectively, of total aliphatic and cyclic hydrocarbons. For SI vehicles, these percentages are more spread out, but for the higher emitting vehicles, they are in the same range. All five branched alkanes are present in the spark ignition high-emtting cold and warm (SI_HC and SI_HW) profiles as well; thus they are not unique tracers for diesel vehicle exhaust.

Polar compounds were measured in the vehicle emissions only. Table S-3 lists the emission rates of several polar compounds: tridecanoic acid (alkanoic acid), succinic and glutaric acid (alkanedioic acids), maleic acid (alkenedioic acid), phthalic and isophthalic acid (aromatic diacid). The emission rates of these compounds are much higher for CI than SI vehicles. It is interesting to note that diacids that are often considered as atmospheric transformation products are emitted by CI vehicles.[43-48] Thus, these compounds are not unique tracers for either vehicle exhaust or secondary organic aerosols.

DISCUSSION

The results of this study are generally consistent with other recent vehicle exhaust emission characterization studies.[4-7, 10,11] PM emissions of most SI vehicles were relatively low compared to CI vehicles, especially in hot-stabilized mode. The $PM_{2.5}$ emissions of some SI high emitters were comparable to the emissions of most CI vehicles on the Highway Test Cycle. Organic carbon and elemental carbon are the most abundant species in motor vehicle exhaust, accounting for over 95% of the total $PM_{2.5}$ mass. Elemental carbon is dominant in diesel exhaust and its proportion to total carbon is generally less at lower engine load. Over half the mass of carbonaceous particles emitted by heavy-duty diesel trucks is EC measured by IMPROVE TOR with about two-thirds in the EC2 fraction. $PM_{2.5}$ emissions from SI high-emitters contain predominantly OC. However, black carbon and PM emission rates for SI vehicles can be two to eight times larger during the cold start phase than during hot stabilized operation, which confirm previous results from NRFAQS.[5, 6] Relatively clean SI vehicles can also produce black carbon emissions during the more aggressive portions of the driving cycle. Therefore, the emission profiles for clean SI vehicles from dynamometer tests may contain higher fractions of EC than would be produced in congested urban driving conditions. There are a few moderate to high-emitting SI vehicles with EC/TC ratios that are comparable to heavy-duty diesel trucks with higher fractions of elemental carbon in the EC2 fraction.

Total carbon measurements by the IMPROVE-TOR and STN-TOT protocols agree well for diesel exhaust samples. EC emission rates measured by IMPROVE were also in good agreement with STN for CI exhaust. While EC measurements for SI vehicles agreed between the two protocols at higher PM emission rates, the divergence increased with decreasing PM emissions. Using IMPROVE EC rather than STN EC in the Chemical Mass Balance fit for the Gasoline/Diesel PM Split Study resulted in about 40 percent higher CI contributions to ambient particulate carbon, but was not statistically significant within two overlapping standard errors.[18] However, these results were attributed to greater differences between the two carbon analysis protocols for ambient samples.[18]

SI vehicles, whether low or high emitters, have higher emission rates than CI vehicles (per travel distance basis) of the high molecular-weight particulate PAHs, benzo(ghi)perylene, indeno(1,2,3-cd)pyrene, and coronene. Diesel vehicles have higher emissions of 2 to 4-ring semi-volatile PAHs. Hopanes and steranes are present in lubricating oil with similar composition for both gasoline and diesel vehicles and are negligible in gasoline or diesel fuels. CI vehicles emitted greater total amounts on a mass per mile basis, but abundances were comparable to SI exhaust normalized to total carbon emissions within margin of error. Emission rates of hopanes and steranes are the highest for both gasoline and diesel “high emitting” vehicles. Diacids were emitted by CI vehicles, and cannot be considered unique tracers for either vehicle exhaust or secondary organic aerosols.

We also confirmed that the high molecular-weight particulate PAHs, benzo(ghi)perylene, ideno(1,2,3-cd)pyrene, and coronene, are found in used gasoline motor oil, but not in fresh oil, and are negligible in used diesel engine oil.[10] The contributions of lubrication oils to abundances of these PAHs in the exhaust were large in some cases and were variable with the age and consumption rate of the oil. These factors contributed to the observed variations in their abundances to total carbon or $PM_{2.5}$ among the SI composition profiles obtained in this study. As in the NFRAQS, we found in this study that the CMB apportionments of SI exhaust were sensitive to the abundance of high-molecular weight PAHs in the profile and to a lesser extent to hopanes and steranes.[18] Variations in abundances of these species in SI and CI exhaust profiles and differences in IMPROVE and STN EC measurements were two of the more important sources of uncertainty in the CMB analysis for this study.[18]

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SUPPORTING INFORMATION AVAILABLE

Table S1 displays the make, model, year, mileage and $PM_{2.5}$ emission rate of each SI vehicle as well as the analytical compositing scheme for composition profiles. Table S2 displays similar information for the CI vehicles. Table S3 lists the speciated emission rates for the composite SI and CI exhaust profiles. A discussion of data quality is presented along with analysis of the dilution tunnel samples. Figure S1 compares $PM_{2.5}$ emission rates determined by EPA/BKI and UWV from their primary dilution tunnel versus the corresponding values obtained by DRI from the secondary dilution tunnel sampler. Figure S2 show correlation plots of gravimetric mass vs. sum of elements by XRF, ions by IC and AA, and carbon by TOR for SI and CI vehicles. Table S4 displays the mass loadings in the tunnel blanks relative to the composite SI and CI exhaust samples. Data and project reports from the study are available online at the following web site: http://www.nrel.gov/vehiclesandfuels/nfti/feat_split_study.html

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Table 1. Numbers of vehicles and analytical composite samples in light-duty vehicle test categories.

Category	Model Year	Odometer (miles)	Number of Vehicles	Number of Composites [1,2]
1	1996 and newer	low mileage (< 50,000)	4	1
2	1993-95	low mileage (< 75,000)	4	1
3	1996 and newer	high mileage (> 100,000)	4	1
4	1990-92	lower mileage (< 100,000)	4	1
5	1993-95	higher mileage (> 125,000)	8	2
6	1990-92	> 125,000	9	3
7	1986-89	> 125,000	6	3
8	1981-85	> 125,000	6	3
9	1980 and earlier	> 125,000	6	3
10	Smoker	no model year or odometer criteria	6	6
11	LD Diesel	no model year or odometer criteria	2	2
			59	26

1. Media composites for Categories 1 through 4 and laboratory composites for all other categories.
2. Separate composite samples for Phase 1 plus 2 of the UDC from a cold and warm start (52 composites total).

Table 2. Numbers of vehicles and analytical composite samples in heavy-duty diesel truck test categories.

Category	Model Year	Gross Vehicle Weight (lbs)	Number of Vehicles	Number of Composites [1]
1	Pre-1990	8,501 to 14,000	1	1
2	1990-93	8,501 to 14,000	1	
3	1994-97	8,501 to 14,000	2	1
4	1998 and newer	8,501 to 14,000	3	
5	Pre-1990	14,001 to 33,000	1	1
6	1990-93	14,001 to 33,000	0	0
7	1994-97	14,001 to 33,000	3	2
8	1998 and newer	14,001 to 33,000	3	
9	Pre-1990	33,001 to 80,000	2	2
10	1990-93	33,001 to 80,000	3	1
11	1994-97	33,001 to 80,000	7	3
12	1998 and newer	33,001 to 80,000	4	1
13	Bus		2	2
			32	14

1. Separate composite samples for CSHVR and HW cycles (28 composites total).

Table 3. Emission rates of OC, EC and sums of organic compounds by analytical composites and composite profile groupings.

			IMPROVE			STN					
Profile Composite [1]	Analytical Composite	PM2.5 (mg/mile)	OC (mg/mile)	EC (mg/mile)	EC/TC	OC (mg/mile)	EC (mg/mile)	EC/TC	Sum High MW PAH [2] (mg/mile)	Sum of Hopanes (mg/mile)	Sum of Steranes (mg/mile)
Light-Duty Gasoline											
SI_LC	SI_1C1	8.0	3.9	1.2	0.23	4.0	0.6	0.14	0.0401	0.0013	0.0018
	SI_2C1	4.4	1.9	1.0	0.34	2.2	0.3	0.13	0.0148	0.0004	0.0029
	SI_6C2	7.5	6.0	2.3	0.28	5.8	1.6	0.22	0.0064	0.0011	0.0077
	SI_7C1	4.6	3.1	2.1	0.40	3.2	0.7	0.18	0.0055	0.0000	0.0067
SI_LW	SI_1W1	3.7	1.5	1.0	0.40	1.8	0.6	0.25	0.0164	0.0000	0.0021
	SI_2W1	1.9	1.2	0.4	0.23	1.5	0.0	0.02	0.0110	0.0000	0.0014
	SI_6W2	3.9	3.5	0.6	0.16	1.6	0.0	0.01	0.0017	0.0018	0.0089
	SI_7W1	2.1	2.1	1.3	0.37	2.5	0.7	0.20	0.0016	0.0000	0.0161
SI_HC	SI_10C2	52.8	46.3	6.6	0.13	40.0	9.2	0.19	0.0681	0.0935	0.0553
	SI_10C3	59.1	45.3	14.4	0.24	49.5	4.6	0.08	0.0609	0.0401	0.0874
	SI_5C1	13.1	4.5	1.2	0.21	5.0	0.2	0.03	0.0133	0.0000	0.0023
	SI_7C2	32.2	24.5	2.4	0.09	23.3	2.1	0.08	0.0095	0.1369	0.0422
	SI_7C3	31.9	26.5	2.0	0.07	23.6	1.1	0.04	0.0034	0.0270	0.0327
	SI_8C1	12.9	9.3	2.5	0.21	8.6	2.0	0.19	0.0106	0.0202	0.0112
	SI_10C1	13.3	12.5	3.3	0.21	13.3	2.6	0.16	0.0422	0.0933	0.0230
SI_HW	SI_10W1	17.8	16.1	1.2	0.07	15.3	0.8	0.05	0.0047	0.0953	0.0429
	SI_10W2	40.2	35.6	3.1	0.08	35.3	1.7	0.05	0.0138	0.0504	0.0310
	SI_10W3	10.1	13.6	4.5	0.25	12.7	2.7	0.18	0.0181	0.0038	0.0099
	SI_5W1	6.7	2.4	1.0	0.30	3.1	0.1	0.02	0.0046	0.0000	0.0029
	SI_7W2	15.8	11.6	2.0	0.15	11.3	1.9	0.14	0.0107	0.0800	0.0167
	SI_7W3	39.3	34.0	1.5	0.04	30.7	0.6	0.02	0.0008	0.0350	0.0355
	SI_8W1	6.7	7.0	1.5	0.18	6.2	0.8	0.11	0.0030	0.0311	0.0387
SI_BC	SI_4C1	6.2	1.7	1.8	0.51	2.1	1.2	0.37	0.0132	0.0001	0.0011
	SI_6C3	16.1	7.7	8.4	0.52	7.1	8.5	0.55	0.0357	0.0130	0.0068
	SI_8C2	26.4	11.9	13.9	0.54	11.2	13.8	0.55	0.0364	0.0482	0.0102
	SI_9C2	17.6	5.7	10.9	0.65	6.8	10.1	0.60	0.0386	0.0000	0.0071
SI_BW	SI_4W1	3.4	0.8	0.9	0.52	1.1	0.6	0.34	0.0058	0.0001	0.0011
	SI_6W3	5.9	4.3	3.2	0.43	3.4	3.1	0.48	0.0048	0.0021	0.0069
	SI_8W2	10.4	4.7	5.8	0.55	4.6	5.6	0.55	0.0166	0.0197	0.0073
	SI_9W2	6.4	2.2	3.5	0.62	2.9	2.6	0.47	0.0728	0.0260	0.0044
Heavy-Duty Diesel											
MDD	HW-5	1630.1	488.7	1332.4	0.73	454.6	1310.9	0.74	0.0000	0.1243	0.2186
MDD	HW-II	130.6	154.7	100.8	0.39	142.6	82.3	0.37	0.0000	0.0000	0.0000
MDD	HCS-5	1827.3	602.5	1490.2	0.71	575.1	1358.1	0.70	0.0025	0.2761	0.2940
MDD	HCS-IIb	445.7	363.0	247.9	0.41	330.2	198.1	0.38	0.0000	0.0000	0.2583
HDD; HW	HW-10	411.0	300.3	371.3	0.55	271.2	316.8	0.54	0.0000	0.1055	0.2714
HDD; HW	HW-11n	208.4	54.0	81.0	0.60	61.5	72.3	0.54	0.0002	0.0063	0.0148
HDD; HCS	HCS-10	1185.9	536.6	929.8	0.63	501.0	818.0	0.62	0.0000	0.3833	0.2239
HDD; HCS	HCS-11n	343.4	120.2	304.8	0.72	123.8	274.9	0.69	0.0007	0.0149	0.0322

1. Abbreviation for SI composites - H = High, L = Low, B = high black carbon; for CI composites - 1 = LHDT & MHDT, 2 = HHDT.
2. Sum of potential marker compounds for SI vehicle exhaust, benzo(ghi)perylene, indeno(1,2,3-cd)pyrene and coronene.

Table 4. Contributions of heavy molecular weight PAHs from the lubrication oil to the vehicle exhaust.

	Lube Oil (ug/g)				Emission (ug/mile)		Emissions (g/mile)	% PAH from Lub Oil		
Analytical Composite	**Sum Hopanes**	**Sum Steranes**	**Sum 8 PAH**	**Sum 3 PAH**	**Sum 8 PAH**	**Sum 3 PAH**	**Oil**	**Sum 8 PAH**	**Sum 3 PAH**	**OC/TC %**
SI_1C1	391.9	519.2	26.1	9.6	50.4	41.2	0.003	0.2%	0.1%	77.1%
SI_2C1	171.8	296.2	85.3	19.1	17.6	15.3	0.010	4.7%	1.2%	66.3%
SI_4C1	551.2	767.5	134.1	22.6	18.5	13.6	0.001	1.0%	0.2%	49.0%
SI_5C1	1377.4	1247.2	94.1	26.1	15.6	13.8	0.002	1.1%	0.3%	78.6%
SI_6C2	169.2	182.7	49.8	12.2	10.2	6.5	0.042	20.6%	7.9%	72.5%
SI_6C3	474.5	367.0	140.1	22.8	61.5	36.7	0.019	4.2%	1.2%	47.9%
SI_7C1	224.9	367.2	65.7	21.4	8.2	5.8	0.018	14.6%	6.7%	60.3%
SI_7C2	224.9	629.3	136.2	13.2	23.4	9.8	0.067	39.0%	9.0%	91.1%
SI_7C3	317.8	340.5	50.1	20.1	6.1	3.5	0.096	78.8%	55.0%	92.9%
SI_8C1	381.0	545.9	49.0	16.2	23.6	10.9	0.021	4.3%	3.1%	78.9%
SI_8C2	100.4	189.2	31.3	4.2	71	37.5	0.054	2.4%	0.6%	46.1%
SI_9C2	2769.8	2496.1	76.4	10.9	51.8	39.7	0.003	0.4%	0.1%	34.5%
SI_10C1	2192.9	1791.3	71.5	16.7	48.7	43.4	0.013	1.9%	0.5%	79.0%
SI_10C2	779.9	729.9	155.7	23.5	96.1	70.1	0.076	12.3%	2.5%	87.5%
SI_10C3	111.3	244.3	29.2	8.8	92.3	62.6	0.358	11.3%	5.1%	75.8%

Figure Captions

Figure 1. Emission rates (mg/mile) of zinc, calcium and phosphorus for (a) light-duty SI vehicles and (b) heavy-duty CI vehicles.

Figure 2. Distributions of emission rates by carbon fractions measured by TOR-IMPROVE method.

Figure 3. Ratios of elemental carbon measured by STN to IMPROVE as a function of EC concentrations and scatterplots of STN versus IMPROVE EC measurements for SI and CI exhaust samples.

Figure 4. Scatterplots of STN versus IMPROVE EC measurements for all CI and SI exhaust samples (upper panel) and for lower sample loadings (lower panel).

Figure 5. Variations in black carbon emissions during the UDC test cycle for very clean, normal and visibly smoking SI vehicle, and a light-duty diesel vehicle.

Figure 6. Emission rates of particulate polycyclic aromatic compounds. Species mnemonics are explained in Table S3.

Figure 7. Concentrations of particulate polycyclic aromatic compounds in diesel fuels and CI and SI vehicle lubrication oils.

Figure 8. Emission rates of hopanes and steranes. This result is inconsistent with previous studies that have shown similar composition of hopanes and steranes in SI and CI exhaust. Some CI samples were not included in the composite profile due to higher uncertainty caused by higher dilution ratios used in sample collection or invalid analytical results for other species.

Figure 9. Concentrations of steranes (upper panel) and hopanes (lower panel) in CI and SI vehicle lubrication oils.

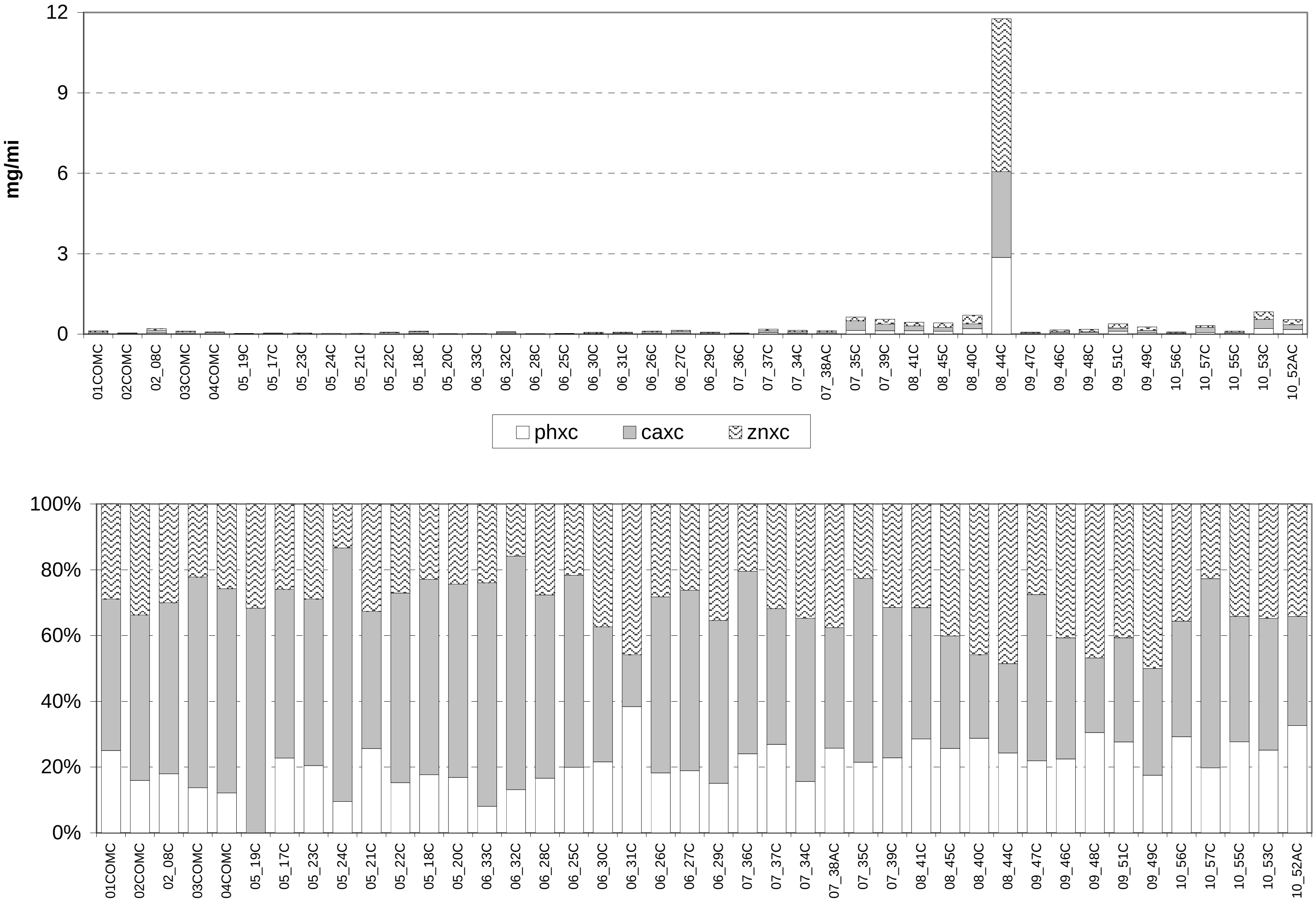

12
9
6
3
0
mg/mi
01COMC
02COMC
02_08C
03COMC
04COMC
05_19C
05_17C
05_23C
05_24C
05_21C
05_22C
05_18C
05_20C
06_33C
06_32C
06_28C
06_25C
06_30C
06_31C
06_26C
06_27C
06_29C
07_36C
07_37C
07_34C
07_38AC
07_35C
07_39C
08_41C
08_45C
08_40C
08_44C
09_47C
09_46C
09_48C
09_51C
09_49C
10_56C
10_57C
10_55C
10_53C
10_52AC
phxc
caxc
znxc
100%
80%
60%
40%
20%
0%
01COMC
02COMC
02_08C
03COMC
04COMC
05_19C
05_17C
05_23C
05_24C
05_21C
05_22C
05_18C
05_20C
06_33C
06_32C
06_28C
06_25C
06_30C
06_31C
06_26C
06_27C
06_29C
07_36C
07_37C
07_34C
07_38AC
07_35C
07_39C
08_41C
08_45C
08_40C
08_44C
09_47C
09_46C
09_48C
09_51C
09_49C
10_56C
10_57C
10_55C
10_53C
10_52AC

Figure 1a

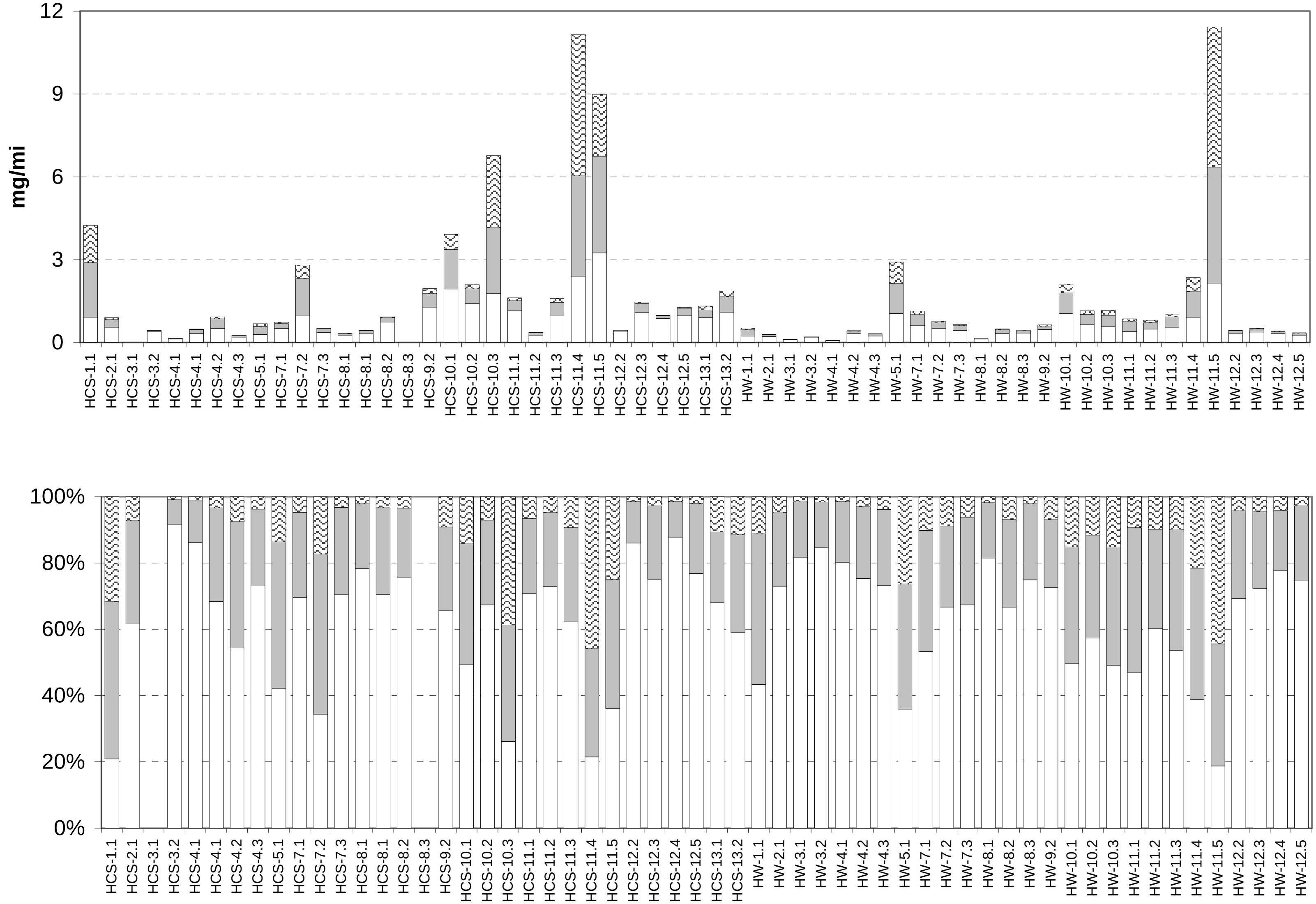

mg/mi
12
9
6
3
0
HCS-1.1
HCS-2.1
HCS-3.1
HCS-3.2
HCS-4.1
HCS-4.1
HCS-4.2
HCS-4.3
HCS-5.1
HCS-7.1
HCS-7.2
HCS-7.3
HCS-8.1
HCS-8.1
HCS-8.2
HCS-8.3
HCS-9.2
HCS-10.1
HCS-10.2
HCS-10.3
HCS-11.1
HCS-11.2
HCS-11.3
HCS-11.4
HCS-11.5
HCS-12.2
HCS-12.3
HCS-12.4
HCS-12.5
HCS-13.1
HCS-13.2
HW-1.1
HW-2.1
HW-3.1
HW-3.2
HW-4.1
HW-4.2
HW-4.3
HW-5.1
HW-7.1
HW-7.2
HW-7.3
HW-8.1
HW-8.2
HW-8.3
HW-9.2
HW-10.1
HW-10.2
HW-10.3
HW-11.1
HW-11.2
HW-11.3
HW-11.4
HW-11.5
HW-12.2
HW-12.3
HW-12.4
HW-12.5
100%
80%
60%
40%
20%
0%
HCS-1.1
HCS-2.1
HCS-3.1
HCS-3.2
HCS-4.1
HCS-4.1
HCS-4.2
HCS-4.3
HCS-5.1
HCS-7.1
HCS-7.2
HCS-7.3
HCS-8.1
HCS-8.1
HCS-8.2
HCS-8.3
HCS-9.2
HCS-10.1
HCS-10.2
HCS-10.3
HCS-11.1
HCS-11.2
HCS-11.3
HCS-11.4
HCS-11.5
HCS-12.2
HCS-12.3
HCS-12.4
HCS-12.5
HCS-13.1
HCS-13.2
HW-1.1
HW-2.1
HW-3.1
HW-3.2
HW-4.1
HW-4.2
HW-4.3
HW-5.1
HW-7.1
HW-7.2
HW-7.3
HW-8.1
HW-8.2
HW-8.3
HW-9.2
HW-10.1
HW-10.2
HW-10.3
HW-11.1
HW-11.2
HW-11.3
HW-11.4
HW-11.5
HW-12.2
HW-12.3
HW-12.4
HW-12.5

Figure 1b

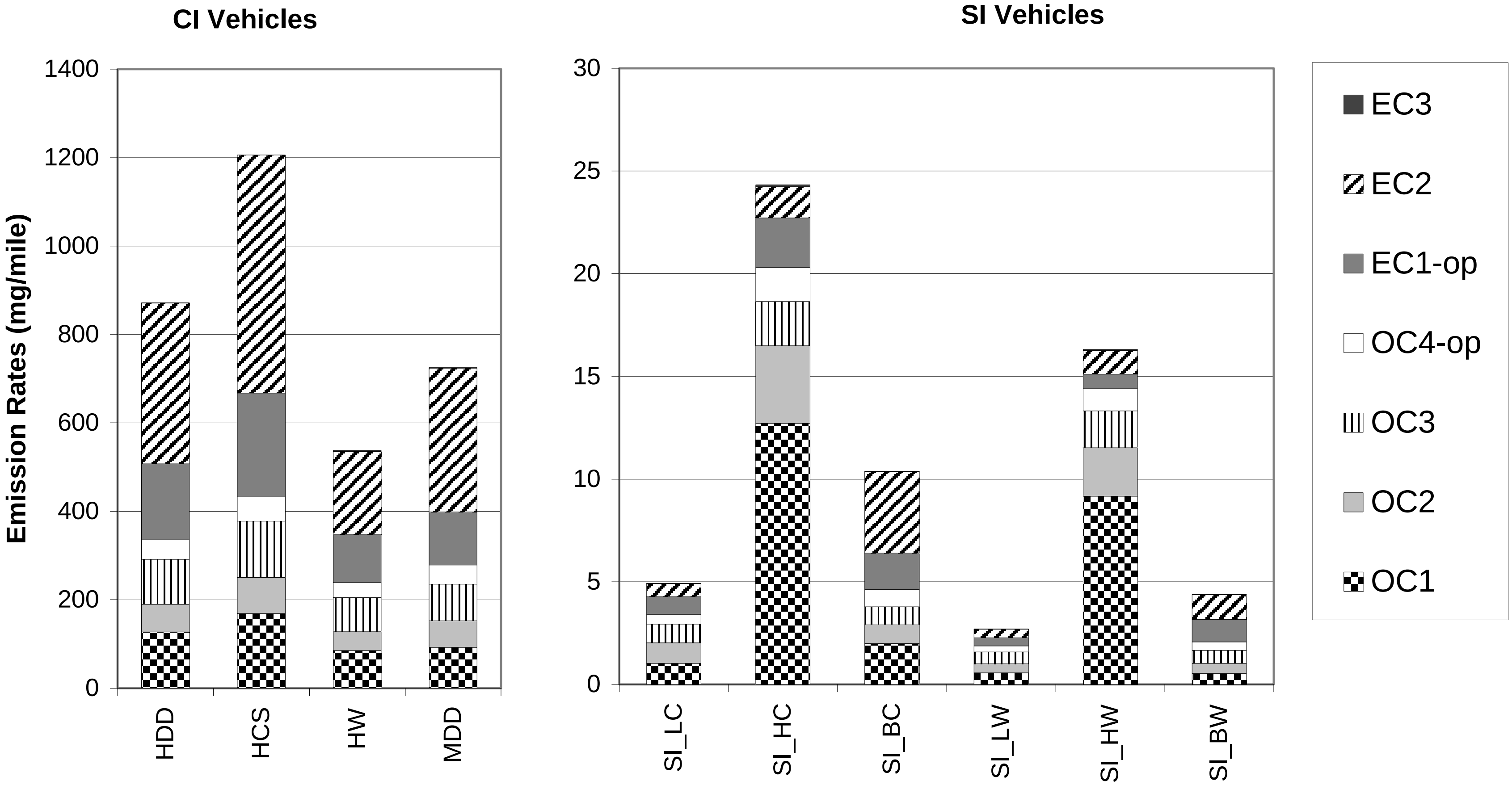

CI Vehicles
SI Vehicles
Emission Rates (mg/mile)
0
200
400
600
800
1000
1200
1400
HDD
HCS
HW
MDD
0
5
10
15
20
25
30
SI_LC
SI_HC
SI_BC
SI_LW
SI_HW
SI_BW
EC3
EC2
EC1-op
OC4-op
OC3
OC2
OC1

Figure 2

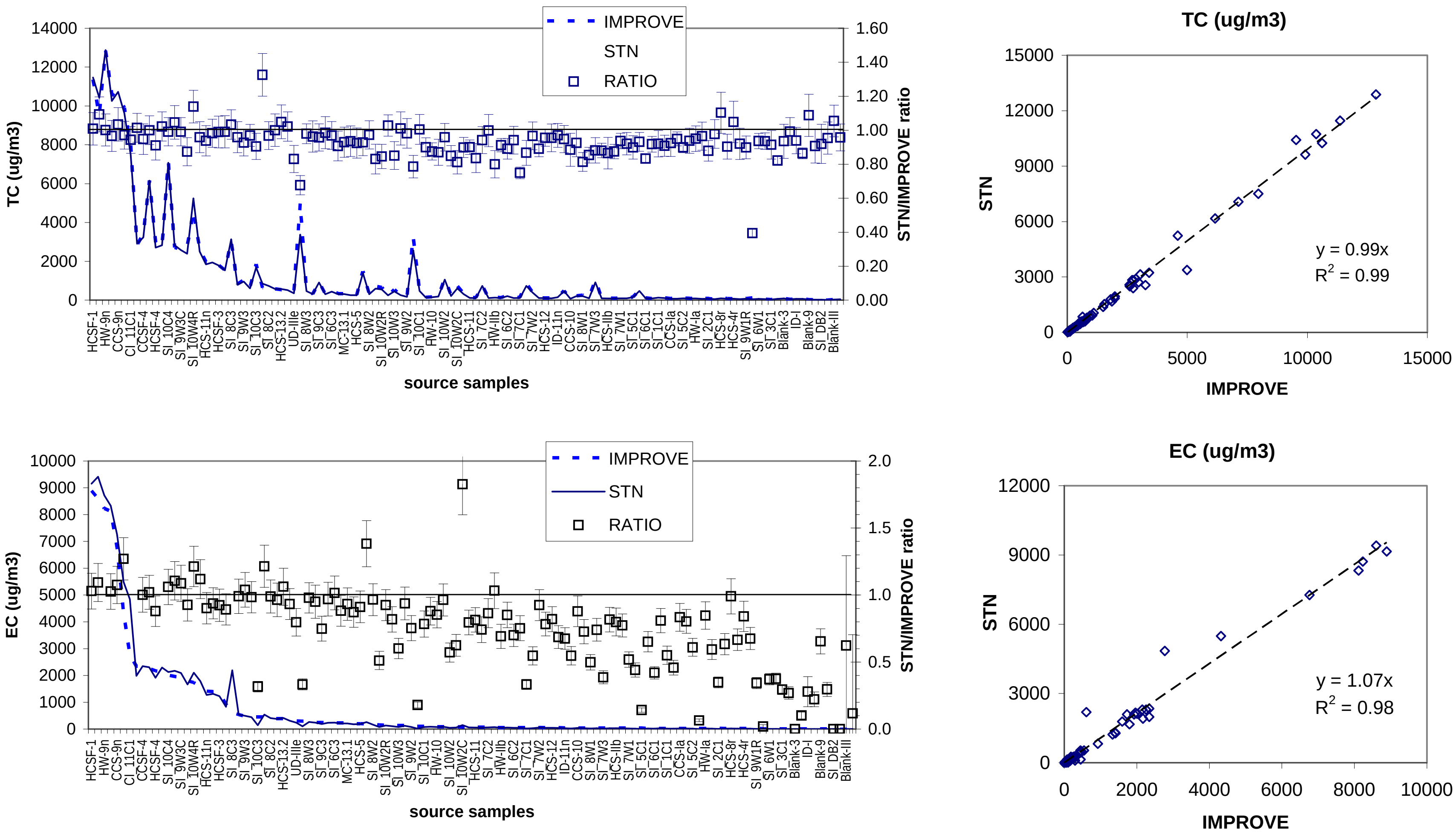

IMPROVE
STN
RATIO
TC (ug/m3)
STN/IMPROVE ratio
source samples
TC (ug/m3)
STN
IMPROVE
y = 0.99x
R^2 = 0.99
EC (ug/m3)
STN/IMPROVE ratio
source samples
EC (ug/m3)
STN
IMPROVE
y = 1.07x
R^2 = 0.98

Figure 3.

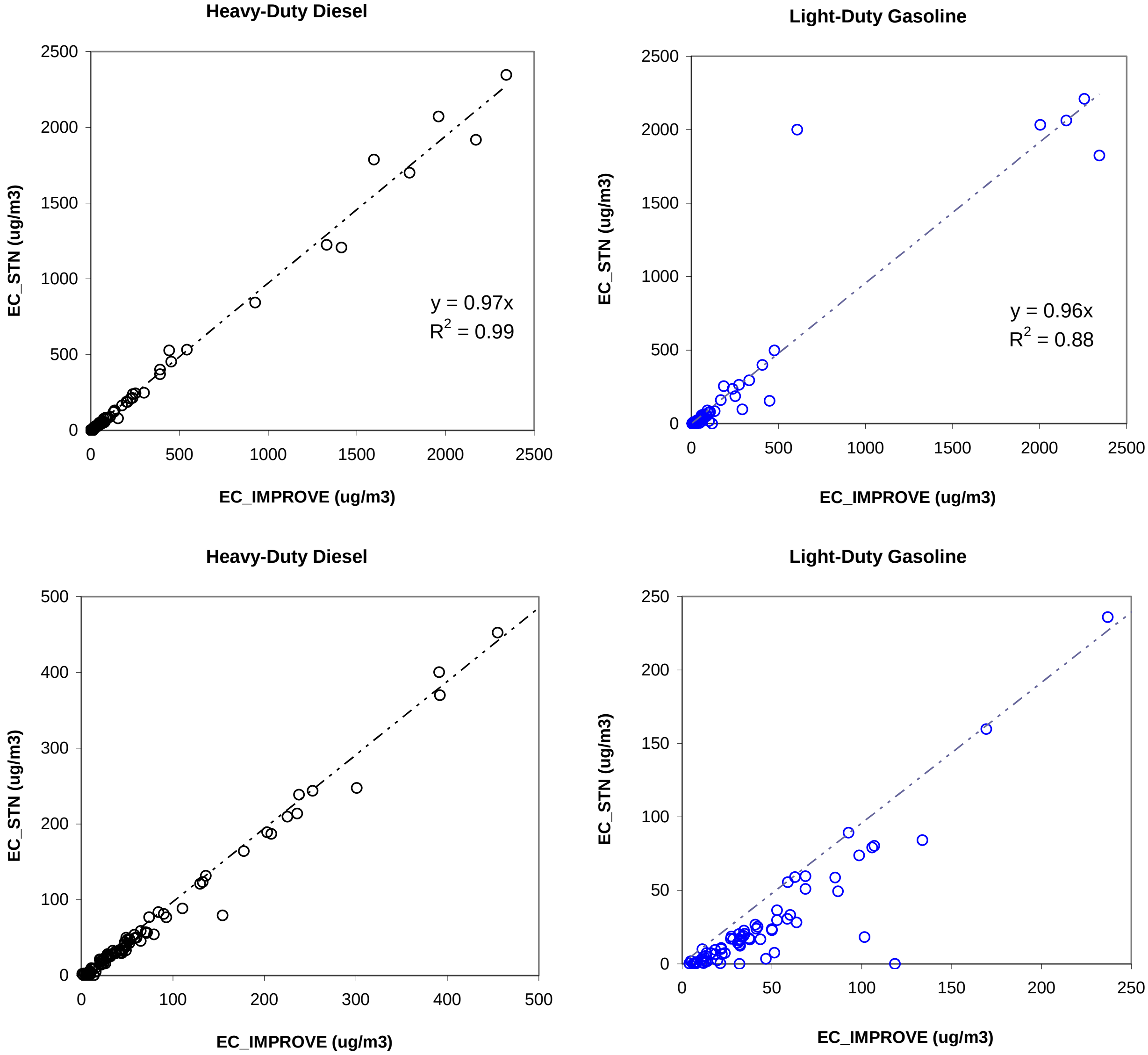
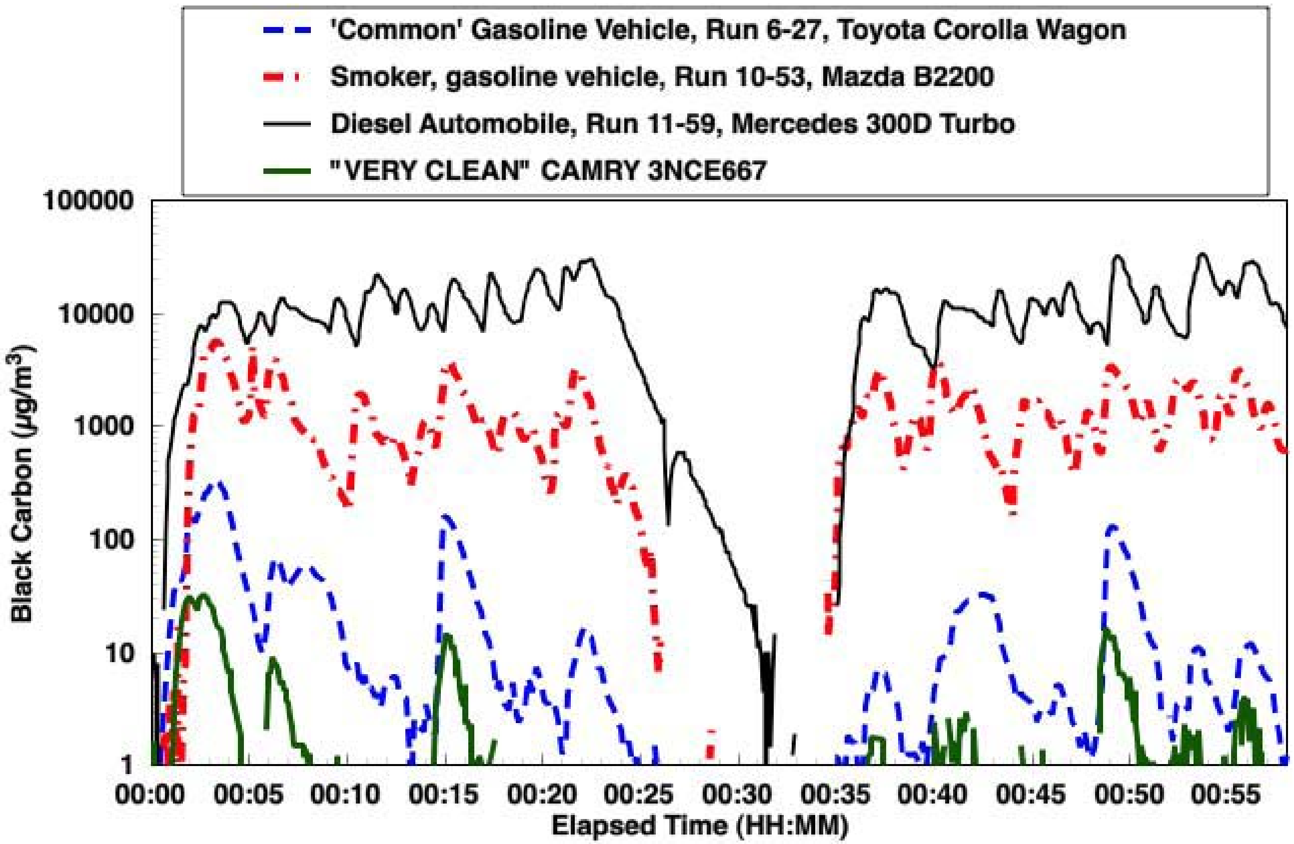
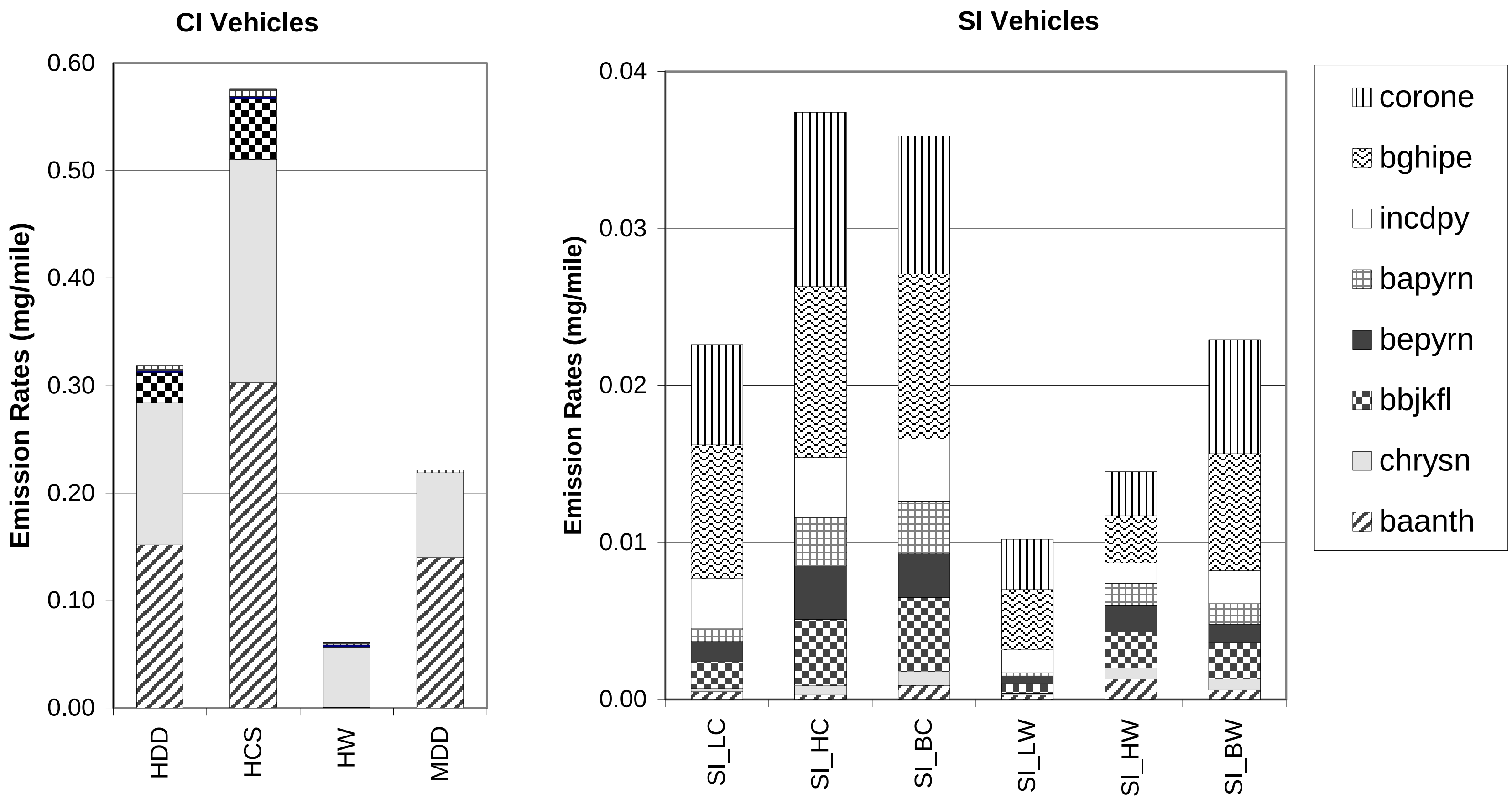

Heavy-Duty Diesel
EC_STN (ug/m3)
EC_IMPROVE (ug/m3)
y = 0.97x
R2 = 0.99
Light-Duty Gasoline
EC_STN (ug/m3)
EC_IMPROVE (ug/m3)
y = 0.96x
R2 = 0.88
Heavy-Duty Diesel
EC_STN (ug/m3)
EC_IMPROVE (ug/m3)
Light-Duty Gasoline
EC_STN (ug/m3)
EC_IMPROVE (ug/m3)

Figure 4



'Common' Gasoline Vehicle, Run 6-27, Toyota Corolla Wagon
Smoker, gasoline vehicle, Run 10-53, Mazda B2200
Diesel Automobile, Run 11-59, Mercedes 300D Turbo
"VERY CLEAN" CAMRY 3NCE667
Black Carbon (μg/m3)
100000
10000
1000
100
10
1
00:00
00:05
00:10
00:15
00:20
00:25
00:30
00:35
00:40
00:45
00:50
00:55
Elapsed Time (HH:MM)

Figure 5.



CI Vehicles
0.60
0.50
0.40
0.30
0.20
0.10
0.00
Emission Rates (mg/mile)
HDD
HCS
HW
MDD
SI Vehicles
0.04
0.03
0.02
0.01
0.00
Emission Rates (mg/mile)
SI_LC
SI_HC
SI_BC
SI_LW
SI_HW
SI_BW
corone
bghipe
incdpy
bapyrn
bepyrn
bbjkfl
chrysn
baanth

Figure 6

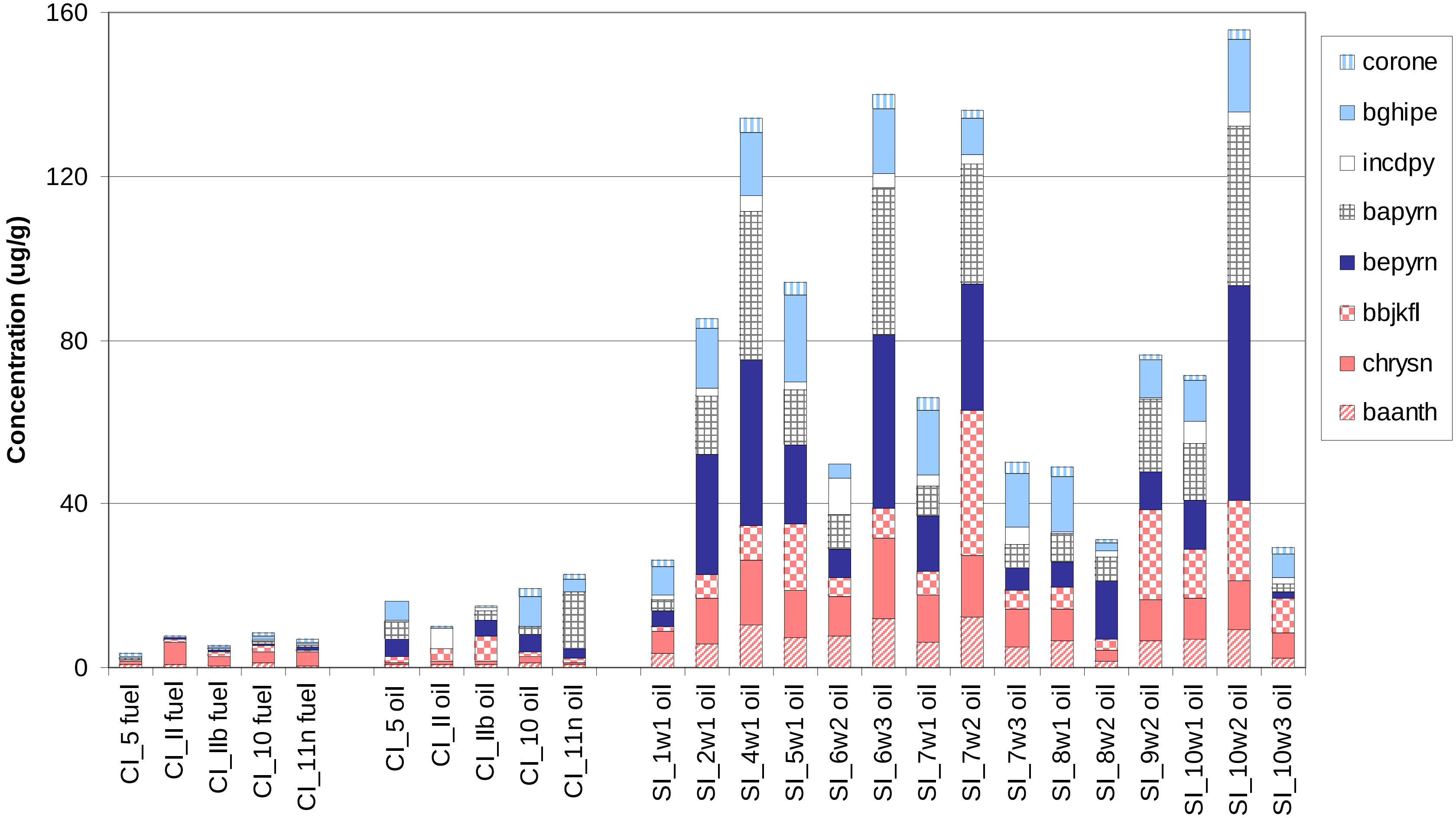

Concentration (ug/g)
0
40
80
120
160
corone
bghipe
incdpy
bapyrn
bepyrn
bbjkfl
chrysn
baanth
CI_5 fuel
CI_II fuel
CI_IIb fuel
CI_10 fuel
CI_11n fuel
CI_5 oil
CI_II oil
CI_IIb oil
CI_10 oil
CI_11n oil
SI_1w1 oil
SI_2w1 oil
SI_4w1 oil
SI_5w1 oil
SI_6w2 oil
SI_6w3 oil
SI_7w1 oil
SI_7w2 oil
SI_7w3 oil
SI_8w1 oil
SI_8w2 oil
SI_9w2 oil
SI_10w1 oil
SI_10w2 oil
SI_10w3 oil

Figure 7

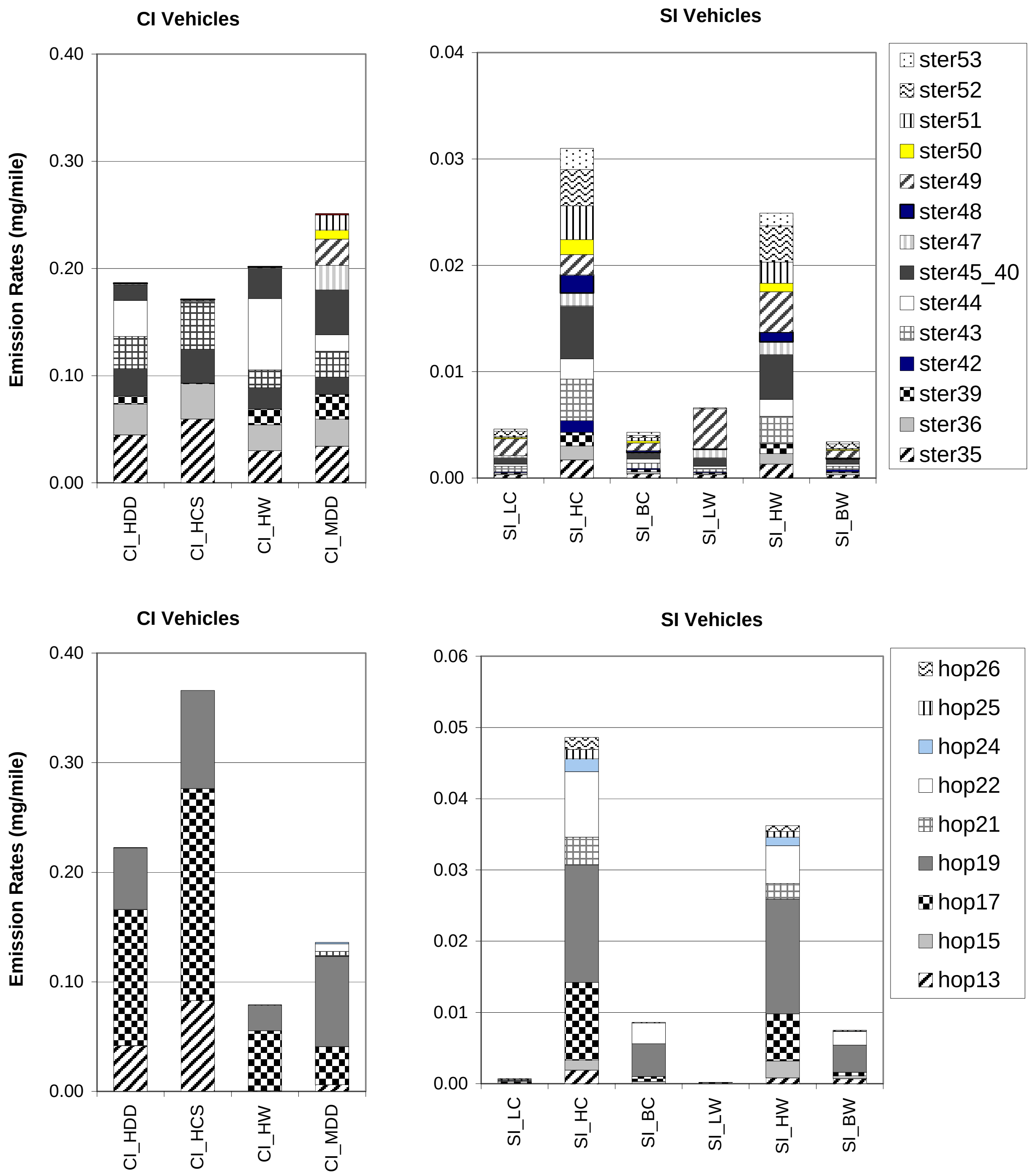

CI Vehicles
SI Vehicles
Emission Rates (mg/mile)
0.40
0.30
0.20
0.10
0.00
0.04
0.03
0.02
0.01
0.00
CI_HDD
CI_HCS
CI_HW
CI_MDD
SI_LC
SI_HC
SI_BC
SI_LW
SI_HW
SI_BW
ster53
ster52
ster51
ster50
ster49
ster48
ster47
ster45_40
ster44
ster43
ster42
ster39
ster36
ster35
CI Vehicles
SI Vehicles
Emission Rates (mg/mile)
0.40
0.30
0.20
0.10
0.00
0.06
0.05
0.04
0.03
0.02
0.01
0.00
CI_HDD
CI_HCS
CI_HW
CI_MDD
SI_LC
SI_HC
SI_BC
SI_LW
SI_HW
SI_BW
hop26
hop25
hop24
hop22
hop21
hop19
hop17
hop15
hop13

Figure 8

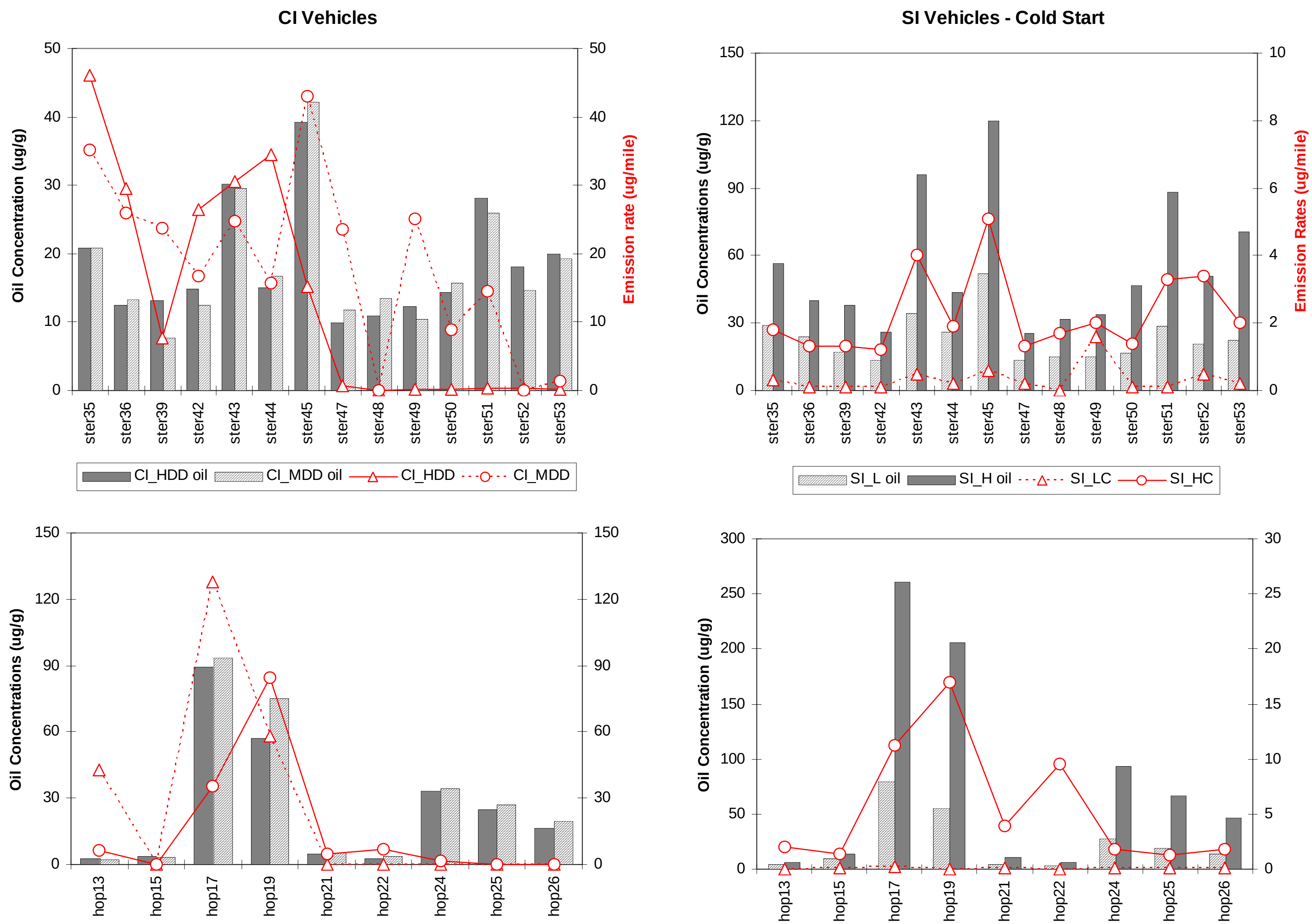

CI Vehicles
SI Vehicles - Cold Start
Oil Concentration (ug/g)
Emission rate (ug/mile)
Oil Concentrations (ug/g)
Emission Rates (ug/mile)
ster35
ster36
ster39
ster42
ster43
ster44
ster45
ster47
ster48
ster49
ster50
ster51
ster52
ster53
CI_HDD oil
CI_MDD oil
CI_HDD
CI_MDD
SI_L oil
SI_H oil
SI_LC
SI_HC
Oil Concentrations (ug/g)
Oil Concentration (ug/g)
hop13
hop15
hop17
hop19
hop21
hop22
hop24
hop25
hop26

Figure 9

Supporting Information

Table S1. PM emission rates of light-duty vehicles and analytical compositing scheme for composition profiles.

Vehicle ID	Model Year	Make & Model	Odometer (miles)	UDC P1+P2 Cold Start Analytical Composite	UDC P1+P2 Cold Start $PM_{2.5}$ (mg/mile)	UDC P1+P2 Warm Start Analytical Composite	UDC P1+P2 Warm Start $PM_{2.5}$ (mg/mile)
1-1	1995	Toyota Camry	47502	SI_1C1*	8.0	SI_1W1*	3.7
1-2	1996	Dodge Dakota Sport	23283				
1-3	1995	GMC Yukon	59493				
1-4	1997	Jeep Cherokee Laredo	45359				
2-5	1995	Ford Explorer	32610	SI_2C1*	6.3	SI_2W1*	3.5
2-6	1995	Toyota Camry	45091				
2-7	1995	Ford Contour	33958				
2-8	1995	Pontiac Trans Sport	83413	SI_2C1	2.3	SI_2W1	0.4
3-9	1999	Ford Ranger XLT	121093	SI_3C1* (a)	1.6	SI_3W1* (a)	0.7
3-10	1996	Geo Prizm	125462				
3-11	1995	Toyota Camry	95350				
3-12	1995	Nissan Maxima	97329				
4-13	1991	Jeep Cherokee Laredo	83210	SI_4C1*	6.2	SI_4W1*	3.4
4-14	1992	BMW 3 Series	52773				
4-15	1992	Toyota Previa	134133				
4-16	1991	Mazda MX-6	70189				
5-17	1995	Ford Windstar	84744	SI_5C1	2.7	SI_5W1	2.1
5-18	1993	Geo Prizm	145260	SI_5C2	3.2	SI_5W2 (a)	1.3
5-19	1984	VW Vanagon	154225	SI_5C1	23.1	SI_5W1	11.0
5-20	1992	Ford Explorer	128,987	SI_5C2	3.5	SI_5W2 (a)	1.6
5-21	1993	Chevrolet Astro	140075	SI_5C2	6.3	SI_5W2 (a)	1.1
5-22	1994	Nissan Sentra	137702	SI_5C2	2.2	SI_5W2 (a)	0.9
5-23	1995	Dodge Caravan	103586	SI_5C2 (a)	1.0	SI_5W2 (a)	0.0
5-24	1994	Toyota Camry	216776	SI_5C2 (a)	0.9	SI_5W2 (a)	0.2
6-25	1992	Infiniti G20	137675	SI_6C1	2.4	SI_6W1 (a)	0.3
6-26	1991	Toyota Corolla	160012	SI_6C2	3.5	SI_6W2	2.1
6-27	1990	Toyota Corolla	149636	SI_6C2	11.4	SI_6W2	5.8
6-28	1992	Honda Accord	124080	SI_6C1	3.3	SI_6W1 (a)	0.6
6-29	1992	Dodge Caravan	160601	SI_6C3	16.1	SI_6W3	5.9
6-30	1991	Pontiac Trans Sport	120102	SI_6C1	5.8	SI_6W1 (a)	2.1
6-31	1991	Buick LeSabre	140958	SI_6C1 (a)	1.6	SI_6W1 (a)	0.3
6-32	1992	Honda Accord	172246	SI_6C1 (a)	1.4	SI_6W1 (a)	0.0
6-33	1995	Ford Explorer	120854	SI_6C1 (a)	1.7	SI_6W1 (a)	0.8
7-34	1988	Ford Ranger	92387	SI_7C1	5.2	SI_7W1	2.1
7-35	1987	Mazda Rx7	162367	SI_7C2	32.2	SI_7W2	15.8
7-36	1986	Chevrolet S-10	418371	SI_7C1	3.6	SI_7W1	1.8
7-37	1989	Plymouth Reliant	147518	SI_7C1	2.3	SI_7W1	2.5
7-38A	1987	Olds Cutlass	118459	SI_7C1	7.2	SI_7W1	1.8
7-39	1989	Acura Legend	174142	SI_7C3	31.9	SI_7W3	39.3
8-40	1985	Toyota Tacoma	212037	SI_8C2	26.4	SI_8W2	10.4
8-41	1984	Toyota Corolla	248202	SI_8C1	18.9	SI_8W1	10.3
8-42	1982	Chevrolet Silverado 20	148210				
8-43	1981	Chrysler Imperial	151948				
8-44	1984	Toyota Pickup	167579	SI_8C3	139.7	SI_8W3	13.7
8-45	1983	Toyota Celica	197122	SI_8C1	7.0	SI_8W1	3.1
8-46	1979	Mercedes 450 Sl	159085	SI_9C1	5.3	SI_9W1	4.2
8-47	1980	Honda Accord	182190	SI_9C1 (a)	1.7	SI_9W1 (a)	0.8
9-48	1977	Chevrolet Luv	158928	SI_9C2	17.6	SI_9W2	6.4
9-49	1980	Toyota Celica	98349	SI_9C4	94.0	SI_9W4	111.4
9-50	1979	Toyota Corolla	121813	SI_9C3	37.7	SI_9W3	35.8
10-52A	1969	Chevrolet Chevelle Malibu	147674	SI_10C5 (b)	219.2	SI_10W5	127.2
10-53	1988	Mazda B2200 PU	149811	SI_10C4 (b)	251.9	SI_10W4 (b)	207.9
10-54	1989	Mitsubishi Mighty Max	273290				
10-55	1978	Chevrolet Caprice Classic	128913	SI_10C3	59.1	SI_10W3	10.1
10-56	1989	Toyota Tacoma	421092	SI_10C1	13.3	SI_10W1	17.8
10-57	1990	Vw Jetta	259488	SI_10C2	52.8	SI_10W2	40.2
11-58	1982	Chevrolet 1500 High Sierra	162308	CI_11C1	305.2	CI_11W1	295.2
11-59	1983	Mercedes 300D	361112				

* Same sampling media used for test within vehicle category ("media composites").
(a) Sample loading too low for valid organic speciation.
(b) Sample loading too high for reliable carbon analysis

Table S2. PM emission rates of heavy-duty diesel vehicles and analytical compositing scheme for composition profiles.

						Hot CSR PM (mg/mi)		Highway PM (mg/mi	
Vehicle ID	Model Year	Manufacturer	Type	GVW (lbs)	Odometer (miles)	Analytical Composite	$PM_{2.5}$ (mg/mile)	Analytical Composite	$PM_{2.5}$ (mg/mile)
1.1	1989	Ford	Box Truck	11000	55973	HCS-Ia (a)	358	HW-Ia (a)	106
2.1	1990	Ford	Tractor Truck	11000		HCS-Ia (a)	122	HW-Ia (a)	66
3.1	1997	Isuzu	Box Truck	12000	114493	HCS-Ib (a)	159	HW-Ib (a)	65
3.2	1997	GMC	Box Truck	10000	86944	HCS-Ib (a)	231	HW-Ib (a)	74
4.1	2000	Isuzu	Box Truck	12000	45164	HCS-Ib (a)	153	HW-Ib (a)	87
4.2	2000	Ford	Van	9500	27965	HCS-Ib (a)	176	HW-Ib (a)	86
4.3	2000	Isuzu	Box Truck	14000	361	HCS-Ib (a)	148	HW-Ib (a)	90
5.1	1988	Ford	Box Truck	26500	170556	HCS-5		HW-5	
5.2	1988	International	Box Truck	18000	169008				
7.1	1995	GM	Box Truck	25950	92000	HCS-II (a)	99	HW-II	205
7.2	1995	International	Flat Bed	25500	151601	HCS-IIb	445	HW-Iib (a)	155
7.3	1996	Freightliner	Box Truck	26000	162300	HCS-II	70	HW-II	67
8.1	1999	Isuzu	Box Truck	19500	15840	HCS-II	153	HW-II	59
8.2	1999	International	Box Truck	25500	56835	HCS-II	340	HW-II	207
8.3	1999	Freightliner	Box Truck	26000	49251	HCS-II		HW-II	119
9.1	1985	International	Tractor Truck	32000	501586	HCS-9n		HW-9n	
9.2	1985	Freightliner	Tractor Truck	80000	36252	HCS-9e		HW-9e	
10.1	1992	Ford	Tractor Truck	48000	769413	HCS-10	862	HW-10	440
10.2	1993	Freightliner	Tractor Truck	52000	842140	HCS-10	680	HW-10	414
10.3	1992	Volvo	Tractor Truck	46000	109897	HCS-10		HW-10	369
11.1	1994	Freightliner	Tractor Truck	52000	109897	HCS-11	539	HW-11	206
11.2	1994	Freightliner	Tractor Truck	80000	602338	HCS-11	392	HW-11	239
11.3	1997	Ford	Tractor Truck	46000	449600	HCS-11	505	HW-11	166
11.4	1997	Volvo	Tractor Truck	50000	437500	HCS-11	1041	HW-11	420
11.5	1996	Volvo	Tractor Truck	50350	472927	HCS-11	1125	HW-11	520
11.6	1994	Freightliner	Tractor Truck	52000		HCS-11n	343	HW-11n	208
11.7	1995	Freightliner	Tractor Truck	50000	241843	HCS-11e	493	HW-11e (a)	8
12.2	1999	Sterling	Tractor Truck	52000	272307	HCS-12	523	HW-12	225
12.3	2000	Sterling	Tractor Truck	52000	255880	HCS-12	412	HW-12	143
12.4	2001	Volvo	Tractor Truck	52000	145749	HCS-12	313	HW-12	185
12.5	1998	Sterling	Tractor Truck	52000	327300	HCS-12	417	HW-12	128
13.1	1992	TMC	Transit Bus	39500	519395	HCS-13.1 (a)	865		
13.2	1982	GMC	Transit Bus	36900	103143	HCS-13.2 (a)			

(a) Sample loading too low for valid organic speciation.

Table S3. Speciated Emission Rates for Composite Diesel and Gasoline Exhaust Profiles.

Species Description	Nmemonic	HDD	HCS	HW	MDD	SI_BC	SI_BW	SI_HC	SI_HW	SI_LC	SI_LW
PM mass and IMPROVE carbon (mg/mile)											
$PM_{2.5}$ Mass	MSGC	667.8 ± 11.8	975.3 ± 22.2	360.4 ± 8.2	569.5 ± 17.3	12.1 ± 0.3	5.2 ± 0.1	26.8 ± 0.5	16.6 ± 0.4	5.9 ± 0.1	2.8 ± 0.0
Total Carbon (TC)	TC	871.8 ± 17.9	1206.1 ± 32.3	537.4 ± 15.3	725.3 ± 26.8	10.4 ± 0.5	4.4 ± 0.2	24.3 ± 2.1	16.3 ± 1.5	4.9 ± 0.1	2.7 ± 0.1
Organic Carbon (OC)	OCTC	335.6 ± 14.1	432.5 ± 24.7	238.7 ± 13.5	278.5 ± 19.1	4.6 ± 0.5	2.1 ± 0.2	20.3 ± 2.0	14.4 ± 1.5	3.4 ± 0.1	1.9 ± 0.1
Elemental Carbon (EC)	ECTC	536.1 ± 11.0	773.5 ± 20.9	298.7 ± 7.2	446.8 ± 18.9	5.8 ± 0.2	2.3 ± 0.1	4.0 ± 0.1	1.9 ± 0.0	1.5 ± 0.0	0.8 ± 0.0
OC Fraction 1	O1TC	127.1 ± 9.9	169.3 ± 17.6	85.0 ± 9.2	92.2 ± 13.6	2.0 ± 0.4	0.5 ± 0.1	12.7 ± 2.0	9.2 ± 1.4	1.0 ± 0.1	0.6 ± 0.1
OC Fraction 2	O2TC	62.6 ± 4.6	81.5 ± 8.1	43.7 ± 4.3	60.3 ± 6.7	1.0 ± 0.1	0.5 ± 0.1	3.8 ± 0.4	2.4 ± 0.3	1.0 ± 0.1	0.4 ± 0.0
OC Fraction 3	O3TC	101.9 ± 8.6	127.1 ± 14.9	76.8 ± 8.6	82.6 ± 11.3	0.8 ± 0.1	0.6 ± 0.1	2.1 ± 0.2	1.8 ± 0.2	0.9 ± 0.1	0.6 ± 0.0
OC Fraction 4 + Pyrolyzed O(	O4_OP	44.0 ± 2.1	54.7 ± 3.7	33.3 ± 2.0	43.4 ± 2.7	0.8 ± 0.3	0.4 ± 0.0	1.7 ± 0.2	1.1 ± 0.2	0.5 ± 0.0	0.3 ± 0.0
EC Fraction 1 - Pyrolyzed OC	E1_OP	172.0 ± 27.5	235.0 ± 50.3	108.9 ± 22.4	120.5 ± 32.6	1.8 ± 0.4	1.1 ± 0.1	2.4 ± 0.3	0.7 ± 0.3	0.9 ± 0.0	0.4 ± 0.0
EC Fraction 2	E2TC	363.0 ± 13.5	538.1 ± 25.4	187.9 ± 9.3	325.1 ± 26.6	4.0 ± 0.4	1.2 ± 0.1	1.5 ± 0.1	1.1 ± 0.1	0.6 ± 0.0	0.4 ± 0.0
EC Fraction 3	E3TC	1.1 ± 0.3	0.3 ± 0.4	1.9 ± 0.3	1.2 ± 0.3	0.0 ± 0.0	0.0 ± 0.0	0.1 ± 0.0	0.1 ± 0.0	0.0 ± 0.0	0.0 ± 0.0
STN carbpm (mg/mile)											
NIOSH OC	OC_STN	312.7 ± 11.9	406.7 ± 21.5	218.7 ± 10.0	259.1 ± 12.7	4.8 ± 0.2	2.2 ± 0.1	19.7 ± 0.5	13.8 ± 0.4	3.5 ± 0.1	1.9 ± 0.0
NIOSH EC	EC_STN	469.0 ± 13.7	682.2 ± 25.8	255.7 ± 9.3	409.8 ± 20.1	5.3 ± 0.2	2.0 ± 0.1	2.6 ± 0.2	1.0 ± 0.2	0.7 ± 0.0	0.4 ± 0.0
Elements (mg/mile)											
Chloride	CLIC	2.11 ± 0.53	3.74 ± 0.98	0.48 ± 0.40	1.16 ± 0.53	0.04 ± 0.00	0.02 ± 0.00	0.07 ± 0.01	0.07 ± 0.01	0.04 ± 0.00	0.02 ± 0.00
Nitrate	N3IC	0.12 ± 0.49	0.00 ± 0.90	0.25 ± 0.39	3.41 ± 0.62	0.11 ± 0.01	0.08 ± 0.01	0.08 ± 0.01	0.08 ± 0.01	0.10 ± 0.00	0.08 ± 0.00
Sulfate	S4IC	11.33 ± 0.54	14.90 ± 0.97	7.77 ± 0.46	16.44 ± 0.62	0.59 ± 0.02	0.20 ± 0.01	0.54 ± 0.02	0.18 ± 0.01	0.54 ± 0.01	0.26 ± 0.01
Ammonium	N4CC	3.01 ± 0.50	3.75 ± 0.91	2.27 ± 0.41	6.05 ± 0.56	0.25 ± 0.01	0.10 ± 0.01	0.20 ± 0.01	0.07 ± 0.01	0.25 ± 0.01	0.12 ± 0.00
Soluble Potassium	KPAC	1.04 ± 0.06	1.51 ± 0.12	0.56 ± 0.05	0.61 ± 0.07	0.00 ± 0.00	0.00 ± 0.00	0.01 ± 0.00	0.01 ± 0.00	0.00 ± 0.00	0.00 ± 0.00
Sodium (qualitative only)	NAXC	0.97 ± 0.46	0.68 ± 0.88	1.26 ± 0.23	1.54 ± 0.39	0.01 ± 0.01	0.00 ± 0.01	0.01 ± 0.01	0.01 ± 0.01	0.00 ± 0.00	0.01 ± 0.00
Magnesium (qualitative only)	MGXC	0.49 ± 0.27	0.83 ± 0.50	0.14 ± 0.20	0.66 ± 0.27	0.02 ± 0.00	0.01 ± 0.00	0.04 ± 0.00	0.04 ± 0.00	0.01 ± 0.00	0.01 ± 0.00
Aluminum	ALXC	0.99 ± 0.12	1.57 ± 0.19	0.41 ± 0.13	1.20 ± 0.09	0.01 ± 0.00	0.00 ± 0.00	0.01 ± 0.00	0.01 ± 0.00	0.01 ± 0.00	0.00 ± 0.00
Silicon	SIXC	8.24 ± 0.13	12.22 ± 0.25	4.26 ± 0.09	6.36 ± 0.19	0.41 ± 0.01	0.31 ± 0.01	0.56 ± 0.01	0.42 ± 0.01	0.21 ± 0.00	0.11 ± 0.00
Phosphorous	PHXC	1.05 ± 0.03	1.45 ± 0.06	0.66 ± 0.03	0.51 ± 0.09	0.03 ± 0.00	0.04 ± 0.00	0.08 ± 0.00	0.05 ± 0.00	0.02 ± 0.00	0.01 ± 0.00
Sulfur	SUXC	5.11 ± 0.08	6.94 ± 0.15	3.28 ± 0.07	7.12 ± 0.13	0.24 ± 0.01	0.08 ± 0.00	0.23 ± 0.01	0.10 ± 0.00	0.21 ± 0.00	0.10 ± 0.00
Chlorine	CLXC	0.49 ± 0.09	0.88 ± 0.15	0.11 ± 0.10	0.51 ± 0.10	0.03 ± 0.00	0.01 ± 0.00	0.03 ± 0.00	0.01 ± 0.00	0.03 ± 0.00	0.01 ± 0.00
Potassium	KPXC	0.70 ± 0.07	1.15 ± 0.11	0.25 ± 0.08	0.70 ± 0.07	0.00 ± 0.00	0.00 ± 0.00	0.01 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00
Calcium	CAXC	4.41 ± 0.08	6.33 ± 0.14	2.49 ± 0.06	2.98 ± 0.09	0.04 ± 0.00	0.10 ± 0.00	0.15 ± 0.00	0.13 ± 0.00	0.04 ± 0.00	0.02 ± 0.00
Chromium	CRXC	0.03 ± 0.06	0.04 ± 0.12	0.01 ± 0.03	0.00 ± 0.06	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00
Manganese	MNXC	0.01 ± 0.03	0.01 ± 0.06	0.01 ± 0.02	0.00 ± 0.04	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00
Iron	FEXC	5.73 ± 0.10	9.88 ± 0.20	1.59 ± 0.03	3.57 ± 0.10	0.02 ± 0.00	0.02 ± 0.00	0.06 ± 0.00	0.03 ± 0.00	0.03 ± 0.00	0.02 ± 0.00
Nickel	NIXC	0.01 ± 0.02	0.02 ± 0.03	0.00 ± 0.01	0.00 ± 0.02	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00
Copper	CUXC	0.15 ± 0.01	0.24 ± 0.01	0.06 ± 0.01	0.04 ± 0.02	0.00 ± 0.00	0.00 ± 0.00	0.02 ± 0.00	0.02 ± 0.00	0.00 ± 0.00	0.00 ± 0.00
Zinc	ZNXC	2.90 ± 0.04	4.43 ± 0.09	1.37 ± 0.02	1.10 ± 0.03	0.05 ± 0.00	0.04 ± 0.00	0.10 ± 0.00	0.07 ± 0.00	0.02 ± 0.00	0.01 ± 0.00
Bromine	BRXC	0.02 ± 0.02	0.03 ± 0.03	0.00 ± 0.02	0.24 ± 0.02	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00
Rubidium	RBXC	0.00 ± 0.02	0.00 ± 0.03	0.00 ± 0.01	0.00 ± 0.02	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00
Strontium	SRXC	0.02 ± 0.02	0.03 ± 0.03	0.01 ± 0.02	0.02 ± 0.02	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00
Molybdenum	MOXC	0.03 ± 0.05	0.04 ± 0.09	0.01 ± 0.04	0.00 ± 0.06	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00
Barium	BAXC	1.56 ± 1.14	2.84 ± 2.07	0.29 ± 0.93	0.87 ± 1.36	0.01 ± 0.01	0.01 ± 0.01	0.01 ± 0.02	0.03 ± 0.02	0.01 ± 0.00	0.01 ± 0.00
Lead	PBXC	0.10 ± 0.06	0.17 ± 0.11	0.03 ± 0.05	0.01 ± 0.07	0.00 ± 0.00	0.00 ± 0.00	0.01 ± 0.00	0.01 ± 0.00	0.00 ± 0.00	0.00 ± 0.00

Table S3 (continued). Speciated emission rates for composite diesel and gasoline exhaust profiles.

Species Description	Nmemonic	HDD	HCS	HW	MDD	SI_BC	SI_BW	SI_HC	SI_HW	SI_LC	SI_LW
Polycyclic aromatic hydrocarbons (ug/mile)											
Naphthalene	NAPHTH	21226 ± 678	42376 ± 1353	77 ± 73	8432 ± 215	3000 ± 72	515 ± 14	2520 ± 71	4732 ± 119	1390 ± 23	763 ± 17
Sum of methyl napthalenes	MNAPH	2137 ± 41	3125 ± 77	1148 ± 28	1232 ± 38	1560 ± 32	301 ± 8	1735 ± 44	2800 ± 66	942 ± 14	377 ± 7
Biphenyl	BIPHEN	273 ± 10	440 ± 20	106 ± 6	58 ± 7	56 ± 1	12 ± 0	70 ± 2	140 ± 4	30 ± 1	15 ± 0
1+2ethylnaphthalene	ENAP12	734 ± 25	1179 ± 49	288 ± 14	654 ± 28	79 ± 2	17 ± 1	86 ± 3	138 ± 5	42 ± 1	13 ± 0
Sum of dimethyl napthalenes	DMNAPH	1912 ± 86	2569 ± 149	1255 ± 88	1177 ± 104	309 ± 24	66 ± 10	343 ± 20	576 ± 27	138 ± 9	47 ± 6
Sum of methylbiphenyls	MBPH	18743 ± 446	35897 ± 878	1588 ± 158	821 ± 321	22 ± 15	2 ± 10	28 ± 13	69 ± 22	3 ± 9	1 ± 9
Bibenzyl	BIBENZ	0.0 ± 524.2	0.0 ± 643.9	0.0 ± 827.3	0.0 ± 746.6	105.1 ± 15.2	41.2 ± 8.5	33.2 ± 13.2	81.2 ± 18.6	30.9 ± 6.5	17.1 ± 6.8
Dibenzofuran	DBZFUR	141.5 ± 4.9	207.2 ± 9.2	75.8 ± 3.6	91.0 ± 5.2	18.9 ± 0.5	6.0 ± 0.2	22.8 ± 0.8	36.9 ± 1.2	10.7 ± 0.3	4.7 ± 0.1
Sum of trimethyl naphthalene	TMNAPH	975.1 ± 18.3	1414.2 ± 33.5	536.1 ± 14.9	762.4 ± 21.0	105.9 ± 1.4	19.3 ± 0.4	105.2 ± 1.9	148.4 ± 2.6	36.0 ± 0.5	9.7 ± 0.1
Sum of ethyl methyl napthale	EMNAPH	580.5 ± 25.0	901.1 ± 44.3	259.9 ± 23.4	393.0 ± 22.7	29.9 ± 1.1	15.4 ± 1.1	24.0 ± 1.0	43.0 ± 1.5	15.9 ± 0.5	6.9 ± 0.3
Acenaphthylene	ACNAPY	320.6 ± 23.2	484.5 ± 43.5	156.6 ± 16.2	232.4 ± 30.5	342.7 ± 14.2	48.9 ± 2.9	190.8 ± 8.3	215.5 ± 9.7	62.9 ± 2.0	15.1 ± 0.5
Acenaphthene	ACNAPE	95.3 ± 31.2	190.5 ± 61.4	0.1 ± 11.4	136.1 ± 20.6	38.8 ± 6.0	1.1 ± 0.3	27.0 ± 3.8	5.3 ± 1.0	4.1 ± 0.4	0.0 ± 0.1
Fluorene	FLUORE	440.4 ± 16.6	532.5 ± 27.2	348.3 ± 18.9	238.9 ± 12.2	65.2 ± 2.5	15.0 ± 0.7	60.1 ± 2.7	100.7 ± 4.6	17.7 ± 0.5	6.7 ± 0.2
Phenanthrene	PHENAN	706.2 ± 21.1	1054.3 ± 40.0	358.1 ± 13.7	283.1 ± 10.3	94.2 ± 2.5	31.8 ± 1.0	87.9 ± 3.4	158.1 ± 4.8	36.9 ± 0.8	18.3 ± 0.4
Sum of methyl flourenes	MFLUOR	198.8 ± 16.6	273.7 ± 30.4	123.8 ± 13.6	253.7 ± 15.8	19.9 ± 0.9	5.5 ± 0.4	14.9 ± 0.8	32.5 ± 1.8	6.0 ± 0.3	1.5 ± 0.1
9-fluorenone	FL9ONE	2790.3 ± 85.7	4002.3 ± 159.3	1578.4 ± 63.2	961.0 ± 38.3	39.3 ± 1.1	25.1 ± 0.8	51.7 ± 2.0	119.1 ± 3.7	33.8 ± 0.8	22.5 ± 0.6
Xanthone	XANONE	35.0 ± 3.5	57.2 ± 6.5	12.8 ± 2.6	13.6 ± 4.5	2.9 ± 0.2	3.1 ± 0.2	3.6 ± 0.3	13.0 ± 0.7	2.3 ± 0.1	2.2 ± 0.1
Acenaphthenequinone	ACQUONE	29.9 ± 3.2	59.7 ± 6.1	0.0 ± 2.0	0.0 ± 4.2	0.3 ± 0.0	0.6 ± 0.1	0.5 ± 0.1	0.7 ± 0.1	0.0 ± 0.0	0.0 ± 0.0
Perinaphthenone	PNAPONE	532.9 ± 31.5	762.7 ± 58.8	303.1 ± 22.6	223.6 ± 18.7	2.0 ± 0.1	3.9 ± 0.3	5.2 ± 0.3	22.1 ± 1.2	2.8 ± 0.1	2.6 ± 0.1
Sum of methyl phenanthrene	MPHEN	291.5 ± 17.3	448.4 ± 30.7	134.7 ± 16.1	91.4 ± 10.7	17.4 ± 0.5	16.3 ± 0.7	22.4 ± 0.8	74.2 ± 2.0	12.4 ± 0.3	6.9 ± 0.2
Sum of di-methyl phenanthre	DMPHEN	142.2 ± 10.0	244.3 ± 18.6	40.1 ± 7.2	93.5 ± 11.6	5.5 ± 0.2	66.3 ± 3.1	7.7 ± 0.3	36.9 ± 1.0	4.7 ± 0.1	3.5 ± 0.1
Anthracene	ANTHRA	36.0 ± 8.1	60.2 ± 14.7	11.7 ± 6.6	25.5 ± 5.2	18.2 ± 1.2	6.3 ± 0.5	19.4 ± 1.8	39.5 ± 3.1	7.5 ± 0.4	3.4 ± 0.2
Fluoranthene	FLUORA	1253.4 ± 46.1	1826.0 ± 86.2	680.9 ± 32.5	326.0 ± 17.5	12.5 ± 0.4	10.5 ± 0.4	28.1 ± 1.5	73.8 ± 3.1	9.1 ± 0.3	7.7 ± 0.2
Pyrene	PYRENE	1404.2 ± 49.5	2083.3 ± 93.1	725.2 ± 33.4	516.8 ± 25.6	11.7 ± 0.4	16.1 ± 0.8	30.1 ± 1.5	80.2 ± 3.1	11.1 ± 0.4	9.0 ± 0.3
Retene	RETENE	3.1 ± 5.2	6.1 ± 9.7	0.0 ± 3.6	0.0 ± 6.0	0.0 ± 0.1	1.3 ± 0.2	0.0 ± 0.1	0.1 ± 0.1	0.2 ± 0.0	0.1 ± 0.0
Sum of methylpyrenes	MFLPYR	264.1 ± 38.4	429.0 ± 65.7	99.1 ± 39.6	185.2 ± 38.5	2.0 ± 3.5	28.2 ± 11.3	4.7 ± 4.3	10.6 ± 6.1	1.3 ± 2.3	1.2 ± 1.7
Benzo(c)phenanthrene	BZCPHEN	0.2 ± 4.3	0.2 ± 7.8	0.3 ± 3.6	0.0 ± 6.3	0.2 ± 0.1	0.1 ± 0.1	0.4 ± 0.1	0.4 ± 0.1	0.1 ± 0.0	0.0 ± 0.0
Benz(a)anthracene	BAANTH	151.6 ± 11.2	302.7 ± 21.3	0.4 ± 7.0	140.0 ± 14.0	0.9 ± 0.1	0.6 ± 0.1	0.3 ± 0.1	1.3 ± 0.2	0.5 ± 0.0	0.3 ± 0.0
Chrysene	CHRYSN	132.1 ± 13.4	207.9 ± 25.0	56.3 ± 9.9	78.9 ± 11.4	0.9 ± 0.1	0.7 ± 0.1	0.6 ± 0.1	0.7 ± 0.1	0.2 ± 0.0	0.1 ± 0.0
Benzo(b+j+k)fluoranthene	BBJKFL	28.2 ± 6.1	56.3 ± 11.8	0.1 ± 3.2	0.0 ± 6.8	4.7 ± 0.5	2.3 ± 0.3	4.2 ± 0.4	2.3 ± 0.3	1.7 ± 0.1	0.6 ± 0.1
BeP	BEPYRN	2.0 ± 2.7	2.2 ± 4.9	1.8 ± 2.2	0.0 ± 4.2	2.8 ± 0.3	1.2 ± 0.1	3.4 ± 0.3	1.7 ± 0.2	1.3 ± 0.1	0.5 ± 0.0
BaP	BAPYRN	4.8 ± 8.5	7.2 ± 15.6	2.4 ± 6.7	2.4 ± 13.6	3.3 ± 0.5	1.3 ± 0.3	3.1 ± 0.4	1.4 ± 0.3	0.8 ± 0.1	0.2 ± 0.1
Indeno[123-cd]pyrene	INCDPY	0.1 ± 7.1	0.2 ± 13.1	0.0 ± 5.4	0.0 ± 11.4	4.0 ± 0.5	2.1 ± 0.4	3.8 ± 0.5	1.3 ± 0.3	3.2 ± 0.3	1.5 ± 0.1
Benzo(ghi)perylene	BGHIPE	0.0 ± 9.2	0.0 ± 17.0	0.0 ± 7.0	0.3 ± 14.8	10.5 ± 1.2	7.5 ± 1.2	10.9 ± 1.3	3.0 ± 0.5	8.5 ± 0.8	3.8 ± 0.3
Dibenzo(ah+ac)anthracene	DBANTH	0.0 ± 10.2	0.0 ± 18.9	0.0 ± 7.8	0.0 ± 16.5	0.1 ± 0.1	0.1 ± 0.1	0.1 ± 0.2	0.0 ± 0.2	0.1 ± 0.1	0.0 ± 0.0
Coronene	CORONE	0.0 ± 2.6	0.0 ± 4.9	0.0 ± 2.0	0.0 ± 4.2	8.8 ± 1.3	7.2 ± 1.7	11.1 ± 1.9	2.8 ± 0.5	6.4 ± 0.7	3.2 ± 0.4
Alkanes (ug/mile)											
Norfarnesane	NORFARN	118.2 ± 10.2	141.8 ± 16.4	94.6 ± 12.3	362.1 ± 29.5	1.7 ± 0.3	0.0 ± 0.1	7.5 ± 0.6	18.1 ± 1.4	0.0 ± 0.0	0.0 ± 0.0
Farnesane	FARNES	33.2 ± 14.1	34.2 ± 23.6	32.1 ± 15.5	640.1 ± 74.0	2.4 ± 0.6	0.1 ± 0.3	1.4 ± 0.3	16.6 ± 2.0	0.0 ± 0.0	0.0 ± 0.0
Norpristane	NORPRIS	491.9 ± 35.2	548.2 ± 54.9	435.6 ± 44.1	841.8 ± 75.3	1.0 ± 0.4	0.0 ± 0.2	0.9 ± 0.2	19.9 ± 2.0	0.0 ± 0.0	0.0 ± 0.0
Pristane	PRIST	179.1 ± 18.0	358.2 ± 36.0	0.0 ± 2.0	30.4 ± 7.1	1.7 ± 0.3	0.5 ± 0.1	0.5 ± 0.1	0.3 ± 0.1	0.0 ± 0.0	0.0 ± 0.0
Phytane	PHYTAN	306.3 ± 47.4	406.8 ± 85.4	205.7 ± 41.3	703.9 ± 64.9	1.1 ± 0.5	0.0 ± 0.3	0.7 ± 0.3	8.1 ± 1.2	0.0 ± 0.0	0.0 ± 0.0
Sum of cyclohexanes	NCYHEXS	3808.7 ± 235.7	4458.7 ± 212.2	3158.7 ± 421.0	2538.7 ± 331.3	11.5 ± 3.9	39.5 ± 3.9	14.4 ± 2.1	64.1 ± 3.1	0.0 ± 0.0	0.0 ± 0.0
Polar Compounds (ug/mile)											
tridecanoic acid (c13)	TDECAC	8.1 ± 14.6	12.0 ± 27.7	4.1 ± 9.0	0.0 ± 7.3	0.3 ± 0.1	0.3 ± 0.1	0.3 ± 0.1	2.5 ± 0.4	0.1 ± 0.1	0.1 ± 0.1
phthalic acid	PHTHAC	1357.3 ± 175.8	2658.5 ± 350.1	56.1 ± 33.2	381.1 ± 94.8	0.0 ± 1.0	0.0 ± 0.5	1.2 ± 0.6	11.5 ± 3.8	0.0 ± 0.5	0.2 ± 0.6
glutaric acid (d-c5)	GLUAC	170.9 ± 43.7	339.2 ± 87.0	2.6 ± 7.5	27.4 ± 17.2	0.0 ± 0.2	0.0 ± 0.1	0.0 ± 0.2	1.5 ± 0.6	0.0 ± 0.2	0.0 ± 0.2
succinic acid (d-c4)	SUCAC	192.4 ± 73.7	372.6 ± 146.3	12.2 ± 18.0	270.6 ± 65.0	0.0 ± 0.5	0.0 ± 0.4	0.0 ± 0.2	0.0 ± 1.4	0.0 ± 0.3	0.0 ± 0.5

Table S3 (continued). Speciated emission rates for composite diesel and gasoline exhaust profiles.

Species Description	Nmemonic	HDD	HCS	HW	MDD	SI_BC	SI_BW	SI_HC	SI_HW	SI_LC	SI_LW
Steranes (ug/mile)											
C27-20S-13ß(H),17a(H)-diasterane	STER35	44.8 ± 3.3	59.5 ± 6.1	30.1 ± 2.7	34.1 ± 11.2	0.4 ± 0.1	0.3 ± 0.1	1.7 ± 0.2	1.3 ± 0.1	0.3 ± 0.0	0.3 ± 0.0
C27-20R-13ß(H),17a(H)-diasterane	STER36	28.6 ± 3.1	33.2 ± 5.4	24.1 ± 2.9	25.3 ± 11.2	0.2 ± 0.0	0.2 ± 0.0	1.3 ± 0.1	1.0 ± 0.1	0.1 ± 0.0	0.1 ± 0.0
C28-20S-13ß(H),17a(H)-diasterane	STER39	7.5 ± 2.8	0.3 ± 4.9	14.7 ± 2.8	23.2 ± 12.0	0.2 ± 0.0	0.1 ± 0.1	1.3 ± 0.2	0.9 ± 0.1	0.1 ± 0.0	0.1 ± 0.0
C27-20S5a(H),14a(H)-cholestane	STER42	25.8 ± 3.5	31.6 ± 6.4	20.0 ± 3.1	16.2 ± 11.2	0.1 ± 0.0	0.2 ± 0.1	1.1 ± 0.2	0.0 ± 0.0	0.1 ± 0.0	0.1 ± 0.0
C27-20R5a(H),14ß(H)-cholestane	STER43	29.8 ± 4.5	43.1 ± 8.4	16.5 ± 3.3	24.1 ± 12.1	0.5 ± 0.1	0.3 ± 0.1	3.9 ± 0.6	2.6 ± 0.3	0.5 ± 0.1	0.3 ± 0.0
C27-20S5a(H),14ß(H),17ß(H)-cholestane	STER44	33.6 ± 4.9	0.6 ± 4.9	66.5 ± 8.4	15.3 ± 11.3	0.4 ± 0.1	0.2 ± 0.1	1.9 ± 0.3	1.6 ± 0.2	0.2 ± 0.0	0.2 ± 0.0
C27-20R5a(H),14a(H),17a(H)-cholestane&C29-20S13ß(H),17a(H)-diasterane	STER45_40	14.7 ± 3.1	0.8 ± 4.9	28.7 ± 3.9	41.9 ± 12.2	0.5 ± 0.1	0.4 ± 0.1	5.0 ± 0.7	4.2 ± 0.5	0.6 ± 0.1	0.8 ± 0.1
C28-20R5a(H),14ß(H),17ß(H)-ergostane	STER47	0.6 ± 2.6	0.9 ± 4.9	0.2 ± 2.0	22.8 ± 12.0	0.1 ± 0.0	0.1 ± 0.1	1.2 ± 0.2	1.2 ± 0.2	0.2 ± 0.0	0.8 ± 0.1
C28-20S5a(H),14ß(H),17ß(H)-ergostane	STER48	0.0 ± 2.6	0.0 ± 4.9	0.0 ± 2.0	0.0 ± 11.2	0.2 ± 0.0	0.1 ± 0.0	1.7 ± 0.2	0.9 ± 0.1	0.0 ± 0.0	0.1 ± 0.0
C28-20R5a(H),14a(H),17a(H)-ergostane	STER49	0.2 ± 2.6	0.2 ± 4.9	0.2 ± 2.0	24.4 ± 11.6	0.7 ± 0.1	0.7 ± 0.1	1.9 ± 0.3	3.8 ± 0.5	1.6 ± 0.1	3.7 ± 0.3
C29-20S5a(H),14a(H),17a(H)-stigmastane	STER50	0.1 ± 2.6	0.2 ± 4.9	0.1 ± 2.0	8.5 ± 11.2	0.2 ± 0.0	0.1 ± 0.0	1.4 ± 0.2	0.8 ± 0.1	0.1 ± 0.0	0.0 ± 0.0
C29-20R5a(H),14ß(H),17ß(H)-stigmastane	STER51	0.3 ± 2.6	0.4 ± 4.9	0.2 ± 2.0	14.0 ± 11.2	0.3 ± 0.1	0.1 ± 0.1	3.2 ± 0.5	2.0 ± 0.4	0.1 ± 0.0	0.0 ± 0.0
C29-20S5a(H),14ß(H),17ß(H)-stigmastane	STER52	0.4 ± 2.6	0.5 ± 4.9	0.3 ± 2.0	0.0 ± 11.2	0.2 ± 0.0	0.4 ± 0.0	3.4 ± 0.2	3.4 ± 0.2	0.5 ± 0.0	0.1 ± 0.0
C29-20R5a(H),14a(H),17a(H)-stigmastane	STER53	0.2 ± 2.6	0.2 ± 4.9	0.1 ± 2.0	1.4 ± 11.2	0.3 ± 0.1	0.2 ± 0.1	2.0 ± 0.3	1.2 ± 0.2	0.2 ± 0.0	0.0 ± 0.0
Hopanes (ug/mile)											
18a(H),21ß(H)-22,29,30-Trisnorhopane	HOP13	41.7 ± 4.6	82.9 ± 9.1	0.5 ± 2.0	6.2 ± 11.3	0.0 ± 0.1	0.7 ± 0.2	1.9 ± 0.3	0.8 ± 0.2	0.0 ± 0.0	0.0 ± 0.0
17a(H),21ß(H)-22,29,30-Trisnorhopane	HOP15	0.1 ± 2.6	0.0 ± 4.9	0.1 ± 2.0	0.0 ± 11.2	0.3 ± 0.3	0.4 ± 0.3	1.4 ± 0.9	2.4 ± 1.3	0.1 ± 0.1	0.1 ± 0.1
17a(H),21ß(H)-30-Norhopane	HOP17	124.1 ± 17.2	193.4 ± 33.0	54.7 ± 9.5	34.6 ± 17.6	0.7 ± 0.2	0.5 ± 0.1	10.9 ± 1.0	6.6 ± 0.9	0.2 ± 0.1	0.1 ± 0.0
17a(H),21ß(H)-Hopane	HOP19	56.4 ± 6.5	89.5 ± 12.4	23.3 ± 3.7	82.4 ± 12.4	4.6 ± 0.9	3.8 ± 0.7	16.5 ± 2.0	16.1 ± 1.7	0.0 ± 0.0	0.0 ± 0.0
22S-17a(H),21ß(H)-30-Homohopane	HOP21	0.2 ± 2.6	0.0 ± 4.9	0.4 ± 2.0	4.5 ± 11.2	0.0 ± 0.1	0.0 ± 0.1	3.9 ± 0.4	2.2 ± 0.4	0.1 ± 0.0	0.0 ± 0.0
22R-17a(H),21ß(H)-30-Homohopane	HOP22	0.0 ± 2.6	0.0 ± 4.9	0.1 ± 2.0	6.9 ± 11.3	2.9 ± 0.7	1.9 ± 0.5	9.2 ± 1.4	5.3 ± 1.1	0.0 ± 0.0	0.0 ± 0.0
22S-17a(H),21ß(H)-30,31-Bishomohopane	HOP24	0.0 ± 2.6	0.0 ± 4.9	0.0 ± 2.0	1.4 ± 11.2	0.0 ± 0.0	0.1 ± 0.0	1.8 ± 0.2	1.2 ± 0.1	0.1 ± 0.0	0.0 ± 0.0
22R-17a(H),21ß(H)-30,31-Bishomohopane	HOP25	0.0 ± 2.6	0.0 ± 4.9	0.0 ± 2.0	0.0 ± 11.2	0.0 ± 0.0	0.0 ± 0.0	1.3 ± 0.2	0.8 ± 0.2	0.1 ± 0.0	0.0 ± 0.0
22S-17a(H),21ß(H)-30,31,32-Trisomohopane	HOP26	0.0 ± 2.6	0.0 ± 4.9	0.0 ± 2.0	0.0 ± 11.2	0.1 ± 0.1	0.1 ± 0.1	1.7 ± 0.3	0.8 ± 0.3	0.1 ± 0.0	0.0 ± 0.0

Data Quality and Analysis of Dilution Tunnel Blanks

Figure S1 shows comparisons of PM emission rates determined by BKI and UWV from their primary dilution tunnels versus the corresponding gravimetric mass data obtained by DRI from the secondary dilution tunnel sampler. The generally good agreement between PM mass measured prior to and after the secondary dilution sampler indicates that the additional residence time and secondary dilution, in the case of the CI tests, had little effect on the measured gravimetric mass. Reconstruction of the total mass concentration by summing the TOR, IC, AC , and XRF species gives good agreement with gravimetric mass as shown in Figure S2. As expected, the reconstructed mass is slightly less since elements have not been converted to their common oxide forms and ammonium is the only cation included, and OC was not converted to organic matter by applying a factor (31) to account for the missing hydrogen, oxygen and other elements that may be present in organic compounds. Sulfate and potassium ions were subtracted from the XRF sulfur and potassium values. There is a positive offset in the material balance for diesel vehicles at lower concentrations, which is due to the semi-volatile carbon species that are emitted by diesel engines (e.g., fuel-related alkanes). These species are collected on the quartz filter and detected by TOR. They are not adsorbed by the Teflon filters that are weighed for mass concentration.

Table S3 shows the mass loadings in the dynamic blanks relative to composite SI and CI exhaust samples. Dynamic blanks were also composited for better analytical sensitivity. A total of six 58-minute blanks were collected during the light-duty vehicle phase, but one (blank #4) was invalidated due to a system malfunction. The first blank was collected prior to the initial vehicle test. Subsequent blanks were collected after vehicle category 2, and during category 5, 8, and 9. All blanks were collected prior to the start of the day's testing, except for the final blank (#6), which was collected about one hour after the last test of the day. The first three SI blanks are consistent in composition and were composited as SI_DB1. Blank 5 (SI_DB2) is similar to the first three but contains slightly increased amounts of higher temperature organic carbon and the elements Al, Ca, Si, and Fe. Ions, which are likely artifacts of ambient air infiltration, show similar proportions among the blanks. In contrast to the others, blank 6 (SI_DB3) contains substantial amounts of elemental carbon and higher concentrations of all organic carbon components plus relatively large concentrations of Zn, Ca, Fe, and Si. In addition, this sample differs from the other dynamic blanks in that the gravimetric mass concentration is more consistent with the total carbon measured suggesting that the compounds evolved in the TOR analysis were primarily in the particle phase.

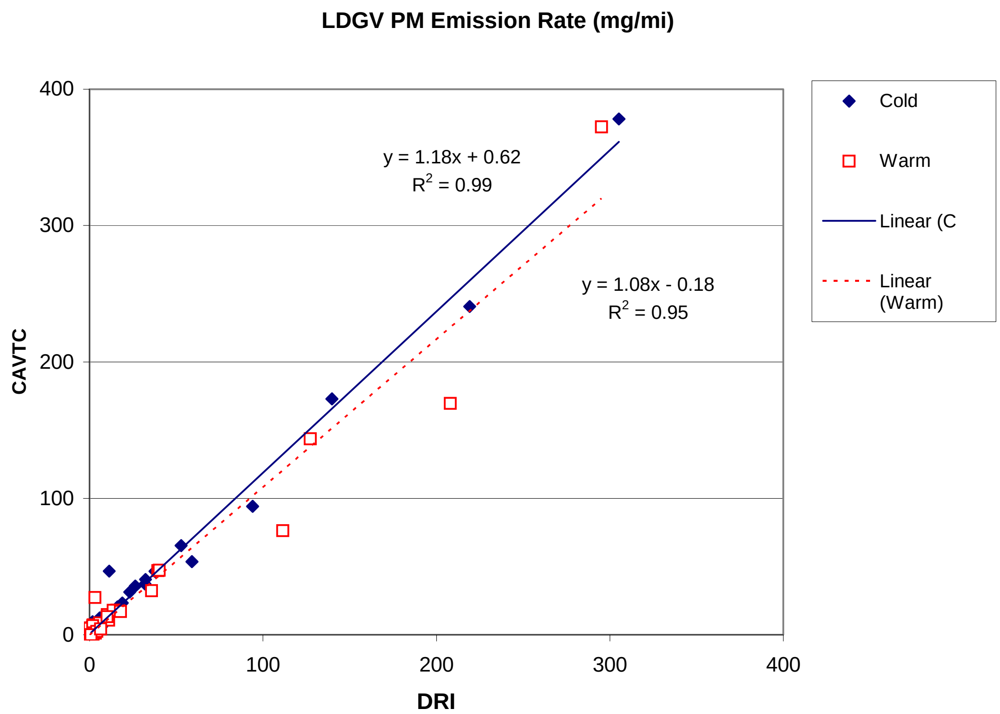
The speciation of heavy (5-7 rings) PAHs for the blanks is consistent with the exhaust samples, but the absolute concentrations measured were larger for the blanks than for many of the low-emitting vehicle tests. Thus, the dynamic blanks cannot be considered representative of 'background' levels for these compounds. Hopanes and steranes did not display any consistency in speciation for the dynamic blanks, due to the analytical uncertainty at such low concentrations. Finally, a very different composition of heavy PAH compounds is present in blank SI_DB3. All other dynamic blanks were collected at the start of the sampling day, whereas blank SI_DB3 was collected at the end of the day following vehicle tests with high emission levels that contaminated the exhaust dilution system.

A total of 11 blanks were collected during the CI phase and composited into 5 groups for analysis. These blanks were collected for 30 minutes, except the first and last blanks (blanks 9 and 3), which were run for 60 minutes. Although most dynamic blanks were collected prior to the start of the day's testing, several were also collected mid-day and one in the afternoon. The composition of the CI blanks was quite consistent except for Blank IIIn, which was collected without secondary dilution. Blank 5 showed slightly increased amounts of the higher temperature carbon compounds, Ca, Si, and Fe, plus sulfate and Zn. Several samples have significant concentration of sulfate ion, which may be due, in large part, to ambient air infiltration. Total carbon measured on the quartz filters generally far exceeds the gravimetric mass on the Teflon filters similar to the SI blanks. The heavy PAHs in the blanks are not consistent in with the speciation in the exhaust compounds and hopanes and steranes concentrations in the blanks were not present in analytically significant levels.

Table S4. Mass loadings in dynamic blanks relative to composite SI and CI exhaust samples *.

Vehicle Group	Weight Class	Test Cycle	Secondary Dilution Ratio	PM2.5 mass (ug/m3)	Total Carbon (ug/m3)	OC (ug/m3)	EC (ug/m3)	particulate PAH (ng/m3)	Hopanes (ng/m3)	Steranes (ng/m3)
SI_DB1	LD	Blank	1	2.2 +/- 2.7	14.9 +/- 1.6	14.1 +/- 1.6	0.8 +/- 0.3	383.6 +/- 34.4	5.3 +/- 7.7	58.0 +/- 3.7
SI_DB2	LD	Blank	1	6.1 +/- 2.7	24.2 +/- 1.8	21.4 +/- 1.8	2.8 +/- 0.3	540.3 +/- 99.7	8.6 +/- 18.7	107.3 +/- 24.7
SI_DB3	LD	Blank	1	107.8 +/- 2.8	113.3 +/- 4.3	51.1 +/- 3.0	62.2 +/- 2.6	263.9 +/- 49.8	1197.0 +/- 345.6	345.7 +/- 42.8
SI- 1	LD	UDC	1	169.3 +/- 1.1	108.3 +/- 2.9	77.4 +/- 3.2	31.0 +/- 0.9	873.3 +/- 110.5	18.3 +/- 6.0	53.1 +/- 4.9
SI- 2	LD	UDC	1	89.3 +/- 2.3	64.1 +/- 1.7	45.0 +/- 1.7	19.1 +/- 0.5	383.6 +/- 34.4	5.3 +/- 7.7	58.0 +/- 3.7
SI- 3	LD	UDC	1	33.3 +/- 1.1	27.5 +/- 1.0	19.4 +/- 0.9	8.2 +/- 0.3	25.8 +/- 6.1	13.1 +/- 7.5	111.7 +/- 11.4
SI- 4	LD	UDC	1	140.6 +/- 1.2	77.8 +/- 2.2	37.8 +/- 1.6	40.0 +/- 1.2	319.1 +/- 38.6	3.7 +/- 2.9	30.4 +/- 3.7
SI- 5	LD	UDC	1	112.1 +/- 1.6	91.5 +/- 1.3	67.8 +/- 1.4	23.7 +/- 0.4	93.4 +/- 8.1	1.4 +/- 1.5	165.0 +/- 6.2
SI- 6	LD	UDC	1	102.2 +/- 1.5	133.8 +/- 1.7	90.8 +/- 1.5	43.0 +/- 0.7	155.6 +/- 11.6	31.8 +/- 6.3	261.4 +/- 10.7
SI- 7	LD	UDC	1	346.2 +/- 1.8	331.9 +/- 4.6	280.0 +/- 6.2	51.9 +/- 0.7	171.1 +/- 10.7	670.5 +/- 54.0	493.8 +/- 18.0
SI- 8	LD	UDC	1	788.9 +/- 2.2	669.6 +/- 12.9	465.8 +/- 14.9	203.7 +/- 3.8	1618.9 +/- 137.4	975.6 +/- 70.5	525.5 +/- 22.1
SI- 9	LD	UDC	1	1055.2 +/- 1.7	962.4 +/- 13.5	307.5 +/- 5.7	654.9 +/- 11.8	6515.6 +/- 801.8	1640.2 +/- 105.6	476.2 +/- 24.9
SI-10	LD	UDC	1	2693.4 +/- 5.0	2428.2 +/- 31.4	1881.7 +/- 35.4	546.5 +/- 10.4	3828.9 +/- 228.5	2220.3 +/- 102.9	1958.5 +/- 64.2
Blank-3	Dyn	Blank	22	25.5 +/- 5.9	94.0 +/- 6.1	83.6 +/- 6.0	10.5 +/- 6.8	0.9 +/- 20.4		
Blank-9	Dyn	Blank	49	22.3 +/- 2.7	33.7 +/- 2.5	28.1 +/- 2.3	5.5 +/- 0.5	0.0 +/- 7.9		
Blank-I	Dyn	Blank	37	1.0 +/- 3.0	40.2 +/- 2.2	39.7 +/- 2.1	0.4 +/- 0.4	0.8 +/- 3.8		
Blank-III	Dyn	Blank	37	4.4 +/- 3.0	34.9 +/- 2.1	34.2 +/- 2.0	0.7 +/- 0.6	0.0 +/- 4.8		
HDD	I	HCS	40	40.8 +/- 2.2	85.2 +/- 2.1	55.4 +/- 1.7	29.9 +/- 0.7	2.4 +/- 4.1		
HDD	II	HCS	30	249.1 +/- 5.8	285.2 +/- 16.2	82.1 +/- 6.0	203.1 +/- 11.3	0.3 +/- 16.3	36.6 +/- 10.8	39.0 +/- 12.5
HDD	II	HCS	40	36.7 +/- 2.3	83.1 +/- 2.2	53.8 +/- 1.7	29.3 +/- 0.7	0.5 +/- 4.5	0.0 +/- 9.6	42.2 +/- 12.4
HDD	III	HCS	40	90.5 +/- 1.9	141.8 +/- 3.0	62.3 +/- 1.7	79.5 +/- 1.7	0.9 +/- 2.1	67.0 +/- 4.3	144.7 +/- 4.6
HDD	III	HCS	50	111.5 +/- 3.4	162.9 +/- 5.7	65.5 +/- 2.8	97.4 +/- 3.5	4.1 +/- 4.9	52.6 +/- 6.3	63.8 +/- 5.6
HDD	I	HW	40	43.4 +/- 2.3	97.2 +/- 2.5	61.0 +/- 1.9	36.2 +/- 0.8	1.2 +/- 2.9		
HDD	II	HW	30	556.5 +/- 6.3	621.7 +/- 34.8	166.8 +/- 11.0	454.9 +/- 25.3	0.0 +/- 17.1	41.3 +/- 13.2	72.6 +/- 13.9
HDD	II	HW	40	56.5 +/- 2.5	115.7 +/- 3.1	69.7 +/- 2.2	46.0 +/- 1.2	0.0 +/- 4.1		
HDD	III	HW	40	82.9 +/- 2.0	137.9 +/- 2.9	68.7 +/- 1.8	69.2 +/- 1.4	0.0 +/- 1.3	56.9 +/- 4.6	87.1 +/- 2.8
HDD	III	HW	50	114.6 +/- 3.0	168.5 +/- 5.3	66.3 +/- 2.6	102.2 +/- 3.4	0.0 +/- 4.9	46.6 +/- 5.7	121.4 +/- 6.4
Blank-IIIn	Dyn	Blank	1	187.9 +/- 9.0	257.6 +/- 11.0	173.9 +/- 8.4	83.8 +/- 4.8	3.0 +/- 6.6		
HDD	III	HCS	1	4985.8 +/- 15.2	5063.4 +/- 206.4	1355.5 +/- 58.2	3707.9 +/- 155.2	89.9 +/- 18.9	46.3 +/- 9.5	137.7 +/- 9.6
HDD	III	HW	1	5799.9 +/- 13.2	4837.7 +/- 240.8	1763.9 +/- 98.1	3073.8 +/- 153.2	40.0 +/- 11.8	78.9 +/- 12.1	214.5 +/- 12.5

* Particulate PAH values are sum sof benzo(bjk)fluoranthene, benzo(a)pyrene, benzo(ghi)perylene, indeno(1,2,3-cd)pyrene, dibenzo(ah+ac)anthracene and coronene, and carbon data are based on IMPROVE TOR method.



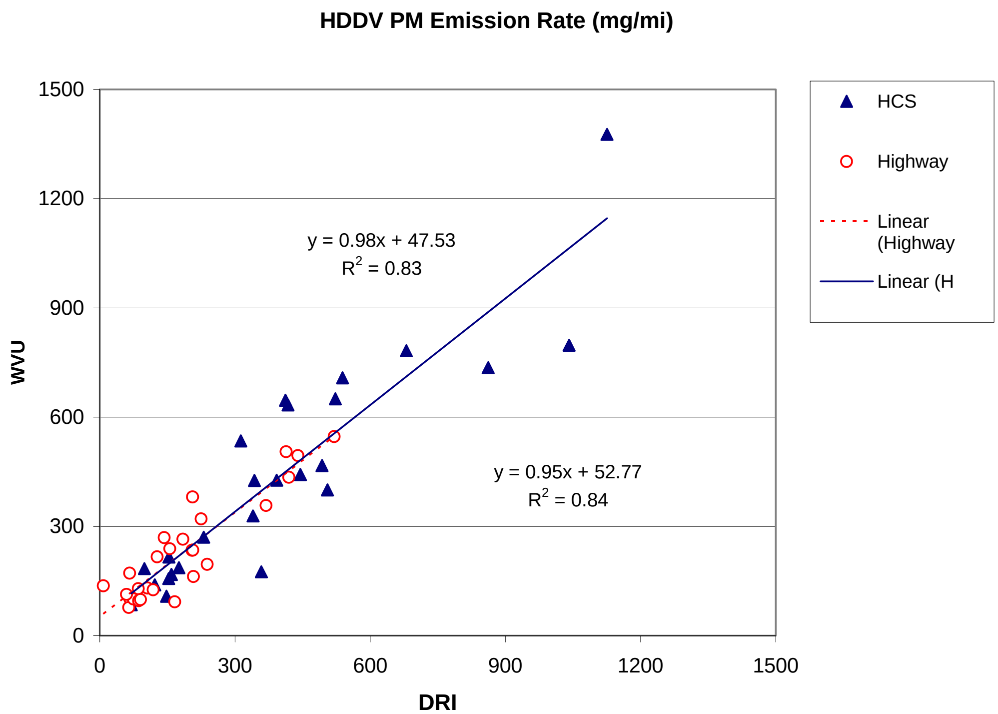


Figure S1. Comparisons of PM emission rates determined by EPA/BKI and UWV from their primary dilution tunnel versus the corresponding values obtained by DRI from the secondary dilution tunnel sampler.

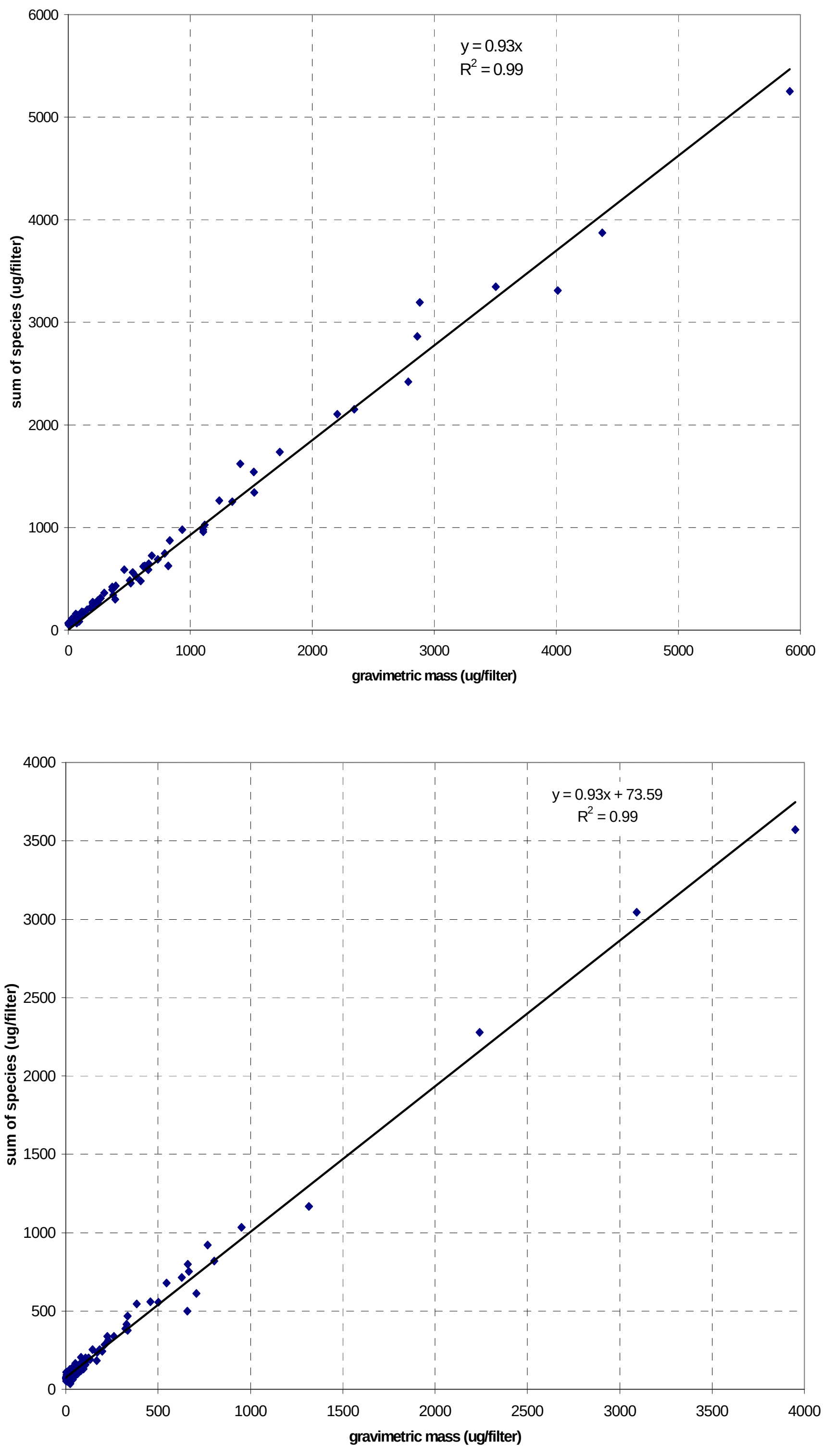


Figure S2. Correlation plot of gravimetric mass vs. sum of elements by XRF, ions by IC and AA, and carbon by TOR for light-duty vehicles (top panel) heavy-duty diesel vehicles (bottom panel).

Kansas City PM Characterization Study

Final Report

Appendix NN
Round 1 and 2 Average Emission Data

Assessment and Standards Division
Office of Transportation and Air Quality
U.S. Environmental Protection Agency

Sponsors:

National Renewable Energy Laboratory, U.S. Department of Energy
Federal Highway Administration, U.S. Department of Transportation
STAPPA-ALAPCO Emission Inventory Improvement Program
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Agency

EPA420-R-08-009
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Round 1 and 2 Phase and Composite Average Emission Data Calculated from Second-by-Second Data from the EPA's Dynamometer Analyzers

(EPA modified this data file from the Contractor's submitted Results after performing additional QA/QC procedures)

Legend:

avg: average emission rate for the number of vehicles tested
std: standard deviation on the emission rate for the number of vehicles tested
cv: coefficient of variance (standard deviation/average) on the emission rate for the number of vehicles tested
min: minimum emission value record for the number of vehicles tested
max: maximum emission value record for the number of vehicles tested

Round	Bin	# of vehicles	THC g/mile	CO g/mile	CO2 g/mile	NOX g/mile	PM mg/mile
			Composite SBS Phase 1				
1	**1**	2					
	avg		17.04	203.52	859.57	2.84	87.80
	std		10.89	69.82	115.85	1.95	107.12
	cv		63.92	34.31	13.48	68.50	122.01
	min		9.34	154.15	777.65	1.47	12.05
	max		24.74	252.90	941.49	4.22	163.54
	2	16					
	avg		8.69	80.01	664.90	4.02	93.80
	std		8.34	80.61	139.01	1.98	166.21
	cv		96.08	100.74	20.91	49.22	177.20
	min		2.96	14.47	415.31	1.79	3.75
	max		33.60	308.17	936.07	7.55	662.78
	3	19					
	avg		4.30	34.66	770.23	4.19	14.48
	std		1.15	19.59	127.26	1.32	24.60
	cv		26.63	56.53	16.52	31.49	169.90
	min		2.39	15.68	558.69	1.76	1.45
	max		5.93	83.91	1048.85	7.02	105.95
	4	41					
	avg		2.05	14.10	815.98	1.99	9.58
	std		1.08	8.95	104.14	1.25	0.99
	cv		52.48	63.47	12.76	62.43	10.37
	min		0.54	2.20	627.39	0.12	0.13
	max		6.00	43.28	1120.21	5.27	4.22
	5	7					
	avg		17.66	250.41	676.00	2.61	160.77
	std		6.34	164.95	158.79	2.60	108.00
	cv		35.91	65.87	23.49	99.77	67.18
	min		9.51	51.84	384.51	0.53	56.76
	max		24.19	460.48	811.22	7.79	326.53
	6	58					
	avg		5.70	43.34	647.44	4.20	35.02
	std		4.10	44.91	124.91	2.09	76.00
	cv		72.01	103.62	19.29	49.91	217.04
	min		1.91	9.97	356.28	0.96	2.38
	max		25.00	271.53	913.64	8.25	461.18
	7	44					
	avg		3.37	25.78	634.01	2.92	11.43
	std		1.19	17.89	128.26	1.04	10.23
	cv		35.22	69.41	20.23	35.59	89.52
	min		1.76	7.34	407.06	0.56	1.65
	max		6.98	84.06	866.92	5.14	38.47
	8	53					
	avg		2.00	12.76	634.13	1.87	7.40
	std		1.05	7.92	112.56	1.16	10.50
	cv		52.27	62.04	17.75	62.34	141.86
	min		0.40	1.22	382.65	0.00	0.17
	max		5.88	50.93	855.73	6.33	61.94

Composite SBS Phase 2

Round	Bin	THC g/mile	CO g/mile	CO2 g/mile	NOX g/mile	PM mg/mile
1	1					
	avg	6.06	64.94	594.34	2.92	45.05
	std	7.13	56.41	57.93	2.50	50.21
	cv	117.68	86.86	9.75	85.79	111.47
	min	1.02	25.05	553.38	1.15	9.54
	max	11.10	104.83	635.31	4.69	80.55
	2					
	avg	2.58	41.25	408.36	2.29	37.65
	std	4.23	60.97	85.89	1.41	65.56
	cv	163.89	147.80	21.03	61.68	174.15
	min	0.13	0.24	264.00	0.32	1.06
	max	16.60	192.37	583.04	5.74	261.52
	3					
	avg	0.47	6.62	476.13	1.89	11.13
	std	0.48	3.84	68.35	1.20	16.73
	cv	101.06	58.09	14.36	63.56	150.35
	min	0.04	0.71	350.33	0.29	0.50
	max	1.77	15.52	621.69	5.59	56.14
	4					
	avg	0.11	2.12	480.59	0.51	4.01
	std	0.19	2.71	60.92	0.68	5.11
	cv	168.13	127.76	12.68	132.60	127.40
	min	0.00	0.07	393.11	0.04	0.36
	max	0.86	12.64	665.09	4.03	30.22
	5					
	avg	7.45	113.63	407.01	2.72	73.09
	std	5.43	88.68	102.90	2.56	99.22
	cv	72.90	78.04	25.28	93.88	135.76
	min	0.77	9.52	257.18	0.23	2.83
	max	14.39	254.04	482.49	7.45	266.15
	6					
	avg	1.25	15.72	388.74	2.61	18.94
	std	1.51	19.20	69.28	1.97	34.58
	cv	120.79	122.11	17.82	75.66	182.54
	min	0.04	0.95	152.96	0.32	0.19
	max	10.01	129.88	521.13	6.78	181.80
	7					
	avg	0.34	8.53	377.44	1.16	7.54
	std	0.51	10.39	65.39	0.83	9.23
	cv	151.76	121.72	17.32	71.93	122.41
	min	0.04	0.19	277.17	0.15	0.24
	max	3.08	48.23	529.87	4.34	41.35
	8					
	avg	0.08	2.81	366.91	0.42	2.48
	std	0.11	3.65	52.77	0.45	5.62
	cv	134.35	130.20	14.38	107.73	226.18
	min	0.00	0.05	240.12	0.02	0.12
	max	0.59	23.92	487.13	3.46	51.12

Composite SBS Phase 3

Round	Bin	THC g/mile	CO g/mile	CO2 g/mile	NOX g/mile	PM mg/mile
1	1					
	avg	8.54	68.45	647.32	2.90	9.14
	std	8.63	50.28	155.95	0.73	9.08
	cv	101.02	73.45	24.09	25.32	99.34
	min	2.44	32.90	537.04	2.38	2.72
	max	14.65	104.01	757.59	3.42	15.56
	2					
	avg	5.06	51.87	528.49	2.65	51.05
	std	7.68	74.68	108.59	1.57	98.67
	cv	151.72	143.97	20.55	59.22	193.28
	min	0.47	0.29	378.50	0.26	0.63
	max	31.09	272.67	781.81	6.01	345.61
	3					
	avg	1.33	11.96	636.71	2.54	14.41
	std	2.58	6.96	97.57	1.47	24.99
	cv	194.66	58.23	15.32	58.11	173.43
	min	0.24	3.45	378.50	0.40	1.25
	max	3.05	28.65	858.74	6.19	86.79
	4					
	avg	0.31	3.55	648.30	0.79	2.33
	std	0.59	5.38	83.11	1.24	2.10
	cv	192.23	151.63	12.82	157.40	90.40
	min	0.01	-0.01	502.27	0.00	0.16
	max	3.27	24.85	869.04	6.71	7.59
	5					
	avg	11.85	137.86	515.28	2.87	63.73
	std	9.65	98.89	131.00	2.82	86.50
	cv	81.46	71.73	25.42	98.37	135.73
	min	1.58	10.48	285.12	0.31	3.56
	max	26.65	282.77	611.56	8.19	200.85
	6					
	avg	2.62	21.62	527.28	3.33	8.79
	std	2.60	22.80	105.58	2.43	15.51
	cv	99.09	105.48	20.02	72.93	176.55
	min	0.22	1.82	256.59	0.45	0.35
	max	14.68	118.87	751.57	8.39	87.15
	7					
	avg	0.94	10.01	510.75	1.61	5.08
	std	1.14	13.77	107.70	1.12	7.73
	cv	121.91	137.50	21.09	69.90	152.28
	min	0.03	0.50	339.75	0.09	0.05
	max	5.38	83.61	760.06	4.86	37.95
	8					
	avg	0.20	2.78	492.57	0.60	1.80
	std	0.22	2.47	81.98	0.70	3.34
	cv	107.65	88.71	16.64	116.27	185.69
	min	0.00	0.01	321.70	0.01	0.09
	max	1.15	12.43	688.15	5.76	28.15

Composite SBS Total

Round	Bin	THC g/mile	CO g/mile	CO2 g/mile	NOX g/mile	PM mg/mile
1	1					
	avg	1.89	19.81	136.89	0.60	44.80
	std	1.76	12.24	17.46	0.40	50.34
	cv	92.82	61.76	12.75	66.46	112.38
	min	0.65	11.16	124.55	0.32	9.20
	max	3.14	28.47	149.24	0.88	80.39
	2					
	avg	0.94	10.70	100.75	0.56	48.70
	std	1.22	12.67	20.59	0.30	77.06
	cv	130.78	118.37	20.44	53.50	158.23
	min	0.18	0.66	66.80	0.16	6,55
	max	5.02	44.88	144.23	1.22	287.25
	3					
	avg	0.31	2.88	118.96	0.52	12.37
	std	0.13	1.23	18.01	0.24	17.58
	cv	42.11	42.57	15.14	46.72	142.08
	min	0.14	1.16	88.48	0.13	1.39
	max	0.58	5.54	157.76	1.23	60.76
	4					
	avg	0.12	1.04	121.88	0.18	4.21
	std	0.09	0.84	14.74	0.18	4.66
	cv	75.04	81.57	12.09	99.12	110.81
	min	0.03	0.20	97.84	0.00	0.41
	max	0.51	3.54	166.49	0.90	26.97
	5					
	avg	2.20	30.18	100.38	0.56	77.09
	std	1.34	20.84	24.67	0.54	95.32
	cv	61.12	69.05	24.58	96.53	123.65
	min	0.59	3.84	59.57	0.06	5.75
	max	3.93	60.56	119.36	1.58	261.02
	6					
	avg	0.53	4.76	98.69	0.64	19.24
	std	0.45	4.83	18.68	0.42	32.29
	cv	85.54	101.51	18.93	66.02	167.83
	min	0.12	0.99	45.82	0.12	0.80
	max	2.97	28.97	133.65	1.54	163.74
	7					
	avg	0.24	2.58	95.67	0.34	8.22
	std	0.15	2.29	18.26	0.18	8.97
	cv	62.25	88.93	19.09	52.92	109.17
	min	0.10	0.57	65.77	0.10	0.35
	max	0.90	11.28	136.23	0.95	37.36
	8					
	avg	0.11	1.00	93.51	0.16	2.86
	std	0.06	0.64	14.83	0.12	5.89
	cv	56.61	63.63	15.86	78.51	206.31
	min	0.02	0.09	59.84	0.00	0.40
	max	0.35	3.30	126.04	0.96	49.61

Round	Bin	# of vehicles	THC g/mile	CO g/mile	CO2 g/mile	NOX g/mile	PM mg/mile
			Composite SBS Phase 1				
2	**1**	9					
	avg		14.14	216.01	800.09	2.80	281.33
	std		8.06	161.81	267.11	1.84	417.87
	cv		56.98	74.91	33.38	65.95	148.53
	min		2.94	6.36	382.11	0.34	4.90
	max		31.57	465.91	1195.00	5.36	1198.94
	2	35					
	avg		12.25	156.37	699.87	3.37	210.94
	std		7.21	96.22	133.91	1.63	297.39
	cv		58.87	61.53	19.13	48.51	140.98
	min		3.71	43.28	454.80	0.47	11.50
	max		32.73	481.45	963.81	7.74	1436.68
	3	34					
	avg		5.92	79.06	776.50	3.56	40.05
	std		2.54	44.49	139.10	1.61	39.71
	cv		42.80	56.28	17.91	45.09	99.14
	min		2.37	19.88	508.91	0.80	3.99
	max		11.55	192.41	1032.15	7.22	152.80
	4	64					
	avg		3.76	35.75	834.76	2.30	40.84
	std		2.50	24.33	115.20	1.40	82.95
	cv		66.46	68.05	13.80	60.93	203.12
	min		0.22	0.72	559.08	0.09	1.88
	max		11.53	103.93	1194.48	7.01	601.42
	5	17					
	avg		16.82	251.28	767.71	2.39	361.73
	std		6.91	126.44	177.28	1.66	436.66
	cv		41.11	50.32	23.09	69.56	120.71
	min		6.51	99.87	490.04	0.69	32.31
	max		31.08	480.88	1242.99	5.86	1652.50
	6	51					
	avg		8.83	113.86	652.62	3.49	114.81
	std		5.67	81.06	135.14	1.78	188.21
	cv		64.19	71.19	20.71	50.92	163.93
	min		2.47	22.33	392.39	0.55	6.83
	max		31.64	356.29	1121.23	6.90	1038.48
	7	48					
	avg		6.37	89.09	701.82	2.77	55.06
	std		4.56	97.47	129.72	1.17	74.73
	cv		71.65	109.40	18.48	42.33	135.73
	min		1.96	16.09	411.83	0.54	4.65
	max		29.10	538.94	967.28	5.99	419.36
	8	40					
	avg		4.11	39.35	700.27	1.79	46.88
	std		2.14	28.60	116.65	0.82	97.71
	cv		52.03	72.69	16.66	45.63	208.40
	min		1.00	3.71	444.64	0.32	0.69
	max		9.99	152.82	903.50	4.23	599.46

Composite SBS Phase 2

Round	Bin	THC g/mile	CO g/mile	CO2 g/mile	NOX g/mile	PM mg/mile
2	**1**					
	avg	4.46	51.12	530.98	2.94	101.70
	std	4.70	27.96	143.42	1.53	129.89
	cv	105.51	54.70	27.01	52.19	127.72
	min	0.30	2.43	235.50	1.33	6.78
	max	15.38	91.67	675.24	5.29	397.78
	2					
	avg	1.78	23.64	456.72	2.40	31.43
	std	3.10	39.48	84.56	1.07	48.98
	cv	174.31	167.01	18.52	44.69	155.85
	min	0.09	0.27	331.07	0.60	1.30
	max	13.26	209.20	644.21	4.98	242.55
	3					
	avg	0.49	7.48	465.33	1.60	19.13
	std	0.71	8.17	77.29	1.24	36.41
	cv	144.55	109.14	16.61	77.70	190.32
	min	0.03	0.33	289.13	0.14	0.58
	max	2.59	40.47	620.15	5.33	213.10
	4					
	avg	0.14	2.89	468.84	0.64	6.02
	std	0.23	3.84	58.94	0.76	6.79
	cv	160.09	132.89	12.57	118.15	112.90
	min	0.01	0.08	340.74	0.01	0.56
	max	1.18	20.25	672.35	5.10	30.16
	5					
	avg	3.00	48.03	492.37	2.89	42.34
	std	3.29	46.80	83.30	1.74	73.47
	cv	109.74	97.44	16.92	60.09	173.53
	min	0.46	5.49	293.65	0.73	3.19
	max	14.75	185.39	637.23	7.12	315.45
	6					
	avg	1.61	21.60	386.61	2.26	23.86
	std	2.50	33.19	56.67	1.68	40.46
	cv	155.02	153.65	14.66	74.27	169.60
	min	0.06	1.77	256.26	0.11	0.82
	max	16.45	169.89	496.80	5.20	177.64
	7					
	avg	0.46	9.37	399.91	1.03	16.25
	std	1.60	33.41	63.41	0.65	27.44
	cv	351.78	356.53	15.86	63.46	168.90
	min	0.03	0.20	261.51	0.17	0.00
	max	11.19	234.74	545.62	3.60	143.30
	8					
	avg	0.08	2.24	379.66	0.38	6.20
	std	0.06	2.02	60.06	0.33	12.89
	cv	74.07	90.19	15.82	86.34	207.91
	min	0.02	0.09	265.67	0.03	0.58
	max	0.25	6.63	503.37	1.29	81.41

Composite SBS Phase 3

Round	Bin		THC g/mile	CO g/mile	CO2 g/mile	NOX g/mile	PM mg/mile
2	1						
		avg	7.17	57.96	618.29	2.93	28.12
		std	8.18	39.25	167.67	1.30	34.39
		cv	113.96	67.72	27.12	44.36	122.31
		min	0.77	1.50	290.82	1.22	0.89
		max	26.28	98.82	798.96	5.17	95.79
	2						
		avg	3.67	20.91	566.51	2.93	22.16
		std	6.43	25.31	107.10	1.41	38.91
		cv	175.24	121.07	18.90	48.06	175.60
		min	0.49	0.17	392.64	1.07	0.92
		max	27.94	115.07	879.91	7.96	140.20
	3						
		avg	1.18	10.54	587.15	2.03	5.22
		std	1.18	7.44	97.84	1.50	6.08
		cv	100.22	70.55	16.66	74.13	116.49
		min	0.18	2.18	388.94	0.31	0.39
		max	4.12	31.35	793.56	5.87	26.44
	4						
		avg	0.30	3.48	609.72	0.75	3.26
		std	0.46	3.97	84.50	0.88	3.67
		cv	155.28	114.11	13.86	117.66	112.34
		min	0.00	-0.01	400.05	0.00	0.05
		max	2.70	18.98	878.59	5.80	26.31
	5						
		avg	4.73	57.55	609.40	3.12	14.31
		std	4.89	76.10	112.65	1.96	17.96
		cv	103.36	132.23	18.49	62.78	125.45
		min	0.97	3.06	351.11	0.70	2.66
		max	22.73	319.06	781.44	8.04	73.58
	6						
		avg	2.81	26.61	493.37	2.79	13.68
		std	3.98	39.54	79.21	2.12	24.97
		cv	141.99	148.58	16.06	75.78	182.52
		min	0.16	2.02	299.20	0.23	1.48
		max	27.33	184.04	658.33	7.21	116.82
	7						
		avg	1.00	10.32	525.38	1.41	6.70
		std	2.28	24.94	100.37	0.83	10.81
		cv	228.58	241.62	19.10	59.13	161.50
		min	0.11	0.26	334.68	0.24	0.15
		max	15.87	174.57	762.26	4.57	60.50
	8						
		avg	0.12	2.00	494.48	0.45	4.21
		std	0.11	1.94	88.92	0.37	4.86
		cv	90.87	97.07	17.98	83.42	115.33
		min	0.00	0.02	342.29	0.05	0.09
		max	0.42	6.63	658.48	1.23	25.13

Round	Bin	THC g/mile	CO g/mile	CO2 g/mile	NOX g/mile	PM mg/mile
				Composite SBS Total		
2	1					
	avg	1.47	17.82	123.74	0.59	106.13
	std	1.26	10.22	34.37	0.25	134.87
	cv	85.69	57.33	27.78	42.65	127.08
	min	0.20	0.61	57.02	0.32	6.38
	max	4.39	34.72	163.09	0.93	416.66
	2					
	avg	0.92	10.39	108.71	0.55	39.69
	std	0.94	8.53	20.21	0.21	51.77
	cv	102.37	82.12	18.59	38.56	130.45
	min	0.25	2.22	75.32	0.17	2.85
	max	4.31	47.11	161.75	1.28	231.92
	3					
	avg	0.37	4.78	114.33	0.43	20.65
	std	0.22	2.67	19.07	0.26	33.50
	cv	58.72	55.84	16.68	61.24	162.20
	min	0.14	1.37	73.80	0.13	1.00
	max	0.91	12.31	150.26	1.18	188.57
	4					
	avg	0.19	2.04	118.81	0.21	7.92
	std	0.13	1.34	15.09	0.18	8.30
	cv	65.90	65.33	12.70	85.16	104.77
	min	0.02	0.16	84.74	0.01	0.75
	max	0.54	6.20	168.82	1.15	36.05
	5					
	avg	1.30	18.90	117.49	0.57	57.47
	std	0.83	12.65	20.97	0.33	79.56
	cv	63.79	66.92	17.85	58.09	138.43
	min	0.58	6.34	73.77	0.20	7.46
	max	4.11	57.43	162.82	1.38	332.43
	6					
	avg	0.71	8.68	95.86	0.54	28.17
	std	0.67	7.77	15.20	0.35	43.99
	cv	94.61	89.50	15.85	64.42	156.13
	min	0.13	1.72	61.17	0.12	1.24
	max	4.50	41.07	134.62	1.19	181.59
	7					
	avg	0.38	5.41	101.08	0.31	18.51
	std	0.46	8.35	16.95	0.14	26.52
	cv	121.77	154.44	16.77	47.42	145.60
	min	0.10	0.91	64.05	0.10	1.05
	max	3.31	57.12	133.20	0.82	132.98
	8					
	avg	0.19	2.06	97.47	0.14	8.23
	std	0.10	1.29	15.90	0.08	14.19
	cv	50.62	62.85	16.31	55.18	172.33
	min	0.06	0.28	67.81	0.02	1.19
	max	0.44	6.81	124.68	0.28	83.25