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1992 Nonmethane Organic Compounds And Speciated Nonmethane Organic Compounds Monitoring Program

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1992 NONMETHANE ORGANIC COMPOUNDS AND SPECIATED NONMETHANE ORGANIC COMPOUNDS MONITORING PROGRAM

FINAL REPORT

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SYMBOLS AND ABBREVIATIONS

a.c.	area counts, generated from a gas chromatograph
ADIFF	absolute value of DIFF
AIRS	Aerometric Information Retrieval System
AL	Alabama
a.m.	ante meridiem
APCDIFF	absolute value of PCDIFF
APR	April
AREAL	Atmospheric Research and Exposure Assessment Laboratory
ASTM	American Society for Testing Materials
Aug	August
B1AL	Birmingham, AL (Tarrant City) - AIRS No. 01-073-6002
B2AL	Birmingham, AL (Pinsun) - AIRS No. 01-073-5002
B3AL	Birmingham, AL (Helena) - AIRS No. 01-117-0004
BMTX	Beaumont, TX - AIRS No. 48-245-0009
BRLA	Baton Rouge, LA - AIRS No. 22-033-0006
Calib.	calibration
Conc.	concentration
cm	centimeter
CRM	Certified Reference Material
CH	State of Chihuahua, Mexico
CHNC	Charlotte, NC - AIRS No. 37-119-0034
CV	coefficient of variation
DIFF	measured NMOC concentration - calculated NMOC concentration
Diff.	ppmC for in-house quality control samples; (NMOC concentration for the second channel) - (NMOC concentration for the first channel)
DLTX	Dallas, TX - AIRS No. 48-113-0069
DNPH	2,4-dinitrophenyl hydrazine
Dup.	duplicate
e	base of natural logarithm, 2.71828...
ECD	electron capture detector
ELTX	El Paso, TX - AIRS No. 48-141-0027
EPA	United States Environmental Protection Agency

SYMBOLS AND ABBREVIATIONS - Continued

F	Friday
F	the F-statistic
FID	flame ionization detector
FL	Florida
FWTX	Fort Worth, TX - AIRS No. 48-439-1002
GC	gas chromatograph
GC/FID	gas chromatography flame ionization detector
GC/MD	gas chromatography multidetector
GC/MS	gas chromatography mass spectrometry
H	Thursday
H	hinge (25th percentile or 75th percentile)
He	helium
hg	mercury
HP-5880	Hewlett-Packard Model 5880
HPLC	high performance liquid chromatography
i.d.	inside diameter
ID	identification
Inj.	injection
JUMX	Juarez-CH, Mexico - AIRS No. 80-006-0001
KI	potassium iodide
L	liter
LA	Louisiana
LCL	lower control limit
LINY	Hempstead, NY (Long Island) - AIRS No. 36-059-0005
m	meter
M	Monday
M	median
Max	maximum
MDL	method detection limit
MIFL	Miami, FL - AIRS No. 12-025-4002

SYMBOLS AND ABBREVIATIONS - Continued

Min	minimum
min	minute
mL	milliliter
mm	millimeter
MNY	New York, NY - AIRS No. 36-061-0010
MU	mean of ln(NMOC)
NAAQS	National Ambient Air Quality Standards
NC	North Carolina
NCAR	National Center for Atmospheric Research
NIST	National Institute of Standards and Technology
nl	nanoliter
NMOC	Nonmethane organic compound
NO_x	oxides of nitrogen
NWNJ	Newark, NJ - AIRS No. 34-013-0011
NJ	New Jersey
NY	New York
o.d.	outside diameter
PCDIFF	percent difference = DIFF/calculated NMOC concentration x 100, for in-house QC samples
PDFID	preconcentration, direct flame ionization detection
PLNJ	Plainfield, NJ - AIRS No. 34-039-5001 (formerly 34-035-1001)
ppbC	parts per billion by volume as carbon
ppbv	parts per billion by volume
ppm	parts per million
ppmC	parts per million by volume as carbon
ppmv	parts per million by volume
psig	pounds (force) per square inch gauge
QA	quality assurance
QAD	Quality Assurance Division (EPA)
QAPP	Quality Assurance Project Plan
QC	quality control

SYMBOLS AND ABBREVIATIONS - Continued

R1NC	Raleigh, NC - AIRS No. 37-183-0015
R	response factor range, (RF_{i+1} - RF_i)
RF	response factor
RPIP	Radian Peak Identification Program
RTP	Research Triangle Park
S2UT	Salt Lake City, UT - AIRS No. 49-035-3001
S3UT	Salt Lake City, UT (Bountiful) - AIRS No. 49-011-0001
S	standard deviation
S_i	sample i
SAROAD	Storage and Retrieval of Aerometric Data
SOP	standard operating procedure
SOx	oxides of sulfur
SIGMA	standard deviation of ln(NMOC)
SNMOC	Speciated nonmethane organic compounds
Std Dev	standard deviation
T	Tuesday
TX	Texas
THC	total hydrocarbon
UATMP	Urban Air Toxics Monitoring Program
UCL	upper control limit
U.S.	United States
UT	Utah
UTM	Universal Transverse Mercator
VOC	volatile organic compound
vs.	versus
W	Wednesday
W	Shapiro-Wilk statistic
WSNC	Winston-Salem, NC - AIRS No. 37-067-0022
XBAR	estimate of the sample mean

SYMBOLS AND ABBREVIATIONS - Continued

"	inch(es)
°C	degrees Celsius
$\epsilon_{l(ijk)}$	residual (or error, assumed to be due to analysis) l from aliquot k, duplicate canister j, and air sample i
°F	degrees Fahrenheit
%CV	percent coefficient of variation
μ	micron
μ	population mean
μg	microgram
μm	micrometer

1.0 BACKGROUND AND SUMMARY

In certain areas of the country where the National Ambient Air Quality Standard (NAAQS) for ozone is being exceeded, additional measurements of ambient nonmethane organic compounds (NMOC) are needed to assist the affected states in developing revised ozone control strategies. Because of previous difficulty in obtaining accurate NMOC measurements, the U.S. Environmental Protection Agency (EPA) has provided monitoring and analytical assistance to these states through Radian Corporation. This assistance began in 1984 and continues through the 1992 NMOC Monitoring Program.

Between 22 June and 30 September, 1992, Radian analyzed 566 ambient air samples, including 70 duplicate samples, collected in SUMMA® polished stainless steel canisters at 8 sites. These NMOC analyses were performed by the cryogenic preconcentration, direct flame ionization detection (PDFID) method.[1] Based on the 1984 through 1991 studies, the method was shown to be precise, accurate, and cost effective relative to the capillary column gas chromatographic, flame ionization detection (GC/FID) method. The 1992 study confirmed these findings and supported the conclusion that the PDFID method is the method of choice to measure total NMOC concentration in ambient air.

In 1987 Radian Corporation developed a gas chromatographic multidetector (GC/MD) method to determine the concentration of 38 selected toxic organic compounds in ambient air. In 1992, air toxic analyses were conducted on 3-hour ambient air samples taken at five sites at which NMOC samples were taken. Air toxics monitoring was also a component of the 1987, 1988, 1989, 1990, and 1991 programs.

Beginning with the 1989 monitoring season, selected carbonyls were measured and reported. In 1989, 3-hour samples were collected and analyzed for selected carbonyls -- formaldehyde, acetaldehyde, and acetone. In the 1990

monitoring season, ozone scrubbers were added to the sampling assemblies to scavenge any ozone present in the ambient air sampled, prior to its being drawn through the 2,4-dinitrophenylhydrazine (DNPH) cartridges. In the 1992 monitoring season, Radian Corporation prepared the DNPH cartridges, supervised the ambient air sampling, and performed the analyses. During the 1992 program, ten 3-hour carbonyl samples were collected from 6:00 a.m. to 9:00 a.m. at two sites and analyzed for 14 carbonyls -- formaldehyde, acetaldehyde, acrolein, acetone, propionaldehyde, crotonaldehyde, butyr/isobutyraldehyde, benzaldehyde, isovaleraldehyde, valeraldehyde, tolualdehyde, hexanaldehyde, and 2,5-dimethylbenzaldehyde.

Beginning in 1991, speciated nonmethane organic compound (SNMOC) concentrations were measured at several sites. This continued in 1992. Seventy-seven hydrocarbons are speciated and quantitated in this analysis. Chlorinated and oxygenated species in the ambient air are not identified in the SNMOC procedure. The SNMOC sampling apparatus is identical to the NMOC sampling apparatus. Three-hour samples are collected in cleaned, evacuated stainless steel canisters from 6:00 to 9:00 a.m. under final pressures of about two atmospheres absolute pressure. Each sample is cryogenically preconcentrated. The concentrated sample aliquot is then transferred through two gas chromatographic columns to separate flame ionization detectors (FIDs). One column separates the ethane, ethene, and acetylene (the C_2-hydrocarbons). The other column separates the remaining 74 target hydrocarbons.

The Final Report for the 1992 Nonmethane Organic Compound Monitoring Programs are included in Sections 1.0 through 13.0 of this report. Sections 2.0 through 5.0 report the data, procedures, and assessment of the NMOC portion of the monitoring program. Sections 6.0 through 7.0 report the data, procedures, and assessment of the 3-hour air toxics portion of the monitoring program.

Section 8.0 reports the 3-hour carbonyl portion of the monitoring program. Sections 9.0 through 11.0 report the SNMOC portion of the monitoring program. Section 12.0 lists recommendations and section 13.0 lists references.

The sampling sites for the 1992 NMOC Monitoring Program are listed in Appendix A. Appendix A also gives the EPA Regions for each site, the Radian Site Code, the Aerometric Information Retrieval System (AIRS) site code and site information, and indicates which base program it participated in, whether or not 3-hour air toxics analyses or SNMOC analyses were performed on selected ambient air samples from the site and whether or not carbonyl samples were collected and analyzed.

Appendix B contains the detailed procedures on the PDFID method. Appendix C lists the 1992 NMOC Monitoring Program site data. Appendix D lists the 1992 NMOC and SNMOC Monitoring Program Invalidated and Missing Samples information. Appendix E gives PDFID Integrator Programming Instructions. Appendix F gives 1992 NMOC Daily Calibration Data. Appendix G gives 1992 NMOC In-House Quality Control Samples, and Appendix H gives Multiple Detector Speciated Three-Hour Site Data Summaries. Appendix I contains the external audit results for the NMOC, 3-hour toxics, and SNMOC programs. The SNMOC analysis method is detailed in Appendix J. Appendix K lists the SNMOC site data and can be obtained from Neil Berg, U.S. EPA.

1.1 NMOC Monitoring Program

1.1.1 Introduction and Data Summary

The sampling schedule is given in the 1992 NMOC Quality Assurance Project Plan (QAPP).[2] For all the sites in the 1992 NMOC Monitoring Program, sampling occurred from 6:00 a.m. to 9:00 a.m. local time, Monday through Friday from 22 June through 30 September, 1992. Site codes for the 1992 NMOC

Monitoring Program are listed in Appendix A. Table 1-1 gives details of the sample completeness results. Percent completeness, a quality measure, is shown in Table 1-1. Completeness, which ratios the number of valid samples to the number of scheduled samples, averaged 90.7% in 1992 compared to 94.1% in 1991, 95.8% in 1990, 95.5% in 1989, 93.4% in 1988, 95.0% in 1987, 96.8% in 1986, 95.8% in 1985, and 90.6% in 1984. Percent completeness for 1992 ranged from 80.0 at New York, NY (MNY), to 101.3 for New York, NY (LINY). Statistics for the NMOC concentrations in parts per million carbon (ppmC) by volume are listed in Table 1-2. This table also includes all duplicate sample concentration statistics.

1.1.2 Calibration and Drift

Each PDFID analysis channel was calibrated, using propane standards referenced to the National Institute of Science and Technology (NIST) Reference Material No. 1666B propane. Daily, before zero and calibration checks were performed, the analytical systems were purged with cleaned, dried air that had been humidified. Zero readings were determined with cleaned, dried air. Daily percent drift of the calibration factor ranged from -5.1% to +2.2 percent. The absolute value of the percent drift of the daily calibration factors ranged from 0.0 to +5.1 percent.

1.1.3 NMOC Precision

Analytical precision was determined by repeated analyses of 50 site samples. Percent differences between the second and the first analysis averaged +8.74 percent. The average of the absolute values of the percent difference was 21.61% with a standard deviation of 20.9 ppmC. The analytical precision includes the variability between Radian analytical measurement channels and within Radian analytical measurement channels. The data quality objective for the percent

Table 1-1

1992 NMOC Completeness Results

Site Location	Radian Site Code	Scheduled Sampling Days	Total Scheduled Duplicate Samples	Total Scheduled Canister Analyses	Total Valid Duplicate Samples	Total Valid Samples	Percent Complete
Long Island, NY	LINY	67	9	76	10	77	101.32
New York, NY	MNY	66	9	75	8	60	80.00
Newark, NJ	NWNJ	69	9	78	8	64	82.05
Plainfield, NJ	PLNJ	70	9	79	9	77	97.47
Raleigh, NC	R1NC	70	9	79	9	74	93.67
Salt Lake City, UT	S2UT	69	9	78	8	65	83.33
Salt Lake City, UT	S3UT	71	9	80	9	72	90.00
Winston-Salem, NC	WSNC	71	9	80	9	78	97.50
OVERALL		553	72	625	70	567	90.72

Table 1-2

NMOC Overall Statistics, by Site

Site	Cases	Concentration, ppmC							W[a]
		Min	Max	Median	Mean	Std Dev	Skew-ness	Kurt-osis	
LINY	77	0.071	1.168	0.227	0.315	0.225	1.269	1.633	0.866
MNY	60	0.128	3.730	0.448	0.637	0.663	3.141	10.694	0.605
NWNJ	64	0.188	4.780	0.520	0.952	0.980	2.081	3.952	0.686
PLNJ	77	0.070	3.347	0.420	0.563	0.559	2.953	10.932	0.705
R1NC	74	0.055	0.692	0.186	0.219	0.131	1.560	2.695	0.858
S2UT	65	0.193	1.648	0.662	0.742	0.313	0.586	-0.207	0.953
S3UT	72	0.114	1.090	0.453	0.488	0.228	0.735	0.112	0.937
WSNC	78	0.047	1.220	0.208	0.264	0.207	1.970	5.258	0.817
OVERALL	567	0.047	4.780	0.388	0.506	0.531	3.685	18.304	0.655

[a]Shapiro-Wilk statistic to test normality of data.

difference as published in the QAPP[2] was ±15%, based on previous NMOC program experience[3,4,5,6,7,8,9,10] with this measurement.

Overall precision, including sampling and analysis variability, was determined by analysis of 70 duplicate site samples, simultaneously collected in two canisters from a common sampling system (a total of 140 canister samples). Percent difference for Radian's analyses of the duplicates averaged +3.050 percent. The average absolute percent difference was 15.6% with a standard deviation of 18.9 ppmC. The data quality objectives for this measurement was ±20%, based on previous experience.[3,4,5,6,7,8,9,10]

1.1.4 Accuracy

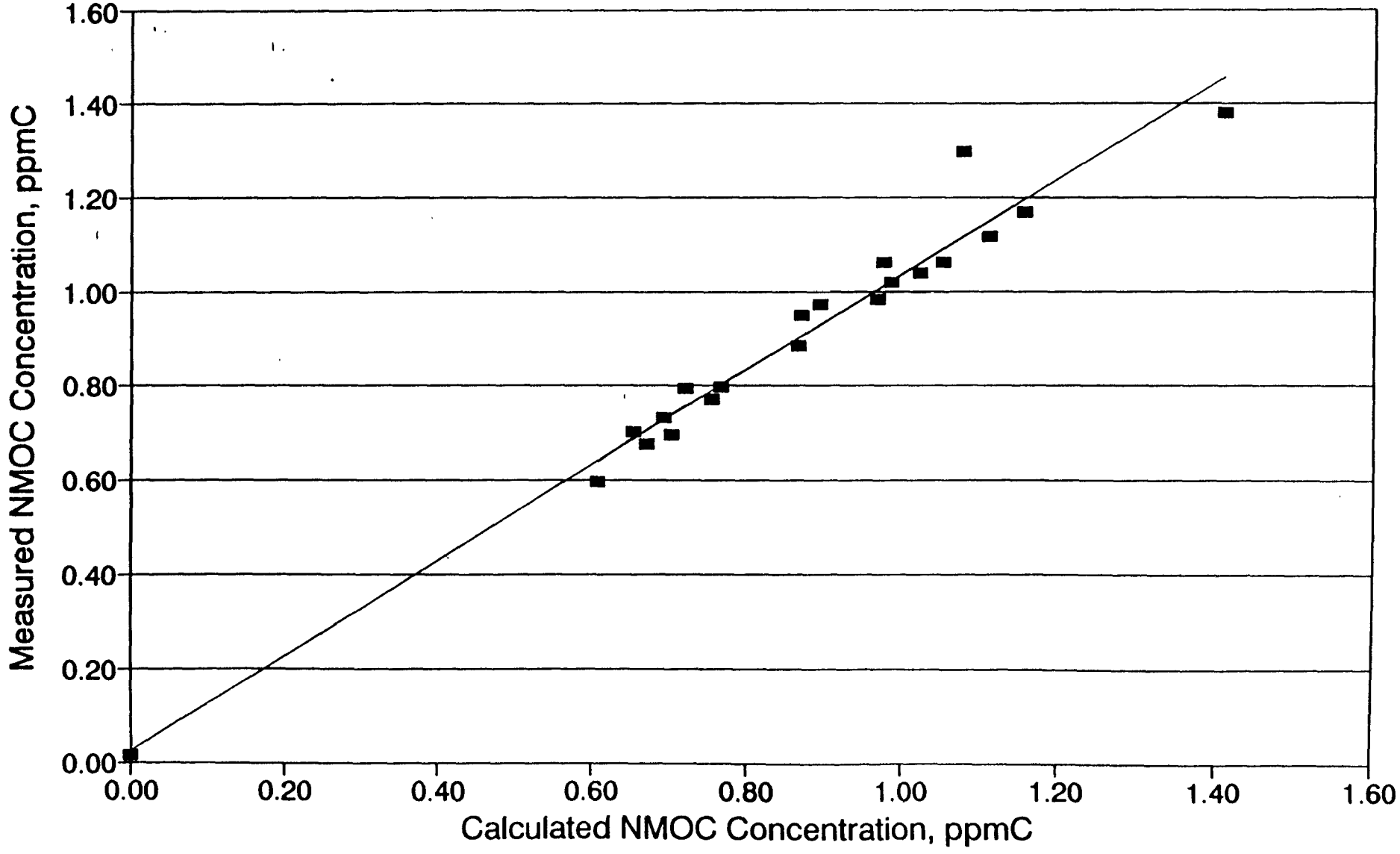
Because the NMOC measurements encompass a range of mixtures of organic compounds whose individual concentrations are unknown, it was not possible to define absolute accuracy. Instead, accuracy was determined relative to propane standards with internal and external audit samples.

Accuracy was monitored internally throughout the program by the use of in-house propane standards. Periodically an in-house propane quality control (QC) sample was prepared with a flow dilution apparatus and analyzed by the PDFID method. The propane used to prepare the in-house QC standards was referenced to NIST propane Certified Reference Material (CRM) No. 1666B.

Figures 1-1 through 1-4 show the in-house quality control results for Radian Channels A, B, C, and D. Measured propane values are plotted against calculated propane standards. Table 1-3 shows the linear regression parameters for the Radian in-house quality control data. Quality control samples of propane were mixed from a propane standard certified by referencing to NIST propane Certified Reference Material (CRM) 1666B. The regression used the propane concentration calculated from the blending operation as the independent variable and

IN-HOUSE PROPANE QC RESULTS

Channel A



IN-HOUSE PROPANE QC RESULTS

Channel B

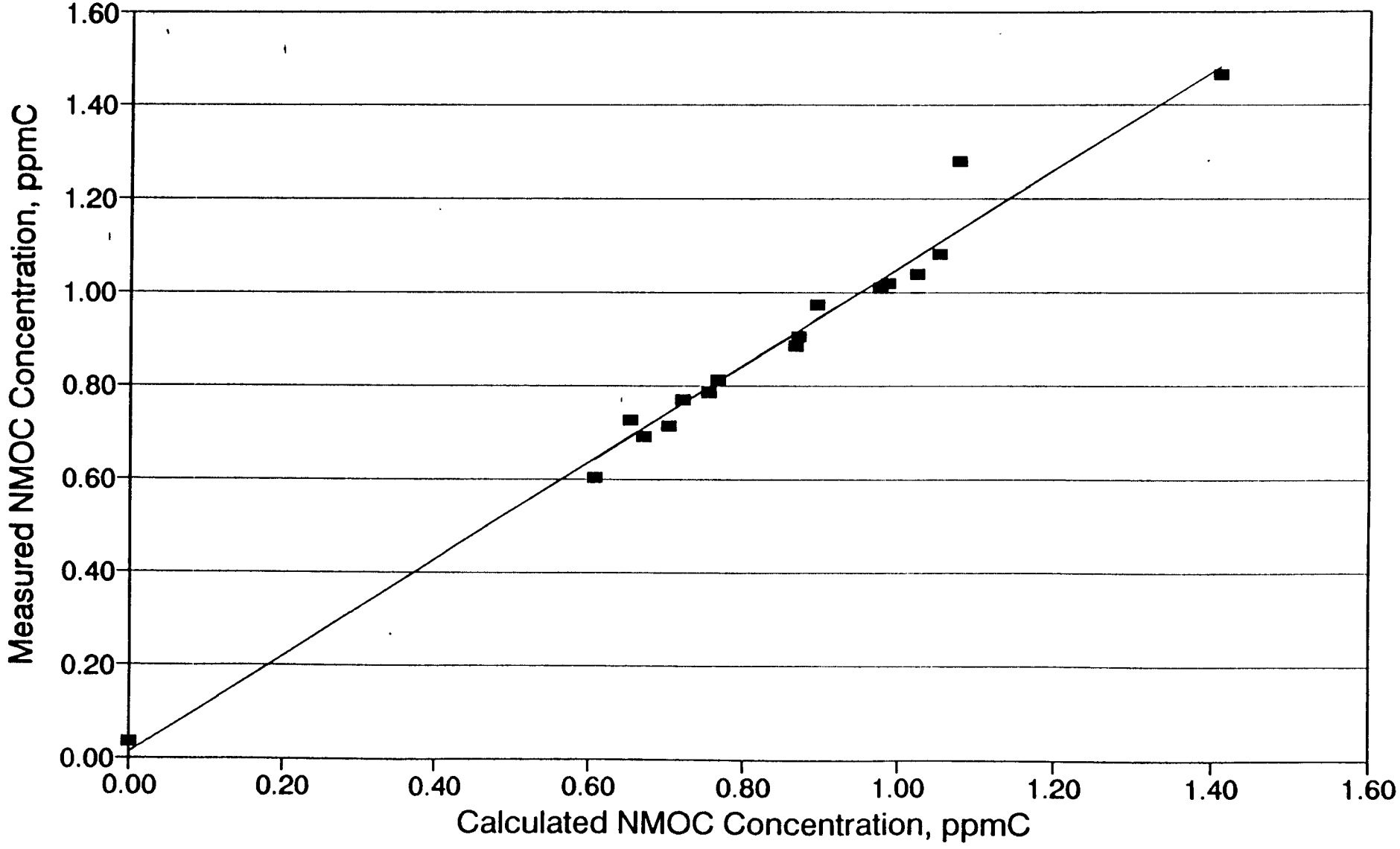
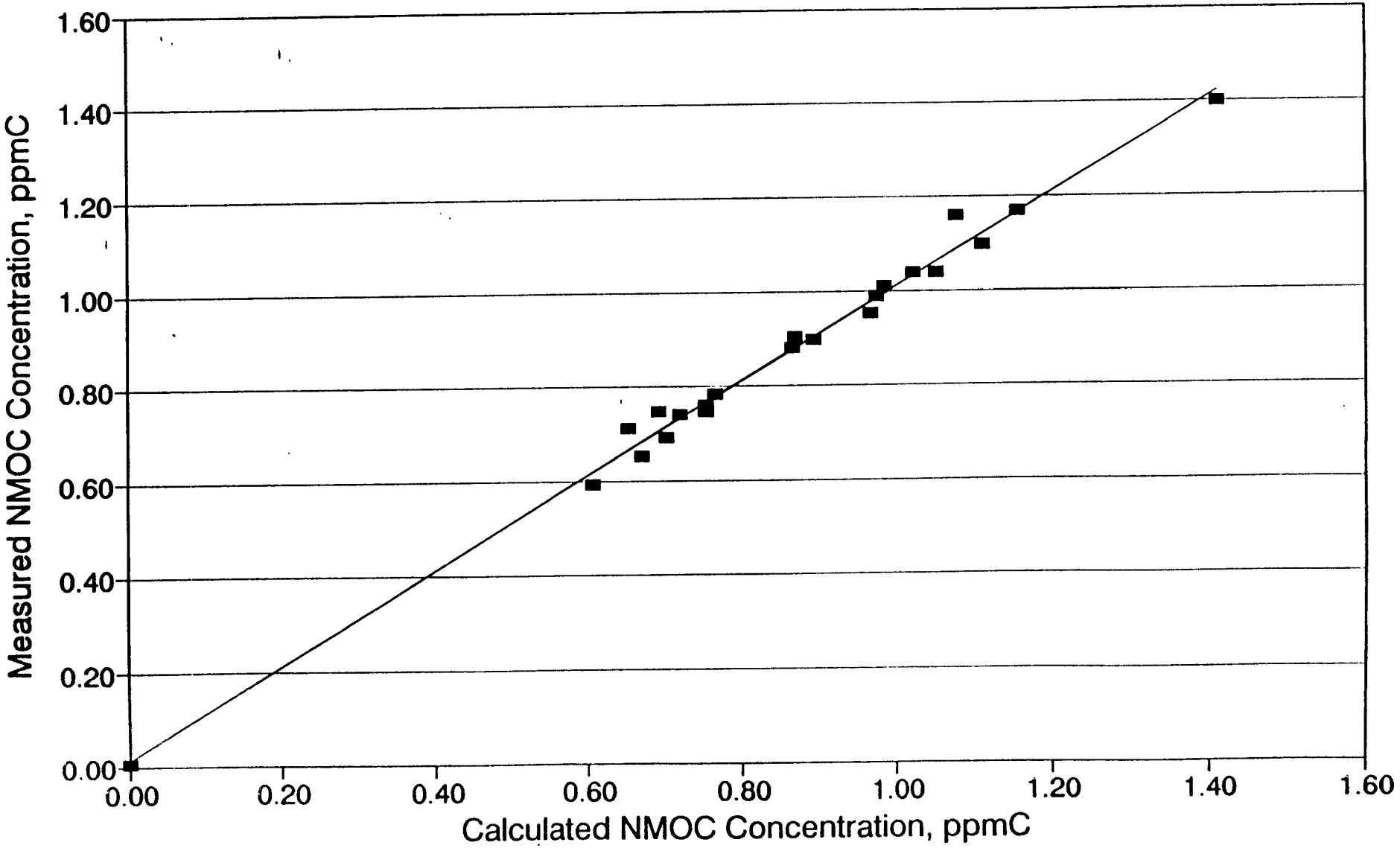


Figure 1-2. In-house quality control results, Channel B.

IN-HOUSE PROPANE QC RESULTS

Channel C



IN-HOUSE PROPANE QC RESULTS

Channel D

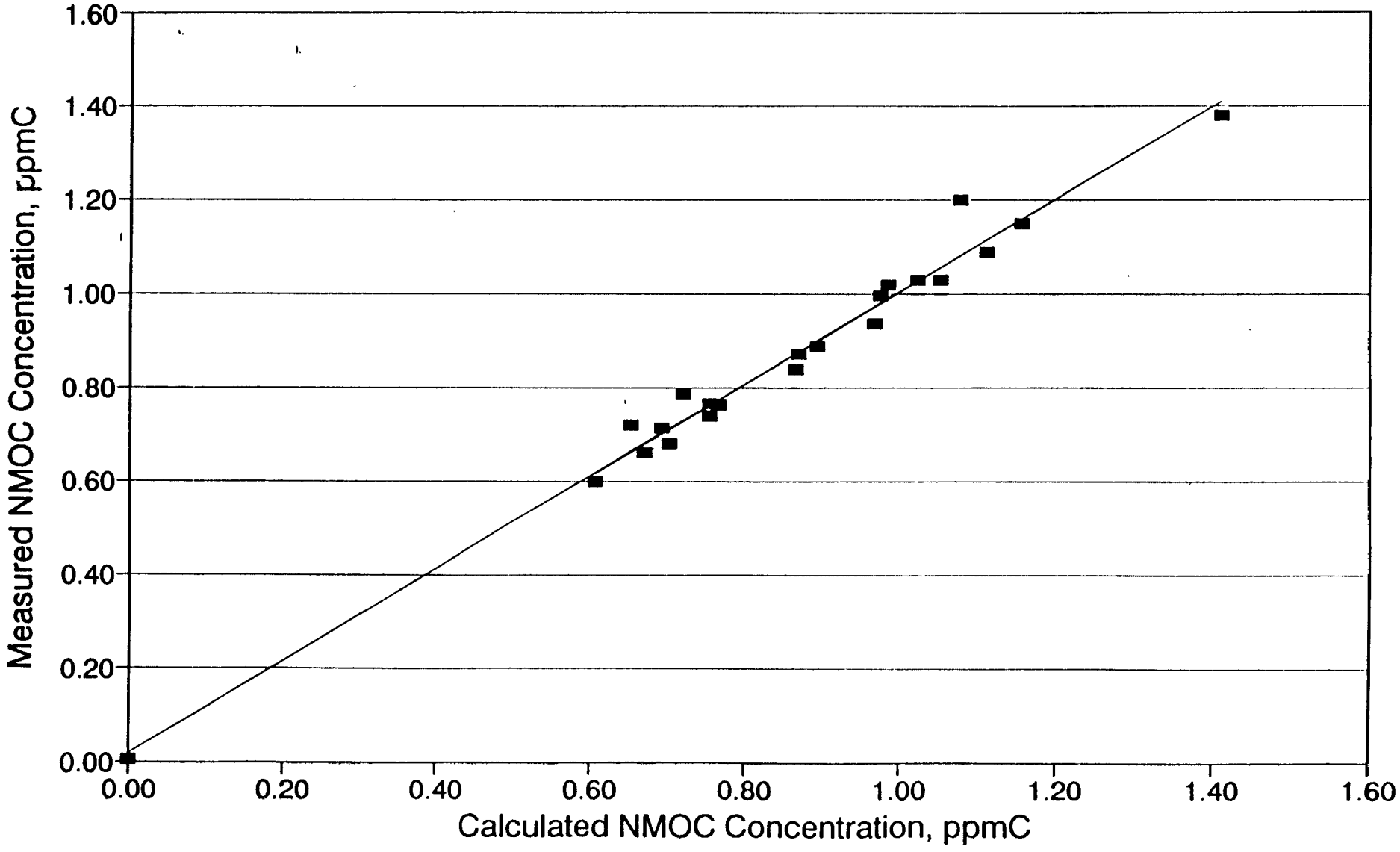


Figure 1-4. In-house quality control results, Channel D.

Table 1-3

Linear Regression Parameters for In-House Quality Control Data

Radian Channel	Cases	Intercept	Slope	Coefficient of Correlation
A	21	0.023610	1.01588	0.983298
B	17	0.010933	1.04250	0.989858
C	22	0.011661	1.000672	0.995431
D	22	0.017274	0.988924	0.990747

concentration determined by each Radian analytical measurement channel as the dependent variable. The concentration range of the in-house quality control samples was 0.000 to 1.411 ppmC. Table 1-3 indicates excellent quality control for each channel. As expected, the intercepts are all near zero, and the slopes and coefficients of correlation are all near 1.0.

External propane audit samples were provided by U.S. EPA through their QA contractor. The propane samples were referenced to NIST propane Certified Reference Material (CRM) 1667B or 1665B. The audit samples were given Radian ID Numbers upon receipt. The average percent bias for the Radian channels was +5.0%, ranging from -3.4 to +24.0 percent. Table 1-4 shows the external audit results.

1.1.5 Other Quality Assurance Measurements

Canister cleanup studies established that there was little carryover of NMOC from one sample to the next, using the canister cleanup apparatus and procedure developed for this study. In over 115 separate determinations, percent cleanup averaged 98.79 percent. Cleanliness was defined in terms of the percent of the NMOC concentration that was removed from each canister considered during the cleanup procedure.

Ten percent (10%) of the NMOC data base was validated by checking data transcriptions from original data sheets to the computerized data for 36 entries per sample. The errors found equal a data base error rate of 0.080 percent. All errors that were identified were corrected.

Table 1-4

External NMOC Audit Samples

Canister No.	Concentration, ppmC					
		Analysis				
	Theoretical	Reference	Radian A	Radian B	Radian C	Radian D
2186	1.970	1.910	1.936	1.933	1.918	1.902
2267	0.450	0.450	0.555	0.558	0.543	0.533
2402	0.450	0.520	0.472	0.492	0.447	0.440
2474	1.980	1.900	1.956	1.934	1.930	1.930

1.2 Three-Hour Air Toxics Monitoring Program

At five sites, NWNJ, PLNJ, B1AL, B2AL, and B3AL, 3-hour NMOC samples were speciated by a GC/MD analytical system for 38 air toxic target compounds for a total of 40 NMOC ambient air samples. After NMOC analysis, the NMOC sample canisters were bled to atmospheric pressure, allowed to equilibrate for at least 18 hours, and then analyzed by GC/MD. Duplicate samples were collected at the sites and analyzed individually by GC/MD. Replicate analyses were performed on one duplicate sample per site. A total of 50 GC/MD analyses were performed, including analysis of duplicate samples and replicate analyses. These data summaries are presented in Appendix H.

1.2.1 Overall Data Summary

Twenty-eight target compounds were identified in the 50 analyses. Chloroform, 1,1,1-trichloroethane, benzene, carbon tetrachloride, toluene, tetrachloroethylene, ethylbenzene, m/p-xylene/bromoform, and o-xylene/ 1,1,2,2-tetrachloroethane were identified in every sample. Concentrations of the target compounds identified ranged from 0.01 ppbv for trichloroethylene to 253.06 ppbv for 1,1,1-trichloroethane. The overall average concentration of the target compounds identified was 1.40 ppbv, averaged over all sites and target compounds. The air toxics data are tabulated in Section 7.0. Results presented include numbers of cases identified, minima, maxima, and means for all target compounds.

1.2.2 Site Results

Overall site mean concentrations were 15.35 ppbv for B1AL, 4.46 ppbv for B2AL, 6.88 ppbv for B3AL, 48.64 ppbv for NWNJ, and 39.531 ppbv for PLNJ averaged over all target compounds identified. These air toxic data are presented in Section 7.0.

1.2.3 Gas Chromatography/Mass Spectrometry (GC/MS) Confirmation Results

Confirmation of compounds identified was based on five GC/MS analyses of the 3-hour air toxics samples, one from each site location. The GC/MS analyses confirmed 86.66% of the GC/MD identifications. The results are summarized in Table 1-5, showing 16.36% positive GC/MD-positive GC/MS confirmation, 11.52% positive GC/MD-negative GC/MS confirmation, 1.82% negative GC/MD-positive GC/MS comparison, and 70.30% negative GC/MD-negative GC/MS comparisons. Comparisons labeled "negative GC/MD-positive GC/MS" refer to specific samples in which a compound was not identified by GC/MD but positively identified by GC/MS analysis. Comparisons labeled "positive GC/MD-negative GC/MS" indicate specific samples in which a compound was positively identified by GC/MD but not identified by GC/MS analysis. Because GC/MD is more sensitive than GC/MS, this last comparison is of limited value. There were 39 cases where the GC/MD identified a compound at a concentration below the detection limit of the GC/MS.

1.2.4 Precision

Sampling and analytical precision of 3-hour air toxics samples was estimated by analyzing duplicate samples. In terms of overall average absolute percent difference, the sampling and analysis precision was 16.01 percent.

Analytical precision was estimated based on the results of one repeated analysis from one of the duplicate sample canisters from each site. The analytical precision measured by the overall average absolute percent difference was 18.73 percent. Both the sampling and analytical precision results are excellent in view of the low concentration range found in this study.

Both the duplicate sample and repeated analyses results are discussed in Section 7.6.

Table 1-5

Compound Identification Confirmation

GC/MD versus GC/MS Comparison*	Cases	Percentage
Positive GC/MD - Positive GC/MS	27	16.36
Positive GC/MD - Negative GC/MS	19	11.52
Negative GC/MD - Positive GC/MS	3	1.82
Negative GC/MD - Negative GC/MS	116	70.30
Total	165	100.00
Total compound identification confirmation = 16.36% + 70.30% = 86.66%		

*There were 39 cases where the GC/MD identified a compound at a concentration below the detection limit of the GC/MS.

1.2.5 External Audit

In the past years, the external audit for the 3-hour air toxics compounds was conducted in conjunction with the Urban Air Toxics Program (UATMP). Because the UATMP was not being conducted during the 1992 NMOC program, the external audit sample for the 3-hour air toxics program was an external audit sample for the SNMOC program.

The external audit sample contained 7 compounds, five of which were target compounds for the 3-hour air toxic analyses. For these five compounds, percent differences range from -46.47% (for toluene) to +22.16% (for o-xylene/1,1,2,2-tetrachloroethane) with an average of -19.63 percent.

1.3 Carbonyl

Carbonyl samples were taken at two sites, NWNJ, and PLNJ, for the 1992 monitoring season. Three-hour samples were taken from 6:00 a.m. to 9:00 a.m. simultaneously with the NMOC samples at the two sites. Samples were collected in duplicate during September 1992. The carbonyl sampler has its own inlet manifold, capillary, critical orifice and separate Metal-Bellows® pump. The inlet manifold leads into an ozone scrubber and then splits into duplicate 2,4-dinitrophenylhydrazine (DNPH) coated parallel cartridges.

Carbonyl concentrations ranged from 0.72 ppbv for valeraldehyde at NWNJ to 38.93 ppbv for acetone at PLNJ. Of the 16 targeted carbonyl analytes, only 2,5-dimethylbenzaldehyde was not detected in any of the samples.

1.4 SNMOC

1.4.1 Introduction and Data Summary

Eleven sites participated in the 1992 SNMOC Monitoring Program. Samples were collected from 6:00 a.m. to 9:00 a.m. local time, Monday through Friday from 22 June through 30 September 1992. Eight sites that participated in the NMOC Monitoring Program also had speciation analysis performed on ten randomly selected samples. Site codes are listed in Appendix A. Table 1-6 and 1-7 give the details of the sample completeness results for the program and option sites, respectively. Table 1-8 lists the 77 target compounds for the SNMOC program.

1.4.2 Calibration

Certified standards from Scott® Speciality Gases were used to prepare analytical calibration standards. Gas-tight syringes were used to inject aliquots of the certified standard into cleaned, evacuated SUMMA® canisters. The canisters were then filled to ambient pressure with cleaned, humidified air using a standards preparation flow dilution system. The canister was then pressurized with nitrogen to approximately 35 psig using a precision canister dilution system.

The analytical system was calibrated monthly by analyzing three propane standards and a system blank of cleaned, humidified air. The calibration was considered valid if the coefficient of correlation of the four points was at least 0.995. At least squares linear regression calculation was performed for the data from each detector. The resulting slopes were used as the propane response factors. Table 1-9 summarizes the monthly propane calibration information.

Prior to sample analysis, a quality control standard was analyzed to ensure the validity of the current monthly response factors. A propane concentration bias of no more than 30% was considered acceptable. For the 1992 SNMOC program,

Table 1-6

Samples Analyzed for 1992 SNMOC Program Sites

Site	Total Duplicate Samples	Total Replicate Analyses	Total Single Samples	Total Valid Sampling Events	Total Valid Samples	Total Analyses Reported
B1AL	16	12	60	68	76	88
B2AL	20	12	61	71	81	93
B3AL	14	10	42	49	56	66
BMTX	20	10	58	68	78	88
BRLA	18	12	38	47	56	68
CHNC	18	10	44	53	62	72
DLTX	18	10	60	69	78	88
EPTX	18	10	61	70	79	89
FWTX	20	10	58	68	78	88
JUMX	14	8	55	62	69	77
MIFL	16	10	48	56	64	74

Table 1-7

Samples Analyzed for 1992 SNMOC Option Sites

Site	Total Duplicate Samples	Total Replicate analyses	Total Single Samples	Total Valid Samples	Total Analyses Reported
L1NY	2	1	7	9	10
MNY	2	1	6	8	9
NWNJ	4	2	5	9	11
PLNJ	2	1	7	9	10
R1NC	2	1	7	9	10
S2UT	2	1	7	9	10
S3UT	2	1	7	9	10
WSNC	2	1	7	9	10

Table 1-8

1992 Ambient Air Hydrocarbon Program Target List

Compound	
Ethylene	2-Methylhexane (Isoheptane)
Acetylene	2,3-Dimethylpentane
Ethane	3-Methylhexane
Propylene	1-Heptene
Propane	2,2,4-Trimethylpentane
Propyne	n-Heptane
Isobutane	Methylcyclohexane
Isobutene	2,2,3-Trimethylpentane
1-Butene	2,3,4-Trimethylpentane
1,3-Butadiene	Toluene
n-Butane	2-Methylheptane
t-2-Butene	3-Methylheptane
c-2-Butene	1-Octene
3-Methyl-1-Butene	n-Octane
Isopentane	Ethylbenzene
1-Pentene	p,m-Xylene
2-Methyl-1-Butene	Styrene
n-Pentane	o-Xylene
Isoprene	1-Nonene
t-2-Pentene	n-Nonane
c-2-Pentene	Isopropylbenzene
2-Methyl-2-Butene	n-Propylbenzene
2,2-Dimethylbutane (Neohexane)	α-Pinene
Cyclopentene	m-Ethyltoluene
4-Methyl-1-Pentene	p-Ethyltoluene
2,3-Dimethylbutane	1,3,5-Trimethylbenzene
Cyclopentane	o-Ethyltoluene
2-Methylpentane (Isohexane)	1,2,4-Trimethylbenzene
3-Methylpentane	1-Decene
2-Methyl-1-Pentene	n-Decane
1-Hexene	1,2,3-Trimethylbenzene
2-Ethyl-1-Butene	p-Diethylbenzene
n-Hexane	1-Undecene
t-2-Hexene	n-Undecane
c-2-Hexene	Dodecene
Methylcyclopentane	n-Dodecane
2,4-Dimethylpentane	Tridecene
Benzene	n-Tridecane
Cyclohexane	

Table 1-9

Summary of Monthly Propane Calibration Curves

Calibration Date	Column A		Column B	
	Correlation Coeffecient	Response Factor (AC/n1-C)	Correlation Coeffecient	Response Factor (AC/n1-C)
6-23-92	0.9996	1776.6	0.9987	1421.2
7-23-92	1.0000	1803.7	1.0000	1435.9
8-23-92	1.0000	2017.5	1.0000	1628.1
9-25-92	1.0000	1937.6	1.0000	1566.5
10-23-92	1.0000	1813.5	1.0000	1415.7

the 30% criteria was met on the first standard analysis for every sample analysis day.

Following the analysis of the QC standard, a sample of cleaned humidified air was analyzed to assess the presence of any potential contamination.

1.4.3 SNMOC Precision

Analytical precision was determined by repeated analysis of 123 samples. These samples were a single canister of a duplicate collection. For those concentrations above the detection limit, the average concentration ranged from 0.60 ppbC (for isopropylbenzene) to 70.78 ppbC (for n-undecane).

Overall precision, including sampling and analysis variability, was determined by analysis of 105 duplicate site samples, simultaneously collected in two canisters from a common sampling system (a total of 210 canister samples). Average concentrations ranged from 0.71 ppbC for 1-tridecene to 63.86 ppbC for isopentane.

1.4.4 Accuracy

Three external audit samples were provided by U.S. EPA through their QA contractor. Percent bias ranged from -38.5% to 10.0 percent. Radian participated in the National Center for Atmospheric Research (NCAR) International Hydrocarbon Intercomparison Experiment. The audit results reported by NCAR showed a percent bias of less than 15% for all 16 compounds included in the audit.

2.0 NMOC DATA SUMMARY

This section presents the data summary for the 1992 NMOC Monitoring Program conducted during June, July, August, and September. Daily NMOC concentrations and other pertinent monitoring data are given by site in Appendix C. The majority of the data presented in this section summarize the NMOC concentrations measured for samples collected at eight sites throughout the continental United States. Sites were selected in urban and/or industrial locations; they are described in Appendix A. The site codes for the 1992 NMOC Monitoring Program are listed in Appendix A and are used throughout the report to identify the sites. Samples were collected in 6-liter (L) stainless steel canisters by local site operators trained on-site by Radian Corporation personnel. The sampling procedure was described in detailed written instructions and provided to the site operators. The sampling procedure instructions also appear in Section 3.1.2. Analytical measurements of the samples collected were made in the Radian Corporation Research Triangle Park (North Carolina) laboratory according to the PDFID method TO-12[1]. The complete PDFID methodology is presented in Appendix B.

The concentration of oxides of nitrogen (NO_x), site temperature, barometric pressure, wind direction, and weather conditions were provided on the field sampling forms by site personnel at the time of sampling. These data were recorded in the 1992 NMOC data base, but are not presented in this report because they were not measured by Radian equipment or personnel, nor were the data subjected to project quality assurance procedures.

Table 2-1 lists the NMOC Monitoring Program completeness results by site code. The scheduling of sample days and the scheduling of duplicate analyses is given in the QAPP[2]. For the 1992 NMOC sites, completeness was 90 percent. A complete listing of invalid samples and the reasons for the invalidation are given in Appendix D.

Table 2-1

1992 NMOC Completeness Results

Site Location	Radian Site Code	Scheduled Sampling Days	Total Scheduled Duplicate Samples	Total Scheduled Canister Analyses	Total Valid Duplicate Samples	Total Valid Samples	Percent Complete
Long Island, NY	LINY	67	9	76	10	77	101.32
New York, NY	MNY	66	9	75	8	60	80.00
Newark, NJ	NWNJ	69	9	78	8	64	82.05
Plainfield, NJ	PLNJ	70	9	79	9	77	97.47
Raleigh, NC	R1NC	70	9	79	9	74	93.67
Salt Lake City, UT	S2UT	69	9	78	8	65	83.33
Salt Lake City, UT	S3UT	71	9	80	9	72	90.00
Winston-Salem, NC	WSNC	71	9	80	9	78	97.50
OVERALL		553	72	625	70	567	90.72

Overall completeness figures for the 1992 NMOC Program show 90.7% complete. This compares with 94.1% in 1991, 95.8% in 1990, 95.5% in 1989, 93.4% in 1988, 95.0% complete in 1987, 96.8% complete in 1986, 95.8% complete in 1985 and 90.6% complete in 1984.[3,4,5,6,7,8,9,10]

Completeness was defined as the percentage of samples, scheduled in the QAPP[2], that were collected and analyzed as valid samples, beginning with the first valid sample and ending with the last scheduled sample.

Table 2-2 summarizes statistics by sites. All sites collected an integrated sample from 6:00 a.m. to 9:00 a.m. The overall average of the NMOC concentration is seen to be 0.490 ppmC.

In Table 2-2, the means presented are the arithmetic averages of the NMOC concentrations at each site. The numbers given for standard deviation, skewness, and kurtosis are the second, third, and fourth moments, respectively about the arithmetic means. A skewness value greater than zero applies to distributions having a longer tail to the right. A distribution that is normally distributed would have a kurtosis of 3.0. A distribution more peaked (or pointed) than a normal distribution, having the same variance, would have a kurtosis greater than 3.0. All the kurtosis figures listed in this report are zero centered, which means that 3.0 has been subtracted from the fourth moment to give a reported kurtosis of 0.0 for a symmetrical distribution. The Shapiro-Wilk statistic (W) tests the normality of the data and ranges from zero to one. The closer the statistic is to one, the better the fit of the data to normality. Comparing W for a site in Tables 2-2 and 2-3 shows that the logarithmic transformation of the NMOC data make the logarithm of NMOC concentrations to be a more nearly normal distribution.

NMOC monitoring data can, therefore, be better characterized by a lognormal distribution than by a normal distribution, considering the findings of this and previous NMOC programs.[3,4,5,6,7,8,9,10] Table 2-3 summarizes the 1992 NMOC

Table 2-2

NMOC Overall Statistics, by Site

Site	Cases	Concentration, ppmC							W[a]
		Min	Max	Median	Mean	Std Dev	Skew-ness	Kurt-osis	
LINY	77	0.071	1.168	0.227	0.315	0.225	1.269	1.633	0.866
MNY	60	0.128	3.730	0.448	0.637	0.663	3.141	10.694	0.605
NWNJ	64	0.188	4.780	0.520	0.952	0.980	2.081	3.952	0.686
PLNJ	77	0.070	3.347	0.420	0.563	0.559	2.953	10.932	0.705
R1NC	74	0.055	0.692	0.186	0.219	0.131	1.560	2.695	0.858
S2UT	65	0.193	1.648	0.662	0.742	0.313	0.586	-0.207	0.953
S3UT	72	0.114	1.090	0.453	0.488	0.228	0.735	0.112	0.937
WSNC	78	0.047	1.220	0.208	0.264	0.207	1.970	5.258	0.817
OVERALL	567	0.047	4.780	0.388	0.506	0.531	3.685	18.304	0.655

[a]Shapiro-Wilk statistic to test normality of data.

Table 2-3

1992 LNMOC[a] Overall Statistics, by Site

Site	Cases	Concentration, ppmC					Concentration, ln(ppmC)		W[e]
		Min	Max	Median	Mean[b]	Mode	Mu[c]	Sigma[d]	
LINY	77	0.071	1.168	0.227	0.317	0.098	-1.395	0.702	0.948
MNY	60	0.128	3.730	0.448	0.605	0.370	-0.738	0.687	0.932
NWNJ	64	0.188	4.780	0.520	0.907	0.465	-0.403	0.782	0.893
PLNJ	77	0.070	3.347	0.420	0.562	0.099	-0.915	0.823	0.977
R1NC	74	0.055	0.692	0.186	0.219	0.101	-1.670	0.546	0.980
S2UT	65	0.193	1.648	0.662	0.747	0.457	-0.391	0.445	0.972
S3UT	72	0.114	1.090	0.453	0.492	0.362	-0.830	0.491	0.972
WSNC	78	0.047	1.220	0.208	0.264	0.106	-1.580	0.703	0.977
OVERALL	567	0.047	4.780	0.388	0.498	0.106	-1.023	0.808	0.976

[a]LNMOC = ln(NMOC), when NMOC is in ppmC.

[b]Mean = exp (Mu + Sigma^2/2).

[c]Mu is the mean of ln(NMOC). e^{MU} is the geometric mean.

[d]Sigma is the standard deviation of ln(NMOC). e^{SIGMA} is called the geometric standard deviation.

[e]Shapiro-Wilk statistic to test normality of data.

data using the definitions that characterize a lognormal distribution overall and for each site. MU and SIGMA are the mean and standard deviation, respectively, of the logarithm of NMOC to the Napierian base e. The geometric mean is e raised to the power MU; the geometric standard deviation is e raised to the power SIGMA. The mode is the most frequently occurring NMOC value for a continuous probability distribution function.

Information listed in Appendix A includes the location of the site, street address as well as the Universal Transverse Mercator (UTM) coordinates for the site, the site code used throughout this report, and the AIRS Number. Appendix A gives the AIRS printouts for all the sites that are in the system for 1992.

Appendix C gives the daily NMOC concentration data listed chronologically for the entire sampling season. In addition, figures are given for each site in which NMOC concentrations in ppmC are plotted versus the 1992 Julian date on which the sample was taken. Data tables for each site include the following:

- calendar date sampled;
- Julian date samples;
- weekday sample (M, T, W, H, F);
- sample ID number, assigned consecutively upon receipt of the sample;
- sample canister number;
- Radian analytical measurement channel; and
- NMOC concentration in ppmC.

Appendix D lists invalidated or missing samples. Table D-1 lists these data chronologically for the sites participating in the NMOC program, while Table D-2 lists these data for the sites participating in the SNMOC program. For each

sample, the tables list the site code, the date of the missing or invalid sample, a brief description of the possible cause of the invalid or missing sample, and the assigned cause for the failure.

3.0 NMOC TECHNICAL NOTES

This section summarizes descriptions of the installation and operation of the field sampling equipment, a summary of the analytical equipment and procedures for NMOC measurement, and a description of the canister cleanup equipment and procedures.

3.1 NMOC Field Sampling Equipment

Two types (A and B) of field sampling equipment were used to collect ambient air samples for NMOC measurement. In Type A, ambient air is drawn through a sintered stainless steel filter (2 micron) and critical orifice by a Metal Bellows® pump and delivered to a SUMMA® canister. In Type B, the ambient air is drawn through a sintered stainless steel filter then through a fine adjust micrometering valve, a glass rotameter, a pump, and delivered to a SUMMA® canister. Both the samplers' components are made of stainless steel. Figures 3-1 and 3-2 are schematic diagrams of the NMOC sampling systems.

3.1.1 Installation

NMOC sampler installation configurations were site dependent. All field sites were installed by or under the direction of Radian personnel. Installation requirements included a temperature-controlled environment (70° to 86°F), close proximity to the atmosphere to be sampled, and noncontaminating sampler connections. Glass tubing or gas-chromatographic-grade stainless steel tubing and stainless steel fittings are the preferred materials of construction for all connections contacting the sample. Typical sampler installations involved three configurations including slip stream connection off of a constant flow glass manifold, a slipstream connection (prior to the air monitoring station's NO_x analyzer) off of a stainless steel manifold with a bypass pump, or separate but collocated NMOC and NO_x sample inlet lines. For sites where the distance between the sample inlet and the

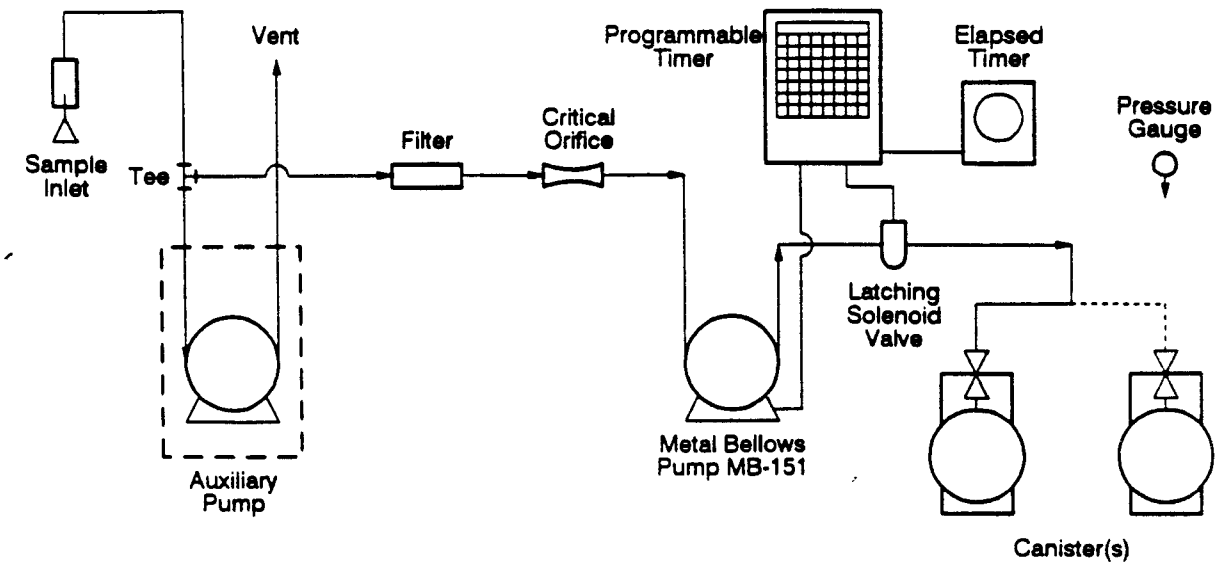


Figure 3-1. Style A Sampling System
for Collecting 3-hour Integrated Ambient Air Samples

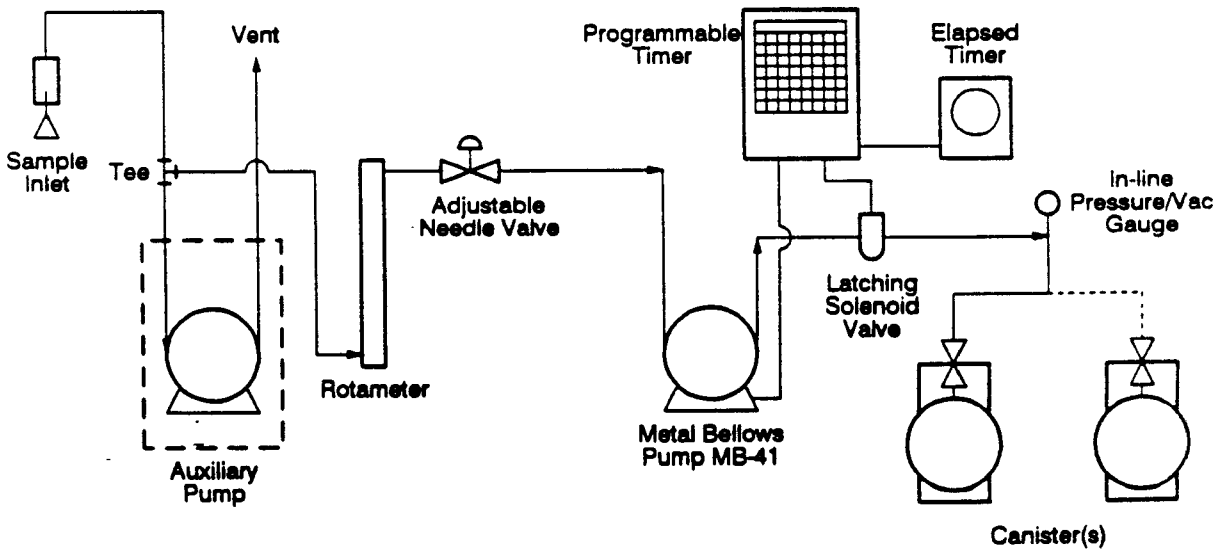


Figure 3-2. Style B Sampling System
for Collecting 3-hour Integrated Ambient Air Samples

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stainless steel probe was greater than eight feet, an auxiliary (by-pass) pump, as shown in Figures 3-1 and 3-2, was used. The auxiliary pump ensures that the air in the sample line is representative of the ambient air being sampled by pulling an excess of sample air past in slipstream connection.

The critical orifice in the Style A sampler (Figure 3-1) was sized to maintain a constant collection flow rate that allowed a 6-L stainless steel canister to be taken from 0.5 mm Hg vacuum (initial pressure) to about 15 psig (final pressure) in three hours. When duplicate samples were taken, the critical orifice used for single sample collection was replaced with an orifice sized to accommodate two 6-L canisters during the 3-hour sampling period.

For the Style B sampling system (Figure 3-2), the adjustable micro-metering valve was used to set a collection flow rate as indicated on the rotameter that allowed a 6-L stainless steel canister to be taken from the 0.5 mm Hg vacuum to about 15 psig in three hours. For duplicate samples, the indicated flow rate was doubled in order to accommodate two 6-L canisters during the sampling period. The rotameter settings for single and duplicate samples were determined in the lab using a bubble flow meter and were provided to the operators at installation.

3.1.2 Operation

3.1.2.1 Presampling - Style A System

The following instructions pertain to the sampling operation prior to collection of the field sample.

1. Verify timer program (see timer instructions). Set to MANUAL position to leak check sampling system. Once the system passes the leak check, turn timer to AUTO position.

2. With no canisters connected to the sampling system, turn the timer switch to the MANUAL position.

3. Disconnect the sample inlet from the top of the orifice/filter assembly mounted on the pump inlet. Connect the rotameter to the top of the orifice/filter assembly. Tighten Swagelok® (1/4") fitting securely with a wrench. Do not over-tighten.

4. Turn timer switch ON. Do not turn the power off and on rapidly. Wait 20 seconds between cycles to prevent premature timer/solenoid failure. The pump should run and the latching valve should open. Verify that the rotameter reading is approximately the same (±15%) as the reading obtained during installation as recommended on the orifice tag. If the rotameter reading is not correct, see the troubleshooting instructions.

5. Allow the pump to run for at least 20 seconds, then press the timer OFF button.

6. Connect a cleaned, evacuated canister to the sampling system. If duplicate samples are to be collected, remove the plug from the second port of the tee and connect a second canister to the sampling system. Remove the orifice assembly marked with an "S," denoting a single orifice. Install the orifice assembly marked with a "D," denoting a double orifice. Replace the filter holder on the "D" orifice. After obtaining scheduled duplicate samples, replace the plug and the "S" orifice assembly to return to single sample collection status.

7. With the pump off, open completely the valve on the canister (or on one of the canisters if two are connected) and verify that no flow is registered on the rotameter. If any flow is detected by the rotameter, immediately close the canister valve and see the troubleshooting instructions.

8. If no flow is observed, disconnect the rotameter and reconnect the inlet sample line to the filter assembly. If two canisters are connected, completely open the valve on the second canister.

9. Reverify that the canister valve(s) is (are) completely open and the timer is properly set for sampling from 6 a.m. to 9 a.m. the next weekday. Set timer to AUTO mode.

10. Reset the elapsed time counter.

3.1.2.2 Presampling - Style B System

The following instructions pertain to the sampling operation prior to collection of the field sample.

1. Verify timer program (see timer instructions). Set to MANUAL position to leak check sampling system. Once the system passes the leak check, turn timer to AUTO position.

2. With no canisters connected to the sampling system, turn the timer switch to the MANUAL position.

3. Turn timer switch ON. Do not turn the power off and on rapidly. Wait 20 seconds between cycles to prevent premature timer/ solenoid failure. The pump should run and the latching valve should open (audible click with 2 to 5 seconds delay). Verify that the rotameter reading is approximately the same (±15%) as the reading obtained during installation as recommended in the installation instructions. If the duplicate samples are to be collected set the rotameter to the duplicate flow rate. If the rotameter reading is not correct, see the troubleshooting instructions.

5. Allow the pump to run for at least 20 seconds, then press the timer OFF button.

6. Connect a cleaned, evacuated canister to the sampling system. If duplicate samples are to be collected, remove the plug from the second port of the tee and connect a second canister to the sampling system.

7. With the pump off, open completely the valve on the canister (or on one of the canisters if two are connected) and verify that a 29" vacuum exists. Close the can and observe the vacuum gauge. If the vacuum begins to drop see the troubleshooting instructions, a leak probably exists.

8. If two canisters are connected, completely open the valve on the second canister.

9. Reverify that the canister valve(s) is (are) completely open and the timer is properly set for sampling from 6 a.m. to 9 a.m. the next weekday. Set timer to AUTO mode.

10. Reset the elapsed time counter.

3.1.2.3 Postsampling

The instructions that follow outline the NMOC postsampling operation procedures in the field.

1. Close the canister valve(s) firmly.

2. Record the pressure reading(s) on the data sheet(s). Disconnect the canister(s). If the pressure reading is not at least 11 psig, see the troubleshooting instructions.

3. Fill in the required information on the NMOC SAMPLING FIELD DATA FORM. PLEASE PRESS HARD AND WRITE WITH A BALLPOINT PEN; YOU ARE MAKING THREE COPIES. (see Figure 3-3).

4. Verify elapsed time counter reading equals 3 hours.

5. Verify that the timer shows the correct time setting. If not, note that fact on the sample form along with any information pertaining to the possible cause. Reset the timer to the correct time, if necessary.

6. Verify that the canister valves are closed firmly. Do not over-tighten them. Put the protective cap(s) on the valve(s) and prepare the canister(s) for shipment to the Radian, RTP laboratory.

3.1.3 Troubleshooting Instructions

A list of troubleshooting instructions was given to each field site during the site installation and operator training. Typical problems encountered with the field sampling apparatus included: loose fittings, misprogrammed timer, or clogged orifices. To minimize downtime, field site operators were encouraged to relay sampling problems to the Radian laboratory daily by telephone. Most sampling problems were addressed promptly through these telephone discussions.

RADIAN CORPORATION

NMOC SAMPLING FIELD DATA FORM

Site Code : _____ SAROAD # : __ __ · __ __ __ __ · __ __ __ · __ __ __

Site Location : City: _____ State: _____

Sample Collection Date : _____ Sampling Period : _____

Operator : _____ Elapsed Time : _____

Final Canister Pressure (psig) : _____

Sample Canister Number : _____ Side : _____

Sample Duplicate for this Date : Yes☐ No☐

If yes, Duplicate Canister Number : _____

NOx Analyzer Operating? Yes☐ No☐

If yes, Average Reading (ppmv as NOx) : _____

Average Wind Speed : _____ Average Wind Direction : _____

Rotameter Indicated Flow Rate : _____ Orifice Number : _____

Average Barometric Pressure (mm Hg or inches Hg) : _____

Ambient Temperature (°F) : _____ Relative Humidity : _____

THC Model (if available) : _____ Average THC : _____

Sky/Weather Conditions : _____

_____

Site Conditions/Remarks : _____

_____

_____

Canister Number : _____

Initial Canister Vacuum : _____

_____

Received By : _____

Date : _____

Sample Validity : _____

If Invalid, Reason : _____

_____

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Figure 3-3. NMOC Sampling Field Data Form

3.1.4 Sampler Performance for 1992

The NMOC sampler was modified in 1989 to improve performance. This modification involved replacing the mechanical timer previously used with an electronic version. The electronic timer improves sample integration. An elapsed time meter was added to the sampler to verify sample collection duration. This system was used as the Style A sampler during the 1992 program. The NMOC sampling system was also modified for the 1992 season. The Style B system eliminated the use of orifices and instead used an adjustable micro-metering valve and in-line rotameter.

In addition to the modifications, all samplers and canisters were subjected to a preseason QC check to ensure field performance. All orifices were checked against the removable rotameter provided with each Style A sampling system, and referenced to a primary standard (bubble flowmeter). For the Style B sampler, the in-line rotameters were also calibrated against a primary standard (bubble flowmeter). Prior to field installation, each sampler was operated in the laboratory to establish an expected final sample pressure range. For the Style A samplers, two single orifices and one double orifice were tested for each sampler kit.

Due to the preseason checks and modifications, the NMOC sampler performance was improved for the 1992 sampling season. This assessment is based on the consistency of the final sample pressures on a site-specific basis (see Section 4.6). The sampler performance in terms of successful sample collection (i.e., completeness) was comparable to previous years. Overall completeness from all sites averaged 90.7 percent. The site-specific completeness ranged from 80.0% for MNY to 101.3% for LINY.

Invalidated samples were primarily due to operator error and equipment malfunctions. Completeness can be improved at all sites through greater attention to sampling procedure, and by ensuring that trained site personnel are available. A

further improvement in completeness may be possible as site operators gain familiarity with the electronic timer. Revised sampler operating instructions will focus additional attention on timer programming and operation, and will include a daily checklist to eliminate common operator errors.

A total of 114 invalidated/missing samples were recorded in the 1992 NMOC Monitoring Program (this included 62 samples for NMOC and 52 samples for SNMOC). Appendix D lists the invalidated/missing samples in chronological order, along with the reason for invalidation. Avoidable operator error accounts for 13% and equipment problems account for 73% of the invalidated samples. Thirteen percent were missed sample collections for unknown reasons. The remaining 1% reflects missed sample collections due to site inaccessibility.

3.1.5 Field Documentation

The field sample collection information was documented by the site operator on pre-printed multiple part forms. Figure 3-3 is an example NMOC Sampling Field Data Form. Each canister sent to the field was accompanied by this form. A copy of the field data form was retained by the site operator for the site notebook. Figure 3-4 is the Invalid Sample Form. This form was completed by the site operator to document the reasons for a missed sample or an invalid field sample collection.

3.2 NMOC Analysis

The NMOC analysis equipment and the analysis procedure are described in detail in Appendix B. A brief description of the equipment and operating procedure used in this study follows.

RADIAN CORPORATION

V-

NMOC INVALID SAMPLE FORM

Site Code : _____ SAROAD # : __ __ __ __ __ . __ __ __ . __ __ __

City : _____ State : _____

Sample Collection Date : _____ Operator : _____

Sample Canister Number : _____

Sample Duplicate for this Date : Yes ☐ No ☐

If Yes, Duplicate Canister Number : _____

Reason for Invalid or Missed Sample : _____

_____

_____

Average NOx Analyzer Reading for this Collection Date : _____

Wind Speed : _____ Wind Direction : _____

Rotameter Indicated Flow Rate : _____ Orifice Number : _____

Average Barometric Pressure (mm Hg or inches Hg) : _____

Ambient Temperature (°F) : _____ Relative Humidity : _____

Sky/Weather Conditions : _____

_____

_____

Received By : _____

Date : _____

Action Taken : _____

_____

Resolution : _____

_____

Field Invalid or In-house Invalid

0781188R

Figure 3-4. NMOC Invalid Sample Form

3.2.1 Instrumentation

Two gas chromatographs were used by Radian. Each was a dual-channel Hewlett-Packard Model 5880 (HP-5880) using flame ionization detection (FID). NMOC instrument Channels A and B refer to the two FIDs on one HP-5880 unit, and Channels C and D refer to the two FIDs on the other HP-5880 unit. These chromatographs were configured for PDFID analysis, consistent with the reference system (EPA-QAD instrument), described in Appendix B.

3.2.2 Hewlett-Packard, Model 5880, Gas Chromatograph Operating Conditions

The sample trap consisted of 30 cm of 1/8-inch outside diameter (o.d.) stainless steel tubing, packed with 60/80 mesh glass beads.

Three support gases were used for PDFID analysis: helium, hydrogen, and hydrocarbon-free air.

The operating temperatures of the HP-5880 were controlled for the PDFID analysis. The FID and auxiliary area were controlled at 250°C and 90°C, respectively. The oven temperature was programmed from 30°C to 90°C at a rate of 30°C per minute for 4 minutes, holding at 90°C for the fourth minute. Oven and integration parameters were controlled by Hewlett-Packard HP Level 4 programmable integrators. A complete listing of the integrator programming sequence for NMOC measurement by the PDFID method is given in Appendix E.

3.2.3 NMOC Analytical Technique

The modified HP-5880, dual-FID chromatographs were operated during the 1992 study according to a project specific Standard Operating Procedure (SOP). Further description is given below to help explain the analytical apparatus and procedure.

The six-port valve shown in Figure 3-5 was installed in the auxiliary heated zone of the HP-5880 and was pneumatically actuated using chromatographic valve control signals to apply either compressed air or vacuum to the valve. The sample trap itself was located inside the chromatograph's column oven. A section of 1/8-inch o.d. stainless steel tubing was sized to a length that prevented pressure surges from extinguishing the FID flame. This length was determined experimentally and differs for each chromatograph and for each channel within chromatographs. Although the length of tubing effectively substitutes for the pressure restriction provided by a column, it does not perform the separation function of a column.

During sample trapping, an excess of sample gas flow from the canister was maintained to ensure back diffusion of room air into the trap did not occur. A pressure change of 80 mm Hg in a 1.7-L vacuum reservoir was used to gauge and control the volume of sample gas cryogenically trapped. After the trapping cycle was complete, the HP-5880 program shown in Appendix B was initiated. When the program triggered a horn emitting an audible beep, the cryogen was removed from the trap and the oven door was closed. The chromatographic program then assumed control of raising the oven temperature, at the preset rate, to release the trapped sample to the FID, and set up the integration parameters.

3.3 Canister Cleanup System

A cleanup cycle consisted of first pulling a vacuum of 0.5 mm Hg absolute pressure in the canister, followed by pressurizing the canister to 20 psig with cleaned, dried air that had been humidified. This cycle was repeated two more times during the canister cleanup procedure. The cleanness of the canister was qualified by PDFID analysis. Upon meeting the cleanness criterion of 20 ppbC, the canister was evacuated to 0.5 mm Hg absolute pressure a fourth time, in preparation for shipment to the site.

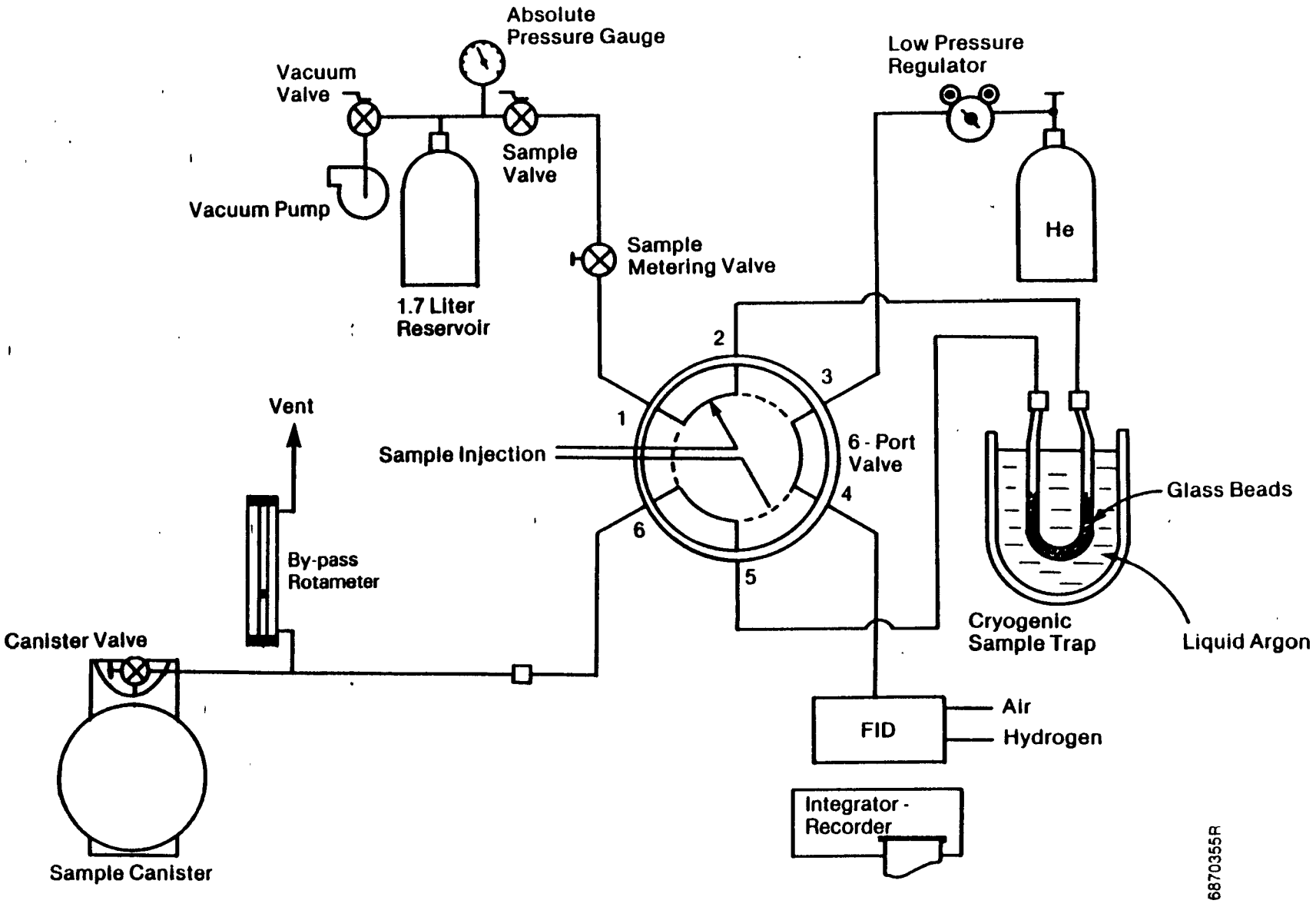

Figure 3-5. NMOC analytical equipment.

3.3.1 Canister Cleanup Equipment

A canister cleanup system was developed and used to prepare sample canisters for reuse after analysis. A diagram of the system is shown in Figure 3-6. An oil-free compressor with a 12-gallon reservoir provided source air for the system. The oil-free compressor was chosen to minimize hydrocarbon contamination. A coalescing filter provided water mist and particulate matter removal down to a particle size of one micron. Permeation dryers removed water vapor from the compressor source air. These permeation dryers were followed by moisture indicators to show detectable moisture in the air leaving the dryer. The moisture indicators never showed any water, indicating that the permeation dryers effectively removed all of the water vapor.

Air was then passed through catalytic oxidizers to destroy residual hydrocarbons. The oxidizers were followed by in-line filters for secondary particulate matter removal, and by a cryogenic trap to condense any water formed in the catalytic oxidizers and any organic compound not destroyed by the catalytic oxidizer. A single-stage regulator controlled the final air pressure in the canisters and a metering valve was used to control the flow rate at which the canisters were filled during each cleanup cycle. The flow was indicated by a rotameter installed in the clean, dried air line. There was a shutoff valve between the rotameters and the humidifier system. The humidifier system consisted of a SUMMA® treated 6-L canister partially filled with high performance liquid chromatographic-grade (HPLC-grade) water. One flowmeter and flow-control valve routed the cleaned, dried air into the 6-L canister where it was bubbled through the HPLC-grade water. A second flow-control valve and flowmeter allowed air to bypass the canister/bubbler. By setting the flow-control valves separately, the downstream relative humidity was regulated. Since the 1990 study, 80% relative humidity has been used for canister cleaning. There was another shutoff valve between the humidifier and the 8-port manifold where the canisters were connected for cleanup.

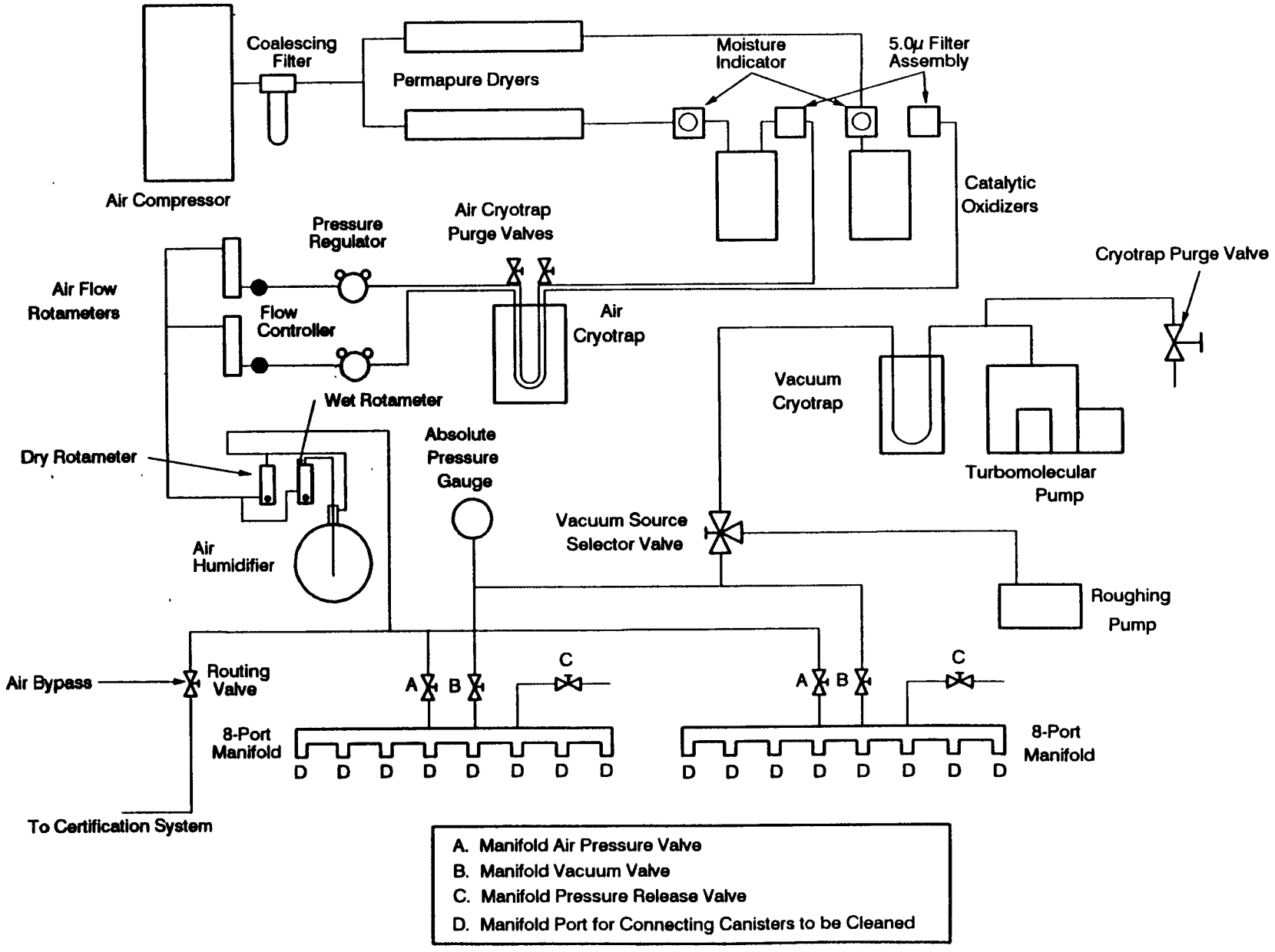

Figure 3-6. Canister Cleanup Apparatus

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The vacuum system consisted of a Precision Model DD-310 turbomolecular vacuum pump, a cryogenic trap, an absolute pressure gauge, and a bellows valve connected as shown in Figure 3-6. The cryogenic trap prevented the sample canisters from being contaminated by back diffusion of hydrocarbons from the vacuum pump into the cleanup system. The bellows valves enabled isolation of the vacuum pump from the system without shutting off the vacuum pump.

3.3.2 Canister Cleanup Procedures

After NMOC analyses were completed, a bank of eight canisters was connected to each manifold shown in Figure 3-6. The valve on each canister was opened, with the shutoff valves and the bellows valves closed. The vacuum pump was started and one of the bellows valves was opened, drawing a vacuum on the canisters connected to the corresponding manifold. After reaching 0.5 mm Hg absolute pressure as indicated by the absolute pressure gauge, the vacuum was maintained for 30 minutes on the eight canisters connected to the manifold. The bellows valve was then closed and the cleaned, dried air that had been humidified was introduced into the evacuated canisters until the pressure reached 20 psig. The canisters were filled from the clean air system at the rate of 7.0 L/min. This flow rate was recommended by the manufacturer as the highest flow rate at which the catalytic oxidizers could handle elimination of hydrocarbons with a minimum 99.7% efficiency.

When the first manifold had completed the evacuation phase and was being pressurized, the second manifold was then subjected to vacuum by opening its bellows valve. After 30 minutes, the second manifold was isolated from the vacuum and connected to the clean, dried air that had been humidified. The first manifold of canisters was then taken through a second cycle of evacuation and pressurization. Each manifold bank of eight canisters was subjected to three cleanup cycles.

During the third cleanup cycle, the canisters were pressurized to 20 psig with clean, dried air that had been humidified. For each bank of eight canisters, the canister having the highest pre-cleanup NMOC concentration was selected for NMOC analysis to determine potential hydrocarbon residues. If the analysis measured less than 0.020 ppmC, then the eight canisters on the manifold were considered to be clean. Finally the canisters were again evacuated to 0.5 mm Hg pressure absolute; they were capped under vacuum and then packed in the containers used for shipping to the field sites.

4.0 NMOC QUALITY ASSURANCE/QUALITY CONTROL PROCEDURES

This section details the steps taken in the 1992 NMOC Monitoring Program to ensure that the data taken were of known quality and were well documented. Analysis results are given in terms of precision, completeness, and accuracy. Repeated analyses provided analytical precision. Duplicate samples provided sampling and analysis precision. Completeness was measured in terms of percent of scheduled samples that resulted in valid samples, beginning with the first valid site-specific sample collected and ending with the last scheduled site-specific sample. Accuracy of NMOC concentrations was reported as percent bias of audit samples of or referenced to an NIST SRM propane by a U.S. EPA contractor.

4.1 Introduction and Conclusions

Completeness for the 1992 NMOC study was 90.72 percent. This value indicates that good communication and planning were maintained between the site personnel and the laboratory personnel. Precision for the 1992 NMOC study averaged 21.61% absolute percent difference of repeated analysis and compared to 14.2% for the 1991 study, 7.6% for the 1990 study, 14.2% for the 1989 study, 10.1% for the 1988 study, 9.61% for the 1987 study, 9.01% for the 1986 study, and 10% for the 1985 study.

Bias of the Radian channels for the 1992 audit results ranged from -3.4% to +24.0 percent. In 1991 the accuracy determined from the external audit samples ranged from +1.9% to +8.9%, from -3.2% to +6.2% in 1990, from +1.3% to +4.5% in 1989; from 1.3% to 4.5% in 1988, and from -2.9% to -0.06% in 1987. In 1986 bias ranged from -0.52% to -3.3% and in 1985 bias ranged from -2.3% to +5.2 percent.

An initial multipoint performance evaluation was conducted using the propane responses for each of the four analytical measurement channels. Daily

calibration checks and in-house propane QC samples monitored instrument and operator performance. Duplicate site samples showed good overall sampling and analysis precision.

Data validation was performed on 10% of the 1992 NMOC data base, as described later in this section.

Calibration and drift determinations showed that the instrumentation was stable and that the calibration procedures were consistent. Canister cleanup results showed there was negligible carryover from one sample to the next. In-house QC samples of propane demonstrated that the analytical systems were in control.

Precision, accuracy, and completeness results for 1992 are comparable to results from previous years and indicate that the data quality are good and meet the data quality objectives of the QAPP[2].

4.2 Calibration and Instrument Performance

Initial performance assessments for NMOC were conducted with propane. Daily calibrations were checked with about 3.0 ppmC propane for the NMOC measurements.

4.2.1 Performance Assessment

An initial multipoint performance evaluation was conducted on each analytical measurement channel, using propane referenced to an NIST propane CRM No. 1666B. The concentration of the propane used in the performance assessment ranged from 2.965 to 19.073 ppmC. The "zero" value was determined using cleaned, dried air from the canister cleanup system described in Section 3.0. Table 4-1 summarizes the performance assessments below. The FID

Table 4-1

1992 Performance Assessment Summary, Radian Channels

Radian Channel	Cases	Linear Regression Results[a]		
		Intercept	Slope	Coefficient of Correlation
A	20	321.317	3593.725	0.999905
B	20	418.233	3594.239	0.999671
C	20	235.217	3569.628	0.999964
D	20	901.824	3434.886	0.998908

[a]Figures 4-1 through 4-4 plot propane area counts vs. concentration in ppmC.

responses for multiple concentration propane standards were linear, having coefficients of correlation from 0.998908 to 0.999964. Figures 4-1 through 4-4 show plots of the NMOC performance results for Radian Channels A, B, C, and D, respectively. The plots show the regression line.

4.2.2 Calibration Zero, Span, and Drift

Radian PDFID channels were tested daily for zero and span. Zero readings were measured using cleaned, dried air. The zero air was supplied by the same system that cleans air for the canister cleanup system. Span readings used a mixture of about 3.0 ppmC propane in dry air. Calibration factors were calculated from the span and zero readings for each measurement channel. Initial calibration factors were determined in the morning before any site samples were analyzed and final calibration factors were determined in the afternoon on randomly selected days after all the ambient air samples had been analyzed. Percent calibration factor drifts were determined based on the initial calibration factor. The data for zeros, calibration factors, and calibration factor drifts are given in Appendix F for each Radian channel and each calendar day of the analysis season. Figures 4-5 through 4-8 show plots for daily calibration zeros for Radian Channels A, B, C, and D. Figures 4-9 through 4-12 show the daily calibration span data as a function of the 1992 Julian date. The figures show an adjustment that was made to the calibration factor data. This adjustment is explained in Section 4.2.3.
Figures 4-13 through 4-16 show the daily percent drift data for Radian Channels A, B, C, and D. Inspection of the percent drift figures shows that the maximum percent drift was 2.17. The average absolute percent drift ranged from 0.292% for Channel D to 0.366% for Channel C.

Four-Point Calibration - 1992

Channel A

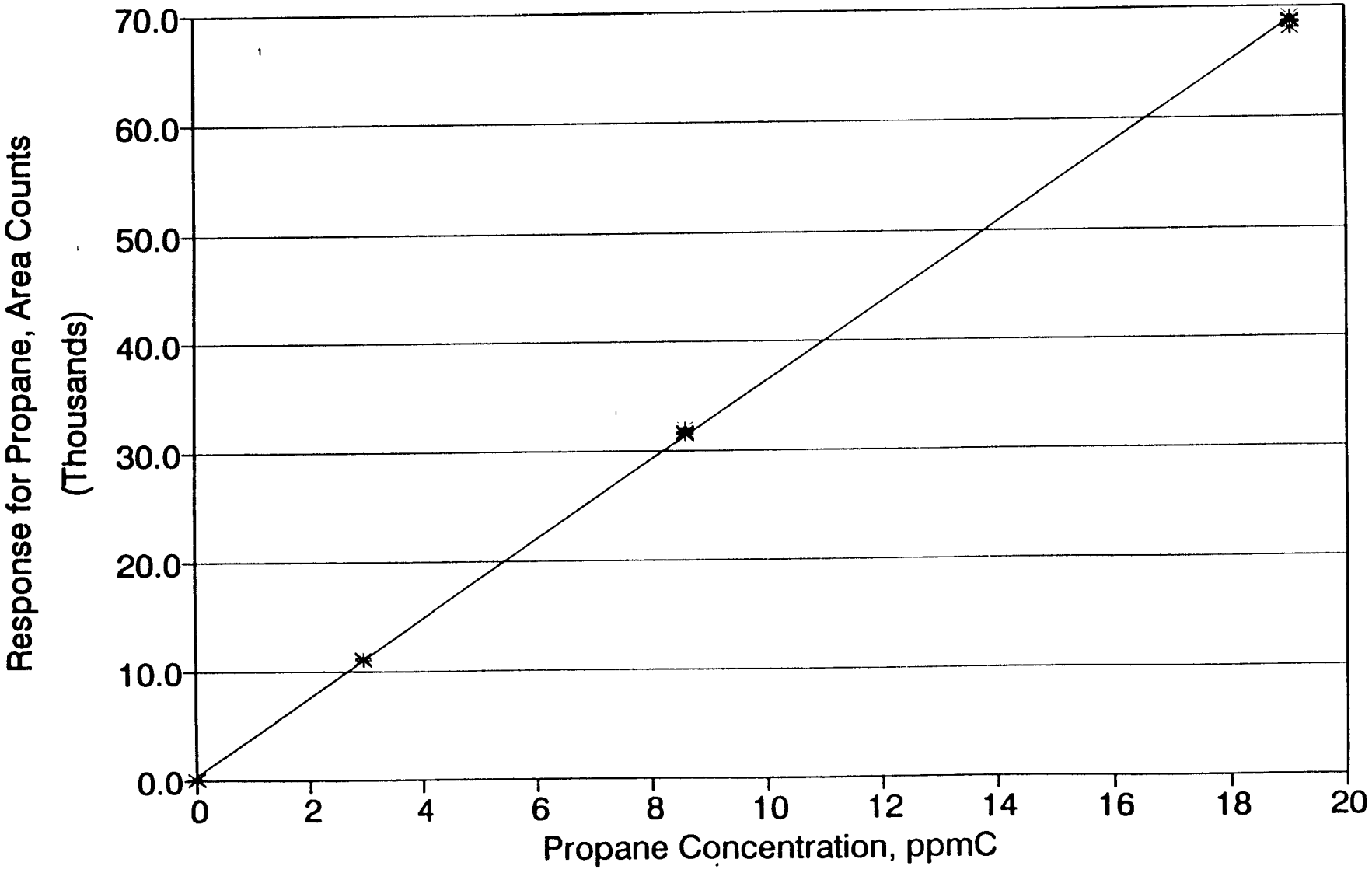
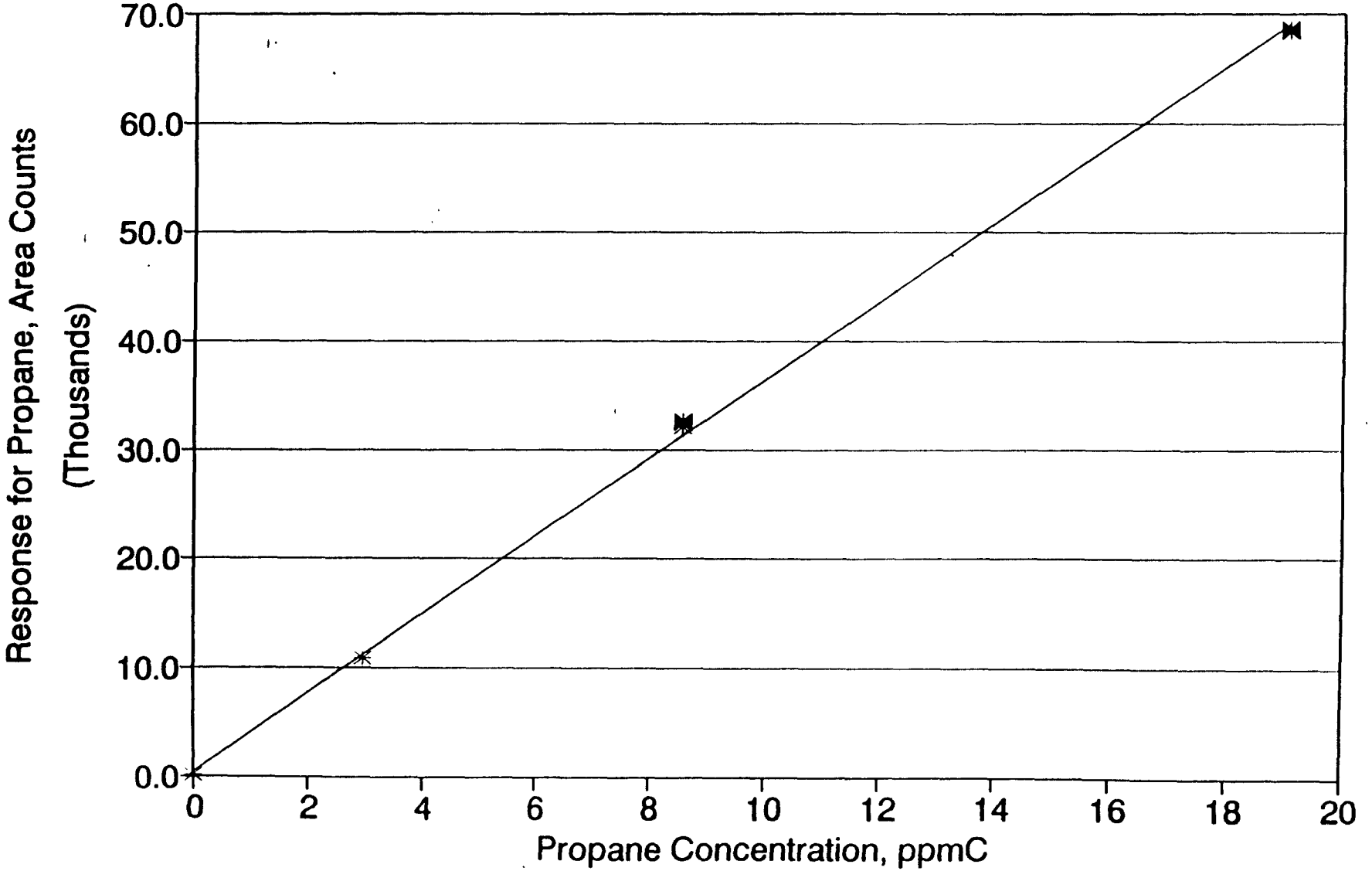


Figure 4-1. NMOC performance results, Channel A.

Four-Point Calibration - 1992

Channel B



Four-Point Calibration - 1992

Channel C

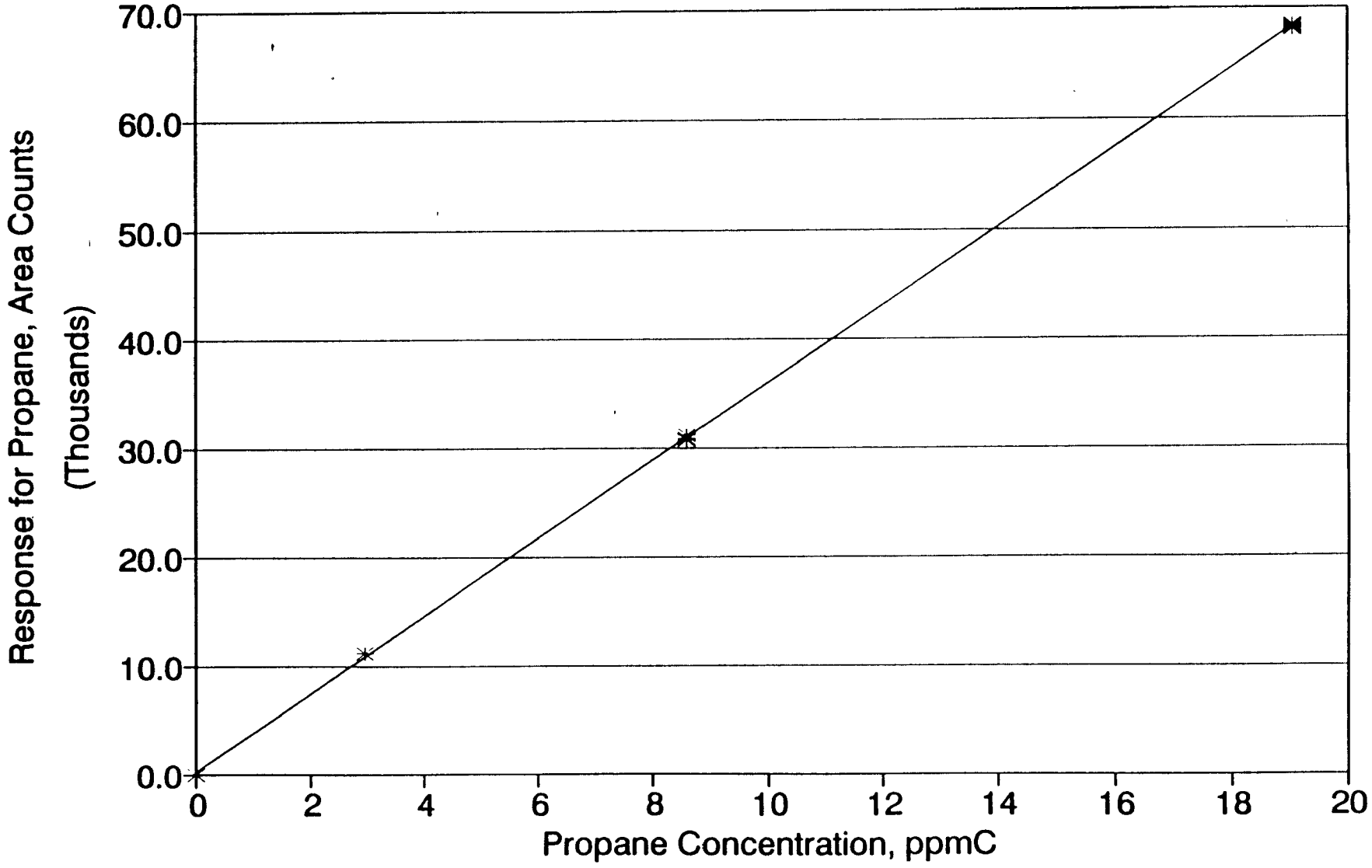
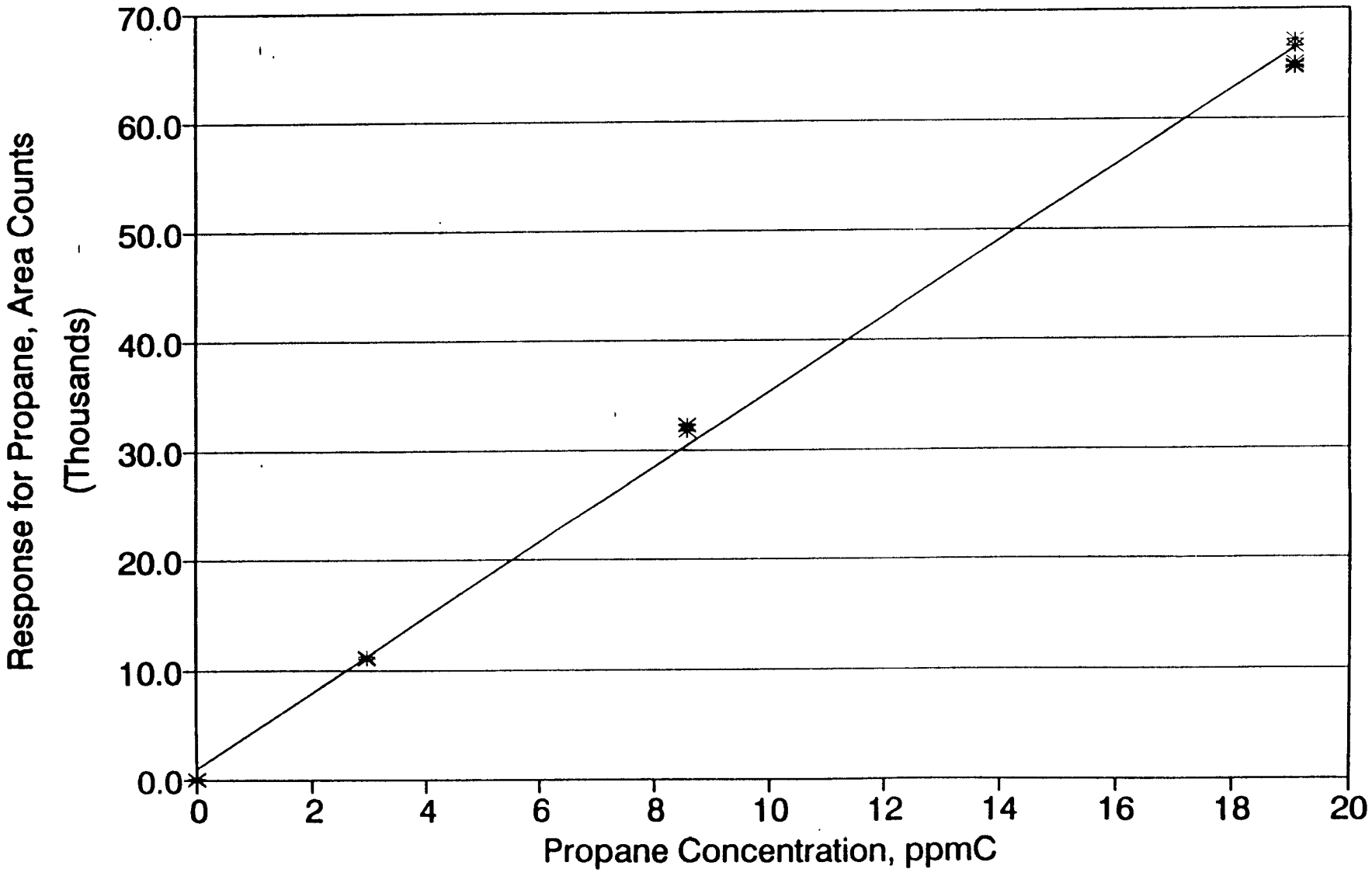


Figure 4-3. NMOC performance results, Channel C.

Four-Point Calibration - 1992

Channel D



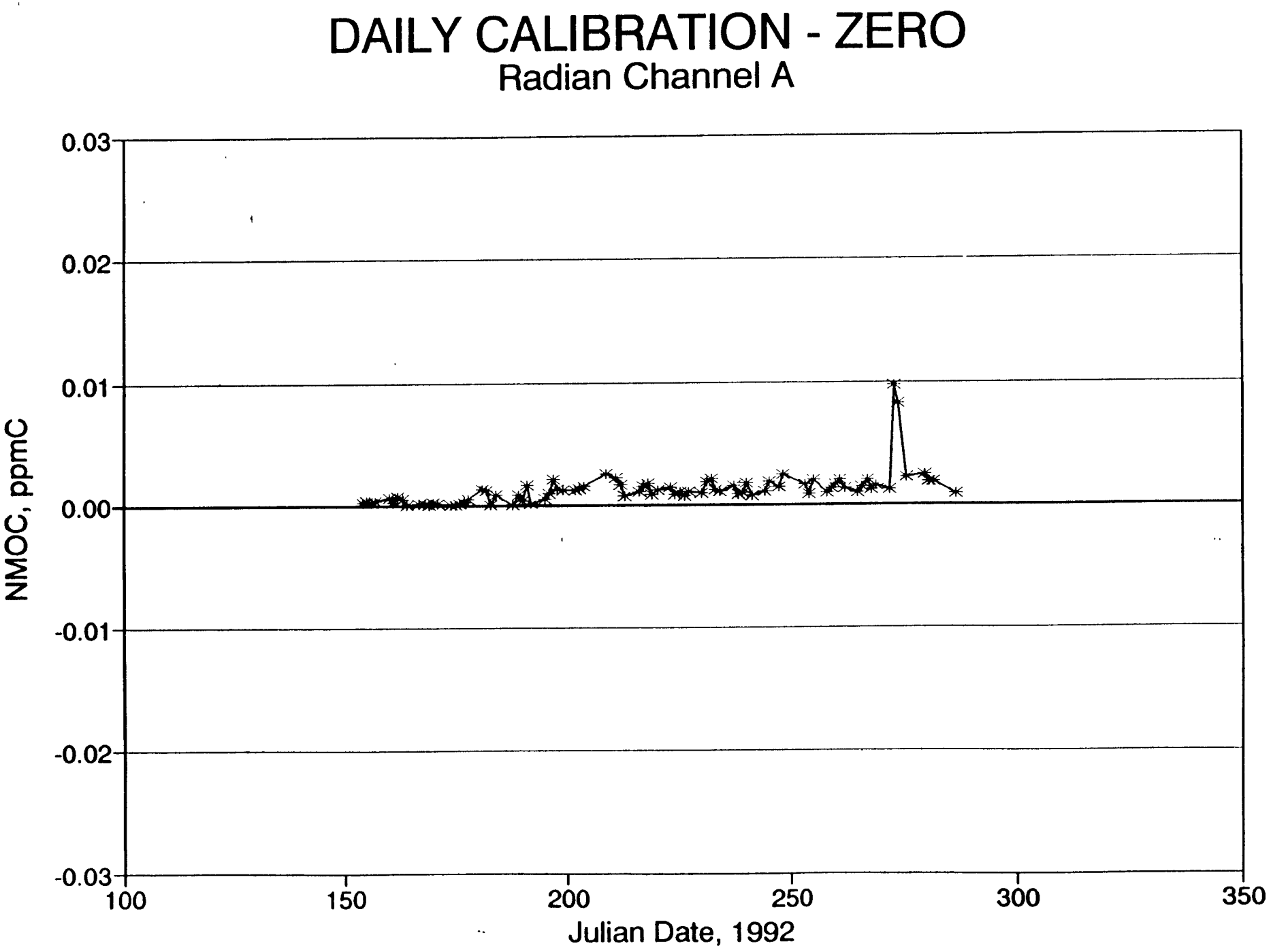
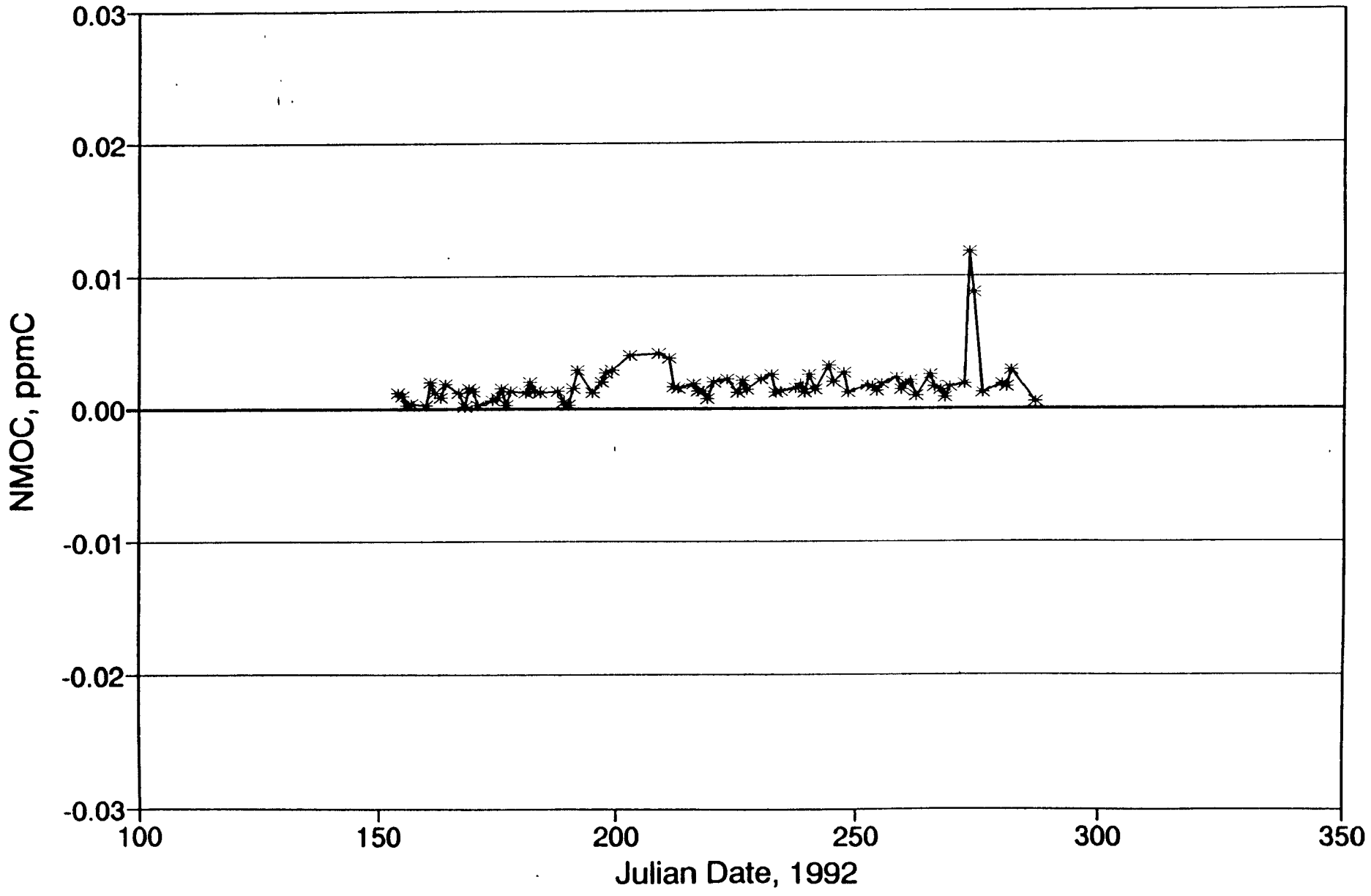


Figure 4-5. Daily calibration zero, Channel A

DAILY CALIBRATION - ZERO

Radian Channel B



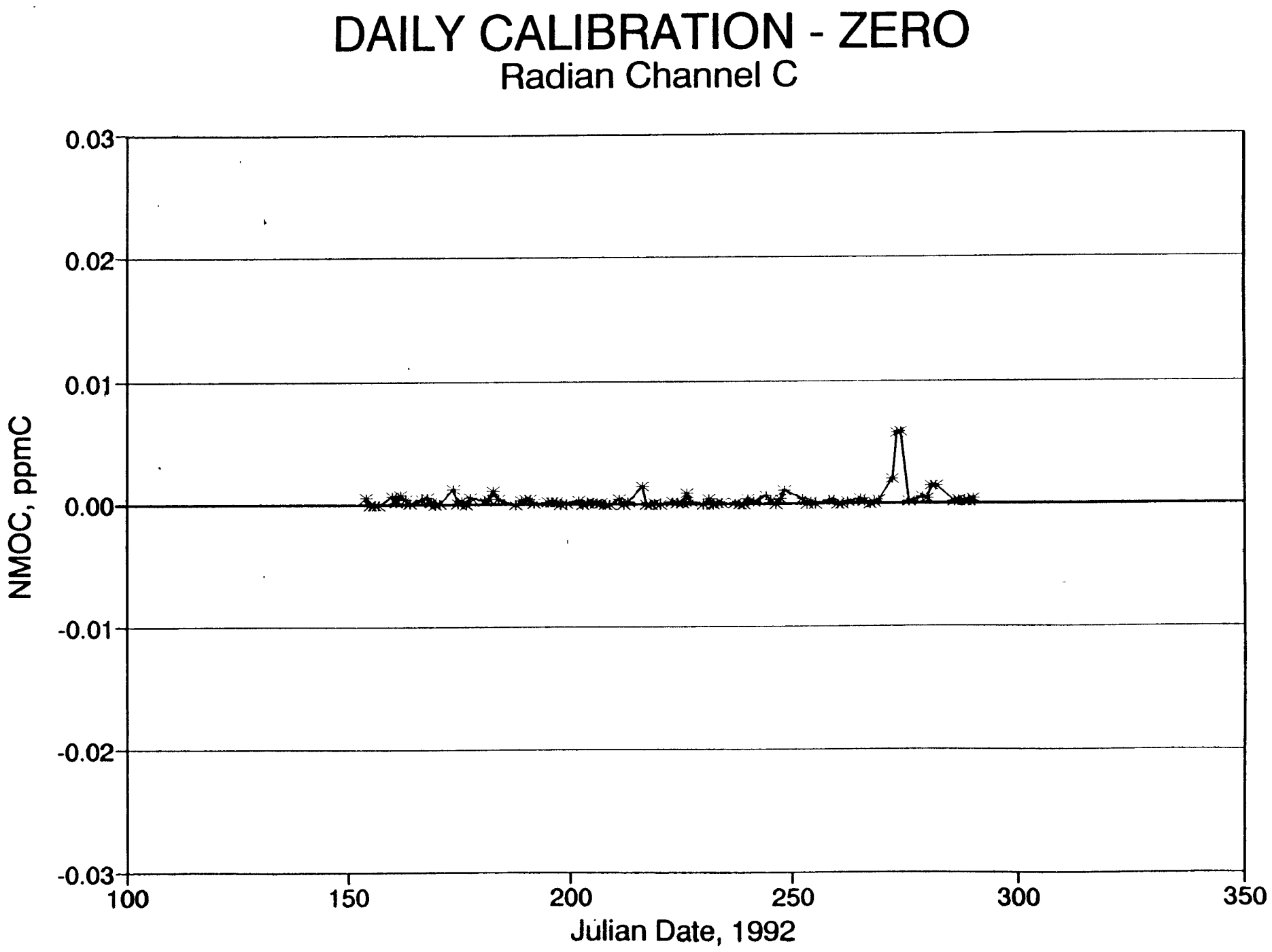
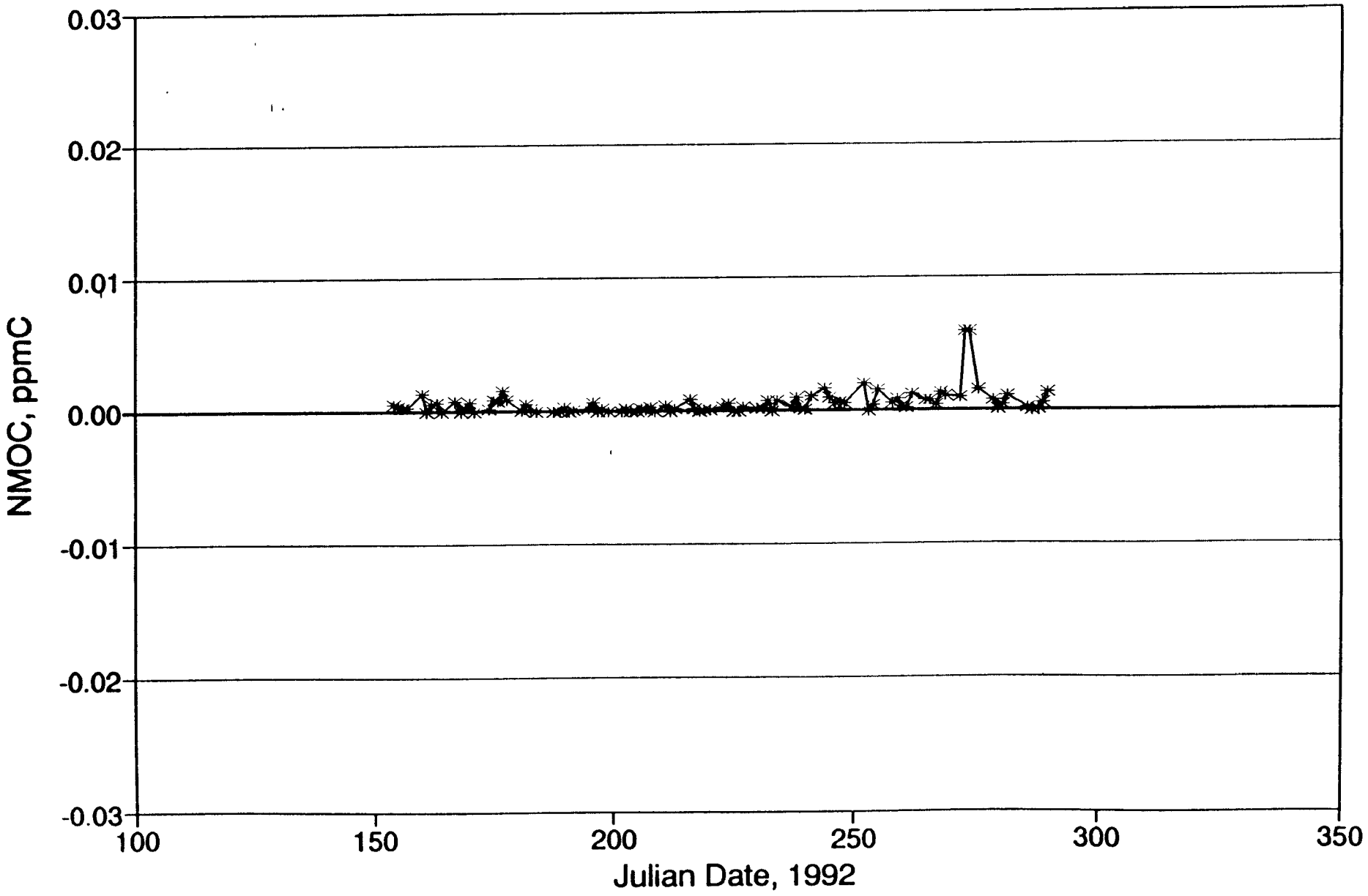


Figure 4-7. Daily Calibration zero, Channel C.

DAILY CALIBRATION - ZERO

Radian Channel D



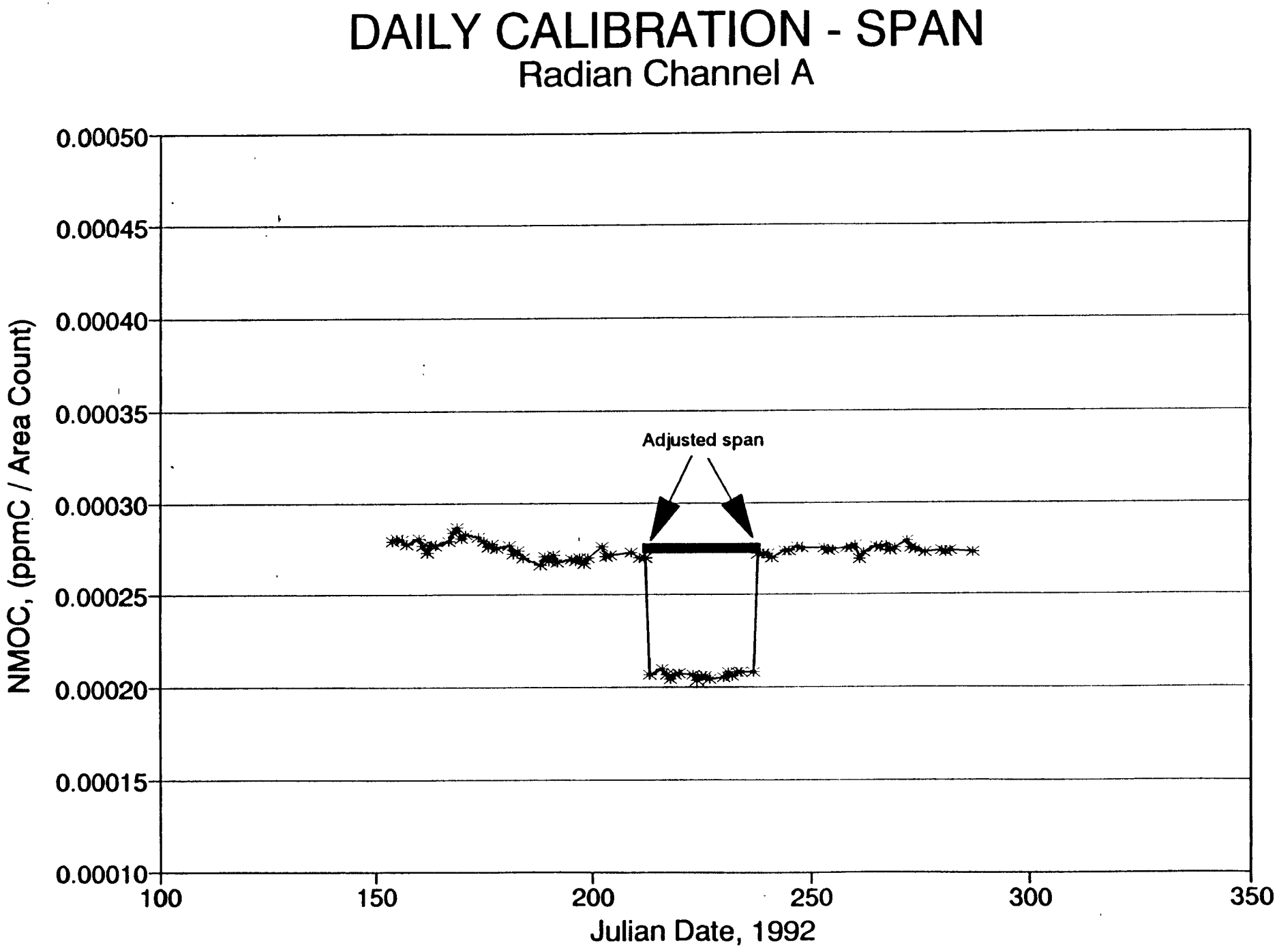
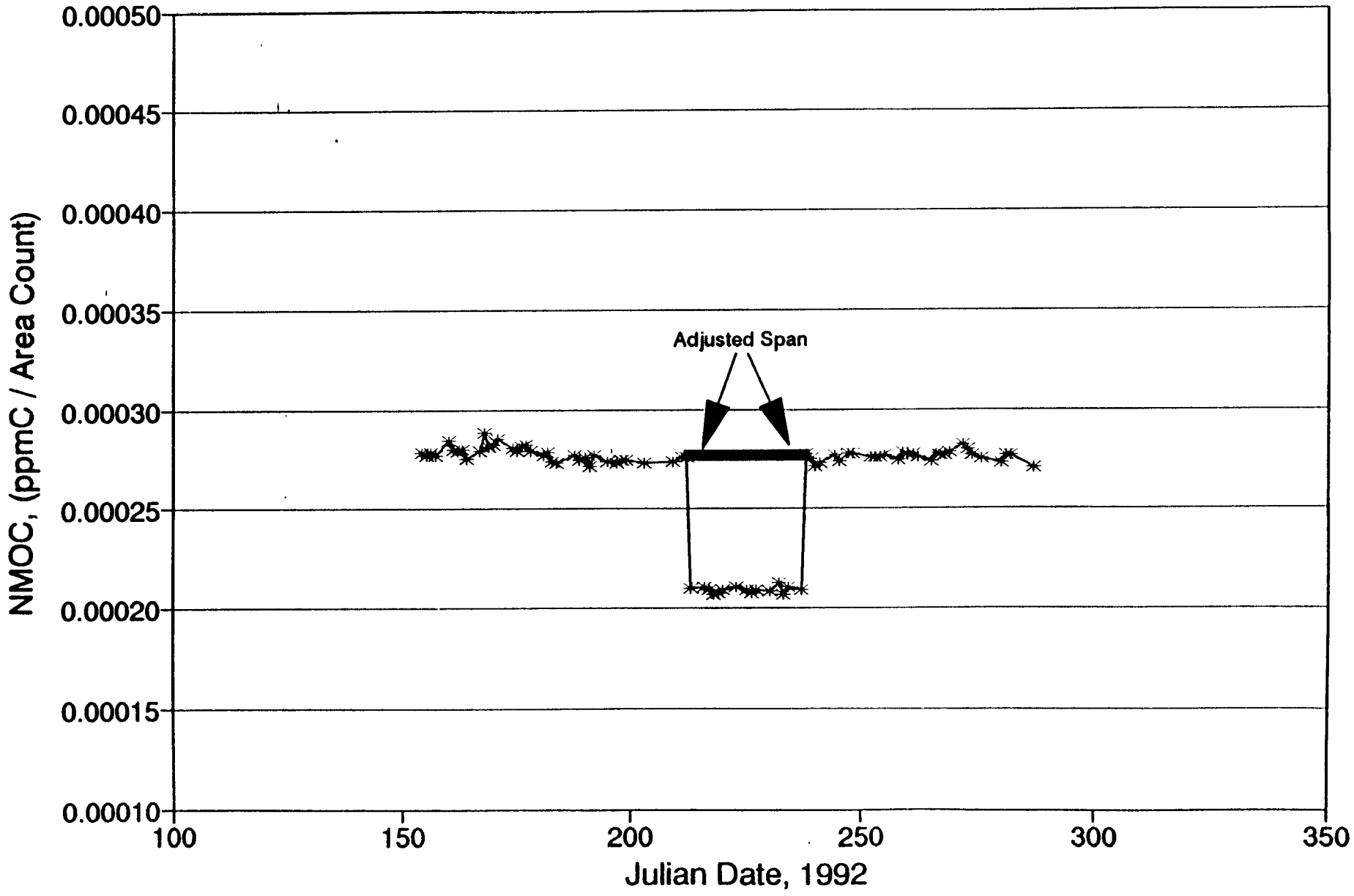


Figure 4-9. Daily calibration span, Channel A.

DAILY CALIBRATION - SPAN

Radian Channel B



DAILY CALIBRATION - SPAN

Radian Channel C

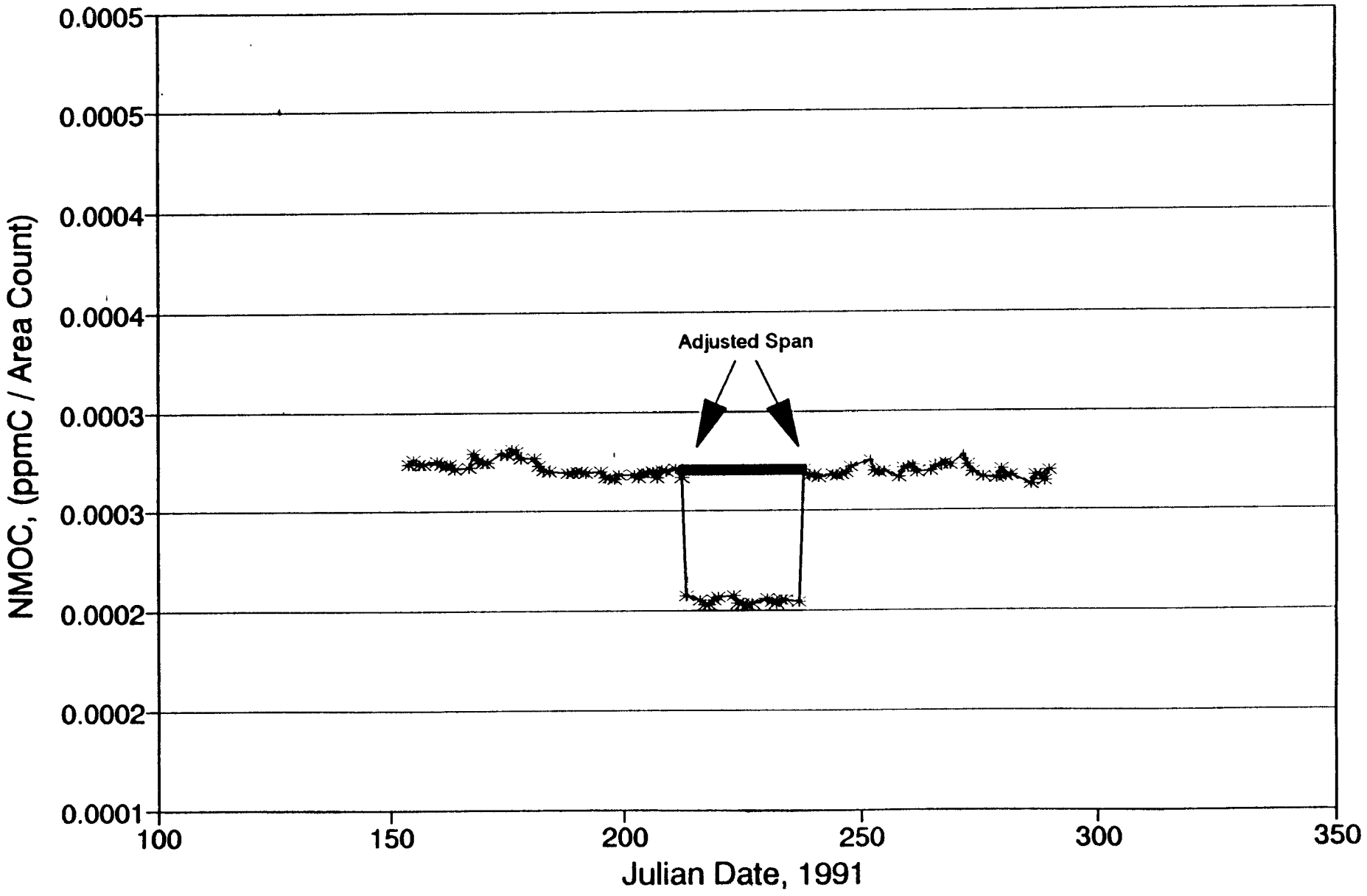
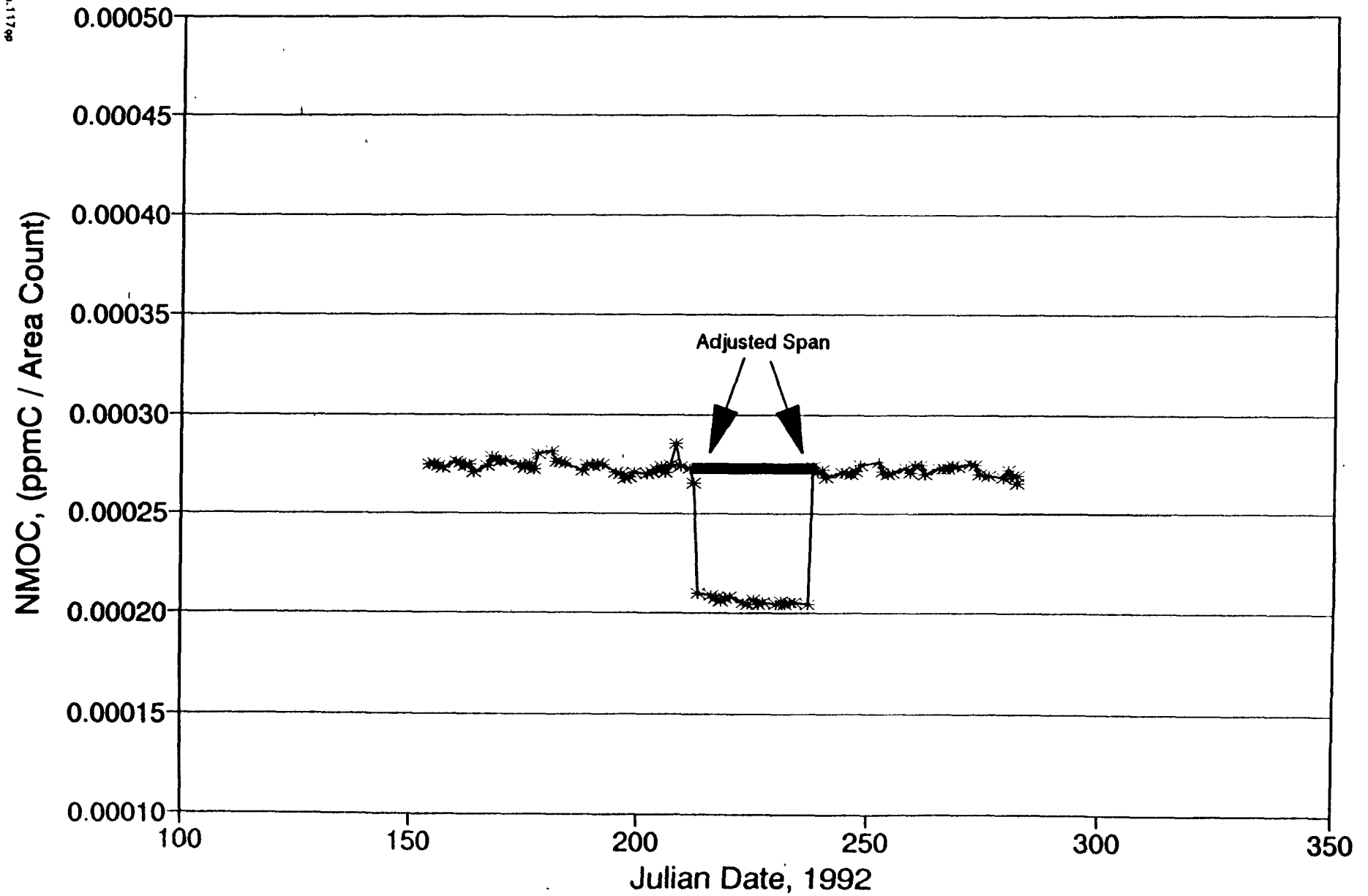


Figure 4-11. Daily calibration span, Channel C.

DAILY CALIBRATION - SPAN

Radian Channel D



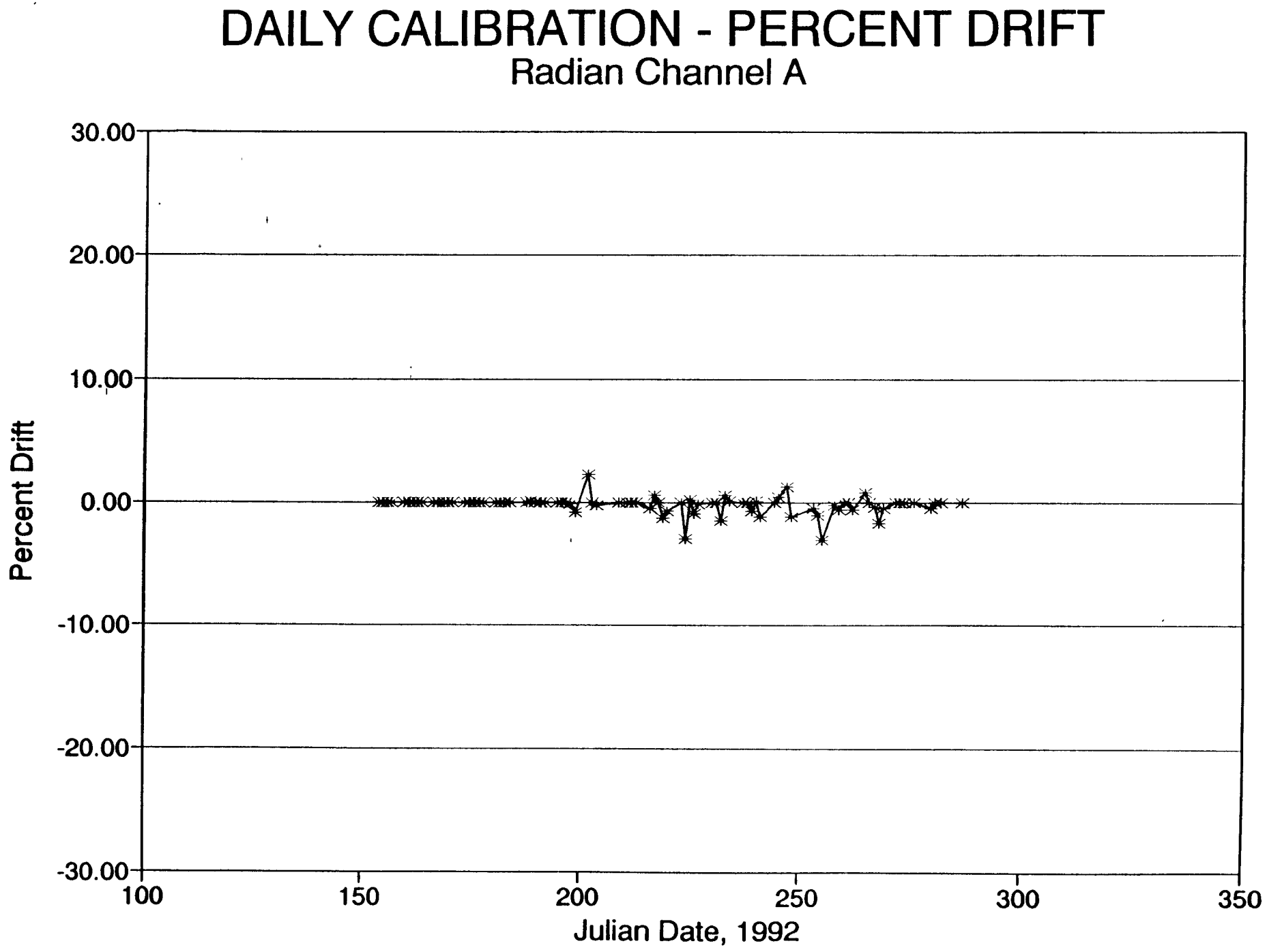


Figure 4-13. Daily calibration percent drift, Channel A.

4.2.3 Calibration Drift

Summary calibration factor drift data are given in Table 4-2. The table presents calibration factor drift, percent calibration factor drift, and absolute percent calibration factor drift. Calibration factors were calculated from an analysis of a propane-air mixture whose concentration was known and was referenced by the EPA-QAD to an NIST propane CRM No. 1666B reference standard as follows:

$$\text{calibration factor} = \frac{\text{concentration of propane standard (ppm)} \times 3 \text{ ppmC/ppm}}{(\text{propane standard response (area counts)} - \text{zero response (area counts)})}$$

Daily calibration factors ranged from 0.000263 ppmC/area count to 0.000288 ppmC/area count, depending on the channel. Maxima, minima, and mean values are given in Table 4-2 for calibration factor drift and percent calibration factor drift. If drift and percent drift are random variables and normally distributed, the mean values would be expected to be zero. The means shown in Table 4-2 for the drift and percent drift are approximately zero, showing little bias overall, or for any channel. The overall mean values shown in Table 4-2 were weighted according to the number of calibration drift data for each channel. The last two columns of Table 4-2 show the means and standard deviations of the absolute percent calibration factor drifts. The fact that the standard deviations are the same order of magnitude as the means indicates that the mean calibration factor drifts are not significantly different from zero.

Calibration factor drift was defined as final calibration factor for the day, minus initial calibration factor. Percent calibration factor drift was defined as the calibration factor drift divided by the initial calibration factor, expressed as a percentage. The absolute percent calibration factor drift is a measure of the calibration drift variability and averaged 0.328% overall. The mean absolute percent calibration drift ranged from 0.292% for Radian Channel D to 0.366% for Radian Channel C.

Table 4-2

Summary NMOC Calibration Factor Drift Results

Radian Channel	Cases	Calibration Factor Drift ppmC/Area Count x 10^6			Percent Factor Drift			Absolute Percent Factor Drift	
		Min	Mean	Max	Min	Mean	Max	Mean	Standard Deviation
A	85	-8.6	-0.5	6.0	-3.119	-0.192	2.169	0.331	0.629
B	81	-14.1	-0.5	3.1	-5.114	-0.192	1.134	0.324	0.790
C	96	-6.7	-0.8	4.4	-2.498	-0.312	1.591	0.366	0.571
D	96	-3.8	-0.5	3.7	-1.738	-0.209	1.333	0.292	0.448
Overall	358	-14.1	-0.6	6.0	-5.114	-0.229	2.169	0.328	0.612

Upon review of the calibration data, Radian identified a problem with the propane calibration standard (#B0220) that was used from 31 July to 24 August 1992. Daily calibration factors are generated with a propane standard (typically 3.0 ppmC). Because the calibration factors are calculated as ppmC/Area Counts, they generally do not vary greatly from day-to-day or from calibration standard to calibration standard provided the propane concentration is approximately the same. During the past 7 years there has been very little fluctuation in the daily calibration factors used to quantitate sample concentrations. The calibration factors that were generated using the propane standard contained in Cylinder #B0220 (used from 31 July to 24 August 1992) dropped significantly in comparison to the calibration factors generated before and after its use. Cylinder #B0220 was prepared by the same vendor as the other cylinders used and was supposed to be at the same concentration level. Lower response factors were observed on the first day of the new cylinder's use and continued through the last day of use. The calibration factors generated after its use (from a new and different cylinder) returned to the value of calibration factors generated prior to 31 July 1992 (also from a different cylinder).

The NMOC program routinely prepares and analyzes in-house QC samples to check the bias of the instruments. The samples are generated as a mixture of air and propane. The air is prepared by Radian and certified clean. A propane standard different from the calibration standard is used for the preparation of the QC check samples. The propane standard used to prepare QC samples is approximately 18.0 ppmC. During the period from 31 July to 24 August 1992, ten in-house QC samples were prepared and analyzed. The difference (measured-calculated) and percent difference ((measured- calculated)/calculated * 100) of each of those QC samples showed a significant change in response toward the negative direction (i.e., the measured concentration is less than the calculated concentration) using the new calibration standard. This data supports the conclusion that the calibration factors generated with the propane in Cylinder #B0220 were lower than expected.

Due to this apparent problem with the propane calibration standard certification for Cylinder #B0220, the calibration factors for the period from 31 July to 24 August have been recalculated. The average calibration factors prior to 31 July and after 24 August were:

	Before	After	During	Channel
•	0.000275	0.000274	0.000207	A
•	0.000278	0.000276	0.000209	B
•	0.000272	0.000270	0.000205	C
•	0.000274	0.000272	0.000206	D

As is indicated, there is very little change in the calibration factors before and after (a maximum of 1% from the information above). New calibration factors for each of the four channels have been calculated as the average of the calibration factors before and after the period in question. The calculations indicate that the new calibration factors used from 31 July to 24 August will be:

- 0.000275 - Channel A;
- 0.000277 - Channel B;
- 0.000271 - Channel C; and
- 0.000273 - Channel D.

All NMOC Program PDFID analyses (site samples and QC check samples) that were performed from 31 July to 24 August have been recalculated using the above calibration factors.

4.3 In-House QC Samples

In-house quality control samples were prepared by Radian personnel. Local ambient sample results are presented and discussed in Section 4.4.2. In-house quality control samples were prepared by diluting dry propane with cleaned, dried air using calibrated flowmeters. The propane used for the in-house quality control samples was certified against an NIST Reference Standard. The concentration of

the in-house standard ranged from about 0.000 ppmC to 1.411 ppmC, but was set to average near the concentration levels that were being analyzed. The analyst did not know the concentration of the in-house standard prior to analysis.

The daily in-house QC data for each Radian channel are given in Appendix G, and include:

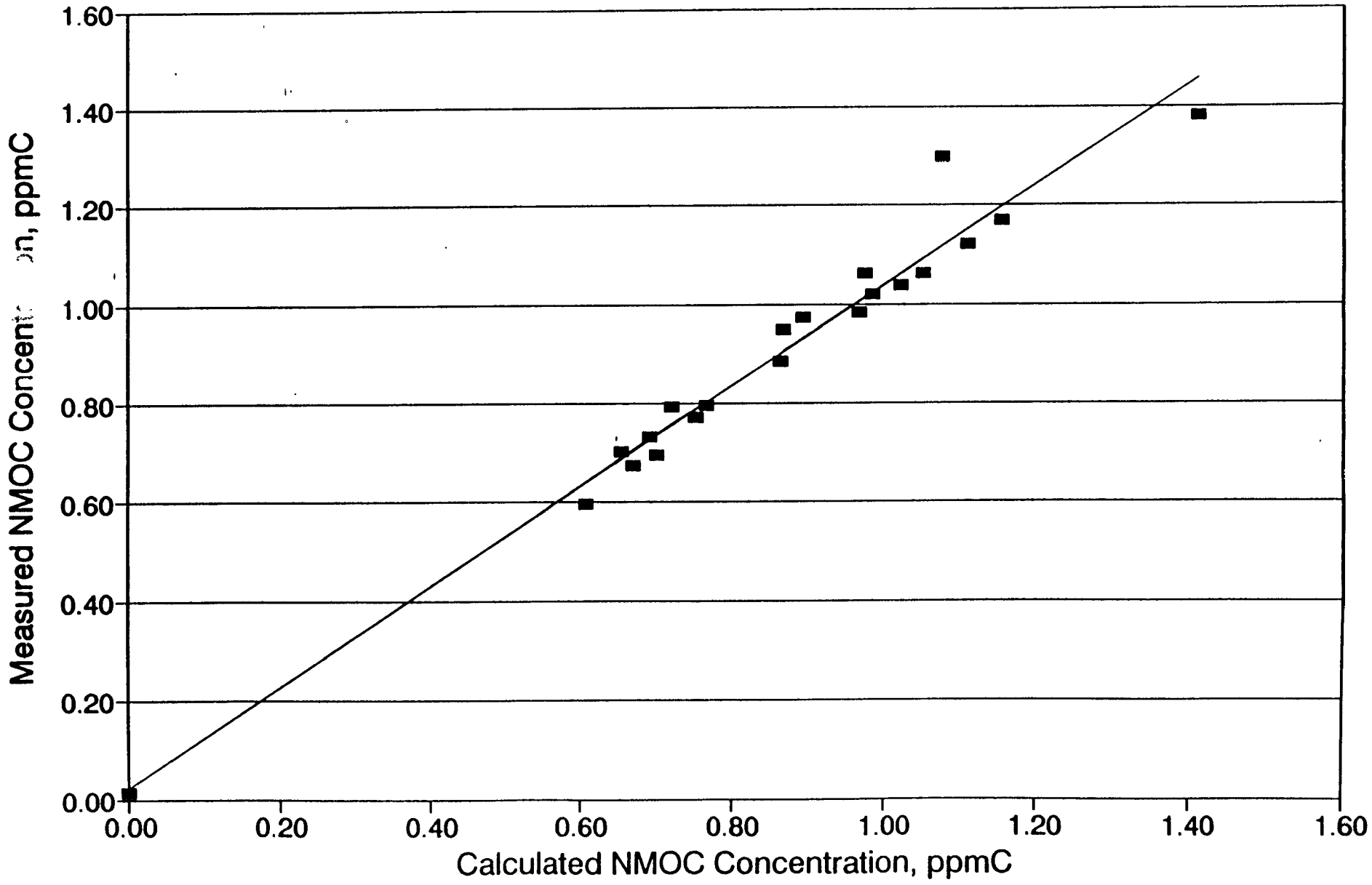
- Calendar date analyzed;
- Julian date for 1992;
- Radian ID Number;
- Calculated NMOC concentration in ppmC;
- Measured NMOC concentration in ppmC;
- Bias (measured NMOC-calculated NMOC); and
- % Bias (Bias * 100 / calculated NMOC).

Measured versus calculated NMOC concentrations in Figures 4-17 through 4-20 show excellent agreement. Table 4-3 summarizes the results of the linear regressions for the Radian in-house quality control data, showing regression intercepts near zero, and slopes and coefficients of correlation all near 1.0.

Tables 4-4 and 4-5 give statistics for in-house quality control measurements. DIFF is the ppmC difference between the measured and the calculated NMOC concentrations, and PCDIFF is the percentage of the difference relative to the calculated value. Both DIFF and PCDIFF may be considered to be bias terms, assuming that the calculated value is the correct NMOC concentration for the in-house QC sample. Overall, PCDIFF shows a mean bias of +2.85%, and ranges from +1.05% for Channel D to +5.20% for Channel B. ADIFF and APCDIFF, absolute values of DIFF and PCDIFF, respectively, were used as measures of precision. The absolute percent difference ranged from 2.64% for Channel C to 5.30% for Channel B and averaged 3.85 percent. These figures show excellent agreement and consistency for the in-house quality control data and include

In-house Propane QC Results

Channel A



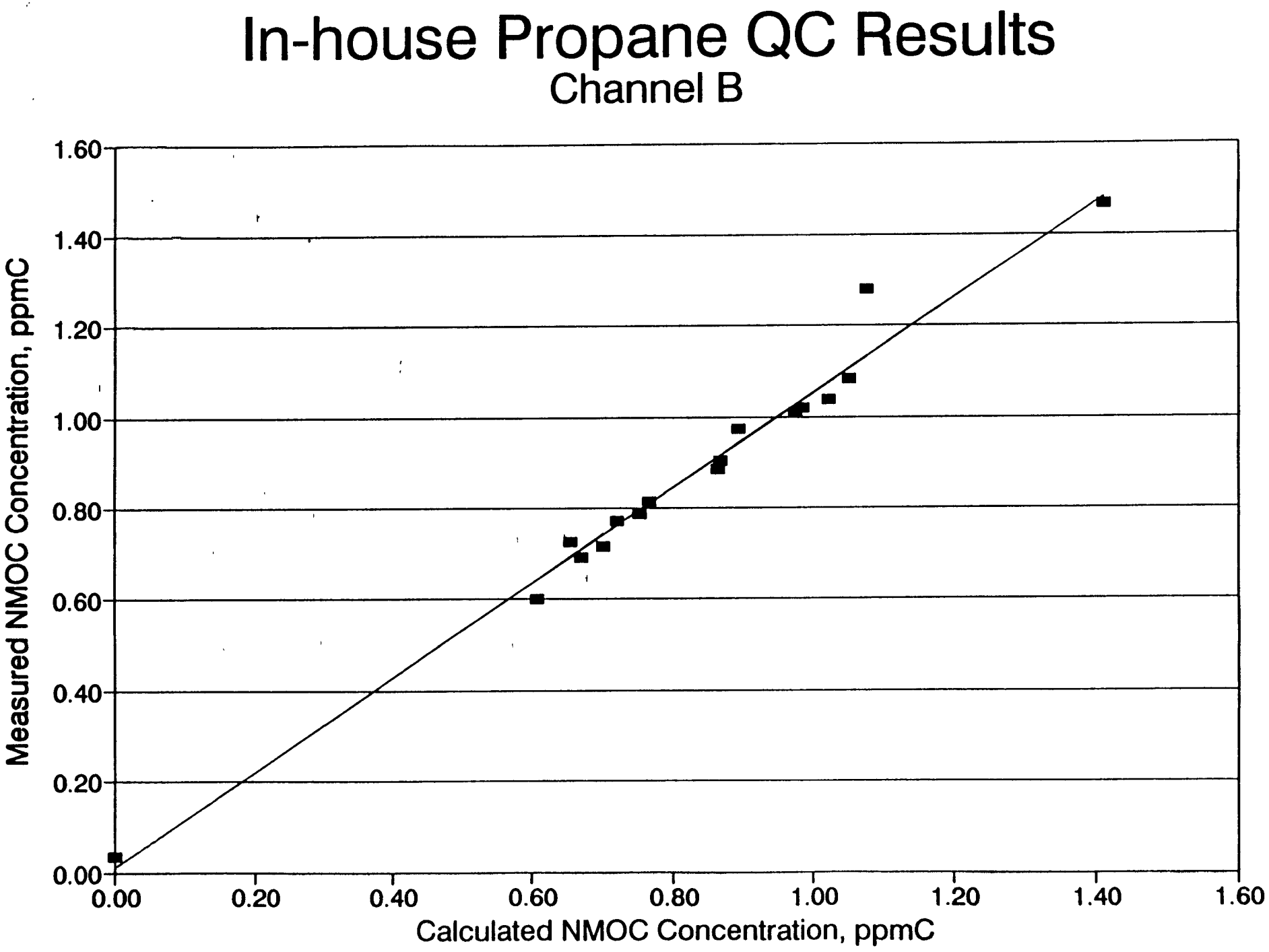
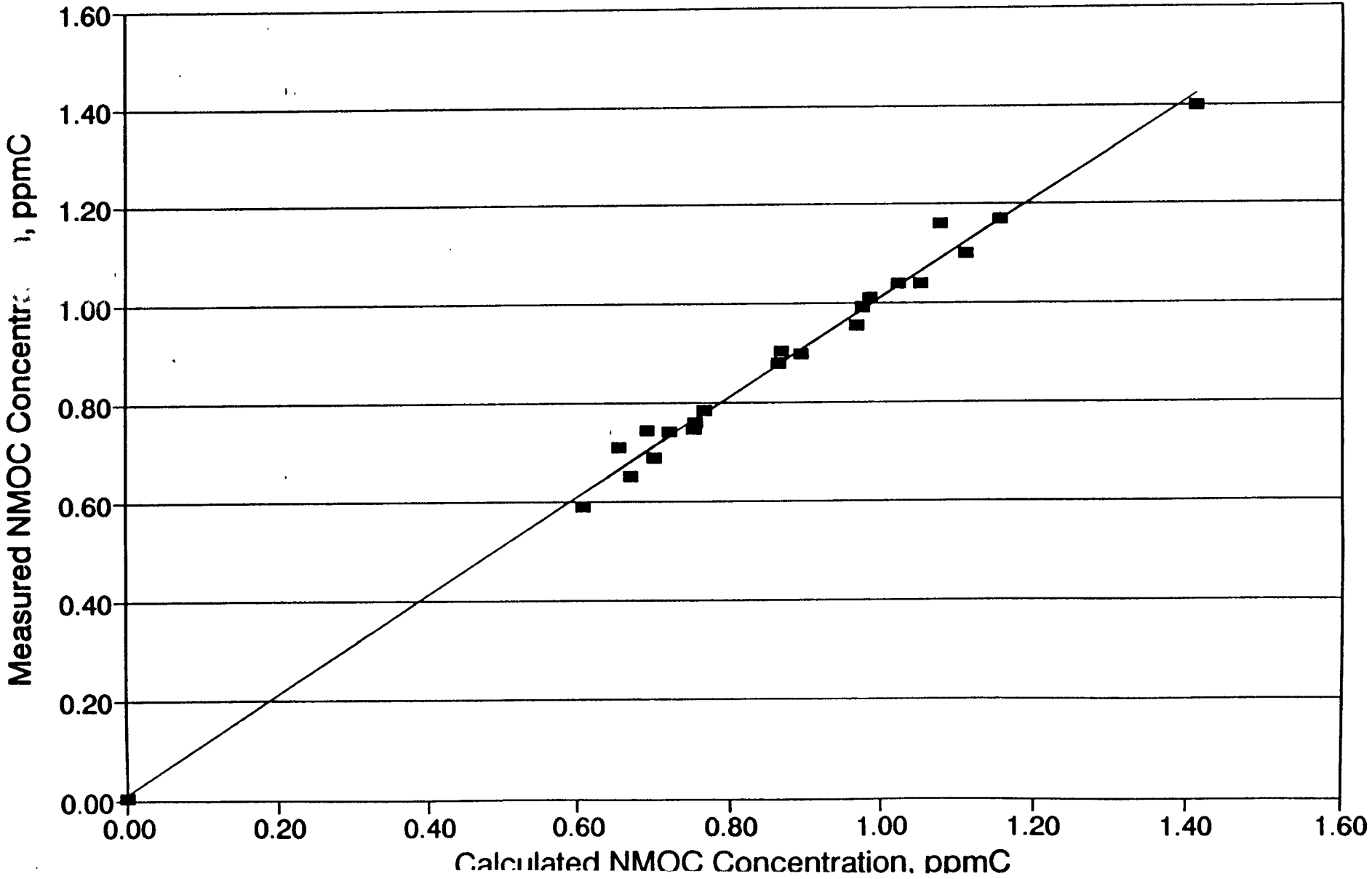


Figure 4-18. In-house quality control results, Channel B.

In-house Propane QC Results

Channel C



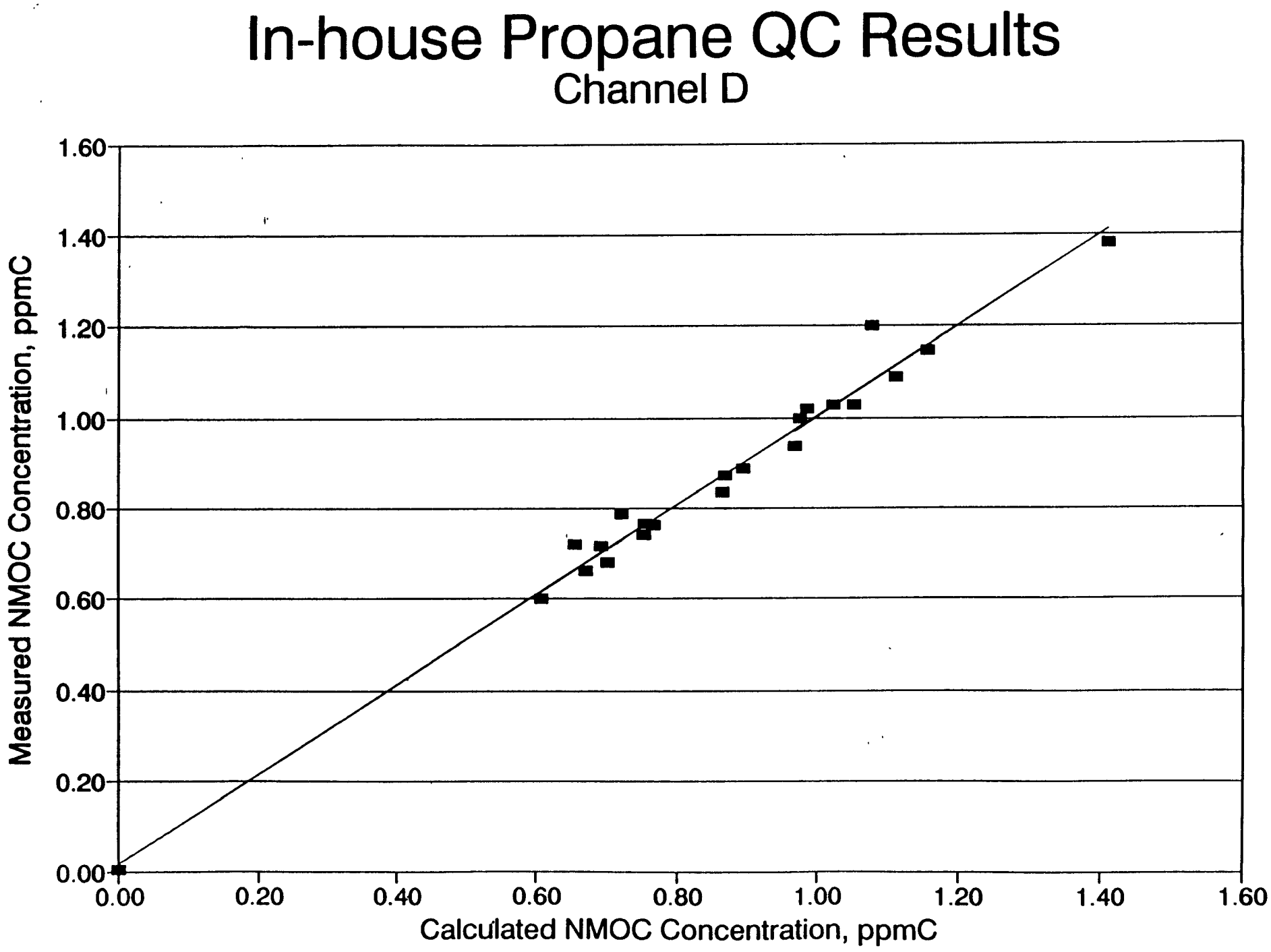


Figure 4-20. In-house quality control results, Channel D.

Table 4-3

Linear Regression Parameters for In-House Quality Control Data

Radian Channel	Cases	Intercept	Slope	Coefficient of Correlation
A	21	0.023610	1.01588	0.983291
B	17	0.010933	1.04250	0.989858
C	22	0.011661	1.00067	0.995431
D	22	0.017274	0.98892	0.990747

Table 4-4

In-House Quality Control Statistics, by Radian Channel

Channel	Statistics	Variables			
		DIFF[a]	PCDIFF[b]	ADIFF[c]	APCDIFF[d]
A	Cases	21	20	21	20
	Minimum	-0.031000	-2.197000	0.005000	0.745000
	Maximum	0.223000	20.706000	0.223000	20.706000
	Mean	0.037190	4.317250	0.041762	4.801250
	Std. Dev.	0.053035	5.415677	0.049332	4.968292
	Std. Error	0.011573	1.210982	0.010765	1.110944
	Skewness	2.275026	1.526859	2.730435	1.925201
	Kurtosis	7.094455	3.146327	9.016235	4.459474
B	Cases	17	16	17	16
	Minimum	-0.005000	-0.824000	0.005000	0.824000
	Maximum	0.203000	18.849000	0.203000	18.849000
	Mean	0.046000	5.195188	0.046588	5.298188
	Std. Dev.	0.045489	4.645217	0.044848	4.519421
	Std. Error	0.011033	1.161304	0.010877	1.129855
	Skewness	2.781125	1.875253	2.907450	2.069150
	Kurtosis	9.502701	4.400949	9.984509	4.864647
C	Cases	22	21	22	21
	Minimum	-0.019000	-2.832000	0.003000	0.336000
	Maximum	0.083000	8.716000	0.083000	8.716000
	Mean	0.012227	1.479905	0.021227	2.635143
	Std. Dev.	0.026403	3.297612	0.019537	2.425426
	Std. Error	0.005629	0.719598	0.004165	0.529271
	Skewness	1.137660	0.952545	2.058736	1.688759
	Kurtosis	1.142899	0.286723	4.176068	1.862462
D	Cases	22	21	22	21
	Minimum	-0.029000	-3.121000	0.003000	0.345000
	Maximum	0.123000	11.421000	0.123000	11.421000
	Mean	0.007864	1.051571	0.025409	3.040429
	Std. Dev.	0.037386	4.334670	0.028039	3.200631
	Std. Error	0.007971	0.945903	0.005978	0.698435
	Skewness	1.720565	1.429178	2.382495	1.841137
	Kurtosis	3.262660	1.143788	6.546126	2.447298

[a]DIFF = Measured NMOC concentration - Calculated NMOC concentration, ppmC.
[b]PCDIFF = DIFF/calculated NMOC concentration x 100.
[c]ADIFF = Absolute value of DIFF.
[d]APCDIFF = Absolute value of PCDIFF.

Table 4-5

Overall In-House Quality Control Statistics

Statistics	DIFF[a]	PCDIFF[b]	ADIFF[c]	APCDIFF[d]
Cases	82	78	82	78
Minimum	-0.031000	-3.121000	0.003000	0.336000
Maximum	0.223000	20.706000	0.223000	20.706000
Mean	0.024451	2.854218	0.032866	3.845936
Standard Deviation	0.043603	4.716095	0.037589	3.938349
Standard Error	0.004815	0.533993	0.004151	0.445930
Skewness	2.185725	1.425603	3.078324	2.148632
Kurtosis	7.246736	2.717929	11.957000	5.525017

[a]DIFF = Measured NMOC concentration - Calculated NMOC concentration, ppmC.

[b]PCDIFF = DIFF/calculated NMOC concentration x 100.

[c]ADIFF = Absolute value of DIFF.

[d]APCDIFF = Absolute value of PCDIFF.

variability not only in the instrumental analysis but also in the apparatus and method used to generate the QC samples.

4.4 Repeated Analyses

Replicate (or repeated) analyses results are listed in Table 4-6. Repeated analyses from the contents of a canister are used to estimate analytical precision. The first analysis is performed at the Radian laboratory on the day the canister is received from the sample site, and is designated by an I. The second analysis from the canister, designated by an R in the sample identification (ID) number (See Table 4-6), was performed at least 24 hours after the first analysis. This procedure was followed to ensure that sufficient time had elapsed between removal of an aliquot for analysis to allow the canister contents to equilibrate with the solid surfaces and to allow any concentration gradients within the canister to disperse.

Sample number; site code; date sampled; sample ID number; measured concentrations for injections 1 and 2; mean NMOC concentration; Radian instrument channel; canister mean; difference between replicate analyses; percent difference between replicate analyses; and absolute percent difference are given in Table 4-6. The mean concentration in Column 7, in parts per million carbon by volume (ppmC), is the arithmetic average of the NMOC concentrations for the two analyses shown in Columns 5 and 6, headed "Inj 1 and Inj 2." Column 8, labeled "Canister Mean" is the concentration for each sample number and is the average of the mean concentrations for each analysis.

Table 4-6. Replicate Samples for the 1992 NMOC Program

Site Code	Sample Date	Julian Sample Date	Redlan ID #		Inj. 1 NMOC, ppmC	Inj. 2 NMOC, ppmC	Analysis Mean, ppmC	Canister Mean, ppmC	Replicates Diff	Replicates % Diff	Replicates Abs % Diff
R1NC	01-Jul-92	183	1080	I	0.069	0.066	0.068	0.087	0.038	43.678	43.678
R1NC	01-Jul-92	183	1080	R	0.095	0.118	0.106				
MNY	01-Jul-92	183	1110	I	0.610	0.595	0.602	0.625	0.045	7.206	7.206
MNY	01-Jul-92	183	1110	R	0.652	0.641	0.647				
NWNJ	30-Jun-92	182	1121	I	0.488	0.497	0.492	0.490	-0.006	-1.227	1.227
NWNJ	30-Jun-92	182	1121	R	0.481	0.493	0.486				
WSNC	07-Jul-92	189	1133	I	0.104	0.125	0.115	0.115	0.000	0.000	0.000
WSNC	07-Jul-92	189	1133	R	0.104	0.125	0.115				
LINY	08-Jul-92	190	1166	I	0.400	0.406	0.403	0.496	0.186	37.500	37.500
LINY	08-Jul-92	190	1166	R	0.592	0.586	0.589				
S3UT	10-Jul-92	192	1201	I	0.728	0.713	0.720	0.676	-0.090	-13.333	13.333
S3UT	10-Jul-92	192	1201	R	0.621	0.640	0.630				
LINY	13-Jul-92	195	1207	I	0.204	0.206	0.205	0.245	0.079	32.311	32.311
LINY	13-Jul-92	195	1207	R	0.281	0.287	0.284				
NWNJ	14-Jul-92	196	1255	I	0.781	0.793	0.787	0.805	0.036	4.472	4.472
NWNJ	14-Jul-92	196	1255	R	0.835	0.810	0.823				
PLNJ	15-Jul-92	197	1275	I	0.503	0.523	0.513	0.601	0.175	29.142	29.142
PLNJ	15-Jul-92	197	1275	R	0.684	0.693	0.688				
MNY	14-Jul-92	196	1304	I	0.305	0.326	0.316	0.286	-0.059	-20.593	20.593
MNY	14-Jul-92	196	1304	R	0.258	0.256	0.257				
MNY	17-Jul-92	199	1322	I	0.159	0.164	0.162	0.158	-0.008	-5.063	5.063
MNY	17-Jul-92	199	1322	R	0.148	0.159	0.154				

Table 4-6. (Continued)

Site Code	Sample Date	Julian Sample Date	Radian ID #		Inj. 1 NMOC, ppmC	Inj. 2 NMOC, ppmC	Analysis Mean, ppmC	Canister Mean, ppmC	Replicates Diff	% Diff	Abs % Diff
LINY	20-Jul-92	202	1341	I	0.508	0.528	0.518	0.551	0.066	11.978	11.978
LINY	20-Jul-92	202	1341	R	0.569	0.599	0.584				
S2UT	22-Jul-92	204	1377	I	0.390	0.383	0.386	0.457	0.141	30.887	30.887
S2UT	22-Jul-92	204	1377	R	0.523	0.531	0.527				
LINY	23-Jul-92	205	1401	I	0.072	0.046	0.059	0.071	0.024	33.451	33.451
LINY	23-Jul-92	205	1401	R	0.093	0.072	0.083				
S2UT	27-Jul-92	209	1456	I	0.673	0.656	0.665	0.660	-0.009	-1.363	1.363
S2UT	27-Jul-92	209	1456	R	0.649	0.662	0.656				
LINY	27-Jul-92	209	1483	I	0.193	0.190	0.192	0.188	-0.009	-4.800	4.800
LINY	27-Jul-92	209	1483	R	0.184	0.183	0.183				
MNY	29-Jul-92	211	1502	I	0.352	0.364	0.358	0.370	0.024	6.486	6.486
MNY	29-Jul-92	211	1502	R	0.380	0.385	0.382				
MNY	30-Jul-92	212	1522	I	0.347	0.351	0.349	0.302	-0.094	-31.126	31.126
MNY	30-Jul-92	212	1522	R	0.253	0.257	0.255				
NWNJ	29-Jul-92	211	1553	I	0.508	0.504	0.506	0.517	0.022	4.255	4.255
NWNJ	29-Jul-92	211	1553	R	0.542	0.514	0.528				
PLNJ	03-Aug-92	216	1585	I	0.468	0.448	0.458	0.461	0.005	1.086	1.086
PLNJ	03-Aug-92	216	1585	R	0.457	0.470	0.463				
R1NC	05-Aug-92	218	1614	I	0.110	0.102	0.106	0.109	0.007	6.393	6.393
R1NC	05-Aug-92	218	1614	R	0.100	0.125	0.113				
PLNJ	04-Aug-92	217	1650	I	0.322	0.320	0.321	0.301	-0.041	-13.644	13.644
PLNJ	04-Aug-92	217	1650	R	0.278	0.283	0.280				

Table 4-6. (Continued)

Site Code	Sample Date	Julian Sample Date	Radian ID #		Inj. 1 NMOC, ppmC	Inj. 2 NMOC, ppmC	Analysis Mean, ppmC	Canister Mean, ppmC	Replicates Diff	% Diff	Abs % Diff
WSNC	06-Aug-92	219	1670	I	0.066	0.062	0.064	0.087	0.045	52.023	52.023
WSNC	06-Aug-92	219	1670	R	0.110	0.108	0.109				
MNY	06-Aug-92	219	1712	I	0.554	0.570	0.562	0.572	0.019	3.325	3.325
MNY	06-Aug-92	219	1712	R	0.595	0.567	0.581				
S2UT	06-Aug-92	219	1717	I	0.566	0.566	0.566	0.568	0.004	0.704	0.704
S2UT	06-Aug-92	219	1717	R	0.568	0.573	0.570				
LINY	11-Aug-92	224	1760	I	0.249	0.250	0.250	0.267	0.034	12.734	12.734
LINY	11-Aug-92	224	1760	R	0.276	0.291	0.284				
S3UT	12-Aug-92	225	1781	I	0.273	0.270	0.271	0.273	0.003	1.101	1.101
S3UT	12-Aug-92	225	1781	R	0.276	0.272	0.274				
LINY	13-Aug-92	226	1801	I	0.168	0.142	0.155	0.158	0.006	3.797	3.797
LINY	13-Aug-92	226	1801	R	0.157	0.164	0.161				
MNY	14-Aug-92	227	1837	I	0.333	0.342	0.338	0.268	-0.140	-52.239	52.239
MNY	14-Aug-92	227	1837	R	0.195	0.201	0.198				
NWNJ	14-Aug-92	227	1854	I	0.230	0.257	0.244	0.311	0.135	43.339	43.339
NWNJ	14-Aug-92	227	1854	R	0.371	0.387	0.379				
S3UT	18-Aug-92	231	1886	I	0.611	0.640	0.625	0.625	-0.001	-0.160	0.160
S3UT	18-Aug-92	231	1886	R	0.636	0.611	0.624				
R1NC	17-Aug-92	230	1916	I	0.093	0.110	0.101	0.157	0.112	71.338	71.338
R1NC	17-Aug-92	230	1916	R	0.213	0.213	0.213				
MNY	20-Aug-92	233	1946	I	0.245	0.243	0.244	0.240	-0.009	-3.758	3.758
MNY	20-Aug-92	233	1946	R	0.235	0.235	0.235				

Table 4-6. (Continued)

Site Code	Sample Date	Julian Sample Date	Radian ID #		Inj. 1 NMOC, ppmC	Inj. 2 NMOC, ppmC	Analysis Mean, ppmC	Canister Mean, ppmC	Replicates Diff	Replicates % Diff	Replicates Abs % Diff
WSNC	21-Aug-92	234	1974	I	0.151	0.123	0.137	0.180	0.085	47.354	47.354
WSNC	21-Aug-92	234	1974	R	0.233	0.211	0.222				
NWNJ	21-Aug-92	234	2012	I	0.442	0.430	0.436	0.540	0.208	38.519	38.519
NWNJ	21-Aug-92	234	2012	R	0.633	0.656	0.644				
S2UT	25-Aug-92	238	2046	I	0.619	0.615	0.617	0.631	[illegible]	4.437	4.437
S2UT	25-Aug-92	238	2046	R	0.656	0.635	0.645				
MNY	26-Aug-92	239	2064	I	2.120	2.120	2.120	2.050	-0.140	-6.829	6.829
MNY	26-Aug-92	239	2064	R	2.000	1.960	1.980				
R1NC	27-Aug-92	240	2207	I	0.347	0.313	0.330	0.335	0.009	2.691	2.691
R1NC	27-Aug-92	240	2207	R	0.335	0.343	0.339				
PLNJ	02-Sep-92	246	2225	I	0.544	0.574	0.559	0.399	-0.319	-79.850	79.850
PLNJ	02-Sep-92	246	2225	R	0.223	0.256	0.240				
LINY	04-Sep-92	248	2237	I	0.284	0.287	0.285	0.318	0.066	20.755	20.755
LINY	04-Sep-92	248	2237	R	0.350	0.352	0.351				
MNY	11-Sep-92	255	2318	I	0.294	0.305	0.300	0.370	0.140	37.838	37.838
MNY	11-Sep-92	255	2318	R	0.448	0.432	0.440				
R1NC	11-Sep-92	255	2385	I	0.093	0.095	0.094	0.111	0.033	29.864	29.864
R1NC	11-Sep-92	255	2385	R	0.121	0.133	0.127				
MNY	21-Sep-92	265	2440	I	0.950	0.961	0.955	0.940	-0.031	-3.300	3.300
MNY	21-Sep-92	265	2440	R	0.912	0.935	0.924				
MNY	21-Sep-92	265	2441	I	0.796	0.781	0.788	0.694	-0.189	-27.253	27.253
MNY	21-Sep-92	265	2441	R	0.588	0.610	0.599				
S2UT	25-Sep-92	269	2525	I	0.516	0.486	0.501	0.467	-0.068	-14.561	14.561
S2UT	25-Sep-92	269	2525	R	0.438	0.429	0.433				

Table 4-6. (Continued)

Site Code	Sample Date	Julian Sample Date	Radian ID #		Inj. 1 NMOC, ppmC	Inj. 2 NMOC, ppmC	Analysis Mean, ppmC	Canister Mean, ppmC	Replicates Diff	% Diff	Abs % Diff
LINY	29-Sep-92	273	2567	I	0.125	0.112	0.118	0.138	0.040	28.986	28.986
LINY	29-Sep-92	273	2567	R	0.154	0.162	0.158				
NWNJ	29-Sep-92	273	2588	I	0.460	0.493	0.477	0.427	-0.099	-23.158	23.158
NWNJ	29-Sep-92	273	2588	R	0.380	0.376	0.378				
NWNJ	29-Sep-92	[illegible]	2590	I	0.464	0.481	0.473	0.431	-0.084	-19.490	19.490
NWNJ	29-Sep-92	273	2590	R	0.386	0.392	0.389				
PLNJ	30-Sep-92	274	2612	I	0.108	0.084	0.096	0.116	0.040	34.483	34.483
PLNJ	30-Sep-92	274	2612	R	0.121	0.150	0.136				
PLNJ	30-Sep-92	274	2619	I	0.053	0.076	0.065	0.105	0.081	76.777	76.777
PLNJ	30-Sep-92	274	2619	R	0.149	0.143	0.146				
							Count =	50	50	50	50
							Average	0.407	0.011	8.743	21.613
							Std Dev	0.318	0.095	28.900	20.894

Percent differences are calculated by the following equation:

$$\% \text{ Diff} = \frac{\bar{X}_2 - \bar{X}_1}{(\bar{X}_1 + \bar{X}_2) / 2} \bullet 100 \qquad (4\text{-}1)$$

where:

$\bar{X}_1$ = The mean NMOC concentration for the first analysis; and

$\bar{X}_2$ = The mean NMOC concentration for the second (or repeated) analysis.

A total of 100 analyses on 50 canister samples are shown in Table 4-6. The percent difference ranged from -79.850 to +76.777 and averaged +8.743 overall. The small value of the overall average percent difference indicated that there was an insignificant average bias between the second and the first analyses.

The final column in Table 4-6 is absolute percent difference. The overall absolute percent difference was 21.61 for 1992. In 1991, the average absolute percent difference was 14.29, in 1990 was 7.59, and in 1989 was 8.24. Experience has shown that in general the lower the concentration, the higher the percent difference, and especially the absolute percent difference.

4.5 Duplicate Sample Results

Duplicate analysis results are given in Table 4-7. Percent differences (between the canister means) ranged from -74.424 to +77.858 and averaged +3.050 overall. The small overall average percent difference indicates that there was no systematic bias between samples. The absolute percent difference averaged 15.626. Absolute percent differences averaged 15.768 in 1991, 7.594 in 1990, and 10.621 in 1989.

Table 4-7. Duplicate Samples for the 1992 NMOC Program

Site Code	Sample Date	Julian Sample Date	Radian ID #		Inj. 1 NMOC, ppmC	Inj. 2 NMOC, ppmC	Analysis Mean, ppmC	Canister Mean, ppmC	Duplicates Diff	% Diff	Abs % Diff
WSNC	07-Jul-92	189	1132		0.112	0.099	0.106	0.106	0.009	7.993	7.993
WSNC	07-Jul-92	189	1133	I	0.104	0.125	0.115	0.115			
WSNC	07-Jul-92	189	1133	R	0.104	0.125	0.115				
R1NC	06-Jul-92	188	1154		0.108	0.130	0.119	0.119	0.018	13.699	13.699
R1NC	06-Jul-92	188	1155		0.133	0.140	0.136	0.137			
LINY	08-Jul-92	190	1165		0.576	0.571	0.573	0.574	-0.077	-14.493	14.493
LINY	08-Jul-92	190	1166	I	0.400	0.406	0.403	0.496			
LINY	08-Jul-92	190	1166	R	0.592	0.586	0.589				
MNY	08-Jul-92	190	1178		1.120	1.130	1.120	1.125	-0.496	-56.630	56.630
MNY	08-Jul-92	190	1182		0.619	0.638	0.628	0.629			
S3UT	10-Jul-92	192	1191		0.716	0.733	0.725	0.725	-0.049	-7.000	7.000
S3UT	10-Jul-92	192	1201	I	0.728	0.713	0.720	0.676			
S3UT	10-Jul-92	192	1201	R	0.621	0.640	0.630				
LINY	13-Jul-92	195	1207	I	0.204	0.206	0.205	0.245	0.032	0.123	0.123
LINY	13-Jul-92	195	1207	R	0.281	0.287	0.284				
LINY	13-Jul-92	195	1208		0.292	0.261	0.276	0.277			
MNY	13-Jul-92	195	1226		0.479	0.511	0.495	0.495	0.014	2.789	2.789
MNY	13-Jul-92	195	1227		0.500	0.518	0.509	0.509			
R1NC	15-Jul-92	197	1252		0.090	0.111	0.101	0.101	0.012	11.710	11.710
R1NC	15-Jul-92	197	1253		0.110	0.116	0.113	0.113			
PLNJ	15-Jul-92	197	1275	I	0.503	0.523	0.513	0.601	0.070	0.110	0.110
PLNJ	15-Jul-92	197	1275	R	0.684	0.693	0.688				
PLNJ	15-Jul-92	197	1276		0.666	0.675	0.671	0.671			
WSNC	16-Jul-92	198	1287		0.166	0.165	0.165	0.166	0.013	7.837	7.837
WSNC	16-Jul-92	198	1291		0.188	0.170	0.179	0.179			

Table 4-7. (Continued)

Site Code	Sample Date	Julian Sample Date	Radian ID #		Inj. 1 NMOC, ppmC	Inj. 2 NMOC, ppmC	Analysis Mean, ppmC	Canister Mean, ppmC	Duplicates Diff	% Diff	Abs % Diff
S3UT	22-Jul-92	204	1368		0.755	0.757	0.756	0.756	-0.122	-17.554	17.554
S3UT	22-Jul-92	204	1369		0.645	0.623	0.634	0.634			
S2UT	22-Jul-92	204	1377	I	0.390	0.383	0.386	0.457	0.071	0.144	0.144
S2UT	22-Jul-92	204	1377	R	0.523	0.531	0.527				
S2UT	22-Jul-92	204	1378		0.535	0.520	0.528	0.528			
LINY	23-Jul-92	205	1400		0.108	0.135	0.122	0.122	-0.051	-52.697	52.697
LINY	23-Jul-92	205	1401	I	0.072	0.046	0.059	0.071			
LINY	23-Jul-92	205	1401	R	0.093	0.072	0.083				
NWNJ	24-Jul-92	206	1445		0.414	0.429	0.421	0.422	-0.047	-11.942	11.942
NWNJ	24-Jul-92	206	1446		0.374	0.374	0.374	0.374			
WSNC	27-Jul-92	209	1447		0.209	0.229	0.219	0.219	0.078	30.233	30.233
WSNC	27-Jul-92	209	1448		0.304	0.290	0.297	0.297			
S3UT	27-Jul-92	209	1451		0.510	0.479	0.495	0.495	0.058	11.079	11.079
S3UT	27-Jul-92	209	1452		0.542	0.563	0.552	0.553			
S2UT	27-Jul-92	209	1455		0.605	0.581	0.593	0.593	0.067	10.694	10.694
S2UT	27-Jul-92	209	1456	I	0.673	0.656	0.665	0.660			
S2UT	27-Jul-92	209	1456	R	0.649	0.662	0.656				
PLNJ	27-Jul-92	209	1464		0.327	0.325	0.326	0.326	0.061	16.982	16.982
PLNJ	27-Jul-92	209	1465		0.380	0.393	0.386	0.387			
NWNJ	29-Jul-92	211	1553	I	0.508	0.504	0.506	0.517	-0.037	-0.073	0.073
NWNJ	29-Jul-92	211	1553	R	0.542	0.514	0.528				
NWNJ	29-Jul-92	211	1554		0.472	0.489	0.481	0.481			
MNY	31-Jul-92	213	1557		0.680	0.671	0.676	0.676	-0.080	-12.505	12.505
MNY	31-Jul-92	213	1558		0.586	0.606	0.596	0.596			

Table 4-7. (Continued)

Site Code	Sample Date	Julian Sample Date	Radian ID #		Inj. 1 NMOC, ppmC	Inj. 2 NMOC, ppmC	Analysis Mean, ppmC	Canister Mean, ppmC	Duplicates Diff	% Diff	Abs % Diff
LINY	03-Aug-92	216	1605		0.130	0.163	0.146	0.147	-0.018	-12.704	12.704
LINY	03-Aug-92	216	1607		0.127	0.131	0.129	0.129			
R1NC	05-Aug-92	218	1614	I	0.110	0.102	0.106	0.109	0.009	0.077	0.077
R1NC	05-Aug-92	218	1614	R	0.100	0.125	0.113				
R1NC	05-Aug-92	218	1615		0.106	0.130	0.118	0.118			
R1NC	31-Jul-92	213	1619		0.145	0.125	0.135	0.135	0.038	24.675	24.675
R1NC	31-Jul-92	213	1620		0.158	0.188	0.173	0.173			
NWNJ	04-Aug-92	217	1637		0.675	0.660	0.668	0.668	-0.059	-9.166	9.166
NWNJ	04-Aug-92	217	1642		0.609	0.609	0.609	0.609			
PLNJ	04-Aug-92	217	1632		0.359	0.369	0.364	0.364	-0.063	-19.030	19.030
PLNJ	04-Aug-92	217	1650	I	0.322	0.320	0.321	0.301			
PLNJ	04-Aug-92	217	1650	R	0.278	0.283	0.280				
WSNC	06-Aug-92	219	1670	I	0.066	0.062	0.064	0.087	0.041	0.383	0.383
WSNC	06-Aug-92	219	1670	R	0.110	0.108	0.109				
WSNC	06-Aug-92	219	1676		0.132	0.123	0.128	0.128			
S3UT	06-Aug-92	219	1715		0.226	0.242	0.234	0.234	0.064	23.895	23.895
S3UT	06-Aug-92	219	1716		0.300	0.295	0.298	0.298			
S2UT	06-Aug-92	219	1717	I	0.566	0.566	0.566	0.568	-0.181	-0.378	0.378
S2UT	06-Aug-92	219	1717	R	0.568	0.573	0.570				
S2UT	06-Aug-92	219	1718		0.404	0.371	0.388	0.388			
S3UT	12-Aug-92	225	1780		0.326	0.326	0.326	0.326	-0.053	-17.787	17.787
S3UT	12-Aug-92	225	1781	I	0.273	0.270	0.271	0.273			
S3UT	12-Aug-92	225	1781	R	0.276	0.272	0.274				

Table 4-7. (Continued)

Site Code	Sample Date	Julian Sample Date	Radian ID #		Inj. 1 NMOC ppmC	Inj. 2 NMOC ppmC	Analysis Mean ppmC	Canister Mean ppmC	Duplicates Diff	% Diff	Abs % Diff
S2UT	12-Aug-92	225	1784		1.129	1.104	1.117	1.117	0.001	0.134	0.134
S2UT	12-Aug-92	225	1785		1.126	1.110	1.118	1.118			
LINY	13-Aug-92	226	1801	I	0.168	0.142	0.155	0.158	-0.048	-0.357	0.357
LINY	13-Aug-92	226	1801	R	0.157	0.164	0.161				
LINY	13-Aug-92	226	1802		0.114	0.106	0.110	0.110			
NWNJ	14-Aug-92	227	1854	I	0.230	0.257	0.244	0.311	-0.005	-0.017	0.017
NWNJ	14-Aug-92	227	1854	R	0.371	0.387	0.379				
NWNJ	14-Aug-92	227	1855		0.294	0.318	0.306	0.306			
WSNC	18-Aug-92	231	1881		0.108	0.103	0.106	0.106	0.135	77.858	77.858
WSNC	18-Aug-92	231	1882		0.236	0.244	0.240	0.240			
S2UT	18-Aug-92	231	1884		1.179	1.207	1.193	1.193	0.037	3.054	3.054
S2UT	18-Aug-92	231	1885		1.232	1.228	1.230	1.230			
S3UT	18-Aug-92	231	1886	I	0.611	0.640	0.625	0.625	0.039	0.061	0.061
S3UT	18-Aug-92	231	1886	R	0.636	0.611	0.624				
S3UT	18-Aug-92	231	1887		0.647	0.681	0.664	0.664			
R1NC	17-Aug-92	230	1915		0.125	0.110	0.118	0.118	0.040	28.935	28.935
R1NC	17-Aug-92	230	1916	I	0.093	0.110	0.101	0.157			
R1NC	17-Aug-92	230	1916	R	0.213	0.213	0.213				
PLNJ	14-Aug-92	227	1922		2.394	2.390	2.392	2.392	0.370	14.358	14.358
PLNJ	14-Aug-92	227	1923		2.754	2.770	2.762	2.762			
NWNJ	26-Aug-92	239	2063		3.020	3.040	3.030	3.030	-0.043	-1.413	1.413
NWNJ	26-Aug-92	239	2070		3.003	2.972	2.987	2.988			
LINY	25-Aug-92	238	2106		0.734	0.719	0.727	0.727	-0.027	-3.858	3.858
LINY	25-Aug-92	238	2107		0.704	0.694	0.699	0.699			

Table 4-7. (Continued)

Site Code	Sample Date	Julian Sample Date	Radian ID #		Inj. 1 NMOC, ppmC	Inj. 2 NMOC, ppmC	Analysis Mean, ppmC	Canister Mean, ppmC	Duplicates Diff	% Diff	Abs % Diff
WSNC	28-Aug-92	241	2109		0.045	0.050	0.047	0.047	0.048	67.602	67.602
WSNC	28-Aug-92	241	2110		0.099	0.092	0.095	0.095			
R1NC	27-Aug-92	240	2206		0.251	0.258	0.254	0.255	0.080	27.165	27.165
R1NC	27-Aug-92	240	2207	I	0.347	0.313	0.330	0.335			
R1NC	27-Aug-92	240	2207	R	0.335	0.343	0.339				
LINY	04-Sep-92	248	2237	I	0.284	0.287	0.285	0.318	0.026	0.078	0.078
LINY	04-Sep-92	248	2237	R	0.350	0.352	0.351				
LINY	04-Sep-92	248	2238		0.346	0.342	0.344	0.344			
WSNC	09-Sep-92	253	2268		0.696	0.678	0.687	0.687	0.124	16.555	16.555
WSNC	09-Sep-92	253	2276		0.806	0.816	0.811	0.811			
MNY	09-Sep-92	253	2270		0.499	0.489	0.494	0.494	-0.125	-28.969	28.969
MNY	09-Sep-92	253	2271		0.356	0.382	0.369	0.369			
PLNJ	10-Sep-92	254	2311		0.154	0.171	0.162	0.163	0.013	7.976	7.976
PLNJ	10-Sep-92	254	2312		0.182	0.170	0.176	0.176			
MNY	11-Sep-92	255	2318	I	0.294	0.305	0.300	0.370	0.107	0.252	0.252
MNY	11-Sep-92	255	2318	R	0.448	0.432	0.440				
MNY	11-Sep-92	255	2322		0.491	0.462	0.476	0.477			
NWNJ	10-Sep-92	254	2326		1.800	1.812	1.806	1.806	0.179	9.443	9.443
NWNJ	10-Sep-92	254	2327		2.000	1.970	1.990	1.985			
NWNJ	14-Sep-92	258	2366		3.543	3.530	3.537	3.537	0.031	0.873	0.873
NWNJ	14-Sep-92	258	2367		3.570	3.565	3.567	3.568			
MNY	16-Sep-92	260	2373		0.867	0.861	0.864	0.864	0.120	12.987	12.987
MNY	16-Sep-92	260	2390		0.984	0.984	0.984	0.984			

Table 4-7. (Continued)

Site Code	Sample Date	Julian Sample Date	Radian ID #		Inj. 1 NMOC, ppmC	Inj. 2 NMOC, ppmC	Analysis Mean, ppmC	Canister Mean, ppmC	Duplicates Diff	Duplicates % Diff	Duplicates Abs % Diff
PLNJ	15-Sep-92	259	2377		1.027	1.048	1.038	1.038	0.014	1.340	1.340
PLNJ	15-Sep-92	259	2381		1.048	1.055	1.051	1.052			
R1NC	11-Sep-92	255	2385	I	0.093	0.095	0.094	0.111	0.045	0.335	0.335
R1NC	11-Sep-92	255	2385	R	0.121	0.133	0.127				
R1NC	11-Sep-92	255	2387		0.164	0.146	0.155	0.155			
LINY	16-Sep-92	260	2392		0.460	0.476	0.468	0.468	0.089	17.277	17.277
LINY	16-Sep-92	260	2396		0.553	0.560	0.557	0.557			
S2UT	17-Sep-92	261	2406		0.509	0.492	0.500	0.501	-0.000	-0.100	0.100
S2UT	17-Sep-92	261	2410		0.499	0.501	0.500	0.500			
S3UT	17-Sep-92	261	2407		0.501	0.487	0.494	0.494	-0.015	-2.979	2.979
S3UT	17-Sep-92	261	2409		0.477	0.482	0.480	0.480			
WSNC	18-Sep-92	262	2427		0.382	0.371	0.377	0.377	0.030	7.540	7.540
WSNC	18-Sep-92	262	2430		0.408	0.404	0.406	0.406			
MNY	21-Sep-92	265	2440	I	0.950	0.961	0.955	0.940	-0.246	-30.093	30.093
MNY	21-Sep-92	265	2440	R	0.912	0.935	0.924				
MNY	21-Sep-92	265	2441	I	0.796	0.781	0.788	0.694			
MNY	21-Sep-92	265	2441	R	0.588	0.610	0.599				
S2UT	22-Sep-92	266	2457		0.989	0.996	0.993	0.993	-0.000	-0.050	0.050
S2UT	22-Sep-92	266	2458		1.001	0.983	0.992	0.992			
S3UT	22-Sep-92	266	2463		1.060	1.050	1.060	1.055	-0.030	-2.885	2.885
S3UT	22-Sep-92	266	2464		1.020	1.030	1.030	1.025			
R1NC	17-Sep-92	261	2496		0.183	0.158	0.171	0.171	0.055	27.560	27.560
R1NC	17-Sep-92	261	2497		0.225	0.225	0.225	0.225			

Table 4-7. (Continued)

Site Code	Sample Date	Julian Sample Date	Radian ID #		Inj. 1 NMOC, ppmC	Inj. 2 NMOC, ppmC	Analysis Means, ppmC	Centered Means, ppmC	Duplicates Diff	% Diff	Abs % Diff
MNY	24-Sep-92	268	2506		0.487	0.482	0.484	0.485	-0.086	-19.603	19.603
MNY	24-Sep-92	268	2507		0.385	0.411	0.398	0.398			
S2UT	25-Sep-92	269	2525	I	0.516	0.486	0.501	0.467	0.094	0.182	0.182
S2UT	25-Sep-92	269	2525	R	0.438	0.429	0.433				
S2UT	25-Sep-92	269	2526		0.576	0.546	0.561	0.561			
S3UT	25-Sep-92	269	2527		0.292	0.274	0.283	0.283	-0.154	-74.424	74.424
S3UT	25-Sep-92	269	2528		0.121	0.138	0.130	0.130			
LINY	29-Sep-92	273	2567	I	0.125	0.112	0.118	0.138	-0.016	-0.121	0.121
LINY	29-Sep-92	273	2567	R	0.154	0.162	0.158				
LINY	29-Sep-92	273	2575		0.127	0.118	0.122	0.123			
PLNJ	28-Sep-92	272	2569		0.460	0.465	0.463	0.463	0.320	51.346	51.346
PLNJ	28-Sep-92	272	2564		0.782	0.782	0.782	0.782			
PLNJ	29-Sep-92	273	2587		0.113	0.084	0.099	0.099	-0.029	-33.828	33.828
PLNJ	29-Sep-92	273	2596		0.084	0.056	0.070	0.070			
NWNJ	29-Sep-92	273	2588	I	0.460	0.493	0.477	0.427	0.004	0.816	0.816
NWNJ	29-Sep-92	273	2588	R	0.380	0.376	0.378				
NWNJ	29-Sep-92	273	2590	I	0.464	0.481	0.473	0.431			
NWNJ	29-Sep-92	273	2590	R	0.386	0.392	0.389				
R1NC	25-Sep-92	269	2601		0.079	0.106	0.093	0.093	0.020	19.512	19.512
R1NC	25-Sep-92	269	2607		0.108	0.117	0.113	0.113			
WSNC	30-Sep-92	274	2604		0.091	0.062	0.077	0.077	0.049	48.766	48.766
WSNC	30-Sep-92	274	2605		0.134	0.118	0.126	0.126			

Table 4-7. (Continued)

Site Code	Sample Date	Julian Sample Date	Radian ID #		Inj. 1 NMOC, ppmC	Inj. 2 NMOC, ppmC	Analysis Mean, ppmC	Canister Mean, ppmC	Duplicates Diff	% Diff	Abs % Diff
PLNJ	30-Sep-92	274	2612	I	0.108	0.084	0.096	0.116	-0.010	-9.502	9.502
PLNJ	30-Sep-92	274	2612	R	0.121	0.150	0.136				
PLNJ	30-Sep-92	274	2619	I	0.053	0.076	0.065	0.105			
PLNJ	30-Sep-92	274	2619	R	0.149	0.143	0.146				
LINY	30-Sep-92	274	2613		0.093	0.086	0.090	0.090	0.059	49.263	49.263
LINY	30-Sep-92	274	2614		0.152	0.144	0.148	0.148			
							Count =	140	70	70	70
							Average	0.557	0.009	3.050	15.626
							Std Dev	0.633	0.111	24.405	18.903

4.6 Canister Pressure Results

Canister pressure results for the NMOC Monitoring Program are an important gauge to assess whether the ambient air samples obtained are representative. The NMOC sampling systems are designed to obtain an integrated ambient air sample between 6:00 a.m. and 9:00 a.m., or at other programmed intervals. Canister pressures are measured to obtain a better understanding of the range and magnitude of pressures being generated by the NMOC sampling systems. Canister pressure data are given in Table 4-8 for both single canister samples and duplicate samples. The pressures reported in Table 4-8 are the canister sampling pressures measured immediately before analysis in the laboratory. A significant decrease between the field sampling pressure and the laboratory value might indicate a leak.

Table 4-8 gives statistics for single and duplicate samples. All sample canisters averaged 12.5 psig, while duplicate samples averaged 14.5 psig. The column entitled "All Samples" includes pressures from both single samples and duplicate samples. Standard deviations were 3.0 and 2.9 psig, respectively.

4.7 Canister Cleanup Results

Prior to the start of the 1992 NMOC Sampling and Analysis Program all of the canisters were cleaned and analyzed for their NMOC content to establish canister initial conditions. The resulting analysis with cleaned, dried air that had been humidified averaged 0.0027 ppmC, ranging from 0.0000 to 0.0093 ppmC. Any canisters that produced more than 0.020 ppmC were recleaned.

Continual monitoring of the cleanup was important to ensure that there was negligible carryover from one site sample to the next. The daily canister cleanup

Table 4-8

NMOC Pressure[a] Statistics

Statistics	All Samples	Duplicate Sample Canisters
Number of Cases	566	140
Minimum Pressure, psig	5.0	7.0
Maximum Pressure, psig	22.0	22.0
Mean Pressure, psig	12.5	14.5
Median Pressure, psig	12.0	14.0
Standard Deviation, psig	3.0	2.9
Skewness, psig	0.29	0.09
Kurtosis, psig	0.30	-0.001

[a]Measured immediately prior to analysis.

procedure is described in detail in Section 3.4. Because the NMOC content was below 0.020 ppmC, cleanup was considered to be satisfactory.

Average percent recoveries, or average percent cleanup, in 1992 averaged 98.79% (99.747% in 1991, 99.747% in 1990, 99.742% in 1989, 99.689% in 1988, 99.374% in 1987, 99.891% in 1986, and 99.898% in 1985). The reported average percent recovery is based on average NMOC concentration and average cleanup concentration. The reported percent cleanup figures should be considered minimum values. The actual percent cleanup was greater than the reported values because, after the percent cleanup was measured, the canister was evacuated a third time before being shipped to the site.

4.8 External Audit Results

Primary measures of accuracy for the NMOC monitoring data were calculated from the results of the analysis of propane audit samples provided by U.S. EPA. Results are reported in terms of percent bias relative to the EPA concentration spiked.

Four audit samples, ID# 2186, 2267, 2402, and 2474 were analyzed during the NMOC program. The EPA Audit Report is given in Appendix I. Table 4-9 gives the concentrations reported by the EPA Auditor and by the four Radian channels. The theoretical concentration reported in Table 4-9 was calculated using dilution factors estimated when the audit samples were prepared. The column labeled Reference is the concentration measured by the EPA Audit Laboratory. The percent bias results are presented in Table 4-10 and were calculated relative to the theoretical values. The Radian bias ranged from -3.452% to +24.000%, and averaged +4.969% for the audit canisters. Table 4-11 shows the bias of the audit samples to the reference measured concentrations.

Table 4-9

External NMOC Audit Samples

Canister No.	Concentration, ppmC					
	Theoretical	Analysis				
		Reference	Radian A	Radian B	Radian C	Radian D
2186	1.970	1.91	1.936	1.933	1.918	1.902
2267	0.450	0.45	0.555	0.558	0.543	0.533
2402	0.450	0.52	0.472	0.492	0.447	0.440
2474	1.980	1.90	1.956	1.934	1.930	1.930

Table 4-10

Bias of Audit Samples from Theoretical Concentrations

Canister No.	Theoretical Concentration, ppmC	Percent Difference from Theoretical				
		Reference	Radian A	Radian B	Radian C	Radian D
2186	1.97	-3.046	-1.726	-1.878	-2.640	-3.452
2267	0.45	0.000	23.333	24.000	20.667	18.444
2402	0.45	15.556	4.889	9.333	-0.667	-2.222
2474	1.98	-4.040	-1.212	-2.323	-2.525	-2.525

Percent Diff = (Analysis Channel - Theoretical) / Theoretical * 100

Table 4-11

NMOC External Audits for 1992

Canister No.	Conc., ppmC Reference	Percent Bias Relative to Reference Analysis				
		Theoretical	Radian A	Radian B	Radian C	Radian D
2186	1.91	3.141	1.361	1.204	0.419	-0.419
2267	0.45	0.000	23.333	24.000	20.667	18.444
2402	0.52	-13.462	-9.231	-5.385	-14.038	-15.385
2474	1.90	4.211	2.947	1.789	1.579	1.579

Bias = (Channel - Reference)/Reference * 100

Based on these findings, the overall bias for the Radian channels for the 1992 NMOC Monitoring Program will be reported at +5.0%, with a range from -3.4 to +24.0 percent.

4.9 Data Validation

The secondary backup disks were updated daily on 20 megabyte hard disks. At the completion of the sampling and analysis phase, 10% of the data base was checked to verify its validity. Items checked included original data sheets, checks of all the calculations, and data transfers. In making the calculations for the final report and other reports, corrections were made to the data base as errors or omissions were encountered.

A total of 714 NMOC concentration measurements were performed by Radian in June through October 1992. This included 566 sample analyses, 50 repeated analyses, 82 in-house QC analyses (on 22 in-house QC samples), and 4 audit samples (x 4 analyses each).

Ten percent of the data base was validated according to the procedure outlined below.

A. Calibration factors were checked.

1. The area count from the strip chart that was used to determine the calibration factor was examined to verify that the data had been properly transferred to the calibration form.

2. The calibration form was examined to verify that the calculations had been correctly made.

3. Each datum on the disk was compared to the corresponding datum on the calibration sheet for accuracy.

B. Analysis data were checked.

1. Area counts were verified from the appropriate strip chart.

2. Calculations were reverified on the analysis forms.

3. Each datum on the disk was compared to the corresponding item on the analysis form.

C. Field data sheet was checked.

1. Each datum on the disk was compared to the corresponding datum on the field data sheet.

The error rate was calculated in terms of the number of items transferred from the original data sources. For each NMOC value in the 1992 data set, 36 items were transferred from original sources to the magnetic disks. In the data validation study each item on the disk was compared with the corresponding value on the original source of data. Sixteen errors were found (and corrected) for an expected error percentage of 0.080 percent.

Each time the data file was opened and a suspected error found, the error was checked against the original archived documents, and corrected where appropriate.

4.10 NMOC Monitoring Program Records

The quality assurance records developed by Radian for this project are extensive and will be preserved as archives. One of the most important objectives of the study was to develop a data base that is well planned and documented and contains NMOC data of known and verifiable quality. Achieving that objective has involved keeping and preserving a number of records that trace the project from planning through reporting.

4.10.1 Archives

In order to keep detailed records that document the quality of the measurements made, Radian developed the following original material:

- Quality Assurance Project Plan (QAPP);
- Notebooks;
- Field Data Sheets;
- Laboratory Calibration Sheets;
- Laboratory Analysis Sheets;
- Chromatographic Strip Charts;
- Bi-weekly, Monthly Reports to EPA;
- Memoranda and Correspondence; and
- Final Report.

In addition to the above items, several papers to be presented at technical meetings and symposia and published in technical journals will be added to the archives.

The QAPP[2] was the Quality Assurance Project Plan and the workplan. The QAPP was designed according to the EPA Quality Assurance Guidelines, and set the pattern of steps necessary to document and control the quality of the data obtained throughout the study.

Several notebooks were necessary to maintain day-to-day records of the project. Field and laboratory data sheets were designed in advance, so that the data recorded appeared in a logical sequence and filled in blanks on the sheet. Additional space was provided for other comments. Each NMOC analysis was assigned a unique Radian Identification Number. Field data sheets and shipping records accompanied the canisters in transit.

4.10.2 Magnetic Disks

In order to manage the data base for report generation and data analysis, pertinent data from the various data sheets and notebooks were transferred to 20 megabyte magnetic disks. The following software was used in the

construction of the data base: Paradox 3.5®, QUATTRO®, and Freelance®. Statistical calculations were performed using SYSTAT® and SAS® software. The data access is rapid and in a convenient form. The primary 20 megabyte magnetic disk has three backup disks.

5.0 NMOC DATA ANALYSIS AND CHARACTERIZATION

The purpose of this section is to characterize the NMOC data qualitatively as well as quantitatively. The NMOC data are shown to fit a two-parameter lognormal distribution better than a normal Gaussian distribution. The summary NMOC data for the sites of the 1992 study are given in Appendix C.

5.1 Overall Characterization

Figure 5-1 gives a stem-and-leaf plot of the 1992 NMOC data along with statistics for NMOC. The stem-and-leaf plots show the actual NMOC concentrations truncated to two or three decimal points. The digits to the left of the vertical open space are called stems and the digits to the right of the open space are the leaves. The data are sorted from the smallest at the top of the graph to the largest at the bottom of the graph. The minimum NMOC value measured was 0.047 ppmC and is shown as "0 4" on the first row at the top of the plot. The maximum NMOC concentration measured was 4.780 shown as "47 8" in the bottom row of the chart. The plot shows 567 leaves, one for each NMOC site datum in the 1992 program. The H's in the open vertical space locate the stem and leaf for the upper and lower hinges, and the M locates the stem and leaf for the median. The median separates the sorted NMOC concentrations into two equal halves; the hinges (or quartiles) separate each half into quarters. The "H spread" or interquartile range is the difference between the NMOC values of the two hinges.

Statistics shown for NMOC are number of cases, minimum, maximum, mean, median, standard deviation, standard error, skewness, kurtosis, and the two hinges. Each NMOC determination is the average of two or three injections of the site samples. In the case of replicates, each NMOC determination is the average of the original and repeated analysis concentrations.

```
 0        44
 0        56777 77788 88888 88999 99999 9999
 1        00000 00000 00011 11111 11111 11112 22222 22222 23333 33333 34444 44444
 1   H    55555 55556 66666 66667 77777 77777 77888 88888 88889 99999 99999
 2        00000 01111 11111 12222 22222 23333 33333 44444 44
 2        55555 56666 66666 67777 77888 88999 999
 3        00000 01111 11111 11111 11222 22333 33333 44444
 3   M    55556 66666 67777 77888 88889 99999 99
 4        00000 00000 11222 22222 22333 33333 44444 4
 4        55555 56666 66666 66777 78888 88888 99999 99999 99
 5        00000 01111 11111 22222 33333 4444
 5        55555 55666 67777 88899 9999
 6   H    00001 11122 22222 22333 44
 6        56666 66777 88889 999
 7        00012 22334
 7        55555 66668
 8        01111 22222 234
 8        56688 99
 9        00011 3444
 9        88899 9
10        2333
10        569
11        01111 222
11        689
12        22347
13        8
14        5
15        7
16        479
17        6
18        0
19        679
20        55
23        9
26        7
27        6
29        68
30        3
31        4
33        4
35        36
37        3
47        8
```

NMOC, ppmC	
Cases	567
Minimum	0.047
Maximum	4.780
Mean	0.506
Standard Deviation	0.531
Standard Error	0.022
Skewness	3.685
Kutosis	18.304
Lower Hinge (H)	0.195
Median (M)	0.388
Upper Hinge (H)	0.601

Figure 5-1. Stem-and-leaf plot of the 1992 NMOC data.

The standard error is the standard deviation divided by the square root of the number of cases. Positive skewness is a third moment about the mean value, and characterizes a tail to the right of the mean value. A normal Gaussian distribution has a skewness of zero. The skewness of 3.685 for the 1992 NMOC data suggests a lognormal frequency distribution; that is by the fact that for the logarithm of the NMOC value (ln(NMOC)) (see Figure 5-2), skewness equals 0.163, which is close to zero. Kurtosis is the fourth moment about the mean and relates to the pointedness of the distribution. A distribution more pointed than a normal distribution, having the same standard deviation, has a kurtosis greater than 3.0. The numerical values of kurtosis listed in this report are zero centered. That is, 3.0 has been subtracted from the fourth moment to give 0.0 for a distribution shaped similar to a normal distribution.

Figure 5-2 is a stem-and-leaf plot of the 1992 ln(NMOC) data. The plot shows an approximately symmetrical distribution (skewness = 0.163). The kurtosis equal to 0.009 indicates the ln(NMOC) distribution to be no more pointed than a normal distribution.

The shape of the stem-and-leaf plots suggests a lognormal distribution. Figures 5-3 and 5-4 support the lognormal distribution hypothesis for NMOC. The vertical scales in Figures 5-3 and 5-4 are arranged so that if the cumulative frequency of occurrence of NMOC were normally distributed, the numbers would plot into a straight line. The line in Figure 5-3 has a noticeable concave downward trend, indicating that the data do not fit a normal distribution well. Figure 5-4 plots the logarithm of NMOC on the same vertical scale. The fact that the digits on the graph plot into approximately a straight line supports the hypothesis that the NMOC data are approximately lognormally distributed. An asterisk on the graph indicates the location of a single datum. Integers, such as 2, 4, or 9, show the location of the corresponding number of data points. The number 999 shows the

```
-30        54
-29        0
-28        1
-27
-26        543
-25        76321 1
-24        86443 10
-23        88766 42211 10
-22        99888 54444 4100
-21        98876 55333 32221 000
-20        77775 54444 11000
-19        98854 43222 11
-18        98765 54442 00000
-17        88886 66544 33222 21110 0
-16   H    99777 77665 44333 3221
-15        88877 65554 43321 100
-14        99988 87766 65443 32222 100
-13        98777 65444 43322 210
-12        99888 76554 33321 100
-11        98877 66666 55554 44444 32221 00
-10        99998 87665 54322 11111
 -9   M    99998 77766 55444 32222 11110 00000 0
 -8        99876 66665 54444 33333 22111 000
 -7        98888 87777 66666 55554 43333 22211 00000 000
 -6        99999 98877 77766 55555 44333 22221 100
 -5   H    99998 88776 65554 43222 21110 00
 -4        99877 77777 66666 54332 11000 0
 -3        99987 77665 55543 22100 0
 -2        88777 77764 10000
 -1        99998 87654 42111 0
 -0        99986 55521 1000
  0        12334 58
  1        00011 11256 799
  2        014
  3        27
  4        59
  5        1269
  6        778
  7        12
  8        7
  9        8
 10        189
 11        04
 12        067
 13        1
 15        6
```

ln(NMOC)	
Cases	567
Minimum	-3.053
Maximum	1.564
Mean	-1.023
Standard Deviation	0.808
Standard Error	0.034
Skewness	0.163
Kutosis	0.009
Lower Hinge (H)	-1.635
Median (M)	-0.947
Upper Hinge (H)	-0.509

Figure 5-2. Stem-and-leaf plot of ln(NMOC) data.

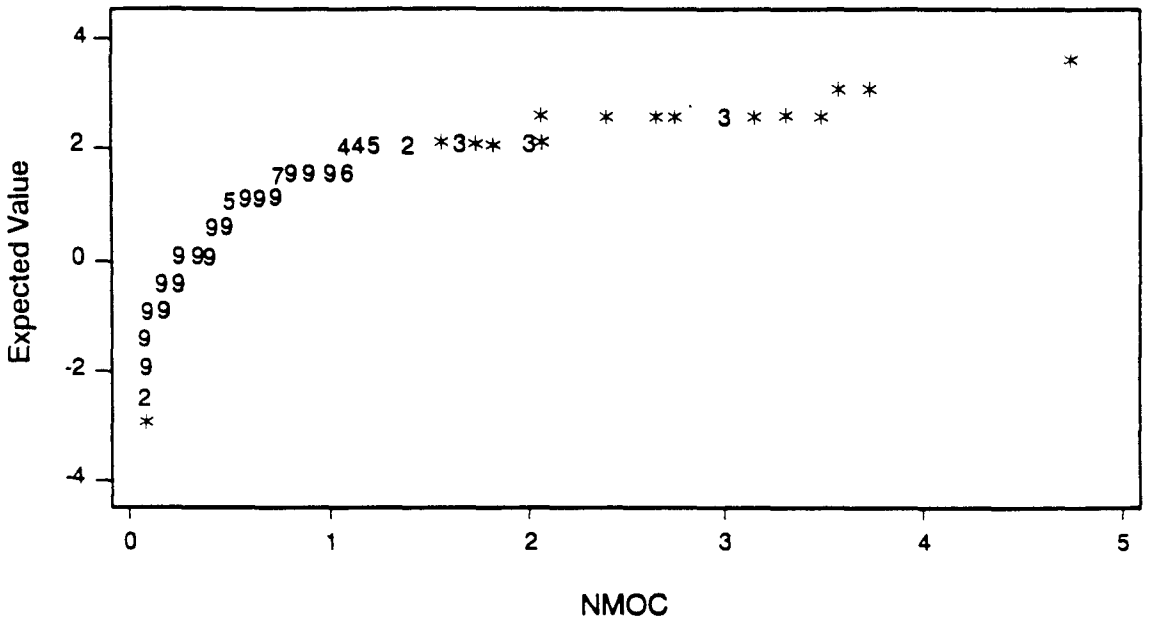


Figure 5-3. Cumulative frequency distribution for the 1992 NMOC data.

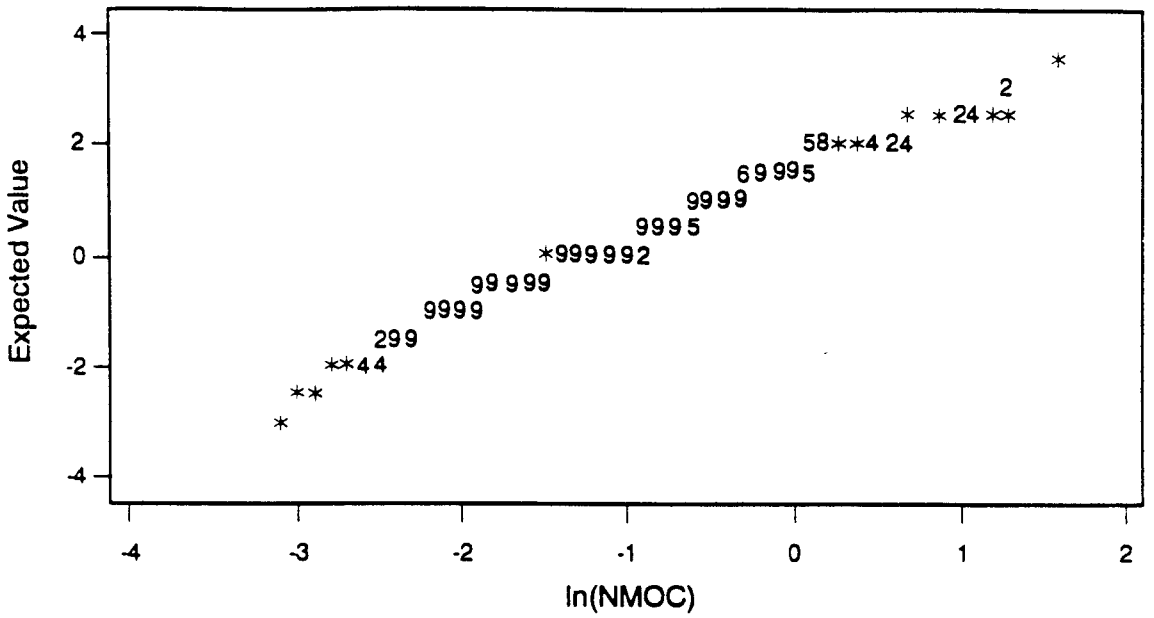


Figure 5-4. Cumulative frequency distribution for 1992 ln(NMOC) data.

approximate location of either 27 data points or 99 + 9 data points. The results, although qualitative, show a dramatic difference between the normal and lognormalhypotheses, and suggest that the latter more nearly describes the NMOC data.

5.2 Monthly Variations, 1992

Table 5-1 partitions the NMOC data for the summer of 1992 into groups that correspond to monthly intervals. For the summer of 1992, the monthly means and medians of the NMOC sites for June, July, August, and September parallel one another. That is, the NMOC mean and median concentrations for July 1992 are less than the mean and median for June 1992. Means and median for August show dramatic increases compared to July 1992. The mean and median for September are approximately the same as August 1992. Arithmetic means are used in Table 5-1 in spite of the observations given in Section 5.1 which conclude that the frequency distribution of NMOC concentrations in ambient air are approximately logarithmic normal distributed. Table 5-1 also gives monthly minima, medians, and maxima. These latter three statistics are independent of the probability distribution from which they derive.

Table 5-1

Summary Statistics for 1992 NMOC Sites, by Month

Sample Month 1991	NMOC Concentration, ppmC					Cases
	Minimum	Median	Mean	Maximum	Standard Deviation	
June	0.085	0.443	0.435	0.829	0.210	30
July	0.071	0.318	0.379	2.670	0.289	172
August	0.047	0.422	0.578	3.730	0.612	178
September	0.048	0.413	0.577	4.780	0.632	177
October	0.060	0.121	0.381	1.648	0.543	10

6.0 THREE-HOUR AIR TOXICS DATA SUMMARY

The 1992 NMOC Program included 3-hour air toxics sample collection at five NMOC sites (see Table 6-1) located in the contiguous United States. Overall concentration results were reported in parts per billion by volume (ppbv) in Section 6.1, and site-specific results are given in Section 6.2.

Analyses were performed using a GC/MD system incorporating a flame ionization detection (FID), photoionization detection (PID), and electron capture detection (ECD). Compound identification was made using a combination of retention time ratios of PID/FID and/or ECD/FID responses, and analyst's experience and judgement. Quantitation was done using the FID response, with the exception of halogenated compounds that were quantitated using the ECD. Propylene, vinyl chloride, 1,3-butadiene, trans-1,2-dichloroethylene, and chloroprene are quantitated from the PID (the FID has interference peaks that coelute with these compounds). If there was an indication that the quantitation detector response for the target compound had interference from an unknown source, quantitation was performed on one of the alternate detectors if applicable. Table 6-1 indicates the number of 3-hour samples taken for GC/MD analyses to speciate for 38 air toxic compounds. Ten analyses were performed on samples from a given site. One duplicate sample was collected from each site, and the analysis of one of the samples from each site was replicated. One of the samples from each site was analyzed by GC/MS for confirmation of compound identification.

Three-hour air toxics samples were regular NMOC or SNMOC Monitoring Program samples that were collected in 6-L stainless steel canisters from 6:00 a.m. to 9:00 a.m. The final canister pressure was about 15 psig. The NMOC samples that were speciated by GC/MD were selected at random during the summer. Each selected sample was first analyzed by the PDFID method for its total NMOC concentration or by the SNMOC method for its speciated target compound

Table 6-1

Three-Hour Ambient Air Samples and Analyses

Site Code	Ambient Air Samples	GC/MD Analyses			GC/MS Analyses
		Duplicate Canister	Replicate Analysis	Total	
B1AL	8	1	1	10	1
B2AL	8	1	1	10	1
B3AL	8	1	1	10	1
NWNJ	7	2	1	10	1
PLNH	8	1	1	10	1
Total	39	6	5	50	5

concentrations. Then the canister pressure was bled to atmospheric pressure and the canister bellows valve was closed. The canister was allowed to equilibrate at least 18 hours before the GC/MD analysis was performed.

6.1 Overall Results

Concentration of the air toxic compounds detected are summarized in Table 6-2 for the 1992 3-hour ambient air samples that were speciated. The table shows the number of cases (samples), the percent of cases in which the compound was identified, the minimum, maximum, and mean (arithmetic average) concentration of the compound in ppbv. In cases where duplicate samples were taken, or replicate analyses were performed, the results of all the analyses were averaged for each sample. The mean refers to the daily sample averages, not the averages of all the analyses. The frequency of occurrence of target compounds fall into four prominent percentile categories at concentration above their detection limits:

- Those occurring in more that 95% of the samples tested;
- Those occurring in more from 50% to 75% of the samples tested;
- Those occurring in less than 20% of the samples tested; and
- Those not identified in any of the 3-hour air samples.

These results are summarized in Table 6-3.

Overall concentration ranged from 0.01 ppbv for trichloroethylene to 253.06 ppbv for 1,1,1-trichloroethane.

Table 6-2. Air Toxics Compound Identifications Summary for All Sites - 1992

Compound	Cases (a) No.	Cases (a) Percent Frequency	Minimum ppbv	Maximum ppbv	Mean (c) ppbv	Mean (c) ug/m3	Mean (d) ppbv	Mean (e) ppbv
Propylene	39	97.50	0.27	8.96	2.50	4.37	2.44	2.44
Chloromethane	24	60.00	0.22	1.44	0.74	1.56	0.49	0.45
1,3-Butadiene	3	7.50	0.09	0.41	0.20	0.46	0.06	0.02
Chloroethane	1	2.50	0.10	0.10	0.10	0.27	0.05	0.00
Methylene chloride	8	20.00	0.44	4.52	2.24	7.90	0.49	0.45
trans-1,2-Dichloroethylene	2	5.00	0.12	0.38	0.25	1.01	0.03	0.01
1,1-Dichloroethane	24	60.00	0.12	1.89	0.60	2.48	0.37	0.36
Chloroform	40	100.00	0.04	0.76	0.19	0.95	0.19	0.19
1,2-Dichloroethane	21	52.50	0.08	5.23	1.38	5.68	0.73	0.72
1,1,1-Trichloroethane	40	100.00	0.29	253.06	8.47	46.95	8.47	8.47
Benzene	40	100.00	0.12	4.09	1.03	3.33	1.03	1.03
Carbon tetrachloride	40	100.00	0.09	0.28	0.13	0.83	0.13	0.13
1,2-Dichloropropane	2	5.00	1.14	1.34	1.24	5.82	0.08	0.06
Trichloroethylene	38	95.00	0.01	0.79	0.14	0.78	0.14	0.14
Toluene	40	100.00	0.14	17.40	3.10	11.87	3.10	3.10
n-Octane	1	2.50	0.31	0.31	0.31	1.47	0.02	0.01
Tetrachloroethylene	40	100.00	0.01	0.92	0.20	1.36	0.20	0.20
Chlorobenzene	23	57.50	0.02	0.52	0.10	0.45	0.06	0.06
Ethylbenzene	40	100.00	0.02	3.62	0.54	2.38	0.54	0.54
m/p-Xylene/Bromoform	40	100.00	0.10	19.22	2.68	51.77	2.68	2.68
Styrene	39	97.50	0.02	0.81	0.27	1.17	0.26	0.26
o-Xylene/1,1,2,2-Tetrachloroethane	40	100.00	0.03	10.12	1.35	15.41	1.35	1.35
m-Dichlorobenzene	17	42.50	0.03	3.08	0.28	0.00	0.00	0.00
p-Dichlorobenzene	30	75.00	0.02	0.36	0.11	0.00	0.00	0.00
o-Dichlorobenzene	23	57.50	0.04	0.23	0.13	0.00	0.00	0.00

a A total of 40 samples were collected and analyzed by GC/MD.

b The percent of the total in which the compound was identitfied.

c The arithmetic average concentration of all the compound identification cases.

d The arithmetic average concentration of all the sample cases using half the MDL values for compounds not detected.

e The arithmetic average concentration of all the sample cases using zero for compounds not detected.

Table 6-3

1992 Air Toxic Compounds Frequency of Occurance

Range for Frequency of Occurance	Target Compounds	
95 to 100%	Propylene Chloroform 1,1,1-Trichloroethane Benzene Carbon tetrachloride Trichloroethylene Toluene	Tetrachloroethylene Ethylbenzene m/p-Xylene/Bromoform Styrene o-Xylene/1,1,2,2-Tetrachloroethane
50 to 75%	Chloromethane 1,1-Dichloroethane 1,2-Dichloroethane Chlorobenzene	m-Dichlorobenzene p-Dichlorobenzene o-Dichlorobenzene
>0 to 20%	1,3-Butadiene Chloromethane Methylene chloride	t-1,2-Dichloroethylene 1,2-Dichloropropane n-Octane
Zero	Acetylene Vinyl chloride Bromomethane Chloroprene Bromochloromethane	Bromodichloromethane cis-1,3-Dichloropropylene trans-1,3-Dichloropropylene 1,1,2-Trichloroethane Dibromochloromethane

6.2 Site Results

Tables 6-4 through 6-8 give 3-hour ambient air concentrations by site code for the 38 air toxics target compounds. The overall site means range from 2.056 ppbv for PLNJ to 3.169 for NWNJ. Appendix H tabulates the complete analytical results and included the NMOC concentrations for each of the 3-hour air toxics samples.

Table 6-4. Air Toxics Compound Identifications for Birmingham, Alabama (B1AL)

Compound	Cases (a)	Minimum ppbv	Maximum ppbv	Mean (b) ppbv	Mean (b) ug/m3	Mean (c) ppbv	Mean (d) ppbv
ropylene	8	0.56	4.82	2.38	4.16	2.38	2.38
hloromethane	2	0.42	0.89	0.66	1.37	0.24	0.16
lethylene chloride	2	1.22	4.52	2.87	10.13	0.76	0.72
1-Dichloroethane	8	0.12	1.08	0.55	2.27	0.55	0.55
hloroform	8	0.07	0.27	0.17	0.84	0.17	0.17
2-Dichloroethane	5	0.39	4.71	1.53	6.29	0.96	0.96
1,1-Trichloroethane	8	0.47	1.47	0.89	4.96	0.89	0.89
enzene	8	0.36	2.24	1.12	3.65	1.12	1.12
arbon tetrachloride	8	0.12	0.14	0.13	0.82	0.13	0.13
2-Dichloropropane	1	1.14	1.14	1.14	5.35	0.16	0.14
ichloroethylene	8	0.04	0.13	0.09	0.48	0.09	0.09
oluene	8	0.77	5.58	2.80	10.74	2.80	2.80
etrachloroethylene	8	0.03	0.68	0.17	1.18	0.17	0.17
hlorobenzene	6	0.02	0.11	0.06	0.30	0.05	0.05
thylbenzene	8	0.12	1.03	0.56	2.46	0.56	0.56
/p-Xylene/Bromoform	8	0.55	5.17	2.75	53.22	2.75	2.75
tyrene	8	0.04	0.69	0.33	1.41	0.33	0.33
-Xylene/1,1,2,2-Tetrachloroethane	8	0.30	2.66	1.32	15.02	1.32	1.32
-Dichlorobenzene	6	0.09	0.14	0.12	0.72	0.09	0.09
-Dichlorobenzene	7	0.02	0.14	0.08	0.48	0.07	0.07
-Dichlorobenzene	6	0.08	0.15	0.11	0.69	0.09	0.09

A total of 8 samples were collected and analyzed by GC/MD.

The arithmetic average concentration of all the compound identification cases.

The arithmetic average concentration of all the sample cases using half the MDL values for compounds not detected.

The arithmetic average concentration of all the sample cases using zero

Table 6-5. Air Toxics Compound Identifications for Birmingham, Alabama (B2AL)

Compound	Cases (a)	Minimum ppbv	Maximum ppbv	Mean (b) ppbv	Mean (b) ug/m3	Mean (c) ppbv	Mean ppl
Propylene	7	0.27	2.62	1.05	1.84	0.93	0
Chloromethane	2	0.45	0.78	0.62	1.29	0.23	0
Methylene chloride	2	0.44	1.02	0.73	2.58	0.22	0
1,1-Dichloroethane	2	0.14	0.32	0.23	0.95	0.07	0
Chloroform	8	0.05	0.10	0.08	0.39	0.08	0
1,2-Dichloroethane	5	0.08	0.55	0.33	1.37	0.22	0
1,1,1-Trichloroethane	8	0.29	0.50	0.40	2.24	0.40	0
Benzene	8	0.15	0.56	0.30	0.97	0.30	0
Carbon tetrachloride	8	0.09	0.13	0.11	0.71	0.11	0
Trichloroethylene	8	0.01	0.04	0.02	0.12	0.02	0
Toluene	8	0.14	0.91	0.56	2.14	0.56	0
Tetrachloroethylene	8	0.01	0.04	0.02	0.10	0.02	0
Chlorobenzene	3	0.02	0.02	0.02	0.09	0.01	0
Ethylbenzene	8	0.02	0.16	0.09	0.39	0.09	0
m/p-Xylene/Bromoform	8	0.11	0.80	0.43	8.27	0.43	0
Styrene	8	0.03	0.12	0.08	0.34	0.08	0
o-Xylene/1,1,2,2-Tetrachloroethane	8	0.03	0.38	0.18	2.02	0.18	0
m-Dichlorobenzene	6	0.03	0.08	0.05	0.33	0.04	0
p-Dichlorobenzene	7	0.03	0.04	0.04	0.22	0.04	0
o-Dichlorobenzene	6	0.04	0.11	0.07	0.45	0.06	0

a A total of 8 samples were collected and analyzed by GC/MD.

b The arithmetic average concentration of all the compound identification cases.

c The arithmetic average concentration of all the sample cases using half the MDL values for compounds not detected.

d The arithmetic average concentration of all the sample cases using zero

Table 6-6. Air Toxics Compound Identifications for Birmingham, Alabama (B3AL)

Compound	Cases (a)	Minimum ppbv	Maximum ppbv	Mean (b) ppbv	Mean (b) ug/m3	Mean (c) ppbv	Mean (d) ppbv
opylene	8	0.34	1.93	1.03	1.80	1.03	1.03
hloromethane	7	0.22	1.44	0.74	1.55	0.66	0.65
hloroethane	1	0.10	0.10	0.10	0.27	0.06	0.01
ethylene chloride	1	3.79	3.79	3.79	13.38	0.52	0.47
1-Dichloroethane	3	0.23	0.38	0.32	1.30	0.13	0.12
hloroform	8	0.04	0.23	0.12	0.60	0.12	0.12
2-Dichloroethane	1	0.99	0.99	0.99	4.07	0.14	0.12
1,1-Trichloroethane	8	0.32	1.29	0.68	3.77	0.68	0.68
enzene	8	0.12	0.73	0.42	1.35	0.42	0.42
arbon tetrachloride	8	0.10	0.14	0.11	0.00	0.11	0.11
ichloroethylene	6	0.01	0.09	0.04	0.00	0.03	0.03
oluene	8	0.17	1.68	0.84	0.00	0.84	0.84
etrachloroethylene	8	0.01	0.30	0.11	0.00	0.11	0.11
hlorobenzene	1	0.04	0.04	0.04	0.00	0.01	0.01
thylbenzene	8	0.02	0.29	0.11	0.00	0.11	0.11
/p-Xylene/Bromoform	8	0.10	1.29	0.53	0.00	0.53	0.53
tyrene	8	0.02	0.19	0.08	0.00	0.08	0.08
-Xylene/1,1,2,2-Tetrachloroethane	8	0.07	0.55	0.27	0.00	0.27	0.27
-Dichlorobenzene	2	0.08	0.08	0.08	0.00	0.02	0.02
-Dichlorobenzene	3	0.02	0.07	0.04	0.00	0.02	0.02
-Dichlorobenzene	3	0.07	0.22	0.16	0.00	0.06	0.06

A total of 8 samples were collected and analyzed by GC/MD.
The arithmetic average concentration of all the compound identification cases.
The arithmetic average concentration of all the sample cases using half the MDL values for compounds not detected.
The arithmetic average concentration of all the sample cases using zero

Table 6-7. Air Toxics Compound Identifications for Newark, New Jersey (NWNJ)

Compound	Cases (a)	Minimum ppbv	Maximum ppbv	Mean (b) ppbv	Mean (b) ug/m3	Mean (c) ppbv	Mea pp
Propylene	8	1.30	3.60	2.57	0.00	2.57	
Chloromethane	7	0.57	1.19	0.89	0.00	0.78	
Methylene chloride	2	2.86	3.03	2.95	0.00	0.74	
trans-1,2-Dichloroethylene	2	0.12	0.38	0.25	0.00	0.06	
1,1-Dichloroethane	4	0.27	0.48	0.37	0.00	0.19	
Chloroform	8	0.14	0.38	0.25	0.00	0.25	
1,2-Dichloroethane	7	0.95	1.76	1.36	0.00	1.19	
1,1,1-Trichloroethane	8	4.42	253.06	37.87	0.00	37.87	3
Benzene	8	0.75	1.37	1.01	0.00	1.01	
Carbon tetrachloride	8	0.14	0.16	0.14	0.00	0.14	
1,2-Dichloropropane	1	1.34	1.34	1.34	0.00	0.17	
Trichloroethylene	8	0.10	0.79	0.34	0.00	0.34	
Toluene	8	2.14	6.01	3.83	0.00	3.83	
n-Octane	1	0.31	0.31	0.31	0.00	0.04	
Tetrachloroethylene	8	0.07	0.92	0.38	0.00	0.38	
Chlorobenzene	7	0.07	0.18	0.11	0.00	0.09	
Ethylbenzene	8	0.36	0.97	0.63	0.00	0.63	
m/p-Xylene/Bromoform	8	1.77	4.59	3.00	0.00	3.00	
Styrene	8	0.24	0.74	0.47	0.00	0.47	
o-Xylene/1,1,2,2-Tetrachloroethane	8	0.90	2.19	1.44	0.00	1.44	
m-Dichlorobenzene	2	0.20	0.21	0.21	0.00	0.05	
p-Dichlorobenzene	7	0.11	0.20	0.15	0.00	0.13	
o-Dichlorobenzene	4	0.17	0.23	0.21	0.00	0.10	

a A total of 8 samples were collected and analyzed by GC/MD.

b The arithmetic average concentration of all the compound identification cases.

c The arithmetic average concentration of all the sample cases using half the MDL values for compounds not detected.

d The arithmetic average concentration of all the sample cases using zero

Table 6-8. Air Toxics Compound Identifications for Plainfield, New Jersey (PLNJ)

Compound	Cases (a)	Minimum ppbv	Maximum ppbv	Mean (b) ppbv	Mean (b) ug/m3	Mean (c) ppbv	Mean (d) ppbv
ropylene	8	1.38	8.96	5.29	0.00	5.29	5.29
hloromethane	6	0.51	1.02	0.65	0.00	0.49	0.49
3-Butadiene	3	0.09	0.41	0.20	0.00	0.08	0.08
lethylene chloride	1	1.02	1.02	1.02	0.00	0.13	0.13
,1-Dichloroethane	7	0.16	1.89	1.02	0.00	0.90	0.90
hloroform	8	0.11	0.76	0.34	0.00	0.34	0.34
,2-Dichloroethane	3	0.54	5.23	3.06	0.00	1.15	1.15
,1,1-Trichloroethane	8	0.84	4.67	2.49	0.00	2.49	2.49
enzene	8	0.60	4.09	2.28	0.00	2.28	2.28
arbon tetrachloride	8	0.13	0.28	0.15	0.00	0.15	0.15
richloroethylene	8	0.05	0.58	0.20	0.00	0.20	0.20
oluene	8	1.50	17.40	7.46	0.00	7.46	7.46
etrachloroethylene	8	0.14	0.58	0.31	0.00	0.31	0.31
hlorobenzene	6	0.05	0.52	0.16	0.00	0.12	0.12
thylbenzene	8	0.22	3.62	1.31	0.00	1.31	1.31
ı/p-Xylene/Bromoform	8	1.20	19.22	6.68	0.00	6.68	6.68
tyrene	7	0.19	0.81	0.41	0.00	0.36	0.36
-Xylene/1,1,2,2-Tetrachloroethane	8	0.61	10.12	3.56	0.00	3.56	3.56
ı-Dichlorobenzene	1	3.08	3.08	3.08	0.00	0.39	0.39
-Dichlorobenzene	6	0.09	0.36	0.22	0.00	0.17	0.17
-Dichlorobenzene	4	0.13	0.21	0.16	0.00	0.08	0.08

A total of 8 samples were collected and analyzed by GC/MD.

) The arithmetic average concentration of all the compound identification cases.

: The arithmetic average concentration of all the sample cases using half the MDL values for compounds not detected.

l The arithmetic average concentration of all the sample cases using zero

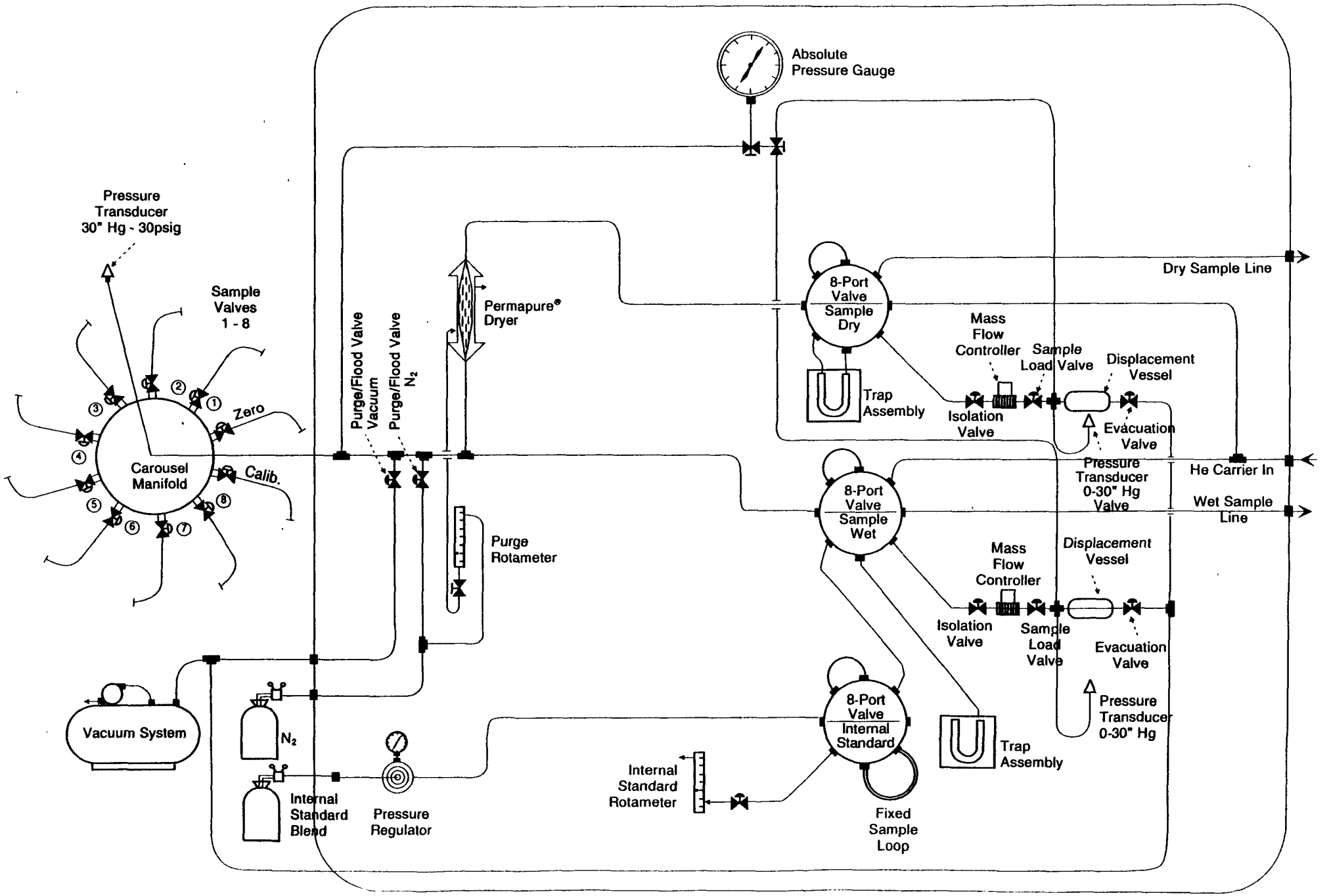
7.0 THREE-HOUR AIR TOXICS TECHNICAL NOTES

This section describes the equipment used to sample and analyze the 3-hour air toxics samples. Also described are sample handling procedures, sampler certification procedures, standard generation and instrument calibration procedures, compound identification procedures, GC/MS compound identification confirmation, quality assurance/quality control procedures, and data records for the 3-hour air toxics compounds.

7.1 Sampling Equipment and Gas Chromatograph/Multiple Detector Analytical System

The sampling equipment for the 3-hour air toxics samples was the NMOC Monitoring Program sampling equipment described in Section 3.1. The original sample was collected as an integrated ambient air sample from 6:00 a.m. to 9:00 a.m. with a final sample pressure of about 15 psig. As stated above, after NMOC or speciated NMOC analysis, the canister was bled to atmospheric pressure and allowed to stand at least 18 hours before being analyzed by GC/MD.

The analytical system consists of a Radian Sample Interface System and GC/MD. Figures 7-1 and 7-2 shows the GC/MD sampling system including the Sample Interface System, Analytical System, and Data System. When the six-port valve is in the sample load mode, the sample interface serves to preconcentrate cryogenically a measurable sample volume. In the sample inject mode, the cryogenically focused water and organic compounds are thermally desorbed and swept by helium carrier gas to the head of the GC column. The GC oven is programmed so the sample is refocused on the column at subambient temperatures and then compounds are chromatographically separated. The toxic organic target compounds are listed in Table 7-1.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Vacuum
Purge/Flood Valve
N_2
Permapure®
Dryer
Purge
Rotameter
8-Port
Valve
Sample
Dry
Trap
Assembly
Mass
Flow
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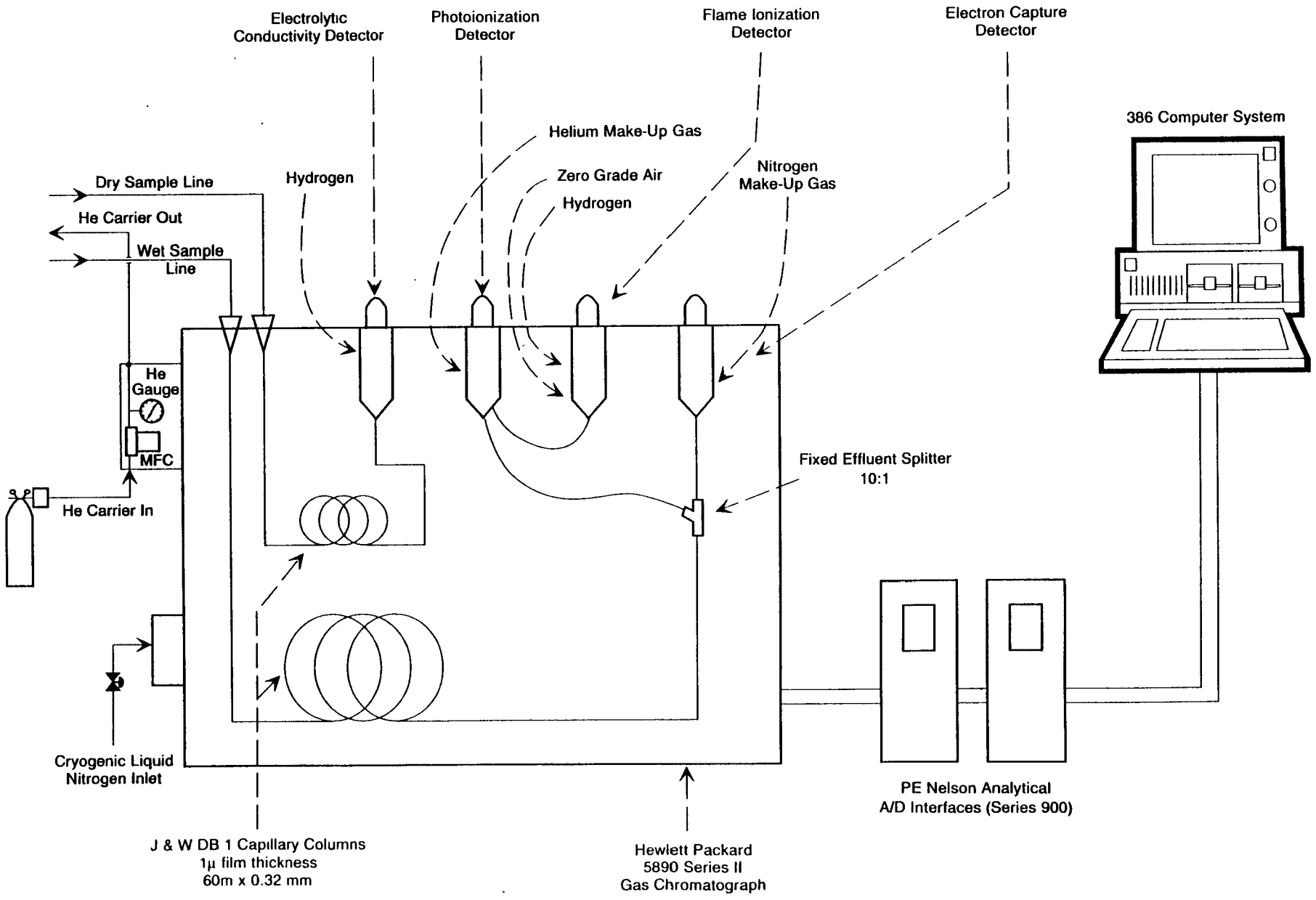

2-93-35918

Figure 7-2. Gas Chromatographic Multidetector System with Data Acquisition System

Table 7-1

Three-hour Air Toxics Target Compounds

Actylene
Propylene
Chloromethane
Vinyl Chloride
1,3-Butadiene
Bromomethane
Chloroethane
Methylene Chloride
trans-1,2-Dichloroethylene
1,1-Dichloroethylene
Chloroprene
Bromochloromethane
Chloroform
1,2-Dichloroethane
Chloroprene
1,2-Dichloroethane
1,1,1-Trichloroethane
Benzene
Carbon tetrachloride
1,2-Dichloropropane
Bromodichloromethane
Trichloroethylene
cis-1,3-Dichloropropylene
trans-1,3-Dichloropropylene
1,1,2-Trichloroethane
Toluene
Dibromochloromethane
n-Octane
Tetrachloroethylene
Chlorobenzene
Ethylbenzene
m/p-Xylene/Bromoform
Styrene
o-Xylene/1,1,2,2-Tetrachloroethane
m-Dichlorobenzene
p-Dichlorobenzene
o-Dichlorobenzene

The Hewlett Packard® 5890 gas chromatograph system consists of a FID, PID, and ECD. The system uses one column (J & W DB-1®, 60M x 0.32mm, and 1μm film thickness) which is split by a 1:10 splitter before the PID. The one-tenth portion of the splitter goes to the ECD. The nine-tenth portion of the splitter goes to the PID and then to the FID. Compound identification is made using a combination of retention time, ratios of PID/FID and/or ECD/FID responses, and analyst experience and judgment. Quantitation is performed using the FID response, with the exception of halogenated compounds that are quantitated using the ECD. Propylene, vinyl chloride, 1,3-butadiene, trans-1,2-dichloroethylene, and chloroprene are quantitated from the PID as the FID has interference peaks with these compounds. The sample concentrations are calculated by using the monthly calibration curve and daily standards' response factors times the samples' area counts of each target compound.

7.2 Three-Hour Air Toxics Sampling Systems Certification

The sampling systems used to collect 3-hour air toxics samples were certified for use per the specifications described in U.S. EPA Compendium of Methods TO-14.[13]

7.2.1 Sampler Certification Blanks--Humidified Zero Air

Zero certification consisted of purging the sampler with cleaned, humidified air, followed by collection a sample of the cleaned,dried air that had been humidified through the purged NMOC samplers for GC/MD analysis. The purpose of the wet purge was to help remove any adherent contaminant from the sampler. The chromatograms from these certification sample analyses were archived for each sampler. Results showed a range of 0.005 ppmC to 0.0098 ppmC of NMOC, with an average of 0.0067 ppmC. The sampling systems were determined to be clean and showed no characteristics of additive bias.

7.2.2 Sampler Certification Challenge - Selected Target Compound

Following the NMOC sampler blank certification, a challenge gas containing five selected target compounds was passed through the samplers. The average concentration of the compounds in the challenge gas was 10.31 ppbv/species. Average percent recoveries ranged from 102.14% to 104.29% with an overall average of 103.53 percent.

7.3 Calibration Standard Preparation

Calibration curves for the multi-detector include a 5-point calibration initially, and daily calibration checks at an average 5 ppbv concentration for the target compounds. The origin of the calibration curve will be used as on of the calibration points.

7.3.1 Calibration Standard Generation

A monthly calibration of the target compounds is performed by analyzing humidified standards prepared at levels of about 0.5, 1, 3, 5, and 10 ppbv from Scott Specialty Gases certified standards. A standard prepared at a level of about 3 ppbv from a Scott Specialty Gases certified standard was used for daily calibration. These standards were prepared by using the dynamic flow dilution system. The gases from Scott are mixed in a SUMMA®-treated mixing sphere and bled into evacuated canisters. One dilution air stream is routed through a SUMMA®-treated bubbler containing HPLC-grade water to humidify, and the other stream is not humidified. The dilution air streams are brought together for mixing with the streams for the Scott certified cylinders. Flow rates from all five streams (four from the certified cylinders and from the dilution cylinder) are gauged and controlled by mass flow controllers. The split air dilution streams are metered by "wet" and "dry" rotameters from the humidified and unhumidified dilutions air streams respectively. The system is evacuated with a vacuum pump while the

closed canister is connected. A precision absolute pressure gauge measures the canister pressure before and after filling. The lines leading to the canister and to the mixing sphere are flushed for at least 15 minutes with standard gas before being connected to the canister for filling.

7.3.2 GC/MD Calibration

Initial calibration curve standards are made at 0.5, 1, 3, 5, and 10 ppbv for each of the target compounds. In addition, the point at 0, 0 is considered to be a calibration point. A linear regression is done for each of the compounds and the linear regression coefficient is expected to be 0.995 or better for selected compounds on the detector used for quantitation. The zero air used for canister cleaning and for standards dilution is analyzed at the time of calibration but the results are not used in the calibration curve. Daily calibration is done with in-house standards made from Scott certified gases with an average concentration of 5 ppbv.

All daily calibration data are used to calculated calibration factors for each compound on each detector. Minima, means, maxima, and standard deviations are recorded and tabulated for each detector. The FID calibration factors are used for quantitation for the majority of compounds except some of the halocarbons. The ECD calibration factors are used in most cases of halogenated compound quantitation because of the greater sensitivity of the ECD at low concentrations. Propylene, vinyl chloride, 1,3-butadiene, trans-1,2-dichloroethylene, and chloroprene are quantitated from the PID as the FID has interference peaks with these compounds.

7.4 Daily Calibration Check

Prior to sample analysis, a 5 ppbv standard was analyzed to assure the validity of the current monthly response factor. This daily check was at the middle range of the calibration curve to show consistency with the monthly calibration curve. The daily standard concentrations and area counts for each compound were entered into a spreadsheet. The result response factors of each compound were compared to the monthly calibration curve's response factors. An absolute valve of the of less than or equal to 30% was acceptable for the quantitated compounds. If the first check doesn't meet this criterion, a second standard may be analyzed, if it passes wet zero analysis may proceed. If the second check doesn't pass, a leak check and system maintenance should be done. If the system maintenance is completed and another standard analysis meets the criterion then analyses may proceed. If the maintenance has caused too great a change in the system response, a new calibration curve will be analyzed and a carbon response factors established before sample analyses will proceed. After acceptance of the daily standard, a wet zero was analyzed. Less than 0.2 ppbv was acceptable except for known detector interferences and the samples would be analyzed. If more than 0.2 ppbv concentration was found, a second wet zero would be run. If a second wet zero failed, system maintenance would be done. A wet zero would be run again and if it passed, the samples would be analyzed.

7.5 Gas Chromatograph/Mass Spectrometer Analysis and Compound Identification Confirmation

Five of the 3-hour air toxics samples were analyzed by GC/MS for compound identification confirmation following completion of the GC/MD analyses. So that the sensitivity of the GC/MS compared favorably with that of the GC/MD, the GC/MS was operated in the multiple ion detection (MID) mode, and the sample volume was about 500-mL (compared to 250-Ml for the GC/MD analyses).

No comparison of the quantitative results for GC/MD and GC/MS was made because the purpose of the GC/MS analyses was compound identification confirmation only. This comparison is discussed below in Section 7.6.1.

7.6 QA/QC Data

Precision was estimated from duplicate samples and repeated analysis. Table 7-2 summarizes the duplicate and replicate analyses performed on the five 3-hour air toxics samples. Columns headed D1, D2, and R2 were taken from the tables in Appendix H. D1 and D2 show the results of the samples in duplicate canisters 1 and 2, respectively. R2 shows the results of the second analysis of duplicate canister D2. From the replicate analyses, R2 and D2, the analytical precision may be estimated, and from the duplicate canister analyses, the sampling and analytical precisions may be estimated.

In the columns under "Replicate Analyses", Replicate Average, Standard Deviation, %CV, and Abs %Diff represent the average concentrations (in analyses D2 and R2), the standard deviation (between analyses D2 and R2), %CV (Standard Deviation/Average * 100), and the absolute percent difference, respectively. Note that average concentrations range between less than detection limit (<0.004) to 20.79 ppbv. Percent CV for replicates ranges from 0.00 to 117.85 %, and absolute percent difference ranges from 0.00 to 117.85 percent. The pooled %CV is 16.42 while the average absolute percent difference is 18.73. These are excellent results, considering the small number of samples involved, and compare favorably with previous 3-hour air toxics replicate analysis results.

Duplicate sample statistics are shown in the last four columns of Table 7-2. Duplicate average represents the best estimate of the sample mean. It was calculated first by average D2 and R2 analyses in the first duplicate canister and then averaging the first average with D1. The duplicate standard deviation was calculated using the average of D2 and R2 and comparing it with D1. The %CV

Table 7-2. 1992 NMOC 3-Hour Replicates and Duplicates, ppbv

					Replicate Analyses				Duplicate Analyses			
Site	Compound	D1	D2	R2	Replicate Avg	Standard Deviation	%CV	Abs % Diff	Duplicate Avg	Standard Deviation	%CV	Abs % Diff
B1AL	Propylene	2.30	2.45	2.20	2.325	0.177	7.603	10.753	2.313	0.018	0.764	1.081
B1AL	1,1-Dichloroethane	0.44	0.44	0.44	0.440	0.000	0.000	0.000	0.440	0.000	0.000	0.000
B1AL	Chloroform	0.26	0.22	0.21	0.215	0.007	3.289	4.651	0.238	0.032	13.398	18.947
B1AL	1,2-Dichloroethane	<0.04	<0.04	3.06								
B1AL	1,1,1-Trichloroethane	0.95	0.92	0.83	0.875	0.064	7.273	10.286	0.913	0.053	5.812	8.219
B1AL	Benzene	1.03	1.00	0.98	0.990	0.014	1.428	2.020	1.010	0.028	2.800	3.960
B1AL	Carbon tetrachloride	0.14	0.13	0.11	0.120	0.014	11.785	16.667	0.130	0.014	10.879	15.385
B1AL	1,2-Dichloropropane	<0.04	<0.04	1.14								
B1AL	Trichloroethylene	0.14	<0.004	0.10								
B1AL	Toluene	2.61	2.63	2.45	2.540	0.127	5.011	7.087	2.575	0.049	1.922	2.718
B1AL	Tetrachloroethylene	0.11	0.10	0.09	0.095	0.007	7.443	10.526	0.103	0.011	10.348	14.634
B1AL	Chlorobenzene	0.07	<0.02	<0.02								
B1AL	Ethylbenzene	0.72	0.70	0.65	0.675	0.035	5.238	7.407	0.698	0.032	4.562	6.452
B1AL	m/p-Xylene/Bromoform	3.28	3.24	3.01	3.125	0.163	5.204	7.360	3.203	0.110	3.422	4.840
B1AL	Styrene	0.30	0.27	0.24	0.255	0.021	8.319	11.765	0.278	0.032	11.467	16.216
B1AL	o-Xylene/1,1,2,2-Tetrachloroethane	1.43	1.39	1.27	1.330	0.085	6.380	9.023	1.380	0.071	5.124	7.246
B1AL	m-Dichlorobenzene	0.14	<0.02	0.09								
B1AL	p-Dichlorobenzene	0.10	0.05	0.06	0.055	0.007	12.856	18.182	0.078	0.032	41.058	58.065
B1AL	o-Dichlorobenzene	0.11	0.08	<0.02								
B2AL	Propylene	1.03	0.92	1.19	1.055	0.191	18.097	25.592	1.043	0.018	1.696	2.398
B2AL	Chloromethane	<0.20	0.62	0.94	0.780	0.226	29.010	41.026				
B2AL	Methylene Chloride	<0.11	<0.11	0.44								
B2AL	1,1-Dichloroethane	0.14	0.14	<0.04								
B2AL	Chloroform	0.09	0.08	0.07	0.075	0.007	9.428	13.333	0.083	0.011	12.856	18.182

Table 7-2. Continued

Site	Compound	D1	D2	R2	Replicate Analyses: Replicate Avg	Replicate Analyses: Standard Deviation	Replicate Analyses: %CV	Replicate Analyses: Abs % Diff	Duplicate Analyses: Duplicate Avg	Duplicate Analyses: Standard Deviation	Duplicate Analyses: %CV	Duplicate Analyses: Abs % Diff
B2AL	1,2-Dichloroethane	0.56	0.53	0.55	0.540	0.014	2.619	3.704	0.550	0.014	2.571	3.636
B2AL	1,1,1-Trichloroethane	0.47	0.38	0.36	0.370	0.014	3.822	5.405	0.420	0.071	16.836	23.810
B2AL	Benzene	0.40	0.38	0.38	0.380	0.000	0.000	0.000	0.390	0.014	3.626	5.128
B2AL	Carbon tetrachloride	0.13	0.14	0.12	0.130	0.014	10.879	15.385	0.130	0.000	0.000	0.000
B2AL	Trichloroethylene	0.03	0.03	0.02	0.025	0.007	28.284	40.000	0.028	0.004	12.856	18.182
B2AL	Toluene	0.74	0.93	0.92	0.925	0.007	0.764	1.081	0.833	0.131	15.713	22.222
B2AL	Tetrachloroethylene	0.01	0.02	0.01	0.015	0.007	47.140	66.667	0.013	0.004	28.284	40.000
B2AL	Ethylbenzene	0.14	0.14	0.12	0.130	0.014	10.879	15.385	0.135	0.007	5.238	7.407
B2AL	m/p-Xylene/Bromoform	0.66	0.70	0.61	0.655	0.064	9.716	13.740	0.658	0.004	0.538	0.760
B2AL	Styrene	0.12	0.13	0.10	0.115	0.021	18.446	26.087	0.118	0.004	3.009	4.255
B2AL	o-Xylene/1,1,2,2-Tetrachloroethane	0.28	0.30	0.28	0.290	0.014	4.877	6.897	0.285	0.007	2.481	3.509
B2AL	m-Dichlorobenzene	0.07	0.06	0.04	0.050	0.014	28.284	40.000	0.060	0.014	23.570	33.333
B2AL	p-Dichlorobenzene	0.04	0.04	0.04	0.040	0.000	0.000	0.000	0.040	0.000	0.000	0.000
B2AL	o-Dichlorobenzene	0.07	0.12	0.10	0.110	0.014	12.856	18.182	0.090	0.028	31.427	44.444
B3AL	Propylene	2.37	1.20	2.23	1.715	0.728	42.468	60.058	2.043	0.463	22.676	32.069
B3AL	Chloromethane	1.34	0.85	<0.20								
B3AL	Chloroethane	0.10	<0.10	<0.10								
B3AL	1,1-Dichloroethane	0.35	0.34	0.34	0.340	0.000	0.000	0.000	0.345	0.007	2.050	2.899
B3AL	Chloroform	0.26	0.23	0.20	0.215	0.021	9.867	13.953	0.238	0.032	13.398	18.947
B3AL	1,2-Dichloroethane	1.00	1.00	0.97	0.985	0.021	2.154	3.046	0.993	0.011	1.069	1.511
B3AL	1,1,1-Trichloroethane	1.32	1.34	1.21	1.275	0.092	7.210	10.196	1.298	0.032	2.452	3.468
B3AL	Benzene	0.78	0.66	0.75	0.705	0.064	9.027	12.766	0.743	0.053	7.142	10.101
B3AL	Carbon tetrachloride	0.15	0.13	0.14	0.135	0.007	5.238	7.407	0.143	0.011	7.443	10.526
B3AL	Trichloroethylene	0.11	0.09	0.07	0.080	0.014	17.678	25.000	0.095	0.021	22.330	31.579

Table 7-2. Continued

					Replicate Analyses				Duplicate Analyses			
Site	Compound	D1	D2	R2	Replicate Avg	Standard Deviation	%CV	Abs % Diff	Duplicate Avg	Standard Deviation	%CV	Abs % Diff
B3AL	Toluene	1.87	1.40	1.76	1.580	0.255	16.111	22.785	1.725	0.205	11.888	16.812
B3AL	Tetrachloroethylene	0.30	0.25	0.26	0.255	0.007	2.773	3.922	0.278	0.032	11.467	16.216
B3AL	Chlorobenzene	<0.02	0.04	<0.02								
B3AL	Ethylbenzene	0.34	0.22	0.30	0.260	0.057	21.757	30.769	0.300	0.057	18.856	26.667
B3AL	m/p-Xylene/Bromoform	1.47	1.06	1.35	1.205	0.205	17.018	24.066	1.338	0.187	14.010	19.813
B3AL	Styrene	0.22	0.18	0.18	0.180	0.000	0.000	0.000	0.200	0.028	14.142	20.000
B3AL	o-Xylene/1,1,2,2-Tetrachloroethane	0.60	0.54	0.52	0.530	0.014	2.668	3.774	0.565	0.049	8.761	12.389
B3AL	m-Dichlorobenzene	0.11	0.08	0.05	0.065	0.021	32.636	46.154	0.088	0.032	36.365	51.429
B3AL	p-Dichlorobenzene	0.09	0.06	0.05	0.055	0.007	12.856	18.182	0.073	0.025	34.136	48.276
B3AL	o-Dichlorobenzene	0.33	0.18	0.06	0.120	0.085	70.711	100.000	0.225	0.148	65.997	93.333
NWNJ	Propylene	2.12	2.29						2.205	0.120	5.452	7.710
NWNJ	Chloromethane	0.92	1.17						1.045	0.177	16.916	23.923
NWNJ	1,1-Dichloroethane	<0.04	0.48									
NWNJ	Chloroform	0.38	0.38						0.380	0.000	0.000	0.000
NWNJ	1,2-Dichloroethane	1.73	1.76						1.745	0.021	1.216	1.719
NWNJ	1,1,1-Trichloroethane	7.44	7.65						7.545	0.148	1.968	2.783
NWNJ	Benzene	1.32	1.37						1.345	0.035	2.629	3.717
NWNJ	Carbon tetrachloride	0.14	0.14						0.140	0.000	0.000	0.000
NWNJ	Trichloroethylene	0.37	0.39						0.380	0.014	3.722	5.263
NWNJ	Toluene	5.64	6.01						5.825	0.262	4.491	6.352
NWNJ	Tetrachloroethylene	0.90	0.92						0.910	0.014	1.554	2.198
NWNJ	Chlorobenzene	0.10	0.13						0.115	0.021	18.446	26.087
NWNJ	Ethylbenzene	0.92	0.97						0.945	0.035	3.741	5.291
NWNJ	m/p-Xylene/Bromoform	4.44	4.59						4.515	0.106	2.349	3.322

Table 7-2. Continued

					Replicate Analyses				Duplicate Analyses			
Site	Compound	D1	D2	R2	Replicate Avg	Standard Deviation	%CV	Abs % Diff	Duplicate Avg	Standard Deviation	%CV	Abs % Diff
NWNJ	Styrene	0.74	0.47						0.605	0.191	31.557	44.628
NWNJ	o-Xylene/1,1,2,2-Tetrachloroethane	2.14	2.19						2.165	0.035	1.633	2.309
NWNJ	p-Dichlorobenzene	0.18	0.20						0.190	0.014	7.443	10.526
NWNJ	o-Dichlorobenzene	0.23	<0.02									
NWNJ	Propylene	3.21	3.25	3.13	3.190	0.085	2.660	3.762	3.200	0.014	0.442	0.625
NWNJ	Chloromethane	0.72	0.63	0.93	0.780	0.212	27.196	38.462	0.750	0.042	5.657	8.000
NWNJ	1,1-Dichloroethane	<0.04	<0.04	0.31								
NWNJ	Chloroform	0.15	0.15	0.13	0.140	0.014	10.102	14.286	0.145	0.007	4.877	6.897
NWNJ	1,2-Dichloroethane	1.01	0.92	0.94	0.930	0.014	1.521	2.151	0.970	0.057	5.832	8.247
NWNJ	1,1,1-Trichloroethane	5.36	5.20	4.77	4.985	0.304	6.099	8.626	5.173	0.265	5.126	7.250
NWNJ	Benzene	0.96	0.93	0.72	0.825	0.148	17.999	25.455	0.893	0.095	10.696	15.126
NWNJ	Carbon tetrachloride	0.15	0.15	0.13	0.140	0.014	10.102	14.286	0.145	0.007	4.877	6.897
NWNJ	Trichloroethylene	0.20	1.98	0.18	1.080	1.273	117.851	166.667	0.640	0.622	97.227	137.500
NWNJ	Toluene	3.28	2.80	2.02	2.410	0.552	22.886	32.365	2.845	0.615	21.623	30.580
NWNJ	Tetrachloroethylene	0.08	0.07	0.05	0.060	0.014	23.570	33.333	0.070	0.014	20.203	28.571
NWNJ	Chlorobenzene	0.14	0.13	0.10	0.115	0.021	18.446	26.087	0.128	0.018	13.865	19.608
NWNJ	Ethylbenzene	0.71	0.75	0.59	0.670	0.113	16.886	23.881	0.690	0.028	4.099	5.797
NWNJ	m/p-Xylene/Bromoform	3.75	3.86	3.08	3.470	0.552	15.895	22.478	3.610	0.198	5.484	7.756
NWNJ	Styrene	0.43	0.52	0.35	0.435	0.120	27.634	39.080	0.433	0.004	0.817	1.156
NWNJ	o-Xylene/1,1,2,2-Tetrachloroethane	1.59	1.56	1.40	1.480	0.113	7.644	10.811	1.535	0.078	5.067	7.166
NWNJ	m-Dichlorobenzene	<0.02	<0.02	0.20								
NWNJ	p-Dichlorobenzene	0.13	0.12	0.14	0.130	0.014	10.879	15.385	0.130	0.000	0.000	0.000
NWNJ	o-Dichlorobenzene	0.22	0.22	0.15	0.185	0.049	26.755	37.838	0.203	0.025	12.222	17.284
PLNJ	Propylene	0.98	1.68	1.47	1.575	0.148	9.428	13.333	1.278	0.421	32.934	46.575

Table 7-2. Continued

Site	Compound	D1	D2	R2	Replicate Analyses: Replicate Avg	Replicate Analyses: Standard Deviation	Replicate Analyses: %CV	Replicate Analyses: Abs % Diff	Duplicate Analyses: Duplicate Avg	Duplicate Analyses: Standard Deviation	Duplicate Analyses: %CV	Duplicate Analyses: Abs % Diff
PLNJ	Chloromethane	0.68	0.55	0.60	0.575	0.035	6.149	8.696	0.628	0.074	11.832	16.733
PLNJ	1,1-Dichloroethane	<0.04	<0.04	7.19								
PLNJ	Chloroform	<0.006	0.12	0.14	0.130	0.014	10.879	15.385				
PLNJ	1,1,1-Trichloroethane	1.06	1.20	1.14	1.170	0.042	3.626	5.128	1.115	0.078	6.976	9.865
PLNJ	Benzene	3.84	4.33	4.11	4.220	0.156	3.686	5.213	4.030	0.269	6.668	9.429
PLNJ	Carbon tetrachloride	0.12	0.13	0.14	0.135	0.007	5.238	7.407	0.128	0.011	8.319	11.765
PLNJ	Trichloroethylene	<0.004	0.08	0.08	0.080	0.000	0.000	0.000				
PLNJ	Toluene	16.25	17.69	18.26	17.975	0.403	2.242	3.171	17.113	1.220	7.128	10.080
PLNJ	Tetrachloroethylene	0.57	0.60	0.58	0.590	0.014	2.397	3.390	0.580	0.014	2.438	3.448
PLNJ	Ethylbenzene	3.07	3.95	3.83	3.890	0.085	2.181	3.085	3.480	0.580	16.662	23.563
PLNJ	m/p-Xylene/Bromoform	16.41	20.79	20.46	20.625	0.233	1.131	1.600	18.518	2.980	16.095	22.762
PLNJ	o-Xylene/1,1,2,2-Tetrachloroethane	9.13	11.26	9.98	10.620	0.905	8.523	12.053	9.875	1.054	10.669	15.089
	Average		=		1.461			18.733	1.542			16.008
	Median		=		0.485				0.485			
	Cases		=		76				89			
	Pooled Standard Deviation		=			0.240				0.390		
	Pooled % CV		=				16.423				25.294	

for duplicates was calculated as the quotient of the standard deviation and the average, multiplied by 100. Finally the absolute percent difference was calculated from the difference between the average concentrations of the duplicate canisters, divided by the average concentration in the duplicate canisters, expressed as a percentage. The statistic %CV ranged from 0.00 to 97.23. The pooled %CV was 25.29. Absolute percent difference ranged from 0.00 to 137.50. The average absolute percent difference for duplicates was 16.87, which is an excellent result.

7.6.1 GC/MS Confirmation Results

Based on five GC/MS analyses of the 3-hour air toxics samples, one from each site location, the following results were obtained. The GC/MS analyses confirmed 86.66% of the GC/MD analyses. The results are summarized in Table 7-3, showing 16.36% positive GC/MD-positive GC/MS confirmation, 11.52% positive GC/MD-negative GC/MS comparisons 1.82% negative GC/MD-positive GC/MS comparisons, and 70.30% negative GC/MD-negative GC/MS confirmation.

7.6.2 External Audits

The external audit for the 3-hour air toxics compounds was conducted with the SNMOC external audit. Table 7-4 presents the results from the external audit. The external audit sample was provided by a U.S. EPA contractor.

7.7 Data Records

Data records for the 3-hour air toxics samples include:

- NMOC concentration of the sample;
- Copies of the gas chromatographic trace for FID, PID, and ECD;
- Response data on removable hard disk;

Table 7-3

Compound Identification Confirmation

GC/MD versus GC/MS Comparison*	Cases	Percentage
Positive GC/MD - Positive GC/MS	27	16.36
Positive GC/MD - Negative GC/MS	19	11.52
Negative GC/MD - Positive GC/MS	3	1.82
Negative GC/MD - Negative GC/MS	116	70.30
Total	165	100.00
Total compound identification confirmation = 16.36% + 70.30% = 86.66%		

*There were 39 cases where the GC/MD identified a compound at a concentration below the detection limit of the GC/MS.

Table 7-4

Three-hour Toxics External Audit Results

Compound	Spiked	Reported	% Difference
Isopentane	5.0	--[a]	--
3-Methylpentane	4.8	--[a]	--
Benzene	5.0	2.832	-43.36
Toluene	4.7	2.516	-46.47
m-Xylene	5.0	9.6[b]	0.00
p-Xylene	4.6		
o-Xylene	4.9	5.986	22.16

[a]Isopentane and 3-Methylpentane are not on the three-hour target compound list.

[b]m-Xylene and p-Xylene coelute on the GC/MD.

- Retention times for each compound; and
- Area counts for each detector.

In addition, daily calibration response factors are recorded on magnetic disk along with the retention time and area counts for each compound in the standard.

8.0 CARBONYL SAMPLING, ANALYSIS, AND QUALITY ASSURANCE PROCEDURES

Carbonyl sampling and analysis procedures and quality assurance procedures used to quantify data quality are described in this section.

8.1 Sampling Equipment and Procedures

A schematic diagram of the 3-hour carbonyl sampling sub-system is shown in Figure 8-1. The 3-hour carbonyl sampling subsystem collects a discrete sample concurrent with the collection of the NMOC canister sample through the use of a common control system.

Ambient air was drawn from a glass manifold, through an ozone scrubber, and then through the carbonyl sample cartridges. The ozone scrubber was maintained at 200°F to prevent moisture condensation. The carbonyl samples are collected in duplicate parallel cartridges during each sample collection period. The carbonyl cartridges used were commercially available (Waters Co.) silica gel Sep-Pak® cartridge that are coated with DNPH. The carbonyl cartridges are prepared in batches by the Radian laboratory and stored under refrigeration until shipped to the field.

The carbonyl cartridges are installed in the sampling sub-system one day prior to scheduled sample collection. A 3-hour sample collection period, concurrent with the NMOC canister collection, was utilized. In addition to the carbonyl cartridges installed in the sampling sub-system, a third cartridge is transported to the site as a trip blank or spare cartridge.

The flow rates through each of the duplicate carbonyl sample was controlled by flow restrictors (or critical orifices). The collection flow rates were quantified and the rotometers were calibrated before the sampling sub-systems were shipped

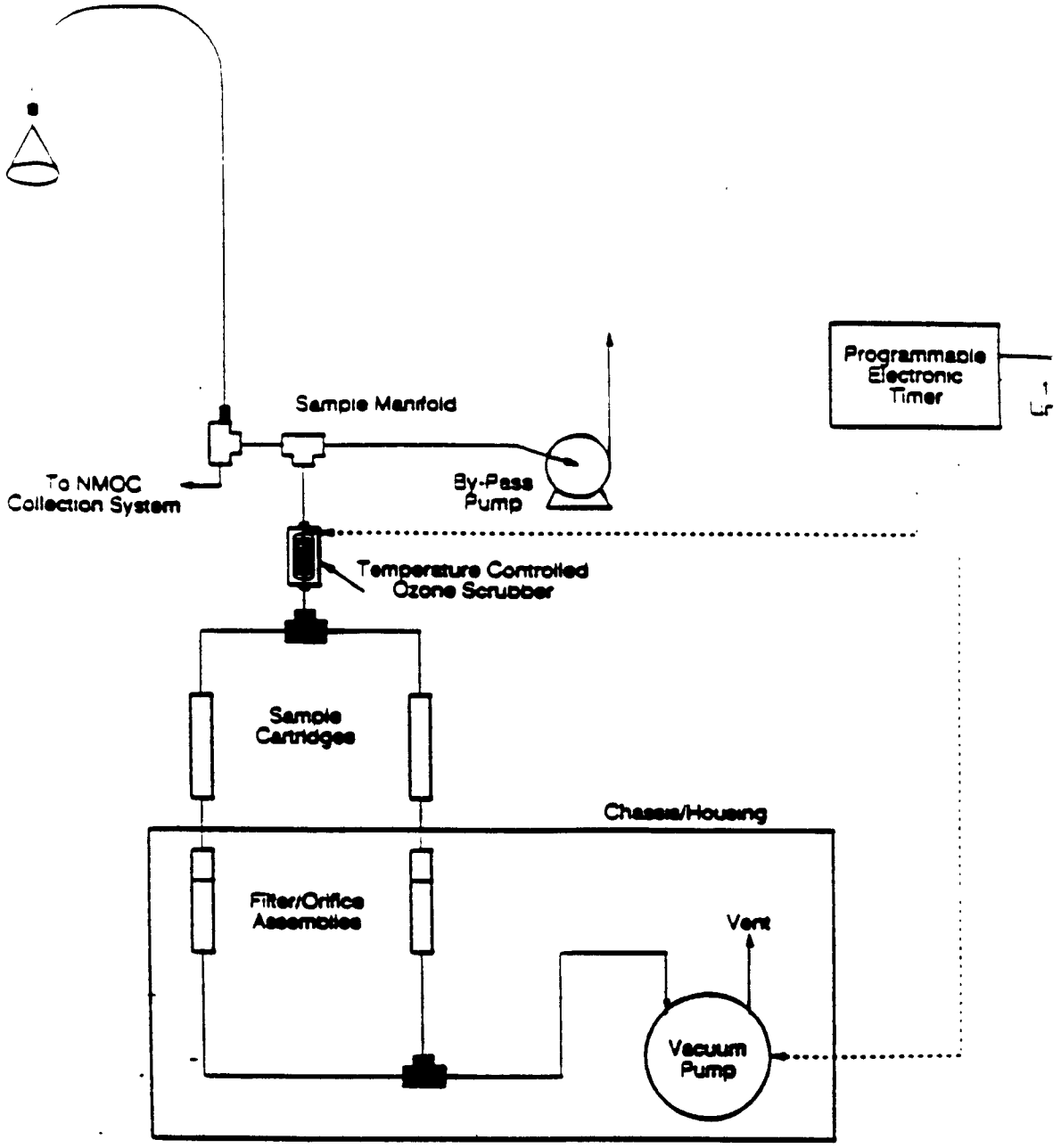

Figure 8-1. 3-Hour Carbonyl Sampling Subsystem

to the sites. The volume of ambient air sampled through each cartridge was calculated in the Radian laboratory based on the field-recorded sampling duration and flow rate information.

8.2 Analytical Procedures

The analytical procedures for carbonyls are given below. Sample preparation and analyses are performed at the Radian PPK laboratory. The preparation procedures of the cartridge samples are as follows:

1. Remove cartridge from its shipping container.
2. Attach cartridge to the end of a 10-mL glass syringe.
3. Add four (4) milliliters of acetonitrile to the syringe and catch drainage in a graduated centrifuge tube.
4. After the syringe has finished draining, add acetonitrile to the graduated centrifuge tube until the total volume is four (4) milliliters, and mix the solution.
5. Transfer the solution in the graduated centrifuge tube to a 4-mL sample vial fitted with a Teflon®-lined self-sealing septum.
6. Store the solution in a refrigerator until analysis.

The U.S. EPA Method TO-11 high pressure liquid chromatography (HPLC) column and elution solvents used for this analysis were modified to decrease analysis time, as shown in the following gradient elution at a flow rate of 0.9 ml/min:

Time (Min.)	% Water	% Acetonitrile	% Methanol
0.0	40	20	40
12.5	25	5	70
28.0	15	5	80
35.0	40	20	40

For the analysis, 24-μl samples are injected with an automatic sampling injector. Compound separation is accomplished using a 25 cm x 4.6 mm C18 5-micron particle size analytical column. Output signals from a multi-wavelength detector are collected for 35 minutes at 360 nanometers (nm).

Chromatographic peaks for targeted compounds were determined by retention time, the area of the integrated peak, and concentrations calculated using calibration curves.

Targeted carbonyl compounds reported were formaldehyde, acetone, acetaldehyde, acrolein, propionaldehyde, crotonaldehyde, butyraldehyde, isobutyraldehyde, benzaldehyde, isovaleraldehyde, valeraldehyde, o-, m-, and p-tolualdehyde, hexanaldehyde and dimethylbenzaldehyde. All measured concentrations were reported in parts per billion by volume (ppbv). The results for the field blanks were also reported in ppbv, assuming the same sample volume as the accompanying samples.

8.3 Quality Assurance Procedures

Quality assurance procedures relative to calibration data for all of the analytes and daily quality control procedures are discussed below. Sampling and analysis precision was determined from the analysis of duplicate field samples and replicate laboratory analyses. Sample custody records were maintained throughout the program. Figure 8-2 shows the multipage field data and custody sheet used for carbonyl sampling documentation. The site operator's task involved recognizing problems with sampling equipment and procedures, and notifying Radian personnel at Research Triangle Park so that appropriate corrective action might be taken. All Radian reported analyses were identified by the unique tube numbers which were recorded on the preformatted field data sheets.

RADIAN CORPORATION

Aldehyde Data Sheet

City _____ Sample Date _____

SAROAD No. __ __·__ __ __ __·__ __ __·A05 Sampler No. _____

Cartridge	Port A (red)	Port B (green)	(blank)
Tube No.	_____	_____	_____
Lot No.	_____	_____	_____

Rotameter No. _____

Rotameter Reading[1] _____ / _____ (before)

Rotameter Reading[1] _____ / _____ (after)

Sampling Time/Duration _____ (hours)

Sampling Volume[3] _____ (liters)

Flow Rate[2]	LPM
Before	_____
After	_____
Average	_____

Average Ambient Temperature _____ (C° or F°)

Average Barometric Pressure _____ (mm Hg)

Site Operator _____

Comments/Remarks _____

Sample Control Copy

[1] Rotameter reading center of black ball.
[2] Calculated from calibration curve by the laboratory.
[3] Calculated by laboratory.

087047R

Figure 8-2. Field Data and Custody Form

8.4 Calibration Procedures

The instrument was calibrated from 0.5 to 20 μg/ml nominal concentration of the derivatized targeted compounds contained in a solution of acetonitrile. The calibration curve consisted of five (5) concentration levels between 0.5 to 20 μg/ml, and each was analyzed in replicate. A standard linear regression analysis was performed on the data for each analyte with the acceptance criteria being that the correlation coefficient must be greater than or equal to 0.995. Table 8-1 presents the calibration curve summary results. As is indicated, the correlation coefficients for all compounds met the acceptance criteria.

8.4.1 Daily Quality Control Procedures

Daily calibration checks were used to assure that the analytical procedures were in control. Daily QC checks were performed after every 10 samples on each day that samples were analyzed.

8.4.2 Duplicate Samples

Duplicate field samples were collected in duplicate cartridges during each sampling episode, as shown in Figure 8-1. One set of field duplicates from each site was prepared and analyzed in replicate to determine both the sampling and analytical precision.

8.4.3 Trip Blanks

Each carbonyl cartridge was issued a unique serial number for identification purposes. A total of three cartridges were shipped to a site. Two cartridges were used to collect the sample, the third tube was called a trip blank and was used to assess the potential for field contamination. The trip blank cartridge was a

Table 8-1

1992 NMOC Calibration Curve

Analyte	Slope	Intercept	R	R^2	Relative Error				
					0.5 ug/mL	1.0 ug/mL	6.0 ug/mL	12 ug/mL	20 ug/mL
Formaldehyde	110853.25	-1686.77	0.9999	0.9999	1.41%	-5.38%	-0.17%	1.09%	-0.37%
Acetaldehyde	130255.89	-7109.94	0.9998	0.9996	-4.42%	-9.08%	0.54%	1.73%	-0.66%
Acrolein	95890.10	-6905.54	0.9998	0.9997	6.28%	-10.58%	0.02%	1.35%	-0.47%
Acetone	84338.02	-7583.19	0.9995	0.9990	5.70%	-16.67%	0.56%	1.95%	-0.73%
Propionaldehyde	111590.50	-16017.88	0.9996	0.9993	6.35%	-17.82%	0.77%	1.87%	-0.72%
Crotonaldehyde	126762.08	-8230.62	0.9997	0.9994	-0.42%	-10.49%	0.59%	1.56%	-0.60%
Butyr/Isobutyraldehyde	111917.92	-30272.60	0.9998	0.9996	3.37%	-16.00%	1.00%	1.72%	-0.69%
Benzaldehyde	39031.09	-1430.22	0.9992	0.9984	-28.76%	-3.82%	0.80%	2.31%	-0.91%
Isovaleraldehyde	111871.46	-5712.10	0.9996	0.9992	-4.47%	-4.94%	-1.30%	2.51%	-0.80%
Valeraldehyde	105984.88	-4702.80	0.9998	0.9996	-5.26%	-8.23%	0.28%	1.87%	-0.69%
Tolualdehydes	105205.32	-22476.42	0.9994	0.9988	-5.98%	-7.05%	-2.13%	3.68%	-1.18%
Hexanaldehyde	88450.37	-10403.76	0.9998	0.9995	3.33%	-13.43%	0.25%	1.96%	-0.71%
2,5-Dimethylbenzaldehyde	111555.47	-7693.18	0.9995	0.9989	-8.86%	-6.30%	-0.71%	2.65%	-0.90%

standardly prepared DNPH-cartridge. The blank cartridge accompanied the duplicate sample cartridges, but at no time was exposed to ambient air.

One trip blank cartridge from each site was analyzed for the target carbonyl analytes. The carbonyl sample results presented in this report are not blank corrected.

8.4.4 Instrument Detection Limits

Instrument detection limits are given in Table 8-2 for the targeted carbonyl compounds in this study. The detection limits were determined by performing nine replicate analyses of a standard that was half the concentration of the lowest calibration standard and following the method listed in the Federal Register, Appendix B, Part 136.

8.5 Results

The analytical results for the sample analyses, replicate analyses, duplicate analyses and quality control standards are discussed below.

8.5.1 Sample Results

Analytical results of ambient air samples and trip blanks for carbonyl compounds at Plainfield, NJ (PLNJ); and Newark, NJ (NWNJ) are given in Table 8-3 and Table 8-4, respectively. The quality control standards analyzed during the program indicate that the analyses remained in control throughout the program as is indicated in Table 8-5. There was a total of four (4) quality control standards. One quality control standard yielded lowest recoveries, but were within

Table 8-2

Detection Limits for Targeted Carbonyl Compounds

Carbonyl	Detection Limit (ppbv)[a]
Formaldehyde	0.25
Acetaldehyde	0.50
Acrolein	0.39
Acetone	0.35
Propionaldehyde	0.37
Crotonaldehyde	0.22
Butyr/Isobutyraldehyde	0.27
Benzaldehyde	0.18
Isovaleraldehyde	0.18
Valeraldehyde	0.19
Tolualdehydes	0.40
Hexanaldehyde	0.12
2,5-Dimethylbenzaldehyde	0.20

[a]Detection limit is based upon an average 150L sample.

Table 8-3

NMOC 1992 Plainfield, New Jersey Site Carbonyl Results

Radian Sample ID	PLNJ R-2224	PLNJ G-2244	PLNJ R-2310	PLNJ R-2311	PLNJ G-2376
Sample Volume (L)	158.63	125.71	158.63	158.63	125.71
Data File ID	RC232937	RC232936	RC232938	RC232940	RC232935
Date Sampled	9/1/92	9/3/92	9/9/92	9/10/92	9/11/92
Date Extracted	11/24/92	11/24/92	11/24/92	11/24/92	11/24/92
Date Analyzed	11/25/92	11/25/92	11/25/92	11/25/92	11/25/92
Dilution Factor	1.00	1.00	1.00	1.00	1.00
Concentrations (ppbv)					
Formaldehyde	1.32	11.41	5.10	2.23	1.21
Acetaldehyde	ND	16.43	7.64	6.85	ND
Acrolein	ND	ND	2.21	ND	2.49
Acetone	ND	24.89	ND	7.14	ND
Propionaldehyde	2.73	4.93	5.57	2.57	7.85
Crotonaldehyde	ND	3.79	3.64	ND	1.84
Butyr/Isobutyraldehyde	ND	4.14	4.00	3.07	ND
Benzaldehyde	ND	1.86	1.41	ND	ND
Isovaleraldehyde	ND	ND	1.45	0.73	ND
Valeraldehyde	0.89	ND	ND	ND	ND
Tolualdehydes	ND	1.69	1.44	4.19	ND
Hexanaldehyde	ND	ND	ND	ND	ND
2,5-Dimethylbenzaldehyde	ND	ND	ND	ND	ND

@ - Estimated concentration is less than the detection limit for the given sample volume

§ - Sample volume is assumed to be the same as the accompanying samples for blank samples

Table 8-3

Continued

Radian Sample ID	PLNJ G-2377	PLNJ G-2438	PLNJ R-2513	PLNJ G-2514	PLNJ B-2587 1
Sample Volume (L)	125.71	125.71	158.63	125.71	158.63
Data File ID	RC232934	RC232933	RC232939	RC23504	RC232941
Date Sampled	9/15/92	9/18/92	9/21/92	9/22/92	9/29/92
Date Extracted	11/24/92	11/24/92	11/24/92	11/24/92	11/24/92
Date Analyzed	11/25/92	11/25/92	11/25/92	12/15/92	11/25/92
Dilution Factor	1.00	1.00	1.00	1.00	1.00
Concentrations (ppbv)					
Formaldehyde	1.96	5.88	5.20	ND	0.68 §
Acetaldehyde	3.85	10.68	ND	ND	2.26 §
Acrolein	ND	ND	ND	ND	ND
Acetone	ND	38.93	ND	ND	9.08 §
Propionaldehyde	4.18	4.47	ND	ND	ND
Crotonaldehyde	ND	1.87	ND	ND	ND
Butyr/Isobutyraldehyde	ND	ND	ND	ND	ND
Benzaldehyde	ND	3.40	ND	ND	ND
Isovaleraldehyde	ND	ND	1.30	ND	ND
Valeraldehyde	ND	ND	ND	ND	ND
Tolualdehydes	ND	ND	ND	ND	ND
Hexanaldehyde	ND	ND	ND	ND	ND
2,5-Dimethylbenzaldehyde	ND	ND	ND	ND	ND

@ - Estimated concentration is less than the detection limit for the given sample volume

§ - Sample volume is assumed to be the same as the accompanying samples for blank samples

Table 8-3

Continued

Radian Sample ID	PLNJ B-2587 2	PLNJ G-2587 1	PLNJ G-2587 2	PLNJ R-2587 1	PLNJ R-2587 2
Sample Volume (L)	158.63	125.71	125.71	158.63	158.63
Data File ID	RC232942	RC232945	RC232946	RC232943	RC232944
Date Sampled	9/29/92	9/29/92	9/29/92	9/29/92	9/29/92
Date Extracted	11/24/92	11/24/92	11/24/92	11/24/92	11/24/92
Date Analyzed	11/25/92	11/25/92	11/25/92	11/25/92	11/25/92
Dilution Factor	1.00	1.00	1.00	1.00	1.00
Concentrations (ppbv)					
Formaldehyde	0.80 §	4.04	3.95	2.91	2.68
Acetaldehyde	3.24 §	1.50	2.21	5.59	6.60
Acrolein	ND	ND	ND	ND	ND
Acetone	8.28 §	ND	ND	9.55	10.00
Propionaldehyde	ND	6.42	5.96	2.58	2.81
Crotonaldehyde	ND	1.99	2.28	ND	ND
Butyr/Isobutyraldehyde	ND	ND	ND	2.90	2.79
Benzaldehyde	ND	ND	ND	ND	ND
Isovaleraldehyde	ND	ND	ND	ND	ND
Valeraldehyde	ND	ND	ND	ND	ND
Tolualdehydes	ND	ND	ND	ND	ND
Hexanaldehyde	ND	ND	ND	ND	ND
2,5-Dimethylbenzaldehyde	ND	ND	ND	ND	ND

@ - Estimated concentration is less than the detection limit for the given sample volume

§ - Sample volume is assumed to be the same as the accompanying samples for blank samples

Table 8-4

NMOC 1992 Newark, New Jersey Site Carbonyl Results

Radian Sample ID	NWNJ G-2187	NWNJ B-2239 1	NWNJ B-2239 2	NWNJ G-2239 1	NWNJ G-2239 2
Sample Volume (L)	157.88	142.29	142.29	157.88	157.88
Data File ID	RC232917	RC232924	RC232925	RC232928	RC232929
Date Sampled	9/1/92	9/3/92	9/3/92	9/3/92	9/3/92
Date Extracted	11/24/92	11/24/92	11/24/92	11/24/92	11/24/92
Date Analyzed	11/24/92	11/24/92	11/24/92	11/24/92	11/25/92
Dilution Factor	1.00	1.00	1.00	1.00	1.00
Concentrations (ppbv)					
Formaldehyde	4.59	ND	ND	6.39	6.55
Acetaldehyde	10.20	4.34 §	3.21 §	11.44	13.12
Acrolein	ND	ND	ND	ND	ND
Acetone	15.74	ND	ND	22.25	22.17
Propionaldehyde	3.33	5.31 §	6.02 §	3.55	2.94
Crotonaldehyde	ND	ND	ND	ND	ND
Butyr/Isobutyraldehyde	ND	ND	ND	ND	ND
Benzaldehyde	ND	ND	ND	ND	ND
Isovaleraldehyde	0.80	ND	ND	0.85	0.76
Valeraldehyde	0.93	ND	0.93 §	0.72	0.89
Tolualdehydes	ND	ND	ND	ND	ND
Hexanaldehyde	ND	2.89 §	2.61 §	3.46	3.67
2,5-Dimethylbenzaldehyde	ND	ND	ND	ND	ND

@ - Estimated concentration is less than the detection limit for the given sample volume

§ - Sample volume is assumed to be the same as the accompanying samples for blank samples

Table 8-4

Continued

Radian Sample ID	NWNJ R-2239 1	NWNJ R-2239 2	NWNJ R-2326	NWNJ R-2367	NWNJ G-2397
Sample Volume (L)	142.29	142.29	142.29	142.29	157.88
Data File ID	RC232926	RC232927	RC232921	RC232922	RC232916
Date Sampled	9/3/92	9/3/92	9/10/92	9/14/92	9/15/92
Date Extracted	11/24/92	11/24/92	11/24/92	11/24/92	11/24/92
Date Analyzed	11/24/92	11/24/92	11/24/92	11/24/92	11/24/92
Dilution Factor	1.00	1.00	1.00	1.00	1.00
Concentrations (ppbv)					
Formaldehyde	7.26	7.37	3.56	1.50	1.70
Acetaldehyde	11.70	14.93	8.39	ND	ND
Acrolein	ND	ND	ND	ND	2.73
Acetone	20.31	21.20	ND	ND	3.98
Propionaldehyde	3.21	3.66	3.09	ND	ND
Crotonaldehyde	ND	ND	1.28	ND	1.53
Butyr/Isobutyraldehyde	ND	ND	3.08	ND	ND
Benzaldehyde	ND	ND	ND	ND	1.57
Isovaleraldehyde	1.27	0.97	ND	1.03	ND
Valeraldehyde	1.12	1.02	ND	1.01	1.19
Tolualdehydes	ND	ND	ND	ND	ND
Hexanaldehyde	3.31	3.55	ND	ND	ND
2,5-Dimethylbenzaldehyde	ND	ND	ND	ND	ND

@ - Estimated concentration is less than the detection limit for the given sample volume

§ - Sample volume is assumed to be the same as the accompanying samples for blank samples

Table 8-4

Continued

Radian Sample ID	NWNJ R-2491	NWNJ G-2536	NWNJ G-2579	NWNJ R-2551	NWNJ R-2588
Sample Volume (L)	142.29	157.88	157.88	142.29	142.29
Data File ID	RC232920	RC232918	RC232915	RC232919	RC232923
Date Sampled	9/22/92	9/23/92	9/24/92	9/28/92	9/29/92
Date Extracted	11/24/92	11/24/92	11/24/92	11/24/92	11/24/92
Date Analyzed	11/24/92	11/24/92	11/24/92	11/24/92	11/24/92
Dilution Factor	1.00	1.00	1.00	1.00	1.00
Concentrations (ppbv)					
Formaldehyde	3.14	0.95	2.05	2.21	1.62
Acetaldehyde	1.25	ND	2.91	2.20	ND
Acrolein	ND	ND	ND	ND	ND
Acetone	2.28	ND	ND	3.14	ND
Propionaldehyde	ND	3.59	3.94	4.71	4.13
Crotonaldehyde	1.54	ND	1.73	ND	ND
Butyr/Isobutyraldehyde	ND	ND	ND	ND	ND
Benzaldehyde	ND	ND	ND	ND	ND
Isovaleraldehyde	0.83	ND	ND	0.91	ND
Valeraldehyde	1.21	ND	ND	0.89	ND
Tolualdehydes	ND	ND	ND	ND	ND
Hexanaldehyde	ND	ND	ND	ND	ND
2,5-Dimethylbenzaldehyde	ND	ND	ND	ND	ND

@ - Estimated concentration is less than the detection limit for the given sample volume

§ - Sample volume is assumed to be the same as the accompanying samples for blank samples

Table 8-5

NMOC 1992 Daily QC Standards Recoveries

Sample ID File ID Date Analyzed	QC RC232914 11/24/92	QC RC232932 11/25/92	QC RC232949 11/25/92	QC RC23501 12/15/92
Formaldehyde	84.24%	55.11%	105.04%	112.92%
Acetaldehyde	83.60%	56.07%	105.03%	111.44%
Acrolein	83.77%	55.93%	107.19%	107.47%
Acetone	82.99%	57.26%	105.71%	108.16%
Propionaldehyde	84.00%	58.41%	106.78%	110.03%
Crotonaldehyde	83.93%	56.70%	108.45%	107.58%
Butyr/Isobutyraldehyde	84.82%	56.39%	106.30%	115.85%
Benzaldehyde	81.74%	49.04%	107.34%	108.21%
Isovaleraldehyde	82.11%	54.93%	106.41%	107.51%
Valeraldehyde	82.25%	55.93%	104.10%	112.63%
Tolualdehydes	87.70%	61.75%	110.35%	118.33%
Hexanaldehyde	75.08%	57.39%	96.90%	105.16%
2,5-Dimethylbenzaldehyde	81.02%	56.46%	105.15%	101.33%

two standard deviations of the average percent recovery. The concentrations of targeted carbonyl compounds in the trip blanks were calculated assuming the sample volume calculated for the accompanying samples. In cases where duplicate samples were taken, or replicate analyses were performed, the results of all the analyses were averaged for each sample. The mean refers to the daily sample averages, not the averages of all the analyses. The concentrations given for the samples were not blank corrected. Table 8-6 gives the average, maximum and minimum carbonyl concentration as well as the standard deviation and frequency of occurrence for each of the targeted carbonyl compounds for the Plainfield site. Table 8-7 gives the same statistical values listed above for the Newark site. For Plainfield, NJ, the average of those compounds identified ranged from 0.089 ppbv for valeraldehyde to 7.585 ppbv for acetone. For Newark, NJ, the average of those compounds identified ranged from 0.157 ppbv for benzaldehyde to 4.662 ppbv for acetone.

8.5.2 Sampling Precision

The sampling precision was measured as the average standard deviation for the results from the field duplicate samples which were analyzed in replicate. The sampling precision results for the Plainfield site are given in Table 8-8. The sampling precision results for the Newark site are given in Table 8-9. The duplicate analyses were performed on 10% of the samples from each site. The average standard deviation was 1.51 ppbv for the Plainfield site and 0.48 ppbv for the Newark site.

8.5.3 Analytical Precision

The analytical precision was measured as the average standard deviation of the replicate analyses performed on the paired duplicate samples. The analytical precision results for the Plainfield site are given in Table 8-10. The analytical precision results for the Newark site are given in Table 8-11. The replicate

Table 8-6

NMOC 1992 Plainfield, New Jersey Site Summary

Analyte	Average Concentration (ppbv)	Maximum Concentration (ppbv)	Minimum Concentration (ppbv)	Standard Deviation	Frequency
Formaldehyde	3.770	11.408	0.000	3.149	90.0%
Acetaldehyde	4.944	16.431	0.000	5.251	60.0%
Acrolein	0.471	2.494	0.000	0.944	20.0%
Acetone	7.585	38.933	0.000	12.785	40.0%
Propionaldehyde	3.675	7.854	0.000	2.307	80.0%
Crotonaldehyde	1.220	3.786	0.000	1.438	50.0%
Butyr/Isobutyraldehyde	1.263	4.136	0.000	1.692	40.0%
Benzaldehyde	0.667	3.396	0.000	1.120	30.0%
Isovaleraldehyde	0.348	1.451	0.000	0.559	30.0%
Valeraldehyde	0.089	0.886	0.000	0.266	10.0%
Tolualdehydes	0.732	4.191	0.000	1.309	30.0%
Hexanaldehyde	0.000	0.000	0.000	0.000	0.0%
2,5-Dimethylbenzaldehyde	0.000	0.000	0.000	0.000	0.0%

Table 8-7

NMOC 1992 Newark, New Jersey Site Summary

Analyte	Average Concentration (ppbv)	Maximum Concentration (ppbv)	Minimum Concentration (ppbv)	Standard Deviation (ppbv)	Frequency
Formaldehyde	2.822	6.894	0.950	1.711	100.0%
Acetaldehyde	3.775	12.796	0.000	4.589	60.0%
Acrolein	0.273	2.734	0.000	0.820	10.0%
Acetone	4.662	21.483	0.000	7.231	50.0%
Propionaldehyde	2.613	4.713	0.000	1.765	70.0%
Crotonaldehyde	0.608	1.734	0.000	0.751	40.0%
Butyr/Isobutyraldehyde	0.308	3.076	0.000	0.923	10.0%
Benzaldehyde	0.157	1.574	0.000	0.472	10.0%
Isovaleraldehyde	0.453	1.029	0.000	0.457	50.0%
Valeraldehyde	0.618	1.212	0.000	0.514	60.0%
Tolualdehydes	0.000	0.000	0.000	0.000	0.0%
Hexanaldehyde	0.350	3.500	0.000	1.050	10.0%
2,5-Dimethylbenzaldehyde	0.000	0.000	0.000	0.000	0.0%

Table 8-8

NMOC 1992 Plainfield, New Jersey Sampling Precision Statistics

DI Factor	1	1	1	1			
Sample ID	PLNJ R-2587 1	PLNJ R-2587 2	PLNJ G-2587 1	PLNJ G-2587 2			
File ID	RC232943	RC232944	RC232945	RC232946			Relative
Date Sampled	9/29/92	9/29/92	9/29/92	9/29/92		Standard	Standard
Date Extracted	11/24/92	11/24/92	11/24/92	11/24/92		Deviation	Deviation
Date Analyzed	11/25/92	11/25/92	11/25/92	11/25/92	Average	(ppbv)	(%)
Concentrations (ppbv)							
Formaldehyde	2.91	2.68	4.04	3.95	3.40	0.60	17.80%
Acetaldehyde	5.59	6.60	1.50	2.21	3.97	2.16	54.45%
Acrolein	0.00	0.00	0.00	0.00	NA	NA	NA
Acetone	9.55	10.00	0.00	0.00	NA	NA	NA
Propionaldehyde	2.58	2.81	6.42	5.96	4.44	1.76	39.56%
Crotonaldehyde	0.00	0.00	1.99	2.28	NA	NA	NA
Butyr/Isobutyraldehyde	2.90	2.79	0.00	0.00	NA	NA	NA
Benzaldehyde	0.00	0.00	0.00	0.00	NA	NA	NA
Isovaleraldehyde	0.00	0.00	0.00	0.00	NA	NA	NA
Valeraldehyde	0.00	0.00	0.00	0.00	NA	NA	NA
Tolualdehydes	0.00	0.00	0.00	0.00	NA	NA	NA
Hexanaldehyde	0.00	0.00	0.00	0.00	NA	NA	NA
2,5-Dimethylbenzaldehyde	0.00	0.00	0.00	0.00	NA	NA	NA
					Average	1.51	37.27%

Table 8-9

NMOC 1992 Newark, New Jersey Sampling Precision Statistics

DI Factor Sample ID File ID Sampled Extracted Analyzed	1 NWNJ R-2239 1 RC232926 9/3/92 11/24/92 11/24/92	1 NWNJ R-2239 2 RC232927 9/3/92 11/24/92 11/24/92	1 NWNJ G-2239 1 RC232928 9/3/92 11/24/92 11/24/92	1 NWNJ G-2239 2 RC232929 9/3/92 11/24/92 11/25/92	Average	Standard Deviation	Relative Standard Deviation (%)
Concentrations (ppbv)							
Formaldehyde	7.26	7.37	6.39	6.55	6.89	0.43	6.23%
Acetaldehyde	11.70	14.93	11.44	13.12	12.80	1.39	10.84%
Acrolein	0.00	0.00	0.00	0.00	NA	NA	NA
Acetone	20.31	21.20	22.25	22.17	21.48	0.80	3.71%
Propionaldehyde	3.21	3.66	3.55	2.94	3.34	0.28	8.43%
Crotonaldehyde	0.00	0.00	0.00	0.00	NA	NA	NA
Butyr/Isobutyraldehyde	0.00	0.00	0.00	0.00	NA	NA	NA
Benzaldehyde	0.00	0.00	0.00	0.00	NA	NA	NA
Isovaleraldehyde	1.27	0.97	0.85	0.76	0.96	0.19	19.80%
Valeraldehyde	1.12	1.02	0.72	0.89	0.94	0.15	15.75%
Tolualdehydes	0.00	0.00	0.00	0.00	NA	NA	NA
Hexanaldehyde	3.31	3.55	3.46	3.67	3.50	0.13	3.71%
2,5-Dimethylbenzaldehyde	0.00	0.00	0.00	0.00	NA	NA	NA
					Average	0.48	9.78%

Table 8-10

NMOC 1992 Plainfield, New Jersey Analytical Precision Statistics

DI Factor Sample ID File ID Date Sampled Date Extracted Date Analyzed	1 PLNJ R-2587 1 RC232943 9/29/92 11/24/92 11/25/92	1 PLNJ R-2587 2 RC232944 9/29/92 11/24/92 11/25/92	Average	Absolute Percent Difference (%)	Standard Deviation	Relative Standard Deviation (%)
Concentrations (ppbv)						
Formaldehyde	2.91	2.68	2.80	8.3%	0.12	4.1%
Acetaldehyde	5.59	6.60	6.09	16.5%	0.50	8.2%
Acrolein	0.00	0.00	NA	NA	NA	NA
Acetone	9.55	10.00	9.78	4.7%	0.23	2.3%
Propionaldehyde	2.58	2.81	2.69	8.4%	0.11	4.2%
Crotonaldehyde	0.00	0.00	NA	NA	NA	NA
Butyr/Isobutyraldehyde	2.90	2.79	2.85	3.9%	0.06	1.9%
Benzaldehyde	0.00	0.00	NA	NA	NA	NA
Isovaleraldehyde	0.00	0.00	NA	NA	NA	NA
Valeraldehyde	0.00	0.00	NA	NA	NA	NA
Tolualdehydes	0.00	0.00	NA	NA	NA	NA
Hexanaldehyde	0.00	0.00	NA	NA	NA	NA
2,5-Dimethylbenzaldehyde	0.00	0.00	NA	NA	NA	NA
			Average	8.3%	0.20	4.2%

Table 8-10

Continued

DI Factor Sample ID File ID Date Sampled Date Extracted Date Analyzed	1 PLNJ G-2587 1 RC232945 9/29/92 11/24/92 11/25/92	1 PLNJ G-2587 2 RC232946 9/29/92 11/24/92 11/25/92	Average	Absolute Percent Difference (%)	Standard Deviation	Relative Standard Deviation (%)
Concentrations (ppbv)						
Formaldehyde	4.04	3.95	3.99	2.4%	0.05	1.2%
Acetaldehyde	1.50	2.21	1.85	37.9%	0.35	18.9%
Acrolein	0.00	0.00	NA	NA	NA	NA
Acetone	0.00	0.00	NA	NA	NA	NA
Propionaldehyde	6.42	5.96	6.19	7.6%	0.23	3.8%
Crotonaldehyde	1.99	2.28	2.13	13.8%	0.15	6.9%
Butyr/Isobutyraldehyde	0.00	0.00	NA	NA	NA	NA
Benzaldehyde	0.00	0.00	NA	NA	NA	NA
Isovaleraldehyde	0.00	0.00	NA	NA	NA	NA
Valeraldehyde	0.00	0.00	NA	NA	NA	NA
Tolualdehydes	0.00	0.00	NA	NA	NA	NA
Hexanaldehyde	0.00	0.00	NA	NA	NA	NA
2,5-Dimethylbenzaldehyde	0.00	0.00	NA	NA	NA	NA
			Average	15.4%	0.20	7.7%

Table 8-10

Continued

DI Factor Sample ID File ID Date Sampled Date Extracted Date Analyzed	1 PLNJ B-2587 1 RC232941 9/29/92 11/24/92 11/25/92	1 PLNJ B-2587 2 RC232942 9/29/92 11/24/92 11/25/92	Average	Absolute Percent Difference (%)	Standard Deviation	Relative Standard Deviation (%)
Concentrations (ppbv)						
Formaldehyde	0.68	0.80	0.74	16.2%	0.06	8.1%
Acetaldehyde	2.26	3.24	2.75	35.6%	0.49	17.8%
Acrolein	0.00	0.00	NA	NA	NA	NA
Acetone	9.08	8.28	8.68	9.2%	0.40	4.6%
Propionaldehyde	0.00	0.00	NA	NA	NA	NA
Crotonaldehyde	0.00	0.00	NA	NA	NA	NA
Butyr/Isobutyraldehyde	0.00	0.00	NA	NA	NA	NA
Benzaldehyde	0.00	0.00	NA	NA	NA	NA
Isovaleraldehyde	0.00	0.00	NA	NA	NA	NA
Valeraldehyde	0.00	0.00	NA	NA	NA	NA
Tolualdehydes	0.00	0.00	NA	NA	NA	NA
Hexanaldehyde	0.00	0.00	NA	NA	NA	NA
2,5-Dimethylbenzaldehyde	0.00	0.00	NA	NA	NA	NA
			Average	20.4%	0.32	10.2%

Table 8-11

NMOC 1992 Newark, New Jersey Analytical Precision Statistics

DI Factor Sample ID File ID Date Sampled Date Extracted Date Analyzed	1 NWNJ R-2239 1 RC232926 9/3/92 11/24/92 11/24/92	1 NWNJ R-2239 2 RC232927 9/3/92 11/24/92 11/24/92	Average	Absolute Percent Difference (%)	Standard Deviation (ppbv)	Relative Standard Deviation (%)
Concentrations (ppbv)						
Formaldehyde	7.26	7.37	7.32	1.4%	0.05	0.7%
Acetaldehyde	11.70	14.93	13.31	24.3%	1.62	12.1%
Acrolein	0.00	0.00	NA	NA	NA	NA
Acetone	20.31	21.20	20.75	4.3%	0.45	2.1%
Propionaldehyde	3.21	3.66	3.44	13.0%	0.22	6.5%
Crotonaldehyde	0.00	0.00	NA	NA	NA	NA
Butyr/Isobutyraldehyde	0.00	0.00	NA	NA	NA	NA
Benzaldehyde	0.00	0.00	NA	NA	NA	NA
Isovaleraldehyde	1.27	0.97	1.12	26.4%	0.15	13.2%
Valeraldehyde	1.12	1.02	1.07	9.1%	0.05	4.5%
Tolualdehydes	0.00	0.00	NA	NA	NA	NA
Hexanaldehyde	3.31	3.55	3.43	7.0%	0.12	3.5%
2,5-Dimethylbenzaldehyde	0.00	0.00	NA	NA	NA	NA
			Average	12.2%	0.38	6.1%

Table 8-11

Continued

DI Factor Sample ID File ID Sampled Extracted Analyzed	1 NWNJ G-2239 1 RC232928 9/3/92 11/24/92 11/24/92	1 NWNJ G-2239 2 RC232929 9/3/92 11/24/92 11/25/92	Average	Absolute Percent Difference (%)	Standard Deviation (ppbv)	Relative Standard Deviation (%)
Concentrations (ppbv)						
Formaldehyde	6.39	6.55	6.47	2.4%	0.08	1.2%
Acetaldehyde	11.44	13.12	12.28	13.7%	0.84	6.8%
Acrolein	0.00	0.00	NA	NA	NA	NA
Acetone	22.25	22.17	22.21	0.4%	0.04	0.2%
Propionaldehyde	3.55	2.94	3.25	18.6%	0.30	9.3%
Crotonaldehyde	0.00	0.00	NA	NA	NA	NA
Butyr/Isobutyraldehyde	0.00	0.00	NA	NA	NA	NA
Benzaldehyde	0.00	0.00	NA	NA	NA	NA
Isovaleraldehyde	0.85	0.76	0.81	10.2%	0.04	5.1%
Valeraldehyde	0.72	0.89	0.81	20.7%	0.08	10.3%
Tolualdehydes	0.00	0.00	NA	NA	NA	NA
Hexanaldehyde	3.46	3.67	3.57	5.7%	0.10	2.9%
2,5-Dimethylbenzaldehyde	0.00	0.00	NA	NA	NA	NA
			Average	10.2%	0.21	5.1%

Table 8-11

Continued

DI Factor Sample ID File ID Sampled Extracted Analyzed	1 NWNJ B-2239 1 RC232924 9/3/92 11/24/92 11/24/92	1 NWNJ B-2239 2 RC232925 9/3/92 11/24/92 11/24/92	Average	Absolute Percent Difference (%)	Standard Deviation (ppbv)	Relative Standard Deviation (%)
Concentrations (ppbv)						
Formaldehyde	0.00	0.00	NA	NA	NA	NA
Acetaldehyde	4.34	3.21	3.78	29.9%	0.57	15.0%
Acrolein	0.00	0.00	NA	NA	NA	NA
Acetone	0.00	0.00	NA	NA	NA	NA
Propionaldehyde	5.31	6.02	5.67	12.5%	0.36	6.3%
Crotonaldehyde	0.00	0.00	NA	NA	NA	NA
Butyr/Isobutyraldehyde	0.00	0.00	NA	NA	NA	NA
Benzaldehyde	0.00	0.00	NA	NA	NA	NA
Isovaleraldehyde	0.00	0.00	NA	NA	NA	NA
Valeraldehyde	0.00	0.93	NA	NA	NA	NA
Tolualdehydes	0.00	0.00	NA	NA	NA	NA
Hexanaldehyde	2.89	2.61	2.75	10.2%	0.14	5.1%
2,5-Dimethylbenzaldehyde	0.00	0.00	NA	NA	NA	NA
			Average	17.5%	0.35	8.8%

analyses were performed on 10% of the samples from each site. The overall average standard deviation for all of the replicate analyses was 0.27 ppbv.

8.5.4 Quality Control Standards

As a quality control (QC) procedure on the analytical results for all of the quantitated analytes, a solution containing all targeted carbonyl compounds at a known concentration was prepared. QC samples were analyzed after every ten samples. Table 8-5 gives the percent recoveries for the quality control standards that were analyzed during this program. Shown in Table 8-12 are the average, maximum and minimum percent recovery and two standard deviations about the average percent recovery for each targeted carbonyl analyte. These results show that the analyses remained in control. The overall average percent recovery ranged from 83.63% for hexanaldehyde to 94.53% for tolualdehydes.

Table 8-12

NMOC 1992 Daily QC Standards Statistics

Analyte	Average	Standard Deviation	Maximum	Minimum	Avg + 2 * STD	Avg - 2 * STD
Formaldehyde	89.33%	22.36%	112.92%	55.11%	134.05%	44.60%
Acetaldehyde	89.04%	21.65%	111.44%	56.07%	132.33%	45.74%
Acrolein	88.59%	21.17%	107.47%	55.93%	130.93%	46.25%
Acetone	88.53%	20.55%	108.16%	57.26%	129.63%	47.43%
Propionaldehyde	89.81%	20.72%	110.03%	58.41%	131.24%	48.38%
Crotonaldehyde	89.16%	21.17%	108.45%	56.70%	131.50%	46.83%
Butyr/Isobutyraldehyde	90.84%	22.85%	115.85%	56.39%	136.53%	45.15%
Benzaldehyde	86.58%	24.14%	108.21%	49.04%	134.86%	38.30%
Isovaleraldehyde	87.74%	21.49%	107.51%	54.93%	130.72%	44.76%
Valeraldehyde	88.73%	21.94%	112.63%	55.93%	132.61%	44.85%
Tolualdehydes	94.53%	22.01%	118.33%	61.75%	138.55%	50.51%
Hexanaldehyde	83.63%	18.72%	105.16%	57.39%	121.06%	46.20%
2,5-Dimethylbenzaldehyde	85.99%	19.36%	105.15%	56.46%	124.71%	47.27%

9.0 SNMOC DATA SUMMARY

This section presents information on the number of samples collected, summary statistics, and individual sample results. For the 1992 SNMOC Monitoring Program 848 valid ambient air samples were received; 971 sample analyses were performed including 123 replicate analyses. The samples were analyzed by gas chromatography using dual flame ionization detectors to determine concentrations of 77 target hydrocarbons. Table 9-1 presents the target compounds. The samples were collected from nineteen sites that participated in the 1992 SNMOC program. Eleven of these sites conducted daily (Monday-Friday) sampling from 22 June to 30 September 1992. Eight sites participated in an optional analysis for which ten samples from each site collected for NMOC analysis were randomly selected to receive analysis by the speciation method. Appendix A presents the sites and the site codes used throughout this report.

9.1 Sample Collection Summary

Tables 9-2 and 9-3 summarize sample collection information for program and option sites, respectively. Program sites collected samples from 22 June to 30 September 1992. The B3AL and BRLA sites started later due to sampler problems, and the MIFL site missed several sampling days due to meteorological conditions (i.e., Hurricane Andrew). Tables 9-4 through 9-6 give information for the program sites on scheduled collection did not occur, the frequency of duplicate sample collection, and frequency of duplicate samples chosen for replicate analyses.

9.2 Site Specific Summary Statistics

Site specific statistics are given in Tables 9-7 through 9-25. Duplicate and duplicate/replicate results were averaged into single compound specific values for the

Table 9-1

1992 Ambient Air Hydrocarbon Program Target List

Compound	
Ethylene	2-Methylhexane (Isoheptane)
Acetylene	2,3-Dimethylpentane
Ethane	3-Methylhexane
Propylene	1-Heptene
Propane	2,2,4-Trimethylpentane
Propyne	n-Heptane
Isobutane	Methylcyclohexane
Isobutene	2,2,3-Trimethylpentane
1-Butene	2,3,4-Trimethylpentane
1,3-Butadiene	Toluene
n-Butane	2-Methylheptane
t-2-Butene	3-Methylheptane
c-2-Butene	1-Octene
3-Methyl-1-Butene	n-Octane
Isopentane	Ethylbenzene
1-Pentene	p,m-Xylene
2-Methyl-1-Butene	Styrene
n-Pentane	o-Xylene
Isoprene	1-Nonene
t-2-Pentene	n-Nonane
c-2-Pentene	Isopropylbenzene
2-Methyl-2-Butene	n-Propylbenzene
2,2-Dimethylbutane (Neohexane)	α-Pinene
Cyclopentene	m-Ethyltoluene
4-Methyl-1-Pentene	p-Ethyltoluene
2,3-Dimethylbutane	1,3,5-Trimethylbenzene
Cyclopentane	o-Ethyltoluene
2-Methylpentane (Isohexane)	1,2,4-Trimethylbenzene
3-Methylpentane	1-Decene
2-Methyl-1-Pentene	n-Decane
1-Hexene	1,2,3-Trimethylbenzene
2-Ethyl-1-Butene	p-Diethylbenzene
n-Hexane	1-Undecene
t-2-Hexene	n-Undecane
c-2-Hexene	Dodecene
Methylcyclopentane	n-Dodecane
2,4-Dimethylpentane	Tridecene
Benzene	n-Tridecane
Cyclohexane	

Table 9-2

Samples Collected and Analyzed for 1992 SNMOC Program Sites

Site	Total Duplicate Samples	Total Replicate Analyses	Total Single Samples	Total Valid Sampling Events	Total Valid Samples	Total Analyses Reported
B1AL	16	12	60	68	76	88
B2AL	20	12	61	71	81	93
B3AL	14	10	42	49	56	66
BMTX	20	10	58	68	78	88
BRLA	18	12	38	47	56	68
CHNC	18	10	44	53	62	72
DLTX	18	10	60	69	78	88
EPTX	18	10	61	70	79	89
FWTX	20	10	58	68	78	88
JUMX	14	8	55	62	69	77
MIFL	16	10	48	56	64	74

Table 9-3

Samples Collected and Analyzed for 1992 SNMOC Option Sites

Site	Total Duplicate Samples	Total Replicate analyses	Total Single Samples	Total Valid Samples	Total Analyses Reported
L1NY	2	1	7	9	10
MNY	2	1	6	8	9
NWNJ	4	2	5	9	11
PLNJ	2	1	7	9	10
R1NC	2	1	7	9	10
S2UT	2	1	7	9	10
S3UT	2	1	7	9	10
WSNC	2	1	7	9	10

Table 9-4. June-July Sampling Frequency

	June							July																					
	22	23	24	25	26	29	30	1	2	3	6	7	8	9	10	13	14	15	16	17	20	21	22	23	24	27	28	29	30	31
B1AL													DR							D							DR			
B2AL													DR														DR		D	
B3AL																											DR			
BMTX															DR							D							DR	
BRLA																														
CHNC												DR						D												
DLTX															DR						D							DR		
EPTX														DR			D								DR					
FWTX															DR							D							DR	
JUMX														D		DR								D						
MIFL												DR							D							DR				

= Single Sample
D = Duplicate Sample
DR = Duplicate/Replicate Sample

Table 9-5. August Sampling Frequency

	August																				
	3	4	5	6	7	10	11	12	13	14	17	18	19	20	21	24	25	26	27	28	31
B1AL													DR								DR
B2AL					D								DR								D
B3AL					DR								D								DR
BMTX							D								DR						
BRLA	DR					D		DR													
CHNC					DR						DR								D		
DLTX		D				DR								D							
EPTX		D								DR								D			
FWTX							D								DR	D					
JUMX									DR								D				
MIFL					D							DR									

D = Single Sample
D = Duplicate Sample
DR = Duplicate/Replicate Sample

Table 9-6. September Sampling Frequency

	September																					October							
	1	2	3	4	7	8	9	10	11	14	15	16	17	18	21	22	23	24	25	28	29	30	1	2	5	6	7	8	9
B1AL			DR								D				DR														
B2AL			DR								D				DR							DR							
B3AL											D				DR							DR							
BMTX		D								DR								D				DR	D						
BRLA																		DR	DR	D	DR	D	DR						
CHNC						DR												D	DR	D									
DLTX	DR								D								DR												
EPTX								DR				D			DR														
FWTX		DR								D							DR					D							
JUMX				DR								DR																	
MIFL							D							DR						DR									

D = Single Sample
D = Duplicate Sample
DR = Duplicate/Replicate Sample

Table 9-7. 1992 Summary Statistics for Birmingham, AL (B1AL)

			ppbC						
Compound	Cases	Frequency	Minimum	Maximum	Median	Average	Standard Deviation	Skewness	Kurtosis
Ethylene	68	100.00%	2.07	42.67	12.84	17.14	11.50	0.73	-0.76
Acetylene	66	97.06%	1.37	40.27	13.18	14.56	10.95	0.63	-0.89
Ethane	67	98.53%	1.48	35.15	11.89	12.95	8.15	0.85	0.04
Propylene	66	97.06%	0.82	14.99	4.97	6.13	4.40	0.51	-1.20
Propane	68	100.00%	1.12	47.48	14.21	15.66	11.38	0.94	0.37
Propyne	0	0.00%	.	.	.	.	.	.	.
Isobutane	66	97.06%	0.68	18.39	4.12	5.14	3.87	1.29	1.85
Isobutene	0	0.00%	.	.	.	.	.	.	.
1-Butene	66	97.06%	0.53	8.21	2.81	3.38	2.19	0.55	-0.99
1,3-Butadiene	44	64.71%	0.55	4.25	1.76	1.75	0.90	0.46	-0.24
n-Butane	68	100.00%	1.26	67.49	10.67	12.49	9.94	2.62	12.73
t-2-Butene	42	61.76%	0.49	4.54	1.56	1.59	0.92	1.34	2.51
c-2-Butene	31	45.59%	0.51	8.55	1.13	1.40	1.49	4.07	18.72
3-Methyl-1-butene	26	38.24%	0.52	2.71	1.03	1.08	0.50	1.72	3.88
Isopentane	68	100.00%	2.35	163.33	21.25	29.10	26.09	2.23	8.96
1-Pentene	25	36.76%	0.54	7.41	1.63	2.26	1.74	2.09	4.56
2-Methyl-1-butene	56	82.35%	0.52	11.64	2.00	2.38	1.92	2.14	8.38
n-Pentane	68	100.00%	0.72	55.21	8.43	11.98	9.89	1.48	3.77
Isoprene	61	89.71%	0.48	19.14	2.86	3.93	3.60	1.92	4.61
t-2-Pentene	61	89.71%	0.47	13.77	1.98	2.58	2.27	2.21	8.38
c-2-Pentene	49	72.06%	0.55	16.71	1.58	2.13	2.45	4.80	27.31
2-Methyl-2-butene	63	92.65%	0.34	16.57	2.38	3.00	2.68	2.33	9.29
Neohexane	68	100.00%	2.40	27.40	12.45	12.72	5.17	0.63	0.58
Cyclopentene	30	44.12%	0.46	2.45	0.87	0.89	0.37	2.63	10.64
4-Methyl-1-pentene	50	73.53%	0.46	3.21	1.31	1.34	0.58	0.85	0.84
2,3-Dimethylbutane	41	60.29%	0.51	4.25	1.59	1.58	0.76	0.91	2.08
Cyclopentane	67	98.53%	0.54	11.94	2.54	3.45	2.48	0.86	0.40
Isohexane	68	100.00%	0.55	35.34	5.62	9.82	7.71	0.88	0.14
3-Methylpentane	67	98.53%	0.86	25.91	5.94	8.25	6.61	0.66	-0.60
1-Hexene	1	1.47%	2.48	2.48	2.48	2.48	.	.	.
2-Methyl-1-pentene	40	58.82%	0.48	4.34	1.71	1.65	0.80	0.83	1.64
2-Ethyl-1-butene	0	0.00%	.	.	.	.	.	.	.
n-Hexane	67	98.53%	0.96	37.85	5.20	8.98	7.79	1.02	1.11
t-2-Hexene	32	47.06%	0.55	2.85	1.16	1.19	0.48	1.24	3 28

Table 9-7. Continued

Compound	Cases	Frequency	ppbC Minimum	Maximum	Median	Average	Standard Deviation	Skewness	Kurtos
c-2-Hexene	28	41.18%	0.51	1.73	0.83	0.85	0.24	1.91	6.
Methylcyclopentane	65	95.59%	0.60	12.47	2.44	4.63	3.51	0.53	-1.
2,4-Dimethylpentane	61	89.71%	0.52	6.12	2.29	2.42	1.62	0.36	-1.
Benzene	68	100.00%	1.92	43.04	9.58	12.11	9.45	1.25	1.
Cyclohexane	60	88.24%	0.63	35.92	3.47	6.40	6.80	2.08	5.
Isoheptane	62	91.18%	0.69	16.96	3.09	4.80	4.14	1.19	0.
2,3-Dimethylpentane	18	26.47%	0.51	2.19	1.57	1.52	0.54	-0.32	-1.
3-Methylhexane	68	100.00%	0.83	10.01	4.16	4.47	2.57	0.39	-1.
2,2,4-Trimethylpentane	66	97.06%	0.53	19.15	5.28	7.48	5.55	0.54	-1.
1-Heptene	33	48.53%	0.58	4.58	1.46	1.54	0.80	2.60	8.
n-Heptane	64	94.12%	0.54	7.67	2.59	2.54	1.72	0.59	-0.
Methylcyclohexane	53	77.94%	0.60	4.67	1.92	1.90	1.10	0.34	-1.
2,2,3-Trimethylpentane	47	69.12%	0.52	2.83	1.51	1.58	0.79	0.08	-1.
2,3,4-Trimethylpentane	65	95.59%	0.56	6.67	2.42	2.87	2.04	0.51	-1.
Toluene	68	100.00%	1.84	68.58	20.99	26.71	18.56	0.51	-1.
2-Methylheptane	61	89.71%	0.55	4.94	1.60	1.94	1.23	0.60	-0.
3-Methylheptane	56	82.35%	0.52	4.11	1.49	1.79	1.06	0.49	-1.
1-Octene	41	60.29%	0.53	2.72	1.83	1.69	0.72	-0.23	-1.
n-Octane	47	69.12%	0.54	4.84	1.35	1.64	1.00	1.27	1
Ethylbenzene	67	98.53%	0.49	13.31	4.77	5.41	3.86	0.41	-1
p-Xylene + m-Xylene	68	100.00%	0.79	46.38	15.77	18.22	13.34	0.43	-1
Styrene	47	69.12%	0.52	2.81	1.48	1.52	0.69	0.11	-1
o-Xylene	67	98.53%	0.66	14.32	5.41	5.95	4.38	0.44	-1
1-Nonene	26	38.24%	0.55	1.24	0.91	0.88	0.18	-0.14	-0
n-Nonane	54	79.41%	0.50	5.15	1.82	2.02	1.30	0.77	-0
Isopropylbenzene	22	32.35%	0.48	2.86	0.72	0.81	0.47	4.21	18
n-Propylbenzene	58	85.29%	0.66	12.88	2.12	2.99	2.67	2.13	4
alpha-Pinene	59	86.76%	0.53	3.37	1.56	1.67	0.98	0.36	-1
m-Ethyltoluene	66	97.06%	0.58	15.33	4.20	4.72	3.34	0.73	-0
p-Ethyltoluene	44	64.71%	0.54	2.84	1.61	1.55	0.71	0.03	-1
1,3,5-Trimethylbenzene	63	92.65%	0.50	5.81	2.17	2.35	1.60	0.62	-0
o-Ethyltoluene	65	95.59%	0.53	6.77	2.32	2.95	1.89	0.49	-1
1-Decene	0	0.00%	.	.	.	.	.	.	.
1,2,4-Trimethylbenzene	67	98.53%	1.02	17.50	5.25	7.22	5.16	0.48	-1

Table 9-7. Continued

Compound	Cases	Frequency	ppbC Minimum	Maximum	Median	Average	Standard Deviation	Skewness	Kurtosis
n-Decane	41	60.29%	0.50	7.59	1.77	2.19	1.54	1.82	4.04
1,2,3-Trimethylbenzene	68	100.00%	0.76	7.16	3.28	3.49	1.78	0.35	-1.11
p-Diethylbenzene	49	72.06%	0.60	4.40	1.32	1.43	0.73	1.95	5.39
1-Undecene	63	92.65%	0.48	6.07	1.31	1.53	0.91	2.54	9.50
n-Undecane	66	97.06%	0.55	17.91	2.89	3.78	3.41	1.88	4.19
1-Dodecene	63	92.65%	0.51	4.45	1.00	1.13	0.62	2.91	12.83
n-Dodecane	61	89.71%	0.59	17.60	1.93	2.82	2.96	2.79	10.17
1-Tridecene	13	19.12%	0.55	1.69	0.85	0.90	0.35	1.04	0.44
n-Tridecane	48	70.59%	0.53	11.95	1.06	1.61	1.80	4.40	23.58

Table 9-8. 1992 Summary Statistics for Birmingham, AL (B2AL)

			ppbC						
Compound	Cases	Frequency	Minimum	Maximum	Median	Average	Standard Deviation	Skewness	Kurtosi
Ethylene	70	98.59%	0.89	19.96	7.85	8.73	4.10	0.63	0.1
Acetylene	65	91.55%	0.96	11.16	3.78	4.16	2.23	0.84	0.3
Ethane	71	100.00%	0.76	12.72	4.43	4.73	2.42	0.93	1.1
Propylene	65	91.55%	0.60	6.65	2.36	2.57	1.37	0.84	0.4
Propane	71	100.00%	1.30	17.44	5.85	6.56	3.61	0.81	0.2
Propyne	0	0.00%	.	.	.	.	.	.	.
Isobutane	64	90.14%	0.59	21.45	1.46	2.63	3.78	3.85	15.6
Isobutene	0	0.00%	.	.	.	.	.	.	.
1-Butene	64	90.14%	0.53	6.46	1.98	2.05	1.13	1.54	3.8
1,3-Butadiene	31	43.66%	0.52	1.70	0.75	0.84	0.27	1.47	2.3
n-Butane	70	98.59%	0.74	84.13	3.71	6.37	10.56	6.08	43.5
t-2-Butene	24	33.80%	0.51	3.59	0.80	0.97	0.65	3.20	11.8
c-2-Butene	9	12.68%	0.52	2.92	0.92	1.11	0.76	1.98	4.2
3-Methyl-1-butene	7	9.86%	0.44	2.11	0.75	0.98	0.60	1.43	1.2
Isopentane	69	97.18%	0.92	137.73	8.46	13.93	21.94	4.42	21.2
1-Pentene	7	9.86%	0.50	6.26	0.80	1.65	2.07	2.48	6.2
2-Methyl-1-butene	41	57.75%	0.50	9.28	0.88	1.34	1.51	4.14	19.8
n-Pentane	70	98.59%	0.56	66.22	3.42	5.30	8.67	5.66	37.0
Isoprene	56	78.87%	0.51	20.27	2.85	3.68	3.34	2.53	10.1
t-2-Pentene	37	52.11%	0.51	10.24	0.83	1.46	1.80	3.92	16.9
c-2-Pentene	20	28.17%	0.52	5.43	0.81	1.20	1.17	2.96	9.4
2-Methyl-2-butene	51	71.83%	0.51	14.03	1.09	1.59	2.06	5.01	28.2
Neohexane	71	100.00%	1.88	8.90	3.70	4.14	1.69	1.12	0.5
Cyclopentene	6	8.45%	0.46	1.71	0.80	0.89	0.48	1.14	0.9
4-Methyl-1-pentene	41	57.75%	0.48	2.32	0.78	0.96	0.47	1.22	0.6
2,3-Dimethylbutane	18	25.35%	0.43	4.77	0.80	1.18	1.16	2.62	6.2
Cyclopentane	51	71.83%	0.55	10.13	1.40	1.65	1.42	4.53	26.1
Isohexane	69	97.18%	0.51	29.10	2.67	3.43	3.74	5.02	32.9
3-Methylpentane	65	91.55%	0.52	17.56	1.86	2.61	2.68	3.50	15.7
1-Hexene	0	0.00%	.	.	.	.	.	.	.
2-Methyl-1-pentene	17	23.94%	0.50	3.42	0.85	1.03	0.69	2.90	9.7
2-Ethyl-1-butene	0	0.00%	.	.	.	.	.	.	.
n-Hexane	66	92.96%	0.50	15.24	1.93	2.64	2.64	3.02	10.2
t-2-Hexene	5	7.04%	0.62	4.33	0.96	1.70	1.54	1.76	3.0

Table 9-8. Continued

Compound	Cases	Frequency	ppbC Minimum	Maximum	Median	Average	Standard Deviation	Skewness	Kurtosis
c-2-Hexene	3	4.23%	0.49	1.14	0.60	0.74	0.35	1.54	.
Methylcyclopentane	56	78.87%	0.57	6.78	1.36	1.73	1.26	2.55	7.22
2,4-Dimethylpentane	42	59.15%	0.59	4.61	0.91	1.08	0.71	3.52	15.47
Benzene	71	100.00%	1.38	18.89	4.32	5.09	3.28	2.07	5.46
Cyclohexane	62	87.32%	0.54	14.97	1.49	2.22	2.55	3.66	14.57
Isoheptane	49	69.01%	0.52	4.76	1.52	1.81	1.02	0.89	0.35
2,3-Dimethylpentane	8	11.27%	0.49	9.42	0.63	2.10	3.06	2.51	6.54
3-Methylhexane	71	100.00%	0.72	8.35	1.75	2.02	1.25	2.69	9.98
2,2,4-Trimethylpentane	67	94.37%	0.52	12.28	2.16	2.48	1.79	2.63	12.40
1-Heptene	6	8.45%	0.52	2.19	0.63	0.95	0.66	1.81	2.99
n-Heptane	48	67.61%	0.53	3.83	0.80	1.03	0.70	3.01	9.12
Methylcyclohexane	27	38.03%	0.50	1.49	0.70	0.80	0.26	1.18	0.94
2,2,3-Trimethylpentane	22	30.99%	0.47	1.63	0.63	0.70	0.24	2.98	11.11
2,3,4-Trimethylpentane	48	67.61%	0.48	3.83	1.03	1.13	0.57	2.39	9.75
Toluene	71	100.00%	1.08	53.99	7.41	8.56	7.35	3.83	20.98
2-Methylheptane	35	49.30%	0.51	1.65	0.75	0.83	0.29	1.65	2.46
3-Methylheptane	26	36.62%	0.50	1.43	0.65	0.78	0.26	1.29	0.80
1-Octene	15	21.13%	0.51	1.25	0.65	0.73	0.22	1.27	0.93
n-Octane	13	18.31%	0.45	1.94	0.73	0.84	0.38	2.27	6.23
Ethylbenzene	60	84.51%	0.58	5.78	1.55	1.77	1.06	1.85	3.94
p-Xylene + m-Xylene	70	98.59%	0.57	22.20	4.70	5.20	3.91	2.03	5.76
Styrene	38	53.52%	0.52	4.46	0.69	0.87	0.63	5.18	29.53
o-Xylene	59	83.10%	0.53	7.84	1.80	1.99	1.30	2.20	6.64
1-Nonene	1	1.41%	1.52	1.52	1.52	1.52	.	.	.
n-Nonane	18	25.35%	0.50	3.82	0.65	0.92	0.79	3.24	11.48
Isopropylbenzene	1	1.41%	0.65	0.65	0.65	0.65	.	.	.
n-Propylbenzene	69	97.18%	0.71	7.45	2.64	2.89	1.63	0.86	0.20
alpha-Pinene	27	38.03%	0.49	2.22	0.62	0.78	0.41	2.41	5.97
m-Ethyltoluene	61	85.92%	0.59	6.35	1.87	2.09	1.15	1.32	2.21
p-Ethyltoluene	10	14.08%	0.42	1.78	0.66	0.84	0.44	1.39	1.20
1,3,5-Trimethylbenzene	45	63.38%	0.53	7.57	0.94	1.10	1.04	5.75	36.18
o-Ethyltoluene	61	85.92%	0.50	3.35	1.17	1.27	0.59	1.09	1.49
1-Decene	0	0.00%	.	.	.	.	.	.	.
1,2,4-Trimethylbenzene	66	92.96%	0.54	7.32	2.13	2.29	1.32	1.25	2.37

Table 9-8. Continued

Compound	Cases	Frequency	ppbC Minimum	Maximum	Median	Average	Standard Deviation	Skewness	Kurtosi
n-Decane	9	12.68%	0.50	20.63	1.54	3.85	6.46	2.73	7.6
1,2,3-Trimethylbenzene	71	100.00%	1.16	10.12	2.82	3.46	1.93	1.97	3.7
p-Diethylbenzene	36	50.70%	0.47	1.74	0.74	0.85	0.29	1.27	1.5
1-Undecene	69	97.18%	0.48	4.99	1.50	1.67	0.81	1.67	3.8
n-Undecane	62	87.32%	0.54	89.40	1.46	3.22	11.19	7.73	60.4
1-Dodecene	60	84.51%	0.54	3.07	0.93	1.06	0.46	2.12	6.0
n-Dodecane	61	85.92%	0.53	104.86	1.06	2.97	13.29	7.77	60.5
1-Tridecene	5	7.04%	0.51	2.77	0.54	0.99	1.00	2.23	4.9
n-Tridecane	28	39.44%	0.47	41.76	0.81	2.41	7.73	5.26	27.7

Table 9-9. 1992 Summary Statistics for Birmingham, AL (B3AL)

			ppbC						
Compound	Cases	Frequency	Minimum	Maximum	Median	Average	Standard Deviation	Skewness	Kurtosis
Ethylene	47	95.92%	1.66	17.12	6.38	7.21	3.74	0.72	-0.17
Acetylene	45	91.84%	0.85	6.48	2.02	2.64	1.62	0.83	-0.49
Ethane	48	97.96%	0.75	11.86	4.67	4.84	2.40	0.41	0.28
Propylene	44	89.80%	0.65	6.00	1.52	2.03	1.26	1.21	0.96
Propane	49	100.00%	0.99	10.35	5.32	5.39	2.25	0.31	-0.35
Propyne	0	0.00%	.	.	.	.	.	.	.
Isobutane	46	93.88%	0.64	7.76	1.66	2.07	1.36	2.11	5.84
Isobutene	0	0.00%	.	.	.	.	.	.	.
1-Butene	48	97.96%	0.55	3.88	1.28	1.46	0.83	1.34	1.28
1,3-Butadiene	13	26.53%	0.50	1.39	0.69	0.77	0.25	1.34	2.04
n-Butane	49	100.00%	0.66	34.02	4.39	6.12	5.71	3.06	12.00
t-2-Butene	15	30.61%	0.51	3.39	0.74	1.09	0.77	2.25	5.40
c-2-Butene	8	16.33%	0.56	1.63	0.76	0.90	0.42	1.16	-0.19
3-Methyl-1-butene	3	6.12%	0.74	0.86	0.75	0.78	0.07	1.69	.
Isopentane	49	100.00%	1.58	76.78	8.65	12.39	13.24	3.06	12.07
1-Pentene	11	22.45%	0.59	2.53	0.75	0.93	0.55	3.01	9.52
2-Methyl-1-butene	20	40.82%	0.56	3.77	1.26	1.48	1.01	1.46	1.10
n-Pentane	48	97.96%	0.62	41.78	3.71	5.79	7.08	3.40	14.40
Isoprene	41	83.67%	0.55	13.52	5.30	5.99	4.44	0.30	-1.34
t-2-Pentene	16	32.65%	0.56	3.80	0.98	1.33	0.96	1.95	3.13
c-2-Pentene	14	28.57%	0.55	2.06	0.77	0.89	0.44	2.17	3.94
2-Methyl-2-butene	22	44.90%	0.36	4.89	1.30	1.55	1.20	1.90	3.60
Neohexane	49	100.00%	2.65	76.61	21.85	23.42	16.16	1.40	2.37
Cyclopentene	2	4.08%	0.53	0.62	0.58	0.58	0.06	.	.
4-Methyl-1-pentene	35	71.43%	0.54	2.64	0.97	1.07	0.47	1.64	3.33
2,3-Dimethylbutane	11	22.45%	0.54	7.96	0.74	1.52	2.18	3.08	9.75
Cyclopentane	40	81.63%	0.58	4.71	1.14	1.47	0.86	1.79	4.22
Isohexane	46	93.88%	0.58	13.60	2.34	3.01	2.56	2.22	6.49
3-Methylpentane	42	85.71%	0.53	8.93	2.09	2.57	1.89	1.74	3.60
1-Hexene	0	0.00%	.	.	.	.	.	.	.
2-Methyl-1-pentene	13	26.53%	0.59	1.49	0.74	0.87	0.28	0.94	0.11
2-Ethyl-1-butene	0	0.00%	.	.	.	.	.	.	.
n-Hexane	44	89.80%	0.55	6.91	1.43	1.91	1.26	1.88	4.95
t-2-Hexene	3	6.12%	0.61	0.72	0.70	0.68	0.06	-1.51	.

Table 9-9. Continued

Compound	Cases	Frequency	ppbC Minimum	Maximum	Median	Average	Standard Deviation	Skewness	Kurtosis
c-2-Hexene	1	2.04%	0.55	0.55	0.55	0.55	.	.	.
Methylcyclopentane	40	81.63%	0.51	4.58	1.55	1.74	0.94	1.04	1.02
2,4-Dimethylpentane	24	48.98%	0.52	4.75	1.00	1.22	0.90	3.05	10.67
Benzene	49	100.00%	1.01	9.09	3.35	3.76	1.99	0.86	-0.09
Cyclohexane	44	89.80%	0.56	29.01	1.88	3.02	4.38	5.11	29.96
Isoheptane	16	32.65%	0.63	2.47	1.03	1.14	0.50	1.37	1.93
2,3-Dimethylpentane	26	53.06%	0.60	13.34	1.42	2.10	2.44	4.17	19.40
3-Methylhexane	49	100.00%	0.62	14.98	2.06	2.72	2.30	3.50	16.52
2,2,4-Trimethylpentane	47	95.92%	0.56	8.95	1.90	2.40	1.73	1.62	3.33
1-Heptene	4	8.16%	0.50	0.84	0.59	0.63	0.15	1.46	2.37
n-Heptane	30	61.22%	0.47	7.20	0.77	1.07	1.20	4.91	25.52
Methylcyclohexane	14	28.57%	0.53	4.20	0.77	1.04	0.93	3.41	12.20
2,2,3-Trimethylpentane	13	26.53%	0.56	1.11	0.66	0.71	0.16	1.40	1.97
2,3,4-Trimethylpentane	29	59.18%	0.48	2.74	0.90	1.07	0.56	1.30	1.59
Toluene	49	100.00%	2.07	98.15	13.62	18.51	18.23	2.28	7.03
2-Methylheptane	12	24.49%	0.53	0.98	0.72	0.72	0.15	0.31	-1.19
3-Methylheptane	11	22.45%	0.43	1.02	0.60	0.64	0.15	1.40	3.27
1-Octene	9	18.37%	0.51	0.98	0.69	0.70	0.14	1.01	1.94
n-Octane	13	26.53%	0.53	5.89	0.73	1.14	1.44	3.53	12.59
Ethylbenzene	40	81.63%	0.63	7.44	1.58	1.77	1.18	2.95	13.27
p-Xylene + m-Xylene	49	100.00%	0.88	47.77	5.03	6.05	6.81	4.96	30.13
Styrene	23	46.94%	0.50	3.50	0.77	0.89	0.59	4.22	19.26
o-Xylene	42	85.71%	0.66	22.37	2.04	2.48	3.32	5.50	33.26
1-Nonene	1	2.04%	0.58	0.58	0.58	0.58	.	.	.
n-Nonane	20	40.82%	0.51	6.10	0.82	1.38	1.64	2.70	6.2
Isopropylbenzene	5	10.20%	0.50	2.95	0.66	1.08	1.04	2.20	4.8
n-Propylbenzene	42	85.71%	0.59	182.16	5.58	14.77	29.15	4.88	27.5
alpha-Pinene	22	44.90%	0.55	6.76	0.75	1.17	1.39	3.63	13.6
m-Ethyltoluene	42	85.71%	0.52	18.29	2.27	2.69	3.09	3.90	17.3
p-Ethyltoluene	5	10.20%	0.45	5.58	0.55	1.53	2.27	2.23	4.9
1,3,5-Trimethylbenzene	28	57.14%	0.50	8.05	0.84	1.11	1.38	5.08	26.4
o-Ethyltoluene	47	95.92%	0.50	6.11	1.27	1.52	1.08	2.89	10.2
1-Decene	0	0.00%	.	.	.	.	.	.	.
1,2,4-Trimethylbenzene	48	97.96%	0.51	22.40	1.70	2.38	3.18	5.56	35.0

Table 9-9. Continued

Compound	Cases	Frequency	ppbC Minimum	Maximum	Median	Average	Standard Deviation	Skewness	Kurtosis
n-Decane	15	30.61%	0.55	17.88	2.25	3.30	4.21	3.36	12.16
1,2,3-Trimethylbenzene	46	93.88%	0.86	17.49	1.66	2.33	2.55	4.97	28.57
p-Diethylbenzene	26	53.06%	0.56	2.86	0.83	0.97	0.46	2.90	11.13
1-Undecene	47	95.92%	0.75	22.50	1.63	3.01	3.64	3.76	17.71
n-Undecane	48	97.96%	0.50	37.94	1.67	4.46	6.62	3.22	13.40
1-Dodecene	47	95.92%	0.67	9.50	1.25	1.70	1.39	4.19	22.08
n-Dodecane	41	83.67%	0.51	26.96	1.66	4.25	5.32	2.42	7.36
1-Tridecene	7	14.29%	0.58	1.81	0.77	0.88	0.42	2.45	6.28
n-Tridecane	35	71.43%	0.51	22.52	1.25	2.66	3.90	4.16	20.53

Table 9-10. 1992 Summary Statistics for Beaumont, TX (BMTX)

			ppbC						
Compound	Cases	Frequency	Minimum	Maximum	Median	Average	Standard Deviation	Skewness	Kurtosis
Ethylene	67	98.53%	1.62	484.61	15.99	41.46	78.16	4.10	18.77
Acetylene	53	77.94%	1.18	15.39	5.03	5.17	3.32	1.09	1.07
Ethane	68	100.00%	8.62	235.60	31.36	40.94	41.05	3.54	14.04
Propylene	67	98.53%	0.71	158.65	4.01	14.03	30.75	3.21	9.87
Propane	68	100.00%	6.09	97.74	30.68	33.50	19.21	1.07	1.39
Propyne	0	0.00%	.	.	.	.	.	.	.
Isobutane	68	100.00%	3.08	120.63	16.70	20.11	17.37	3.55	17.04
Isobutene	0	0.00%	.	.	.	.	.	.	.
1-Butene	67	98.53%	0.87	19.98	2.59	3.45	3.43	3.19	11.32
1,3-Butadiene	41	60.29%	0.51	30.78	1.33	2.96	5.06	4.49	23.49
n-Butane	68	100.00%	6.01	66.12	23.17	26.21	13.86	0.99	0.73
t-2-Butene	43	63.24%	0.54	7.41	1.31	1.75	1.57	2.44	5.90
c-2-Butene	32	47.06%	0.55	8.64	1.12	1.71	1.80	2.83	8.11
3-Methyl-1-butene	36	52.94%	0.55	3.51	1.17	1.32	0.71	1.48	2.25
Isopentane	66	97.06%	6.58	135.35	30.22	37.14	26.47	1.21	1.60
1-Pentene	34	50.00%	0.62	9.62	1.83	2.54	2.05	2.06	4.58
2-Methyl-1-butene	59	86.76%	0.53	6.12	1.83	2.22	1.52	0.90	0.03
n-Pentane	68	100.00%	2.29	58.20	11.87	15.40	10.88	1.78	4.18
Isoprene	62	91.18%	0.52	21.38	1.65	2.55	2.93	4.60	27.87
t-2-Pentene	57	83.82%	0.54	8.18	2.14	2.72	1.96	1.03	0.38
c-2-Pentene	51	75.00%	0.69	4.19	1.53	1.68	0.87	0.92	0.12
2-Methyl-2-butene	66	97.06%	0.53	9.08	2.40	2.88	2.07	1.06	0.60
Neohexane	67	98.53%	5.38	38.69	15.05	16.61	6.60	0.91	1.2
Cyclopentene	25	36.76%	0.40	1.40	0.87	0.85	0.23	0.39	0.23
4-Methyl-1-pentene	53	77.94%	0.51	1.75	0.75	0.84	0.30	1.42	1.72
2,3-Dimethylbutane	64	94.12%	0.55	4.37	1.49	1.82	1.07	1.03	0.12
Cyclopentane	66	97.06%	0.82	9.79	2.59	2.84	1.65	1.60	3.97
Isohexane	68	100.00%	1.69	49.15	7.09	9.72	8.40	2.47	7.8
3-Methylpentane	68	100.00%	1.79	23.16	6.38	7.27	4.23	1.27	2.1
1-Hexene	1	1.47%	2.93	2.93	2.93	2.93	.	.	.
2-Methyl-1-pentene	40	58.82%	0.52	3.43	1.04	1.21	0.67	1.84	3 3
2-Ethyl-1-butene	1	1.47%	0.59	0.59	0.59	0.59	.	.	.
n-Hexane	68	100.00%	1.15	50.40	7.71	10.54	8.48	2.03	6.4
t-2-Hexene	22	32.35%	0.53	2.59	0.75	0.91	0.46	2.45	7.6

Table 9-10. Continued

Compound	Cases	Frequency	ppbC Minimum	Maximum	Median	Average	Standard Deviation	Skewness	Kurtosis
c-2-Hexene	15	22.06%	0.44	2.15	0.64	0.79	0.41	2.88	9.45
Methylcyclopentane	68	100.00%	0.73	14.09	4.58	5.14	3.08	1.05	0.74
2,4-Dimethylpentane	53	77.94%	0.56	3.81	1.11	1.29	0.66	1.79	4.04
Benzene	68	100.00%	2.45	55.97	6.60	9.53	9.87	3.12	10.62
Cyclohexane	67	98.53%	1.38	18.85	3.78	4.85	3.68	2.04	4.26
Isoheptane	64	94.12%	0.66	14.27	3.52	4.14	2.87	1.55	2.61
2,3-Dimethylpentane	6	8.82%	0.50	3.67	2.97	2.36	1.40	-0.77	-1.86
3-Methylhexane	68	100.00%	1.22	11.97	3.38	3.96	2.30	1.61	2.64
2,2,4-Trimethylpentane	67	98.53%	0.57	15.41	3.36	4.14	3.25	1.37	1.74
1-Heptene	39	57.35%	0.44	2.70	0.84	1.06	0.60	1.73	2.38
n-Heptane	67	98.53%	0.67	18.88	2.30	3.34	3.37	3.22	11.54
Methylcyclohexane	67	98.53%	0.78	16.23	2.75	3.59	2.84	2.81	9.05
2,2,3-Trimethylpentane	45	66.18%	0.37	2.44	0.91	1.02	0.47	1.21	1.19
2,3,4-Trimethylpentane	59	86.76%	0.49	5.73	1.49	1.77	1.12	1.62	2.71
Toluene	68	100.00%	3.14	71.93	13.38	17.22	13.33	1.79	3.79
2-Methylheptane	66	97.06%	0.55	8.83	1.38	1.78	1.52	3.02	10.51
3-Methylheptane	58	85.29%	0.50	4.85	1.10	1.40	0.92	1.96	4.07
1-Octene	28	41.18%	0.50	1.43	0.70	0.76	0.24	1.14	0.81
n-Octane	57	83.82%	0.54	10.88	0.94	1.68	2.06	3.24	10.81
Ethylbenzene	68	100.00%	0.81	9.51	2.59	2.94	1.76	1.44	2.61
p-Xylene + m-Xylene	68	100.00%	2.16	30.04	7.98	9.29	5.74	1.55	2.65
Styrene	51	75.00%	0.53	3.56	0.98	1.18	0.68	1.64	2.69
o-Xylene	67	98.53%	0.73	10.40	2.75	3.11	1.91	1.54	2.91
1-Nonene	8	11.76%	0.37	1.97	0.96	1.14	0.62	0.40	-1.56
n-Nonane	53	77.94%	0.49	9.30	0.96	1.94	2.25	2.23	4.13
Isopropylbenzene	3	4.41%	0.62	0.68	0.65	0.65	0.03	0.00	.
n-Propylbenzene	58	85.29%	0.55	10.66	1.82	2.38	1.87	2.08	5.93
alpha-Pinene	55	80.88%	0.51	4.76	0.96	1.18	0.76	2.48	8.36
m-Ethyltoluene	66	97.06%	0.64	6.86	2.25	2.64	1.47	1.21	1.11
p-Ethyltoluene	34	50.00%	0.52	2.61	0.92	1.05	0.50	1.50	1.98
1,3,5-Trimethylbenzene	59	86.76%	0.49	4.01	1.07	1.32	0.79	1.69	2.73
o-Ethyltoluene	68	100.00%	0.79	5.77	1.56	1.89	0.95	1.68	3.55
1-Decene	2	2.94%	1.95	4.04	2.99	2.99	1.47	.	.
1,2,4-Trimethylbenzene	68	100.00%	0.82	12.57	3.50	4.24	2.62	1.49	2.40

Table 9-10. Continued

Compound	Cases	Frequency	ppbC Minimum	Maximum	Median	Average	Standard Deviation	Skewness	Kurtosis
n-Decane	41	60.29%	0.54	15.12	1.53	2.74	2.90	2.56	8.07
1,2,3-Trimethylbenzene	68	100.00%	1.17	18.55	2.44	3.04	2.29	4.97	31.88
p-Diethylbenzene	44	64.71%	0.54	3.33	0.96	1.11	0.57	1.90	4.54
1-Undecene	67	98.53%	0.80	5.05	1.36	1.67	0.87	2.05	4.30
n-Undecane	68	100.00%	0.75	21.62	2.41	3.37	3.21	3.41	15.93
1-Dodecene	67	98.53%	0.56	3.23	0.93	1.14	0.61	1.97	3.75
n-Dodecane	68	100.00%	0.51	8.77	1.65	2.07	1.56	2.32	6.95
1-Tridecene	21	30.88%	0.50	2.14	0.90	1.02	0.42	0.99	1.01
n-Tridecane	50	73.53%	0.43	6.51	0.88	1.17	1.02	3.90	17.36

Table 9-11. 1992 Summary Statistics for Baton Rouge, LA (BRLA)

			ppbC						
Compound	Cases	Frequency	Minimum	Maximum	Median	Average	Standard Deviation	Skewness	Kurtosis
Ethylene	47	100.00%	3.78	40.47	10.33	12.82	7.44	1.95	4.50
Acetylene	42	89.36%	1.08	20.89	4.78	5.96	4.67	1.68	3.06
Ethane	47	100.00%	4.25	95.48	24.02	27.28	18.75	1.15	2.10
Propylene	47	100.00%	1.74	40.59	5.10	7.72	7.51	2.53	7.81
Propane	47	100.00%	7.90	1851.76	26.95	87.86	271.04	6.27	41.25
Propyne	0	0.00%	.	.	.	.	.	.	.
Isobutane	47	100.00%	2.90	73.78	12.01	13.60	11.78	3.22	14.56
Isobutene	0	0.00%	.	.	.	.	.	.	.
1-Butene	47	100.00%	1.29	11.80	2.76	3.29	1.95	2.21	7.08
1,3-Butadiene	28	59.57%	0.39	5.25	1.19	1.35	0.99	2.56	8.45
n-Butane	47	100.00%	7.00	126.81	21.15	25.53	20.82	3.07	12.31
t-2-Butene	40	85.11%	0.51	12.10	1.05	1.59	1.89	4.68	25.38
c-2-Butene	28	59.57%	0.53	11.63	0.89	1.43	2.10	4.61	22.70
3-Methyl-1-butene	13	27.66%	0.45	3.78	0.80	1.09	0.86	2.86	9.10
Isopentane	46	97.87%	6.84	141.25	24.13	31.33	26.32	2.54	7.80
1-Pentene	15	31.91%	0.70	8.06	1.77	2.65	2.22	1.64	1.89
2-Methyl-1-butene	45	95.74%	0.52	13.31	1.19	2.05	2.33	3.18	12.35
n-Pentane	47	100.00%	2.59	52.13	10.73	13.18	10.46	2.30	6.32
Isoprene	40	85.11%	0.54	6.32	1.70	2.03	1.45	1.46	1.93
t-2-Pentene	45	95.74%	0.49	15.76	1.39	2.39	2.96	3.23	11.48
c-2-Pentene	35	74.47%	0.44	8.65	1.19	1.61	1.49	3.43	14.76
2-Methyl-2-butene	46	97.87%	0.64	21.14	1.73	2.73	3.37	4.03	20.06
Neohexane	47	100.00%	2.70	34.70	8.47	10.15	6.94	1.89	3.58
Cyclopentene	16	34.04%	0.59	2.50	0.78	0.97	0.53	2.13	4.33
4-Methyl-1-pentene	37	78.72%	0.51	2.46	0.90	0.97	0.39	1.70	4.43
2,3-Dimethylbutane	37	78.72%	0.50	3.54	0.92	1.15	0.72	2.18	4.88
Cyclopentane	47	100.00%	1.08	8.62	2.14	2.96	1.94	1.44	1.37
Isohexane	47	100.00%	2.12	30.22	6.25	8.29	6.42	2.04	4.23
3-Methylpentane	47	100.00%	1.08	24.46	4.98	6.74	5.22	1.72	3.09
1-Hexene	3	6.38%	0.71	1.04	0.76	0.84	0.18	1.58	.
2-Methyl-1-pentene	26	55.32%	0.56	4.59	1.52	1.72	1.15	1.12	0.52
2-Ethyl-1-butene	0	0.00%	.	.	.	.	.	.	.
n-Hexane	47	100.00%	1.65	45.44	4.98	8.02	7.87	2.88	10.84
t-2-Hexene	20	42.55%	0.49	2.66	1.10	1.17	0.68	1.16	0.66

Table 9-11. Continued

Compound	Cases	Frequency	ppbC Minimum	Maximum	Median	Average	Standard Deviation	Skewness	Kurtosis
c-2-Hexene	12	25.53%	0.58	1.64	0.69	0.80	0.31	2.19	4.71
Methylcyclopentane	47	100.00%	0.92	21.03	3.17	4.20	3.56	2.71	10.17
2,4-Dimethylpentane	45	95.74%	0.56	4.87	1.18	1.54	1.04	1.56	2.09
Benzene	47	100.00%	2.95	33.95	5.45	7.81	5.83	2.70	8.99
Cyclohexane	47	100.00%	0.56	7.56	2.68	3.15	1.59	1.02	0.98
Isoheptane	47	100.00%	1.08	15.33	3.30	4.14	3.05	1.67	3.06
2,3-Dimethylpentane	7	14.89%	0.56	2.44	0.71	0.99	0.67	2.16	4.77
3-Methylhexane	47	100.00%	1.85	13.23	3.80	4.49	2.26	1.65	3.74
2,2,4-Trimethylpentane	47	100.00%	1.41	23.45	4.58	6.23	4.49	1.62	3.36
1-Heptene	20	42.55%	0.53	2.21	0.77	0.97	0.52	1.44	1.3
n-Heptane	47	100.00%	0.65	6.84	1.77	2.30	1.42	1.46	2.2
Methylcyclohexane	46	97.87%	0.54	6.35	1.82	2.06	1.30	1.38	2.4
2,2,3-Trimethylpentane	38	80.85%	0.55	3.76	1.01	1.22	0.69	1.66	3.5
2,3,4-Trimethylpentane	47	100.00%	0.68	8.84	1.58	2.21	1.63	1.86	4.6
Toluene	47	100.00%	6.07	65.19	15.60	19.23	11.74	1.63	3.6
2-Methylheptane	47	100.00%	0.51	4.73	1.25	1.58	1.00	1.69	2.6
3-Methylheptane	42	89.36%	0.58	4.07	0.94	1.31	0.79	1.58	2.3
1-Octene	31	65.96%	0.52	3.99	1.09	1.33	0.81	1.44	2.2
n-Octane	43	91.49%	0.50	3.31	1.03	1.23	0.68	1.62	2.3
Ethylbenzene	47	100.00%	1.41	13.84	3.58	4.46	2.60	1.76	3.7
p-Xylene + m-Xylene	47	100.00%	3.36	37.04	8.98	10.79	6.69	1.73	3.9
Styrene	32	68.09%	0.45	3.42	0.94	1.21	0.69	1.22	1.6
o-Xylene	47	100.00%	0.93	12.26	2.75	3.38	2.36	1.70	3.3
1-Nonene	22	46.81%	0.54	1.23	0.59	0.70	0.18	1.58	2.4
n-Nonane	45	95.74%	0.64	3.68	1.59	1.66	0.70	0.97	1.4
Isopropylbenzene	14	29.79%	0.57	2.63	0.94	1.09	0.56	2.08	4.3
n-Propylbenzene	46	97.87%	0.51	10.68	2.20	2.96	2.43	1.74	2.7
alpha-Pinene	40	85.11%	0.52	3.34	0.80	1.06	0.57	2.05	5.4
m-Ethyltoluene	45	95.74%	0.66	8.89	2.08	2.58	1.62	1.79	4.1
p-Ethyltoluene	22	46.81%	0.40	2.32	1.01	1.04	0.53	1.16	1.2
1,3,5-Trimethylbenzene	39	82.98%	0.52	4.20	1.01	1.37	0.91	1.65	2.3
o-Ethyltoluene	47	100.00%	0.63	5.24	1.38	1.65	0.93	1.76	3.7
1-Decene	0	0.00%	.	.	.	.	.	.	.
1,2,4-Trimethylbenzene	47	100.00%	1.09	15.25	3.07	3.89	2.82	1.90	4.6

Table 9-11. Continued

Compound	Cases	Frequency	ppbC Minimum	Maximum	Median	Average	Standard Deviation	Skewness	Kurtosis
n-Decane	31	65.96%	0.43	3.72	0.91	1.20	0.78	1.73	3.29
1,2,3-Trimethylbenzene	47	100.00%	1.19	10.60	2.59	3.00	1.66	2.75	9.83
p-Diethylbenzene	40	85.11%	0.49	2.01	0.98	1.02	0.39	0.76	-0.08
1-Undecene	44	93.62%	1.52	15.65	7.42	7.93	3.66	0.28	-0.44
n-Undecane	47	100.00%	0.57	4.10	1.36	1.68	0.91	0.95	-0.05
1-Dodecene	44	93.62%	1.54	13.45	4.69	5.16	2.70	1.11	1.48
n-Dodecane	47	100.00%	0.55	9.84	1.22	1.55	1.56	4.19	19.53
1-Tridecene	13	27.66%	0.48	1.69	0.66	0.84	0.39	1.27	0.68
n-Tridecane	31	65.96%	0.51	1.66	0.78	0.85	0.29	1.40	1.75

Table 9-12. 1992 Summary Statistics for Charlotte, NC (CHNC)

			ppbC						
Compound	Cases	Frequency	Minimum	Maximum	Median	Average	Standard Deviation	Skewness	Kurtosis
Ethylene	52	98.11%	1.18	35.92	9.85	11.25	7.36	1.30	2.06
Acetylene	46	86.79%	0.59	23.52	6.39	7.23	4.85	1.43	2.31
Ethane	52	98.11%	1.26	15.81	5.01	5.90	3.21	0.94	0.73
Propylene	52	98.11%	0.69	13.63	3.49	4.02	3.12	1.67	2.65
Propane	52	98.11%	1.37	33.68	6.24	7.31	6.00	2.61	8.22
Propyne	0	0.00%	.	.	.	.	.	.	.
Isobutane	53	100.00%	0.69	12.23	2.18	3.65	3.11	1.40	1.27
Isobutene	0	0.00%	.	.	.	.	.	.	.
1-Butene	53	100.00%	0.53	7.79	2.39	2.73	1.80	1.42	1.58
1,3-Butadiene	30	56.60%	0.53	3.79	1.20	1.47	0.91	1.19	0.41
n-Butane	53	100.00%	1.03	26.20	5.95	7.53	5.73	1.36	1.56
t-2-Butene	28	52.83%	0.54	2.54	1.09	1.23	0.61	0.85	-0.18
c-2-Butene	19	35.85%	0.48	39.63	0.83	3.02	8.88	4.33	18.85
3-Methyl-1-butene	16	30.19%	0.51	2.16	0.80	1.06	0.53	0.82	-0.59
Isopentane	53	100.00%	2.63	65.29	13.92	19.87	16.16	1.48	1.58
1-Pentene	16	30.19%	0.60	6.01	1.34	1.76	1.35	2.28	6.33
2-Methyl-1-butene	37	69.81%	0.54	5.46	1.39	1.82	1.35	1.57	1.93
n-Pentane	52	98.11%	0.89	65.49	4.93	7.55	9.81	4.36	24.04
Isoprene	48	90.57%	0.48	19.19	3.13	4.14	3.87	1.90	4.75
t-2-Pentene	39	73.58%	0.62	6.66	1.54	2.13	1.60	1.65	2.32
c-2-Pentene	34	64.15%	0.50	3.73	1.09	1.37	0.88	1.67	2.30
2-Methyl-2-butene	41	77.36%	0.62	8.61	1.44	2.30	1.97	1.97	3.74
Neohexane	41	77.36%	0.57	16.54	5.20	5.42	3.70	0.95	1.27
Cyclopentene	15	28.30%	0.51	1.33	0.66	0.78	0.30	1.14	-0.20
4-Methyl-1-pentene	42	79.25%	0.52	3.42	1.08	1.22	0.67	1.64	2.90
2,3-Dimethylbutane	31	58.49%	0.51	2.46	0.88	1.04	0.56	1.41	0.94
Cyclopentane	51	96.23%	0.56	6.98	1.74	2.39	1.67	1.45	1.58
Isohexane	53	100.00%	0.72	18.63	4.37	5.48	4.39	1.74	2.88
3-Methylpentane	52	98.11%	0.76	13.41	3.61	4.19	2.96	1.65	2.84
1-Hexene	0	0.00%	.	.	.	.	.	.	.
2-Methyl-1-pentene	24	45.28%	0.65	5.65	1.21	1.63	1.15	2.07	5.47
2-Ethyl-1-butene	0	0.00%	.	.	.	.	.	.	.
n-Hexane	53	100.00%	0.52	9.93	2.69	3.27	2.44	1.34	1.39
t-2-Hexene	17	32.08%	0.49	1.90	0.76	0.98	0.50	1.11	-0.46

Table 9-12. Continued

Compound	Cases	Frequency	ppbC Minimum	Maximum	Median	Average	Standard Deviation	Skewness	Kurtosis
c-2-Hexene	7	13.21%	0.46	1.13	0.99	0.83	0.30	-0.32	-2.56
Methylcyclopentane	50	94.34%	0.59	7.20	1.85	2.32	1.74	1.57	2.14
2,4-Dimethylpentane	43	81.13%	0.52	5.56	1.35	1.78	1.25	1.72	2.65
Benzene	53	100.00%	1.75	20.06	6.25	6.83	4.30	1.48	2.24
Cyclohexane	51	96.23%	0.64	4.64	1.83	1.97	0.93	0.73	0.30
Isoheptane	40	75.47%	0.55	11.59	1.37	1.91	1.84	3.98	19.86
2,3-Dimethylpentane	30	56.60%	0.55	14.24	1.36	2.31	2.75	3.29	12.51
3-Methylhexane	53	100.00%	0.54	7.58	2.55	3.12	1.76	1.09	0.43
2,2,4-Trimethylpentane	53	100.00%	0.95	20.38	4.77	5.76	4.70	1.74	3.00
1-Heptene	16	30.19%	0.50	1.79	0.74	0.90	0.44	1.37	0.51
n-Heptane	48	90.57%	0.48	4.63	1.43	1.66	1.00	1.35	1.46
Methylcyclohexane	42	79.25%	0.52	3.35	1.20	1.39	0.77	1.34	1.13
2,2,3-Trimethylpentane	39	73.58%	0.49	2.87	0.85	1.12	0.65	1.72	2.29
2,3,4-Trimethylpentane	45	84.91%	0.59	7.36	1.77	2.24	1.73	1.83	3.18
Toluene	53	100.00%	4.05	159.74	17.40	21.61	23.04	4.37	24.98
2-Methylheptane	44	83.02%	0.56	3.37	1.22	1.36	0.73	1.42	1.81
3-Methylheptane	34	64.15%	0.50	2.84	1.01	1.23	0.64	1.52	1.53
1-Octene	34	64.15%	0.53	3.00	0.98	1.15	0.65	1.56	1.74
n-Octane	36	67.92%	0.48	2.11	0.73	0.95	0.46	0.97	0.03
Ethylbenzene	52	98.11%	0.66	8.66	2.61	2.98	1.97	1.53	2.32
p-Xylene + m-Xylene	53	100.00%	1.73	29.77	7.70	9.29	6.79	1.65	2.55
Styrene	39	73.58%	0.50	4.66	1.34	1.52	0.95	1.26	1.60
o-Xylene	53	100.00%	0.59	11.07	2.73	3.24	2.54	1.67	2.75
1-Nonene	15	28.30%	0.50	1.12	0.62	0.70	0.21	1.15	0.07
n-Nonane	38	71.70%	0.48	5.99	0.89	1.09	0.89	4.72	25.86
Isopropylbenzene	7	13.21%	0.60	1.99	0.69	0.87	0.50	2.51	6.42
n-Propylbenzene	49	92.45%	0.58	18.90	2.45	4.62	5.06	1.64	1.77
alpha-Pinene	41	77.36%	0.53	4.08	0.98	1.27	0.74	1.87	4.10
m-Ethyltoluene	52	98.11%	0.65	9.99	2.52	3.23	2.29	1.42	1.64
p-Ethyltoluene	29	54.72%	0.50	2.18	0.89	1.07	0.51	1.08	0.16
1,3,5-Trimethylbenzene	43	81.13%	0.53	5.19	1.19	1.63	1.13	1.75	2.87
o-Ethyltoluene	53	100.00%	0.68	7.05	1.84	2.31	1.58	1.66	2.36
1-Decene	2	3.77%	0.81	1.04	0.93	0.93	0.16	.	.
1,2,4-Trimethylbenzene	53	100.00%	1.03	15.10	3.69	4.62	3.38	1.56	2.42

Table 9-12. Continued

Compound	Cases	Frequency	ppbC Minimum	Maximum	Median	Average	Standard Deviation	Skewness	Kurtosi
n-Decane	19	35.85%	0.51	10.77	4.59	4.69	2.98	0.54	-0.4
1,2,3-Trimethylbenzene	53	100.00%	1.28	6.79	2.71	3.19	1.40	0.95	0.2
p-Diethylbenzene	31	58.49%	0.58	5.37	1.01	1.23	0.94	3.41	13.3
1-Undecene	52	98.11%	0.85	9.80	2.70	3.17	1.72	1.75	3.6
n-Undecane	53	100.00%	0.65	51.62	1.85	3.85	7.73	5.27	30.1
1-Dodecene	52	98.11%	0.52	7.47	1.64	1.96	1.30	2.28	6.4
n-Dodecane	53	100.00%	0.52	103.12	1.49	4.46	14.29	6.61	45.8
1-Tridecene	20	37.74%	0.47	1.73	0.71	0.78	0.29	2.1[illegible]	5.5
n-Tridecane	41	77.36%	0.50	24.82	0.87	1.74	3.86	5.68	33.9

Table 9-13. 1992 Summary Statistics for Dallas, TX (DLTX)

			ppbC						
Compound	Cases	Frequency	Minimum	Maximum	Median	Average	Standard Deviation	Skewness	Kurtosis
Ethylene	69	100.00%	3.38	85.80	11.35	13.16	11.08	4.69	28.16
Acetylene	66	95.65%	0.90	28.46	6.52	7.27	5.42	1.67	3.38
Ethane	69	100.00%	3.68	69.50	13.45	16.28	11.62	2.31	7.28
Propylene	68	98.55%	1.23	19.09	3.58	3.99	2.61	3.15	15.98
Propane	69	100.00%	4.94	66.11	14.50	16.06	10.85	2.46	8.25
Propyne	0	0.00%	.	.	.	.	.	.	.
Isobutane	67	97.10%	1.31	18.46	4.58	4.82	3.02	2.14	6.72
Isobutene	0	0.00%	.	.	.	.	.	.	.
1-Butene	68	98.55%	0.71	10.42	2.24	2.54	1.45	2.88	12.82
1,3-Butadiene	48	69.57%	0.52	4.11	0.96	1.19	0.70	2.08	5.48
n-Butane	69	100.00%	0.99	40.56	9.46	10.62	6.92	2.27	7.46
t-2-Butene	42	60.87%	0.54	3.76	0.80	1.00	0.59	3.28	12.62
c-2-Butene	21	30.43%	0.45	5.63	0.67	1.04	1.17	3.47	12.72
3-Methyl-1-butene	23	33.33%	0.48	2.35	0.64	0.80	0.41	2.65	8.62
Isopentane	69	100.00%	6.01	127.33	16.76	21.62	17.74	3.87	19.75
1-Pentene	21	30.43%	0.61	5.83	1.25	1.79	1.42	2.09	3.93
2-Methyl-1-butene	64	92.75%	0.54	9.65	1.24	1.58	1.32	4.25	23.19
n-Pentane	68	98.55%	2.44	37.15	7.49	8.34	5.58	2.86	11.53
Isoprene	61	88.41%	0.50	6.29	0.89	1.25	1.03	3.39	13.42
t-2-Pentene	67	97.10%	0.52	8.45	1.48	1.82	1.37	2.75	9.34
c-2-Pentene	51	73.91%	0.56	5.93	1.03	1.26	0.86	3.79	17.83
2-Methyl-2-butene	68	98.55%	0.65	13.80	1.75	2.14	1.85	4.37	24.55
Neohexane	69	100.00%	5.67	85.75	19.64	24.55	16.58	1.82	3.63
Cyclopentene	15	21.74%	0.46	2.17	0.61	0.75	0.45	2.70	7.47
4-Methyl-1-pentene	53	76.81%	0.54	2.38	0.94	1.08	0.43	1.28	1.38
2,3-Dimethylbutane	46	66.67%	0.51	4.54	0.87	1.14	0.86	2.89	8.16
Cyclopentane	67	97.10%	0.58	13.60	1.89	2.62	2.41	2.78	8.86
Isohexane	69	100.00%	1.95	33.71	5.43	6.43	4.63	3.67	18.68
3-Methylpentane	69	100.00%	0.54	20.27	4.94	5.56	3.83	1.86	4.48
1-Hexene	1	1.45%	0.76	0.76	0.76	0.76	.	.	.
2-Methyl-1-pentene	40	57.97%	0.51	4.31	0.81	0.95	0.65	4.01	19.07
2-Ethyl-1-butene	0	0.00%	.	.	.	.	.	.	.
n-Hexane	69	100.00%	1.21	20.02	3.83	4.49	3.00	2.90	11.37
t-2-Hexene	23	33.33%	0.46	5.91	0.68	1.16	1.28	2.84	8.65

Table 9-13. Continued

Compound	Cases	Frequency	ppbC Minimum	Maximum	Median	Average	Standard Deviation	Skewness	Kurtosi
c-2-Hexene	7	10.14%	0.52	1.67	0.72	0.87	0.42	1.50	1.5
Methylcyclopentane	69	100.00%	0.73	10.02	2.34	2.64	1.57	2.49	9.2
2,4-Dimethylpentane	57	82.61%	0.46	6.20	1.05	1.31	0.91	3.43	15.4
Benzene	69	100.00%	2.61	27.42	5.65	6.63	3.74	2.96	13.7
Cyclohexane	65	94.20%	0.65	6.09	1.71	1.82	0.85	2.54	10.0
Isoheptane	68	98.55%	0.82	19.43	3.37	4.07	3.09	2.82	10.7
2,3-Dimethylpentane	2	2.90%	0.70	2.13	1.42	1.42	1.01	.	.
3-Methylhexane	69	100.00%	1.34	12.75	2.99	3.64	2.04	2.41	7.4
2,2,4-Trimethylpentane	69	100.00%	1.53	30.39	4.71	5.46	3.99	3.89	22.1
1-Heptene	29	42.03%	0.51	1.68	0.75	0.78	0.23	2.33	7.8
n-Heptane	68	98.55%	0.84	10.35	1.77	2.33	1.81	2.57	8.0
Methylcyclohexane	66	95.65%	0.60	4.07	1.16	1.25	0.58	2.14	7.7
2,2,3-Trimethylpentane	53	76.81%	0.47	4.48	0.92	1.08	0.62	3.60	17.3
2,3,4-Trimethylpentane	68	98.55%	0.63	11.46	1.81	2.10	1.51	3.88	21.8
Toluene	69	100.00%	5.15	90.33	16.54	20.64	14.61	2.38	7.8
2-Methylheptane	67	97.10%	0.51	6.86	1.27	1.50	0.92	3.35	16.8
3-Methylheptane	64	92.75%	0.54	8.12	1.09	1.39	1.17	4.14	20.2
1-Octene	41	59.42%	0.49	3.51	0.78	0.89	0.51	3.82	18.3
n-Octane	59	85.51%	0.52	5.11	0.87	1.13	0.71	3.26	15.9
Ethylbenzene	69	100.00%	0.95	25.04	2.82	3.60	3.27	4.50	27.1
p-Xylene + m-Xylene	69	100.00%	3.00	91.09	9.72	12.64	11.97	4.54	27.2
Styrene	45	65.22%	0.52	2.59	0.80	0.89	0.40	2.37	7.2
o-Xylene	68	98.55%	1.11	28.10	3.33	4.27	3.70	4.35	25.6
1-Nonene	7	10.14%	0.53	0.90	0.64	0.66	0.13	1.22	1.4
n-Nonane	64	92.75%	0.52	6.80	1.11	1.63	1.22	2.01	4.5
Isopropylbenzene	9	13.04%	0.57	0.97	0.61	0.64	0.13	2.72	7.7
n-Propylbenzene	65	94.20%	0.50	5.55	1.82	1.96	0.84	1.70	4.7
alpha-Pinene	63	91.30%	0.52	6.05	1.05	1.34	0.88	3.14	13.1
m-Ethyltoluene	68	98.55%	1.02	16.62	2.89	3.48	2.38	3.13	13.8
p-Ethyltoluene	59	85.51%	0.51	5.54	0.93	1.14	0.75	3.88	20.6
1,3,5-Trimethylbenzene	68	98.55%	0.47	7.97	1.44	1.67	1.08	3.44	16.9
o-Ethyltoluene	68	98.55%	0.77	9.70	1.84	2.26	1.35	3.09	13.9
1-Decene	0	0.00%	.	.	.	.	.	.	.
1,2,4-Trimethylbenzene	69	100.00%	1.84	28.81	5.08	5.92	3.87	3.49	17.9

Table 9-13. Continued

Compound	Cases	Frequency	ppbC Minimum	Maximum	Median	Average	Standard Deviation	Skewness	Kurtosis
n-Decane	60	86.96%	0.54	9.90	1.23	2.07	1.90	2.18	5.16
1,2,3-Trimethylbenzene	69	100.00%	1.47	10.76	2.81	3.40	1.68	2.21	5.85
p-Diethylbenzene	52	75.36%	0.47	6.43	1.05	1.30	1.04	3.07	11.83
1-Undecene	66	95.65%	0.54	4.55	1.38	1.65	0.90	1.56	2.08
n-Undecane	68	98.55%	1.01	46.02	2.48	3.69	5.54	6.93	52.80
1-Dodecene	64	92.75%	0.51	7.22	0.96	1.31	1.13	3.75	16.24
n-Dodecane	69	100.00%	0.67	27.79	1.45	2.53	3.61	5.52	36.28
1-Tridecene	25	36.23%	0.54	4.32	0.85	1.29	0.95	1.95	3.59
n-Tridecane	57	82.61%	0.46	7.68	0.86	1.27	1.17	3.47	15.69

Table 9-14. 1992 Summary Statistics for El Paso, TX (EPTX)

			ppbC						
Compound	Cases	Frequency	Minimum	Maximum	Median	Average	Standard Deviation	Skewness	Kurtosi
Ethylene	70	100.00%	8.48	52.92	21.76	23.00	8.84	1.23	2.1
Acetylene	70	100.00%	5.41	52.58	15.92	17.01	7.73	1.71	5.6
Ethane	70	100.00%	3.39	68.23	14.21	18.08	12.60	1.79	3.4
Propylene	70	100.00%	2.78	23.22	8.92	9.40	3.95	1.11	1.8
Propane	70	100.00%	3.58	235.92	20.51	33.83	40.66	3.07	11.5
Propyne	0	0.00%	.	.	.	.	.	.	.
Isobutane	70	100.00%	1.18	30.95	6.39	8.80	7.10	1.71	2.8
Isobutene	0	0.00%	.	.	.	.	.	.	.
1-Butene	70	100.00%	1.60	22.51	5.51	6.16	2.88	2.91	14.3
1,3-Butadiene	66	94.29%	0.90	4.04	1.83	1.93	0.67	0.84	1.1
n-Butane	70	100.00%	4.31	88.13	17.30	21.25	16.92	1.98	4.3
t-2-Butene	67	95.71%	0.58	10.77	1.73	2.10	1.42	3.68	20.4
c-2-Butene	63	90.00%	0.51	11.66	1.27	1.75	1.87	3.89	16.4
3-Methyl-1-butene	42	60.00%	0.52	2.35	0.88	1.02	0.48	1.18	0.6
Isopentane	69	98.57%	6.80	126.92	28.96	35.80	21.95	1.71	3.8
1-Pentene	38	54.29%	0.60	10.22	1.69	2.20	1.77	2.89	10.9
2-Methyl-1-butene	69	98.57%	0.77	11.27	2.42	3.03	1.91	2.03	5.3
n-Pentane	70	100.00%	3.61	72.53	15.12	19.68	12.48	1.81	4.3
Isoprene	62	88.57%	0.52	1.94	0.96	1.05	0.35	0.85	0.1
t-2-Pentene	69	98.57%	0.58	12.62	2.54	3.27	2.38	2.34	6.0
c-2-Pentene	65	92.86%	0.55	6.00	1.65	1.85	0.92	2.04	6.2
2-Methyl-2-butene	70	100.00%	0.71	14.50	3.55	4.15	2.37	2.01	5.5
Neohexane	70	100.00%	11.36	97.97	28.84	33.01	17.84	1.39	2.0
Cyclopentene	40	57.14%	0.42	2.05	0.76	0.85	0.36	1.81	3.6
4-Methyl-1-pentene	62	88.57%	0.56	2.22	0.92	0.96	0.33	1.55	3.0
2,3-Dimethylbutane	69	98.57%	0.65	6.56	1.69	2.02	1.19	1.90	4.3
Cyclopentane	70	100.00%	1.29	11.49	4.43	4.66	2.11	0.91	1.0
Isohexane	70	100.00%	2.72	37.80	10.47	12.19	6.67	1.66	3.4
3-Methylpentane	70	100.00%	1.80	27.02	7.76	9.00	4.93	1.24	1.9
1-Hexene	0	0.00%	.	.	.	.	.	.	.
2-Methyl-1-pentene	67	95.71%	0.56	4.03	1.11	1.33	0.66	1.74	3.8
2-Ethyl-1-butene	0	0.00%	.	.	.	.	.	.	.
n-Hexane	70	100.00%	2.58	30.86	8.58	9.87	5.20	1.68	3.8
t-2-Hexene	57	81.43%	0.53	2.95	0.86	1.01	0.47	2.27	6.

Table 9-14. Continued

Compound	Cases	Frequency	ppbC Minimum	Maximum	Median	Average	Standard Deviation	Skewness	Kurtosis
c-2-Hexene	32	45.71%	0.49	1.58	0.73	0.81	0.28	1.29	1.18
Methylcyclopentane	70	100.00%	1.55	21.52	6.15	7.07	3.59	1.57	3.58
2,4-Dimethylpentane	70	100.00%	1.23	12.40	4.54	5.06	2.35	1.10	1.55
Benzene	70	100.00%	4.78	37.75	15.81	16.88	6.49	0.97	1.42
Cyclohexane	69	98.57%	0.84	9.04	3.35	3.67	1.49	1.10	2.01
Isoheptane	63	90.00%	0.59	5.16	1.73	1.90	1.02	1.24	1.53
2,3-Dimethylpentane	69	98.57%	0.69	14.32	5.11	5.67	2.71	1.02	1.36
3-Methylhexane	70	100.00%	1.57	12.98	5.10	5.69	2.40	1.05	1.30
2,2,4-Trimethylpentane	70	100.00%	3.14	26.23	10.44	11.01	4.72	1.02	1.28
1-Heptene	61	87.14%	0.50	4.51	1.01	1.27	0.81	2.35	6.17
n-Heptane	70	100.00%	0.80	9.83	3.30	3.60	1.76	1.27	2.11
Methylcyclohexane	70	100.00%	0.63	6.97	2.05	2.25	1.11	1.70	4.61
2,2,3-Trimethylpentane	68	97.14%	0.70	4.33	1.62	1.82	0.79	1.28	1.74
2,3,4-Trimethylpentane	70	100.00%	1.16	10.89	3.86	4.24	1.96	1.19	1.90
Toluene	70	100.00%	9.94	115.43	37.50	40.81	18.56	1.50	3.58
2-Methylheptane	70	100.00%	0.74	6.99	2.35	2.65	1.19	1.30	2.44
3-Methylheptane	70	100.00%	0.65	5.96	2.13	2.36	1.05	1.26	2.10
1-Octene	70	100.00%	0.68	4.01	1.65	1.79	0.72	0.94	1.09
n-Octane	69	98.57%	0.61	4.83	1.44	1.66	0.89	1.69	3.25
Ethylbenzene	70	100.00%	1.47	16.47	6.54	7.05	3.06	1.00	1.39
p-Xylene + m-Xylene	70	100.00%	5.12	48.59	19.71	21.21	8.86	0.98	1.37
Styrene	69	98.57%	0.62	15.83	1.29	1.61	1.85	6.98	53.61
o-Xylene	70	100.00%	1.52	15.61	6.38	6.84	2.92	0.96	1.35
1-Nonene	59	84.29%	0.49	2.58	1.03	1.14	0.43	1.26	1.86
n-Nonane	70	100.00%	0.60	7.83	2.65	2.73	1.47	1.24	2.17
Isopropylbenzene	34	48.57%	0.38	1.23	0.69	0.74	0.20	0.95	0.43
n-Propylbenzene	68	97.14%	0.78	7.50	3.05	3.14	1.30	0.63	1.06
alpha-Pinene	69	98.57%	0.54	4.67	1.81	1.92	0.82	1.11	1.62
m-Ethyltoluene	70	100.00%	1.20	10.38	4.72	5.11	2.01	0.60	0.14
p-Ethyltoluene	61	87.14%	0.61	3.09	1.51	1.52	0.56	0.60	0.16
1,3,5-Trimethylbenzene	70	100.00%	0.78	6.34	2.22	2.38	1.01	1.52	3.81
o-Ethyltoluene	70	100.00%	0.52	6.43	3.15	3.18	1.21	0.41	0.24
1-Decene	1	1.43%	2.34	2.34	2.34	2.34	.	.	.
1,2,4-Trimethylbenzene	70	100.00%	1.37	21.90	8.23	8.67	3.76	1.08	2.08

Table 9-14. Continued

Compound	Cases	Frequency	ppbC Minimum	Maximum	Median	Average	Standard Deviation	Skewness	Kurtosi
n-Decane	67	95.71%	0.52	16.47	2.04	3.31	3.30	2.01	4.1
1,2,3-Trimethylbenzene	70	100.00%	1.33	11.62	3.64	3.82	1.62	1.91	7.0
p-Diethylbenzene	65	92.86%	0.53	4.24	1.73	1.64	0.75	0.81	0.9
1-Undecene	66	94.29%	0.65	3.31	1.61	1.66	0.65	0.77	0.1
n-Undecane	70	100.00%	1.10	76.41	3.18	4.73	9.95	6.39	42.7
1-Dodecene	62	88.57%	0.49	3.40	0.85	0.99	0.46	2.75	11.2
n-Dodecane	70	100.00%	0.79	60.45	1.71	3.62	9.73	5.68	31.5
1-Tridecene	18	25.71%	0.51	3.45	1.10	1.33	0.80	1.29	1.4
n-Tridecane	65	92.86%	0.50	17.94	0.92	1.56	2.75	5.27	28.1

Table 9-15. 1992 Summary Statistics for Ft. Worth, TX (FWTX)

			ppbC						
Compound	Cases	Frequency	Minimum	Maximum	Median	Average	Standard Deviation	Skewness	Kurtosis
Ethylene	68	100.00%	3.24	32.37	8.42	9.93	5.54	1.69	3.69
Acetylene	63	92.65%	0.86	27.47	4.54	5.98	4.46	2.27	8.05
Ethane	68	100.00%	1.05	129.85	14.64	18.09	18.34	3.88	20.58
Propylene	68	100.00%	0.85	12.34	2.58	3.24	2.15	1.78	4.50
Propane	68	100.00%	2.43	123.20	12.45	16.07	16.60	4.49	26.30
Propyne	0	0.00%	.	.	.	.	.	.	.
Isobutane	68	100.00%	1.22	24.87	4.40	5.62	4.11	2.13	6.61
Isobutene	0	0.00%	.	.	.	.	.	.	.
1-Butene	64	94.12%	0.67	6.82	1.83	2.35	1.44	1.45	1.53
1,3-Butadiene	31	45.59%	0.48	2.33	0.81	1.02	0.53	1.41	1.18
n-Butane	68	100.00%	2.34	57.38	12.02	14.87	11.12	2.12	5.52
t-2-Butene	33	48.53%	0.52	3.43	0.93	1.17	0.74	1.72	2.40
c-2-Butene	20	29.41%	0.53	13.81	0.84	1.65	2.92	4.22	18.31
3-Methyl-1-butene	18	26.47%	0.53	4.07	0.87	1.19	0.92	2.36	5.64
Isopentane	68	100.00%	6.09	157.30	16.30	23.23	22.89	3.66	18.10
1-Pentene	24	35.29%	0.50	9.71	1.53	2.54	2.68	1.53	1.22
2-Methyl-1-butene	55	80.88%	0.51	11.93	1.20	1.84	1.85	3.55	16.51
n-Pentane	68	100.00%	2.13	59.03	7.34	10.45	10.13	3.05	11.53
Isoprene	44	64.71%	0.54	4.05	0.85	1.14	0.76	2.63	7.47
t-2-Pentene	62	91.18%	0.53	13.35	1.30	1.99	1.95	3.81	19.06
c-2-Pentene	44	64.71%	0.50	7.14	1.14	1.45	1.18	2.99	11.99
2-Methyl-2-butene	61	89.71%	0.65	17.70	1.61	2.49	2.74	3.59	16.26
Neohexane	67	98.53%	3.70	51.41	8.37	10.28	7.51	3.18	13.50
Cyclopentene	14	20.59%	0.51	2.49	0.70	0.90	0.53	2.41	6.40
4-Methyl-1-pentene	52	76.47%	0.52	2.17	0.85	0.98	0.39	1.11	0.76
2,3-Dimethylbutane	46	67.65%	0.52	6.09	1.00	1.31	1.04	3.01	10.82
Cyclopentane	66	97.06%	0.59	9.83	1.74	2.35	1.81	2.17	5.69
Isohexane	68	100.00%	1.55	33.93	4.93	6.68	5.56	2.59	9.02
3-Methylpentane	67	98.53%	0.99	21.87	3.67	5.36	4.44	1.95	4.34
1-Hexene	0	0.00%	.	.	.	.	.	.	.
2-Methyl-1-pentene	32	47.06%	0.48	3.77	1.00	1.19	0.82	1.86	3.28
2-Ethyl-1-butene	0	0.00%	.	.	.	.	.	.	.
n-Hexane	68	100.00%	1.09	20.24	3.63	4.66	3.48	2.09	5.78
t-2-Hexene	21	30.88%	0.57	3.95	0.94	1.44	0.99	1.29	0.96

Table 9-15. Continued

Compound	Cases	Frequency	ppbC Minimum	Maximum	Median	Average	Standard Deviation	Skewness	Kurtosis
c-2-Hexene	10	14.71%	0.50	1.92	0.68	0.84	0.46	1.88	3.19
Methylcyclopentane	68	100.00%	0.83	11.51	2.23	2.98	2.33	2.16	5.00
2,4-Dimethylpentane	55	80.88%	0.52	5.07	1.06	1.38	0.91	2.16	5.62
Benzene	68	100.00%	1.89	18.35	5.03	6.02	3.59	1.58	2.65
Cyclohexane	62	91.18%	0.53	5.92	1.93	2.06	0.97	1.61	4.33
Isoheptane	65	95.59%	0.64	13.95	2.69	3.62	2.75	1.96	4.17
2,3-Dimethylpentane	3	4.41%	0.81	1.27	1.01	1.03	0.23	0.39	.
3-Methylhexane	68	100.00%	1.01	9.98	2.63	3.28	1.90	1.65	2.79
2,2,4-Trimethylpentane	68	100.00%	1.09	28.35	4.69	5.92	4.55	2.35	8.25
1-Heptene	28	41.18%	0.45	2.17	0.78	0.86	0.43	1.90	3.32
n-Heptane	68	100.00%	0.65	6.67	1.36	1.81	1.23	1.72	3.15
Methylcyclohexane	63	92.65%	0.54	6.53	1.14	1.42	1.01	2.83	10.56
2,2,3-Trimethylpentane	53	77.94%	0.49	4.54	0.83	1.14	0.72	2.59	9.31
2,3,4-Trimethylpentane	67	98.53%	0.61	10.01	1.63	2.16	1.61	2.39	8.10
Toluene	68	100.00%	2.78	218.21	13.31	26.32	39.43	3.18	10.47
2-Methylheptane	60	88.24%	0.53	5.56	1.18	1.42	0.92	2.12	6.26
3-Methylheptane	56	82.35%	0.49	4.78	1.08	1.30	0.82	2.01	5.18
1-Octene	32	47.06%	0.47	3.04	0.80	0.97	0.53	2.47	7.54
n-Octane	46	67.65%	0.51	26.34	0.94	2.06	4.26	4.86	25.32
Ethylbenzene	68	100.00%	0.60	10.29	2.25	2.85	1.96	1.60	2.88
p-Xylene + m-Xylene	68	100.00%	0.97	35.75	8.08	10.12	7.01	1.54	2.49
Styrene	41	60.29%	0.50	4.32	0.76	0.98	0.65	3.73	17.84
o-Xylene	67	98.53%	0.60	12.95	2.86	3.50	2.54	1.62	2.78
1-Nonene	3	4.41%	0.50	0.90	0.61	0.67	0.21	1.20	.
n-Nonane	41	60.29%	0.52	2.30	0.83	0.94	0.39	1.48	2.4
Isopropylbenzene	9	13.24%	0.47	0.99	0.71	0.72	0.18	0.24	-1.1
n-Propylbenzene	66	97.06%	0.57	8.39	1.97	2.00	1.18	2.90	13.7
alpha-Pinene	51	75.00%	0.52	3.26	0.94	1.17	0.61	1.51	2.1
m-Ethyltoluene	67	98.53%	0.64	10.43	2.35	2.91	1.90	1.76	3.8
p-Ethyltoluene	41	60.29%	0.44	2.97	0.94	1.10	0.55	1.68	3.1
1,3,5-Trimethylbenzene	61	89.71%	0.55	5.42	1.38	1.66	1.09	1.81	3.5
o-Ethyltoluene	66	97.06%	0.60	5.75	1.50	1.80	1.04	1.67	3.2
1-Decene	1	1.47%	1.83	1.83	1.83	1.83	.	.	.
1,2,4-Trimethylbenzene	68	100.00%	0.56	18.66	4.09	4.91	3.47	1.75	3.7

Table 9-15. Continued

Compound	Cases	Frequency	ppbC Minimum	Maximum	Median	Average	Standard Deviation	Skewness	Kurtosis
n-Decane	33	48.53%	0.50	34.23	0.90	2.03	5.81	5.66	32.31
1,2,3-Trimethylbenzene	68	100.00%	1.33	8.23	2.97	3.37	1.41	1.23	1.56
p-Diethylbenzene	45	66.18%	0.52	2.39	0.94	1.08	0.48	1.05	0.31
1-Undecene	63	92.65%	0.52	6.53	1.34	1.68	1.03	2.28	7.19
n-Undecane	65	95.59%	0.65	9.65	1.91	2.28	1.67	2.19	6.28
1-Dodecene	63	92.65%	0.50	4.60	0.91	1.22	0.78	2.23	6.12
n-Dodecane	62	91.18%	0.59	7.70	1.08	1.69	1.60	2.77	7.63
1-Tridecene	11	16.18%	0.51	1.70	0.58	0.69	0.35	2.96	9.08
n-Tridecane	36	52.94%	0.51	5.96	0.76	1.14	1.09	3.32	11.91

Table 9-16. 1992 Summary Statistics for Juarez, Mexico (JUMX)

			ppbC						
Compound	Cases	Frequency	Minimum	Maximum	Median	Average	Standard Deviation	Skewness	Kurtosi
Ethylene	62	100.00%	1.15	213.71	13.97	17.58	26.55	6.81	50.7
Acetylene	62	100.00%	0.74	38.02	9.87	11.30	7.52	1.04	1.4
Ethane	62	100.00%	2.06	36.92	13.12	14.81	8.58	0.75	-0.1
Propylene	62	100.00%	0.75	13.71	5.15	5.45	3.11	0.58	-0.4
Propane	62	100.00%	10.08	188.55	40.68	53.14	43.20	1.26	0.9
Propyne	0	0.00%	.	.	.	.	.	.	.
Isobutane	62	100.00%	2.04	36.17	6.54	8.52	6.42	2.13	5.7
Isobutene	0	0.00%	.	.	.	.	.	.	.
1-Butene	61	98.39%	0.53	9.54	3.02	3.43	1.92	0.94	0.9
1,3-Butadiene	42	67.74%	0.52	3.56	1.18	1.37	0.65	1.54	2.7
n-Butane	62	100.00%	1.21	62.54	19.28	21.90	13.94	1.01	0.6
t-2-Butene	44	70.97%	0.50	4.20	1.25	1.41	0.83	2.04	4.7
c-2-Butene	30	48.39%	0.53	14.24	0.87	1.54	2.54	4.67	23.3
3-Methyl-1-butene	22	35.48%	0.53	2.83	0.75	0.97	0.56	2.18	5.0
Isopentane	62	100.00%	3.45	81.55	18.32	23.18	16.74	1.78	3.7
1-Pentene	37	59.68%	0.56	2.85	1.06	1.19	0.58	1.51	2.1
2-Methyl-1-butene	54	87.10%	0.49	5.54	1.59	1.79	1.01	1.37	2.7
n-Pentane	62	100.00%	2.47	49.78	11.17	14.65	10.47	1.54	2.6
Isoprene	60	96.77%	1.18	23.91	5.65	7.26	5.05	1.53	2.1
t-2-Pentene	47	75.81%	0.56	9.16	1.54	1.99	1.74	2.58	7.4
c-2-Pentene	42	67.74%	0.51	2.85	1.04	1.12	0.50	1.49	3.0
2-Methyl-2-butene	53	85.48%	0.61	11.82	1.86	2.27	1.77	3.30	15.6
Neohexane	62	100.00%	11.40	131.26	32.28	40.16	24.69	1.36	2.1
Cyclopentene	10	16.13%	0.55	2.48	0.91	1.19	0.77	1.01	-0.6
4-Methyl-1-pentene	41	66.13%	0.52	1.77	0.81	0.87	0.33	1.29	1.2
2,3-Dimethylbutane	53	85.48%	0.44	4.50	1.33	1.48	0.84	1.54	2.8
Cyclopentane	61	98.39%	0.78	8.02	2.78	3.12	1.73	0.97	0.9
Isohexane	61	98.39%	1.02	24.76	7.58	8.82	5.68	1.09	0.9
3-Methylpentane	62	100.00%	1.14	16.47	6.23	7.04	3.65	0.44	-0.7
1-Hexene	1	1.61%	1.74	1.74	1.74	1.74	.	.	.
2-Methyl-1-pentene	36	58.06%	0.55	2.62	0.98	1.06	0.45	1.71	3.8
2-Ethyl-1-butene	0	0.00%	.	.	.	.	.	.	.
n-Hexane	62	100.00%	0.95	19.14	6.57	7.21	4.10	0.85	0.6
t-2-Hexene	20	32.26%	0.49	1.76	0.66	0.72	0.27	3.10	11.

Table 9-16. Continued

Compound	Cases	Frequency	ppbC Minimum	Maximum	Median	Average	Standard Deviation	Skewness	Kurtosis
c-2-Hexene	9	14.52%	0.51	0.85	0.59	0.64	0.12	0.92	-0.59
Methylcyclopentane	62	100.00%	0.55	13.21	3.66	4.53	2.72	0.95	0.81
2,4-Dimethylpentane	60	96.77%	0.62	6.25	2.63	2.91	1.53	0.49	-0.85
Benzene	62	100.00%	1.81	23.82	8.47	9.92	5.19	0.50	-0.50
Cyclohexane	61	98.39%	0.83	10.92	3.42	3.59	1.94	1.46	3.08
Isoheptane	56	90.32%	0.52	4.39	1.40	1.54	0.83	1.34	2.05
2,3-Dimethylpentane	59	95.16%	0.55	7.19	2.84	3.12	1.67	0.48	-0.67
3-Methylhexane	62	100.00%	1.54	10.57	4.12	4.48	1.99	0.73	0.03
2,2,4-Trimethylpentane	61	98.39%	0.71	12.39	5.45	5.79	3.04	0.34	-0.98
1-Heptene	37	59.68%	0.49	13.20	1.02	1.85	2.47	3.41	12.91
n-Heptane	61	98.39%	0.63	10.12	2.39	2.84	1.69	1.51	4.24
Methylcyclohexane	57	91.94%	0.59	5.18	1.26	1.60	1.04	1.90	3.80
2,2,3-Trimethylpentane	52	83.87%	0.54	2.10	1.07	1.15	0.44	0.42	-0.84
2,3,4-Trimethylpentane	58	93.55%	0.47	5.27	2.23	2.34	1.21	0.47	-0.77
Toluene	62	100.00%	4.27	71.11	24.81	27.40	15.60	0.82	0.46
2-Methylheptane	58	93.55%	0.53	4.73	1.78	1.88	0.91	0.64	0.08
3-Methylheptane	57	91.94%	0.46	4.16	1.43	1.61	0.79	0.68	0.33
1-Octene	43	69.35%	0.49	2.42	1.10	1.13	0.44	0.62	0.14
n-Octane	53	85.48%	0.50	22.98	1.39	1.99	3.06	6.42	44.35
Ethylbenzene	62	100.00%	0.50	18.55	4.69	5.89	4.26	1.22	1.07
p-Xylene + m-Xylene	62	100.00%	1.40	70.38	14.94	19.25	15.35	1.57	2.23
Styrene	41	66.13%	0.50	6.39	1.06	1.65	1.43	2.15	4.25
o-Xylene	61	98.39%	0.58	22.49	4.71	6.06	4.74	1.61	2.51
1-Nonene	32	51.61%	0.52	1.72	0.84	0.92	0.30	0.82	0.19
n-Nonane	59	95.16%	0.56	4.87	1.64	1.69	0.89	1.03	1.36
Isopropylbenzene	15	24.19%	0.55	0.89	0.71	0.70	0.10	0.21	-0.33
n-Propylbenzene	58	93.55%	0.52	18.53	2.01	2.48	2.50	4.97	30.40
alpha-Pinene	55	88.71%	0.52	3.22	1.39	1.40	0.61	0.71	0.22
m-Ethyltoluene	59	95.16%	0.77	7.75	2.81	3.15	1.69	0.89	0.39
p-Ethyltoluene	44	70.97%	0.50	2.26	1.03	1.06	0.42	0.91	0.76
1,3,5-Trimethylbenzene	55	88.71%	0.53	3.51	1.34	1.43	0.67	1.26	1.70
o-Ethyltoluene	61	98.39%	0.45	5.02	1.86	2.06	0.97	0.60	0.14
1-Decene	1	1.61%	3.69	3.69	3.69	3.69	.	.	.
1,2,4-Trimethylbenzene	62	100.00%	0.65	13.06	4.71	4.96	2.72	0.65	0.18

Table 9-16. Continued

Compound	Cases	Frequency	ppbC Minimum	Maximum	Median	Average	Standard Deviation	Skewness	Kurtosi
n-Decane	31	50.00%	0.52	33.14	1.10	3.31	6.66	3.61	14.1
1,2,3-Trimethylbenzene	62	100.00%	1.10	24.20	2.38	3.17	3.14	5.33	34.0
p-Diethylbenzene	48	77.42%	0.52	3.14	1.07	1.18	0.53	1.17	2.3
1-Undecene	62	100.00%	0.77	5.67	2.18	2.12	0.97	0.98	1.8
n-Undecane	62	100.00%	0.57	6.49	2.28	2.45	1.28	1.22	1.9
1-Dodecene	54	87.10%	0.57	5.18	1.33	1.56	0.98	2.11	5.1
n-Dodecane	60	96.77%	0.49	5.21	1.54	1.87	0.97	1.15	1.5
1-Tridecene	13	20.97%	0.52	11.15	0.86	1.89	2.92	3.12	10.1
n-Tridecane	49	79.03%	0.56	3.76	1.06	1.19	0.65	2.47	7.6

Table 9-17. 1992 Summary Statistics for Long Island, NY (LINY)

			ppbC						
Compound	Cases	Frequency	Minimum	Maximum	Median	Average	Standard Deviation	Skewness	Kurtosis
Ethylene	8	100.00%	3.28	25.69	12.92	14.47	8.60	0.17	-1.84
Acetylene	7	87.50%	1.94	12.01	3.63	5.95	4.44	0.77	-1.55
Ethane	8	100.00%	2.44	26.93	7.05	10.75	9.60	0.73	-1.05
Propylene	8	100.00%	1.20	9.99	3.59	4.75	3.49	0.55	-1.64
Propane	8	100.00%	2.08	15.67	5.29	6.83	5.30	0.82	-0.85
Propyne	0	0.00%	.	.	.	.	.	.	.
Isobutane	8	100.00%	0.77	10.62	3.22	4.59	3.77	0.72	-1.14
Isobutene	0	0.00%	.	.	.	.	.	.	.
1-Butene	8	100.00%	0.77	6.61	3.01	3.42	2.39	0.24	-2.05
1,3-Butadiene	5	62.50%	0.69	1.92	1.84	1.48	0.56	-0.88	-1.70
n-Butane	8	100.00%	2.05	20.57	7.03	9.61	7.57	0.46	-1.86
t-2-Butene	5	62.50%	0.70	2.57	2.03	1.72	0.82	-0.45	-2.50
c-2-Butene	5	62.50%	0.56	2.16	1.53	1.33	0.67	-0.08	-2.05
3-Methyl-1-butene	4	50.00%	0.47	0.81	0.67	0.65	0.15	-0.43	-0.98
Isopentane	8	100.00%	3.70	38.67	14.89	18.32	14.41	0.46	-1.70
1-Pentene	3	37.50%	1.18	1.70	1.28	1.39	0.28	1.50	.
2-Methyl-1-butene	5	62.50%	0.74	2.88	2.13	1.90	0.90	-0.39	-2.06
n-Pentane	8	100.00%	1.34	13.83	4.68	6.22	4.93	0.60	-1.41
Isoprene	5	62.50%	0.49	2.31	1.35	1.41	0.66	-0.04	0.94
t-2-Pentene	6	75.00%	0.55	3.10	1.68	1.70	1.11	0.11	-2.44
c-2-Pentene	5	62.50%	0.52	1.63	1.11	1.06	0.47	-0.02	-2.21
2-Methyl-2-butene	6	75.00%	0.41	3.72	2.52	2.28	1.27	-0.47	-1.24
Neohexane	5	62.50%	0.60	1.09	0.92	0.85	0.20	-0.23	-1.57
Cyclopentene	3	37.50%	0.56	0.69	0.58	0.61	0.07	1.63	.
4-Methyl-1-pentene	4	50.00%	0.68	1.01	0.87	0.86	0.18	-0.07	-5.57
2,3-Dimethylbutane	4	50.00%	0.67	1.28	1.06	1.02	0.27	-0.67	-1.38
Cyclopentane	6	75.00%	0.45	6.04	1.68	2.64	2.36	0.81	-1.56
Isohexane	8	100.00%	0.80	10.66	3.45	4.77	3.96	0.65	-1.42
3-Methylpentane	8	100.00%	0.62	7.58	2.24	3.28	2.84	0.78	-1.19
1-Hexene	0	0.00%	.	.	.	.	.	.	.
2-Methyl-1-pentene	3	37.50%	0.98	1.23	1.22	1.14	0.14	-1.73	.
2-Ethyl-1-butene	0	0.00%	.	.	.	.	.	.	.
n-Hexane	8	100.00%	0.63	5.99	2.10	2.70	2.15	0.61	-1.41
t-2-Hexene	3	37.50%	0.73	0.86	0.78	0.79	0.07	0.59	.

Table 9-17. Continued

Compound	Cases	Frequency	ppbC Minimum	Maximum	Median	Average	Standard Deviation	Skewness	Kurtos
c-2-Hexene	3	37.50%	0.46	0.63	0.46	0.52	0.10	1.73	.
Methylcyclopentane	6	75.00%	0.63	4.39	2.33	2.44	1.50	0.16	-1.7
2,4-Dimethylpentane	5	62.50%	0.65	2.91	1.74	1.71	0.89	0.22	-1.0
Benzene	8	100.00%	2.83	13.53	6.90	7.63	4.49	0.23	-2.0
Cyclohexane	6	75.00%	0.49	2.28	1.20	1.28	0.65	0.50	-0.4
Isoheptane	5	62.50%	0.80	16.84	1.28	5.59	7.01	1.39	1.0
2,3-Dimethylpentane	2	25.00%	1.81	4.88	3.35	3.35	2.17	.	.
3-Methylhexane	8	100.00%	1.14	12.93	2.38	3.78	3.96	2.22	5.1
2,2,4-Trimethylpentane	8	100.00%	0.90	8.24	3.70	4.28	3.14	0.28	-2.0
1-Heptene	3	37.50%	0.69	1.01	0.71	0.80	0.18	1.71	.
n-Heptane	6	75.00%	0.66	10.01	1.30	3.78	4.20	1.03	-1.4
Methylcyclohexane	4	50.00%	0.78	2.95	1.38	1.62	0.96	1.23	1.2
2,2,3-Trimethylpentane	4	50.00%	0.72	1.45	1.27	1.18	0.34	-1.05	-0.2
2,3,4-Trimethylpentane	7	87.50%	0.45	3.04	1.61	1.75	1.13	0.04	-2.2
Toluene	8	100.00%	4.68	72.65	14.96	23.18	23.32	1.60	2.4
2-Methylheptane	5	62.50%	0.59	2.14	1.47	1.46	0.64	-0.35	-1.5
3-Methylheptane	4	50.00%	1.02	1.83	1.45	1.44	0.36	-0.15	-2.0
1-Octene	3	37.50%	0.81	1.05	1.01	0.96	0.13	-1.51	.
n-Octane	4	50.00%	0.69	1.47	0.81	0.95	0.36	1.82	3.
Ethylbenzene	8	100.00%	0.77	6.47	2.41	3.06	2.28	0.53	-1.
p-Xylene + m-Xylene	8	100.00%	2.37	22.34	8.84	10.74	8.00	0.46	-1.
Styrene	4	50.00%	0.69	1.28	1.17	1.08	0.26	-1.72	3.
o-Xylene	8	100.00%	0.68	7.53	3.02	3.59	2.79	0.40	-1.
1-Nonene	3	37.50%	0.47	0.77	0.60	0.61	0.15	0.40	.
n-Nonane	4	50.00%	0.65	2.04	1.25	1.30	0.60	0.36	-1.
Isopropylbenzene	2	25.00%	0.54	0.64	0.59	0.59	0.07	.	.
n-Propylbenzene	8	100.00%	0.75	4.70	1.11	1.54	1.31	2.58	6.
alpha-Pinene	5	62.50%	0.56	1.91	1.26	1.29	0.54	-0.26	-1.
m-Ethyltoluene	8	100.00%	0.61	5.48	2.37	2.80	1.85	0.37	-1.
p-Ethyltoluene	5	62.50%	0.55	1.52	1.14	1.08	0.41	-0.33	-2
1,3,5-Trimethylbenzene	7	87.50%	0.55	2.73	1.41	1.66	0.95	0.03	-2
o-Ethyltoluene	8	100.00%	0.52	3.49	1.45	1.68	1.15	0.57	-1
1-Decene	0	0.00%	.	.	.	.	.	.	.
1,2,4-Trimethylbenzene	8	100.00%	1.13	9.26	4.07	4.73	3.36	0.35	-1

Table 9-17. Continued

Compound	Cases	Frequency	ppbC Minimum	Maximum	Median	Average	Standard Deviation	Skewness	Kurtosis
n-Decane	2	25.00%	1.48	5.94	3.71	3.71	3.16	.	.
1,2,3-Trimethylbenzene	8	100.00%	0.88	4.04	2.29	2.41	1.21	0.14	-1.79
p-Diethylbenzene	5	62.50%	0.76	1.96	1.05	1.26	0.57	0.48	-2.85
1-Undecene	8	100.00%	1.00	3.75	2.49	2.34	0.92	-0.03	-0.89
n-Undecane	8	100.00%	0.61	5.42	1.17	1.78	1.62	1.98	4.14
1-Dodecene	8	100.00%	0.69	2.05	0.94	1.07	0.44	1.91	4.12
n-Dodecane	6	75.00%	0.64	1.47	1.25	1.13	0.34	-0.76	-1.44
1-Tridecene	0	0.00%	.	.	.	.	.	.	.
n-Tridecane	5	62.50%	0.52	0.95	0.73	0.77	0.19	-0.18	-1.69

Table 9-18. 1992 Summary Statistics for Miami, FL (MIFL)

Compound	Cases	Frequency	ppbC Minimum	Maximum	Median	Average	Standard Deviation	Skewness	Kurtos
Ethylene	56	100.00%	5.23	46.16	15.45	19.12	9.67	1.38	1.2
Acetylene	56	100.00%	3.97	33.50	10.27	12.18	6.43	1.03	0.6
Ethane	55	98.21%	0.78	23.32	4.56	5.76	4.23	2.21	5.9
Propylene	56	100.00%	1.06	19.77	5.66	7.52	4.56	1.08	0.3
Propane	56	100.00%	2.47	186.07	14.59	34.65	42.28	1.89	3.5
Propyne	0	0.00%	.	.	.	.	.	.	.
Isobutane	56	100.00%	1.53	26.48	4.04	5.96	5.29	2.05	4.7
Isobutene	0	0.00%	.	.	.	.	.	.	.
1-Butene	56	100.00%	2.02	12.49	5.01	5.75	2.76	1.01	0.
1,3-Butadiene	54	96.43%	0.58	4.40	1.34	1.72	0.92	1.36	1.
n-Butane	56	100.00%	3.14	34.73	10.60	13.25	7.49	1.02	0.
t-2-Butene	54	96.43%	0.62	7.94	1.45	1.85	1.26	2.47	9.
c-2-Butene	49	87.50%	0.55	4.82	0.89	1.26	0.82	2.24	6.
3-Methyl-1-butene	37	66.07%	0.45	1.88	0.86	0.98	0.42	0.77	-0.
Isopentane	56	100.00%	9.30	165.71	33.80	44.57	31.31	1.66	3.
1-Pentene	29	51.79%	0.59	10.73	2.32	2.44	1.98	2.67	10.
2-Methyl-1-butene	55	98.21%	1.02	8.64	2.45	3.20	1.91	1.14	0.
n-Pentane	56	100.00%	3.04	55.71	9.87	13.34	10.10	2.02	5.
Isoprene	55	98.21%	0.71	3.64	1.22	1.53	0.71	1.30	1.
t-2-Pentene	56	100.00%	0.93	15.78	2.75	4.02	3.27	2.01	4.
c-2-Pentene	54	96.43%	0.71	5.24	1.59	1.97	1.08	1.13	0.
2-Methyl-2-butene	56	100.00%	1.66	12.90	3.54	4.93	2.97	1.14	0.
Neohexane	56	100.00%	3.86	105.35	21.26	25.39	17.64	2.44	8.
Cyclopentene	39	69.64%	0.53	2.09	0.92	1.09	0.48	0.62	-0.
4-Methyl-1-pentene	48	85.71%	0.43	2.29	0.87	0.97	0.39	1.12	1.
2,3-Dimethylbutane	54	96.43%	0.55	4.39	1.13	1.45	0.90	1.47	2.
Cyclopentane	56	100.00%	1.30	13.48	4.12	4.63	2.57	1.26	1.
Isohexane	56	100.00%	2.76	35.94	9.51	11.83	7.60	1.27	1
3-Methylpentane	56	100.00%	1.72	23.73	6.30	7.40	4.51	1.22	1
1-Hexene	0	0.00%	.	.	.	.	.	.	.
2-Methyl-1-pentene	54	96.43%	0.54	4.09	1.27	1.61	0.97	1.05	-0
2-Ethyl-1-butene	0	0.00%	.	.	.	.	.	.	.
n-Hexane	56	100.00%	1.91	17.15	5.01	5.85	3.48	1.27	1
t-2-Hexene	48	85.71%	0.55	3.67	0.90	1.22	0.76	1.68	2

Table 9-18. Continued

Compound	Cases	Frequency	ppbC Minimum	Maximum	Median	Average	Standard Deviation	Skewness	Kurtosis
c-2-Hexene	37	66.07%	0.44	1.88	0.82	0.97	0.46	0.71	-0.73
Methylcyclopentane	56	100.00%	1.24	12.16	3.47	4.12	2.25	1.30	1.74
2,4-Dimethylpentane	56	100.00%	0.96	11.13	3.04	3.84	2.34	1.29	1.16
Benzene	56	100.00%	4.51	29.04	9.27	11.62	5.95	1.14	0.46
Cyclohexane	51	91.07%	0.57	10.94	1.75	2.25	1.61	3.57	16.95
Isoheptane	41	73.21%	0.66	4.69	1.34	1.75	1.08	1.13	0.49
2,3-Dimethylpentane	56	100.00%	0.80	10.17	2.59	3.31	2.34	1.20	0.98
3-Methylhexane	56	100.00%	1.56	15.21	4.11	4.67	2.54	1.69	4.28
2,2,4-Trimethylpentane	56	100.00%	4.43	46.03	13.92	16.59	9.98	1.20	0.63
1-Heptene	41	73.21%	0.49	2.58	0.96	1.16	0.56	0.70	-0.57
n-Heptane	55	98.21%	0.76	6.01	1.61	1.99	1.30	1.63	2.35
Methylcyclohexane	55	98.21%	0.70	5.26	1.32	1.75	1.08	1.60	2.40
2,2,3-Trimethylpentane	53	94.64%	0.73	5.99	1.96	2.33	1.34	1.05	0.09
2,3,4-Trimethylpentane	56	100.00%	1.42	15.12	4.67	5.54	3.34	1.16	0.50
Toluene	56	100.00%	12.49	115.96	33.07	40.66	24.11	1.34	1.50
2-Methylheptane	55	98.21%	0.80	5.89	1.76	2.16	1.21	1.26	1.02
3-Methylheptane	55	98.21%	0.69	5.21	1.54	1.87	1.04	1.23	1.01
1-Octene	54	96.43%	0.67	5.88	1.71	2.20	1.38	1.19	0.43
n-Octane	51	91.07%	0.55	5.11	1.14	1.44	0.93	2.13	5.53
Ethylbenzene	56	100.00%	1.62	16.09	4.91	6.00	3.37	1.21	0.93
p-Xylene + m-Xylene	56	100.00%	6.62	56.95	17.48	21.00	11.33	1.30	1.30
Styrene	55	98.21%	0.66	8.90	1.54	2.15	1.74	2.27	5.92
o-Xylene	55	98.21%	2.39	21.59	6.22	7.64	4.30	1.33	1.45
1-Nonene	31	55.36%	0.44	1.94	0.84	0.95	0.38	0.90	0.40
n-Nonane	55	98.21%	0.68	5.07	1.51	1.84	1.04	1.57	2.30
Isopropylbenzene	27	48.21%	0.51	1.70	0.72	0.82	0.30	1.29	1.32
n-Propylbenzene	56	100.00%	0.51	15.13	2.40	2.83	2.29	3.37	15.51
alpha-Pinene	56	100.00%	0.86	7.15	2.09	2.47	1.37	1.41	1.94
m-Ethyltoluene	56	100.00%	2.05	19.35	5.60	6.95	3.86	1.23	1.01
p-Ethyltoluene	53	94.64%	0.69	5.49	1.66	2.00	1.09	1.22	0.91
1,3,5-Trimethylbenzene	56	100.00%	1.11	9.44	3.16	3.78	2.04	1.04	0.29
o-Ethyltoluene	55	98.21%	1.68	11.25	3.94	4.42	2.19	1.34	1.59
1-Decene	0	0.00%	.	.	.	.	.	.	.
1,2,4-Trimethylbenzene	56	100.00%	3.84	34.96	10.00	12.42	6.82	1.29	1.25

Table 9-18. Continued

Compound	Cases	Frequency	ppbC Minimum	Maximum	Median	Average	Standard Deviation	Skewness	Kurtos
n-Decane	56	100.00%	0.80	14.91	1.91	3.03	3.07	2.21	4.4
1,2,3-Trimethylbenzene	56	100.00%	2.12	10.47	4.69	5.13	2.08	0.93	0.2
p-Diethylbenzene	55	98.21%	0.59	3.80	1.27	1.49	0.72	1.08	0.7
1-Undecene	52	92.86%	0.92	10.63	1.80	2.27	1.72	3.02	11.2
n-Undecane	56	100.00%	1.79	43.14	4.35	5.71	5.57	5.73	38.1
1-Dodecene	54	96.43%	0.59	8.27	1.03	1.53	1.44	3.34	12.3
n-Dodecane	56	100.00%	0.93	27.51	1.78	2.57	3.57	6.46	45.3
1-Tridecene	28	50.00%	0.46	2.20	0.70	0.85	0.46	2.25	4.3
n-Tridecane	52	92.86%	0.57	5.52	1.03	1.22	0.78	3.74	17.8

Table 9-19. 1992 Summary Statistics for Manhattan, NY (MNY)

			ppbC						
Compound	Cases	Frequency	Minimum	Maximum	Median	Average	Standard Deviation	Skewness	Kurtosis
Ethylene	7	100.00%	9.02	32.62	14.48	16.42	8.10	1.62	2.61
Acetylene	6	85.71%	4.21	9.45	7.43	6.96	2.46	-0.20	-2.75
Ethane	7	100.00%	5.25	80.52	13.41	23.85	26.66	2.06	4.38
Propylene	7	100.00%	2.93	14.57	6.02	6.64	3.87	1.69	3.47
Propane	7	100.00%	3.91	42.15	8.99	14.19	13.49	1.87	3.57
Propyne	0	0.00%	.	.	.	.	.	.	.
Isobutane	7	100.00%	3.47	32.79	9.17	12.71	10.23	1.41	2.19
Isobutene	0	0.00%	.	.	.	.	.	.	.
1-Butene	7	100.00%	1.76	11.44	5.88	5.90	3.63	0.55	-1.01
1,3-Butadiene	6	85.71%	0.73	2.55	1.01	1.26	0.67	1.87	3.62
n-Butane	7	100.00%	4.07	60.42	15.04	23.45	19.90	1.12	0.94
t-2-Butene	7	100.00%	0.85	6.89	1.75	2.68	2.15	1.50	2.03
c-2-Butene	6	85.71%	0.57	11.33	1.94	3.85	4.14	1.53	1.73
3-Methyl-1-butene	3	42.86%	0.96	1.91	1.09	1.32	0.52	1.60	.
Isopentane	7	100.00%	7.18	194.43	18.90	51.93	66.68	2.08	4.58
1-Pentene	4	57.14%	0.81	4.45	1.95	2.29	1.58	1.09	1.01
2-Methyl-1-butene	6	85.71%	0.76	7.03	2.12	2.81	2.36	1.36	1.64
n-Pentane	7	100.00%	2.46	42.62	13.37	15.14	14.31	1.37	1.61
Isoprene	5	71.43%	0.61	9.03	0.99	2.52	3.65	2.21	4.89
t-2-Pentene	6	85.71%	0.57	6.50	2.51	2.93	2.34	0.62	-1.02
c-2-Pentene	5	71.43%	0.68	3.89	1.42	1.77	1.31	1.35	1.57
2-Methyl-2-butene	5	71.43%	0.56	4.38	1.98	2.07	1.49	0.99	0.95
Neohexane	4	57.14%	0.62	1.50	0.78	0.92	0.40	1.76	3.29
Cyclopentene	2	28.57%	0.79	1.36	1.08	1.08	0.40	.	.
4-Methyl-1-pentene	4	57.14%	0.54	1.17	0.73	0.79	0.28	0.91	-0.58
2,3-Dimethylbutane	4	57.14%	0.60	2.42	1.25	1.38	0.77	0.96	1.56
Cyclopentane	7	100.00%	0.75	8.27	3.33	3.74	2.71	0.65	-0.52
Isohexane	7	100.00%	1.97	25.15	4.32	8.69	8.30	1.59	2.26
3-Methylpentane	7	100.00%	1.09	11.72	5.58	5.26	3.83	0.60	-0.40
1-Hexene	0	0.00%	.	.	.	.	.	.	.
2-Methyl-1-pentene	5	71.43%	0.71	2.73	1.17	1.38	0.83	1.36	1.65
2-Ethyl-1-butene	0	0.00%	.	.	.	.	.	.	.
n-Hexane	7	100.00%	1.30	13.04	3.37	4.88	4.13	1.53	2.26
t-2-Hexene	4	57.14%	0.50	2.82	0.92	1.29	1.08	1.41	1.50

Table 9-19. Continued

Compound	Cases	Frequency	ppbC Minimum	Maximum	Median	Average	Standard Deviation	Skewness	Kurtos
c-2-Hexene	2	28.57%	0.64	0.93	0.79	0.79	0.21	.	.
Methylcyclopentane	7	100.00%	1.00	6.29	1.92	2.57	1.90	1.43	2.(
2,4-Dimethylpentane	6	85.71%	0.82	4.70	1.80	2.28	1.50	0.93	-0.:
Benzene	7	100.00%	3.97	20.68	7.72	9.64	5.68	1.47	1.!
Cyclohexane	5	71.43%	1.20	9.92	3.46	4.69	3.57	0.84	-0.(
Isoheptane	6	85.71%	0.57	4.76	1.19	1.91	1.60	1.46	1.(
2,3-Dimethylpentane	6	85.71%	0.65	3.53	1.94	1.91	1.09	0.29	-0.7
3-Methylhexane	7	100.00%	1.35	21.14	6.26	7.58	7.31	1.24	0.!
2,2,4-Trimethylpentane	7	100.00%	2.27	16.29	5.12	6.91	4.80	1.49	2.(
1-Heptene	3	42.86%	0.53	1.45	0.59	0.86	0.52	1.71	.
n-Heptane	7	100.00%	0.61	8.91	2.28	3.12	3.01	1.43	1.!
Methylcyclohexane	7	100.00%	0.56	3.60	1.00	1.37	1.07	1.93	3.!
2,2,3-Trimethylpentane	6	85.71%	0.60	2.45	1.23	1.30	0.65	1.14	1.7
2,3,4-Trimethylpentane	7	100.00%	0.84	5.31	1.86	2.33	1.51	1.52	2.(
Toluene	7	100.00%	10.28	89.49	22.11	33.52	28.23	1.63	2.(
2-Methylheptane	7	100.00%	0.62	4.82	1.64	1.92	1.46	1.53	2.(
3-Methylheptane	6	85.71%	0.60	3.79	1.29	1.67	1.17	1.48	2.
1-Octene	5	71.43%	0.65	2.16	0.99	1.13	0.62	1.53	2.
n-Octane	6	85.71%	0.67	7.53	5.09	4.27	2.92	-0.50	-1.
Ethylbenzene	7	100.00%	1.61	18.65	4.17	6.51	6.17	1.62	2.
p-Xylene + m-Xylene	7	100.00%	5.60	71.60	13.99	26.04	24.24	1.32	1.
Styrene	6	85.71%	0.54	8.42	1.48	2.48	2.99	2.16	4.
o-Xylene	7	100.00%	1.85	27.27	4.58	9.71	9.37	1.28	0.
1-Nonene	4	57.14%	0.86	13.04	2.61	4.78	5.66	1.70	2.
n-Nonane	7	100.00%	1.02	40.77	4.58	11.18	14.47	1.74	3.
Isopropylbenzene	4	57.14%	0.57	5.80	2.27	2.72	2.35	0.82	-0.
n-Propylbenzene	7	100.00%	1.28	29.31	6.68	8.89	9.99	1.70	3.
alpha-Pinene	7	100.00%	0.96	37.54	3.50	11.44	13.80	1.29	1.
m-Ethyltoluene	7	100.00%	2.08	38.63	4.62	15.36	15.86	0.59	-1.
p-Ethyltoluene	7	100.00%	0.74	19.25	2.13	6.48	7.28	0.98	-0
1,3,5-Trimethylbenzene	7	100.00%	1.15	19.55	2.25	8.08	8.31	0.51	-2
o-Ethyltoluene	7	100.00%	1.60	30.30	5.19	12.00	12.06	0.59	-1
1-Decene	0	0.00%	.	.	.	.	.	.	.
1,2,4-Trimethylbenzene	7	100.00%	3.84	57.18	9.08	22.37	21.91	0.72	-1

Table 9-19. Continued

Compound	Cases	Frequency	ppbC Minimum	Maximum	Median	Average	Standard Deviation	Skewness	Kurtosis
n-Decane	7	100.00%	1.24	59.05	3.23	12.58	20.82	2.48	6.30
1,2,3-Trimethylbenzene	7	100.00%	2.19	17.81	5.95	8.15	6.35	0.73	-1.29
p-Diethylbenzene	5	71.43%	2.04	4.64	2.70	2.88	1.06	1.53	2.48
1-Undecene	5	71.43%	0.91	49.40	6.21	18.56	20.88	0.99	-0.90
n-Undecane	7	100.00%	4.11	131.67	8.73	44.97	51.64	0.84	-0.88
1-Dodecene	6	85.71%	0.52	3.32	1.35	1.58	1.01	1.09	1.03
n-Dodecane	7	100.00%	1.79	25.03	2.99	9.48	10.04	0.93	-1.16
1-Tridecene	4	57.14%	1.25	1.62	1.33	1.38	0.17	1.29	0.93
n-Tridecane	7	100.00%	0.66	3.60	0.94	1.61	1.21	1.17	-0.57

Table 9-20. 1992 Summary Statistics for Newark, NJ (NWNJ)

			ppbC						
Compound	Cases	Frequency	Minimum	Maximum	Median	Average	Standard Deviation	Skewness	Kurtosis
Ethylene	7	100.00%	6.06	20.17	14.93	14.73	4.70	-0.95	1.16
Acetylene	7	100.00%	4.85	8.27	7.14	6.86	1.41	-0.68	-1.20
Ethane	7	100.00%	9.33	24.00	18.47	17.11	5.09	-0.45	-0.55
Propylene	7	100.00%	3.24	11.68	8.29	7.94	2.71	-0.56	0.67
Propane	7	100.00%	13.41	32.24	17.73	20.43	7.40	1.01	-0.74
Propyne	0	0.00%	.	.	.	.	.	.	.
Isobutane	7	100.00%	4.93	22.92	9.06	9.88	6.10	2.05	4.72
Isobutene	0	0.00%	.	.	.	.	.	.	.
1-Butene	7	100.00%	2.58	5.33	3.78	3.81	0.95	0.40	-0.51
1,3-Butadiene	4	57.14%	0.70	1.05	0.85	0.86	0.17	0.21	-4.32
n-Butane	7	100.00%	11.53	16.57	16.17	15.29	1.86	-1.78	2.6
t-2-Butene	7	100.00%	1.32	2.16	1.42	1.56	0.32	1.47	1.0
c-2-Butene	4	57.14%	1.05	6.28	1.54	2.60	2.48	1.86	3.47
3-Methyl-1-butene	4	57.14%	0.50	0.62	0.59	0.57	0.05	-1.17	1.0
Isopentane	7	100.00%	15.99	35.49	28.61	28.02	7.38	-0.55	-0.8
1-Pentene	7	100.00%	0.67	1.28	1.18	1.00	0.29	-0.33	-2.7
2-Methyl-1-butene	7	100.00%	1.29	2.45	1.74	1.77	0.39	0.50	0.5
n-Pentane	7	100.00%	6.07	22.26	8.83	10.80	5.42	1.99	4.3
Isoprene	7	100.00%	0.59	3.73	0.91	1.29	1.11	2.33	5.6
t-2-Pentene	5	71.43%	1.33	4.19	1.45	2.06	1.21	2.04	4.2
c-2-Pentene	7	100.00%	0.66	1.19	0.90	0.95	0.18	-0.22	-0.7
2-Methyl-2-butene	6	85.71%	0.89	2.53	1.50	1.57	0.57	0.87	1.1
Neohexane	6	85.71%	0.55	0.87	0.67	0.69	0.12	0.53	-0.7
Cyclopentene	1	14.29%	1.05	1.05	1.05	1.05	.	.	.
4-Methyl-1-pentene	4	57.14%	0.49	1.70	1.17	1.13	0.50	-0.42	1.5
2,3-Dimethylbutane	6	85.71%	0.68	1.67	0.84	0.96	0.38	1.77	3.2
Cyclopentane	7	100.00%	1.25	5.06	2.81	2.88	1.39	0.47	-0.9
Isohexane	7	100.00%	4.39	9.71	6.48	6.56	1.82	0.79	0.1
3-Methylpentane	7	100.00%	2.64	8.88	5.48	5.49	2.22	0.22	-0.9
1-Hexene	0	0.00%	.	.	.	.	.	.	.
2-Methyl-1-pentene	6	85.71%	0.56	2.86	0.91	1.16	0.85	2.20	5.1
2-Ethyl-1-butene	0	0.00%	.	.	.	.	.	.	.
n-Hexane	7	100.00%	2.43	6.55	3.45	4.02	1.58	0.95	-0.7
t-2-Hexene	4	57.14%	0.55	4.04	1.97	2.13	1.44	0.67	1.7

Table 9-20. Continued

Compound	Cases	Frequency	ppbC Minimum	Maximum	Median	Average	Standard Deviation	Skewness	Kurtosis
c-2-Hexene	1	14.29%	0.48	0.48	0.48	0.48	.	.	.
Methylcyclopentane	7	100.00%	2.18	4.13	3.38	3.31	0.62	-0.76	1.27
2,4-Dimethylpentane	7	100.00%	1.01	2.07	1.23	1.45	0.40	0.61	-1.35
Benzene	7	100.00%	5.05	10.55	7.27	7.30	1.86	0.80	0.30
Cyclohexane	7	100.00%	1.44	40.45	6.58	10.38	13.40	2.52	6.54
Isoheptane	7	100.00%	1.58	4.50	2.93	2.69	1.02	0.76	0.27
2,3-Dimethylpentane	5	71.43%	0.63	1.59	1.34	1.21	0.37	-1.19	1.52
3-Methylhexane	7	100.00%	3.71	10.01	6.64	6.60	2.46	0.20	-1.77
2,2,4-Trimethylpentane	7	100.00%	4.77	9.15	6.78	6.90	1.56	0.09	-1.19
1-Heptene	3	42.86%	0.58	0.63	0.62	0.61	0.03	-1.23	.
n-Heptane	7	100.00%	1.23	5.00	2.11	2.43	1.24	1.80	3.78
Methylcyclohexane	6	85.71%	0.94	1.51	1.14	1.16	0.20	1.15	1.80
2,2,3-Trimethylpentane	7	100.00%	0.64	1.26	1.04	0.99	0.23	-0.35	-1.51
2,3,4-Trimethylpentane	7	100.00%	1.33	2.57	1.90	1.97	0.44	-0.05	-1.12
Toluene	7	100.00%	17.09	61.88	29.75	33.39	15.60	1.16	0.76
2-Methylheptane	7	100.00%	1.05	2.25	1.36	1.44	0.38	1.94	4.70
3-Methylheptane	7	100.00%	0.78	1.88	1.12	1.18	0.35	1.52	3.37
1-Octene	6	85.71%	0.54	1.06	0.66	0.76	0.21	0.83	-1.52
n-Octane	7	100.00%	0.59	1.63	0.85	0.99	0.45	0.96	-1.01
Ethylbenzene	7	100.00%	2.91	7.87	4.24	4.99	1.64	0.76	0.41
p-Xylene + m-Xylene	7	100.00%	10.61	29.10	14.84	18.09	6.40	0.78	-0.17
Styrene	7	100.00%	1.38	2.58	1.68	1.76	0.40	1.65	3.25
o-Xylene	7	100.00%	3.85	8.92	4.84	5.69	1.73	1.15	1.05
1-Nonene	5	71.43%	0.53	1.91	0.60	0.94	0.59	1.54	1.84
n-Nonane	7	100.00%	1.23	3.09	1.67	1.82	0.61	1.78	3.77
Isopropylbenzene	4	57.14%	0.69	0.85	0.74	0.76	0.07	1.07	0.88
n-Propylbenzene	7	100.00%	1.05	7.38	3.76	3.87	2.50	0.24	-1.69
alpha-Pinene	7	100.00%	1.28	2.46	1.56	1.65	0.42	1.38	1.75
m-Ethyltoluene	7	100.00%	2.95	5.66	3.14	3.86	1.09	0.91	-0.91
p-Ethyltoluene	6	85.71%	0.65	1.78	0.97	1.04	0.40	1.52	2.74
1,3,5-Trimethylbenzene	7	100.00%	1.37	2.64	1.47	1.71	0.46	1.75	2.62
o-Ethyltoluene	7	100.00%	1.87	4.10	2.96	2.86	0.80	0.41	-0.87
1-Decene	0	0.00%	.	.	.	.	.	.	.
1,2,4-Trimethylbenzene	7	100.00%	4.73	9.83	5.60	6.31	1.77	1.54	2.45

Table 9-20. Continued

Compound	Cases	Frequency	ppbC Minimum	Maximum	Median	Average	Standard Deviation	Skewness	Kurtos
n-Decane	7	100.00%	1.50	27.46	3.88	7.89	9.10	2.14	4.7
1,2,3-Trimethylbenzene	7	100.00%	1.38	7.17	2.57	3.05	2.04	1.68	2.9
p-Diethylbenzene	6	85.71%	0.50	4.90	1.06	1.67	1.63	2.13	4.7
1-Undecene	7	100.00%	1.41	5.92	2.30	3.18	1.87	0.58	-1.7
n-Undecane	7	100.00%	3.31	326.10	12.27	58.40	118.69	2.59	6.7
1-Dodecene	5	71.43%	0.59	2.75	0.86	1.27	0.87	1.73	2.9
n-Dodecane	7	100.00%	2.32	107.74	8.17	29.31	38.61	1.72	2.9
1-Tridecene	2	28.57%	0.56	1.53	1.05	1.05	0.69	.	.
n-Tridecane	7	100.00%	0.83	26.78	2.39	6.90	9.86	1.79	2.6

Table 9-21. 1992 Summary Statistics for Plainfield, NJ (PLNJ)

			ppbC						
Compound	Cases	Frequency	Minimum	Maximum	Median	Average	Standard Deviation	Skewness	Kurtosis
Ethylene	8	100.00%	13.24	105.06	58.09	52.43	31.96	0.21	-0.81
Acetylene	8	100.00%	3.81	47.23	13.57	18.40	15.53	1.10	0.19
Ethane	8	100.00%	10.08	115.23	61.10	55.54	37.96	0.28	-1.06
Propylene	8	100.00%	3.39	23.59	17.16	15.67	7.50	-0.96	-0.39
Propane	8	100.00%	5.55	465.52	24.83	80.27	156.33	2.78	7.80
Propyne	0	0.00%	.	.	.	.	.	.	.
Isobutane	8	100.00%	3.27	28.40	20.19	19.31	7.88	-1.17	1.90
Isobutene	0	0.00%	.	.	.	.	.	.	.
1-Butene	8	100.00%	1.99	12.48	9.44	8.65	3.59	-0.89	0.13
1,3-Butadiene	6	75.00%	0.56	2.85	2.45	2.18	0.86	-1.68	2.92
n-Butane	8	100.00%	4.57	54.69	30.90	30.47	14.19	-0.21	1.87
t-2-Butene	8	100.00%	0.78	8.22	4.72	4.95	2.11	-0.70	2.37
c-2-Butene	7	87.50%	3.29	7.54	3.61	4.23	1.51	2.35	5.75
3-Methyl-1-butene	7	87.50%	1.09	4.28	1.24	1.77	1.15	2.32	5.53
Isopentane	8	100.00%	9.32	247.17	67.12	93.40	75.03	1.41	1.94
1-Pentene	7	87.50%	2.05	14.42	3.23	4.71	4.39	2.40	5.95
2-Methyl-1-butene	8	100.00%	0.65	25.78	4.96	7.56	7.74	2.30	5.85
n-Pentane	8	100.00%	2.95	106.50	21.29	33.50	33.03	1.89	3.66
Isoprene	7	87.50%	1.68	4.37	2.70	2.72	0.96	0.80	-0.16
t-2-Pentene	8	100.00%	1.02	35.37	6.03	10.48	11.24	1.95	3.68
c-2-Pentene	7	87.50%	1.11	19.48	3.41	5.79	6.24	2.32	5.64
2-Methyl-2-butene	8	100.00%	1.10	51.48	7.77	13.37	15.95	2.46	6.43
Neohexane	7	87.50%	0.80	3.91	1.71	2.00	1.11	0.99	-0.03
Cyclopentene	7	87.50%	0.90	7.25	1.35	2.27	2.24	2.45	6.15
4-Methyl-1-pentene	7	87.50%	0.98	5.77	1.16	1.86	1.74	2.56	6.65
2,3-Dimethylbutane	7	87.50%	1.71	15.76	2.49	4.46	5.10	2.41	5.96
Cyclopentane	8	100.00%	1.30	29.09	6.05	8.70	8.58	2.38	6.25
Isohexane	8	100.00%	2.72	105.04	22.21	30.17	31.29	2.45	6.57
3-Methylpentane	8	100.00%	1.54	55.83	11.68	16.71	16.80	2.22	5.46
1-Hexene	0	0.00%	.	.	.	.	.	.	.
2-Methyl-1-pentene	7	87.50%	1.84	17.01	2.42	4.74	5.47	2.54	6.53
2-Ethyl-1-butene	0	0.00%	.	.	.	.	.	.	.
n-Hexane	8	100.00%	1.45	28.83	12.27	13.44	8.74	0.66	0.16
t-2-Hexene	7	87.50%	1.33	15.11	3.37	6.00	6.19	1.11	-0 94

Table 9-21. Continued

Compound	Cases	Frequency	ppbC Minimum	Maximum	Median	Average	Standard Deviation	Skewness	Kurtosi
c-2-Hexene	7	87.50%	0.75	9.48	1.04	2.46	3.16	2.45	6.1
Methylcyclopentane	8	100.00%	1.35	22.99	8.87	9.42	6.31	1.44	3.4
2,4-Dimethylpentane	8	100.00%	0.80	8.38	4.03	4.41	2.18	0.31	1.5
Benzene	8	100.00%	4.94	31.19	19.22	18.47	7.67	-0.16	1.1
Cyclohexane	8	100.00%	0.76	8.02	2.58	3.30	2.56	0.98	0.0
Isoheptane	7	87.50%	3.05	15.59	10.10	8.42	4.58	0.24	-0.9
2,3-Dimethylpentane	4	50.00%	2.22	18.46	2.81	6.58	7.93	1.99	3.9
3-Methylhexane	8	100.00%	1.69	18.10	7.33	8.56	5.15	0.91	0.7
2,2,4-Trimethylpentane	8	100.00%	4.01	21.47	13.96	13.77	4.92	-0.73	2.5
1-Heptene	7	87.50%	0.82	8.34	1.41	2.38	2.65	2.57	6.7
n-Heptane	8	100.00%	0.62	6.42	4.47	4.18	2.08	-0.57	-0.7
Methylcyclohexane	8	100.00%	0.65	12.42	2.77	3.71	3.63	2.47	6.6
2,2,3-Trimethylpentane	8	100.00%	0.66	8.54	2.42	3.04	2.34	2.24	5.9
2,3,4-Trimethylpentane	8	100.00%	2.18	16.81	5.91	7.05	4.31	1.91	4.6
Toluene	8	100.00%	11.57	187.39	72.49	75.96	50.95	1.56	3.8
2-Methylheptane	8	100.00%	0.78	20.71	3.40	5.27	6.34	2.66	7.3
3-Methylheptane	8	100.00%	0.78	16.59	2.96	4.43	4.99	2.64	7.2
1-Octene	8	100.00%	1.61	4.64	2.03	2.55	1.11	1.09	0.1
n-Octane	7	87.50%	0.58	6.65	1.75	2.29	1.99	2.29	5.7
Ethylbenzene	8	100.00%	2.01	30.84	9.89	11.47	8.38	2.06	5.4
p-Xylene + m-Xylene	8	100.00%	7.15	114.81	36.16	42.01	31.39	2.09	5.5
Styrene	7	87.50%	1.42	5.20	1.75	2.25	1.32	2.50	6.4
o-Xylene	8	100.00%	2.50	39.30	12.68	14.63	10.72	2.02	5.3
1-Nonene	7	87.50%	0.83	5.43	1.08	1.70	1.66	2.54	6.5
n-Nonane	8	100.00%	0.67	3.79	1.86	2.04	0.97	0.58	0.5
Isopropylbenzene	7	87.50%	0.61	35.26	1.07	6.51	12.78	2.56	6.6
n-Propylbenzene	8	100.00%	0.62	4.61	1.98	2.14	1.55	0.39	-1.6
alpha-Pinene	8	100.00%	0.59	7.19	2.90	3.25	1.91	1.19	2.7
m-Ethyltoluene	8	100.00%	1.84	21.75	8.53	9.46	5.67	1.46	3.8
p-Ethyltoluene	8	100.00%	0.63	6.65	2.48	2.74	1.72	1.86	5.0
1,3,5-Trimethylbenzene	8	100.00%	1.36	14.80	4.58	5.77	3.97	1.96	4.8
o-Ethyltoluene	8	100.00%	1.27	11.74	5.05	5.38	2.98	1.31	3.4
1-Decene	0	0.00%	.	.	.	.	.	.	.
1,2,4-Trimethylbenzene	8	100.00%	3.24	39.37	15.35	16.96	10.29	1.50	3.9

Table 9-21. Continued

Compound	Cases	Frequency	ppbC Minimum	Maximum	Median	Average	Standard Deviation	Skewness	Kurtosis
n-Decane	4	50.00%	0.93	35.38	5.46	11.81	16.10	1.74	2.97
1,2,3-Trimethylbenzene	8	100.00%	1.90	9.33	5.15	5.28	2.11	0.56	2.04
p-Diethylbenzene	7	87.50%	1.40	5.18	1.69	2.18	1.33	2.54	6.57
1-Undecene	7	87.50%	1.05	2.14	1.30	1.39	0.40	1.26	1.21
n-Undecane	7	87.50%	2.42	404.04	3.38	65.23	149.91	2.61	6.85
1-Dodecene	6	75.00%	0.53	2.22	0.84	1.07	0.62	1.68	2.87
n-Dodecane	7	87.50%	1.05	308.21	1.98	51.45	114.29	2.55	6.57
1-Tridecene	0	0.00%	.	.	.	.	.	.	.
n-Tridecane	7	87.50%	0.55	35.78	0.75	10.75	16.95	1.23	-0.84

Table 9-22. 1992 Summary Statistics for Raleigh, NC (R1NC)

			ppbC						
Compound	Cases	Frequency	Minimum	Maximum	Median	Average	Standard Deviation	Skewness	Kurtos
Ethylene	8	100.00%	5.23	14.35	9.54	9.17	3.32	0.25	-1.1
Acetylene	8	100.00%	1.07	8.48	4.60	4.21	2.40	0.37	0.2
Ethane	8	100.00%	2.29	13.64	5.26	5.79	3.38	2.12	5.4
Propylene	8	100.00%	0.77	3.61	2.97	2.41	1.12	-0.59	-1.8
Propane	8	100.00%	3.58	14.30	8.28	8.15	3.93	0.22	-1.2
Propyne	0	0.00%	.	.	.	.	.	.	.
Isobutane	8	100.00%	0.83	4.43	2.52	2.42	1.24	0.23	-0.9
Isobutene	0	0.00%	.	.	.	.	.	.	.
1-Butene	8	100.00%	0.64	2.77	1.90	1.58	0.80	-0.10	-1.3
1,3-Butadiene	3	37.50%	0.57	0.89	0.62	0.69	0.17	1.57	.
n-Butane	8	100.00%	2.21	10.16	5.41	5.33	2.90	0.39	-1.0
t-2-Butene	4	50.00%	0.50	0.60	0.58	0.56	0.04	-1.50	2.0
c-2-Butene	0	0.00%	.	.	.	.	.	.	.
3-Methyl-1-butene	0	0.00%	.	.	.	.	.	.	.
Isopentane	8	100.00%	4.31	23.85	12.47	12.07	7.11	0.35	-0.8
1-Pentene	2	25.00%	0.88	1.04	0.96	0.96	0.11	.	.
2-Methyl-1-butene	6	75.00%	0.93	1.59	1.20	1.20	0.26	0.46	-0.
n-Pentane	8	100.00%	1.51	9.07	4.25	4.15	2.61	0.77	0.
Isoprene	5	62.50%	0.78	9.24	2.37	3.50	3.34	1.83	3.
t-2-Pentene	5	62.50%	1.09	1.54	1.26	1.27	0.19	0.72	-0.
c-2-Pentene	4	50.00%	0.69	0.79	0.75	0.75	0.05	-0.12	-5.
2-Methyl-2-butene	6	75.00%	0.70	1.94	1.51	1.41	0.42	-0.84	1.
Neohexane	2	25.00%	0.53	1.61	1.07	1.07	0.76	.	.
Cyclopentene	0	0.00%	.	.	.	.	.	.	.
4-Methyl-1-pentene	5	62.50%	0.56	1.78	0.68	0.86	0.52	2.16	4.
2,3-Dimethylbutane	2	25.00%	0.55	0.79	0.67	0.67	0.17	.	.
Cyclopentane	7	87.50%	0.58	2.19	1.39	1.37	0.69	0.09	-2.
Isohexane	8	100.00%	1.27	6.43	3.81	3.44	1.91	0.16	-1.
3-Methylpentane	7	87.50%	0.74	5.16	2.64	2.52	1.57	0.53	-0.
1-Hexene	0	0.00%	.	.	.	.	.	.	.
2-Methyl-1-pentene	4	50.00%	0.61	0.74	0.65	0.66	0.06	0.73	-1.
2-Ethyl-1-butene	0	0.00%	.	.	.	.	.	.	.
n-Hexane	8	100.00%	0.72	4.23	2.56	2.38	1.47	0.02	-1
t-2-Hexene	0	0.00%	.	.	.	.	.	.	.

Table 9-22. Continued

Compound	Cases	Frequency	ppbC Minimum	Maximum	Median	Average	Standard Deviation	Skewness	Kurtosis
c-2-Hexene	0	0.00%	.	.	.	.	.	.	.
Methylcyclopentane	6	75.00%	0.56	2.51	1.87	1.70	0.66	-0.94	1.44
2,4-Dimethylpentane	5	62.50%	0.89	1.49	1.05	1.11	0.23	1.34	1.90
Benzene	8	100.00%	2.24	8.15	4.97	4.64	2.01	0.42	-0.41
Cyclohexane	7	87.50%	0.51	3.11	1.25	1.43	0.92	1.05	0.65
Isoheptane	7	87.50%	0.65	4.95	0.82	1.58	1.59	2.06	4.14
2,3-Dimethylpentane	4	50.00%	0.52	0.79	0.58	0.62	0.12	1.57	2.61
3-Methylhexane	8	100.00%	1.05	5.11	2.42	2.63	1.45	0.66	-0.59
2,2,4-Trimethylpentane	8	100.00%	1.07	6.34	3.76	3.24	1.89	0.17	-0.87
1-Heptene	0	0.00%	.	.	.	.	.	.	.
n-Heptane	6	75.00%	0.57	1.94	1.27	1.27	0.58	-0.03	-2.15
Methylcyclohexane	4	50.00%	0.59	0.97	0.65	0.71	0.18	1.74	3.00
2,2,3-Trimethylpentane	5	62.50%	0.59	0.94	0.63	0.68	0.15	2.10	4.53
2,3,4-Trimethylpentane	5	62.50%	1.29	2.13	1.46	1.57	0.33	1.69	3.12
Toluene	8	100.00%	4.31	19.81	11.82	10.72	5.56	0.20	-0.92
2-Methylheptane	5	62.50%	0.73	1.18	0.76	0.84	0.19	2.17	4.77
3-Methylheptane	5	62.50%	0.61	0.99	0.62	0.70	0.16	2.16	4.72
1-Octene	4	50.00%	0.55	0.85	0.56	0.63	0.15	1.99	3.98
n-Octane	2	25.00%	1.03	2.54	1.79	1.79	1.07	.	.
Ethylbenzene	7	87.50%	0.59	2.99	2.11	1.92	0.93	-0.68	-1.10
p-Xylene + m-Xylene	8	100.00%	1.79	10.53	6.68	5.77	3.18	-0.07	-1.38
Styrene	5	62.50%	0.58	0.77	0.61	0.66	0.09	0.58	-2.78
o-Xylene	8	100.00%	0.53	3.72	2.11	1.94	1.22	0.09	-1.49
1-Nonene	0	0.00%	.	.	.	.	.	.	.
n-Nonane	3	37.50%	0.59	0.98	0.67	0.75	0.21	1.44	.
Isopropylbenzene	0	0.00%	.	.	.	.	.	.	.
n-Propylbenzene	7	87.50%	0.76	11.92	5.54	5.29	3.74	0.69	0.71
alpha-Pinene	5	62.50%	0.56	1.29	0.64	0.77	0.30	2.01	4.19
m-Ethyltoluene	8	100.00%	0.61	7.56	2.08	2.74	2.29	1.48	2.47
p-Ethyltoluene	0	0.00%	.	.	.	.	.	.	.
1,3,5-Trimethylbenzene	5	62.50%	0.87	1.49	0.97	1.07	0.25	1.90	3.87
o-Ethyltoluene	8	100.00%	0.57	2.83	1.51	1.39	0.78	0.67	0.30
1-Decene	0	0.00%	.	.	.	.	.	.	.
1,2,4-Trimethylbenzene	8	100.00%	0.96	5.41	3.00	2.66	1.53	0.50	-0.07

Table 9-22. Continued

Compound	Cases	Frequency	ppbC Minimum	Maximum	Median	Average	Standard Deviation	Skewness	Kurtosis
n-Decane	0	0.00%	.	.	.	.	.	.	.
1,2,3-Trimethylbenzene	8	100.00%	0.76	2.58	1.95	1.78	0.64	-0.41	-0.95
p-Diethylbenzene	3	37.50%	0.49	1.23	0.71	0.81	0.38	1.10	.
1-Undecene	8	100.00%	1.74	5.36	2.89	3.21	1.40	0.79	-0.73
n-Undecane	8	100.00%	0.75	2.18	1.06	1.24	0.56	1.16	-0.28
1-Dodecene	8	100.00%	0.96	2.95	1.81	1.82	0.66	0.40	-0.13
n-Dodecane	8	100.00%	0.59	1.44	0.91	0.97	0.33	0.58	-1.25
1-Tridecene	2	25.00%	0.52	0.77	0.65	0.65	0.18	.	.
n-Tridecane	3	37.50%	0.55	0.96	0.66	0.72	0.21	1.22	.

Table 9-23. 1992 Summary Statistics for Salt Lake City, UT (S2UT)

			ppbC						
Compound	Cases	Frequency	Minimum	Maximum	Median	Average	Standard Deviation	Skewness	Kurtosis
Ethylene	8	100.00%	11.63	51.54	39.82	35.49	12.56	-0.94	0.76
Acetylene	8	100.00%	6.84	34.22	23.75	22.95	9.08	-0.59	-0.14
Ethane	8	100.00%	7.21	61.51	38.52	39.74	17.85	-0.59	0.15
Propylene	8	100.00%	3.50	21.61	15.42	14.24	5.27	-1.10	2.41
Propane	8	100.00%	6.23	39.23	28.39	28.65	10.59	-1.41	2.67
Propyne	0	0.00%	.	.	.	.	.	.	.
Isobutane	8	100.00%	2.86	18.71	13.03	12.34	4.70	-1.05	2.05
Isobutene	0	0.00%	.	.	.	.	.	.	.
1-Butene	8	100.00%	2.01	10.70	7.91	7.24	2.53	-1.17	2.59
1,3-Butadiene	8	100.00%	0.54	3.91	2.62	2.49	0.98	-0.88	1.98
n-Butane	8	100.00%	9.20	53.95	35.99	33.66	13.35	-0.51	0.94
t-2-Butene	7	87.50%	2.11	3.86	2.92	2.98	0.55	0.14	0.97
c-2-Butene	7	87.50%	0.81	3.38	1.87	1.99	0.93	0.52	-0.89
3-Methyl-1-butene	7	87.50%	0.93	1.52	1.25	1.21	0.20	0.11	-0.37
Isopentane	8	100.00%	15.67	163.79	73.21	82.13	45.04	0.54	0.65
1-Pentene	7	87.50%	1.85	3.16	2.20	2.39	0.48	0.80	-0.73
2-Methyl-1-butene	8	100.00%	0.97	6.01	4.45	4.25	1.57	-1.34	2.42
n-Pentane	8	100.00%	8.37	46.22	35.33	33.91	11.85	-1.53	3.18
Isoprene	8	100.00%	0.76	2.24	1.82	1.74	0.44	-1.83	4.53
t-2-Pentene	8	100.00%	1.13	8.20	5.14	5.30	2.23	-0.63	0.69
c-2-Pentene	8	100.00%	0.60	3.51	2.46	2.42	0.90	-1.13	1.78
2-Methyl-2-butene	8	100.00%	1.40	8.72	6.36	5.90	2.28	-1.06	1.44
Neohexane	7	87.50%	1.28	1.84	1.72	1.59	0.22	-0.43	-2.03
Cyclopentene	7	87.50%	0.64	1.28	0.90	0.93	0.22	0.55	-0.41
4-Methyl-1-pentene	6	75.00%	0.56	1.60	1.19	1.19	0.37	-0.87	1.15
2,3-Dimethylbutane	8	100.00%	0.59	3.15	2.42	2.31	0.79	-1.59	3.48
Cyclopentane	8	100.00%	2.10	10.18	7.93	7.65	2.49	-1.79	4.09
Isohexane	8	100.00%	6.06	32.79	24.58	23.80	8.27	-1.49	3.11
3-Methylpentane	8	100.00%	3.26	24.53	19.01	18.44	6.81	-1.80	4.01
1-Hexene	0	0.00%	.	.	.	.	.	.	.
2-Methyl-1-pentene	7	87.50%	1.95	3.10	2.35	2.44	0.39	0.67	0.12
2-Ethyl-1-butene	0	0.00%	.	.	.	.	.	.	.
n-Hexane	8	100.00%	5.58	29.11	22.80	21.54	7.29	-1.64	3.60
t-2-Hexene	7	87.50%	0.89	1.74	1.37	1.33	0.27	-0.22	0.55

Table 9-23. Continued

Compound	Cases	Frequency	ppbC Minimum	Maximum	Median	Average	Standard Deviation	Skewness	Kurtos
c-2-Hexene	7	87.50%	0.62	1.31	0.94	0.97	0.23	-0.06	0.(
Methylcyclopentane	8	100.00%	1.91	14.63	11.46	9.87	4.74	-1.09	-0.:
2,4-Dimethylpentane	8	100.00%	1.67	9.10	7.12	6.62	2.32	-1.52	2.(
Benzene	8	100.00%	7.94	40.90	30.81	29.59	9.76	-1.69	4.'
Cyclohexane	8	100.00%	4.03	7.89	6.59	6.42	1.23	-1.04	1.(
Isoheptane	7	87.50%	4.58	7.35	5.59	6.05	1.11	0.09	-1.!
2,3-Dimethylpentane	7	87.50%	4.04	27.80	6.48	9.13	8.35	2.49	6.·
3-Methylhexane	8	100.00%	5.59	15.73	12.55	12.18	3.40	-1.03	0.:
2,2,4-Trimethylpentane	8	100.00%	4.86	25.02	21.26	18.85	6.54	-1.62	2.
1-Heptene	8	100.00%	0.66	2.55	2.01	1.90	0.59	-1.37	2.
n-Heptane	8	100.00%	3.87	13.28	10.05	9.96	3.13	-0.98	0.
Methylcyclohexane	8	100.00%	1.65	7.86	5.96	5.64	2.04	-1.11	1.
2,2,3-Trimethylpentane	8	100.00%	0.91	4.07	3.37	3.04	1.01	-1.51	2.
2,3,4-Trimethylpentane	8	100.00%	1.69	9.40	7.45	6.68	2.43	-1.36	1.
Toluene	8	100.00%	20.55	107.00	83.65	79.04	27.11	-1.56	3.
2-Methylheptane	8	100.00%	1.51	8.01	5.73	5.66	2.11	-1.04	1.
3-Methylheptane	8	100.00%	1.23	7.01	5.19	4.98	1.81	-1.34	2.
1-Octene	8	100.00%	0.55	2.97	2.49	2.17	0.79	-1.43	1.
n-Octane	8	100.00%	0.94	9.13	5.20	5.33	2.60	-0.19	0.
Ethylbenzene	8	100.00%	2.95	15.06	11.10	10.64	3.64	-1.36	2.
p-Xylene + m-Xylene	8	100.00%	12.42	65.81	47.86	46.04	16.01	-1.30	2.
Styrene	7	87.50%	1.13	3.56	2.23	2.26	0.76	0.37	1
o-Xylene	8	100.00%	3.52	20.09	14.70	13.99	4.94	-1.36	3
1-Nonene	7	87.50%	1.09	1.63	1.24	1.34	0.20	0.38	-1
n-Nonane	8	100.00%	1.10	4.71	3.25	3.24	1.12	-0.72	1
Isopropylbenzene	7	87.50%	0.50	0.61	0.57	0.55	0.05	-0.17	-2
n-Propylbenzene	8	100.00%	2.03	3.60	3.12	2.97	0.55	-0.67	-0
alpha-Pinene	8	100.00%	0.79	3.32	2.51	2.43	0.78	-1.40	2
m-Ethyltoluene	8	100.00%	2.08	11.23	8.25	7.73	2.69	-1.28	2
p-Ethyltoluene	7	87.50%	1.85	3.07	2.32	2.40	0.38	0.57	1
1,3,5-Trimethylbenzene	8	100.00%	1.11	6.84	4.62	4.67	1.74	-1.09	2
o-Ethyltoluene	8	100.00%	1.53	5.73	4.20	4.06	1.21	-1.20	3
1-Decene	0	0.00%	.	.	.	.	.	.	.
1,2,4-Trimethylbenzene	8	100.00%	4.10	20.82	15.02	14.27	4.91	-1.16	2

Table 9-23. Continued

Compound	Cases	Frequency	ppbC Minimum	Maximum	Median	Average	Standard Deviation	Skewness	Kurtosis
n-Decane	6	75.00%	1.50	2.37	1.98	1.94	0.34	-0.18	-1.55
1,2,3-Trimethylbenzene	8	100.00%	3.86	6.36	4.29	4.61	0.86	1.50	1.71
p-Diethylbenzene	7	87.50%	1.16	2.67	1.61	1.72	0.60	0.77	-1.01
1-Undecene	7	87.50%	0.56	3.35	0.85	1.21	0.96	2.44	6.16
n-Undecane	8	100.00%	3.28	5.15	4.00	4.19	0.67	0.26	-1.47
1-Dodecene	3	37.50%	0.55	1.68	0.86	1.03	0.58	1.20	.
n-Dodecane	8	100.00%	1.88	3.64	2.50	2.53	0.66	0.49	-1.13
1-Tridecene	0	0.00%	.	.	.	.	.	.	.
n-Tridecane	8	100.00%	0.81	1.88	1.16	1.25	0.39	0.77	-0.74

Table 9-24. 1992 Summary Statistics for Salt Lake City, UT (S3UT)

			ppbC						
Compound	Cases	Frequency	Minimum	Maximum	Median	Average	Standard Deviation	Skewness	Kurtosis
Ethylene	8	100.00%	5.10	35.83	28.83	23.45	11.62	-0.63	-1.50
Acetylene	8	100.00%	1.87	30.14	20.09	16.97	11.24	-0.27	-1.70
Ethane	8	100.00%	5.01	42.55	30.46	26.18	12.45	-0.64	-0.45
Propylene	8	100.00%	1.03	19.39	11.93	10.40	6.79	-0.23	-1.62
Propane	8	100.00%	2.89	109.29	42.57	40.07	34.51	1.06	1.55
Propyne	0	0.00%	.	.	.	.	.	.	.
Isobutane	8	100.00%	0.81	40.00	18.45	18.07	14.00	0.20	-1.19
Isobutene	0	0.00%	.	.	.	.	.	.	.
1-Butene	8	100.00%	0.74	9.03	6.14	5.48	2.97	-0.53	-1.08
1,3-Butadiene	5	62.50%	0.63	2.15	1.89	1.53	0.72	-0.60	-2.82
n-Butane	8	100.00%	2.75	61.82	39.18	33.27	21.61	-0.21	-1.32
t-2-Butene	7	87.50%	0.81	3.78	2.38	2.35	0.97	-0.20	0.04
c-2-Butene	6	75.00%	1.16	2.30	1.79	1.73	0.45	-0.15	-1.73
3-Methyl-1-butene	5	62.50%	0.72	1.13	0.94	0.94	0.18	-0.13	-2.37
Isopentane	8	100.00%	4.90	81.44	66.03	53.49	28.76	-0.98	-0.61
1-Pentene	6	75.00%	1.94	4.75	2.33	2.69	1.04	2.10	4.61
2-Methyl-1-butene	7	87.50%	1.10	5.10	3.60	3.34	1.25	-0.70	1.42
n-Pentane	8	100.00%	2.18	48.01	35.39	28.82	16.46	-0.76	-0.85
Isoprene	7	87.50%	0.56	3.36	1.23	1.49	0.88	1.97	4.91
t-2-Pentene	7	87.50%	1.27	5.50	3.84	3.55	1.34	-0.52	0.79
c-2-Pentene	6	75.00%	0.69	2.98	2.14	2.03	0.83	-0.70	0.02
2-Methyl-2-butene	8	100.00%	0.86	8.25	3.91	4.03	2.55	0.39	-0.99
Neohexane	7	87.50%	0.57	2.59	1.22	1.36	0.64	1.24	2.34
Cyclopentene	5	62.50%	0.56	0.96	0.70	0.73	0.15	1.01	1.90
4-Methyl-1-pentene	6	75.00%	0.93	1.43	1.12	1.16	0.19	0.42	-1.32
2,3-Dimethylbutane	7	87.50%	0.55	2.81	2.50	2.12	0.80	-1.53	2.10
Cyclopentane	8	100.00%	0.73	8.54	6.19	5.55	2.61	-1.06	0.36
Isohexane	8	100.00%	1.76	27.14	19.78	17.75	8.98	-1.06	-0.01
3-Methylpentane	8	100.00%	0.99	17.91	12.55	11.32	5.91	-0.90	-0.12
1-Hexene	0	0.00%	.	.	.	.	.	.	.
2-Methyl-1-pentene	6	75.00%	0.64	2.65	1.97	1.84	0.66	-1.20	2.81
2-Ethyl-1-butene	0	0.00%	.	.	.	.	.	.	.
n-Hexane	8	100.00%	1.41	22.49	17.87	15.27	7.70	-1.16	0.01
t-2-Hexene	6	75.00%	0.62	1.67	1.19	1.15	0.35	-0.02	1.16

Table 9-24. Continued

Compound	Cases	Frequency	ppbC Minimum	Maximum	Median	Average	Standard Deviation	Skewness	Kurtosis
c-2-Hexene	5	62.50%	0.65	1.13	0.86	0.84	0.19	0.95	0.99
Methylcyclopentane	8	100.00%	0.55	11.76	8.57	7.60	3.85	-1.11	0.26
2,4-Dimethylpentane	7	87.50%	0.95	8.06	4.90	4.38	2.40	-0.01	-0.36
Benzene	8	100.00%	2.81	28.54	21.05	17.81	8.74	-0.71	-0.57
Cyclohexane	8	100.00%	0.66	8.63	5.15	5.11	2.59	-0.48	-0.04
Isoheptane	5	62.50%	1.34	13.64	4.94	5.78	4.68	1.57	3.07
2,3-Dimethylpentane	6	75.00%	1.96	20.03	8.82	10.24	7.53	0.30	-2.19
3-Methylhexane	8	100.00%	1.56	12.62	8.71	7.98	3.65	-0.81	0.03
2,2,4-Trimethylpentane	8	100.00%	1.51	23.47	15.64	13.90	7.15	-0.60	-0.22
1-Heptene	7	87.50%	0.59	2.10	1.43	1.47	0.49	-0.71	0.89
n-Heptane	8	100.00%	0.57	13.33	8.32	7.67	4.25	-0.58	-0.39
Methylcyclohexane	7	87.50%	1.86	13.42	7.76	7.44	3.63	0.16	0.81
2,2,3-Trimethylpentane	7	87.50%	1.12	3.67	2.55	2.48	0.90	-0.39	-0.80
2,3,4-Trimethylpentane	8	100.00%	0.53	7.54	5.74	4.68	2.36	-0.76	-0.47
Toluene	8	100.00%	5.09	85.69	53.99	46.62	25.77	-0.26	-0.37
2-Methylheptane	7	87.50%	1.69	15.33	4.73	6.04	4.38	1.96	4.59
3-Methylheptane	7	87.50%	1.53	9.36	4.10	4.40	2.53	1.34	2.38
1-Octene	7	87.50%	0.84	2.94	1.82	1.68	0.77	0.55	-0.68
n-Octane	7	87.50%	1.10	28.68	4.66	7.24	9.55	2.54	6.58
Ethylbenzene	8	100.00%	0.75	12.53	7.17	6.64	3.95	-0.04	-0.87
p-Xylene + m-Xylene	8	100.00%	3.19	52.99	32.18	29.45	17.06	-0.19	-1.00
Styrene	6	75.00%	0.70	3.11	1.32	1.55	0.83	1.64	3.41
o-Xylene	8	100.00%	0.77	14.93	9.48	8.78	4.91	-0.38	-0.78
1-Nonene	6	75.00%	1.00	2.40	1.38	1.49	0.52	1.24	1.42
n-Nonane	6	75.00%	2.47	9.34	4.22	4.72	2.40	1.82	3.91
Isopropylbenzene	2	25.00%	0.57	0.78	0.67	0.67	0.15	.	.
n-Propylbenzene	8	100.00%	0.91	3.47	2.36	2.26	0.85	-0.42	-0.44
alpha-Pinene	7	87.50%	0.69	2.52	1.75	1.72	0.59	-0.57	0.98
m-Ethyltoluene	7	87.50%	1.75	7.94	4.75	4.45	2.30	0.26	-1.32
p-Ethyltoluene	7	87.50%	0.67	6.33	1.40	2.05	1.95	2.29	5.56
1,3,5-Trimethylbenzene	7	87.50%	1.30	4.83	2.58	2.95	1.55	0.18	-2.43
o-Ethyltoluene	8	100.00%	0.63	4.37	2.80	2.63	1.18	-0.55	0.27
1-Decene	0	0.00%	.	.	.	.	.	.	.
1,2,4-Trimethylbenzene	8	100.00%	1.09	14.74	9.84	8.47	4.57	-0.40	-0.87

Table 9-24. Continued

Compound	Cases	Frequency	ppbC Minimum	Maximum	Median	Average	Standard Deviation	Skewness	Kurtosi
n-Decane	7	87.50%	0.68	3.35	2.96	2.45	0.95	-1.26	0.9
1,2,3-Trimethylbenzene	8	100.00%	1.22	4.71	3.45	3.24	1.13	-0.71	0.1
p-Diethylbenzene	5	62.50%	0.97	1.60	1.17	1.26	0.31	0.36	-3.0
1-Undecene	6	75.00%	0.55	4.19	0.90	1.47	1.37	2.16	4.8
n-Undecane	8	100.00%	1.45	5.07	3.05	3.17	1.25	0.00	-0.8
1-Dodecene	4	50.00%	0.61	3.44	0.99	1.50	1.32	1.79	3.2
n-Dodecane	8	100.00%	0.94	4.17	1.73	2.21	1.19	0.73	-0.9
1-Tridecene	1	12.50%	0.26	0.26	0.26	0.26	.	.	.
n-Tridecane	7	87.50%	0.55	1.71	1.19	1.16	0.35	-0.32	1.6

Table 9-25. 1992 Summary Statistics for Winston Salem, NC (WSNC)

			ppbC						
Compound	Cases	Frequency	Minimum	Maximum	Median	Average	Standard Deviation	Skewness	Kurtosis
Ethylene	8	100.00%	3.97	21.97	6.78	9.72	6.91	1.34	0.10
Acetylene	7	87.50%	1.79	16.03	3.17	6.15	5.71	1.27	-0.13
Ethane	8	100.00%	3.75	18.10	6.16	7.74	4.83	1.64	2.79
Propylene	7	87.50%	1.10	6.67	1.30	2.77	2.33	1.22	-0.45
Propane	8	100.00%	2.65	23.54	5.48	9.23	8.49	1.27	-0.19
Propyne	0	0.00%	.	.	.	.	.	.	.
Isobutane	8	100.00%	0.81	6.83	1.76	2.75	2.34	1.30	-0.05
Isobutene	0	0.00%	.	.	.	.	.	.	.
1-Butene	8	100.00%	0.59	4.71	0.92	1.68	1.61	1.49	0.60
1,3-Butadiene	2	25.00%	1.13	1.84	1.49	1.49	0.50	.	.
n-Butane	8	100.00%	1.37	11.97	2.80	4.87	4.08	1.28	-0.08
t-2-Butene	2	25.00%	1.50	1.57	1.54	1.54	0.05	.	.
c-2-Butene	1	12.50%	0.75	0.75	0.75	0.75	.	.	.
3-Methyl-1-butene	2	25.00%	0.83	0.91	0.87	0.87	0.06	.	.
Isopentane	8	100.00%	3.61	42.16	6.31	13.41	15.28	1.51	0.60
1-Pentene	1	12.50%	1.23	1.23	1.23	1.23	.	.	.
2-Methyl-1-butene	2	25.00%	2.65	3.15	2.90	2.90	0.35	.	.
n-Pentane	8	100.00%	1.21	14.75	2.10	4.84	5.51	1.45	0.24
Isoprene	3	37.50%	0.60	5.61	2.55	2.92	2.53	0.65	.
t-2-Pentene	4	50.00%	0.49	3.12	1.71	1.76	1.39	0.04	-5.68
c-2-Pentene	2	25.00%	1.49	1.93	1.71	1.71	0.31	.	.
2-Methyl-2-butene	4	50.00%	0.48	5.01	1.95	2.35	2.21	0.48	-3.28
Neohexane	4	50.00%	0.60	1.17	0.90	0.89	0.32	-0.01	-5.92
Cyclopentene	2	25.00%	0.64	0.86	0.75	0.75	0.16	.	.
4-Methyl-1-pentene	1	12.50%	1.05	1.05	1.05	1.05	.	.	.
2,3-Dimethylbutane	2	25.00%	1.12	1.29	1.21	1.21	0.12	.	.
Cyclopentane	6	75.00%	0.68	4.29	1.05	1.92	1.59	1.01	-1.38
Isohexane	8	100.00%	1.19	11.87	1.87	4.08	4.51	1.42	0.06
3-Methylpentane	8	100.00%	0.73	10.91	1.13	3.26	4.26	1.47	0.26
1-Hexene	0	0.00%	.	.	.	.	.	.	.
2-Methyl-1-pentene	2	25.00%	1.28	1.65	1.47	1.47	0.26	.	.
2-Ethyl-1-butene	0	0.00%	.	.	.	.	.	.	.
n-Hexane	8	100.00%	0.69	6.34	1.01	2.20	2.37	1.43	0.10
t-2-Hexene	2	25.00%	1.48	2.82	2.15	2.15	0.95	.	.

Table 9-25. Continued

Compound	Cases	Frequency	ppbC Minimum	Maximum	Median	Average	Standard Deviation	Skewness	Kurtosis
c-2-Hexene	2	25.00%	0.69	0.79	0.74	0.74	0.07	.	.
Methylcyclopentane	6	75.00%	0.54	4.38	0.82	1.84	1.79	0.98	-1.6
2,4-Dimethylpentane	4	50.00%	0.77	3.31	1.98	2.01	1.39	0.02	-5.8
Benzene	8	100.00%	2.21	12.60	3.01	5.13	4.27	1.41	0.0
Cyclohexane	6	75.00%	0.58	3.01	0.79	1.23	0.94	1.83	3.1
Isoheptane	3	37.50%	1.27	2.32	1.95	1.85	0.53	-0.84	.
2,3-Dimethylpentane	4	50.00%	0.68	2.10	1.34	1.36	0.65	0.15	-3.2
3-Methylhexane	8	100.00%	1.07	5.12	1.52	2.34	1.68	1.31	-0.1
2,2,4-Trimethylpentane	8	100.00%	1.19	11.80	2.24	4.41	4.49	1.33	-0.1
1-Heptene	1	12.50%	1.15	1.15	1.15	1.15	.	.	.
n-Heptane	5	62.50%	0.60	9.95	0.96	4.11	4.54	0.70	-2.8
Methylcyclohexane	3	37.50%	0.48	2.36	1.67	1.50	0.95	-0.76	.
2,2,3-Trimethylpentane	3	37.50%	0.53	1.82	1.73	1.36	0.72	-1.70	.
2,3,4-Trimethylpentane	6	75.00%	0.58	4.63	1.06	2.04	1.86	0.94	-1.7
Toluene	8	100.00%	4.36	51.13	7.75	17.04	19.55	1.43	0.1
2-Methylheptane	3	37.50%	0.50	2.32	2.08	1.63	0.99	-1.62	.
3-Methylheptane	2	25.00%	1.77	2.05	1.91	1.91	0.20	.	.
1-Octene	3	37.50%	0.46	1.59	1.56	1.20	0.64	-1.73	.
n-Octane	3	37.50%	0.67	1.47	1.18	1.11	0.41	-0.79	.
Ethylbenzene	8	100.00%	0.57	5.73	1.05	2.09	2.25	1.40	-0.0
p-Xylene + m-Xylene	8	100.00%	1.70	19.05	3.37	6.77	7.56	1.40	-0.0
Styrene	2	25.00%	1.11	1.22	1.17	1.17	0.08	.	.
o-Xylene	8	100.00%	0.54	6.90	0.88	2.25	2.77	1.43	0.0
1-Nonene	2	25.00%	0.75	0.87	0.81	0.81	0.09	.	.
n-Nonane	3	37.50%	0.58	3.30	1.58	1.82	1.38	0.76	.
Isopropylbenzene	0	0.00%	.	.	.	.	.	.	.
n-Propylbenzene	8	100.00%	0.51	6.88	1.45	1.89	2.06	2.60	7.0
alpha-Pinene	2	25.00%	2.18	2.44	2.31	2.31	0.18	.	.
m-Ethyltoluene	7	87.50%	0.66	5.77	1.07	2.28	2.32	1.22	-0.
p-Ethyltoluene	2	25.00%	1.38	1.60	1.49	1.49	0.16	.	.
1,3,5-Trimethylbenzene	4	50.00%	0.56	2.80	1.59	1.64	1.23	0.02	-5.
o-Ethyltoluene	6	75.00%	0.59	4.41	0.80	1.77	1.70	1.08	-1.
1-Decene	0	0.00%	.	.	.	.	.	.	.
1,2,4-Trimethylbenzene	8	100.00%	0.84	10.18	1.47	3.38	3.88	1.44	0.

Table 9-25. Continued

Compound	Cases	Frequency	ppbC Minimum	Maximum	Median	Average	Standard Deviation	Skewness	Kurtosis
n-Decane	3	37.50%	0.54	5.57	3.79	3.30	2.55	-0.83	.
1,2,3-Trimethylbenzene	8	100.00%	1.02	4.91	2.25	2.49	1.30	1.07	0.48
p-Diethylbenzene	5	62.50%	1.05	1.44	1.41	1.28	0.20	-0.60	-3.28
1-Undecene	8	100.00%	1.04	6.39	3.58	3.68	1.53	0.16	1.64
n-Undecane	8	100.00%	0.73	4.90	1.44	2.16	1.50	1.04	-0.17
1-Dodecene	7	87.50%	1.14	2.25	1.49	1.60	0.35	0.99	1.69
n-Dodecane	8	100.00%	0.82	3.79	1.56	1.96	1.16	1.02	-0.56
1-Tridecene	1	12.50%	0.52	0.52	0.52	0.52	.	.	.
n-Tridecane	8	100.00%	0.57	4.86	0.87	1.41	1.43	2.57	6.83

sample date and considered as one sample for the summary statistics. The target compounds for the 1992 monitoring season are given in the first column of the summary statistics tables. The cases columns denote the number of samples the compound was identified in for the 1992 monitoring season. The third column in the tables records the percent of the samples in which a particular compound was identified. The minimum, maximum, median, average, standard deviation, skewness, and kurtosis of the measured concentrations in ppbC are also listed in each table for each target compound.

9.3 Overall Data Summary

Table 9-26 presents the overall summary statistics for all daily monitoring sites in the 1992 monitoring program. The analysis results of 681 samples were considered for these statistics. Duplicate and duplicate/replicate data for a given sample date were averaged and considered as one sample. Average concentrations ranged from 0.59 ppbC for 2-ethyl-1-butene to 27.04 ppbC for propane. The largest standard deviation of concentration, 77.63 ppbC, was observed for propane.

Table 9-27 contains overall summary statistics for all optional analysis sties in the 1992 monitoring program. A total of 62 samples were considered, and statistics are reported in the same manner as the daily monitoring summary statistics. Average concentrations ranged from 0.97 ppbC for 1-tridecene to 44.23 ppbC for isopentane. The largest standard deviation was 67.90 ppbC for n-undecane.

Table 9-26. 1992 Summary Statistics for All Program Sites

Compound	Cases	Frequency	ppbC Minimum	Maximum	Median	Average	Standard Deviation	Skewness	Kurtosis
Ethylene	676	99.27%	0.89	484.61	11.78	16.92	28.34	10.71	146.61
Acetylene	634	93.10%	0.59	52.58	6.44	8.89	7.60	1.64	3.19
Ethane	677	99.41%	0.75	235.60	10.02	15.75	19.55	5.65	51.29
Propylene	665	97.65%	0.60	158.65	3.84	6.14	10.86	8.91	96.86
Propane	680	99.85%	0.99	1851.76	13.10	27.04	77.63	19.47	451.25
Propyne	0	0.00%	.	.	.	.	.	.	.
Isobutane	667	97.94%	0.59	120.63	4.66	7.47	9.17	4.99	43.94
Isobutene	0	0.00%	.	.	.	.	.	.	.
1-Butene	664	97.50%	0.53	22.51	2.66	3.37	2.55	2.27	9.13
1,3-Butadiene	428	62.85%	0.39	30.78	1.21	1.60	1.79	10.90	167.01
n-Butane	680	99.85%	0.66	126.81	10.99	15.16	13.84	2.48	10.19
t-2-Butene	432	63.44%	0.49	12.10	1.22	1.53	1.22	3.78	23.03
c-2-Butene	310	45.52%	0.45	39.63	0.96	1.57	2.78	9.45	116.57
3-Methyl-1-butene	243	35.68%	0.44	4.07	0.86	1.05	0.59	2.10	5.81
Isopentane	675	99.12%	0.92	165.71	19.36	26.62	24.26	2.27	7.07
1-Pentene	257	37.74%	0.50	10.73	1.39	2.06	1.82	2.37	6.29
2-Methyl-1-butene	555	81.50%	0.49	13.31	1.64	2.15	1.77	2.37	8.14
n-Pentane	677	99.41%	0.56	72.53	8.26	11.57	10.63	2.22	6.52
Isoprene	590	86.64%	0.48	23.91	1.61	3.12	3.56	2.54	7.95
t-2-Pentene	556	81.64%	0.47	15.78	1.72	2.46	2.29	2.69	9.50
c-2-Pentene	459	67.40%	0.44	16.71	1.28	1.59	1.26	5.09	48.01
2-Methyl-2-butene	597	87.67%	0.34	21.14	2.04	2.84	2.56	2.58	9.77
Neohexane	667	97.94%	0.57	131.26	13.88	19.07	17.36	2.18	6.44
Cyclopentene	212	31.13%	0.40	2.50	0.79	0.92	0.44	1.74	2.98
4-Methyl-1-pentene	514	75.48%	0.43	3.42	0.90	1.02	0.46	1.61	3.52
2,3-Dimethylbutane	470	69.02%	0.43	7.96	1.16	1.50	1.03	2.15	6.46
Cyclopentane	642	94.27%	0.54	13.60	2.30	3.00	2.19	1.56	2.86
Isohexane	675	99.12%	0.51	49.15	5.69	7.90	6.70	1.93	4.90
3-Methylpentane	665	97.65%	0.52	27.02	4.77	6.14	4.76	1.40	2.03
1-Hexene	7	1.03%	0.71	2.93	1.04	1.49	0.91	0.81	-1.18
2-Methyl-1-pentene	389	57.12%	0.48	5.65	1.07	1.33	0.83	1.81	3.69
2-Ethyl-1-butene	1	0.15%	0.59	0.59	0.59	0.59	.	.	.
n-Hexane	670	98.38%	0.50	50.40	4.25	6.30	5.85	2.44	9.89
t-2-Hexene	268	39.35%	0.46	5.91	0.83	1.10	0.72	2.65	9.91

Table 9-26. Continued

Compound	Cases	Frequency	ppbC Minimum	Maximum	Median	Average	Standard Deviation	Skewness	Kurtos
c-2-Hexene	161	23.64%	0.44	2.15	0.73	0.84	0.35	1.52	2.0
Methylcyclopentane	651	95.59%	0.51	21.52	2.83	3.87	3.05	1.70	4.0
2,4-Dimethylpentane	566	83.11%	0.46	12.40	1.58	2.35	1.98	1.79	3.9
Benzene	681	100.00%	1.01	55.97	6.64	8.90	7.02	2.12	6.6
Cyclohexane	639	93.83%	0.53	35.92	2.31	3.23	3.27	4.35	28.0
Isoheptane	571	83.85%	0.52	19.43	2.18	3.03	2.76	2.41	7.0
2,3-Dimethylpentane	284	41.70%	0.49	14.32	2.59	3.37	2.66	1.53	2.7
3-Methylhexane	681	100.00%	0.54	15.21	3.18	3.87	2.36	1.38	2.3
2,2,4-Trimethylpentane	671	98.53%	0.52	46.03	4.77	6.68	6.08	2.28	7.6
1-Heptene	314	46.11%	0.44	13.20	0.91	1.19	1.07	6.21	57.3
n-Heptane	626	91.92%	0.47	18.88	1.76	2.35	1.92	3.07	17.5
Methylcyclohexane	560	82.23%	0.50	16.23	1.44	1.87	1.53	3.93	26.1
2,2,3-Trimethylpentane	483	70.93%	0.37	5.99	1.11	1.36	0.87	1.95	4.6
2,3,4-Trimethylpentane	612	89.87%	0.47	15.12	1.94	2.63	2.16	2.07	5.1
Toluene	681	100.00%	1.08	218.21	17.94	24.37	22.31	2.88	14.3
2-Methylheptane	575	84.43%	0.51	8.83	1.39	1.75	1.16	1.88	5.3
3-Methylheptane	529	77.68%	0.43	8.12	1.21	1.56	1.01	1.81	5.6
1-Octene	398	58.44%	0.47	5.88	1.10	1.38	0.89	1.90	4.
n-Octane	487	71.51%	0.45	26.34	1.08	1.52	1.94	8.32	90.
Ethylbenzene	659	96.77%	0.49	25.04	3.08	4.16	3.29	1.72	4.
p-Xylene + m-Xylene	680	99.85%	0.57	91.09	9.60	13.15	11.08	1.98	6.
Styrene	481	70.63%	0.45	15.83	1.01	1.37	1.20	5.43	49.
o-Xylene	656	96.33%	0.53	28.10	3.27	4.50	3.71	1.94	5.
1-Nonene	205	30.10%	0.37	2.58	0.87	0.94	0.38	1.39	2.
n-Nonane	517	75.92%	0.48	9.30	1.26	1.76	1.36	2.19	6.
Isopropylbenzene	146	21.44%	0.38	2.95	0.69	0.80	0.38	3.61	15.
n-Propylbenzene	635	93.25%	0.50	182.16	2.22	3.57	8.32	16.37	337.
alpha-Pinene	538	79.00%	0.49	7.15	1.15	1.48	0.97	2.02	5
m-Ethyltoluene	652	95.74%	0.52	19.35	2.80	3.64	2.72	1.97	5
p-Ethyltoluene	402	59.03%	0.40	5.58	1.13	1.32	0.78	2.08	6
1,3,5-Trimethylbenzene	587	86.20%	0.47	9.44	1.42	1.88	1.42	2.07	5
o-Ethyltoluene	661	97.06%	0.45	11.25	1.79	2.32	1.57	1.80	4
1-Decene	7	1.03%	0.81	4.04	1.95	2.24	1.23	0.51	-1
1,2,4-Trimethylbenzene	674	98.97%	0.51	34.96	4.13	5.66	4.66	1.96	5

Table 9-26. Continued

Compound	Cases	Frequency	ppbC Minimum	Maximum	Median	Average	Standard Deviation	Skewness	Kurtosis
n-Decane	403	59.18%	0.43	34.23	1.51	2.72	3.63	4.50	28.86
1,2,3-Trimethylbenzene	678	99.56%	0.76	24.20	2.86	3.42	2.09	3.34	21.83
p-Diethylbenzene	491	72.10%	0.47	6.43	1.04	1.25	0.71	2.35	9.25
1-Undecene	651	95.59%	0.48	22.50	1.65	2.38	2.31	3.52	16.73
n-Undecane	665	97.65%	0.50	89.40	2.35	3.58	6.25	8.68	94.45
1-Dodecene	630	92.51%	0.49	13.45	1.10	1.60	1.54	3.45	15.18
n-Dodecane	648	95.15%	0.49	104.86	1.48	2.73	7.03	11.19	145.44
1-Tridecene	174	25.55%	0.46	11.15	0.77	1.05	1.00	6.66	61.52
n-Tridecane	492	72.25%	0.43	41.76	0.92	1.49	2.74	9.58	115.34

Table 9-27. 1992 Summary Statistics for All Option Sites

			ppbC						
Compound	Cases	Frequency	Minimum	Maximum	Median	Average	Standard Deviation	Skewness	Kurtosis
Ethylene	62	100.00%	3.28	105.06	14.57	22.19	19.46	2.04	5.09
Acetylene	59	95.16%	1.07	47.23	7.48	11.43	10.45	1.44	1.56
Ethane	62	100.00%	2.29	115.23	16.12	23.43	24.01	1.82	3.52
Propylene	61	98.39%	0.77	23.59	6.32	8.21	6.50	0.73	-0.66
Propane	62	100.00%	2.08	465.52	13.73	26.26	59.58	6.82	50.36
Propyne	0	0.00%	.	.	.	.	.	.	.
Isobutane	62	100.00%	0.77	40.00	6.69	10.23	9.39	1.15	0.74
Isobutene	0	0.00%	.	.	.	.	.	.	.
1-Butene	62	100.00%	0.59	12.48	3.90	4.72	3.40	0.59	-0.71
1,3-Butadiene	39	62.90%	0.54	3.91	1.84	1.64	0.89	0.50	-0.68
n-Butane	62	100.00%	1.37	61.82	15.44	19.50	16.85	0.92	-0.09
t-2-Butene	47	75.81%	0.50	8.22	2.11	2.56	1.78	1.27	1.50
c-2-Butene	36	58.06%	0.56	11.33	1.93	2.63	2.22	2.25	6.15
3-Methyl-1-butene	32	51.61%	0.47	4.28	1.07	1.13	0.68	3.39	15.04
Isopentane	62	100.00%	3.61	247.17	27.73	44.23	48.73	2.13	5.40
1-Pentene	37	59.68%	0.67	14.42	2.05	2.41	2.30	4.17	21.24
2-Methyl-1-butene	49	79.03%	0.65	25.78	2.65	3.46	3.78	4.52	25.86
n-Pentane	62	100.00%	1.21	106.50	9.44	17.31	18.84	2.13	6.94
Isoprene	47	75.81%	0.49	9.24	1.66	2.09	1.85	2.61	7.79
t-2-Pentene	49	79.03%	0.49	35.37	3.10	4.13	5.48	4.35	22.92
c-2-Pentene	44	70.97%	0.52	19.48	1.51	2.25	2.93	4.99	28.98
2-Methyl-2-butene	51	82.26%	0.41	51.48	2.53	4.66	7.39	5.34	33.37
Neohexane	42	67.74%	0.53	3.91	1.17	1.25	0.70	1.86	4.60
Cyclopentene	27	43.55%	0.56	7.25	0.90	1.20	1.27	4.49	21.7
4-Methyl-1-pentene	37	59.68%	0.49	5.77	1.08	1.18	0.85	4.58	24.9
2,3-Dimethylbutane	40	64.52%	0.55	15.76	1.69	2.09	2.41	4.90	27.7
Cyclopentane	57	91.94%	0.45	29.09	3.59	4.53	4.41	3.19	16.3
Isohexane	62	100.00%	0.80	105.04	6.57	12.56	15.36	3.76	20.9
3-Methylpentane	61	98.39%	0.62	55.83	5.58	8.47	9.20	2.59	10.6
1-Hexene	0	0.00%	.	.	.	.	.	.	.
2-Methyl-1-pentene	40	64.52%	0.56	17.01	1.79	2.10	2.58	5.20	30.3
2-Ethyl-1-butene	0	0.00%	.	.	.	.	.	.	.
n-Hexane	62	100.00%	0.63	29.11	4.54	8.43	8.65	1.06	-0.2
t-2-Hexene	33	53.23%	0.50	15.11	1.37	2.38	3.37	3.40	11.2

Table 9-27. Continued

Compound	Cases	Frequency	ppbC Minimum	Maximum	Median	Average	Standard Deviation	Skewness	Kurtosis
c-2-Hexene	27	43.55%	0.46	9.48	0.86	1.23	1.70	4.75	23.56
Methylcyclopentane	56	90.32%	0.54	22.99	3.31	5.22	4.70	1.40	2.26
2,4-Dimethylpentane	50	80.65%	0.65	9.10	2.20	3.30	2.50	0.86	-0.47
Benzene	62	100.00%	2.21	40.90	8.29	12.66	10.19	1.02	0.02
Cyclohexane	55	88.71%	0.49	40.45	3.01	4.36	5.65	4.98	31.47
Isoheptane	47	75.81%	0.57	16.84	3.06	4.36	3.99	1.53	2.08
2,3-Dimethylpentane	38	61.29%	0.52	27.80	2.16	4.84	6.28	2.26	4.89
3-Methylhexane	62	100.00%	1.05	21.14	5.32	6.44	4.95	0.90	0.12
2,2,4-Trimethylpentane	62	100.00%	0.90	25.02	6.86	9.10	7.06	0.72	-0.67
1-Heptene	32	51.61%	0.53	8.34	1.41	1.57	1.37	4.07	20.14
n-Heptane	55	88.71%	0.57	13.33	2.84	4.80	4.05	0.68	-0.90
Methylcyclohexane	47	75.81%	0.48	13.42	1.81	3.35	3.23	1.47	1.66
2,2,3-Trimethylpentane	48	77.42%	0.53	8.54	1.48	1.93	1.43	2.27	8.52
2,3,4-Trimethylpentane	56	90.32%	0.45	16.81	2.59	3.75	3.07	1.66	4.44
Toluene	62	100.00%	4.31	187.39	27.29	40.14	35.70	1.43	3.18
2-Methylheptane	50	80.65%	0.50	20.71	2.11	3.39	3.68	2.94	10.86
3-Methylheptane	47	75.81%	0.60	16.59	1.88	2.92	2.87	2.76	10.60
1-Octene	44	70.97%	0.46	4.64	1.38	1.56	0.96	1.07	1.01
n-Octane	44	70.97%	0.58	28.68	1.69	3.47	4.56	4.14	21.89
Ethylbenzene	61	98.39%	0.57	30.84	4.24	5.99	5.40	1.96	6.33
p-Xylene + m-Xylene	62	100.00%	1.70	114.81	15.48	23.15	21.73	1.63	3.94
Styrene	44	70.97%	0.54	8.42	1.51	1.77	1.35	3.24	13.70
o-Xylene	62	100.00%	0.53	39.30	5.17	7.57	7.25	1.82	5.11
1-Nonene	34	54.84%	0.47	13.04	1.14	1.69	2.22	4.44	21.82
n-Nonane	46	74.19%	0.58	40.77	2.04	3.79	6.35	4.82	26.54
Isopropylbenzene	26	41.94%	0.50	35.26	0.68	2.53	6.82	4.78	23.60
n-Propylbenzene	61	98.39%	0.51	29.31	2.31	3.49	4.27	4.10	22.25
alpha-Pinene	49	79.03%	0.56	37.54	1.89	3.35	6.02	4.56	23.02
m-Ethyltoluene	60	96.77%	0.61	38.63	4.11	6.06	7.09	2.96	9.87
p-Ethyltoluene	42	67.74%	0.55	19.25	1.69	2.69	3.49	3.39	12.90
1,3,5-Trimethylbenzene	53	85.48%	0.55	19.55	2.50	3.70	4.07	2.49	6.33
o-Ethyltoluene	60	96.77%	0.52	30.30	2.82	3.93	5.21	3.62	14.25
1-Decene	0	0.00%	.	.	.	.	.	.	.
1,2,4-Trimethylbenzene	62	100.00%	0.84	57.18	6.30	9.75	10.62	2.48	7.46

Table 9-27. Continued

Compound	Cases	Frequency	ppbC Minimum	Maximum	Median	Average	Standard Deviation	Skewness	Kurtos
n-Decane	36	58.06%	0.54	59.05	2.95	6.58	11.43	3.55	13.5
1,2,3-Trimethylbenzene	62	100.00%	0.76	17.81	3.45	3.82	3.03	2.74	9.6
p-Diethylbenzene	43	69.35%	0.49	5.18	1.44	1.70	1.05	2.03	4.3
1-Undecene	56	90.32%	0.55	49.40	2.22	3.86	7.45	5.20	28.7
n-Undecane	61	98.39%	0.61	404.04	3.31	20.99	67.90	4.74	23.1
1-Dodecene	47	75.81%	0.52	3.44	1.20	1.40	0.74	1.10	0.7
n-Dodecane	59	95.16%	0.59	308.21	1.88	11.86	42.54	6.25	42.3
1-Tridecene	10	16.13%	0.26	1.62	1.01	0.97	0.49	-0.04	-1.8
n-Tridecane	52	83.87%	0.52	35.78	0.97	3.27	7.64	3.69	12.9

9.4 Individual Sample Results

Appendix K contains the results from individual sample analyses. For each site sample, all target compounds are listed along with the concentration reported for each sample. There is also an unidentified compound sum concentration reported for each sample, labeled Unidentified VOC (Volatile Organic Compounds). The unidentified VOC total does not include the targeted compounds.

For daily monitoring program sites, the results are presented in a weekly report format (Monday to Friday). For days when duplicate samples were taken, the results for one of the duplicate samples was chosen to appear on the weekly report. The duplicate sample date can be used to reference a duplicate or duplicate/replicate report. The duplicate reports appear after the weekly reports for each site, and show a comparison of the results for a duplicate sample pair, or a duplicate pair with replicate analyses when done. For the optional analysis sites the five column report format is used, and the analytical results are presented in chronological order based on the sample collection date.

10.0 SNMOC TECHNICAL NOTES

This section describes the sampling and analytical equipment and procedures used for the 1992 SNMOC Monitoring Program. The sample collection method follows the general guidelines of EPA's Compendium of Methods TO-12. The analysis method follows the general guidelines of EPA's "Research Protocol Method for Analysis of C_2-C_{12} Hydrocarbons in Ambient Air by Gas Chromatography with Cryogenic Concentration" given in Appendix J.

10.1 Sampling Equipment and Procedure

The 1992 SNMOC monitoring program was scheduled to begin 22 June 1992, and end 30 September 1992. Integrated ambient air samples for program sites were collected from 6:00 a.m. to 9:00 a.m. (local civil time), Monday through Friday. The sampling equipment and sampling procedures used to collect these samples were the same as those used for the NMOC monitoring program described in Section 3.1.

10.2 Analytical System

Figure 10-2 presents the schematic of the analytical system used to perform the hydrocarbon analysis. The analytical system consists of a Radian Sample Interface System, a dual FID GC, and a data acquisition system.

Figures 10-2 and 10-3 show the flow paths of the valve located in the Radian Sample Interface System during the sample loading and sample injecting mode, respectively. When the six-port valve is in the sample load mode (see Figure 10-2), the sample interface cryogenically concentrates a predetermined repeated aliquot of sample. In the sample inject mode (see Figure 10-3), the cryogenically focused sample aliquot is thermally desorbed and the sample is swept by helium carrier gas to the head of the GC column. The GC oven temperature is programmed so the sample

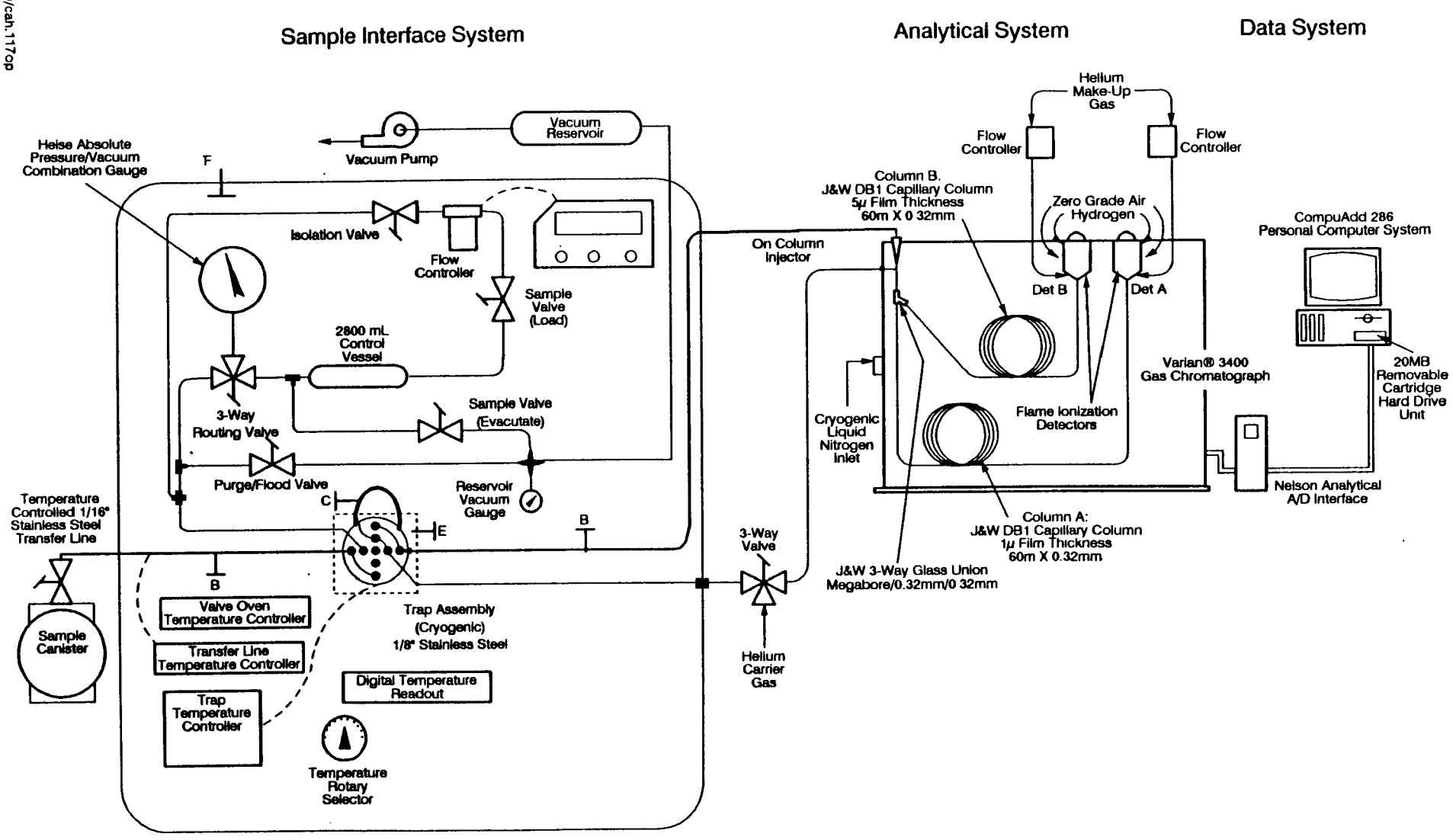

Figure 10-1. Hydrocarbon Analysis System

5116032R

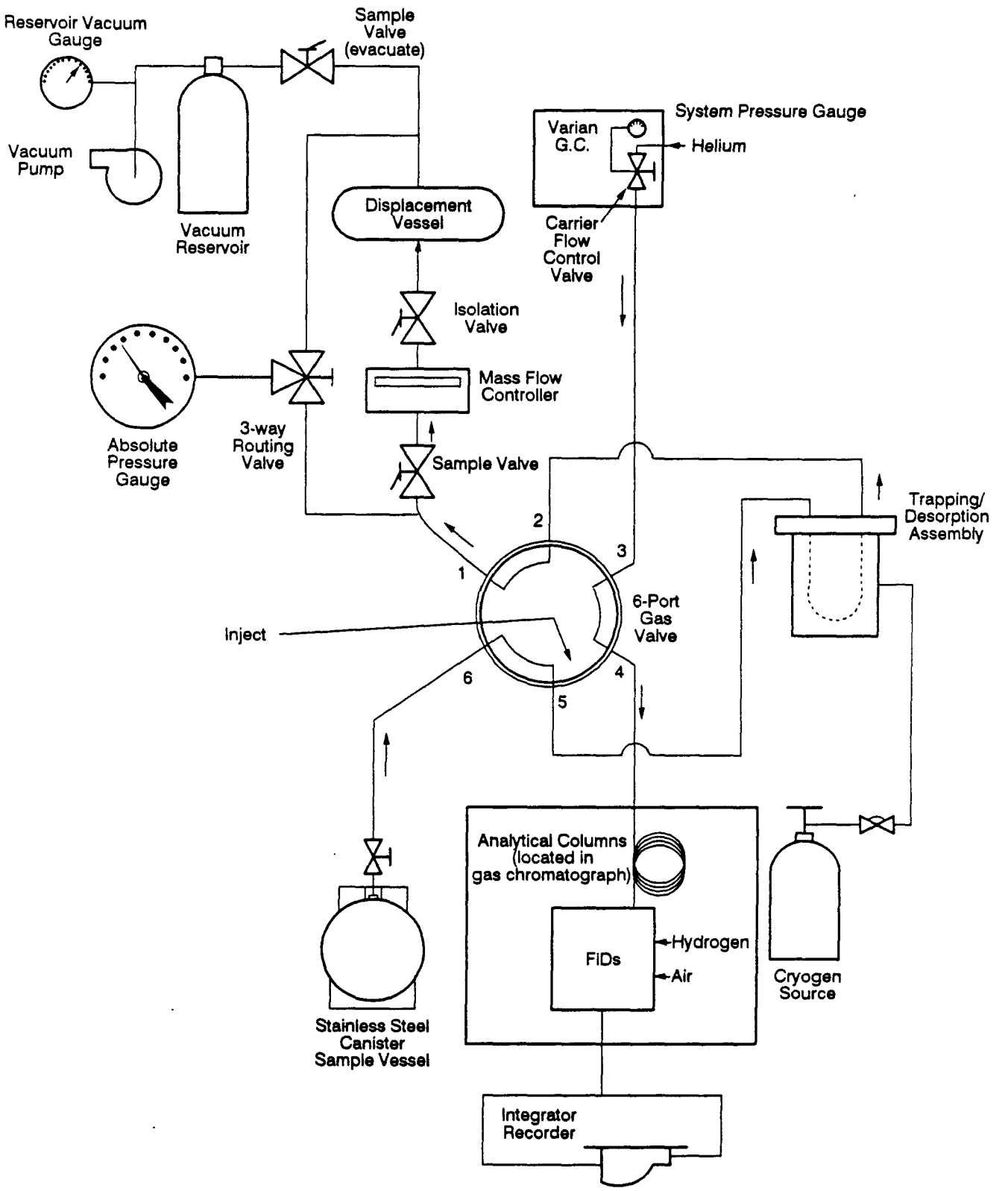

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Figure 10-2. Radian Sample Interface in Sample Load Mode

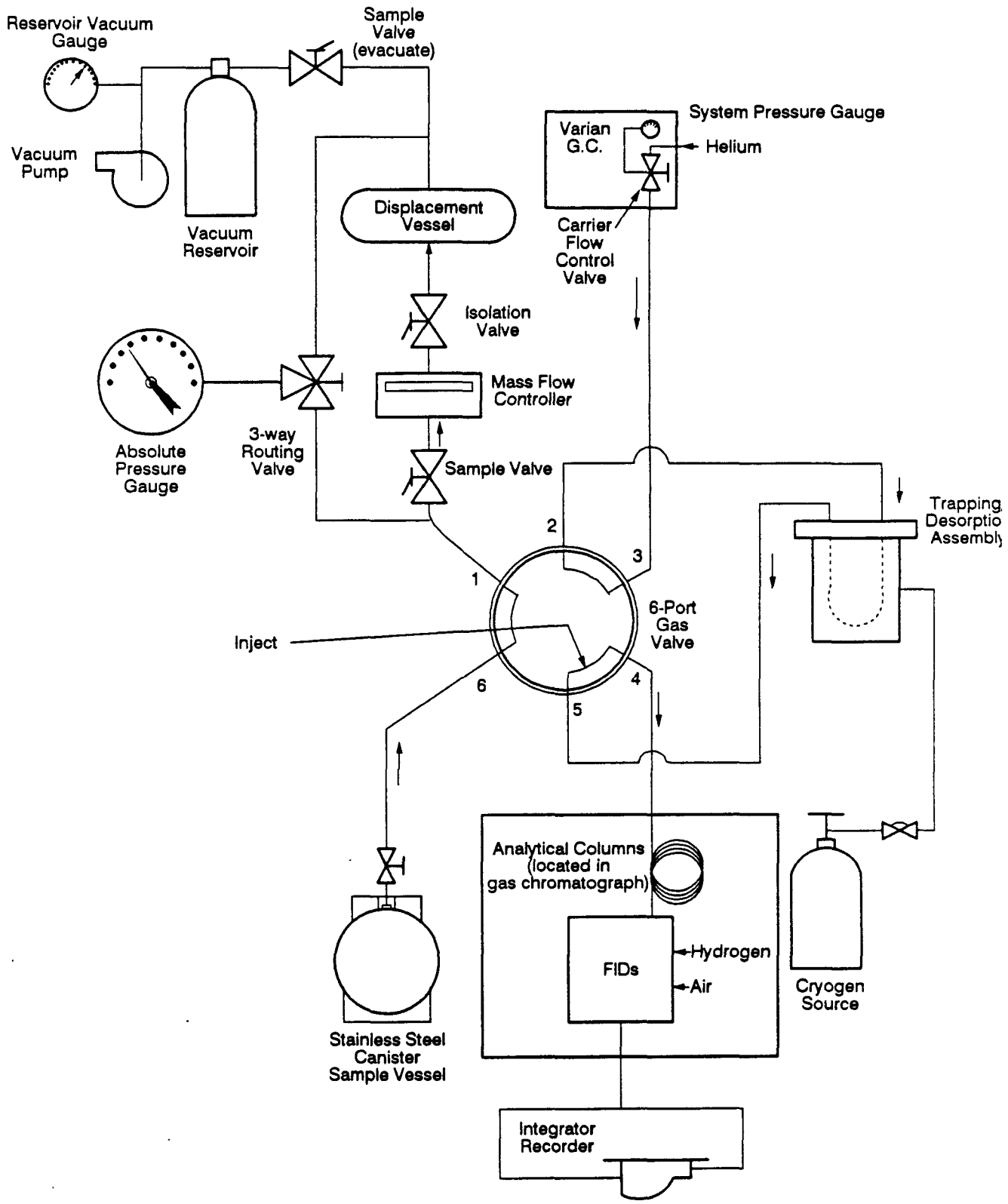

Figure 10-3. Radian Sample Interface in Sample Inject Mode

is refocused on the column at subambient conditions. The temperature is then increased to chromatographically separate the target compounds.

The GC contains two fused silica capillary columns each connected to a FID. The sample is split between the columns in a 1:1 ratio with a J&W precision splitter. Each column has a J&W DB-1® phase. One column has a phase thickness of 1 μm, to separate C_3 to C_{13} hydrocarbons effectively. The other has a phase thickness of 5 μm, to separate C_2 hydrocarbons consistently, and provide back-up capabilities for C_3 separation and quantitation. The chromatography for propylene and propane was better on the 5 μm column than the 1 μm column, so quantitation was performed from the secondary column data. Table 10-1 gives the operating conditions for the analytical system used for the 1992 SNMOC Monitoring Program.

Table 10-1

1992 Hydrocarbon Analysis GC/FID Operating Conditions

Parameter	Operating Value
Sample Volume	800 mL
J&W DB-1® Capillary Columns	
Column A:	
Film Thickness	1 μm
Length	60 m
Inside Diameter	0.32 mm
Column B:	
Film Thickness	5 μm
Length	60 m
Inside Diameter	0.32 mm
Oven Temperature Program	-60° for 5 min. Then: 6°C/min. to 150°C, then 20°C/min. to 180°C.
Analysis Time	45 min.
Detector Temperatures	
2 FIDs	300°C
Gas Flow Rates	
Helium Carrier Gas	3 mL/min.
Helium Make-Up	30 mL/min.
H_2 to FID	30 mL/min.
Air to FID	300 mL/min.

11.0 SNMOC QUALITY ASSURANCE AND CONTROL PROCEDURES

This section details the steps incorporated into the 1992 SNMOC Monitoring Program to ensure the data were of high and known quality. Procedures for standard preparation, database set-up, GC calibration, and daily analytical system checks are described. Duplicate samples and repeated analyses (replicates) provided information on sampling and analytical precision. Accuracy is assessed as the percent bias calculated from the analysis of external audit samples. An interlaboratory comparison with EPA provided information on the equivalency of the data reported for this program to data resulting from a comparable program.

11.1 Standards Preparation

Certified high pressure stock standards from Scott® Specialty Gases were used to prepare analytical calibration standards across the measurement range of the analytical system. Standards used to establish retention time information were prepared from stock standards prepared using neat liquid compounds injected into cleaned, evacuated canisters, and from certified gaseous stock standards.

All calibration and daily calibration check standards were made from certified standard gases. Gas-tight syringes were used to inject aliquots of the certified standard into cleaned, evacuated SUMMA® canisters. The canisters were then filled to ambient pressure with cleaned, humidified air using a standards preparation flow dilution system, then pressurized with nitrogen to approximately 35 psig using a precision canister dilution system.

11.2 Target Compounds Database

Standards used to gather retention time information and to set up a reference database using relative retention times referenced to toluene were prepared and analyzed. These relative retention times were used to identify the

target compounds in the ambient air samples. These standards were prepared, encompassing the list of target hydrocarbons found in Table 11-1, by using gas-tight syringes to inject aliquots of stock standards into clean, evacuated SUMMA® canisters.

11.3 GC/FID Monthly Calibration

The analytical system was calibrated monthly by analyzing three propane standards and a system blank of cleaned, humidified air. Three calibration standards were prepared from a Scott® Specialty Gases certified high pressure gaseous standard. The three levels prepared were 45, 150, 360 ppbC. The calibration range was based on the expected typical levels of target compound concentrations based on historical information.

The calibration standards were analyzed in order of increasing concentration. This was followed by the system blank to ensure no carryover after analysis of the high level standard. The area count recorded by each FID for each calibration standard was correlated to the nanoliters (nl) of propane, and the calibration was considered representative if the coefficient of correlation for the four points was greater than or equal to 0.995.

A least squares linear regression calculation was performed for the data from each detector, and the resulting slopes were used as the propane response factors. These response factors were divided by 3 (carbons/molecule of propane) to calculate a per carbon response factor for each detector. This value was used to calculate sample concentrations for the following month. Monthly propane calibration information is summarized in Table 11-2.

Table 11-1

1992 Ambient Air Hydrocarbon Program Target List

Compound	
Ethylene	2-Methylhexane (Isoheptane)
Acetylene	2,3-Dimethylpentane
Ethane	3-Methylhexane
Propylene	1-Heptene
Propane	2,2,4-Trimethylpentane
Propyne	n-Heptane
Isobutane	Methylcyclohexane
Isobutene	2,2,3-Trimethylpentane
1-Butene	2,3,4-Trimethylpentane
1,3-Butadiene	Toluene
n-Butane	2-Methylheptane
t-2-Butene	3-Methylheptane
c-2-Butene	1-Octene
3-Methyl-1-Butene	n-Octane
Isopentane	Ethylbenzene
1-Pentene	p,m-Xylene
2-Methyl-1-Butene	Styrene
n-Pentane	o-Xylene
Isoprene	1-Nonene
t-2-Pentene	n-Nonane
c-2-Pentene	Isopropylbenzene
2-Methyl-2-Butene	n-Propylbenzene
2,2-Dimethylbutane (Neohexane)	α-Pinene
Cyclopentene	m-Ethyltoluene
4-Methyl-1-Pentene	p-Ethyltoluene
2,3-Dimethylbutane	1,3,5-Trimethylbenzene
Cyclopentane	o-Ethyltoluene
2-Methylpentane (Isohexane)	1,2,4-Trimethylbenzene
3-Methylpentane	1-Decene
2-Methyl-1-Pentene	n-Decane
1-Hexene	1,2,3-Trimethylbenzene
2-Ethyl-1-Butene	p-Diethylbenzene
n-Hexane	1-Undecene
t-2-Hexene	n-Undecane
c-2-Hexene	Dodecene
Methylcyclopentane	n-Dodecane
2,4-Dimethylpentane	Tridecene
Benzene	n-Tridecane
Cyclohexane	

Table 11-2

Summary of Monthly Propane Calibration Curves

Calibration Date	Column A		Column B	
	Correlation Coefficient	Response Factor (AC/n1-C)	Correlation Coefficient	Response Factor (AC/n1-C)
6-23-92	0.9996	1776.6	0.9987	1421.2
7-23-92	1.0000	1803.7	1.0000	1435.9
8-23-92	1.0000	2017.5	1.0000	1628.1
9-25-92	1.0000	1937.6	1.0000	1566.5
10-23-92	1.0000	1813.5	1.0000	1415.7

11.4 Daily Quality Control Check

Daily, prior to sample analysis, a quality control standard, prepared from a Scott® Specialty Gases certified high pressure gaseous standard, was analyzed to ensure the validity of the current monthly response factors. This standard had an approximate propane concentration of 45 ppbC. This level was considered representative of the majority of concentrations expected in the monitoring ambient air samples.

The load volume (in liters) and the propane area count from each detector were entered into a computer spreadsheet and the current monthly response factors were used to calculate propane concentrations. These concentrations were compared to the calculated theoretical propane concentration of the quality control standard. A propane concentration percent bias of less than or equal to 30% was considered to be acceptable and that the analytical system was in control.

For the SNMOC Monitoring Program, if the daily QC standard did not meet the 30% criterion a second QC standard was prepared and analyzed. If the second QC standard met the criterion, the analytical system was considered in control. If the second QC check did not pass, a leak test and system maintenance were performed, and a third QC standard analysis was performed. If the criterion was met by the third analysis, the analytical system was considered in control. If the maintenance caused a change in system response a new calibration curve would be required. For the 1992 program the 30% criterion was met on the first standard analysis for every sample analysis day.

11.5 Daily Analytical System Blank

A dedicated cleaned, evacuated SUMMA® canister was reserved for system blank use during this analytical program. This canister was periodically pressurized with clean, humidified air from the canister cleaning system (described in

Section 3.3). A sample from this canister was analyzed after the daily QC standard analysis and prior to sample analysis. This allowed the presence of contamination to be assessed. The results from these analyses were filed with the daily QC checks and were used as a reference should questions arise concerning analytical interferences and results.

One interference was noted consistently from the system blank data. A peak occurring near the retention time of ethylene on the column used to quantitate ethylene was present in every blank analyzed. From data gathered this peak most commonly occurred at levels of 2-3.5 ppbC.

As a check for this possible interference, a nitrogen cylinder was connected to the analytical system and a normal sample volume analyzed, after a daily system canister blank had been analyzed. The interfering peak was present in the system canister blank at a concentration of 2.7 ppbC. The nitrogen analysis had no peak occurring at this time. This information indicated that the source of this peak was not the analytical system.

11.6 Precision of Sampling and Analysis

The precision of the sampling and analytical methods used for the 1992 SNMOC Monitoring Program was assessed using data from duplicate sample collections and replicate analyses.

11.6.1 Duplicate Samples

For each program site nine duplicate sample pairs were scheduled to be collected and analyzed. The actual number of sample pairs collected ranged from seven to ten. For the option sites one duplicate pair was randomly chosen for analysis. Pooled standard deviations for the duplicate samples were calculated as an indication of sampling precision. Table 11-3 presents the data for all program

Table 11-3. 1992 Duplicate Statistics for All Program Sites

		Duplicate Pair Statistics			
		Concentration		Average Absolute %	Pooled Standard
Compound	Cases	Median	Average	Difference	Deviation
Ethylene	96	12.27	22.43	14.05	1.96
Acetylene	84	5.86	8.35	18.77	1.38
Ethane	93	9.23	17.25	14.19	1.44
Propylene	95	3.82	7.33	8.63	1.06
Propane	96	12.48	20.97	5.72	1.41
Propyne	0	.	.	.	.
Isobutane	95	4.30	7.72	10.20	0.90
Isobutene	0	.	.	.	.
1-Butene	94	2.51	3.40	14.67	0.79
1,3-Butadiene	52	1.26	2.24	25.31	0.97
n-Butane	96	11.36	14.73	14.50	1.69
t-2-Butene	57	1.17	1.45	13.34	0.24
c-2-Butene	39	1.01	1.28	11.24	0.36
3-Methyl-1-butene	27	1.05	1.13	16.65	0.20
Isopentane	96	17.40	25.12	3.91	1.36
1-Pentene	25	1.53	2.15	24.36	0.88
2-Methyl-1-butene	77	1.43	2.09	7.18	0.21
n-Pentane	96	7.83	10.74	2.40	0.32
Isoprene	77	1.18	2.41	8.81	0.58
t-2-Pentene	72	1.52	2.43	11.93	0.51
c-2-Pentene	58	1.18	1.53	13.38	0.20
2-Methyl-2-butene	86	1.72	2.52	13.46	0.21
Neohexane	95	7.58	9.47	8.67	1.15
Cyclopentene	25	0.75	0.88	4.95	0.03
4-Methyl-1-pentene	68	0.87	0.95	13.34	0.16
2,3-Dimethylbutane	60	1.18	1.52	3.94	0.06
Cyclopentane	93	2.04	2.78	12.10	0.59
Isohexane	96	5.57	7.54	3.39	0.33
3-Methylpentane	94	4.52	6.12	16.63	0.87
1-Hexene	1	2.48	2.48	20.97	0.37
2-Methyl-1-pentene	41	1.01	1.33	11.31	0.52
2-Ethyl-1-butene	0	.	.	.	.
n-Hexane	95	4.11	5.96	3.35	0.15
t-2-Hexene	30	0.78	1.09	6.37	0.07

Table 11-3. Continued

Compound	Cases	Duplicate Pair Statistics: Concentration Median	Concentration Average	Average Absolute % Difference	Pooled Standard Deviation
c-2-Hexene	14	0.81	0.98	6.21	0.05
Methylcyclopentane	94	2.53	3.66	7.46	0.26
2,4-Dimethylpentane	76	1.50	2.19	16.38	0.25
Benzene	96	5.84	8.76	5.84	0.74
Cyclohexane	90	2.44	3.26	27.74	0.87
Isoheptane	77	2.17	3.20	22.44	0.86
2,3-Dimethylpentane	31	2.57	3.26	34.46	1.08
3-Methylhexane	95	3.36	3.99	19.80	0.77
2,2,4-Trimethylpentane	96	4.31	6.24	4.85	0.24
1-Heptene	41	0.87	1.20	5.55	0.08
n-Heptane	89	1.66	2.38	11.50	0.24
Methylcyclohexane	73	1.40	2.14	9.35	0.58
2,2,3-Trimethylpentane	61	1.09	1.37	5.59	0.05
2,3,4-Trimethylpentane	88	1.68	2.42	3.77	0.08
Toluene	96	16.12	20.88	3.13	0.70
2-Methylheptane	80	1.33	1.76	8.39	0.25
3-Methylheptane	70	1.10	1.52	4.80	0.04
1-Octene	51	1.06	1.33	5.57	0.04
n-Octane	59	1.18	1.97	13.14	0.22
Ethylbenzene	95	2.70	3.77	9.39	0.46
p-Xylene + m-Xylene	96	8.34	12.29	5.02	1.68
Styrene	54	0.99	1.30	12.35	0.27
o-Xylene	94	2.75	4.06	6.95	0.58
1-Nonene	23	0.90	1.01	5.95	0.07
n-Nonane	70	1.06	1.72	9.85	0.11
Isopropylbenzene	15	0.79	0.95	6.28	0.05
n-Propylbenzene	84	2.04	2.85	31.70	1.66
alpha-Pinene	71	1.13	1.50	11.12	0.15
m-Ethyltoluene	95	2.39	3.42	14.65	0.68
p-Ethyltoluene	49	1.10	1.40	5.92	0.10
1,3,5-Trimethylbenzene	83	1.16	1.81	11.77	0.19
o-Ethyltoluene	95	1.56	2.18	10.07	0.28
1-Decene	2	3.86	3.86	3.83	0.11
1,2,4-Trimethylbenzene	96	3.31	5.27	9.49	0.35

Table 11-3. Continued

Compound	Cases	Duplicate Pair Statistics: Concentration Median	Concentration Average	Average Absolute % Difference	Pooled Standard Deviation
n-Decane	48	2.03	2.67	31.11	1.08
1,2,3-Trimethylbenzene	96	2.69	3.38	31.56	3.54
p-Diethylbenzene	58	1.09	1.27	36.70	0.46
1-Undecene	91	1.92	2.68	33.63	1.28
n-Undecane	91	2.12	2.73	28.79	0.81
1-Dodecene	87	1.23	1.79	36.67	1.09
n-Dodecane	86	1.36	1.97	34.59	1.17
1-Tridecene	13	0.66	0.71	25.16	0.16
n-Tridecane	60	0.90	1.16	36.90	0.65

sites. Table 11-4 presents the data for all optional analysis sites. The duplicate pooled standard deviations show similar results for each compound. This indicates that the sampling procedure for duplicates provided representative ambient air samples.

11.6.2 Replicate Analyses

For each program site half of a duplicate sample pair (a single canister of a duplicate collection) was scheduled to be analyzed in replicate to measure analytical precision. For the option sites, half of the duplicate sample pair was also selected to be analyzed in replicate. Tables 11-5 and 11-6 summarize the statistics for the replicate analyses of the program sites and option sites, respectively, in terms of average concentrations, average absolute percent differences, and pooled standard deviations. The results show excellent results for analytical precision.

11.7 Accuracy

Three external audits were supplied by the EPA's QA contractor. Table 11-7 summarizes the results of these audits. The results show good analytical accuracy. The percent bias for propane in the first audit (ID #2185) is higher than expected. It is unusual that propane showed the greatest percent bias. The system is calibrated with propane, and the response factor used to calculate all other concentrations for these reports is based on the propane calibration. The daily calibration checks for the days this audit was analyzed showed a propane bias of -13.9% and -6.0%, so the analytical system was operating within the expected limits, particularly for propane. If the true bias for propane was -38.5%, then this amount of bias would also be expected for all other compounds reported for Audit #2185. Unfortunately the contractor's analysis check did not include

Table 11-4. 1992 Duplicate Statistics for All Option Sites

		Duplicate Pair Statistics			
		Concentration		Average Absolute %	Pooled Standard
Compound	Cases	Median	Average	Difference	Deviation
Ethylene	9	17.04	20.04	6.45	0.89
Acetylene	9	8.62	11.51	13.15	2.96
Ethane	9	16.53	18.37	8.25	1.39
Propylene	9	6.44	8.21	6.54	0.33
Propane	9	15.69	18.70	5.18	0.76
Propyne	0	.	.	.	.
Isobutane	9	13.39	12.03	4.08	0.17
Isobutene	0	.	.	.	.
1-Butene	8	5.98	5.30	11.21	0.82
1,3-Butadiene	5	1.81	1.83	13.46	0.32
n-Butane	9	20.86	25.45	9.47	1.58
t-2-Butene	7	2.73	3.17	4.52	0.10
c-2-Butene	7	2.21	3.41	28.97	1.43
3-Methyl-1-butene	5	1.12	1.67	10.63	0.11
Isopentane	9	36.85	63.86	2.74	1.61
1-Pentene	7	1.44	3.58	16.35	0.83
2-Methyl-1-butene	8	2.71	5.74	3.51	0.16
n-Pentane	9	13.72	25.97	1.75	0.36
Isoprene	8	1.43	1.36	5.90	0.05
t-2-Pentene	8	4.15	7.37	12.58	0.79
c-2-Pentene	8	1.41	3.86	5.55	0.18
2-Methyl-2-butene	8	2.78	9.63	9.25	0.35
Neohexane	5	0.93	1.19	9.89	0.08
Cyclopentene	4	0.93	2.43	2.55	0.11
4-Methyl-1-pentene	6	1.15	1.87	10.22	0.09
2,3-Dimethylbutane	7	1.19	3.52	2.68	0.06
Cyclopentane	9	4.76	7.23	8.36	0.24
Isohexane	9	9.68	21.87	2.87	0.43
3-Methylpentane	9	6.69	13.21	18.86	1.67
1-Hexene	0	.	.	.	.
2-Methyl-1-pentene	8	1.17	3.35	11.43	0.17
2-Ethyl-1-butene	0	.	.	.	.
n-Hexane	9	5.38	10.78	3.39	0.20
t-2-Hexene	6	1.55	3.57	12.00	0.31

Table 11-4. Continued

Compound	Cases	Duplicate Pair Statistics: Concentration Median	Concentration Average	Average Absolute % Difference	Pooled Standard Deviation
c-2-Hexene	4	1.06	3.03	10.29	0.15
Methylcyclopentane	9	3.85	6.94	4.43	0.28
2,4-Dimethylpentane	9	2.19	3.70	5.36	0.09
Benzene	9	10.58	15.19	3.17	0.19
Cyclohexane	8	5.58	4.81	8.61	0.37
Isoheptane	8	3.17	3.90	23.38	0.70
2,3-Dimethylpentane	6	4.35	6.78	30.00	2.41
3-Methylhexane	9	6.66	8.18	18.49	1.27
2,2,4-Trimethylpentane	9	8.15	10.48	8.13	1.74
1-Heptene	5	1.86	2.87	11.39	0.25
n-Heptane	9	5.00	5.24	6.89	0.17
Methylcyclohexane	8	1.58	4.07	7.81	0.15
2,2,3-Trimethylpentane	8	1.34	2.62	5.92	0.15
2,3,4-Trimethylpentane	9	2.57	4.76	8.73	0.95
Toluene	9	38.76	58.20	1.95	2.12
2-Methylheptane	8	2.13	5.11	4.06	0.16
3-Methylheptane	8	1.77	4.23	6.19	0.16
1-Octene	8	1.00	1.76	6.75	0.36
n-Octane	7	1.62	3.02	8.15	0.19
Ethylbenzene	9	5.99	8.81	4.46	0.55
p-Xylene + m-Xylene	9	22.82	34.30	4.52	4.21
Styrene	8	1.70	1.56	6.96	0.07
o-Xylene	9	7.02	11.07	5.81	1.81
1-Nonene	5	1.22	1.87	3.38	0.03
n-Nonane	8	2.99	2.85	6.33	0.15
Isopropylbenzene	5	0.64	7.57	39.43	19.90
n-Propylbenzene	9	2.98	3.36	44.50	1.59
alpha-Pinene	7	2.37	3.08	9.63	1.10
m-Ethyltoluene	9	4.99	6.90	14.83	2.25
p-Ethyltoluene	7	2.15	2.53	11.97	0.72
1,3,5-Trimethylbenzene	9	2.63	4.00	11.41	1.89
o-Ethyltoluene	9	4.18	4.19	9.70	1.03
1-Decene	0	.	.	.	.
1,2,4-Trimethylbenzene	9	9.15	12.35	7.02	4.59

Table 11-4. Continued

Compound	Cases	Duplicate Pair Statistics: Concentration Median	Concentration Average	Average Absolute % Difference	Pooled Standard Deviation
n-Decane	6	4.85	8.86	44.68	14.45
1,2,3-Trimethylbenzene	9	4.07	4.12	16.31	1.21
p-Diethylbenzene	8	1.79	2.14	51.10	0.88
1-Undecene	9	1.56	2.14	35.30	1.49
n-Undecane	9	4.43	39.15	54.88	140.68
1-Dodecene	7	0.83	1.32	38.06	0.94
n-Dodecane	9	3.00	32.77	68.87	109.89
1-Tridecene	0	.	.	.	.
n-Tridecane	8	1.13	6.56	62.90	15.28

Table 11-5. 1992 Replicate Statistics for All Program Sites

		Replicate Pair Statistics			
		Concentration		Average Absolute %	Pooled Standard
Compound	Cases	Median	Average	Difference	Deviation
Ethylene	114	12.47	24.05	21.65	3.01
Acetylene	95	5.54	8.73	23.97	1.84
Ethane	112	9.29	17.25	18.54	3.07
Propylene	109	3.82	7.29	10.58	0.66
Propane	114	10.94	21.46	7.69	1.60
Propyne	0	.	.	.	.
Isobutane	110	4.05	7.24	12.11	1.22
Isobutene	0	.	.	.	.
1-Butene	110	2.59	3.35	13.03	0.83
1,3-Butadiene	40	1.73	2.31	20.36	0.39
n-Butane	114	10.35	14.74	14.80	2.47
t-2-Butene	60	1.21	1.48	13.16	0.17
c-2-Butene	43	1.06	1.50	17.37	1.50
3-Methyl-1-butene	27	1.09	1.19	27.24	0.45
Isopentane	113	16.40	25.09	4.92	1.76
1-Pentene	28	1.96	2.53	14.34	0.22
2-Methyl-1-butene	86	1.45	2.21	4.35	0.10
n-Pentane	110	8.10	10.85	3.68	0.50
Isoprene	84	1.25	2.55	6.46	0.22
t-2-Pentene	83	1.53	2.51	10.78	0.59
c-2-Pentene	63	1.22	1.64	13.74	0.20
2-Methyl-2-butene	90	2.02	2.77	11.80	0.23
Neohexane	110	7.82	9.21	3.70	0.65
Cyclopentene	25	0.91	1.02	6.30	0.05
4-Methyl-1-pentene	78	0.92	1.01	7.55	0.19
2,3-Dimethylbutane	68	1.22	1.63	5.03	0.07
Cyclopentane	108	2.11	2.90	12.31	0.35
Isohexane	114	5.54	7.61	4.15	0.45
3-Methylpentane	111	4.10	5.91	15.37	1.14
1-Hexene	0	.	.	.	.
2-Methyl-1-pentene	41	1.25	1.53	16.00	1.10
2-Ethyl-1-butene	0	.	.	.	.
n-Hexane	114	4.08	5.96	5.16	0.33
t-2-Hexene	28	1.01	1.27	7.66	0.08

Table 11-5. Continued

Compound	Cases	Replicate Pair Statistics: Concentration Median	Concentration Average	Average Absolute % Difference	Pooled Standard Deviation
c-2-Hexene	17	0.99	1.12	9.56	0.09
Methylcyclopentane	111	2.77	3.77	5.94	0.20
2,4-Dimethylpentane	94	1.66	2.30	5.68	0.19
Benzene	114	5.63	8.95	6.79	0.59
Cyclohexane	98	2.64	3.58	14.53	0.45
Isoheptane	82	2.09	3.46	23.38	1.47
2,3-Dimethylpentane	35	2.63	3.24	18.87	1.43
3-Methylhexane	114	3.58	4.20	4.53	0.18
2,2,4-Trimethylpentane	113	4.16	6.56	6.33	0.39
1-Heptene	41	1.00	1.50	15.47	0.34
n-Heptane	99	1.67	2.51	11.77	0.30
Methylcyclohexane	82	1.44	2.28	5.02	0.12
2,2,3-Trimethylpentane	68	1.17	1.48	5.64	0.08
2,3,4-Trimethylpentane	99	1.69	2.59	4.15	0.12
Toluene	114	16.30	21.19	3.08	0.99
2-Methylheptane	86	1.36	1.87	5.32	0.12
3-Methylheptane	72	1.30	1.69	5.30	0.08
1-Octene	56	1.14	1.45	5.16	0.07
n-Octane	69	1.16	1.58	13.47	0.43
Ethylbenzene	113	2.52	3.88	7.22	0.27
p-Xylene + m-Xylene	114	8.18	12.73	3.48	0.88
Styrene	55	1.14	1.49	5.61	0.08
o-Xylene	114	2.49	4.11	7.21	0.33
1-Nonene	26	0.90	1.02	9.72	0.15
n-Nonane	76	1.18	1.77	12.08	0.20
Isopropylbenzene	19	0.79	1.06	5.62	0.07
n-Propylbenzene	99	2.13	3.22	17.25	0.92
alpha-Pinene	71	1.32	1.78	8.02	0.14
m-Ethyltoluene	111	2.22	3.68	12.15	0.81
p-Ethyltoluene	46	1.33	1.71	7.69	0.18
1,3,5-Trimethylbenzene	94	1.22	2.00	11.05	0.29
o-Ethyltoluene	113	1.45	2.24	7.09	0.13
1-Decene	0	.	.	.	.
1,2,4-Trimethylbenzene	113	3.19	5.49	8.69	0.48

Table 11-5. Continued

Compound	Cases	Replicate Pair Statistics: Concentration Median	Concentration Average	Average Absolute % Difference	Pooled Standard Deviation
n-Decane	47	1.54	2.82	14.82	0.99
1,2,3-Trimethylbenzene	114	2.66	3.75	14.14	0.39
p-Diethylbenzene	62	1.08	1.35	34.97	0.66
1-Undecene	111	1.85	2.87	20.50	0.69
n-Undecane	105	2.00	2.85	27.88	1.12
1-Dodecene	100	1.37	1.93	29.40	0.51
n-Dodecane	97	1.32	2.18	23.59	0.59
1-Tridecene	10	0.70	0.75	18.74	0.22
n-Tridecane	62	0.90	1.37	19.42	0.30

Table 11-6. 1992 Replicate Statistics for All Option Sites

		Replicate Pair Statistics			
		Concentration		Average Absolute %	Pooled Standard
Compound	Cases	Median	Average	Difference	Deviation
Ethylene	9	17.15	20.07	15.72	2.26
Acetylene	9	7.56	12.01	12.01	0.83
Ethane	9	16.53	18.99	7.24	0.79
Propylene	9	6.51	8.30	3.78	0.23
Propane	9	15.65	18.95	3.54	0.38
Propyne	0	.	.	.	.
Isobutane	8	11.95	11.52	3.79	0.20
Isobutene	0	.	.	.	.
1-Butene	8	6.81	5.48	4.22	0.19
1,3-Butadiene	6	1.41	1.53	19.74	0.35
n-Butane	9	20.00	25.58	9.49	1.36
t-2-Butene	7	2.59	3.16	6.67	0.16
c-2-Butene	6	2.00	2.76	12.12	0.19
3-Methyl-1-butene	5	1.06	1.61	7.58	0.09
Isopentane	9	36.76	63.76	4.58	2.93
1-Pentene	5	1.66	3.98	8.97	0.14
2-Methyl-1-butene	8	2.67	5.67	2.35	0.14
n-Pentane	9	13.65	25.95	2.17	0.69
Isoprene	7	1.47	1.35	2.57	0.03
t-2-Pentene	8	4.41	7.52	8.22	0.32
c-2-Pentene	8	1.39	3.83	18.66	0.30
2-Methyl-2-butene	8	2.71	9.49	15.80	0.41
Neohexane	6	0.91	1.10	15.39	0.15
Cyclopentene	4	0.94	2.40	4.22	0.05
4-Methyl-1-pentene	6	1.23	1.90	7.28	0.06
2,3-Dimethylbutane	7	1.19	3.51	2.75	0.09
Cyclopentane	9	4.95	7.20	11.30	0.27
Isohexane	9	9.77	21.78	2.88	0.61
3-Methylpentane	9	5.01	12.69	10.59	0.62
1-Hexene	0	.	.	.	.
2-Methyl-1-pentene	7	1.28	3.73	4.11	0.11
2-Ethyl-1-butene	0	.	.	.	.
n-Hexane	9	5.39	10.80	2.24	0.25
t-2-Hexene	6	1.55	3.60	11.91	0.37

Table 11-6. Continued

Compound	Cases	Replicate Pair Statistics: Concentration Median	Concentration Average	Average Absolute % Difference	Pooled Standard Deviation
c-2-Hexene	3	1.09	3.77	7.55	0.10
Methylcyclopentane	9	3.77	6.86	10.76	0.56
2,4-Dimethylpentane	9	2.17	3.70	5.62	0.15
Benzene	9	10.51	15.22	3.29	0.25
Cyclohexane	8	5.52	4.85	9.32	0.36
Isoheptane	7	3.07	3.73	22.15	0.85
2,3-Dimethylpentane	6	4.92	7.56	27.20	5.33
3-Methylhexane	9	8.15	8.56	3.30	0.23
2,2,4-Trimethylpentane	9	8.15	10.10	17.08	3.35
1-Heptene	5	1.87	2.89	3.70	0.14
n-Heptane	9	5.01	5.27	5.58	0.12
Methylcyclohexane	8	1.58	4.03	18.47	0.28
2,2,3-Trimethylpentane	8	1.40	2.62	2.06	0.10
2,3,4-Trimethylpentane	9	2.56	4.50	21.12	1.80
Toluene	9	38.66	57.70	1.97	1.23
2-Methylheptane	8	2.11	5.09	1.93	0.10
3-Methylheptane	8	1.75	4.18	1.49	0.08
1-Octene	8	0.99	1.67	11.67	0.55
n-Octane	7	1.63	2.97	27.22	0.38
Ethylbenzene	9	5.79	8.66	3.49	0.27
p-Xylene + m-Xylene	9	21.92	33.09	1.57	0.65
Styrene	8	1.66	1.53	1.91	0.03
o-Xylene	9	7.04	10.59	2.18	0.21
1-Nonene	6	1.29	1.87	3.57	0.04
n-Nonane	8	2.96	2.84	3.23	0.08
Isopropylbenzene	2	0.60	0.60	2.45	0.00
n-Propylbenzene	9	2.98	2.98	23.96	1.43
alpha-Pinene	6	2.29	2.81	2.01	0.05
m-Ethyltoluene	9	4.94	6.48	2.01	0.23
p-Ethyltoluene	7	2.08	2.34	5.97	0.17
1,3,5-Trimethylbenzene	9	2.65	3.61	8.24	0.60
o-Ethyltoluene	9	3.96	3.97	2.59	0.05
1-Decene	0	.	.	.	.
1,2,4-Trimethylbenzene	9	8.94	11.26	2.74	0.34

Table 11-6. Continued

Compound	Cases	Replicate Pair Statistics: Concentration Median	Concentration Average	Average Absolute % Difference	Pooled Standard Deviation
n-Decane	7	3.25	11.65	37.88	26.37
1,2,3-Trimethylbenzene	9	3.98	3.98	13.11	0.39
p-Diethylbenzene	7	1.48	1.96	63.13	1.30
1-Undecene	9	1.47	2.51	8.27	0.20
n-Undecane	9	4.03	70.78	37.02	273.75
1-Dodecene	7	0.95	1.64	19.12	0.21
n-Dodecane	9	2.54	53.76	38.39	204.27
1-Tridecene	2	1.02	1.02	4.19	0.03
n-Tridecane	7	1.02	8.78	56.12	27.99

Table 11-7. Summary of External Audit Results

ID #	Compound	Theoretical Spike Level ppbv	Analysis Results ppbv		Percent Bias Results Relative to Theoretical		Percent Bias Results Relative to ManTech Radian
			ManTech	Radian	ManTech	Radian	
2185	Ethane	18.9	NA	15.1		-20.1	
	Propane	20.5	NA	12.6		-38.5	
	Isobutane	20.4	NA	18.4		-9.8	
	n-Butane	20.9	NA	19.4		-7.2	
	Isopentane	20.3	21.6	19.6	6.4	-3.4	-9.3
	n-Pentane	20.4	NA	19.8		-2.9	
	3-Methylpentane	20.0	19	19.4	-5.0	-3.0	2.1
	n-Hexane	20.0	NA	19.4		-3.0	
	Benzene	20.7	18.6	19.8	-10.1	-4.3	6.5
	n-Heptane	20.0	NA	19.7		-1.5	
	Toluene	19.9	NA	19.3		-3.0	
	n-Octane	19.8	17.4	19.3	-12.1	-2.5	10.9
	o-Xylene	19.3	18.7	17.8	-3.1	-7.8	-4.8
2403	Isopentane	5.0	5.0	5.2	0.0	4.0	4.0
	3-Methylpentane	4.8	4.9	5.0	2.1	4.2	2.0
	Benzene	5.0	5.8	5.5	16.0	10.0	-5.2
	Toluene	4.7	6.5	5.3	38.3	12.8	-18.5
	m-Xylene	5.0	4.6	9.3[a]	-8.0	-3.1	2.2
	p-Xylene	4.6	4.5	---	-2.2	---	
	o-Xylene	4.9	4.9	4.5	0.0	-8.2	-8.2
2580	Isobutane	5.0[b]	5.0	4.6	0.0	-8.0	-8.0
	n-Butane	5.0[b]	4.9	4.7	-2.0	-6.0	-4.1
	Isopentane	5.0[b]	5.8	4.9	16.0	-2.0	-15.5
	n-Pentane	5.0[b]	6.5	4.6	30.0	-8.0	-29.2
	n-Hexane	5.0[b]	4.6	4.7	-8.0	-6.0	2.2
	n-Heptane	5.0[b]	4.5	4.6	-10.0	-8.0	2.2
	n-Octane	5.0[b]	4.9	4.0	-2.0	-20.0	-18.4

NA = Not Analyzed
[a] = m-Xylene and p-Xylene reported as coeluting compounds

propane, so there are not additional analytical data to support any conclusions. The daily calibration checks and the results for all other compounds indicate the true bias may have been a function of the theoretical spike level reported. This conclusion is supported further by the additional study described below.

During the 1992 analysis season the same analytical system also participated in the National Center for Atmospheric Research (NCAR) International Hydrocarbon Intercomparison Experiment. An audit canister containing 16 hydrocarbons was prepared by NCAR and analyzed in replicate using the same analysis procedures as applied to the previous audits. The percent bias reported by NCAR was less than 15% for all 16 compounds, the propane percent bias reported was 1.92% and 6.82% for the analyses.

The results from the EPA contractor audits and the NCAR experiment show good analytical accuracy. It was difficult to draw a conclusion about the large percent bias for propane in contractor Audit #2185. This percent bias is not considered a reasonable indication of the system accuracy for propane during this program since the results for all the other compounds reported are within reasonable percent bias expectations, the daily calibration check is within required limits, and all depend on the propane response factor in effect. In addition, results from a supporting experiment show good accuracy for propane and other compounds.

11.8 Comparative Analysis

Nine samples were supplied to the EPA's Atmospheric Research and Exposure Assessment Laboratory (AREAL) at Research Triangle Park, North Carolina, for comparative analyses. Fifty-one compounds chosen by the EPA AREAL were compared. Results of this comparison are given in Tables 11-8, 11-9, and 11-10. Table 11-8 displays the comparison data in ppbC units of concentration. Table 11-9 shows results expressed as a percent bias, using the

Table 11-8. Results of EPA Comparison Analysis

SITE ID	B1AL		B2AL		B3AL		BMTX		CHNC		DLTX		EPTX		FWTX		JUMX	
SAMPLE ID	2141		2190		2154		2435		2453		2314		2583		2581		2622	
	Radian	EPA	Radian	EPA	Radian	EPA	Radian	EPA	Radian	EPA	Radian	EPA	Radian	EPA	Radian	EPA	Radian	EPA
COMPOUND																		
Ethylene	13.5	9.8	10.1	10.1	12.6	10.2	7.2	2.6	18.9	21.9	12.5	9.6	52.9	55.0	15.2	14.7	24.6	25.5
Acetylene	4.2	5.0	6.2	8.5	6.5	7.3	1.9	1.8	12.0	10.9	7.0	8.1	52.6	64.4	9.6	12.5	20.5	27.2
Ethane	8.9	8.7	3.4	4.4	7.7	7.5	9.7	8.4	4.1	6.5	13.6	14.6	41.3	48.4	20.3	22.1	26.6	29.3
Propylene	2.8	3.2	3.7	4.6	4.3	4.7	1.1	1.4	6.0	5.4	3.9	4.2	23.2	24.4	5.6	6.6	9.3	11.6
Propane	12.4	13.6	8.9	11.2	10.3	6.4	10.9	11.9	11.6	11.6	16.2	17.7	87.6	91.6	17.6	19.6	40.1	48.7
Isobutane	1.7	1.8	1.1	1.3	5.3	5.8	9.3	10.3	6.0	5.8	4.8	5.4	30.9	32.9	6.5	7.1	11.2	12.5
1-Butene	1.7	1.9	2.2	2.8	3.6	4.1	1.9	2.2	3.8	3.7	2.3	2.6	22.5	21.8	3.5	3.9	5.7	6.5
1,3-Butadiene	ND	0.6	0.8	1.1	0.8	0.8	ND	0.2	1.3	1.2	ND	0.9	4.0	3.7	1.3	1.5	1.9	2.3
n-Butane	3.4	3.6	4.1	3.7	20.9	22.5	21.0	22.9	9.0	11.1	13.2	10.7	69.8	69.2	18.3	20.0	28.2	28.2
t-2-Butene	ND	0.4	0.5	0.7	1.9	1.6	1.4	1.2	1.3	1.2	ND	0.5	10.8	10.8	1.4	1.4	1.8	0.4
c-2-Butene	ND	0.3	ND	0.4	1.6	1.7	1.7	1.7	0.8	0.8	ND	0.4	8.7	7.6	0.8	0.9	0.8	1.2
3-Methyl-1-butene	ND	0.1	ND	0.3	0.7	0.9	1.2	1.2	0.6	0.5	ND	0.3	2.4	2.4	0.7	0.8	0.6	0.6
Isopentane	7.7	7.9	10.2	12.0	51.5	52.2	36.9	36.6	29.0	26.2	16.8	19.1	127.0	117.7	34.2	39.0	31.4	34.3
1-Pentane	ND	0.3	ND	0.5	ND	2.0	ND	1.7	ND	1.2	ND	0.7	5.2	5.7	ND	1.7	1.2	1.6
2-Methyl-1-butene	ND	0.4	0.9	1.0	3.4	3.6	2.7	2.8	2.4	2.3	1.2	1.3	11.3	4.5	2.4	2.6	2.7	3.0
n-Pentane	3.4	3.6	3.9	4.8	15.7	16.9	13.1	14.0	9.7	9.5	7.5	8.4	72.5	72.8	13.7	14.9	19.5	39.3
t-2-Pentene	0.6	0.6	1.0	1.2	3.8	4.6	2.9	3.2	3.2	3.2	1.4	2.0	12.5	8.9	2.5	2.8	2.1	3.0
c-2-Pentene	ND	0.4	0.5	0.7	1.7	2.3	1.3	1.6	1.9	1.5	0.9	0.9	6.0	4.9	1.8	1.5	1.4	1.7
2-Methyl-2-butene	0.7	0.8	1.3	1.6	4.9	5.2	3.9	4.1	4.2	3.7	1.9	2.2	14.5	1.1	2.8	3.2	3.6	4.2
Cyclopentene	ND	0.2	1.1	0.2	0.5	0.6	ND	0.4	0.7	0.7	ND	0.3	1.9	1.1	ND	0.5	0.6	0.7
Cyclopentane	1.2	0.4	ND	0.4	3.5	1.3	2.4	2.1	3.4	1.0	1.6	1.0	11.5	6.9	3.7	1.7	4.6	2.4
2,3-Dimethylbutane	ND	1.2	ND	1.3	1.3	3.6	2.0	2.3	1.1	3.0	0.8	2.1	6.6	11.5	1.3	4.0	2.0	5.2
Isohexane (a)	3.0	2.9	3.5	4.0	10.5	11.9	4.3	11.8	9.1	8.2	5.6	6.5	37.8	35.7	9.4	11.0	12.9	14.6
3-Methylpentane	1.8	3.3	2.2	3.4	8.4	8.4	5.3	6.8	5.8	6.2	5.6	5.0	27.0	24.5	5.6	8.1	7.2	9.3
2-Methyl-1-pentene	ND	0.3	ND	0.3	1.2	1.5	0.5	0.2	1.2	0.7	0.6	0.9	4.0	1.0	1.1	0.7	1.4	0.9
n-Hexane	1.9	2.1	1.3	2.3	5.0	5.4	5.7	6.1	4.8	4.9	3.8	4.4	30.9	31.0	6.0	6.4	12.3	13.1
t-2-Hexene	ND	0.3	ND	0.4	0.7	0.8	ND	0.4	0.9	0.7	ND	0.7	2.6	2.5	0.6	0.8	0.6	1.1
Methylcyclopentane	1.5	1.3	1.3	1.5	3.7	3.5	3.3	3.3	3.4	2.9	2.5	2.6	21.5	21.0	4.0	3.8	7.1	7.3
2,4-Dimethylpentane	0.7	1.1	0.7	1.3	1.8	2.0	0.8	1.5	2.4	2.6	1.0	1.8	12.0	12.3	1.8	2.5	5.3	6.3
Benzene	16.0	16.0	5.6	6.0	7.1	8.0	4.2	3.7	10.2	8.9	5.2	6.0	37.7	37.2	8.1	9.0	16.6	18.4
Cyclohexane	2.4	0.3	0.8	0.3	1.7	0.9	2.8	1.7	3.1	0.4	1.8	0.9	9.0	9.5	1.5	0.5	3.9	3.4
Isoheptane (b)	1.9	1.1	2.2	1.5	1.2	2.2	2.9	2.1	1.6	3.0	2.4	2.2	5.2	12.4	5.3	3.7	2.0	5.8
2,3-Dimethylpentane	ND	1.4	ND	1.7	1.0	2.8	ND	1.8	1.3	3.3	ND	1.8	14.3	25.2	ND	2.5	6.6	12.4
3-Methylhexane	2.0	2.4	1.8	2.5	3.1	3.5	3.0	3.3	3.9	4.2	3.5	4.4	13.0	13.7	4.0	4.8	6.5	7.7
2,2,4-Trimethylpentane	2.7	3.2	2.8	4.1	6.1	7.2	3.6	4.2	9.3	9.1	4.4	5.0	26.2	29.7	10.3	11.7	12.4	14.4
n-Heptane	1.3	0.8	0.7	0.8	1.3	1.6	2.2	2.0	2.1	2.3	1.6	1.9	9.8	11.2	2.1	2.5	4.6	5.4
Methylcyclohexane	0.7	1.1	0.5	1.1	1.1	1.7	2.1	2.5	1.8	2.0	1.4	2.4	7.0	8.5	1.4	2.6	2.1	3.6
2,3,4-Trimethylpentane	1.0	1.1	1.1	1.3	2.1	2.2	1.0	1.1	3.3	2.8	1.6	1.8	10.9	10.4	3.7	3.7	5.0	5.2
Toluene	11.1	11.3	8.9	10.7	18.3	19.1	6.4	6.7	27.5	24.2	15.2	16.3	85.0	82.8	26.2	26.7	64.7	65.2
2-Methylheptane	0.6	0.6	0.6	0.6	0.9	0.9	0.9	0.7	1.6	1.0	1.1	1.0	7.0	5.4	1.7	1.5	2.9	2.3
3-Methylheptane	ND	0.5	0.5	0.6	0.8	0.9	0.6	0.7	1.3	1.2	0.9	1.0	6.0	5.9	1.5	1.7	2.6	2.8
n-Octane	ND	0.6	ND	0.5	ND	0.6	0.5	0.9	0.7	1.0	0.7	1.0	4.8	6.4	1.4	1.3	2.3	2.8
Ethylbenzene	1.4	1.7	2.0	2.2	2.6	3.1	1.7	1.8	4.1	4.0	2.2	2.9	16.5	16.6	4.6	4.9	14.0	14.2
m/p-Xylene	6.1	6.2	5.6	6.8	9.7	10.0	4.4	4.4	14.4	12.8	8.3	8.8	47.2	45.6	15.5	16.2	48.9	49.2
Styrene	0.6	1.7	0.6	1.6	0.8	1.8	ND	1.3	1.8	3.2	0.5	3.1	2.8	4.1	1.0	2.0	4.6	6.4
o-Xylene	1.7	2.3	1.8	2.8	3.3	3.8	1.4	1.7	5.2	5.2	2.8	3.7	15.4	16.6	5.3	6.1	14.4	15.9
n-Nonane	0.6	0.5	ND	0.4	0.7	0.5	0.6	0.5	0.9	0.8	0.7	0.8	5.8	4.6	1.0	0.9	2.7	2.4
1,3,5-Trimethylbenzene	0.7	0.1	1.0	1.5	ND	1.4	0.6	0.1	2.2	0.5	1.5	1.8	6.3	6.2	2.4	2.5	2.1	0.6
1,2,4-Trimethylbenzene	2.4	7.1	2.8	7.2	4.1	7.0	2.0	9.4	7.4	46.1	4.3	8.2	18.0	19.4	6.7	8.9	8.8	21.7
n-Decane	ND	0.6	ND	0.9	ND	0.9	ND	0.9	ND	1.2	ND	1.0	8.5	5.6	0.6	1.3	1.2	3.3
1,2,3-Trimethylbenzene	1.3	0.8	2.5	1.3	3.3	1.8	1.7	0.9	4.4	3.1	3.0	1.5	7.0	5.1	2.7	2.1	3.4	3.1
TOTAL NMOC (c)	257	239	226	248	438	437	376	419	537	508	343	365	1720	1496	484	458	839	877

All concentrations given in ppbC.

ND not detected

(a) 2-Methylpentane = Isohexane

(b) 2-Methylhexane = Isoheptane

(c) NMOC = Nonmethane Organic Compounds

Table 11-9. Percent Bias Results of EPA Comparison Analysis

RESULTS OF EPA COMPARISON ANALYSIS

Percent difference between Radian analysis and EPA analysis.
All concentrations given in ppbC.

SITE ID	B1AL	B2AL	B3AL	BMTX	CHNC	DLTX	EPTX	FWTX	JUMX	AVERAGE FOR
SAMPLE ID	2141	2190	2154	2435	2453	2314	2583	2581	2622	COMPOUND
COMPOUND										
Ethylene	37.8	0.0	23.5	176.9	-13.7	30.2	-3.8	3.4	-3.5	27.9
Acetylene	-16.0	-27.1	-11.0	5.6	10.1	-13.6	-18.3	-23.2	-24.6	-13.1
Ethane	2.3	-22.7	2.7	15.5	-36.9	-6.8	-14.7	-8.1	-9.2	-8.7
Propylene	-12.5	-19.6	-8.5	-21.4	11.1	-7.1	-4.9	-15.2	-19.8	-10.9
Propane	-8.8	-20.5	60.9	-8.4	0.0	-8.5	-4.4	-10.2	-17.7	-1.9
Isobutane	-5.6	-15.4	-8.6	-9.7	3.4	-11.1	-6.1	-8.5	-10.4	-8.0
1-Butene	-10.5	-21.4	-12.2	-13.6	2.7	-11.5	3.2	-10.3	-12.3	-9.6
1,3-Butadiene	(a)	-27.3	0.0	(a)	8.3	(a)	8.1	-13.3	-17.4	-6.9
n-Butane	-5.6	10.8	-7.1	-8.3	-18.9	23.4	0.9	-8.5	0.0	-1.5
t-2-Butene	(a)	-28.6	18.7	16.7	8.3	(a)	0.0	0.0	350.0	52.2
c-2-Butene	(a)	(a)	-5.9	0.0	0.0	(a)	14.5	-11.1	-33.3	-6.0
3-Methyl-1-butene	(a)	(a)	-22.2	0.0	20.0	(a)	0.0	-12.5	0.0	-2.5
Isopentane	-2.5	-15.0	-1.3	0.8	10.7	-12.0	7.9	-12.3	-8.5	-3.6
1-Pentane	(a)	(a)	(a)	(a)	(a)	(a)	-8.8	(a)	-25.0	-16.9
2-Methyl-1-butene	(a)	-10.0	-5.6	-3.6	4.3	-7.7	151.1	-7.7	-10.0	13.9
n-Pentane	-5.6	-18.8	-7.1	-6.4	2.1	-10.7	-0.4	-8.1	-50.4	-11.7
t-2-Pentene	0.0	-16.7	-17.4	-9.4	0.0	-30.0	40.4	-10.7	-30.0	-8.2
c-2-Pentene	(a)	-28.6	-26.1	-18.8	26.7	0.0	22.4	20.0	-17.6	-2.7
2-Methyl-2-butene	-12.5	-18.8	-5.8	-4.9	13.5	-13.6	1218.2	-12.5	-14.3	127.7
Cyclopentene	(a)	450.0	-16.7	(a)	0.0	(a)	72.7	(a)	-14.3	98.4
Cyclopentane	200.0	(a)	169.2	14.3	240.0	60.0	66.7	117.6	91.7	119.9
2,3-Dimethylbutane	(a)	(a)	-63.9	-13.0	-63.3	-61.9	-42.6	-67.5	-61.5	-53.4
Isohexane (b)	3.4	-12.5	-11.8	-63.6	11.0	-13.8	5.9	-14.5	-11.6	-12.0
3-Methylpentane	-45.5	-35.3	0.0	-22.1	-6.5	12.0	10.2	-30.9	-22.6	-15.6
2-Methyl-1-pentene	(a)	(a)	-20.0	150.0	71.4	-33.3	300.0	57.1	55.6	83.0
n-Hexane	-9.5	-43.5	-7.4	-6.6	-2.0	-13.6	-0.3	-6.3	-6.1	-10.6
t-2-Hexane	(a)	(a)	-12.5	(a)	28.6	(a)	4.0	-25.0	-45.5	-10.1
Methylcyclopentane	15.4	-13.3	5.7	0.0	17.2	-3.8	2.4	5.3	-2.7	2.9
2,4-Dimethylpentane	-36.4	-46.2	-10.0	-46.7	-7.7	-44.4	-2.4	-28.0	-15.9	-26.4
Benzene	0.0	-6.7	-11.3	13.5	14.6	-13.3	1.3	-10.0	-9.8	-2.4
Cyclohexane	700.0	166.7	88.9	64.7	675.0	100.0	-5.3	200.0	14.7	222.7
Isoheptane (c)	72.7	46.7	-45.5	38.1	-46.7	9.1	-58.1	43.2	-65.5	-0.7
2,3-Dimethylpentane	(a)	(a)	-64.3	(a)	-60.6	(a)	-43.3	(a)	-46.8	-53.7
3-Methylhexane	-16.7	-28.0	-11.4	-9.1	-7.1	-20.5	-5.1	-16.7	-15.6	-14.5
2,2,4-Trimethylpentane	-15.6	-31.7	-15.3	-14.3	2.2	-12.0	-11.8	-12.0	-13.9	-13.8
n-Heptane	62.5	-12.5	-18.8	10.0	-8.7	-15.8	-12.5	-16.0	-14.8	-2.9
Methylcyclohexane	-36.4	-54.5	-35.3	-16.0	-10.0	-41.7	-17.6	-46.2	-41.7	-33.3
2,3,4-Trimethylpentane	-9.1	-15.4	-4.5	-9.1	17.9	-11.1	4.8	0.0	-3.8	-3.4
Toluene	-1.8	-16.8	-4.2	-4.5	13.6	-6.7	2.7	-1.9	-0.8	-2.3
2-Methylheptane	0.0	0.0	0.0	28.6	60.0	10.0	29.6	13.3	26.1	18.6
3-Methylheptane	(a)	-16.7	-11.1	-14.3	8.3	-10.0	1.7	-11.8	-7.1	-7.6
n-Octane	(a)	(a)	(a)	-44.4	-30.0	-30.0	-25.0	7.7	-17.9	-23.3
Ethylbenzene	-17.6	-9.1	-16.1	-5.6	2.5	-24.1	-0.6	-6.1	-1.4	-8.7
m/p-Xylene	-1.6	-17.6	-3.0	0.0	12.5	-5.7	3.5	-4.3	-0.6	-1.9
Styrene	-64.7	-62.5	-55.6	(a)	-43.8	-83.9	-31.7	-50.0	-28.1	-52.5
o-Xylene	-26.1	-35.7	-13.2	-17.6	0.0	-24.3	-7.2	-13.1	-9.4	-16.3
n-Nonane	20.0	(a)	40.0	20.0	12.5	-12.5	26.1	11.1	12.5	16.2
1,3,5-Trimethylbenzene	600.0	-33.3	(a)	500.0	340.0	-16.7	1.6	-4.0	250.0	204.7
1,2,4-Trimethylbenzene	-66.2	-61.1	-41.4	-78.7	-83.9	-47.6	-7.2	-24.7	-59.4	-52.3
n-Decane	(a)	(a)	(a)	(a)	(a)	(a)	51.8	-53.8	-63.6	-21.9
1,2,3-Trimethylbenzene	62.5	92.3	83.3	88.9	41.9	100.0	37.3	28.6	9.7	60.5
Average for sample	37.5	-1.9	-3.0	15.3	25.5	-8.0	34.4	-2.2	-1.5	9.7 (d)

(a) No percent difference since compound response was below detection limit for Radian analysis.

(b) 2-Methylpentane = Isohexane

(c) 2-Methylhexane = Isoheptane

(d) Average of accumulated compound averages.

Table 11-10. Absolute Percent Bias Results of EPA Comparison Analysis

Absolute percent difference between Radian analysis and EPA analysis.
All concentrations given in ppbC.

SITE ID	B1AL	B2AL	B3AL	BMTX	CHNC	DLTX	EPTX	FWTX	JUMX	AVERAGE FOR
SAMPLE ID	2141	2190	2154	2435	2453	2314	2583	2581	2622	COMPOUND
COMPOUND										
Ethylene	31.8	0.0	21.1	93.9	14.7	26.2	3.9	3.3	3.6	22.1
Acetylene	17.4	31.3	11.6	5.4	9.6	14.6	20.2	26.2	28.1	18.3
Ethane	2.3	25.6	2.6	14.4	45.3	7.1	15.8	8.5	9.7	14.6
Propylene	13.3	21.7	8.9	24.0	10.5	7.4	5.0	16.4	22.0	14.4
Propane	9.2	22.9	46.7	8.8	0.0	8.8	4.5	10.8	19.4	14.6
Isobutane	5.7	16.7	9.0	10.2	3.4	11.8	6.3	8.8	11.0	9.2
1-Butene	11.1	24.0	13.0	14.6	2.7	12.2	3.2	10.8	13.1	11.6
1,3-Butadiene	(a)	31.6	0.0	(a)	8.0	(a)	7.8	14.3	19.0	13.5
n-Butane	5.7	10.3	7.4	8.7	20.9	20.9	0.9	8.9	0.0	9.3
t-2-Butene	(a)	33.3	17.1	15.4	8.0	(a)	0.0	0.0	127.3	28.7
c-2-Butene	(a)	(a)	6.1	0.0	0.0	(a)	13.5	11.8	40.0	11.9
3-Methyl-1-butene	(a)	(a)	25.0	0.0	18.2	(a)	0.0	13.3	0.0	9.4
Isopentane	2.6	16.2	1.4	0.8	10.1	12.8	7.6	13.1	8.8	8.2
1-Pentane	(a)	(a)	(a)	(a)	(a)	(a)	9.2	(a)	28.6	18.9
2-Methyl-1-butene	(a)	10.5	5.7	3.6	4.3	8.0	86.1	8.0	10.5	17.1
n-Pentane	5.7	20.7	7.4	6.6	2.1	11.3	0.4	8.4	67.3	14.4
t-2-Pentene	0.0	18.2	19.0	9.8	0.0	35.3	33.6	11.3	35.3	18.1
c-2-Pentene	(a)	33.3	30.0	20.7	23.5	0.0	20.2	18.2	19.4	20.7
2-Methyl-2-butene	13.3	20.7	5.9	5.0	12.7	14.6	171.8	13.3	15.4	30.3
Cyclopentene	(a)	138.5	18.2	(a)	0.0	(a)	53.3	(a)	15.4	45.1
Cyclopentane	100.0	(a)	91.7	13.3	109.1	46.2	50.0	74.1	62.9	68.4
2,3-Dimethylbutane	(a)	(a)	93.9	14.0	92.7	89.7	54.1	101.9	88.9	76.4
Isohexane (b)	3.4	13.3	12.5	93.2	10.4	14.9	5.7	15.7	12.4	20.2
3-Methylpentane	58.8	42.9	0.0	24.8	6.7	11.3	9.7	36.5	25.5	24.0
2-Methyl-1-pentene	(a)	(a)	22.2	85.7	52.6	40.0	120.0	44.4	43.5	58.4
n-Hexane	10.0	55.6	7.7	6.8	2.1	14.6	0.3	6.5	6.3	12.2
t-2-Hexene	(a)	(a)	13.3	(a)	25.0	(a)	3.9	28.6	58.8	25.9
Methylcyclopentane	14.3	14.3	5.6	0.0	15.9	3.9	2.4	5.1	2.8	7.1
2,4-Dimethylpentane	44.4	60.0	10.5	60.9	8.0	57.1	2.5	32.6	17.2	32.6
Benzene	0.0	6.9	11.9	12.7	13.6	14.3	1.3	10.5	10.3	9.1
Cyclohexane	155.6	90.9	61.5	48.9	154.3	66.7	5.4	100.0	13.7	77.4
Isoheptane (c)	53.3	37.8	58.8	32.0	60.9	8.7	81.8	35.6	97.4	51.8
2,3-Dimethylpentane	(a)	(a)	94.7	(a)	87.0	(a)	55.2	(a)	61.1	74.5
3-Methylhexane	18.2	32.6	12.1	9.5	7.4	22.8	5.2	18.2	16.9	15.9
2,2,4-Trimethylpentane	16.9	37.7	16.5	15.4	2.2	12.8	12.5	12.7	14.9	15.7
n-Heptane	47.6	13.3	20.7	9.5	9.1	17.1	13.3	17.4	16.0	18.2
Methylcyclohexane	44.4	75.0	42.9	17.4	10.5	52.6	19.4	60.0	52.6	41.6
2,3,4-Trimethylpentane	9.5	16.7	4.7	9.5	16.4	11.8	4.7	0.0	3.9	8.6
Toluene	1.8	18.4	4.3	4.6	12.8	7.0	2.6	1.9	0.8	6.0
2-Methylheptane	0.0	0.0	0.0	25.0	46.2	9.5	25.8	12.5	23.1	15.8
3-Methylheptane	(a)	18.2	11.8	15.4	8.0	10.5	1.7	12.5	7.4	10.7
n-Octane	(a)	(a)	(a)	57.1	35.3	35.3	28.6	7.4	19.6	30.6
Ethylbenzene	19.4	9.5	17.5	5.7	2.5	27.5	0.6	6.3	1.4	10.0
m/p-Xylene	1.6	19.4	3.0	0.0	11.8	5.8	3.4	4.4	0.6	5.6
Styrene	95.7	90.9	76.9	(a)	56.0	144.4	37.7	66.7	32.7	75.1
o-Xylene	30.0	43.5	14.1	19.4	0.0	27.7	7.5	14.0	9.9	18.4
n-Nonane	18.2	(a)	33.3	18.2	11.8	13.3	23.1	10.5	11.8	17.5
1,3,5-Trimethylbenzene	150.0	40.0	(a)	142.9	125.9	18.2	1.6	4.1	111.1	74.2
1,2,4-Trimethylbenzene	98.9	88.0	52.3	129.8	144.7	62.4	7.5	28.2	84.6	77.4
n-Decane	(a)	(a)	(a)	(a)	(a)	(a)	41.1	73.7	93.3	69.4
1,2,3-Trimethylbenzene	47.6	63.2	58.8	61.5	34.7	66.7	31.4	25.0	9.2	44.2
Average for sample	32.2	34.1	23.6	26.7	27.9	26.3	22.0	22.3	29.5	28.3 (d)

(a) No percent difference since compound response was below detection limit for Radian analysis.

(b) 2-Methylpentane = Isohexane

(c) 2-Methylhexane = Isoheptane

(d) Average of accumulated compound averages.

AREAL results as the reference. Table 11-10 gives the absolute percent differences.

The comparison results seen in Table 11-9 do not show an overall positive or negative bias tendency, and as a result the overall percent difference is low (< 10%). The majority of percent differences show good comparisons (< 50%). There are several very high positive percent differences (> 100%) caused by very low reported concentrations (< 1 ppbC), that are considered at or below detection limits for the SNMOC analysis method. The percent differences in Table 11-9 range from -83.9% to 1218.2%, with an overall average of 9.7 percent.

Table 11-10 compares the data on an absolute percent difference basis. The overall absolute percent difference is 28.3 percent. These are considered excellent results, showing comparable procedures and results between both laboratories. Because of a tendency for some compounds to have higher differences for all samples, it appears there may have been coelution problems for different compounds in each laboratory.

11.9 Data Acquisition and Reduction Procedures

A PE Nelson 2600 Chromatography Data System consisting of a 900 Series Intelligent Interface and a PC system containing the 2600 software was used to acquire, integrate and store the analytical data. A chromatogram and area count report from each detector are printed for each analysis. Electronic copies of the data were stored on 20 Mb flexible disk cartridges, and a compressed backup disk was also made.

The data was processed using Radian Peak Identification Program (RPIP) software. The RPIP used a database containing relative retention time information for all compounds of interest and applicable response factors to process the data files. A preliminary report was generated containing possible peak identifications

and quantitations based on the carbon response factor in effect at the time of analysis.

A data reviewer compared the RPIP report to the chromatogram to determine proper peak identifications. A second data review was performed to check for items which may have been overlooked on the first pass. After the data was reviewed twice, a final RPIP report was processed and reviewed for completeness. Final report versions containing information on all quantitated peaks were printed and filed with the analysis chromatogram printout and preliminary RPIP report. Electronic copies of all RPIP reports were also kept on file.

12.0 RECOMMENDATIONS

12.1 General

12.1.1 Vertical Stratification Study

In 1987, 1988, and 1989 ambient air samples were taken at ground level (3 to 10 meters) and at the 1197-foot (364.9-meter) level at one site. In 1988, an additional site was located on top of the World Trade Center in New York, a height of over 1000 feet. It is recommended that further study be performed at these sampling heights and that at least one more level (at 100 meters or some other appropirate height above ground level) be sampled at the same location. Upper atmospheric meteorological characterization measurements need to be made using a Wind Profiling system. Subsequent NMOC and meteorological data should be correlated. These samples should be analyzed for NMOC content as well as for the air toxics compound concentrations. It is also recommended that ozone concentrations and NO_x concentrations be monitored at the same locations and altitudes. The information gained from such a study would be useful in validating various atmospheric model predicitions.

12.1.2 Seasonal NMOC Studies

Data derived in a study qualifying NMOC and NO_x in seasons other than summer could be useful in understanding the relationship of NMOC to NO_x and meteorological conditions. Currently a year-round study for 24-hour air toxics ambient air samples is being conducted. No study is currently in progress to determine seasonal NMOC concentration changes.

12.1.3 Field Audit

It is recommended that a field audit be designed and conducted at several NMOC/SNMOC sites during the 1993 Monitoring Program. One field audit per month should be performed at an NMOC/SNMOC site during June, July, August, and September 1993. the field audit should use at least one standard of known NMOC/SNMOC concentration and should collect duplicate samples plus a zero-air blank for each site. The audit samples should use both dry and humid standards.

12.2 Equipment

12.2.1 Multiple Episode Sample Collection Equipment

A design for a multiple episode sampler has been completed. It is recommended that a prototype instrument be built according to the design. The prototype sampler should then be checked out and tested.

12.2.2 Current Sampling Equipment

The NMOC Program began in 1984. Some of the sampling equipment has been in used since 1984. Prior to the beginning of the 1992 sampling season, approximately 10 sampling systems were rebuilt using a new chassis-design (See Section 3.0). As the current sampling equipment fails, it is recommended to rebuild the samplers according to the more user-friendly chassis-design system (Style B) or the above mentioned multiple episode sampler.

12.2.3 Cleaning and Analytical Equipment

Much of the current cleanup system has been in operation since 1984. The original intended use of the equipment has been expanded to include year-round use. As components fail, provisions need to be made for replacements.

The GCs used for the PDFID method are also beginning to show signs of wear and tear. Maintenance of these systems must be maintained. And as with the cleanup system components, provisions need to be made for replacement parts as the need arises.

12.3 SNMOC

12.3.1 Expansion of Target Compound List

With the approval of the Clean Air Act Amendments (CAAA) compounds, it is recommended to expand the list of the current target compounds to include the appropriate ozone precursor CAAA compounds.

12.4 Air Toxics

12.4.1 Compound Stability Study

Depending on the intended use of the data collected under this option of the NMOC Program, further study may be needed to determine the compound stability in canisters. If health risk assessment is the intended use of this data, a compound stability study is recommended. Compound stability in this context refers to whether the apparent concentration of a compound in a sample taken from a canister is changing over time. The apparent change in concentration may result from a chemical reaction of the compound while it is in the canister, or result from a change in the gas phase concentration caused by adsorption of the compound on the interior canister surfaces.

A study needed to investigate this phenomenon would take several canisters--at least three from each initial concentration--ranging in target compound concentration from 0.0 to 20 ppbv. The canisters would be analyzed 24 hours after mixing, 72 hours after mixing, 30 days after mixing, and 60 days after mixing

to determine any concentration changes. It is also recommended that the same concentration be mixed in canisters, but that equilibration time of 7 days and 30 days be assigned before the first samples are drawn from the canisters to determine the effect of equilibration time on the concentration sample withdrawn from the canisters.

12.4.2 Expansion of Target Compound List

With the approval of the Clean Air Act Amendments compounds, it is recommended to expand the list of the current target 38 air toxic compounds to include the appropriate airborne toxic compounds.

12.5 Carbonyls

12.5.1 Use of Ozone Scrubber

Previous studies showed that the ozone scrubber was needed to accurately measure the carbonyl concentration in ambient air when sampling occurs with silica gel media. It is recommended to continue using the carbonyl ozone scrubber when sampling for carbonyl compounds.

12.5.2 Life of Ozone Scrubber

It is recommended to determine the life of the effectiveness of the ozone scrubbers. Some preliminary studies performed by the US EPA indicated that the effective life was approximately 6000 sample-hours. These results need to be checked and more definitively defined with field studies that extend over several years.

13.0 REFERENCES

1. Compendium Method TO-12, "Determination of Non-Methane Organic Compounds (NMOC) in Ambient Air Using Cryogenic Pre-Concentration and Direct Flame Ionization Detection (PDFID)," Quality Assurance Division, Environmental Monitoring Systems Laboratory, U.S. Environmental Protection Agency, Research Triangle Park, NC, 27711, May 1988.

2. Radian Corporation. 1991 Nonmethane Organic Compound, Speciated Nonmethane Organic Compound, and Three-Hour Urban Air Toxics Monitoring Programs, Work Plan and Quality Assurance Project Plan. DCN No. 91-262-045-56. Prepared for the U.S. Environmental Protection Agency, Research Triangle Park, NC. EPA Contract No. 68D80014.

3. Radian Corporation. 1990 Nonmethane Organic Compound and Three-Hour Air Toxics Monitoring Program. Final Report. Prepared for U. S. Environmental Protection Agency, Research Triangle Park, NC, 27711, DCN No. 91-262-045-04. January 1991.

4. Radian Corporation. 1989 Nonmethane Organic Compound and Three-Hour Air Toxics Monitoring Program. Final Report. Prepared for U. S. Environmental Protection Agency, Research Triangle Park, NC, 27711, EPA-450/4-90-011. May 1990.

5. Radian Corporation. 1988 Nonmethane Organic Compound and Urban Air Toxics Monitoring Program. Final Report. Volume I. U. S. Environmental Protection Agency, Research Triangle Park, NC, 27711, EPA-450/4-89-003. December 1988.

6. Radian Corporation, 1987 Nonmethane Organic Compound and Air Toxics Monitoring Programs. Final Report Volume 1 - Hydrocarbons, U. S. Environmental Protection Agency, Research Triangle Park, NC. EPA-450/4-88-011. August 19, 1988.

7. McAllister, R. A., R. F. Jongleux, D-P. Dayton, P. L. O'Hara, and D. E. Wagoner (Radian Corporation). Nonmethane Organic Compound Monitoring. Final Report. Prepared for U.S. Environmental Protection Agency, Research Triangle Park, NC. EPA Contract No. 68-02-3889, July 1987.

8. McAllister, R. A., D-P. Dayton, and D. E. Wagoner (Radian Corporation). Nonmethane Organic Compound Monitoring. Final Project Report. Prepared for U.S. Environmental Protection Agency, Research Triangle Park, NC. EPA Contract No. No. 68-02-3889, January 1986.

9. Radian Corporation. Nonmethane Organic Compounds Monitoring Assistance for Certain States in EPA Regions III, IV, V, VI, and VII, Phase II. Final Project Report. Prepared for the U.S. Environmental Protection Agency, Research Triangle Park, NC. EPA Contract No. 38-02-3513, February 1985.

APPENDIX A

SAMPLING SITES FOR 1992 NMOC MONITORING PROGRAM

TABLE A-1
1992 NMOC Monitoring Program Sites

US EPA Region	Site Code	City	AIRS Number	Base Program	Speciated NMOC Option	3-Hour Air Tox Option	Carbonyl Option
II	MNY	New York, NY	36-061-0010	NMOC	Yes		
II	LINY	Long Island, NY	36-059-0005	NMOC	Yes		
II	NWNJ	Newark, NJ	34-013-0011	NMOC	Yes	Yes	Yes
II	PLNJ	Plainfield, NJ	34-039-5001	NMOC	Yes	Yes	Yes
IV	B1AL	Birmingham, AL	01-073-6002	Speciated NMOC		Yes	
IV	B2AL	Birmingham, AL	01-073-5002	Speciated NMOC		Yes	
IV	B3AL	Birmingham, AL	01-117-0004	Speciated NMOC		Yes	
IV	CHNC	Charlotte, NC	37-119-0034	Speciated NMOC			
IV	R1NC	Raleigh, NC	37-183-0015	NMOC	Yes		
IV	WSNC	Winston Salem, NC	37-067-0022	NMOC	Yes		
IV	MIFL	Dade County, FL	12-025-4002	Speciated NMOC			
VI	BRLA	Baton Rouge, LA	22-033-0006	Speciated NMOC			
VI	DLTX	Dallas, TX	48-113-0069	Speciated NMOC			
VI	BMTX	Beaumont TX	48-245-0009	Speciated NMOC			
VI	FWTX	Ft. Worth, TX	48-439-1002	Speciated NMOC			
VI	ELTX	El Paso, TX	48-141-0027	Speciated NMOC			
VI	JUMX	Juarez, Mexico	80-006-0001	Speciated NMOC			
XIII	S2UT	Salt Lake City, UT	49-035-3001	NMOC	Yes		
XIII	S3UT	Salt Lake City, UT	49-011-0001	NMOC	Yes		

The site at Ciudad Juarez, State of Chihuahua, Mexico, is sponsored by U.S. EPA Region VI

EPA AEROMETRIC INFORMATION RETRIEVAL SYSTEM (AIRS)
AIR QUALITY SUBSYSTEM
SITE DESCRIPTION INVENTORY

EPA-REGION: 04 STATE (01): ALABAMA

SITE ID : 01-073-5002 CITY (00000): NOT IN A CITY
CITY POPULATION : 1 COUNTY (073): JEFFERSON CO
AQCR POPULATION : 1,168,098 AQCR (004): METROPOLITAN BIRMINGHAM
DATE ESTABLISHED: / / LAND USE (1): RESIDENTIAL
DATE TERMINATED : / / LOCATION SETTING (3): RURAL
SITE ADDR: PINSON, HIGH SCH., BOX 360 HWY 75 NORTH
URBAN AREA (1000): BIRMINGHAM, AL
SUPPORTING AGENCY (012): JEFFERSON COUNTY DEPARTMENT OF HEALTH
COMMENTS: PINSON VALLEY HIGH SCHOOL BY TENNIS COURTS IN FRONT OF SCHOOL
SITE-USER-INFO: NAMS OZONE

LATITUDE : 33:42:16 N HQ EVAL DATE : 80/07/17
LONGITUDE: 86:40:08 W DIFF. GMT : 06
UTM ZONE : 16 ELEVATION ABOVE MSL: 201 M
UTM NORTHING: 3729242 RECORD LAST UPDATED: 92/06/22
UTM EASTING : 530684 LAST REG EVAL : / /
DISTANCE CITY: 032 COMPASS SECTOR : NE
HC IND: Y MET DATA : N
MSA (1000): BIRMINGHAM, AL

SITE ID : 01-073-6002 CITY (75000): TARRANT CITY
CITY POPULATION : 8,148 COUNTY (073): JEFFERSON CO
AQCR POPULATION : 1,168,098 AQCR (004): METROPOLITAN BIRMINGHAM
DATE ESTABLISHED: / / LAND USE (1): RESIDENTIAL
DATE TERMINATED : / / LOCATION SETTING (2): SUBURBAN
SITE ADDR: TARRANT, ELEM. SCH., 1269 PORTLAND STREE
URBAN AREA (1000): BIRMINGHAM, AL
SUPPORTING AGENCY (012): JEFFERSON COUNTY DEPARTMENT OF HEALTH
COMMENTS: TARRANT ELEM. SCH. NEAR TENNIS COURTS BEHIND SCHOOL
SITE-USER-INFO: NAMS TSP AND OZONE

LATITUDE : 33:34:42 N HQ EVAL DATE : 80/07/17
LONGITUDE: 86:46:26 W DIFF. GMT : 06
UTM ZONE : 16 ELEVATION ABOVE MSL: 171 M
UTM NORTHING: 3715234 RECORD LAST UPDATED: 92/05/18
UTM EASTING : 520984 LAST REG EVAL : / /
DISTANCE CITY: 013 COMPASS SECTOR : NE
HC IND: Y MET DATA : N
MSA (1000): BIRMINGHAM, AL

SITE ID : 01-117-0004 CITY (00000): NOT IN A CITY
CITY POPULATION : 1 COUNTY (117): SHELBY CO
AQCR POPULATION : 1,168,098 AQCR (004): METROPOLITAN BIRMINGHAM
DATE ESTABLISHED: 83/01/01 LAND USE (4): AGRICULTURAL
DATE TERMINATED : / / LOCATION SETTING (3): RURAL
SITE ADDR: BEARDEN FARM
URBAN AREA (1000): BIRMINGHAM, AL
SUPPORTING AGENCY (011): AL DEPT. OF ENV. MGT.
COMMENTS:

LATITUDE : 33:19:01 N HQ EVAL DATE : / /
LONGITUDE: 86:49:30 W DIFF. GMT :
UTM ZONE : 16 ELEVATION ABOVE MSL: 600 M
UTM NORTHING: 3686270 RECORD LAST UPDATED: 92/09/17
UTM EASTING : 516280 LAST REG EVAL : / /
DISTANCE CITY: COMPASS SECTOR :
HC IND: Y MET DATA : N
MSA (1000): BIRMINGHAM, AL

AIR QUALITY SUBSYSTEM
SITE DESCRIPTION INVENTORY

EPA-REGION: 04 STATE (12): FLORIDA

SITE ID : 12-025-4002 CITY (45000): MIAMI
CITY POPULATION : 346,865 COUNTY (025): DADE CO
AQCR POPULATION : 3,515,388 AQCR (050): SOUTHEAST FLORIDA
DATE ESTABLISHED: / / LAND USE (2): COMMERCIAL
DATE TERMINATED : / / LOCATION SETTING (1): URBAN AND CENTER CITY
SITE ADDR: METRO ANNEX 864 NW 3RD STREET
URBAN AREA (5000): MIAMI, FL
SUPPORTING AGENCY (018): DADE COUNTY DEPARTMENT ENVIRONMENTAL RESOURCES MANA
COMMENTS: DCPC #1

LATITUDE : 25:47:52 N
LONGITUDE: 80:12:37 W
UTM ZONE : 17
UTM NORTHING: 2853365
UTM EASTING : 579171
DISTANCE CITY: 029
HC IND: Y
MSA (5000): MIAMI-HIALEAH, FL

HQ EVAL DATE : / /
DIFF. GMT : 05
ELEVATION ABOVE MSL: 5 M
RECORD LAST UPDATED: 92/08/03
LAST REG EVAL : / /
COMPASS SECTOR :
MET DATA : N

EPA AEROMETRIC INFORMATION RETRIEVAL SYSTEM (AIRS)
AIR QUALITY SUBSYSTEM
SITE DESCRIPTION INVENTORY

EPA-REGION: 06

STATE (22): LOUISIANA

SITE ID : 22-033-0006
CITY (05000): BATON ROUGE
CITY POPULATION : 219,419
COUNTY (033): EAST BATON ROUGE PAR
AQCR POPULATION : 3,921,588
AQCR (106): SOUTHERN LOUISIANA-SOUTHEAST T
DATE ESTABLISHED: 90/01/03
LAND USE (2): COMMERCIAL
DATE TERMINATED : / /
LOCATION SETTING (1): URBAN AND CENTER CITY
SITE ADDR: 1600 RIVERSIDE RD
URBAN AREA (0760): BATON ROUGE, LA
SUPPORTING AGENCY (001): STATE OF LOUISIANA
COMMENTS: CAPITOL SITE - RELOCATION FOR 220330004

LATITUDE : 30:27:52 N
LONGITUDE: 91:11:17 W
UTM ZONE : 15
UTM NORTHING: 3371464
UTM EASTING : 673956
DISTANCE CITY:
HC IND: N
MSA (0760): BATON ROUGE, LA

HQ EVAL DATE : / /
DIFF. GMT : 06
ELEVATION ABOVE MSL: 62 M
RECORD LAST UPDATED: 92/03/11
LAST REG EVAL : / /
COMPASS SECTOR :
MET DATA : Y

EPA-REGION: 02 STATE (34): NEW JERSEY

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SITE ID          : 34-013-0011 CITY (51000): NEWARK                        LATITUDE :  40:43:37 N  HQ EVAL DATE       :   /  /
CITY POPULATION  :     329,248 COUNTY (013): ESSEX CO                      LONGITUDE:  74:08:39 W  DIFF. GMT           : 05
AQCR POPULATION  : 16,525,701  AQCR   (043): NEW JERSEY-NEW YORK-CONNECTICU UTM ZONE : 18          ELEVATION ABOVE MSL:     3 M
DATE ESTABLISHED: 85/01/01     LAND USE (3): INDUSTRIAL                    UTM NORTHING: 4508570   RECORD LAST UPDATED: 92/05/14
DATE TERMINATED  :   /  /      LOCATION SETTING (1): URBAN AND CENTER CITY UTM EASTING :   572280  LAST REG EVAL       : 86/05/06
SITE ADDR: ST. CHARLES BETWEEN KOSSUTH & KAMERON ST                        DISTANCE CITY: 015      COMPASS SECTOR      : SW
URBAN AREA (5601): NEW YORK, NY-NORTHEASTERN NJ                            HC IND: Y               MET DATA            : N
SUPPORTING AGENCY (001): NEW JERSEY STATE DEPARTMENT OF ENVIRONMENTAL PROTEC MSA (5640): NEWARK, NJ
COMMENTS: NJ #07142,START 1/1/85,RELOC.FROM 340130008, SITTING CRITERIA?
SITE-USER-INFO: PM10,DICHOT,START 3/15/86,ELEV.16';03 DOWN 5/16/86-3/25/87

SITE ID          : 34-039-5001 CITY (59190): PLAINFIELD                    LATITUDE :  40:36:03 N  HQ EVAL DATE       :   /  /
CITY POPULATION  :      45,555 COUNTY (039): UNION CO                      LONGITUDE:  74:26:31 W  DIFF. GMT           : 05
AQCR POPULATION  : 16,525,701  AQCR   (043): NEW JERSEY-NEW YORK-CONNECTICU UTM ZONE : 18          ELEVATION ABOVE MSL:    18 M
DATE ESTABLISHED: 80/05/01     LAND USE (1): RESIDENTIAL                   UTM NORTHING: 4494399   RECORD LAST UPDATED: 91/04/10
DATE TERMINATED  :   /  /      LOCATION SETTING (2): SUBURBAN              UTM EASTING :   547218  LAST REG EVAL       : 90/07/06
SITE ADDR: WEST THIRD AND BERGEN STREETS                                   DISTANCE CITY: 042      COMPASS SECTOR      : SW
URBAN AREA (5601): NEW YORK, NY-NORTHEASTERN NJ                            HC IND: Y               MET DATA            : N
SUPPORTING AGENCY (001): NEW JERSEY STATE DEPARTMENT OF ENVIRONMENTAL PROTEC MSA (5640): NEWARK, NJ
COMMENTS: NJ #20121, SLAMS-NO2,03  1980 NE OXIDANT STUDY;03,SO2,NOX
SITE-USER-INFO: FORMERLY CODED 340351001
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EPA-REGION: 02 STATE (36): NEW YORK

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SITE ID          : 36-059-0005 CITY (00000): NOT IN A CITY                  LATITUDE :  40:44:43 N  HQ EVAL DATE       :   /  /
CITY POPULATION  :           1 COUNTY (059): NASSAU CO                      LONGITUDE:  73:35:13 W  DIFF. GMT           : 05
AQCR POPULATION  : 16,525,701  AQCR   (043): NEW JERSEY-NEW YORK-CONNECTICU UTM ZONE : 18           ELEVATION ABOVE MSL:    27 M
DATE ESTABLISHED: 71/01/01     LAND USE (2): COMMERCIAL                     UTM NORTHING: 4511200   RECORD LAST UPDATED: 92/11/04
DATE TERMINATED :   /  /       LOCATION SETTING (2): SUBURBAN               UTM EASTING :   619300  LAST REG EVAL      :   /  /
SITE ADDR: EISENHOWER PARK,MERRICK AV&OLD COUNTRY R                         DISTANCE CITY: 033      COMPASS SECTOR     : E
URBAN AREA (5601): NEW YORK, NY-NORTHEASTERN NJ                             HC IND:                 MET DATA           : Y
SUPPORTING AGENCY (001): NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVA MSA (5380): NASSAU-SUFFOLK, NY
COMMENTS: NYS #2950-10 START SO2,CO,O3,NO2,TSP'71,PB'72;NECRMP'80,NO,NO2,O3
SITE-USER-INFO: O3-#334105002F01 12/82,MIDDLE SCALE,MEETS SITING,NO2-2-025 - 12/86

SITE ID          : 36-061-0010 CITY (51000): NEW YORK CITY                  LATITUDE :  40:44:22 N  HQ EVAL DATE       : 80/09/23
CITY POPULATION  :   7,071,639 COUNTY (061): NEW YORK CO                    LONGITUDE:  73:59:10 W  DIFF. GMT           : 05
AQCR POPULATION  : 16,525,701  AQCR   (043): NEW JERSEY-NEW YORK-CONNECTICU UTM ZONE : 18           ELEVATION ABOVE MSL:    38 M
DATE ESTABLISHED:   /  /       LAND USE (1): RESIDENTIAL                    UTM NORTHING: 4510116   RECORD LAST UPDATED: 92/09/30
DATE TERMINATED :   /  /       LOCATION SETTING (1): URBAN AND CENTER CITY  UTM EASTING :   585607  LAST REG EVAL      : 80/09/22
SITE ADDR: MABEL DEAN HIGH SCH.ANNEX, 240 2ND AVE.                          DISTANCE CITY: 003      COMPASS SECTOR     : S
URBAN AREA (5601): NEW YORK, NY-NORTHEASTERN NJ                             HC IND: Y               MET DATA           : Y
SUPPORTING AGENCY (001): NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVA MSA (5600): NEW YORK, NY
COMMENTS: NYS#7093-05,START NO2,O3 11/18/76,TSP 10/10,CO 10/3/77,SO2 2/5/78
SITE-USER-INFO: 1980 NECRMP,DISC.CO,O3 5/25,RESTART O3 9/24/82;ELEV.TSP 102'
```

AIR QUALITY SUBSYSTEM
SITE DESCRIPTION INVENTORY

EPA-REGION: 04 STATE (37): NORTH CAROLINA

SITE ID : 37-067-0022 CITY (75000): WINSTON-SALEM LATITUDE : 36:06:38 N HQ EVAL DATE : / /
CITY POPULATION : 131,885 COUNTY (067): FORSYTH CO LONGITUDE: 80:13:36 W DIFF. GMT : 05
AQCR POPULATION : 1,114,750 AQCR (136): NORTHERN PIEDMONT UTM ZONE : 17 ELEVATION ABOVE MSL: 287 M
DATE ESTABLISHED: / / LAND USE (1): RESIDENTIAL UTM NORTHING: 3996287 RECORD LAST UPDATED: 90/03/29
DATE TERMINATED : / / LOCATION SETTING (1): URBAN AND CENTER CITY UTM EASTING : 569604 LAST REG EVAL : / /
SITE ADDR: 1300 BLK. HATTIE AVENUE DISTANCE CITY: COMPASS SECTOR :
URBAN AREA (9220): WINSTON-SALEM, NC HC IND: MET DATA :
SUPPORTING AGENCY (002): FORSYTH COUNTY ENVIRONMENTAL AFFAIRS DEPARTMENT MSA (3120): GREENSBORO-WINSTON-SALEM-HIGH POIN
COMMENTS: NEXT TO CHURCH SCHOOL. POP EXPOSURE.
SITE-USER-INFO: RJR BAILEY POWER PLANT PT MAX.

SITE ID : 37-183-0015 CITY (55000): RALEIGH LATITUDE : 35:47:18 N HQ EVAL DATE : / /
CITY POPULATION : 150,255 COUNTY (183): WAKE CO LONGITUDE: 78:37:20 W DIFF. GMT : 05
AQCR POPULATION : 1,082,284 AQCR (166): EASTERN PIEDMONT UTM ZONE : 17 ELEVATION ABOVE MSL: 127 M
DATE ESTABLISHED: 91/06/06 LAND USE (1): RESIDENTIAL UTM NORTHING: 3962881 RECORD LAST UPDATED: 92/07/17
DATE TERMINATED : / / LOCATION SETTING (1): URBAN AND CENTER CITY UTM EASTING : 714899 LAST REG EVAL : / /
SITE ADDR: 808 NORTH STATE STREET DISTANCE CITY: 002 COMPASS SECTOR :
URBAN AREA (6639): RALEIGH, NC HC IND: Y MET DATA : N
SUPPORTING AGENCY (001): NORTH CAROLINA DEPT NATURAL RESOURCES&COMMUNITY DEV MSA (6640): RALEIGH-DURHAM, NC
COMMENTS:

AIR QUALITY SUBSYSTEM
SITE DESCRIPTION INVENTORY

EPA-REGION: 04 STATE (37): NORTH CAROLINA

SITE ID : 37-119-0034 CITY (12000): CHARLOTTE LATITUDE : 35:14:50 N HQ EVAL DATE : 83/07/22
CITY POPULATION : 314,447 COUNTY (119): MECKLENBURG CO LONGITUDE: 80:45:50 W DIFF. GMT : 05
AQCR POPULATION : 1,216,719 AQCR (167): METROPOLITAN CHARLOTTE UTM ZONE : 17 ELEVATION ABOVE MSL: 239 M
DATE ESTABLISHED: / / LAND USE (1): RESIDENTIAL UTM NORTHING: 3900287 RECORD LAST UPDATED: 92/07/17
DATE TERMINATED : / / LOCATION SETTING (2): SUBURBAN UTM EASTING : 521481 LAST REG EVAL : / /
SITE ADDR: PLAZA ROAD AND LAKEDELL DISTANCE CITY: 010 COMPASS SECTOR : E
URBAN AREA (1519): CHARLOTTE, NC HC IND: Y MET DATA :
SUPPORTING AGENCY (003): MECKLENBURG COUNTY DEPARTMENT OF ENVIRONMENTAL HEAL MSA (1520): CHARLOTTE-GASTONIA-ROCK HILL, NC-S
COMMENTS: NEW SITE-OZONE CARBON MONOXIDE AND NO 2 CONTINUOUS
SITE-USER-INFO: NEIGHBORHOOD SCALE POPULATION ORIENTED FOR CO & OZONE

EPA-REGION: 06 STATE (48): TEXAS

SITE ID : 48-113-0069 CITY (19000): DALLAS
CITY POPULATION : 904,078 COUNTY (113): DALLAS CO
AQCR POPULATION : 3,257,903 AQCR (215): METROPOLITAN DALLAS-FORT WORTH
DATE ESTABLISHED: 86/01/01 LAND USE (2): COMMERCIAL
DATE TERMINATED : / / LOCATION SETTING (1): URBAN AND CENTER CITY
SITE ADDR: 1415 HINTON STREET
URBAN AREA (1920): DALLAS-FORT WORTH, TX
SUPPORTING AGENCY (002): CITY OF DALLAS AIR POLLUTION CONTROL SECTION
COMMENTS: FORMERLY MOCKINGBIRD SITE 451310044H01
SITE-USER-INFO: OFFICES MOVED, NEW SITE NEEDED

LATITUDE : 32:49:34 N HQ EVAL DATE : / /
LONGITUDE: 96:51:50 W DIFF. GMT : 06
UTM ZONE : 14 ELEVATION ABOVE MSL: 125 M
UTM NORTHING: 3633840 RECORD LAST UPDATED: 92/10/29
UTM EASTING : 699960 LAST REG EVAL : 86/12/11
DISTANCE CITY: COMPASS SECTOR :
HC IND: Y MET DATA :
MSA (1920): DALLAS, TX

SITE ID : 48-141-0027 CITY (24000): EL PASO
CITY POPULATION : 425,259 COUNTY (141): EL PASO CO
AQCR POPULATION : 660,806 AQCR (153): EL PASO-LAS CRUCES-ALAMOGORDO
DATE ESTABLISHED: 73/01/01 LAND USE (2): COMMERCIAL
DATE TERMINATED : / / LOCATION SETTING (1): URBAN AND CENTER CITY
SITE ADDR: 500 NORTH CAMPBELL ST.
URBAN AREA (2320): EL PASO, TX
SUPPORTING AGENCY (001): TEXAS AIR CONTROL BOARD
COMMENTS: SIP MONITOR
SITE-USER-INFO: ACTIVE 11/73

LATITUDE : 31:45:45 N HQ EVAL DATE : / /
LONGITUDE: 106:29:13 W DIFF. GMT : 07
UTM ZONE : 13 ELEVATION ABOVE MSL: 1140 M
UTM NORTHING: 3514886 RECORD LAST UPDATED: 92/08/05
UTM EASTING : 359179 LAST REG EVAL : / /
DISTANCE CITY: COMPASS SECTOR :
HC IND: Y MET DATA :
MSA (2320): EL PASO, TX

SITE ID : 48-245-0009 CITY (07000): BEAUMONT
CITY POPULATION : 118,102 COUNTY (245): JEFFERSON CO
AQCR POPULATION : 3,921,588 AQCR (106): SOUTHERN LOUISIANA-SOUTHEAST T
DATE ESTABLISHED: 80/01/01 LAND USE (1): RESIDENTIAL
DATE TERMINATED : / / LOCATION SETTING (2): SUBURBAN
SITE ADDR: GEORGIA AT CUNNINGHAM, BEAUMONT, TX
URBAN AREA (0839): BEAUMONT, TX
SUPPORTING AGENCY (001): TEXAS AIR CONTROL BOARD
COMMENTS: MOVED FROM VIRGINIA ST
SITE-USER-INFO: LAMAR UNIVERSITY CAMPUS

LATITUDE : 30:02:22 N HQ EVAL DATE : / /
LONGITUDE: 94:04:29 W DIFF. GMT : 06
UTM ZONE : 15 ELEVATION ABOVE MSL: 13 M
UTM NORTHING: 3323462 RECORD LAST UPDATED: 92/08/05
UTM EASTING : 396381 LAST REG EVAL : / /
DISTANCE CITY: COMPASS SECTOR :
HC IND: MET DATA :
MSA (0840): BEAUMONT-PORT ARTHUR, TX

SITE ID : 48-439-1002 CITY (27000): FORT WORTH
CITY POPULATION : 385,164 COUNTY (439): TARRANT CO
AQCR POPULATION : 3,257,903 AQCR (215): METROPOLITAN DALLAS-FORT WORTH
DATE ESTABLISHED: 75/01/01 LAND USE (2): COMMERCIAL
DATE TERMINATED : / / LOCATION SETTING (1): URBAN AND CENTER CITY
SITE ADDR: ROSS AVE BETWEEN LONG AND 34TH ST
URBAN AREA (1920): DALLAS-FORT WORTH, TX
SUPPORTING AGENCY (001): TEXAS AIR CONTROL BOARD
COMMENTS: CONTINUOUS MONITRING STATION

LATITUDE : 32:48:19 N HQ EVAL DATE : 80/10/28
LONGITUDE: 97:21:26 W DIFF. GMT : 06
UTM ZONE : 14 ELEVATION ABOVE MSL: 204 M
UTM NORTHING: 3630705 RECORD LAST UPDATED: 92/08/05
UTM EASTING : 653810 LAST REG EVAL : 80/08/01
DISTANCE CITY: 006 COMPASS SECTOR : N
HC IND: Y MET DATA : Y
MSA (2800): FORT WORTH-ARLINGTON, TX

EPA-REGION: 08 STATE (49): UTAH

SITE ID : 49-011-0001 CITY (07690): BOUNTIFUL
CITY POPULATION : 32,877 COUNTY (011): DAVIS CO
AQCR POPULATION : 1,154,361 AQCR (220): WASATCH FRONT
DATE ESTABLISHED: / / LAND USE (2): COMMERCIAL
DATE TERMINATED : / / LOCATION SETTING (2): SUBURBAN
SITE ADDR: 65W 300S BOUNTIFUL UTAH
URBAN AREA (7159): SALT LAKE CITY, UT
SUPPORTING AGENCY (001): UTAH DEPARTMENT OF HEALTH
COMMENTS: COMPLETE MONITORING STATION BEGAN 9-13-74

LATITUDE : 40:53:44 N HQ EVAL DATE : 81/10/28
LONGITUDE: 111:52:55 W DIFF. GMT : 07
UTM ZONE : 12 ELEVATION ABOVE MSL: 1335 M
UTM NORTHING: 4527325 RECORD LAST UPDATED: 92/04/30
UTM EASTING : 425708 LAST REG EVAL : 81/10/28
DISTANCE CITY: 015 COMPASS SECTOR : N
HC IND: Y MET DATA : Y
MSA (7160): SALT LAKE CITY-OGDEN, UT

SITE ID : 49-035-3001 CITY (67000): SALT LAKE CITY
CITY POPULATION : 163,697 COUNTY (035): SALT LAKE CO
AQCR POPULATION : 1,154,361 AQCR (220): WASATCH FRONT
DATE ESTABLISHED: 62/01/01 LAND USE (2): COMMERCIAL
DATE TERMINATED : / / LOCATION SETTING (1): URBAN AND CENTER CITY
SITE ADDR: HEALTH DEPT BLDG 610 SOUTH 2ND EAST
URBAN AREA (7159): SALT LAKE CITY, UT
SUPPORTING AGENCY (001): UTAH DEPARTMENT OF HEALTH
COMMENTS:

LATITUDE : 40:45:21 N HQ EVAL DATE : 81/10/27
LONGITUDE: 111:53:06 W DIFF. GMT : 07
UTM ZONE : 12 ELEVATION ABOVE MSL: 1305 M
UTM NORTHING: 4511818 RECORD LAST UPDATED: 92/04/30
UTM EASTING : 425294 LAST REG EVAL : 81/10/27
DISTANCE CITY: 002 COMPASS SECTOR : S
HC IND: Y MET DATA : Y
MSA (7160): SALT LAKE CITY-OGDEN, UT

EPA AEROMETRIC INFORMATION RETRIEVAL SYSTEM (AIRS)
AIR QUALITY SUBSYSTEM
SITE DESCRIPTION INVENTORY

EPA-REGION: 06

STATE (80): COUNTRY OF MEXICO

SITE ID : 80-006-0001
CITY POPULATION : 355,555
AQCR POPULATION : 34,923,129
DATE ESTABLISHED: 90/06/04
DATE TERMINATED : / /
SITE ADDR: TECHNICAL INSTITUTE
URBAN AREA (2320): EL PASO, TX
SUPPORTING AGENCY (002): SEDUE
COMMENTS: SPECIAL EL PASO/JUAREZ MONITORING SITE.

CITY (01150): CIUDAD-JUAREZ
COUNTY (006): CHIHUAHUA STATE
AQCR (250): COUNTRY OF MEXICO
LAND USE (2): COMMERCIAL
LOCATION SETTING (1): URBAN AND CENTER CITY

LATITUDE :
LONGITUDE:
UTM ZONE :
UTM NORTHING:
UTM EASTING :
DISTANCE CITY:
HC IND: N
MSA (2320): EL PASO, TX

HQ EVAL DATE : / /
DIFF. GMT :
ELEVATION ABOVE MSL:
RECORD LAST UPDATED: 92/04/02
LAST REG EVAL : / /
COMPASS SECTOR :
MET DATA :

APPENDIX B

CRYOGENIC PRECONCENTRATION AND DIRECT FLAME IONIZATION DETECTION (PDFID) METHOD

COMPENDIUM METHOD T0-12

DETERMINATION OF NON-METHANE ORGANIC COMPOUNDS (NMOC) IN AMBIENT AIR USING CRYOGENIC PRE-CONCENTRATION AND DIRECT FLAME IONIZATION DETECTION (PDFID)

QUALITY ASSURANCE DIVISION
ENVIRONMENTAL MONITORING SYSTEMS LABORATORY
U.S. ENVIRONMENTAL PROTECTION AGENCY
RESEARCH TRIANGLE PARK, NORTH CAROLINA 27711

MAY, 1988

METHOD TO12

METHOD FOR THE DETERMINATION OF NON-METHANE ORGANIC COMPOUNDS (NMOC) IN AMBIENT AIR USING CRYOGENIC PRECONCENTRATION AND DIRECT FLAME IONIZATION DETECTION (PDFID)

1. Scope

1.1 In recent years, the relationship between ambient concentrations of precursor organic compounds and subsequent downwind concentrations of ozone has been described by a variety of photochemical dispersion models. The most important application of sucn model is to determine the degree of control of precursor organic compounds that is necessary in an urban area to acnieve compliance with applicable ambient air quality standards for ozone (1,2).

1.2 The more elaborate theoretical models generally require detailec organic species data obtained by multicomponent gas chromatograp The Empirical Kinetic Modeling Approach (EKMA), however, require only the total non-methane organic compound (NMOC) concentratior data; specifically, the average total NMOC concentration from 6 a.m. to 9 a.m. daily at the sampling location. The use of tota NMOC concentration data in the EKMA substantially reduces the cost and complexity of the sampling and analysis system by not requiring qualitative and quantitative species identification.

1.3 Method TO1, "Method for The Determination of Volatile Organic Compounds in Ambient Air Using Tenax® Adsorption and Gas Chromatography/Mass Spectrometry (GC/MS)", employs collection of certain volatile organic compounds on Tenax® GC with subsequent analysis by thermal desorption/cryogenic preconcentration and GC/MS identification. This method (TO12) combines the same type of cryogenic concentration technique used in Method TO1 for high sensitivity with the simple flame ionization detector (FID) of the GC for total NMOC measurements, without the GC columns and complex procedures necessary for species separation

1.4 In a flame ionization detector, the sample is injected into a hydrogen-rich flame where the organic vapors burn producing ionized molecular fragments. The resulting ion fragments are then collected and detected. The FID is nearly a univer detector. However, the detector response varies with t species of [functional group in] the organic compound in an oxy atmosphere. Because this method employs a helium or argon carrier gas, the detector response is nearly one for all compounds. Thus, the historical short-coming of the FID involving varying detector response to different organic functional groups is minimized.

1.5 The method can be used either for direct, in situ ambient measurements or (more commonly) for analysis of integrated samples collected in specially treated stainless steel canisters. EKMA models generally require 3-hour integrated NMOC measurements over the 6 a.m. to 9 a.m. period and are used by State or local agencies to prepare State Implementation Plans (SIPs) for ozone control to achieve compliance with the National Ambient Air Quality Standards (NAAQS) for ozone. For direct, in situ ambient measurements, the analyst must be presen ring the 6 a.m. to 9 a.m. period, and repeat measurements (a oximately six per hour) must be taken to obtain the 6 a.m. to 9 a.m. average NMOC concentration. The use of sample canisters allows the col tion of integrated air samples over the 6 a.m. to 9 a.m. period by unattended, automated samplers. This method has incorporated both sampling approaches.

2. Applicable Documents

2.1 ASTM Standards

D1356 - Definition of Terms Related to Atmospheric Sampling and Analysis

E260 - Recommended Practice for General Gas Chromatography Procedures

E355 - Practice for Gas Chromatography Terms and Relationships

2.2 Other Documents

U. S. Environmental Protection Agency Technical Assistance Documents (4,5)
Laboratory and Ambient Air Studies (6-10)

3. Summary of Method

3.1 A whole air sample is either extracted directly from the ambier air and analyzed on site by the GC system or collected into a precleaned sample canister and analyzed off site.

3.2 The analysis requires drawing a fixed-volume portion of the sample air at a low flow rate through a glass-bead filled trap that is cooled to approximately -186°C with liquid argon. The cryogenic trap simultaneously collects and concentrates the NMOC (either via condensation or adsorption) while allowing the methane, nitrogen, oxygen, etc. to pass through the trap without retention. The system is dynamically calibrated so that the volume of sample passing through the trap does not have to be quantitatively measured, but must be precisely repeatable between the calibration and the analytical phases.

3.3 After the fixed-volume air sample has been drawn through the trap, a helium carrier gas flow is diverted to pass through the trap, in the opposite direction to the sample flow, and into an FID. When the residual air and methane have been flushed from the trap and the FID baseline restabilizes, the cryogen is removed and the temperature of the trap is raised to approximately 90°C.

3.4 The organic compounds previously collected in the trap revolatilize due to the increase in temperature and are carried int the FID, resulting in a response peak or peaks from the FID. The area of the peak or peaks is integrated, and the integrate value is translated to concentration units via a previously-obtained calibration curve relating integrated peak areas with known concentrations of propane.

3.5 By convention, concentrations of NMOC are reported in units of parts per million carbon (ppmC), which, for a specific compour is the concentration by volume (ppmV) multiplied by the numbe of carbon atoms in the compound.

3.6 The cryogenic trap simultaneously concentrates the NMOC while separating and removing the methane from air samples. The technique is thus direct reading for NMOC and, because of the concentration step, is more sensitive than conventional continuous NMOC analyzers.

4. Significance

4.1 Accurate measurements of ambient concentrations of NMOC are important for the control of photochemical smog because these organic compounds are primary precursors of atmospheric ozone and other oxidants. Achieving and maintaining compliance with the NAAQS for ozone thus depends largely on control of ambient levels of NMOC.

4.2 The NMOC concentrations typically found at urban sites may range up to 5-7 ppmC or higher. In order to determine transport of precursors into an area, measurement of NMOC upwind of the area may be necessary. Upwind NMOC concentrations are likely to be less than a few tenths of 1 ppm.

4.3 Conventional methods that depend on gas chromatography and qualitative and quantitative species evaluation are excessively difficult and expensive to operate and maintain when speciated measurements are not needed. The method described here involves a simple, cryogenic preconcentration procedure with subsequent, direct, flame ionization detection. The method is sensitive and provides accurate measurements of ambient NMOC concentrations where speciated data are not required as applicable to the EKMA.

5. Definitions

[Note: Definitions used in this document and in any user-prepared Standard Operating Procedures (SOPs) should be consistent with ASTM Methods D1356 and E355. All abbreviations and symbols are defined within this document at point of use.]

5.1 Absolute pressure - Pressure measured with reference to absolute zero pressure (as opposed to atmospheric pressure), usually expressed as pounds-force per square inch absolute (psia).

5.2 Cryogen - A substance used to obtain very low trap temperatures in the NMOC analysis system. Typical cryogens are liquid argon (bp -185.7) and liquid oxygen (bp-183.0).

5.3 Dynamic calibration - Calibration of an analytical system with pollutant concentrations that are generated in a dynamic, flowing system, such as by quantitative, flow-rate dilution of a high concentration gas standard with zero gas.

5.4 EKMA - Empirical Kinetics Modeling Approach; an empirical model that attempts to relate morning ambient concentrations of nonmethane organic compounds (NMOC) and NO_x with subsequent peak, downwind ambient ozone concentrations; used by pollution control agencies to estimate the degree of hydrocarbon emission reductio needed to achieve compliance with national ambient air quality standards for ozone.

5.5 Gauge pressure - Pressure measured with reference to atmospheric pressure (as opposed to absolute pressure). Zero gauge pressure (0 psig) is equal to atmospheric pressure, or 14.7 psia (101 kPa

5.6 *In situ* - In place; *In situ* measurements are obtained by direct on-the-spot analysis, as opposed to subsequent, remote analysis of a collected sample.

5.7 Integrated sample - A sample obtained uniformly over a specifiec time period and representative of the average levels of pollutar during the time period.

5.8 NMOC - Nonmethane organic compounds; total organic compounds as measured by a flame ionization detector, excluding methane.

5.9 ppmC - Concentration unit of parts per million carbon; for a spe cific compound, ppmC is equivalent to parts per million by volur (ppmv) multiplied by the number of carbon atoms in the compound

5.10 Sampling - The process of withdrawing or isolating a representa portion of an ambient atmosphere, with or without the simultane isolation of selected components for subsequent analysis.

6. Interferences

6.1 In field and laboratory evaluation, water was found to cause a positive shift in the FID baseline. The effect of this shift is minimized by carefully selecting the integration termination point and adjusted baseline used for calculating the area of the NMOC peak(s)

6.2 When using helium as a carrier gas, FID response is quite uniform for most hydrocarbon compounds, but the response can vary considerably for other types of organic compounds.

7. Apparatus

7.1 Direct Air Sampling (Figure 1)

7.1.1 Sample manifold or sample inlet line - to bring sample air into the analytical system.

7.1.2 Vacuum pump or blower - to draw sample air through a sample manifold or long inlet line to reduce inlet residence time. Maximum residence time should be no greater than 1 minute.

7.2 Remote Sample Collection in Pressurized Canisters (Figure 2)

7.2.1 Sample canister(s) - stainless steel, Summa®-polished vessel(s) of 4-6 L capacity (Scientific Instrumentation Specialists, Inc., P.O. Box 8941, Moscow, ID 83843), used for automatic collection of 3-hour integrated field air samples. Each canister should have a unique identification number stamped on its frame.

7.2.2 Sample pump - stainless steel, metal bellows type (Model MB-151, Metal Bellows Corp., 1075 Providence Highway, Sharon, MA 02067) capable of 2 atmospheres minimum output pressure. Pump must be free of leaks, clean, and uncontaminated by oil or organic compounds.

7.2.3 Pressure gauge - 0-30 psig (0-240 kPa).

7.2.4 Solenoid valve - special electrically-operated, bistable solenoid valve (Skinner Magnelatch Valve, New Britain,

CT), to control sample flow to the canister with negligible temperature rise (Figure 3). The use of the Skinner Magnelatch valve avoids any substantial temperature rise that would occur with a conventional, normally closed solenoid valve, which would have to be energized during the entire sample period. This temperature rise in the valve could cause outgasing of organics from the Viton valve seat material. The Skinner Magnelatch valve requires only a brief electrical pulse to open or close at the appropriate start and stop times and therefore experiences no temperature increase. The pulses may be obtained with an electronic timer that can be programmed for short (5 to 60 seconds) ON periods or with a conventional mechanical timer and a special pulse circuit. Figure 3 [a] illustrates a simple electrical pulse circuit for operating the Skinner Magnelatch solenoid valve with a conventional mechanical timer. However, with this simple circuit, the valve may operate unpredictably during brief power interruptions or if the timer is manually switched on and off too fast. A better circuit incorporating a time-delay relay to provide more reliable valve operation is shown in Figure 3[b].

7.2.5 Stainless steel orifice (or short capillary) - capable of maintaining a substantially constant flow over the sampling period (see Figure 4).

7.2.6 Particulate matter filter - 2 micron stainless steel sintered in-line type (see Figure 4).

7.2.7 Timer - used for unattended sample collection. Capabl of controlling pump(s) and solenoid valve.

7.3 Sample Canister Cleaning (Figure 5)

7.3.1 Vacuum pump - capable of evacuating sample canister(s) to an absolute pressure of <5 mm Hg.

7.3.2 Manifold - stainless steel manifold with connections for simultaneously cleaning several canisters.

7.3.3 Shut off valve(s) - seven required.

7.3.4 Vacuum gauge - capable of measuring vacuum in the mani to an absolute pressure of 5 mm Hg or less.

7.3.5 Cryogenic trap (2 required) - U-shaped open tubular trap cooled with liquid nitrogen or argon used to prevent contamination from back diffusion of oil from vacuum pump, and to provide clean, zero air to sample canister(s).

7.3.6 Pressure gauge - 0-50 psig (0-345 kPa), to monitor zero air pressure.

7.3.7 Flow control valve - to regulate flow of zero air into canister(s).

7.3.8 Humidifier - water bubbler or other system capable of providing moisture to the zero air supply.

7.4 Analytical System (Figure 1)

7.4.1 FID detector system - including flow controls for the FID fuel and air, temperature control for the FID, and signal processing electronics. The FID burner air, hydrogen, and helium carrier flow rates should be set according to the manufacturer's instructions to obtain an adequate FID response while maintaining as stable a flame as possible throughout all phases of the analytical cycle.

7.4.2 Chart recorder - compatible with the output signal, to record FID response.

7.4.3 Electronic integrator - capable of integrating the area of one or more FID response peaks and calculating peak area corrected for baseline drift. If a separate integrator and chart recorder are used, care must be exercised to be sure that these components do not interfere with each other electrically. Range selector controls on both the integrator and the FID analyzer may not provide accurate range ratios, so individual calibration curves should be prepared for each range to be used. The integrator should be capable of marking the beginning and ending of peaks, constructing the appropriate baseline between the start and end of the integration period, and calculating the peak area.

Note: The FID (7.4.1), chart recorder (7.4.2), integrator (7.4.3), valve heater (7.4.5), and a trap heating system are conveniently provided by a standard laboratory chromatograph and associated integrator. EPA has adapted two such systems for the PDFID method: a Hewlett-Packard model 5880 (Hewlett-Packard Corp., Avondale, PA) and a Shimadzu model GC8APF (Shimadzu Scientif Instruments Inc., Columbia, MD; see Reference 5). Other similar systems may also be applicable.

7.4.4 Trap - the trap should be carefully constructed from a single piece of chromatographic-grade stainless steel tubing (0.32 cm O.D, 0.21 cm I.D.) as shown in Figure 6 The central portion of the trap (7-10 cm) is packed wit 60/80 mesh glass beads, with small glass wool (dimethyl chlorosilane-treated) plugs to retain the beads. The trap must fit conveniently into the Dewar flask (7.4.9) and the arms must be of an appropriate length to allow the beaded portion of the trap to be submerged below the level of liquid cryogen in the Dewar. The trap sh connect directly to the six-port valve, if possible, to minimize line length between the trap and the FID. trap must be mounted to allow the Dewar to be slipped conveniently on and off the trap and also to facilitat heating of the trap (see 7.4.13).

7.4.5 Six-port chromatographic valve - Seiscor Model VIII (Seismograph Service Corp., Tulsa, OK), Valco Model 91 (Valco Instruments Co., Houston, TX), or equivalent. The six-port valve and as much of the interconnecting tubing as practical should be located inside an oven otherwise heated to 80 - 90°C to minimize wall losses or adsorption/desorption in the connecting tubing. A lines should be as short as practical.

7.4.6 Multistage pressure regulators - standard two-stage, stainless steel diaphram regulators with pressure ga for helium, air, and hydrogen cylinders.

7.4.7 Pressure regulators - optional single stage, stainle steel, with pressure gauge, if needed, to maintain constant helium carrier and hydrogen flow rates.

7.4.8 Fine needle valve - to adjust sample flow rate through trap.

7.4.9 Dewar flask - to hold liquid cryogen to cool the trap, sized to contain submerged portion of trap.

7.4.10 Absolute pressure gauge - 0-450 mm Hg,(2 mm Hg [scale divisions indicating units]). To monitor repeatable volumes of sample air through cryogenic trap (Wallace and Tiernan, Model 61C-ID-0410, 25 Main Street, Belleville, NJ).

7.4.11 Vacuum reservoir - 1-2 L capacity, typically 1 L.

7.4.12 Gas purifiers - gas scrubbers containing Drierite® or silica gel and 5A molecular sieve to remove moisture and organic impurities in the helium, air, and hydrogen gas flows (Alltech Associates, Deerfield, IL). Note: Check purity of gas purifiers prior to use by passing zero-air through the unit and analyzing according to Section 11.4. Gas purifiers are clean if produce [contain] less than 0.02 ppmC hydrocarbons.

7.4.13 Trap heating system - chromatographic oven, hot water, or other means to heat the trap to 80° to 90°C. A simple heating source for the trap is a beaker or Dewar filled with water maintained at 80-90°C. More repeatable types of heat sources are recommended, including a temperature-programmed chromatograph oven, electrical heating of the trap itself, or any type of heater that brings the temperature of the trap up to 80-90°C in 1-2 minutes.

7.4.14 Toggle shut-off valves (2) - leak free, for vacuum valve and sample valve.

7.4.15 Vacuum pump - general purpose laboratory pump capable of evacuating the vacuum reservoir to an appropriate vacuum that allows the desired sample volume to be drawn through the trap.

7.4.16 Vent - to keep the trap at atmospheric pressure during trapping when using pressurized canisters.

7.4.17 Rotameter - to verify vent flow.

7.4.18 Fine needle valve (optional) - to adjust flow rate of sample from canister during analysis.

7.4.19 Chromatographic-grade stainless steel tubing (Alltech Applied Science, 2051 Waukegan Road, Deerfield, IL, 6001 (312) 948-8600) and stainless steel plumbing fittings - for interconnections. All such materials in contact with the sample, analyte, or support gases prior to analysis should be stainless steel or other inert metal. Do not use plastic or Teflon® tubing or fittings

7.5 Commercially Available PDFID System (5)

7.5.1 A convenient and cost-effective modular PDFID system sui able for use with a conventional laboratory chromatograp is commercially available (NuTech Corporation, Model 854 2806 Cheek Road, Durham, NC, 27704, (919) 682-0402).

7.5.2 This modular system contains almost all of the apparatus items needed to convert the chromatograph into a PDFID analytical system and has been designed to be readily available and easy to assemble.

8. Reagents and Materials

8.1 Gas cylinders of helium and hydrogen - ultrahigh purity grade.

8.2 Combustion air - cylinder containing less than 0.02 ppm hydrocarbons, or equivalent air source.

8.3 Propane calibration standard - cylinder containing 1-100 ppm (3-300 ppmC) propane in air. The cylinder assay should be traceable to a National Bureau of Standards (NBS) Standard Refe ence Material (SRM) or to a NBS/EPA-approved Certified Referen Material (CRM).

8.4 Zero air - cylinder containing less than 0.02 ppmC hydrocarbons. Zero air may be obtained from a cylinder of zero-grade compressed air scrubbed with Drierite® or silica gel and 5A molecular sieve or activated charcoal, or by catalytic cleanup

of ambient air. All zero air should be passed through a liquid argon cold trap for final cleanup, then passed through a hyrdo-carbon-free water bubbler (or other device) for humidification.

8.5 Liquid cryogen - liquid argon (bp -185.7°C) or liquid oxygen, (bp -183°C) may be used as the cryogen. Experiments have shown no differences in trapping efficiency between liquid argon and liquid oxygen. However, appropriate safety precautions must be taken if liquid oxygen is used. Liquid nitrogen (bp -195°C) should not be used because it causes condensation of oxygen and methane in the trap.

9. Direct Sampling

9.1 For direct ambient air sampling, the cryogenic trapping system draws the air sample directly from a pump-ventilated distribution manifold or sample line (see Figure 1). The connecting line should be of small diameter (1/8" O.D.) stainless steel tubing and as short as possible to minimize its dead volume.

9.2 Multiple analyses over the sampling period must be made to establish hourly or 3-hour NMOC concentration averages.

10. Sample Collection in Pressurized Canister(s)

For integrated pressurized canister sampling, ambient air is sampled by a metal bellows pump through a critical orifice (to maintain constant flow), and pressurized into a clean, evacuated, Summa®-polished sample canister. The critical orifice size is chosen so that the canister is pressurized to approximately one atmosphere above ambient pressure, at a constant flow rate over the desired sample period. Two canisters are connected in parallel for duplicate samples. The canister(s) are then returned to the laboratory for analysis, using the PDFID analytical system. Collection of ambient air samples in pressurized canisters provides the following advantages:

- o Convenient integration of ambient samples over a specific time period
- o Capability of remote sampling with subsequent central laboratory analysis
- o Ability to ship and store samples, if necessary

- o Unattended sample collection
- o Analysis of samples from multiple sites with one analytical system
- o Collection of replicate samples for assessment of measurement precision

With canister sampling, however, great care must be exercised in selecting, cleaning, and handling the sample canister(s) and sampling apparatus to avoid losses or contamination of the samples.

10.1 Canister Cleanup and Preparation

10.1.1 All canisters must be clean and free of any contaminants before sample collection.

10.1.2 Leak test all canisters by pressurizing them to approximately 30 psig [200 kPa (gauge)] with zero air. The use of the canister cleaning system (see Figure 5) may be adequate for this task. Measure the final pressure close the canister valve, then check the pressure after 24 hours. If leak tight, the pressure should not vary more than ± 2 psig over the 24-hour period. Note leak check result on sampling data sheet, Figure 7.

10.1.3 Assemble a canister cleaning system, as illustrated in Figure 5. Add cryogen to both the vacuum pump and zero air supply traps. Connect the canister(s) to the manifold. Open the vent shut off valve and the canister valve(s) to release any remaining pressure in the canister. Now close the vent shut off valve and open the vacuum shut off valve. Start the vacuum pump and evacu the canister(s) to ≤ 5.0 mm Hg (for at least one hour) [Note: On a daily basis or more often if necessary, bl out the cryogenic traps with zero air to remove any trapped water from previous canister cleaning cycles.]

10.1.4 Close the vacuum and vacuum gauge shut off valves and open the zero air shut off valve to pressurize the can ter(s) with moist zero air to approximately 30 psig [2 kPa (gauge)]. If a zero gas generator system is used,

the flow rate may need to be limited to maintain the zero air quality.

10.1.5 Close the zero shut off valve and allow canister(s) to vent down to atmospheric pressure through the vent shut off valve. Close the vent shut off valve. Repeat steps 10.1.3 through 10.1.5 two additional times for a total of three (3) evacuation/pressurization cycles for each set of canisters.

10.1.6 As a "blank" check of the canister(s) and cleanup procedure, analyze the final zero-air fill of 100% of the canisters until the cleanup system and canisters are proven reliable. The check can then be reduced to a lower percentage of canisters. Any canister that does not test clean (compared to direct analysis of humidified zero air of less than 0.02 ppmC) should not be utilized.

10.1.7 The canister is then re-evacuated to $\leq$ 5.0 mm Hg, using the canister cleaning system, and remains in this condition until use. Close the canister valve, remove the canister from the canister cleaning system and cap canister connection with a stainless steel fitting. The canister is now ready for collection of an air sample. Attach an identification tag to the neck of each canister for field notes and chain-of-custody purposes.

10.2 Collection of Integrated Whole-Air Samples

10.2.1 Assemble the sampling apparatus as shown in Figure 2. The connecting lines between the sample pump and the canister(s) should be as short as possible to minimize their volume. A second canister is used when a duplicate sample is desired for quality assurance (QA) purposes (see Section 12.2.4). The small auxiliary vacuum pump purges the inlet manifold or lines with a flow of several L/min to minimize the sample residence time. The larger metal bellows pump takes a small portion of this sample to fill and pressurize the sample canister(s) Both pumps should be shock-mounted to minimize vibration. Prior to field use, each sampling system should be leak

tested. The outlet side of the metal bellows pump can be checked for leaks by attaching the 0-30 psig pressure gauge to the canister(s) inlet via connecting tubing and pressurizing to 2 atmospheres or approximately 29.4 psig. If pump and connecting lines are leak free pressure should remain at ± 2 psig for 15 minutes. To check the inlet side, plug the sample inlet and insure that there is no flow at the outlet of the pump.

10.2.2 Calculate the flow rate needed so that the canister(s) are pressurized to approximately one atmosphere above ambient pressure (2 atmospheres absolute pressure) over the desired sample period, utilizing the following equation:

$$F = \frac{(P)(V)(N)}{(T)(60)}$$

where:

F = flow rate (cm^3/min)

P = final canister pressure (atmospheres absolute) $= (P_g/P_a) + 1$

V = volume of the canister (cm^3)

N = number of canisters connected together for simultaneous sample collection

T = sample period (hours)

P_g = gauge pressure in canister, psig (kPa)

P_a = standard atmospheric pressure, 14.7 psig (101 kP

For example, if one 6-L canister is to be filled to 2 atmospheres absolute pressure (14.7 psig) in 3 hours, the flow rate would be calculated as follows:

$$F = \frac{2 \times 6000 \times 1}{3 \times 60} = 67 \text{ cm}^3/\text{min}$$

10.2.3 Select a critical orifice or hypodermic needle suitable to maintain a substantially constant flow at the calculated flow rate into the canister(s) over the desired sample period. A 30-gauge hypodermic needle, 2.5 cm

long, provides a flow of approximately 65 cm^3/min with the Metal Bellows Model MBV-151 pump (see Figure 4). Such a needle will maintain approximately constant flow up to a canister pressure of about 10 psig (71 kPa), after which the flow drops with increasing pressure. At 14.7 psig (2 atmospheres absolute pressure), the flow is about 10% below the original flow.

10.2.4 Assemble the 2.0 micron stainless steel in-line particulate filter and position it in front of the critical orifice. A suggested filter-hypodermic needle assembly can be fabricated as illustrated in Figure 4.

10.2.5 Check the sampling system for contamination by filling two evacuated, cleaned canister(s) (See Section 10.1) with humidified zero air through the sampling system. Analyze the canisters according to Section 11.4. The sampling system is free of contamination if the canisters contain less than 0.02 ppmC hydrocarbons, similar to that of humidified zero air.

10.2.6 During the system contamination check procedure, check the critical orifice flow rate on the sampling system to insure that sample flow rate remains relatively constant (±10%) up to about 2 atmospheres absolute pressure (101 kPa). Note: A drop in the flow rate may occur near the end of the sampling period as the canister pressure approaches two atmospheres.

10.2.7 Reassemble the sampling system. If the inlet sample line is longer than 3 meters, install an auxiliary pump to ventilate the sample line, as illustrated in Figure 2.

10.2.8 Verify that the timer, pump(s) and solenoid valve are connected and operating properly.

10.2.9 Verify that the timer is correctly set for the desired sample period, and that the solenoid valve is closed.

10.2.10 Connect a cleaned, evacuated canister(s) (Section 10.1) to the non-contaminated sampling system, by way of the solenoid valve, for sample collection.

10.2.11 Make sure the solenoid valve is closed. Open the canister valve(s). Temporarily connect a small rotamet to the sample inlet to verify that there is no flow. Note: Flow detection would indicate a leaking (or open solenoid valve. Remove the rotameter after leak detection procedure.

10.2.12 Fill out the necessary information on the Field Data Sheet (Figure 7).

10.2.13 Set the automatic timer to start and stop the pump or pumps to open and close the solenoid valve at the appropriate time for the intended sample period. Sampling will begin at the pre-determined time.

10.2.14 After the sample period, close the canister valve(s) a disconnect the canister(s) from the sampling system. Connect a pressure gauge to the canister(s) and briefl open and close the canister valve. Note the canister pressure on the Field Data Sheet (see Figure 7). The canister pressure should be approximately 2 atmosphere absolute [1 atmosphere or 101 kPa (gauge)]. Note: I the canister pressure is not approximately 2 atmosphe absolute (14.7 psig), determine and correct the cause fore next sample. Re-cap canister valve.

10.2.15 Fill out the identification tag on the sample caniste and complete the Field Data Sheet as necessary. Note any activities or special conditions in the area (rai smoke, etc.) that may affect the sample contents on t sampling data sheet.

10.2.16 Return the canister(s) to the analytical system for analysis.

11. Sample Analysis

11.1 Analytical System Leak Check

11.1.1 Before sample analysis, the analytical system is ass (see Figure 1) and leak checked.

11.1.2 To leak check the analytical system, place the six-port gas valve in the trapping position. Disconnect and cap the absolute pressure gauge. Insert a pressure gauge capable of recording up to 60 psig at the vacuum valve outlet.

11.1.3 Attach a valve and a zero air supply to the sample inlet port. Pressurize the system to about 50 psig (350 kPa) and close the valve.

11.1.4 Wait approximately 3 hrs. and re-check pressure. If the pressure did not vary more than ± 2 psig, the system is con dered leak tight.

11.1.5 If the system is leak free, de-pressurize and reconnect absolute pressure gauge.

11.1.6 The analytical system leak check procedure needs to be performed during the system checkout, during a series of analysis or if leaks are suspected. This should b part of the user-prepared SOP manual (see Section 12..

11.2 Sample Volume Determination

11.2.1 The vacuum reservoir and absolute pressure gauge are used to meter a precisely repeatable volume of sample air through the cryogenically-cooled trap, as follows: With the sample valve closed and the vacuum valve open, the reservoir is first evacuated with the vacuum pump to a predetermined pressure (e.g., 100 mm Hg). Then the vacuum valve is closed and the sample valve is opened to allow sample air to be drawn through the cryogenic trap and into the evacuated reservoir until a second predetermined reservoir pressure is reached (e.g., 300 mm Hg). The (fixed) volume of air thus sampled is determined by the pressure rise in the vacuum reservoir (difference between the predetermined pressures) as measured by the absolute pressure gauge (see Section 12.2.1).

11.2.2 The sample volume can be calculated by:

$$V_s = \frac{(\Delta P)(V_r)}{(P_s)}$$

where:

V_s = volume of air sampled (standard cm^3)
ΔP = pressure difference measured by gauge (mm Hg)
V_r = volume of vacuum reservoir (cm^3) usually 1 L
P_s = standard pressure (760 mm Hg)

For example, with a vacuum reservoir of 1000 cm^3 and a pressure change of 200 mm Hg (100 to 300 mm Hg), the volum sampled would be 263 cm^3. [Note: Typical sample volume using this procedure is between 200-300 cm^3.]

11.2.3 The sample volume determination need only be performed onc during the system check-out and shall be part of the user-prepared SOP Manual (see Section 12.1).

11.3 Analytical System Dynamic Calibration

11.3.1 Before sample analysis, a complete dynamic calibration of the analytical system should be carried out at five or more concentrations on each range to define the calibration curve. This should be carried out initially and periodically thereafter [may be done only once during a series of analyses]. This should be part of the user-prepared SOP Manual (See Section 12.1). The calibration should be verified with two or three-point calibration checks (including zero) each day the analytical system is used to analyze samples.

11.3.2 Concentration standards of propane are used to calibrate the analytical system. Propane calibration standards may be obtained directly from low concentration cylinder standards or by dilution of high concentration cylinder

standards with zero air (see Section 8.3). Dilution flow rates must be measured accurately, and the combined gas stream must be mixed thoroughly for successful calibration of the analyzer. Calibration standards should be sampled directly from a vented manifold or tee. Note: Remember that a propane NMOC concentration in ppmC is three times the volumetric concentration in ppm.

11.3.3 Select one or more combinations of the following parameters to provide the desired range or ranges (e.g., 0-1.0 ppmC or 0-5.0 ppmC): FID attenuator setting, output voltage setting, integrator resolution (if applicable), and sample volume. Each individual range should be calibrated separately and should have a separate calibration curve. Note: Modern GC integrators may provide automatic ranging such that several decades of concentration may be covered in a single range. The user-prepared SOP manual should address variations applicable to a specific system design (see Section 12.1).

11.3.4 Analyze each calibration standard three times according to the procedure in Section 11.4. Insure that flow rates, pressure gauge start-stop readings, initial cryogen liquid level in the jar, timing, heating, integrator settings, and other variables are the same as those that will be used during analysis of ambient samples. Typical flow rates for the gases are: hydrogen, 30 cm^3/minute; helium carrier, 30 cm^3/minute; burner air, 400 cm^3/minute.

11.3.5 Average the three analyses for each concentration standard and plot the calibration curve(s) as average integrated peak area reading versus concentration in ppmC. The relative standard deviation for the three analyses should be less

than 3% (except for zero concentration). Linearity should be expected; points that appear to deviate abnormally should be repeated. Response has been shown to be linear over a wide range (0-10,000 ppbC). If nonlinearity is observed, an effort should be made to identify and correct the problem. If the problem cannot be corrected, additional points in the nonlinear region may be needed to define the calibration curve adequately.

11.4 Analysis Procedure

11.4.1 Insure the analytical system has been assembled properly, leaked checked, and properly calibrated through a dynamic standard calibration. Light the FID detector and allow t stabilize.

11.4.2 Check and adjust the helium carrier pressure to provide t correct carrier flow rate for the system. Helium is used to purge residual air and methane from the trap at the end of the sampling phase and to carry the re-volatilized NMOC from the trap into the FID. A single-stage auxilia regulator between the cylinder and the analyzer may not be necessary, but is recommended to regulate the helium pressure better than the multistage cylinder regulator. When an auxiliary regulator is used, the secondary stage of the two-stage regulator must be set at a pressure higher than the pressure setting of the single-stage regulator. Also check the FID hydrogen and burner air flow rates (see 11.3.4).

11.4.3 Close the sample valve and open the vacuum valve to evacuate the vacuum reservoir to a specific predetermin value (e.g., 100 mm Hg).

11.4.4 With the trap at room temperature, place the six-port valve in the inject position.

11.4.5 Open the sample valve and adjust the sample flow rate needle valve for an appropriate trap flow of 50-100 cm^3/min. Note: The flow will be lower later, when the trap is cold.

11.4.6 Check the sample canister pressure before attaching it to the analytical system and record on Field Data Sheet (see Figure 7). Connect the sample canister or direct sample inlet to the six-port valve, as shown in Figure 1. For a canister, either the canister valve or an optional fine needle valve installed between the canister and the vent is used to adjust the canister flow rate to a value slightly higher than the trap flow rate set by the sample flow rate needle valve. The excess flow exhausts through the vent, which assures that the sample air flowing through the trap is at atmospheric pressure. The vent is connected to a flow indicator such as a rotameter as an indication of vent flow to assist in adjusting the flow control valve. Open the canister valve and adjust the canister valve or the sample flow needle valve to obtain a moderate vent flow as indicated by the rotameter. The sample flow rate will be lower (and hence the vent flow rate will be higher) when the the trap is cold.

11.4.7 Close the sample valve and open the vacuum valve (if t a' ·y o; · to evacuate the vacuum reservoir. ·h t ·ix-p·· · va·ve in the inject position and the acuum valve open, open the sampie valve for 2-3 minutes [with both valves open, the pressure reading won't change] to flush and condition the inlet lines.

11.4.8 Close the sample valve and evacuate the reservoir to the predetermined sample starting pressure (typically 100 mm Hg) as indicated by the absolute pressure gauge.

11.4.9 Switch the six-port valve to the sample position.

11.4.10 Submerge the trap in the cryogen. Allow a few minutes for the trap to cool completely (indicated when the cryogen stops boiling). Add cryogen to the initial level used during system dynamic calibration. The level of the cryogenic liquid should remain constant with respect to the trap and should completely cover the beaded portion of the trap.

11.4.11 Open the sample valve and observe the increasing pressure on the pressure gauge. When it reaches the specific predetermined pressure (typically 300 mm Hg) representative of the desired sample volume (Section 11.2), close the sample valve.

11.4.12 Add a little cryogen or elevate the Dewar to raise the liquid level to a point slightly higher (3-15 mm) than the initial level at the beginning of the trapping. Note: This insures that organics do not bleed from the trap and are counted as part of the NMOC peak(s).

11.4.13 Switch the 6-port valve to the inject position, keeping the cryogenic liquid on the trap until the methane and upset peaks have deminished (10-20 seconds). Now close the canister valve to conserve the remaining sample in the canister.

11.4.14 Start the integrator and remove the Dewar flask containir the cryogenic liquid from the trap.

11.4.15 Close the GC oven door and allow the GC oven (or alternate trap heating system) to heat the trap at a predetermined rate (typically, 30°C/min) to 90°. Heating the tr volatilizes the concentrated NMOC such that the FID produces integrated peaks. A uniform trap temperature rise rate (above 0°C) helps to reduce variability and facilitates more accurate correction for the moisture-shifted baseline. With a chromatograph oven to heat the trap, the following parameters have been found to be acceptabl initial temperature, 30°C; initial time, 0.20 minutes (following start of the integrator); heat rate, 30°/minu final temperature, 90°C.

11.4.16 Use the same heating process and temperatures for both calibration and sample analysis. Heating the trap too quickly may cause an initial negative response that could hamper accurate integration. Some initial experimentation may be necessary to determine the optimal heating procedure for each system. Once established, the procedure should be consistent for each analysis as outlined in the user-prepared SOP Manual.

11.4.17 Continue the integration (generally, in the range of 1-2 minutes is adequate) only long enough to include all of the organic compound peaks and to establish the end point FID baseline, as illustrated in Figure 8. The integrator should be capable of marking the beginning and ending of peaks, constructing the appropriate operational baseline between the start and end of the integration period, and calculating the resulting corrected peak area. This ability is necessary because the moisture in the sample, which is also concentrated in the trap, will cause a slight positive baseline shift. This baseline shift starts as the trap warms and continues until all of the moisture is swept from the trap, at which time the baseline returns to its normal level. The shift always continues longer than the ambient organic peak(s). The integrator should be programmed to correct for this shifted baseline by ending the integration at a point after the last NMOC peak and prior to the return of the shifted baseline to normal (see Figure 8) so that the calculated operational baseline effectively compensates for the water-shifted baseline. Electronic integrators either do this automatically or they should be programmed to make this correction. Alternatively, analyses of humidified zero air prior to sample analyses should be performed to determine the water envelope and the proper blank value for correcting the ambient air concentration measurements accordingly. Heating and flushing of the trap should continue after the integration period has ended to insure all water has been removed to prevent buildup of water in the trap. Therefore, be sure that the 6-port valve remains in the inject position until all moisture has purged from the trap (3 minutes or longer).

11.4.18 Use the dynamic calibration curve (see Section 11.3) to convert the integrated peak area reading into concentration units (ppmC). Note that the NMOC peak shape may not be precisely reproducible due to variations in heating the trap, but the total NMOC peak area should be reproducible.

11.4.19 Analyze each canister sample at least twice and report the average NMOC concentration. Problems during an analysis occasionally will cause erratic or inconsistent results. If the first two analyses do not agree within ± 5% relative standard deviation (RSD), additional analyses should be made to identify inaccurate measurements and produce a more accurate average (see also Section 12.2.).

12. Performance Criteria and Quality Assurance

This section summarizes required quality assurance measures and provides guidance concerning performance criteria that should be achieved within each laboratory.

12.1 Standard Operating Procedures (SOPs)

12.1.1 Users should generate SOPs describing and documenting the following activities in their laboratory: (1) assembly, calibration, leak check, and operation of the specific sampling system and equipment used; (2) preparation, storage, shipment, and handling of samples; (3) assembly, leak-check, calibration, and operation of the analytical system, addressing the specific equipment use (4) canister storage and cleaning; and (5) all aspects o of data recording and processing, including lists of computer hardware and software used.

12.1.2 SOPs should provide specific stepwise instructions and should be readily available to, and understood by, the laboratory personnel conducting the work.

12.2 Method Sensitivity, Accuracy, Precision and Linearity

12.2.1 The sensitivity and precision of the method is proportional to the sample volume. However, ice formation in the trap may reduce or s[illegible] the sample [illegible] during trapping if the sample volume [illegible]eeds [illegible]0 cm[illegible]. Sample volumes below about 100-150 c[illegible] may cause increased measurement variability due to dead volume in lines and valves. For most typica[illegible] ambient NMOC concentrations, sample voi[illegible]es in the range of 200-400 cm^3 appear to be appropriate. If a response peak obtained with a 400 cm^3 sample is off scale or exceeds the calibration range, a second analysis can be carr[illegible] out with a smaller volume. The actual sample volume [illegible]ed need not be accurately known if it is precisely repeatable during both calibration and analysis. Similarly, the actual volume of the vacuum reservoir need not be accurately known. But the reservoir volume should be matched to the pressure range and resolution of the absolute pressure gauge so that the measurement of the pressure change in the reservoir, hence the sample volume, is repeatable within 1%. A 1000 cm^3 vacuum reservoir and a pressure change of 200 mm Hg, measured with the specified pressure gauge, have provided a sampling precision of $\pm$ 1.31 cm^3. A smaller volume reservoir may be used with a greater pressure change to accommodate absolute pressure gauges with lower resolution, and vice versa.

12.2.2 Some FID detector systems associated with laboratory chromatographs may have autoranging. Others may provide attenuator control and internal full-scale output voltage selectors. An appropriate combination should be chosen so that an adequate output level for accurate integration is obtained down to the detection limit; however, the electrometer or integrator must not be driven into saturation at the upper end of the calibration. Saturation of the electrometer may be indicated by flattening of the calibration curve at

high concentrations. Additional adjustments of range and sensitivity can be provided by adjusting the sample volume used, as discussed in Section 12.2.1.

12.2.3 System linearity has been documented (6) from 0 to 10,000 ppbC.

12.2.4 Some organic compounds contained in ambient air are "sticky" and may require repeated analyses before they fully appear in the FID output. Also, some adjustment may have to be made in the integrator off time setting to accommodate compounds that reach the FID late in the analysis cycle. Similarly, "sticky" compounds from ambient samples or from contaminated propane standards may temporarily contaminate the analytical system and can affect subsequent analyses. Such temporary contamination can usually be removed by repeated analyses of humidified zero air.

12.2.5 Simultaneous collection of duplicate samples decreases the possibility of lost measurement data from samples lost due to leakage or contamination in either of the canisters. Two (or more) canisters can be filled simultaneously by connecting them in parallel (see Figure 2(a)) and selecting an appropriate flow rate to accommodate the number of canisters (Section 10.2.2). Duplicate (or replicate) samples also allow assessment of measurement precision based on the differences between duplicate samp (or the standard deviations among replicate samples).

13. Method Modification

13.1 Sample Metering System

13.1.1 Although the vacuum reservoir and absolute pressure gauge technique for metering the sample volume during analysis efficient and convenient, other techniques should work al

13.1.2 A constant sample flow could be established with a vacuun pump and a critical orifice, with the six-port valve bei switched to the sample position for a measured time peri

A gas volume meter, such as a wet test meter, could also be used to measure the total volume of sample air drawn through the trap. These alternative techniques should be tested and evaluated as part of a user-prepared SOP manual.

13.2 FID Detector System

13.2.1 A variety of FID detector systems should be adaptable to the method.

13.2.2 The specific flow rates and necessary modifications for the helium carrier for any alternative FID instrument should be evaluated prior to use as part of the user-prepared SOP manual.

13.3 Range

13.3.1 It may be possible to increase the sensitivity of the method by increasing the sample volume. However, limitations may arise such as plugging of the trap by ice.

13.3.2 Any attempt to increase sensitivity should be evaluated as part of the user-prepared SOP manual.

13.4 Sub-Atmospheric Pressure Canister Sampling

13.4.1 Collection and analysis of canister air samples at sub-atmospheric pressure is also possible with minor modifications to the sampling and analytical procedures.

13.4.2 Method TO-14, "Integrated Canister Sampling for Selective Organics: Pressurized and Sub-atmospheric Collection Mechanism," addresses sub-atmospheric pressure canister sampling. Additional information can be found in the literature (11-17).

1. Uses, Limitations, and Technical Basis of Procedures for Quantifying Relationsnips Between Photochemical Oxidants and Precursors, EPA-450/2-77-21a, U.S. Environmental Protection Agency, Research Triangle Park, NC, November 1977.

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12. Rasmussen, R. A. and Khalil, M.A.K. " Atmospheric Halocarbons: Measurements and Analyses of Selected Trace Gases," Proc. NATO ASI on Atmospheric Ozone, 1980, 209-231.

13. Oliver, K. D., Pleil J.D. and McClenny, W.A. "Sample Intergrity of Trace Level Volatile Organic Compounds in Ambient Air Stored in "SUMMA®" Polished Canisters," accepted for publication in Atmospheric Environment as of January 1986. Draft available from W. A. McClenny, MD-44, EMSL, EPA, Research Triangle Park, NC 27711.

14. McClenny, W. A. Pleil J.D. Holdren, J.W.; and Smith, R.N.; 1984. " Automated Cryogenic Preconcentration and Gas Chromatographic Determination of Volatile Organic Compounds," Anal. Chem. 56:2947.

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17. Oliver, K. D. Pleil, J. D., 1985, "Automated Cryogenic Sampling and Gas Chromatographic Analysis of Ambient Vapor-Phase Organic Compounds: Procedures and Comparison Tests," EPA Contract No. 68-02-4035, Research Triangle Park, NC, Northrop Services, Inc. - Environmental Sciences.

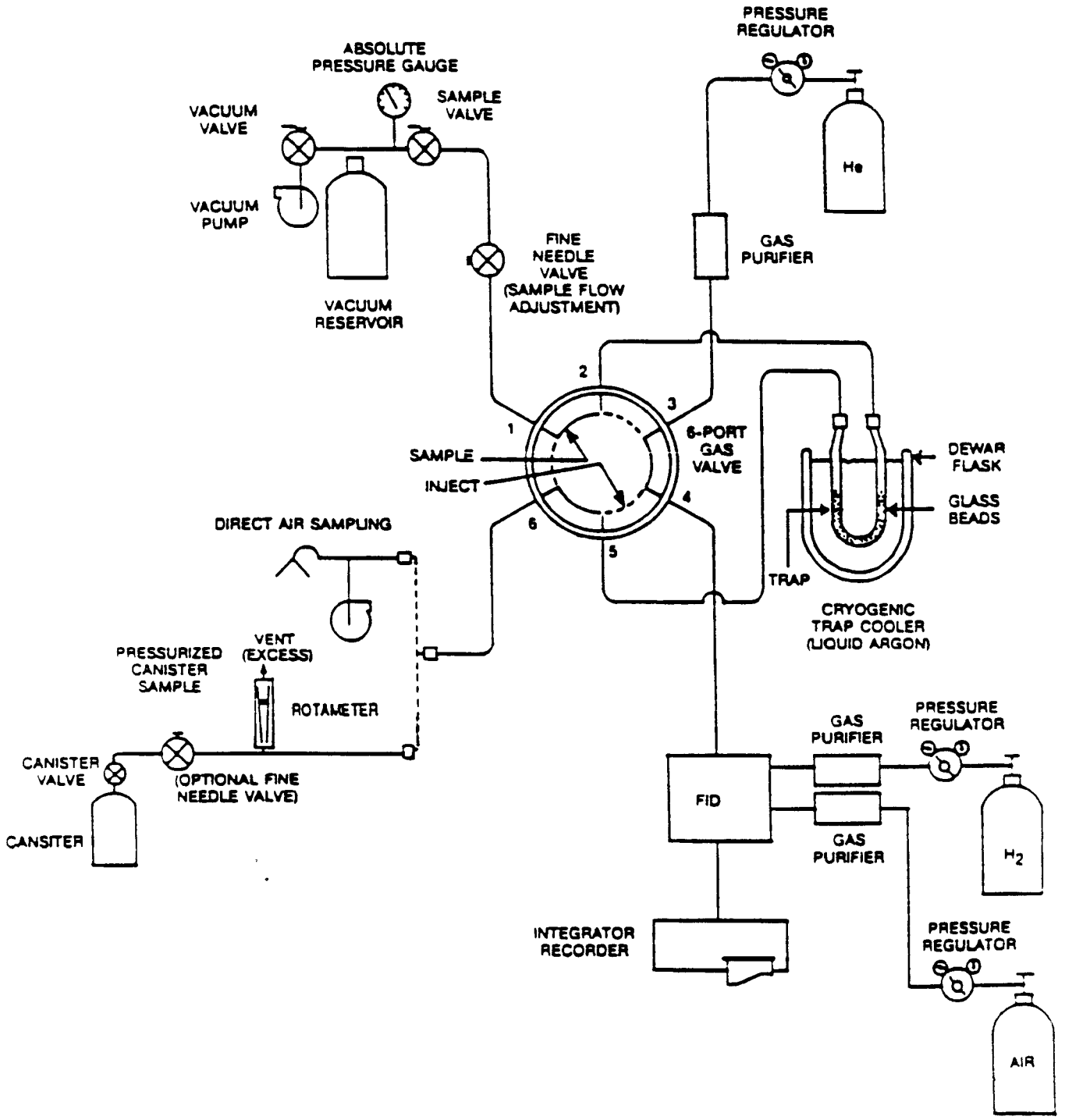


FIGURE 1. SCHEMATIC OF ANALYTICAL SYSTEM FOR NMOC—TWO SAMPLING MODES

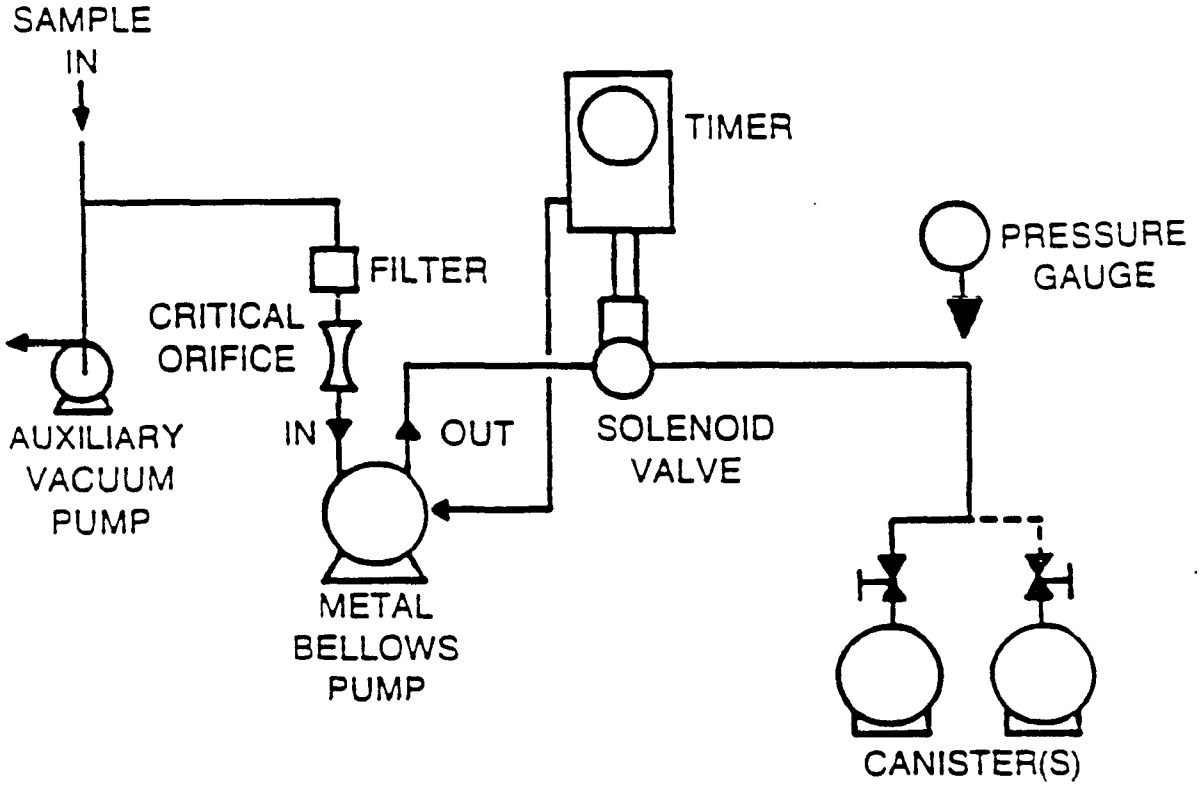
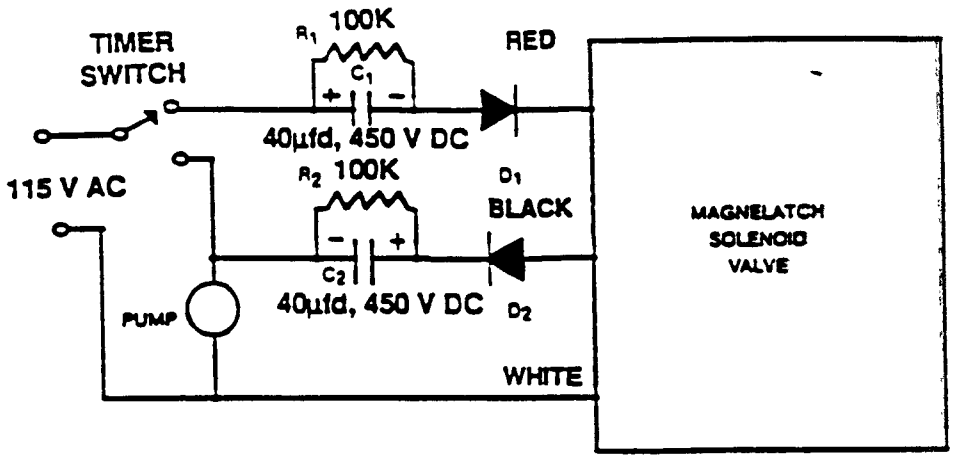
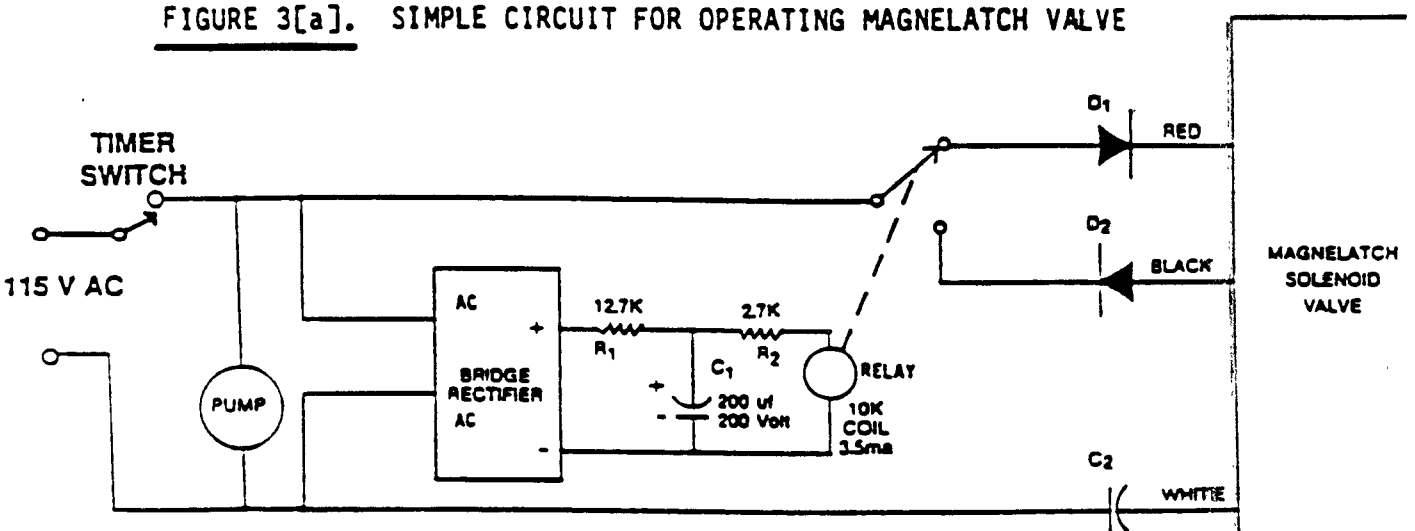


FIGURE 2. SAMPLE SYSTEM FOR AUTOMATIC COLLECTION OF 3-HOUR INTEGRATED AIR SAMPLES



COMPONENTS
Capacitor C_1 and C_2 - 40 uf, 450 VDC (Sprague Atom® TVA 1712 or equivalent)
Resistor R_1 and R_2 - 0.5 watt, 5% tolerance
Diode D_1 and D_2 - 1000 PRV, 2.5 A (RCA, SK 3081 or equivalent)

FIGURE 3[a]. SIMPLE CIRCUIT FOR OPERATING MAGNELATCH VALVE



COMPONENTS
Bridge Rectifier - 200 PRV, 1.5 A (RCA, SK 3108 or equivalent)
Diode D_1 and D_2 - 1000 PRV, 2.5 A (RCA, SK 3081 or equivalent)
Capacitor C_1 - 200 uf, 250 VDC (Sprague Atom® TVA 1526 or equivalent)
Capacitor C_2 - 20 uf, 400 VDC Non-Polarized (Sprague Atom® TVAN 1652 or equivalent)
Relay - 10 000 ohm coil, 3.5 ma (AMF Potter and Brumfield, KCP 5, or equivalent)
Resistor R_1 and R_2 - 0.5 watt, 5% tolerance

FIGURE 3[b]. IMPROVED CIRCUIT DESIGNED TO HANDLE POWER INTERRUPTIONS

FIGURE 3. ELECTRICAL PULSE CIRCUITS FOR DRIVING SKINNER MAGNELATCH SOLENOID VALVE WITH A MECHANICAL TIMER

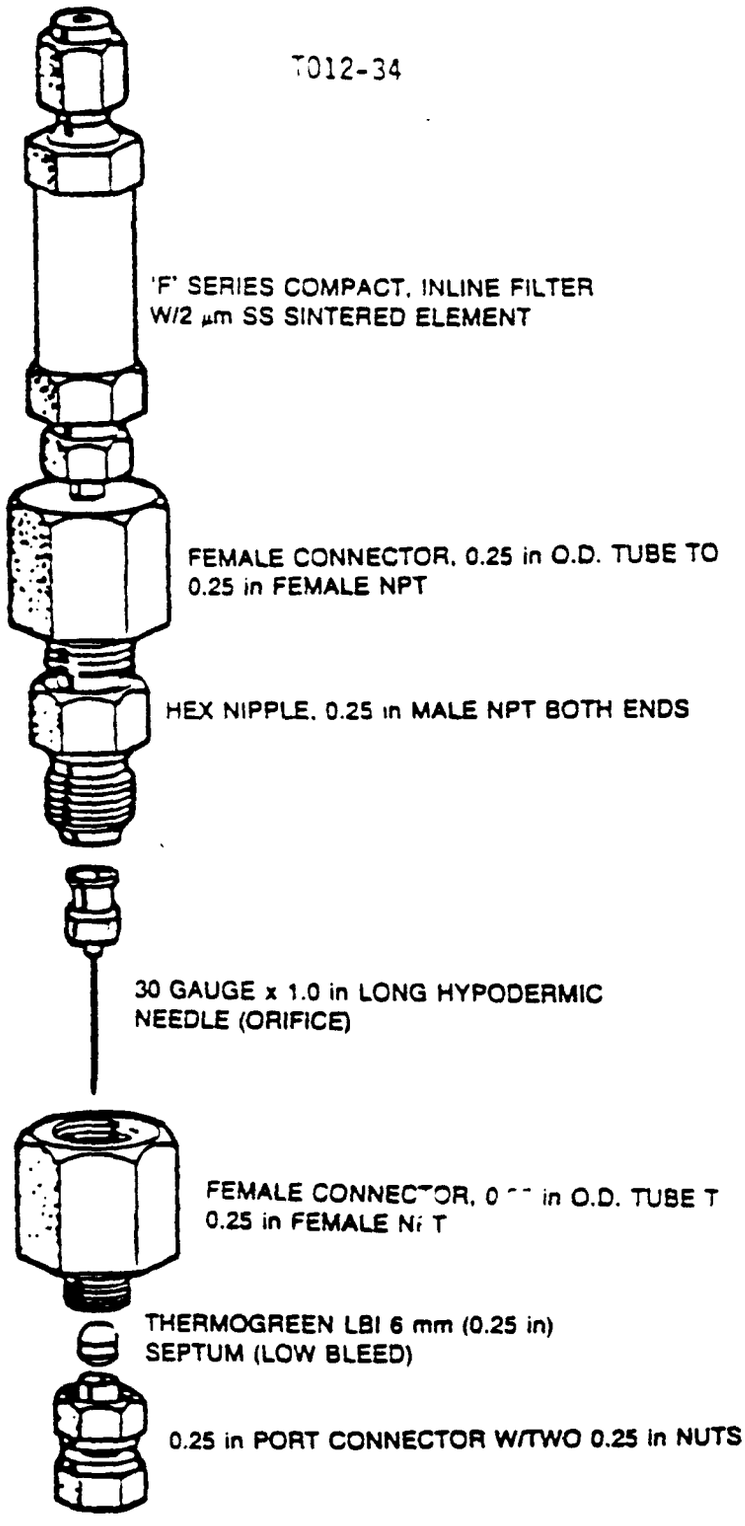


FIGURE 4. FILTER AND HYPODERMIC NEEDLE ASSEMBLY FOR SAMPLE INLET FLOW CONTROL

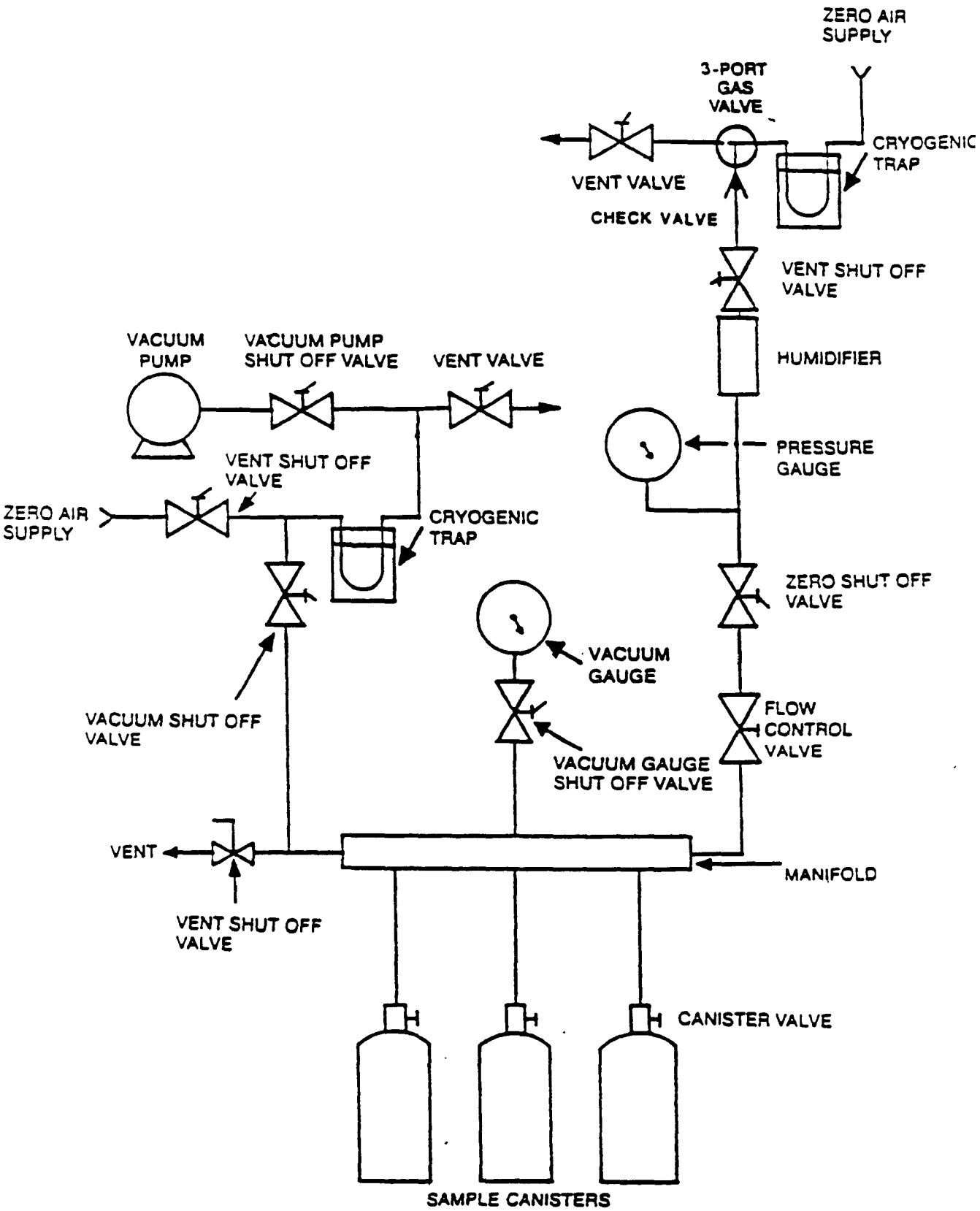


FIGURE 5. CANISTER CLEANING SYSTEM

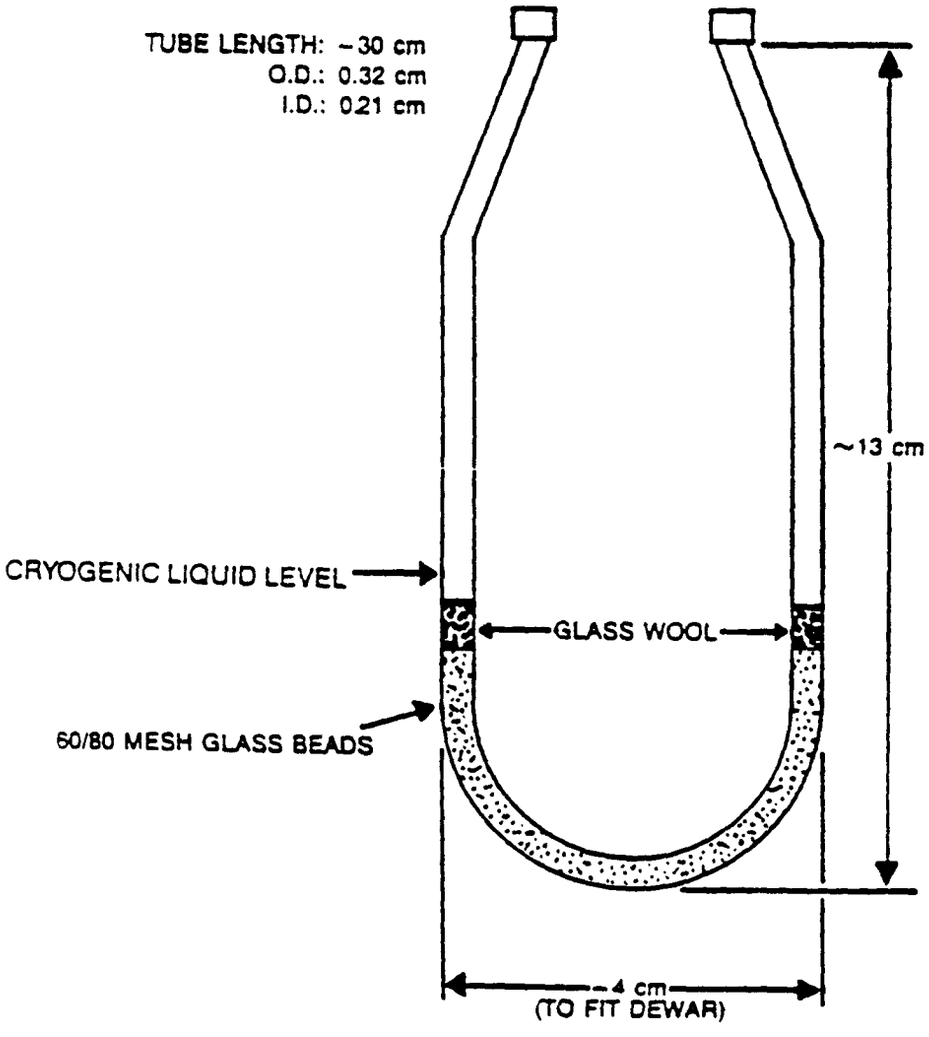


FIGURE 6. CRYOGENIC SAMPLE TRAP DIMENSIONS

PRESSURIZED CANISTER SAMPLING DATA SHEET

GENERAL INFORMATION:

PROJECT: _____
SITE: _____
LOCATION: _____
MONITOR STATION NUMBER: _____
PUMP SERIAL NUMBER: _____

OPERATOR: _____
ORIFICE IDENTIFICATION: _____
FLOW RATE: _____
CALIBRATED BY: _____
LEAK CHECK _____ Pass _____ Fail

FIELD DATA:

Date	Canister Serial Number	Sample Number	Sample Time		Average Atmospheric Conditions			Canister pressure Final, Laboratory		Comments
			Start	Stop	Temperature	Pressure	Relative Humidity			

Date _____ Title _____ Signature _____

T012-37

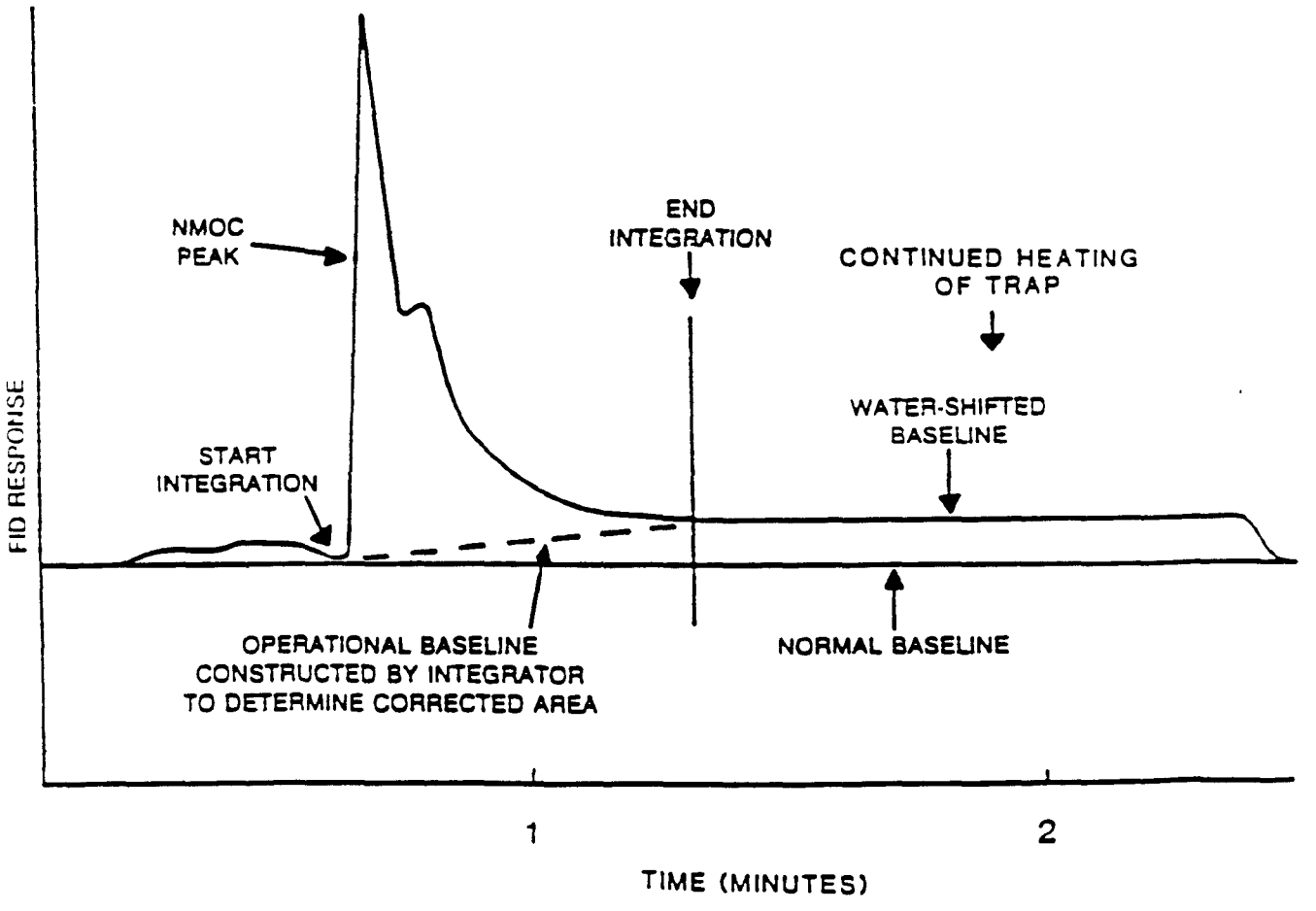


FIGURE 8. CONSTRUCTION OF OPERATIONAL BASELINE AND CORRESPONDING CORRECTION OF PEAK AREA

APPENDIX C

1992 NMOC MONITORING PROGRAM SITE DATA

APPENDIX C

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Long Island, NY (LINY)

1992 NMOC Program (AIRS# 36-059-0005)

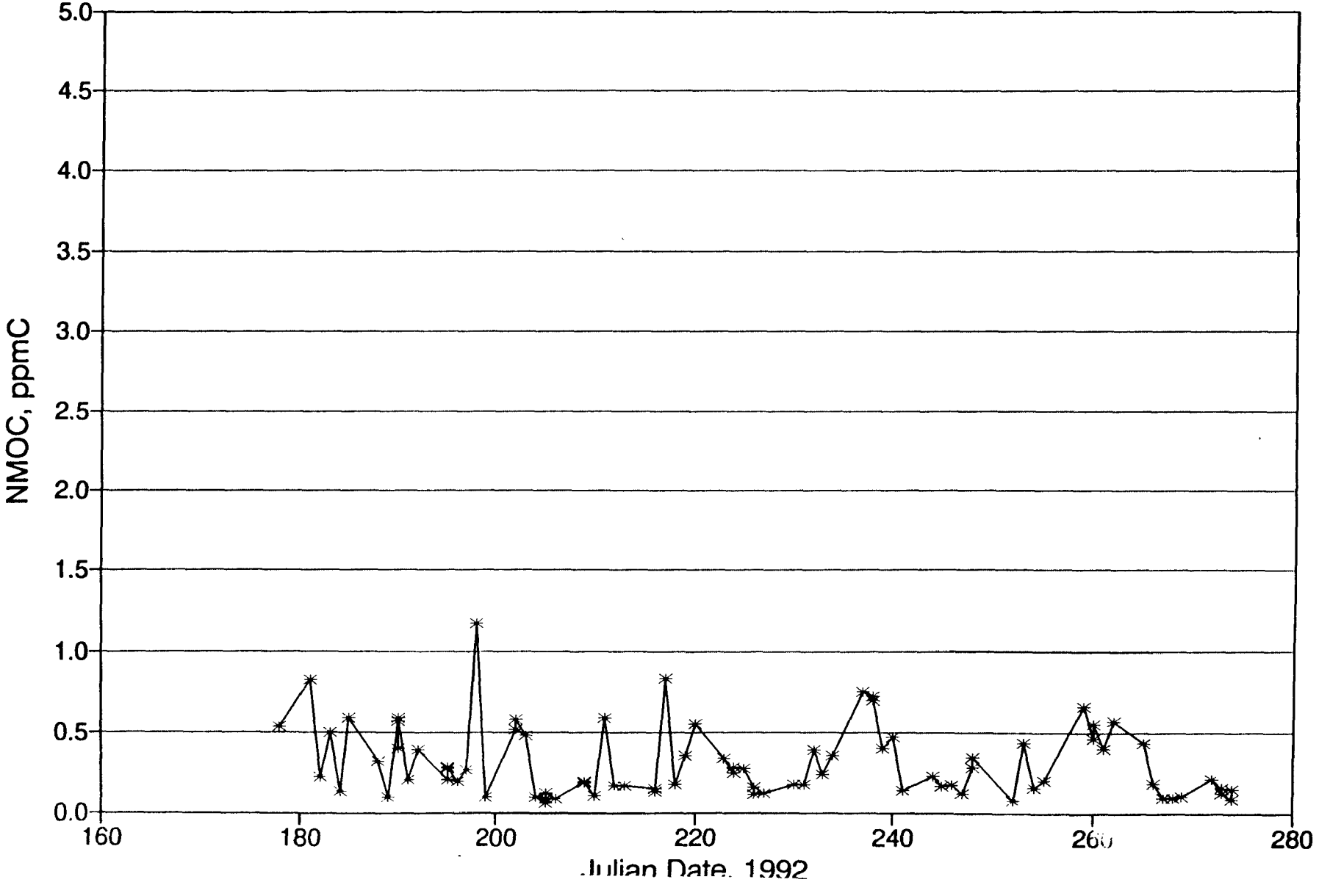


TABLE C-1. SUMMARY OF THE 1992 NMOC DATA FOR LONG ISLAND, NY (LINY)

Sample Period: 6:00 a.m. to 9:00 a.m.

Date Sampled	Julian Date Sampled	Sample ID Number	Sample Canister Number	Sample Pressure (psig)	Analysis Pressure (psig)	Radian Channel	Mean NMOC ppmC
26-Jun-92	178	1119	48	12.0	14.0	A	0.536
29-Jun-92	181	1114	188	11.5	13.0	D	0.829
30-Jun-92	182	1098	140	12.0	14.0	A	0.223
01-Jul-92	183	1096	711	12.0	14.0	C	0.502
02-Jul-92	184	1099	789	12.0	14.0	B	0.129
03-Jul-92	185	1163	401	12.0	12.0	C	0.590
06-Jul-92	188	1169	153	12.0	10.0	C	0.318
07-Jul-92	189	1153	788	12.5	13.0	D	0.092
08-Jul-92	190	1165	193	14.0	14.0	C	0.573
08-Jul-92	190	1166	680	14.0	14.0	C	0.403
08-Jul-92	190	1166	680	14.0	14.0	C	0.589
09-Jul-92	191	1218	929	12.0	12.0	B	0.204
10-Jul-92	192	1216	914	12.0	13.0	A	0.395
13-Jul-92	195	1207	717	13.5	14.0	D	0.205
13-Jul-92	195	1207	717	13.5	14.0	D	0.284
13-Jul-92	195	1208	927	13.5	14.0	D	0.276
14-Jul-92	196	1284	638	12.5	13.0	C	0.193
15-Jul-92	197	1285	166	12.0	13.0	D	0.264
16-Jul-92	198	1286	109	15.0	12.0	D	1.168
17-Jul-92	199	1355	143	13.0	12.0	C	0.098
20-Jul-92	202	1341	153	14.0	14.0	C	0.518
20-Jul-92	202	1341	153	14.0	14.0	C	0.584
21-Jul-92	203	1356	172	12.0	12.0	D	0.487
22-Jul-92	204	1389	186	12.5	13.0	D	0.098
23-Jul-92	205	1400	178	13.5	14.0	C	0.122
23-Jul-92	205	1401	105	13.5	14.0	C	0.059
23-Jul-92	205	1401	105	13.5	14.0	C	0.083
24-Jul-92	206	1469	770	13.0	14.0	D	0.088
27-Jul-92	209	1483	823	12.0	12.0	D	0.192
27-Jul-92	209	1483	823	12.0	12.0	D	0.183
28-Jul-92	210	1468	789	13.0	14.0	C	0.102
29-Jul-92	211	1548	674	13.0	14.0	A	0.592

TABLE C-1. SUMMARY OF THE 1992 NMOC DATA FOR LONG ISLAND, NY (LINY)

Sample Period: 6:00 a.m. to 9:00 a.m.

Date Sampled	Julian Date Sampled	Sample ID Number	Sample Canister Number	Sample Pressure (psig)	Analysis Pressure (psig)	Radian Channel	Mean NMOC ppmC
30-Jul-92	212	1550	840	12.0	13.0	D	0.164
31-Jul-92	213	1549	178	12.0	13.0	C	0.168
03-Aug-92	216	1605	705	13.5	14.0	D	0.146
03-Aug-92	216	1607	36	13.5	14.0	D	0.129
04-Aug-92	217	1629	164	5.0	5.0	B	0.837
05-Aug-92	218	1665	49	12.0	14.0	B	0.178
06-Aug-92	219	1675	910	12.0	14.0	C	0.356
07-Aug-92	220	1734	837	12.0	14.0	B	0.556
10-Aug-92	223	1737	48	14.0	14.0	A	0.340
11-Aug-92	224	1760	113	12.0	14.0	C	0.250
11-Aug-92	224	1760	113	12.0	14.0	C	0.284
12-Aug-92	225	1807	799	12.5	14.0	A	0.273
13-Aug-92	226	1801	104	13.0	14.0	D	0.155
13-Aug-92	226	1801	104	13.0	14.0	D	0.161
13-Aug-92	226	1802	146	13.0	14.0	C	0.110
14-Aug-92	227	1865	783	13.0	14.0	D	0.119
17-Aug-92	230	1856	179	12.0	14.0	D	0.172
18-Aug-92	231	1911	130	12.0	14.0	B	0.174
19-Aug-92	232	1929	137	12.0	13.0	A	0.396
20-Aug-92	233	1998	113	12.0	14.0	C	0.240
21-Aug-92	234	2004	883	13.0	14.0	D	0.359
24-Aug-92	237	2008	151	12.0	13.0	D	0.752
25-Aug-92	238	2106	662	14.0	15.0	D	0.727
25-Aug-92	238	2107	707	14.0	15.0	B	0.699
26-Aug-92	239	2116	885	12.0	13.0	D	0.399
27-Aug-92	240	2114	842	12.0	13.0	C	0.471
28-Aug-92	241	2104	685	13.0	14.0	C	0.138
31-Aug-92	244	2197	175	12.0	14.0	C	0.227
01-Sep-92	245	2198	8	12.0	14.0	D	0.167
02-Sep-92	246	2199	304	12.5	15.0	D	0.176
03-Sep-92	247	2232	583	12.0	15.0	D	0.119
04-Sep-92	248	2237	51	13.5	16.0	C	0.285

TABLE C-1. SUMMARY OF THE 1992 NMOC DATA FOR LONG ISLAND, NY (LINY)

Sample Period: 6:00 a.m. to 9:00 a.m.

Date Sampled	Julian Date Sampled	Sample ID Number	Sample Canister Number	Sample Pressure (psig)	Analysis Pressure (psig)	Radian Channel	Mean NMOC ppmC
04-Sep-92	248	2237	51	13.5	16.0	C	0.351
04-Sep-92	248	2238	707	13.5	16.0	B	0.344
08-Sep-92	252	2297	872	12.0	14.0	C	0.081
09-Sep-92	253	2300	627	13.0	15.0	B	0.435
10-Sep-92	254	2299	788	13.0	15.0	D	0.158
11-Sep-92	255	2325	762	13.0	15.0	D	0.199
15-Sep-92	259	2356	680	13.0	15.0	A	0.665
16-Sep-92	260	2392	706	14.0	16.0	D	0.468
16-Sep-92	260	2396	853	14.0	16.0	C	0.557
17-Sep-92	261	2405	11	12.0	14.0	D	0.405
18-Sep-92	262	2437	983	13.0	14.0	B	0.569
21-Sep-92	265	2439	100	12.0	15.0	B	0.441
22-Sep-92	266	2456	807	12.0	15.0	A	0.181
23-Sep-92	267	2498	815	12.0	12.0	A	0.094
24-Sep-92	268	2503	84	12.0	12.0	A	0.092
25-Sep-92	269	2570	889	13.0	12.0	A	0.100
28-Sep-92	272	2578	569	12.0	13.0	B	0.209
29-Sep-92	273	2567	822	13.0	15.0	C	0.118
29-Sep-92	273	2567	822	13.0	15.0	C	0.158
29-Sep-92	273	2575	137	13.0	14.0	D	0.122
30-Sep-92	274	2613	102	13.5	14.0	B	0.090
30-Sep-92	274	2614	761	13.5	14.0	C	0.148

New York, NY (MNY)

1992 NMOC Program (AIRS # 36-061-0010)

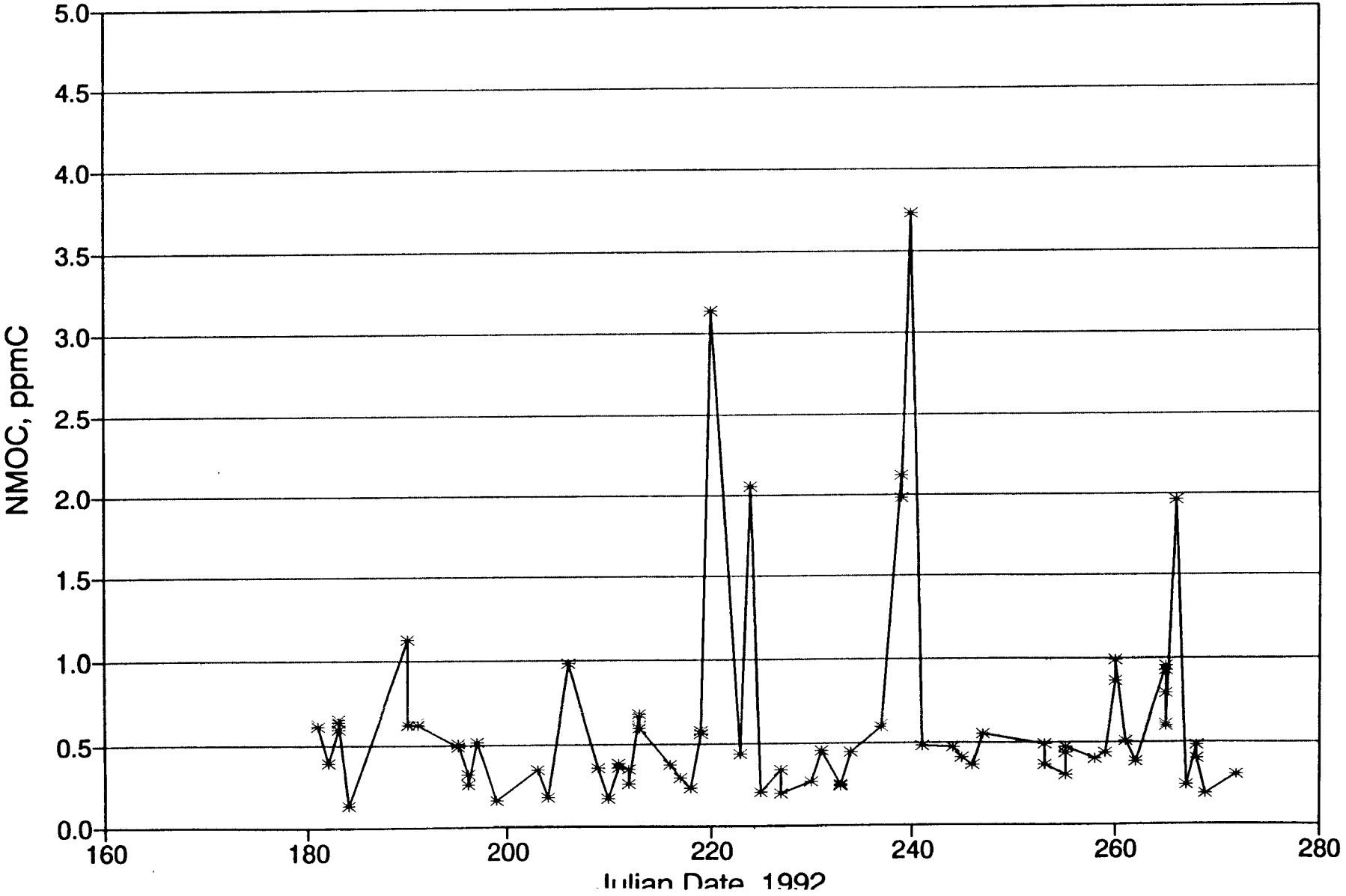


TABLE C-2. SUMMARY OF THE 1992 NMOC DATA FOR MANHATTEN, NY (MNY)

Sample Period: 6:00 a.m. to 9:00 a.m.

Date Sampled	Julian Date Sampled	Sample ID Number	Sample Canister Number	Sample Pressure (psig)	Analysis Pressure (psig)	Radian Channel	Mean NMOC ppmC
29-Jun-92	181	1122	704	16.0	14.0	D	0.619
30-Jun-92	182	1101	921	15.0	15.0	A	0.396
01-Jul-92	183	1110	107	15.0	16.0	D	0.602
01-Jul-92	183	1110	107	15.0	16.0	D	0.647
02-Jul-92	184	1109	649	15.0	16.0	C	0.128
08-Jul-92	190	1178	772	12.0	12.0	A	1.120
08-Jul-92	190	1182	165	17.5	17.0	B	0.628
09-Jul-92	191	1203	656	15.0	16.0	D	0.626
13-Jul-92	195	1226	188	19.0	19.0	B	0.495
13-Jul-92	195	1227	140	19.0	19.0	B	0.509
14-Jul-92	196	1304	197	22.0	22.0	D	0.316
14-Jul-92	196	1304	197	22.0	22.0	D	0.257
15-Jul-92	197	1303	764	15.0	15.0	A	0.517
17-Jul-92	199	1322	407	15.0	15.0	C	0.162
17-Jul-92	199	1322	407	15.0	15.0	C	0.154
21-Jul-92	203	1372	821	14.5	15.0	D	0.346
22-Jul-92	204	1408	766	15.0	15.0	C	0.175
24-Jul-92	206	1434	82	15.0	15.0	B	0.983
27-Jul-92	209	1459	855	14.5	14.0	D	0.359
28-Jul-92	210	1470	771	15.5	16.0	C	0.167
29-Jul-92	211	1502	679	15.0	16.0	D	0.358
29-Jul-92	211	1502	679	15.0	16.0	D	0.382
30-Jul-92	212	1522	875	14.0	15.0	C	0.349
30-Jul-92	212	1522	875	14.0	15.0	C	0.255
31-Jul-92	213	1557	624	17.0	17.0	B	0.676
31-Jul-92	213	1558	711	17.0	17.0	A	0.596
03-Aug-92	216	1595	50	14.0	15.0	C	0.376
04-Aug-92	217	1623	137	14.0	14.0	D	0.290
05-Aug-92	218	1631	15	14.5	16.0	D	0.227
06-Aug-92	219	1712	816	14.5	16.0	D	0.562
06-Aug-92	219	1712	816	14.5	16.0	D	0.581

TABLE C-2. SUMMARY OF THE 1992 NMOC DATA FOR MANHATTEN, NY (MNY)

Sample Period: 6:00 a.m. to 9:00 a.m.

Date Sampled	Julian Date Sampled	Sample ID Number	Sample Canister Number	Sample Pressure (psig)	Analysis Pressure (psig)	Radian Channel	Mean NMOC pprnC
07-Aug-92	220	1703	902	15.0	17.0	A	3.140
10-Aug-92	223	1736	889	14.0	16.0	B	0.437
11-Aug-92	224	1754	872	14.5	16.0	B	2.057
12-Aug-92	225	1779	50	14.5	16.0	D	0.205
14-Aug-92	227	1837	626	15.0	15.0	C	0.338
14-Aug-92	227	1837	626	15.0	15.0	C	0.198
17-Aug-92	230	1861	697	15.0	16.0	C	0.267
18-Aug-92	231	1879	50	14.5	16.0	B	0.452
20-Aug-92	233	1946	843	14.5	16.0	C	0.244
20-Aug-92	233	1946	843	14.5	16.0	C	0.235
21-Aug-92	234	1983	921	15.0	16.0	D	0.444
24-Aug-92	237	2001	121	15.0	15.0	C	0.602
26-Aug-92	239	2064	782	21.0	21.0	A	2.120
26-Aug-92	239	2064	782	21.0	21.0	A	1.980
27-Aug-92	240	2097	670	20.0	20.0	D	3.730
28-Aug-92	241	2121	4	11.0	11.0	D	0.480
31-Aug-92	244	2143	301	11.0	12.0	C	0.471
01-Sep-92	245	2161	154	12.0	13.0	A	0.407
02-Sep-92	246	2200	171	11.5	13.0	A	0.362
03-Sep-92	247	2257	974	11.0	14.0	A	0.552
09-Sep-92	253	2270	662	16.0	18.0	A	0.494
09-Sep-92	253	2271	853	16.0	18.0	D	0.369
11-Sep-92	255	2318	105	19.0	20.0	D	0.300
11-Sep-92	255	2318	105	19.0	19.0	D	0.440
11-Sep-92	255	2322	708	18.5	20.0	A	0.476
14-Sep-92	258	2334	815	12.0	13.0	A	0.399
15-Sep-92	259	2350	130	12.0	14.0	C	0.434
16-Sep-92	260	2373	183	17.0	20.0	B	0.864
16-Sep-92	260	2390	720	9.0	10.0	D	0.984
17-Sep-92	261	2416	623	12.0	14.0	C	0.509
18-Sep-92	262	2422	800	12.0	13.0	A	0.381

TABLE C-2. SUMMARY OF THE 1992 NMOC DATA FOR MANHATTEN, NY (MNY)

Sample Period: 6:00 a.m. to 9:00 a.m.

Date Sampled	Julian Date Sampled	Sample ID Number	Sample Canister Number	Sample Pressure (psig)	Analysis Pressure (psig)	Radian Channel	Mean NMOC ppmC
21-Sep-92	265	2440	2	16.0	18.0	C	0.955
21-Sep-92	265	2440	2	16.0	18.0	C	0.924
21-Sep-92	265	2441	79	16.0	18.0	C	0.788
21-Sep-92	265	2441	79	16.0	18.0	C	0.599
22-Sep-92	266	2454	723	12.0	12.0	A	1.964
23-Sep-92	267	2490	130	11.5	12.0	C	0.236
24-Sep-92	268	2506	36	16.5	15.0	C	0.484
24-Sep-92	268	2507	659	16.5	15.0	C	0.398
25-Sep-92	269	2524	51	11.0	11.0	C	0.189
28-Sep-92	272	2617	983	12.0	12.0	D	0.301

Newark, NJ (NWNJ)

1992 NMOC Program (AIRS #34-013-0011)

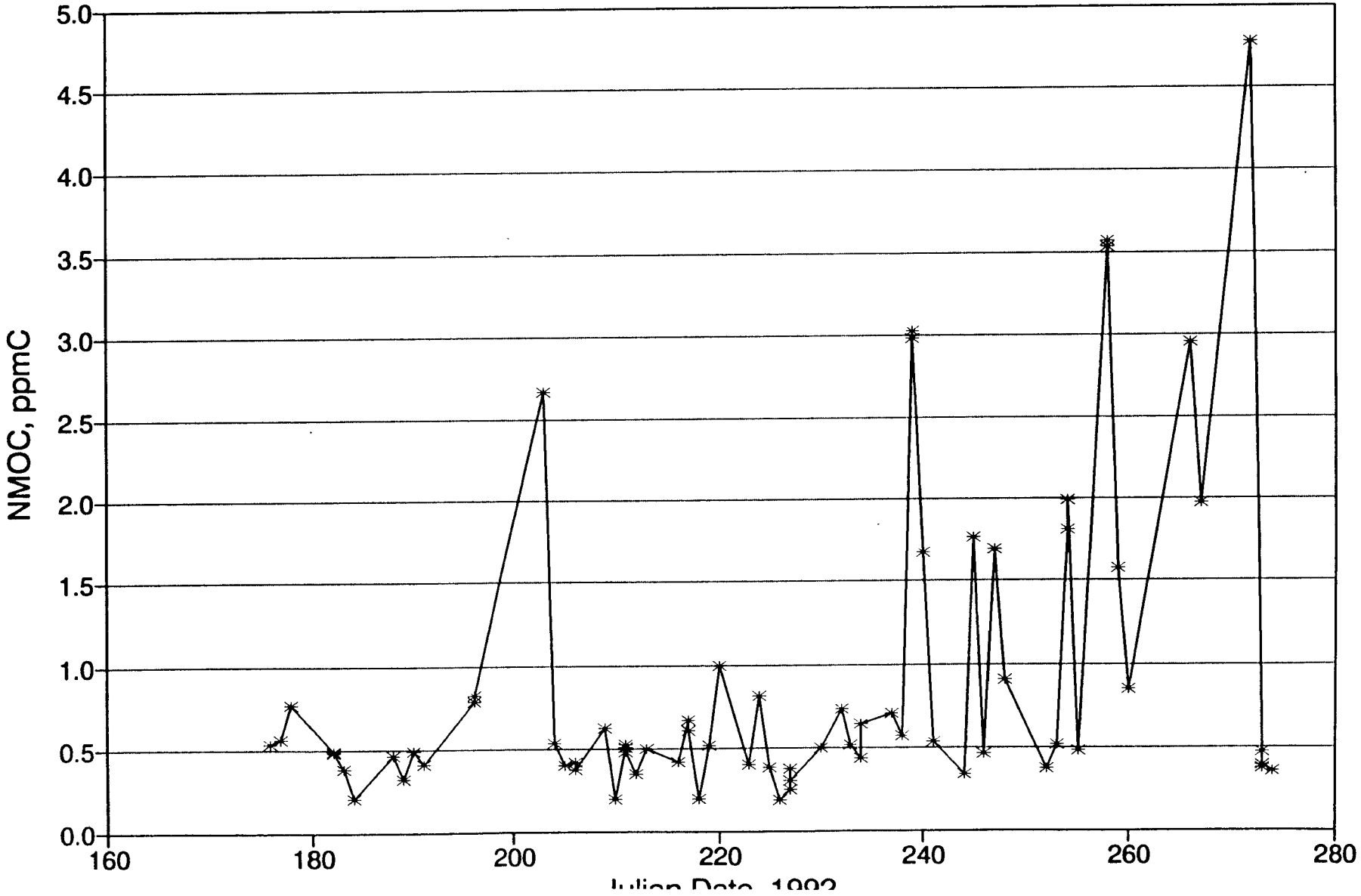


TABLE C-3. SUMMARY OF THE NMOC DATA FOR NEWARK, NJ (NWNJ)

Sample Period: 6:00 a.m. to 9:00 a.m.

Date Sampled	Julian Date Sampled	Sample ID Number	Sample Canister Number	Sample Pressure (psig)	Analysis Pressure (psig)	Radian Channel	Mean NMOC ppmC
24-Jun-92	176	1051	680	15.0	15.0	D	0.536
25-Jun-92	177	1053	815	14.0	14.0	C	0.563
26-Jun-92	178	1064	780	12.4	12.0	D	0.768
30-Jun-92	182	1121	764	12.0	13.0	B	0.492
30-Jun-92	182	1121	764	12.0	13.0	B	0.486
01-Jul-92	183	1117	607	14.1	13.0	B	0.388
02-Jul-92	184	1130	20	13.9	13.0	C	0.205
06-Jul-92	188	1139	84	11.2	12.0	D	0.465
07-Jul-92	189	1177	186	10.0	9.5	A	0.319
08-Jul-92	190	1181	663	10.1	10.0	A	0.493
09-Jul-92	191	1217	43	10.0	9.0	B	0.409
14-Jul-92	196	1255	878	15.5	15.5	C	0.787
14-Jul-92	196	1255	878	15.5	15.5	C	0.823
21-Jul-92	203	1404	157	18.5	18.0	D	2.670
22-Jul-92	204	1395	767	18.5	18.0	D	0.533
23-Jul-92	205	1444	52	14.0	14.0	A	0.406
24-Jul-92	206	1445	1	16.4	16.0	C	0.421
24-Jul-92	206	1446	35	16.4	16.0	C	0.374
27-Jul-92	209	1494	796	15.0	14.0	B	0.625
28-Jul-92	210	1495	308	14.1	14.0	C	0.197
29-Jul-92	211	1553	14	15.4	1.0	D	0.506
29-Jul-92	211	1553	14	15.4	14.0	D	0.528
29-Jul-92	211	1554	631	15.4	14.0	A	0.481
30-Jul-92	212	1564	849	14.4	14.0	D	0.347
31-Jul-92	213	1569	914	14.5	14.0	B	0.498
03-Aug-92	216	1609	406	16.3	16.0	A	0.422
04-Aug-92	217	1637	632	15.1	11.0	D	0.668
04-Aug-92	217	1642	794	15.1	16.0	C	0.609
05-Aug-92	218	1647	852	16.0	16.0	D	0.194
06-Aug-92	219	1711	74	14.3	16.0	A	0.515
07-Aug-92	220	1709	713	16.2	17.0	C	0.998

TABLE C-3. SUMMARY OF THE NMOC DATA FOR NEWARK, NJ (NWNJ)

Sample Period: 6:00 a.m. to 9:00 a.m.

Date Sampled	Julian Date Sampled	Sample ID Number	Sample Canister Number	Sample Pressure (psig)	Analysis Pressure (psig)	Radian Channel	Mean NMOC ppmC
10-Aug-92	223	1799	657	15.8	14.0	C	0.405
11-Aug-92	224	1800	690	15.4	14.0	C	0.816
12-Aug-92	225	1820	815	15.0	14.0	C	0.382
13-Aug-92	226	1838	197	10.0	10.0	C	0.188
14-Aug-92	227	1854	140	15.8	16.0	C	0.244
14-Aug-92	227	1854	140	15.8	16.0	C	0.379
14-Aug-92	227	1855	915	15.8	16.0	C	0.306
17-Aug-92	230	1942	837	16.2	20.0	C	0.498
19-Aug-92	232	1943	198	14.1	15.0	D	0.740
20-Aug-92	233	1935	38	14.0	14.0	D	0.523
21-Aug-92	234	2012	848	14.1	14.0	C	0.436
21-Aug-92	234	2012	848	14.1	14.0	C	0.644
24-Aug-92	237	2075	838	14.4	14.0	B	0.712
25-Aug-92	238	2072	83	15.4	15.0	A	0.577
26-Aug-92	239	2063	649	16.2	16.0	C	3.030
26-Aug-92	239	2070	832	16.2	15.0	D	2.987
27-Aug-92	240	2095	770	15.8	15.0	D	1.670
28-Aug-92	241	2118	137	14.0	14.0	B	0.533
31-Aug-92	244	2187	784	17.2	18.0	B	0.338
01-Sep-92	245	2211	72	15.0	16.0	B	1.760
02-Sep-92	246	2213	644	15.9	16.0	C	0.465
03-Sep-92	247	2239	57	14.3	16.0	A	1.690
04-Sep-92	248	2243	305	15.0	16.0	B	0.906
08-Sep-92	252	2285	852	18.0	19.0	B	0.378
09-Sep-92	253	2317	56	14.1	15.0	B	0.517
10-Sep-92	254	2326	823	15.8	16.0	C	1.806
10-Sep-92	254	2327	112	15.8	16.0	B	1.990
11-Sep-92	255	2328	551	17.0	18.0	C	0.484
14-Sep-92	258	2366	684	20.1	20.0	D	3.537
14-Sep-92	258	2367	114	20.1	21.0	C	3.567
15-Sep-92	259	2397	659	19.9	20.0	D	1.579

TABLE C-3. SUMMARY OF THE NMOC DATA FOR NEWARK, NJ (NWNJ)

Sample Period: 6:00 a.m. to 9:00 a.m.

Date Sampled	Julian Date Sampled	Sample ID Number	Sample Canister Number	Sample Pressure (psig)	Analysis Pressure (psig)	Radian Channel	Mean NMOC ppmC
16-Sep-92	260	2399	889	21.0	20.0	C	0.855
22-Sep-92	266	2491	39	14.9	14.0	B	2.960
23-Sep-92	267	2536	184	15.0	12.0	D	1.970
28-Sep-92	272	2551	33	14.3	13.0	A	4.780
29-Sep-92	273	2588	114	16.0	16.0	C	0.477
29-Sep-92	273	2588	114	16.0	16.0	C	0.378
29-Sep-92	273	2590	8	16.0	16.0	D	0.473
29-Sep-92	273	2590	8	16.0	16.0	D	0.389
30-Sep-92	274	2616	905	20.6	20.0	A	0.353

Plainfield, NJ (PLNJ)

1992 NMOC Program (AIRS # 34-039-5001)

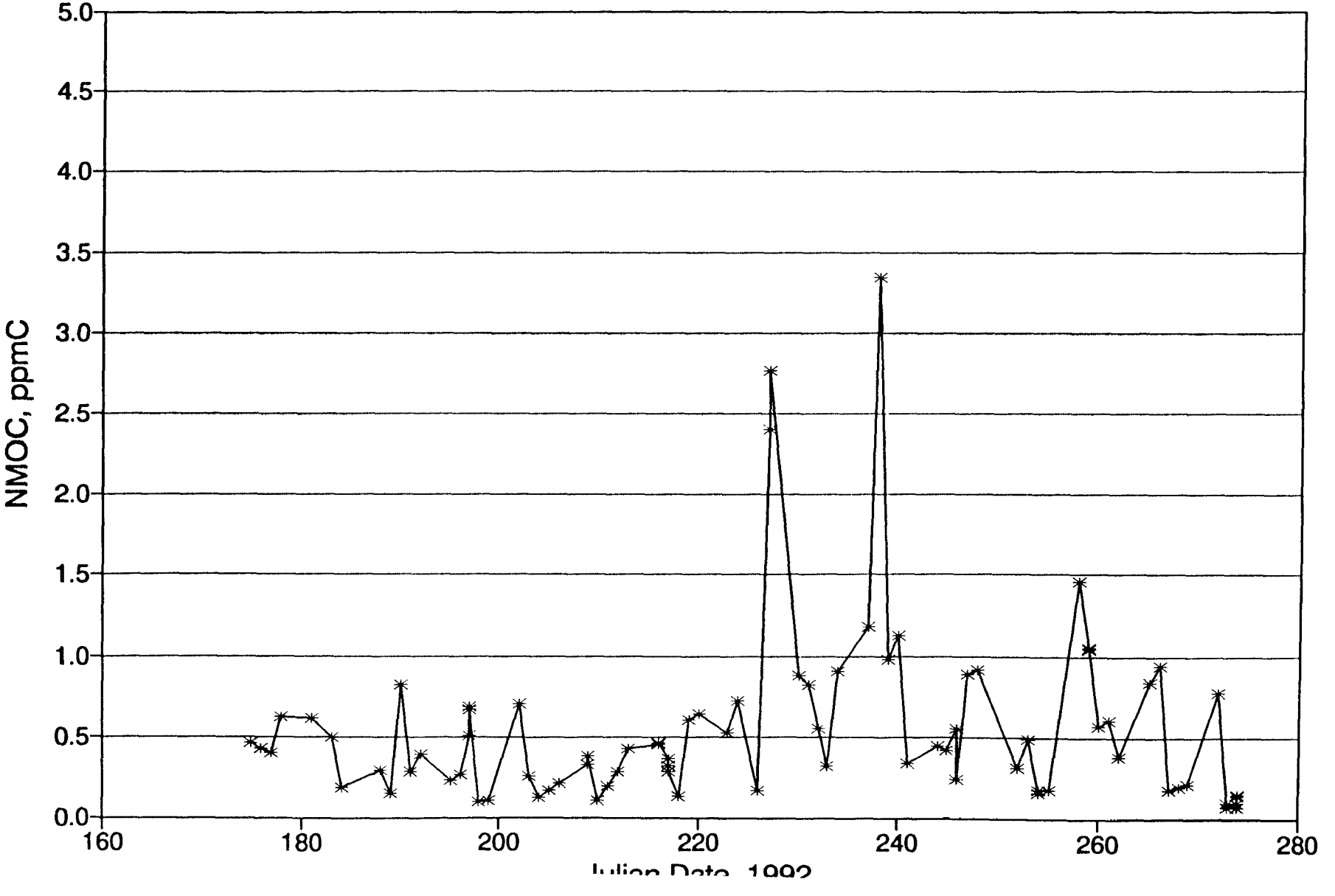


TABLE C-4. SUMMARY OF THE 1992 NMOC DATA FOR PLAINFIELD, NJ (PLNJ)

Sample Period: 6:00 a.m. to 9:00 a.m.

Date Sampled	Julian Date Sampled	Sample ID Number	Sample Canister Number	Sample Pressure (psig)	Analysis Pressure (psig)	Radian Channel	Mean NMOC ppmC
23-Jun-92	175	1048	148	13.5	14.0	C	0.465
24-Jun-92	176	1056	686	13.0	13.0	C	0.428
25-Jun-92	177	1063	648	13.0	12.0	A	0.400
26-Jun-92	178	1058	100	12.2	12.0	D	0.623
29-Jun-92	181	1060	928	15.1	14.0	C	0.620
01-Jul-92	183	1097	151	12.0	13.0	B	0.503
02-Jul-92	184	1116	77	12.2	12.0	C	0.188
06-Jul-92	188	1148	56	12.0	14.0	A	0.294
07-Jul-92	189	1168	707	13.4	13.0	D	0.147
08-Jul-92	190	1239	97	12.2	12.0	C	0.829
09-Jul-92	191	1236	762	12.6	12.5	B	0.285
10-Jul-92	192	1224	837	12.0	12.0	A	0.394
13-Jul-92	195	1235	796	13.5	13.0	A	0.232
14-Jul-92	196	1279	649	12.8	12.5	D	0.264
15-Jul-92	197	1275	130	16.2	16.0	C	0.513
15-Jul-92	197	1275	130	16.2	16.0	C	0.688
15-Jul-92	197	1276	921	16.2	16.0	D	0.671
16-Jul-92	198	1282	8	12.0	12.0	C	0.099
17-Jul-92	199	1340	104	12.2	12.0	C	0.102
20-Jul-92	202	1351	929	13.8	14.0	C	0.707
21-Jul-92	203	1393	724	13.0	13.0	C	0.260
22-Jul-92	204	1402	164	12.3	13.0	C	0.126
23-Jul-92	205	1463	171	12.3	12.0	D	0.164
24-Jul-92	206	1466	129	12.2	12.0	D	0.212
27-Jul-92	209	1464	140	16.2	16.0	D	0.326
27-Jul-92	209	1465	28	16.2	16.0	B	0.386
28-Jul-92	210	1531	889	12.1	12.0	C	0.106
29-Jul-92	211	1529	154	12.2	12.0	D	0.197
30-Jul-92	212	1525	782	13.0	13.0	A	0.280
31-Jul-92	213	1593	799	12.8	13.0	D	0.432
03-Aug-92	216	1585	704	13.8	14.0	C	0.458
03-Aug-92	216	1585	704	13.8	14.0	C	0.463

TABLE C-4. SUMMARY OF THE 1992 NMOC DATA FOR PLAINFIELD, NJ (PLNJ)

Sample Period: 6:00 a.m. to 9:00 a.m.

Date Sampled	Julian Date Sampled	Sample ID Number	Sample Canister Number	Sample Pressure (psig)	Analysis Pressure (psig)	Radian Channel	Mean NMOC ppmC
04-Aug-92	217	1632	638	16.9	18.0	C	0.364
04-Aug-92	217	1650	618	16.9	18.0	C	0.321
04-Aug-92	217	1650	618	16.9	18.0	C	0.280
05-Aug-92	218	1639	730	13.4	15.0	D	0.133
06-Aug-92	219	1708	54	12.4	14.0	D	0.611
07-Aug-92	220	1702	883	12.5	14.0	C	0.648
10-Aug-92	223	1819	675	14.0	14.0	D	0.526
11-Aug-92	224	1804	868	12.1	12.0	D	0.724
13-Aug-92	226	1809	36	12.2	12.0	C	0.165
14-Aug-92	227	1922	677	17.2	18.0	B	2.392
14-Aug-92	227	1923	704	17.2	17.0	B	2.762
17-Aug-92	230	1931	165	13.0	12.5	A	0.880
18-Aug-92	231	1926	882	12.1	12.0	A	0.824
19-Aug-92	232	1938	724	13.1	14.0	D	0.553
20-Aug-92	233	1932	657	13.0	13.0	D	0.318
21-Aug-92	234	2005	178	13.0	12.0	C	0.907
24-Aug-92	237	2071	854		14.0	A	1.180
25-Aug-92	238	2065	633	20.5	11.0	C	3.347
26-Aug-92	239	2150	50	12.0	13.0	A	0.980
27-Aug-92	240	2151	130	12.0	13.0	B	1.120
28-Aug-92	241	2117	825	12.0	12.0	A	0.336
31-Aug-92	244	2160	631	13.8	15.0	C	0.449
01-Sep-92	245	2224	406	12.8	14.0	C	0.420
02-Sep-92	246	2225	49	12.3	14.0	B	0.559
02-Sep-92	246	2225	49	12.3	14.0	B	0.240
03-Sep-92	247	2241	500	12.3	14.0	A	0.892
04-Sep-92	248	2269	104	12.2	15.0	C	0.918
08-Sep-92	252	2275	706	12.9	14.0	B	0.309
09-Sep-92	253	2310	148	12.6	14.0	A	0.492
10-Sep-92	254	2311	716	10.1	11.0	D	0.162
10-Sep-92	254	2312	979	10.1	10.5	C	0.176
11-Sep-92	255	2376	406	12.3	14.0	A	0.180

TABLE C-4. SUMMARY OF THE 1992 NMOC DATA FOR PLAINFIELD, NJ (PLNJ)

Sample Period: 6:00 a.m. to 9:00 a.m.

Date Sampled	Julian Date Sampled	Sample ID Number	Sample Canister Number	Sample Pressure (psig)	Analysis Pressure (psig)	Radian Channel	Mean NMOC ppmC
14-Sep-92	258	2400	631	14.7	16.0	D	1.457
15-Sep-92	259	2377	641	12.2	12.0	C	1.038
15-Sep-92	259	2381	304	12.2	12.0	C	1.051
16-Sep-92	260	2401	978	13.0	14.0	C	0.573
17-Sep-92	261	2438	653	13.2	15.0	A	0.606
18-Sep-92	262	2445	798	13.1	16.0	C	0.383
21-Sep-92	265	2513	989	13.8	13.0	D	0.847
22-Sep-92	266	2514	695	13.2	11.0	A	0.944
23-Sep-92	267	2502	917	12.7	13.0	C	0.179
24-Sep-92	268	2518	301	13.0	13.0	A	0.190
25-Sep-92	269	2566	129	12.9	12.0	C	0.214
28-Sep-92	272	2564	304	17.4	18.0	A	0.782
28-Sep-92	273	2569	645	17.2	16.0	C	0.070
29-Sep-92	273	2587	923	17.2	17.0	C	0.099
30-Sep-92	274	2612	72	17.0	17.0	B	0.096
30-Sep-92	274	2612	72	17.0	17.0	B	0.136
30-Sep-92	274	2619	657	17.0	17.0	B	0.065
30-Sep-92	274	2619	657	17.0	17.0	B	0.146

Raleigh, NC (R1NC)

1992 NMOC Program (AIRS # 37-183-0015)

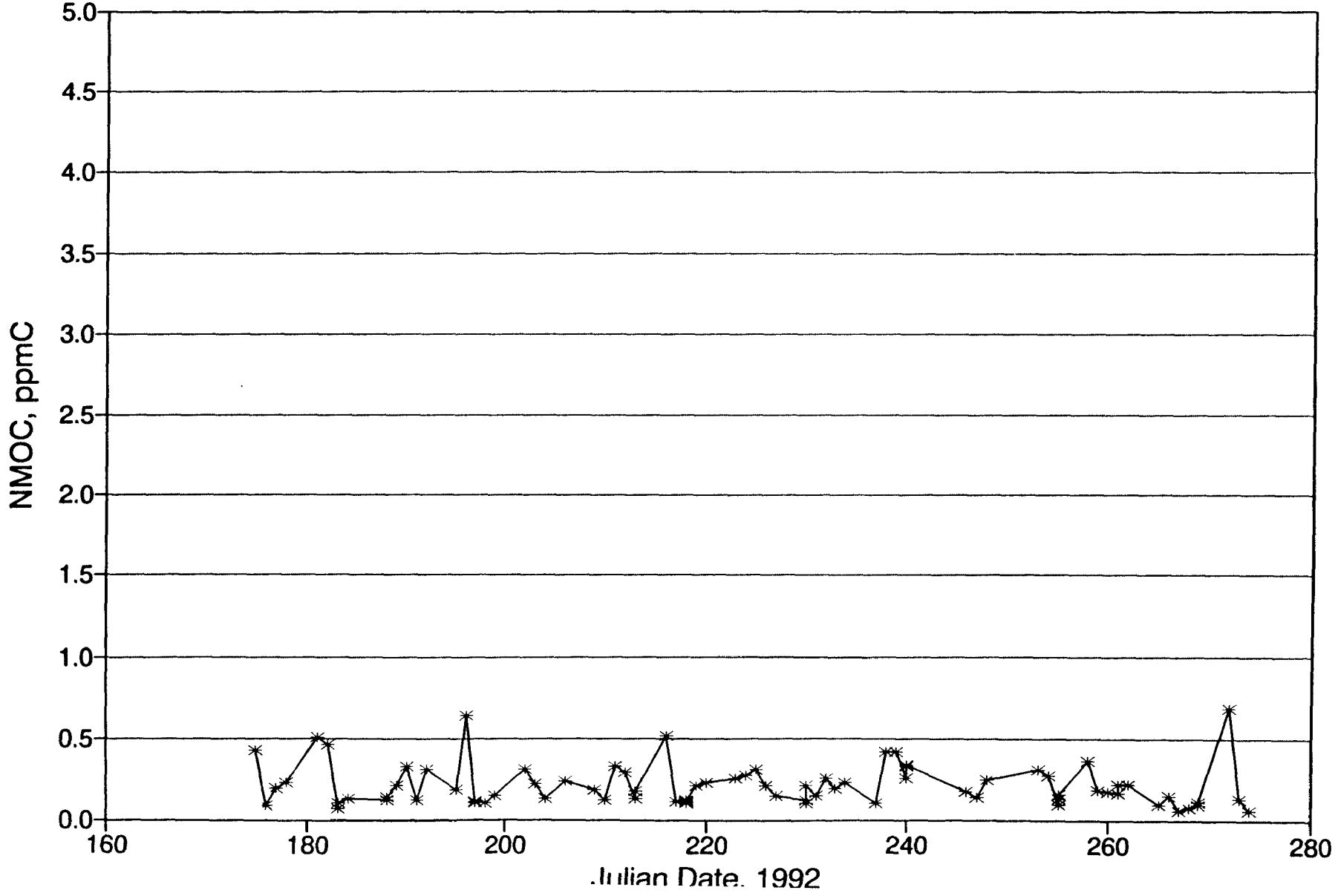


TABLE C-5. SUMMARY OF THE 1992 NMOC DATA FOR RALEIGH, NC (R1NC)

Sample Period: 6:00 a.m. to 9:00 a.m.

Date Sampled	Julian Date Sampled	Sample ID Number	Sample Canister Number	Sample Pressure (psig)	Analysis Pressure (psig)	Radian Channel	Mean NMOC ppmC
23-Jun-92	175	1023	649	10.5	10.0	D	0.428
24-Jun-92	176	1024	308	8.0	6.0	B	0.085
25-Jun-92	177	1025	765	8.0	8.0	A	0.195
26-Jun-92	178	1076	137	10.0	10.0	B	0.229
29-Jun-92	181	1078	304	11.0	10.0	B	0.511
30-Jun-92	182	1084	36	6.0	7.0	D	0.468
01-Jul-92	183	1080	850	10.0	9.0	C	0.068
01-Jul-92	183	1080	850	10.0	9.0	C	0.106
02-Jul-92	184	1077	166	10.0	8.0	D	0.130
06-Jul-92	188	1154	675	8.0	7.0	B	0.119
06-Jul-92	188	1155	653	8.0	7.0	A	0.136
07-Jul-92	189	1161	176	10.5	10.0	D	0.216
08-Jul-92	190	1158	131	10.0	8.0	B	0.328
09-Jul-92	191	1256	870	11.0	10.0	C	0.122
10-Jul-92	192	1257	129	10.0	9.0	D	0.314
13-Jul-92	195	1244	164	10.0	9.0	D	0.184
14-Jul-92	196	1247	77	8.0	8.0	A	0.647
15-Jul-92	197	1252	789	10.0	9.0	C	0.101
15-Jul-92	197	1253	621	10.0	9.0	C	0.113
16-Jul-92	198	1371	704	10.0	9.0	D	0.101
17-Jul-92	199	1373	813	9.0	8.0	D	0.153
20-Jul-92	202	1385	850	11.0	10.0	D	0.311
21-Jul-92	203	1379	894	10.5	10.0	D	0.225
22-Jul-92	204	1388	927	9.0	8.0	C	0.133
24-Jul-92	206	1518	684	9.0	8.0	B	0.239
27-Jul-92	209	1520	33	10.0	10.0	B	0.188
28-Jul-92	210	1515	808	10.0	9.0	A	0.125
29-Jul-92	211	1519	165	10.0	9.0	B	0.332
30-Jul-92	212	1517	670	11.0	10.0	A	0.290
31-Jul-92	213	1619	836	11.0	10.0	C	0.135
31-Jul-92	213	1620	831	12.0	11.0	B	0.173
03-Aug-92	216	1630	807	11.5	14.0	B	0.520

TABLE C-5. SUMMARY OF THE 1992 NMOC DATA FOR RALEIGH, NC (R1NC)

Sample Period: 6:00 a.m. to 9:00 a.m.

Date Sampled	Julian Date Sampled	Sample ID Number	Sample Canister Number	Sample Pressure (psig)	Analysis Pressure (psig)	Radian Channel	Mean NMOC ppmC
04-Aug-92	217	1628	171	6.0	5.0	C	0.111
05-Aug-92	218	1614	878	16.0	15.0	A	0.106
05-Aug-92	218	1614	878	16.0	15.0	A	0.113
05-Aug-92	218	1615	911	17.0	15.0	D	0.118
06-Aug-92	219	1787	28	11.0	11.0	C	0.212
07-Aug-92	220	1788	155	9.0	9.0	C	0.227
10-Aug-92	223	1783	80	10.0	10.0	D	0.260
11-Aug-92	224	1782	660	11.0	10.0	D	0.276
12-Aug-92	225	1789	198	10.0	10.0	A	0.311
13-Aug-92	226	1786	162	10.0	10.0	D	0.211
14-Aug-92	227	1913	825	10.0	10.0	C	0.151
17-Aug-92	230	1915	154	11.0	10.0	D	0.118
17-Aug-92	230	1916	149	11.0	11.0	C	0.101
17-Aug-92	230	1916	149	11.0	11.0	C	0.213
18-Aug-92	231	1920	816	10.0	10.0	D	0.146
19-Aug-92	232	1912	166	10.0	10.0	B	0.254
20-Aug-92	233	1914	889	10.5	10.0	D	0.194
21-Aug-92	234	2051	651	10.0	10.0	A	0.231
24-Aug-92	237	2053	667	10.0	10.0	D	0.105
25-Aug-92	238	2054	104	10.0	10.0	D	0.421
26-Aug-92	239	2052	193	10.0	10.0	B	0.418
27-Aug-92	240	2206	915	12.0	12.0	A	0.254
27-Aug-92	240	2207	179	12.0	12.0	D	0.330
27-Aug-92	240	2207	179	12.0	12.0	D	0.339
02-Sep-92	246	2209	653	9.0	10.0	B	0.178
03-Sep-92	247	2208	114	11.0	11.0	B	0.143
04-Sep-92	248	2289	113	11.0	11.0	D	0.248
09-Sep-92	253	2290	552	10.0	11.0	C	0.313
10-Sep-92	254	2288	883	10.0	10.0	C	0.274
11-Sep-92	255	2385	990	15.0	18.0	D	0.094
11-Sep-92	255	2385	990	15.0	18.0	D	0.127
11-Sep-92	255	2387	553	15.0	18.0	C	0.155

TABLE C-5. SUMMARY OF THE 1992 NMOC DATA FOR RALEIGH, NC (R1NC)

Sample Period: 6:00 a.m. to 9:00 a.m.

Date Sampled	Julian Date Sampled	Sample ID Number	Sample Canister Number	Sample Pressure (psig)	Analysis Pressure (psig)	Radian Channel	Mean NMOC ppmC
14-Sep-92	258	2384	635	11.0	12.0	B	0.369
15-Sep-92	259	2382	4	12.0	12.0	D	0.188
16-Sep-92	260	2383	587	9.0	8.0	A	0.180
17-Sep-92	261	2496	648	10.0	10.0	C	0.171
17-Sep-92	261	2497	683	10.0	10.0	D	0.225
18-Sep-92	262	2492	707	9.0	10.0	D	0.223
21-Sep-92	265	2494	102	10.0	10.0	C	0.099
22-Sep-92	266	2495	884	10.0	10.0	B	0.145
23-Sep-92	267	2493	865	11.0	10.0	A	0.055
24-Sep-92	268	2608	922	11.0	11.0	D	0.080
25-Sep-92	269	2601	801	9.0	10.0	B	0.093
25-Sep-92	269	2607	118	9.0	10.0	C	0.113
28-Sep-92	272	2600	987	10.0	10.0	A	0.692
29-Sep-92	273	2602	786	9.0	10.0	B	0.134
30-Sep-92	274	2606	834	11.0	11.0	D	0.060

Salt Lake City, Utah (S2UT)

1992 NMOC Program (AIRS # 49-035-3001)

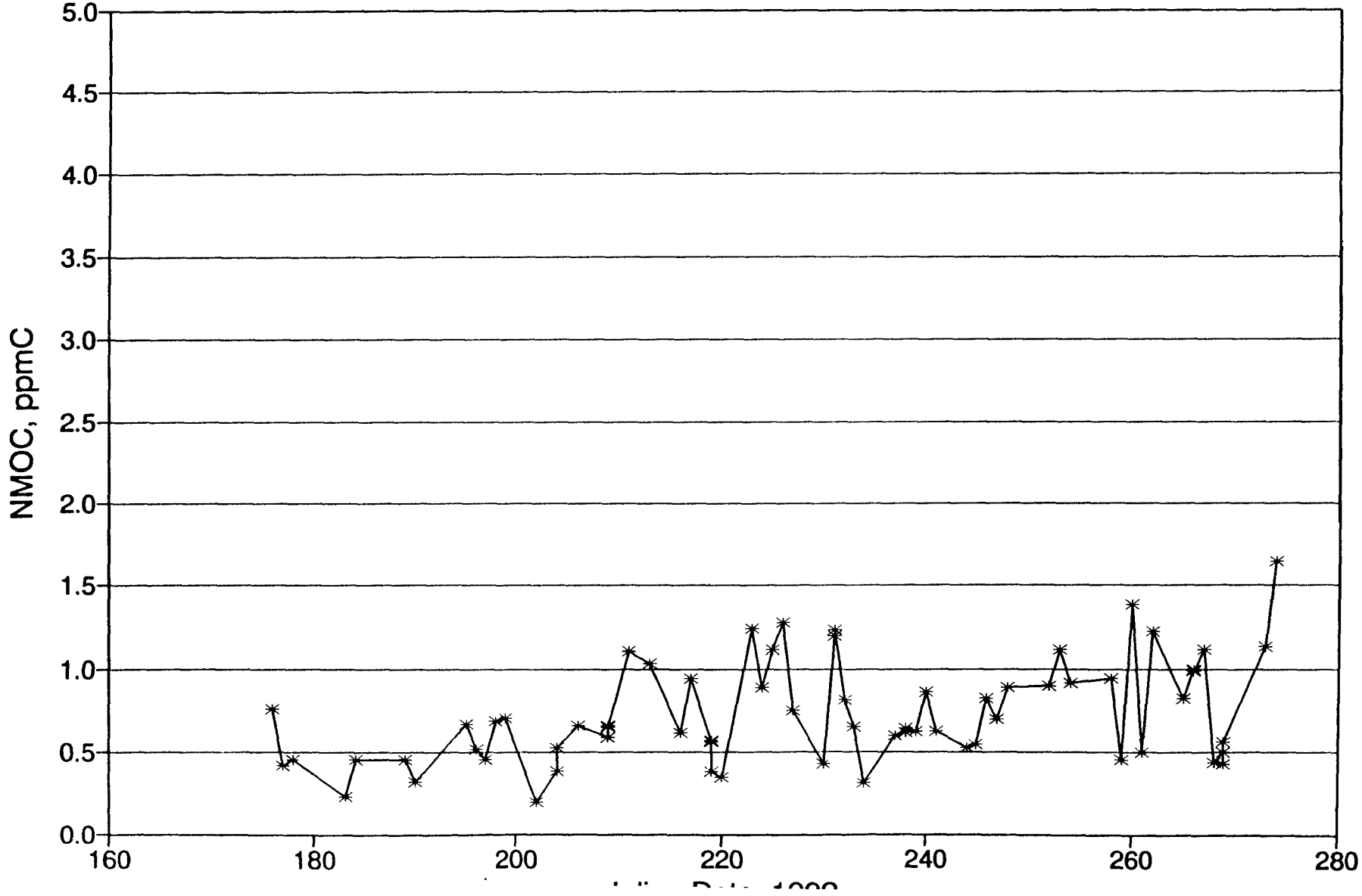


TABLE C-6. SUMMARY OF THE 1992 NMOC DATA FOR SALT LAKE CITY, UTAH (S2UT)

Sample Period: 6:00 a.m. to 9:00 a.m.

Date Sampled	Julian Date Sampled	Sample ID Number	Sample Canister Number	Sample Pressure (psig)	Analysis Pressure (psig)	Radian Channel	Mean NMOC ppmC
24-Jun-92	176	1016	118	11.0	11.0	A	0.763
25-Jun-92	177	1027	138	11.0	10.0	C	0.424
26-Jun-92	178	1067	823	11.0	9.0	A	0.458
01-Jul-92	183	1082	991	10.5	9.0	B	0.232
02-Jul-92	184	1104	998	11.0	10.0	D	0.458
07-Jul-92	189	1140	767	12.0	12.0	C	0.460
08-Jul-92	190	1162	994	11.0	10.0	B	0.317
13-Jul-92	195	1205	996	12.0	11.0	C	0.669
14-Jul-92	196	1229	993	11.0	10.0	C	0.517
15-Jul-92	197	1259	997	11.0	10.0	A	0.460
16-Jul-92	198	1277	992	11.0	10.0	A	0.686
17-Jul-92	199	1296	990	11.0	10.0	C	0.704
20-Jul-92	202	1487	37	11.0	10.0	C	0.193
22-Jul-92	204	1377	994	15.0	13.0	D	0.386
22-Jul-92	204	1377	994	15.0	13.0	D	0.527
22-Jul-92	204	1378	993	15.0	13.0	C	0.528
24-Jul-92	206	1460	992	11.0	10.0	D	0.662
27-Jul-92	209	1455	990	15.0	16.0	A	0.593
27-Jul-92	209	1456	997	15.0	16.0	D	0.665
27-Jul-92	209	1456	997	15.0	16.0	D	0.656
29-Jul-92	211	1505	993	12.0	10.0	D	1.108
31-Jul-92	213	1568	129	11.0	10.0	B	1.037
03-Aug-92	216	1622	855	12.0	12.0	D	0.619
04-Aug-92	217	1626	990	12.0	9.0	A	0.947
06-Aug-92	219	1717	997	15.0	15.0	C	0.566
06-Aug-92	219	1717	997	15.0	15.0	C	0.570
06-Aug-92	219	1718	991	15.0	15.0	C	0.388
07-Aug-92	220	1707	918	11.0	10.0	D	0.348
10-Aug-92	223	1735	165	11.0	10.0	A	1.240
11-Aug-92	224	1758	995	12.0	10.0	C	0.889
12-Aug-92	225	1784	992	16.0	14.0	B	1.117

TABLE C-6. SUMMARY OF THE 1992 NMOC DATA FOR SALT LAKE CITY, UTAH (S2UT)

Sample Period: 6:00 a.m. to 9:00 a.m.

Date Sampled	Julian Date Sampled	Sample ID Number	Sample Canister Number	Sample Pressure (psig)	Analysis Pressure (psig)	Radian Channel	Mean NMOC ppmC
12-Aug-92	225	1785	990	16.0	14.0	C	1.118
13-Aug-92	226	1821	998	11.0	10.0	B	1.277
14-Aug-92	227	1842	993	11.0	9.0	D	0.758
17-Aug-92	230	1858	991	8.0	8.0	D	0.432
18-Aug-92	231	1884	996	16.0	15.0	D	1.193
18-Aug-92	231	1885	994	16.0	15.0	C	1.230
19-Aug-92	232	1944	992	11.0	10.0	C	0.814
20-Aug-92	233	1947	766	11.0	10.0	C	0.655
21-Aug-92	234	1987	999	11.0	10.0	C	0.310
24-Aug-92	237	2017	991	11.0	9.0	C	0.597
25-Aug-92	238	2046	994	11.0	10.0	B	0.617
25-Aug-92	238	2046	994	11.0	10.0	B	0.645
26-Aug-92	239	2062	990	9.0	9.0	C	0.628
27-Aug-92	240	2094	992	11.0	9.0	C	0.861
28-Aug-92	241	2102	999	11.0	10.0	C	0.626
31-Aug-92	244	2135	991	11.0	9.0	D	0.528
01-Sep-92	245	2159	994	11.0	10.0	D	0.548
02-Sep-92	246	2201	996	11.0	10.0	A	0.823
03-Sep-92	247	2215	999	11.0	10.0	C	0.702
04-Sep-92	248	2245	991	11.0	12.0	D	0.890
08-Sep-92	252	2255	994	11.0	10.0	A	0.902
09-Sep-92	253	2281	996	11.0	10.0	C	1.116
10-Sep-92	254	2307	990	11.0	10.0	A	0.912
14-Sep-92	258	2344	991	11.0	10.0	A	0.944
15-Sep-92	259	2359	997	11.0	10.0	C	0.457
16-Sep-92	260	2370	999	11.0	10.0	A	1.383
17-Sep-92	261	2406	995	16.0	14.0	A	0.500
17-Sep-92	261	2410	148	16.0	14.0	A	0.500
18-Sep-92	262	2420	996	11.0	10.0	A	1.220
21-Sep-92	265	2433	991	11.0	10.0	A	0.823
22-Sep-92	266	2457	998	16.0	14.0	A	0.993

TABLE C-6. SUMMARY OF THE 1992 NMOC DATA FOR SALT LAKE CITY, UTAH (S2UT)

Sample Period: 6:00 a.m. to 9:00 a.m.

Date Sampled	Julian Date Sampled	Sample ID Number	Sample Canister Number	Sample Pressure (psig)	Analysis Pressure (psig)	Radian Channel	Mean NMOC ppmC
22-Sep-92	266	2458	993	16.0	13.0	A	0.992
23-Sep-92	267	2487	995	16.0	16.0	C	1.111
24-Sep-92	268	2505	800	16.0	12.0	A	0.436
25-Sep-92	269	2525	991	16.5	13.0	D	0.501
25-Sep-92	269	2525	991	16.5	13.0	D	0.433
25-Sep-92	269	2526	994	16.5	12.0	C	0.561
29-Sep-92	273	2573	999	15.0	14.0	A	1.129
30-Sep-92	274	2589	36	12.5	12.0	A	1.648

Salt Lake City, UT (S3UT)

1992 NMOC Program (AIRS # 49-011-0001)

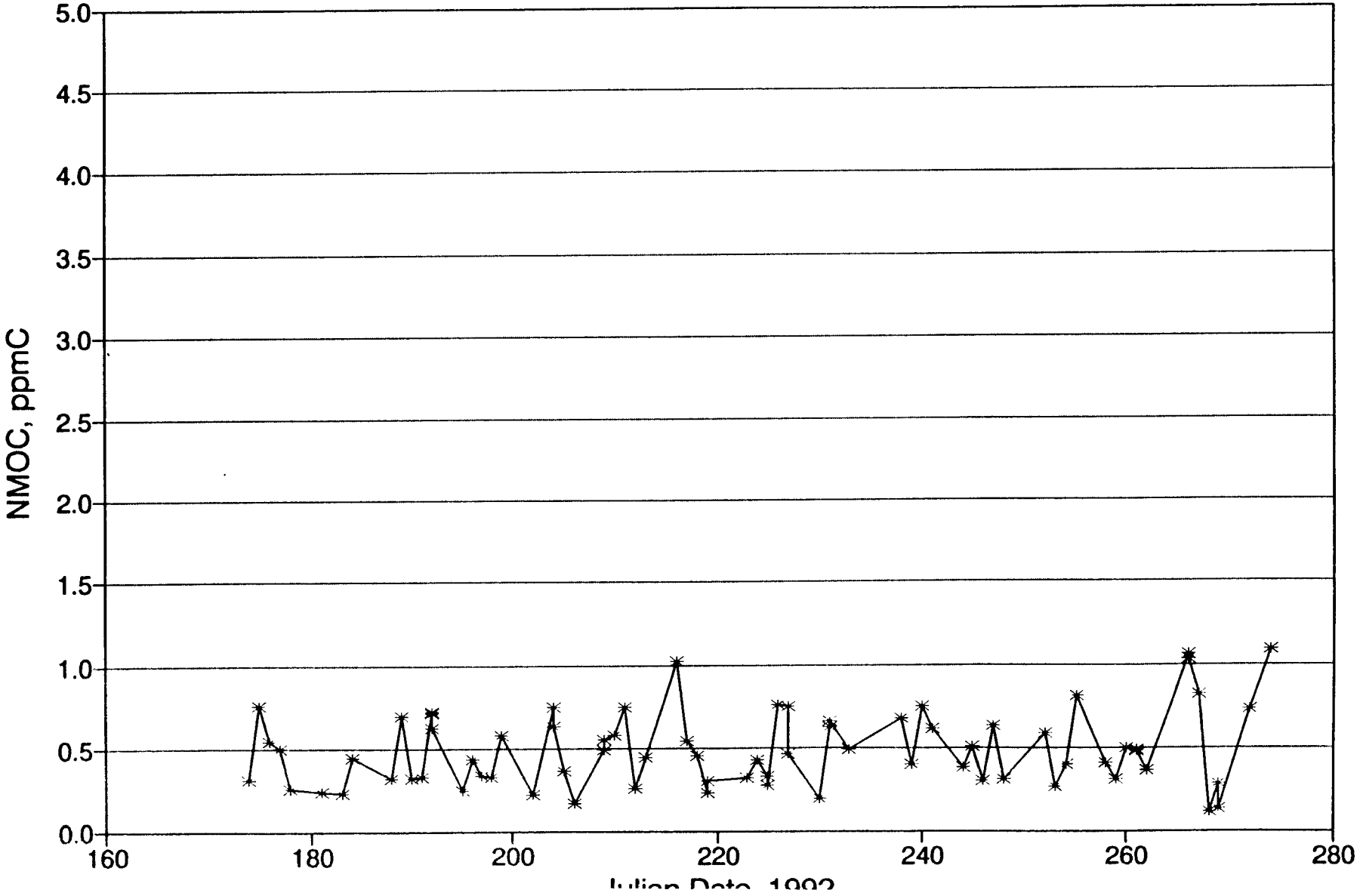


TABLE C-7. SUMMARY OF THE 1992 NMOC DATA FOR SALT LAKE CITY, UTAH (S3UT)

Sample Period: 6:00 a.m. to 9:00 a.m.

Date Sampled	Julian Date Sampled	Sample ID Number	Sample Canister Number	Sample Pressure (psig)	Analysis Pressure (psig)	Radian Channel	Mean NMOC ppmC
22-Jun-92	174	1005	874	12.0	13.0	B	0.311
23-Jun-92	175	1007	111	12.0	14.0	A	0.763
24-Jun-92	176	1015	623	11.0	12.0	A	0.542
25-Jun-92	177	1026	635	8.0	10.0	C	0.497
26-Jun-92	178	1059	783	9.0	8.0	D	0.257
29-Jun-92	181	1062	86	9.0	8.0	C	0.240
01-Jul-92	183	1079	990	8.0	8.0	A	0.229
02-Jul-92	184	1105	996	7.0	9.0	C	0.445
06-Jul-92	188	1129	150	7.0	9.0	A	0.318
07-Jul-92	189	1143	162	8.0	8.0	A	0.698
08-Jul-92	190	1152	993	8.0	9.0	D	0.316
09-Jul-92	191	1176	91	8.0	8.0	B	0.333
10-Jul-92	192	1191	137	12.0	13.0	A	0.725
10-Jul-92	192	1201	775	12.0	13.0	C	0.720
10-Jul-92	192	1201	775	12.0	13.0	C	0.630
13-Jul-92	195	1210	998	8.0	8.0	D	0.245
14-Jul-92	196	1231	994	8.0	8.0	A	0.437
15-Jul-92	197	1249	999	8.0	8.0	D	0.334
16-Jul-92	198	1290	995	10.0	8.0	A	0.332
17-Jul-92	199	1298	991	9.0	8.0	D	0.584
20-Jul-92	202	1325	778	10.0	9.0	D	0.219
22-Jul-92	204	1368	844	14.0	13.0	C	0.756
22-Jul-92	204	1369	882	14.0	12.0	C	0.634
23-Jul-92	205	1399	921	10.0	8.0	D	0.362
24-Jul-92	206	1457	995	10.0	8.0	D	0.165
27-Jul-92	209	1451	911	14.0	12.0	C	0.495
27-Jul-92	209	1452	867	14.0	13.0	A	0.552
28-Jul-92	210	1484	998	10.0	8.0	C	0.580
29-Jul-92	211	1492	927	12.0	10.0	A	0.755
30-Jul-92	212	1507	153	11.0	9.0	C	0.255
31-Jul-92	213	1570	994	10.0	8.0	A	0.449

TABLE C-7. SUMMARY OF THE 1992 NMOC DATA FOR SALT LAKE CITY, UTAH (S3UT)

Sample Period: 6:00 a.m. to 9:00 a.m.

Date Sampled	Julian Date Sampled	Sample ID Number	Sample Canister Number	Sample Pressure (psig)	Analysis Pressure (psig)	Radian Channel	Mean NMOC ppmC
03-Aug-92	216	1624	992	10.0	8.0	D	1.020
04-Aug-92	217	1627	995	10.0	8.0	B	0.548
05-Aug-92	218	1651	998	10.0	10.0	A	0.457
06-Aug-92	219	1715	60	14.0	15.0	C	0.234
06-Aug-92	219	1716	788	14.0	15.0	B	0.298
10-Aug-92	223	1740	994	10.0	10.0	D	0.323
11-Aug-92	224	1751	303	11.0	10.0	D	0.427
12-Aug-92	225	1780	996	14.0	14.0	C	0.326
12-Aug-92	225	1781	35	14.0	13.0	D	0.271
12-Aug-92	225	1781	35	14.0	13.0	D	0.274
13-Aug-92	226	1817	730	10.0	10.0	D	0.761
14-Aug-92	227	1842	993	11.0	9.0	D	0.758
14-Aug-92	227	1843	74	10.0	8.0	C	0.464
17-Aug-92	230	1859	997	10.0	8.0	D	0.195
18-Aug-92	231	1886	995	15.0	14.0	B	0.625
18-Aug-92	231	1886	995	15.0	15.0	B	0.624
18-Aug-92	231	1887	872	15.0	14.0	A	0.664
20-Aug-92	233	1945	690	11.0	10.0	D	0.492
25-Aug-92	238	2047	997	10.0	10.0	B	0.682
26-Aug-92	239	2067	996	9.0	5.0	B	0.404
27-Aug-92	240	2093	995	10.0	9.0	C	0.758
28-Aug-92	241	2103	51	10.0	8.0	A	0.614
31-Aug-92	244	2144	993	8.0	8.0	C	0.388
01-Sep-92	245	2158	997	10.0	10.0	B	0.511
02-Sep-92	246	2210	990	10.0	10.0	A	0.305
03-Sep-92	247	2216	995	10.0	10.0	D	0.639
04-Sep-92	248	2244	98	10.0	10.0	A	0.315
08-Sep-92	252	2256	993	10.0	12.0	C	0.589
09-Sep-92	253	2287	997	10.0	10.0	A	0.265
10-Sep-92	254	2305	999	10.0	10.0	B	0.403
11-Sep-92	255	2319	992	10.0	9.5	C	0.814

TABLE C-7. SUMMARY OF THE 1992 NMOC DATA FOR SALT LAKE CITY, UTAH (S3UT)

Sample Period: 6:00 a.m. to 9:00 a.m.

Date Sampled	Julian Date Sampled	Sample ID Number	Sample Canister Number	Sample Pressure (psig)	Analysis Pressure (psig)	Radian Channel	Mean NMOC ppmC
14-Sep-92	258	2343	994	10.0	9.0	C	0.413
15-Sep-92	259	2362	883	10.0	9.5	C	0.314
16-Sep-92	260	2371	990	10.0	12.0	A	0.499
17-Sep-92	261	2407	716	15.0	14.0	D	0.494
17-Sep-92	261	2409	189	15.0	14.0	D	0.480
18-Sep-92	262	2418	8	10.0	9.0	C	0.362
22-Sep-92	266	2463	990	14.0	12.0	C	1.060
22-Sep-92	266	2464	992	14.0	12.0	A	1.030
23-Sep-92	267	2483	997	10.0	10.0	D	0.822
24-Sep-92	268	2512	906	10.0	6.0	D	0.114
25-Sep-92	269	2527	685	16.5	12.0	A	0.283
25-Sep-92	269	2528	627	16.5	12.0	B	0.130
28-Sep-92	272	2568	660	11.0	11.0	B	0.736
30-Sep-92	274	2591	904	10.0	10.0	C	1.090

Winston Salem, NC (WSNC)

1992 NMOC Program (AIRS # 37-067-0022)

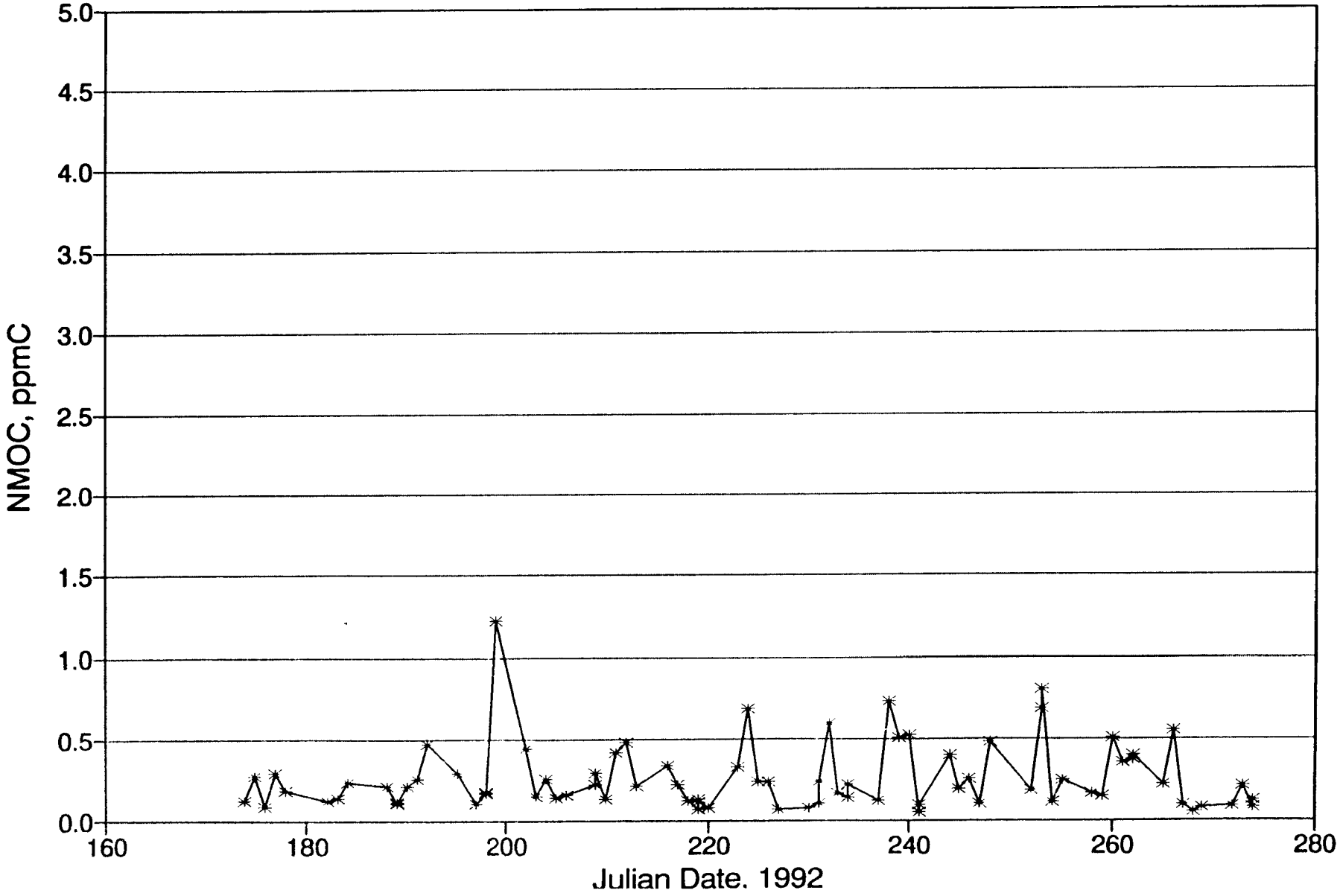


TABLE C-8. SUMMARY OF THE 1992 NMOC DATA FOR WINSTON SALEM, NC (WSNC)

Sample Period: 6:00 a.m. to 9:00 a.m.

Date Sampled	Julian Date Sampled	Sample ID Number	Sample Canister Number	Sample Pressure (psig)	Analysis Pressure (psig)	Radian Channel	Mean NMOC ppmC
22-Jun-92	174	1004	632	11.5	12.0	A	0.121
23-Jun-92	175	1011	674	11.5	10.0	C	0.277
24-Jun-92	176	1022	673	11.0	10.0	C	0.089
25-Jun-92	177	1034	788	14.0	14.0	D	0.289
26-Jun-92	178	1036	794	13.0	12.0	D	0.184
30-Jun-92	182	1075	135	11.0	9.0	C	0.125
01-Jul-92	183	1073	115	13.0	11.0	D	0.142
02-Jul-92	184	1112	49	13.0	12.0	D	0.237
06-Jul-92	188	1124	41	14.0	12.0	C	0.208
07-Jul-92	189	1132	833	24.0	22.0	B	0.106
07-Jul-92	189	1133	726	24.0	22.0	C	0.115
07-Jul-92	189	1133	726	24.0	22.0	C	0.115
08-Jul-92	190	1145	146	12.0	11.0	A	0.216
09-Jul-92	191	1185	191	12.0	10.5	B	0.260
10-Jul-92	192	1197	651	13.0	12.0	C	0.474
13-Jul-92	195	1209	626	13.0	11.0	A	0.292
15-Jul-92	197	1263	828	12.0	10.0	D	0.106
16-Jul-92	198	1287	131	13.0	12.0	D	0.165
16-Jul-92	198	1291	193	13.0	12.0	A	0.179
17-Jul-92	199	1295	901	13.0	11.5	C	1.220
20-Jul-92	202	1316	409	13.0	12.0	C	0.444
21-Jul-92	203	1349	692	13.0	11.0	D	0.146
22-Jul-92	204	1374	914	13.0	12.0	D	0.260
23-Jul-92	205	1407	870	13.0	12.0	D	0.143
24-Jul-92	206	1425	878	13.0	12.0	B	0.156
27-Jul-92	209	1447	708	13.0	12.0	C	0.219
27-Jul-92	209	1448	730	13.0	12.0	C	0.297
28-Jul-92	210	1480	901	12.0	10.0	D	0.134
29-Jul-92	211	1491	859	12.0	10.0	C	0.421
30-Jul-92	212	1516	821	13.0	10.0	B	0.483
31-Jul-92	213	1565	894	12.0	10.0	C	0.208
03-Aug-92	216	1587	767	11.0	10.0	C	0.339

TABLE C-8. SUMMARY OF THE 1992 NMOC DATA FOR WINSTON SALEM, NC (WSNC)

Sample Period: 6:00 a.m. to 9:00 a.m.

Date Sampled	Julian Date Sampled	Sample ID Number	Sample Canister Number	Sample Pressure (psig)	Analysis Pressure (psig)	Radian Channel	Mean NMOC ppmC
04-Aug-92	217	1616	35	12.0	10.0	C	0.224
05-Aug-92	218	1643	77	12.0	12.0	C	0.118
06-Aug-92	219	1670	112	13.0	13.0	D	0.064
06-Aug-92	219	1670	112	13.0	13.0	D	0.109
06-Aug-92	219	1676	828	13.0	12.0	A	0.128
07-Aug-92	220	1705	662	13.0	13.0	D	0.076
10-Aug-92	223	1739	166	13.0	13.0	C	0.325
11-Aug-92	224	1757	633	18.0	12.0	A	0.687
12-Aug-92	225	1790	642	13.0	12.0	A	0.243
13-Aug-92	226	1824	150	12.0	10.0	A	0.238
14-Aug-92	227	1827	638	13.0	11.0	C	0.072
17-Aug-92	230	1867	112	13.0	12.0	C	0.081
18-Aug-92	231	1881	707	20.0	20.0	D	0.106
18-Aug-92	231	1882	189	20.0	20.0	A	0.240
19-Aug-92	232	1921	97	8.0	6.0	C	0.596
20-Aug-92	233	1949	80	8.0	7.0	D	0.168
21-Aug-92	234	1974	114	12.0	11.0	D	0.137
21-Aug-92	234	1974	114	12.0	11.0	D	0.222
24-Aug-92	237	1999	640	12.0	10.0	D	0.118
25-Aug-92	238	2038	783	12.0	12.0	A	0.737
26-Aug-92	239	2066	781	12.0	10.0	D	0.511
27-Aug-92	240	2098	97	11.0	9.0	D	0.532
28-Aug-92	241	2109	716	14.0	12.0	C	0.047
28-Aug-92	241	2110	823	14.0	12.0	D	0.095
31-Aug-92	244	2130	148	11.0	8.0	D	0.405
01-Sep-92	245	2165	762	8.0	8.0	C	0.192
02-Sep-92	246	2188	667	12.0	12.0	C	0.253
03-Sep-92	247	2221	723	13.0	12.0	C	0.102
04-Sep-92	248	2231	992	11.0	10.0	C	0.480
08-Sep-92	252	2260	908	14.0	14.0	D	0.181
09-Sep-92	253	2268	154	17.0	19.0	D	0.687
09-Sep-92	253	2276	837	17.0	16.0	B	0.811

TABLE C-8. SUMMARY OF THE 1992 NMOC DATA FOR WINSTON SALEM, NC (WSNC)

Sample Period: 6:00 a.m. to 9:00 a.m.

Date Sampled	Julian Date Sampled	Sample ID Number	Sample Canister Number	Sample Pressure (psig)	Analysis Pressure (psig)	Radian Channel	Mean NMOC ppmC
10-Sep-92	254	2308	674	11.0	11.0	C	0.116
11-Sep-92	255	2329	915	8.0	8.0	A	0.251
14-Sep-92	258	2345	723	11.0	10.0	A	0.171
15-Sep-92	259	2352	583	13.0	12.0	A	0.152
16-Sep-92	260	2394	993	11.0	10.0	D	0.514
17-Sep-92	261	2413	605	11.0	10.0	B	0.361
18-Sep-92	262	2427	657	18.0	17.0	C	0.377
18-Sep-92	262	2430	651	18.0	17.0	A	0.406
21-Sep-92	265	2442	627	10.0	10.0	B	0.218
22-Sep-92	266	2468	806	10.0	7.0	C	0.559
23-Sep-92	267	2482	821	11.0	10.0	A	0.094
24-Sep-92	268	2520	183	10.0	8.0	C	0.048
25-Sep-92	269	2523	587	11.0	7.0	A	0.079
28-Sep-92	272	2558	911	10.0	10.0	D	0.083
29-Sep-92	273	2572	798	10.0	10.0	D	0.214
30-Sep-92	274	2604	995	10.0	10.0	B	0.077
30-Sep-92	274	2605	829	10.0	10.0	A	0.126

APPENDIX D

1992 NMOC MONITORING PROGRAM INVALIDATED AND MISSING SAMPLES

APPENDIX D

TABLE 1

1992 NMOC PROGRAM

VOID OR INVALIDATED SAMPLES BY DATE

#	Site	Date	Description	Assigned
1	S2UT	06/22/92	NO PRESSURE	EQUIPMENT
2	S2UT	06/23/92	LOW ORIFICE FLOW	EQUIPMENT
3	NWNJ	06/23/92	LOW CANISTER PRESSURE	EQUIPMENT
4	S2UT	06/29/92	LOW CANISTER PRESSURE	EQUIPMENT
5	NWNJ	06/29/92	LOW CANISTER PRESSURE	EQUIPMENT
6	WSNC	06/29/92	POWER FAILURE	EQUIPMENT
7	S3UT	06/30/92	POWER FAILURE	EQUIPMENT
8	S2UT	06/30/92	LOW CANISTER PRESSURE	EQUIPMENT
9	PLNJ	06/30/92	NO PRESSURE	EQUIPMENT
10	S2UT	07/06/92	POWER FAILURE	EQUIPMENT
11	MNY	07/06/92	NO PRESSURE	EQUIPMENT
12	MNY	07/07/92	UNKNOWN	UNKNOWN
13	S2UT	07/09/92	TIMER MALFUNCTION	EQUIPMENT
14	S2UT	07/10/92	TIMER MALFUNCTION (DUPLICATE)	EQUIPMENT
15	MNY	07/10/92	NO PRESSURE	EQUIPMENT
16	NWNJ	07/10/92	NO PRESSURE	EQUIPMENT
17	NWNJ	07/13/92	SYSTEM LEAK	EQUIPMENT
18	WSNC	07/14/92	LOW CANISTER PRESSURE	EQUIPMENT
19	NWNJ	07/15/92	LOW CANISTER PRESSURE	EQUIPMENT
20	NWNJ	07/16/92	UNKNOWN	UNKNOWN
21	MNY	07/16/92	UNKNOWN	UNKNOWN
22	NWNJ	07/17/92	UNKNOWN	UNKNOWN
23	NWNJ	07/20/92	UNKNOWN	UNKNOWN
24	S2UT	07/21/92	SAMPLER SET ON MANUAL	OPERATOR
25	S3UT	07/21/92	SAMPLER SET ON MANUAL	OPERATOR
26	MNY	07/20/92	SAMPLER SET ON MANUAL	OPERATOR
27	S2UT	07/23/92	SYSTEM LEAK	EQUIPMENT
28	MNY	07/23/92	NO PRESSURE (DUPLICATE)	EQUIPMENT
29	S2UT	08/05/92	SYSTEM LEAK	EQUIPMENT
30	S2UT	07/28/92	TIMER MALFUNCTION	EQUIPMENT
31	R1NC	07/23/92	POWER FAILURE	EQUIPMENT
32	S2UT	07/30/92	SAMPLER SET ON MANUAL	OPERATOR
33	S3UT	08/07/92	INLET NOT ATTACHED	OPERATOR
34	PLNJ	08/12/92	TIMER MALFUNCTION	EQUIPMENT

APPENDIX D

TABLE 1

1992 NMOC PROGRAM

VOID OR INVALIDATED SAMPLES BY DATE

#	Site	Date	Description	Assigned
35	MNY	08/13/92	UNKNOWN	UNKNOWN
36	MNY	08/19/92	SAMPLER SET ON MANUAL	OPERATOR
37	NWNJ	08/18/92	CAN RECEIVED UNDER VACUUM	UNKNOWN
38	S3UT	08/19/92	POWER FAILURE	EQUIPMENT
39	S3UT	08/21/92	NO PRESSURE	EQUIPMENT
40	S3UT	08/24/92	POWER FAILURE	EQUIPMENT
41	MNY	08/25/92	SAMPLER SET ON MANUAL (DUPLICATE)	OPERATOR
42	R1NC	08/28/92	SAMPLER RAN 9 HOURS	OPERATOR
43	R1NC	08/31/92	SAMPLER RAN 9 HOURS	OPERATOR
44	R1NC	09/01/92	SAMPLER RAN 9 HOURS	OPERATOR
45	MNY	09/04/92	UNKNOWN	UNKNOWN
46	MNY	09/08/92	UNKNOWN	UNKNOWN
47	R1NC	09/08/92	TIMER MALFUNCTION (DUPLICATE)	EQUIPMENT
48	MNY	09/10/92	NO PRESSURE	EQUIPMENT
49	S2UT	09/11/92	VALVE LEFT CLOSED	OPERATOR
50	NWNJ	09/18/92	NEW SAMPLER PROBLEMS	EQUIPMENT
51	NWNJ	09/17/92	NO PRESSURE	EQUIPMENT
52	NWNJ	09/21/92	UNKNOWN	UNKNOWN
53	S3UT	09/21/92	VALVE LEFT CLOSED	OPERATOR
54	NWNJ	09/25/92	UNKNOWN	UNKNOWN
55	NWNJ	09/28/92	NO PRESSURE	EQUIPMENT
56	NWNJ	09/24/92	MOTOR FAILED	EQUIPMENT
57	S2UT	09/28/92	UNKNOWN	UNKNOWN
58	S3UT	09/29/92	UNKNOWN	UNKNOWN
59	MNY	09/29/92	UNKNOWN	UNKNOWN
60	MNY	09/30/92	UNKNOWN	UNKNOWN
61	NWNJ	09/30/92	NO PRESSURE	EQUIPMENT
62	LINY	09/14/92	NO PRESSURE	EQUIPMENT

APPENDIX D

TABLE 2

1992 SPECIATED NMOC PROGRAM

VOID OR INVALIDATED SAMPLES BY DATE

#	Site	Date	Description	Assigned
1	CHNC	06/23/92	NO PRESSURE	EQUIPMENT
2	BRLA	06/22/92	SAMPLER RAN 31 HOURS	EQUIPMENT
3	BRLA	06/23/92	NO PRESSURE	EQUIPMENT
4	CHNC	06/24/92	NO PRESSURE	EQUIPMENT
5	BRLA	06/24/92	FINAL PRESSURE 28	EQUIPMENT
6	EPTX	06/25/92	TIMER MALFUNCTION	EQUIPMENT
7	FWTX	06/29/92	POWER FAILURE	EQUIPMENT
8	FWTX	07/01/92	TIMER MALFUNCTION	EQUIPMENT
9	BRLA	07/06/92	PUMP PROBLEMS	EQUIPMENT
10	B3AL	07/06/92	LOW CANISTER PRESSURE	EQUIPMENT
11	MIFL	07/02/92	SAMPLER RAN 7.5 HOURS	EQUIPMENT
12	JUMX	07/08/92	SAMPLER DID NOT RUN (DUPLICATE)	EQUIPMENT
13	DLTX	07/09/92	USED WRONG ORIFICE (DUPLICATE)	OPERATOR
14	BRLA	07/09/92	SAMPLER PROBLEMS	EQUIPMENT
15	BRLA	07/17/92	TEST CANISTER FOR NEW SAMPLER	EQUIPMENT
16	B2AL	07/17/92	NO PRESSURE	EQUIPMENT
17	B3AL	07/17/92	TIMER MALFUNCTION	EQUIPMENT
18	BRLA	07/18/92	SAMPLE LINE BLOCKED	EQUIPMENT
19	JUMX	07/27/92	CAN RECEIVED UNDER VACUUM	EQUIPMENT
20	B1AL	07/24/92	SAMPLER RAN 55 HOURS	EQUIPMENT
21	CHNC	07/29/92	FINAL PRESSURE 34.5 (DUPLICATE)	EQUIPMENT
22	CHNC	07/31/92	CANISTER VALVE LEFT CLOSED	OPERATOR
23	JUMX	07/31/92	NO PRESSURE	EQUIPMENT
24	JUMX	08/03/92	CAN RECV'D UNDER VACUUM (DUPLICATE)	EQUIPMENT
25	B3AL	08/03/92	LOW CANISTER PRESSURE	EQUIPMENT
26	CHNC	08/04/92	FINAL PRESSURE 38	EQUIPMENT
27	CHNC	08/06/92	FINAL PRESSURE 40	EQUIPMENT
28	CHNC	07/23/92	FINAL PRESSURE 30.5 ORIFICE LEAK	EQUIPMENT
29	CHNC	07/24/92	FINAL PRESSURE 37 SAMPLE LINE BROKE	EQUIPMENT
30	CHNC	07/27/92	NO PRESSURE	EQUIPMENT
31	CHNC	07/28/92	NO PRESSURE ORIFICE BLOCKED	EQUIPMENT
32	B3AL	08/04/92	SAMPLER RAN 7.2 HOURS	EQUIPMENT
33	B1AL	08/07/92	CANISTERS LEFT CLOSED (DUPLICATE)	OPERATOR
34	CHNC	08/10/92	FINAL PRESSURE 32	EQUIPMENT
35	CHNC	08/12/92	FINAL PRESSURE 32	EQUIPMENT

APPENDIX D

TABLE 2

1992 SPECIATED NMOC PROGRAM

VOID OR INVALIDATED SAMPLES BY DATE

#	Site	Date	Description	Assigned
36	JUMX	08/12/92	NO PRESSURE	EQUIPMENT
37	CHNC	08/13/92	FINAL PRESSURE 32	EQUIPMENT
38	CHNC	08/18/92	CANISTER VALVE WOULDN'T OPEN	EQUIPMENT
39	BMTX	08/24/92	LEAK IN SWAGELOK (DUPLICATE)	EQUIPMENT
40	FWTX	08/27/92	STATE HOLIDAY	HOLIDAY
41	CHNC	08/26/92	NO PRESSURE	EQUIPMENT
42	BRLA	08/26/92	SAMPLER RAN 8.3 HOURS	EQUIPMENT
43	BMTX	08/28/92	TIMER MALFUNCTION	EQUIPMENT
44	CHNC	08/31/92	NO PRESSURE	EQUIPMENT
45	MIFL		POWER SHUT OFF-HURRICANE	EQUIPMENT
46	B1AL	09/02/92	NO PRESSURE	EQUIPMENT
47	B3AL	09/04/92	POWER FAILURE	EQUIPMENT
48	JUMX	09/09/92	NO PRESSURE	EQUIPMENT
49	B3AL	09/18/92	SAMPLER RAN 6 HOURS	EQUIPMENT
50	JUMX	09/21/92	NO PRESSURE	EQUIPMENT
51	CHNC	09/18/92	FINAL PRESSURE 34.5 (DUPLICATE)	EQUIPMENT
52	BRLA	09/14/92	NO PRESSURE	EQUIPMENT

APPENDIX E

PDFID INTEGRATOR PROGRAMMING INSTRUCTIONS

INTEGRATOR PROGRAMMING INSTRUCTIONS

Instructions for programming the integrators are as follows. Be sure to press **ENTER** after each key sequence.

Control Integrator

Oven Temp 90
Oven Temp Limit 405
Oven Temp ON
Oven Temp OFF
List Oven Temp
(A listing should say OvenTemp X°C Setpt 90°C Limit 405°C)
Oven Temp Initial Time 0.20
Oven Temp Initial Value 90
Oven Temp Pgrm Rate 30.00
Oven Temp Final Value 90.00
Oven Temp Final Time 4.00
Oven Temp Equil Time 1.00

Detector A ON
Signal A
Chart speed 4.00
%Offset 10
Zero
Attn 2^ 4

Run Time Annotation ON
Run Table Annotation ON
Clock Table Annotation OFF
Program Annotation OFF
Oven Temp Annotation OFF
Report Annotation OFF

Slave Integrator

Detector B ON
Signal B
Chart speed 4.00
%Offset 10
Zero
Attn 2^ 4

Run Time Annotation ON
Run Table Annotation ON
Clock Table Annotation OFF
Program Annotation OFF
Oven Temp Annotation OFF
(should say ***Warning***Oven Temp now owned by Chnl 2)
Report Annotation OFF

Control Integrator

Oven Temp Annotation OFF
(should say ***Warning***Oven Temp now owned by Chnl 1)
Run Time 0.01 Intg OFF
Run Time 0.01 Valve 5 ON
Run Time 0.01 Page
Run Time 0.02 List Attn2^
Run Time 0.04 Oven Temp ON
Run Time 0.20 Valve 2 ON
Run Time 0.21 Valve 2 OFF
Run Time 0.22 Intg ON
Run Time 0.23 Set BL
Run Time 0.23 List Intg
Rum Time 1.87 Set BL
Run Time 1.88 Intg OFF
Run Time 1.89 List Intg
Run Time 1.90 Chart Spped 1.5
Run Time 3.44 Valve 2 ON
Run Time 3.45 Valve 2 OFF
Run Time 3.46 Valve 2 ON
Run Time 3.47 Valve 2 OFF
Run Time 3.48 Valve 2 ON
Run Time 3.49 Valve 2 OFF
Run Time 3.50 STOP

Slave Integrator

Run Time 0.01 Intg OFF
Run Time 0.01 Page
Run Time 0.02 List Attn2^
Run Time 0.22 Intg ON
Run Time 0.23 Set BL
Run Time 0.23 List Intg
Rum Time 1.87 Set BL
Run Time 1.88 Intg OFF
Run Time 1.89 List Intg
Run Time 1.90 Chart Spped 1.5
Run Time 3.50 STOP

Control Integrator

Det 1 Temp 250
Det 1 Temp Limit 405
Inj 1 Temp 31
Inj 1 Temp Limit 405
Aux 1 Temp 90
Aux 1 Temp Limit 405
Flow A 30
Flow A Limit 500

INTEGRATOR PROGRAMMING INSTRUCTIONS (Continued)

Slave Integrator

Flow B 30
Flow B Limit 500

Control Integrator

Valve 1 OFF
Valve 2 OFF
Valve 3 OFF
Valve 4 OFF
Valve 5 ON
Valve 6 OFF
Valve 7 OFF
Valve 8 OFF
Valve 9 OFF
Valve 10 OFF
Valve 11 OFF
Valve 12 OFF

Thresnold 1
Peak Width 0.04

Slave Integrator

Threshold 1
Peak Width 0.04

Control Integrator

20 Valve 5 OFF
25 List Valve 5
30 Oven Temp Initial Value 30
35 Oven Temp OFF
40 Wait 2
60 Start
70 Oven Temp 90
80 Vale 5 ON

Sync ON

APPENDIX F

1992 NMOC DAILY CALIBRATION DATA

Table F-1. Daily Calibration Data Summary (Channel A)

Cal Date	Julian Cal Date	Initial Zero A.C.	Final Zero A.C.	Initial Zero ppmC	Final Zero ppmC	Initial Cal Factor	Final Cal Factor	Cal Factor Drift	Cal Factor % Drift
02/92	154	1.01	1.01	0.000281	0.000281	0.000279	0.000279	0.000000	0.000000
03/92	155	1.38	1.38	0.000386	0.000386	0.000281	0.000281	0.000000	0.000000
04/92	156	0.95	0.95	0.000266	0.000266	0.000280	0.000280	0.000000	0.000000
05/92	157	1.25	1.25	0.000347	0.000347	0.000277	0.000277	0.000000	0.000000
08/92	160	2.09	2.09	0.000586	0.000586	0.000281	0.000281	0.000000	0.000000
09/92	161	1.04	1.04	0.000288	0.000288	0.000277	0.000277	0.000000	0.000000
10/92	162	2.70	2.70	0.000736	0.000736	0.000273	0.000273	0.000000	0.000000
11/92	163	1.86	1.86	0.000517	0.000517	0.000278	0.000278	0.000000	0.000000
12/92	164	0.20	0.20	0.000055	0.000055	0.000277	0.000277	0.000000	0.000000
15/92	167	0.61	0.61	0.000170	0.000170	0.000279	0.000279	0.000000	0.000000
16/92	168	0.63	0.63	0.000177	0.000177	0.000284	0.000284	0.000000	0.000000
17/92	169	0.12	0.12	0.000034	0.000034	0.000287	0.000287	0.000000	0.000000
18/92	170	1.10	1.10	0.000307	0.000307	0.000281	0.000281	0.000000	0.000000
19/92	171	0.51	0.51	0.000145	0.000145	0.000283	0.000283	0.000000	0.000000
22/92	174	0.13	0.13	0.000037	0.000037	0.000281	0.000281	0.000000	0.000000
23/92	175	0.29	0.29	0.000080	0.000080	0.000279	0.000279	0.000000	0.000000
24/92	176	0.72	0.72	0.000199	0.000199	0.000276	0.000276	0.000000	0.000000
25/92	177	1.08	1.08	0.000298	0.000298	0.000277	0.000277	0.000000	0.000000
26/92	178	1.93	1.93	0.000532	0.000532	0.000275	0.000275	0.000000	0.000000
29/92	181	4.75	4.75	0.001317	0.001317	0.000277	0.000277	0.000000	0.000000
30/92	182	4.53	4.53	0.001231	0.001231	0.000272	0.000272	0.000000	0.000000
01/92	183	0.33	0.33	0.000089	0.000089	0.000274	0.000274	0.000000	0.000000
02/92	184	2.96	2.96	0.000799	0.000799	0.000270	0.000270	0.000000	0.000000
06/92	188	0.38	0.38	0.000101	0.000101	0.000266	0.000266	0.000000	0.000000
07/92	189	3.32	3.32	0.000897	0.000897	0.000271	0.000271	0.000000	0.000000
08/92	190	1.60	1.60	0.000429	0.000429	0.000269	0.000269	0.000000	0.000000
09/92	191	6.24	6.24	0.001694	0.001694	0.000272	0.000272	0.000000	0.000000
10/92	192	0.55	0.55	0.000147	0.000147	0.000267	0.000267	0.000000	0.000000
13/92	195	1.71	1.71	0.000461	0.000461	0.000269	0.000269	0.000000	0.000000

Table F-1. Daily Calibration Data Summary (Channel A)

Cal Date	Julian Cal Date	Initial Zero A.C.	Final Zero A.C.	Initial Zero ppmC	Final Zero ppmC	Initial Cal Factor	Final Cal Factor	Cal Factor Drift	F %
07/14/92	196	3.57	3.57	0.000957	0.000957	0.000268	0.000268	0.000000	0
07/15/92	197	7.93	7.93	0.002138	0.002138	0.000270	0.000270	0.000000	0
07/16/92	198	5.01	5.01	0.001336	0.001339	0.000267	0.000267	-0.000000	-0
07/17/92	199	4.32	4.24	0.001166	0.001156	0.000270	0.000273	-0.000002	-0
07/20/92	202	4.25	6.66	0.001173	0.001798	0.000276	0.000270	0.000006	2
07/21/92	203	4.94	4.94	0.001337	0.001337	0.000271	0.000271	0.000000	0
07/22/92	204	5.77	8.86	0.001568	0.002412	0.000272	0.000272	-0.000001	-0
07/27/92	209	9.42	9.42	0.002568	0.002568	0.000273	0.000273	0.000000	0
07/29/92	211	8.19	8.19	0.002210	0.002210	0.000270	0.000270	0.000000	0
07/30/92	212	6.09	6.09	0.001642	0.001642	0.000270	0.000270	0.000000	0
07/31/92	213	3.48	3.48	0.000720	0.000720	0.000207	0.000207	0.000000	0
08/03/92	216	5.39	8.04	0.001129	0.001694	0.000210	0.000211	-0.000001	-0
08/04/92	217	7.42	3.04	0.001535	0.000626	0.000207	0.000206	0.000001	0
08/05/92	218	8.85	8.85	0.001813	0.001813	0.000205	0.000205	0.000000	0
08/06/92	219	4.06	3.40	0.000838	0.000712	0.000207	0.000209	-0.000003	-1
08/07/92	220	5.89	2.96	0.001222	0.000617	0.000207	0.000209	-0.000001	-0
08/10/92	223	6.98	6.98	0.001443	0.001443	0.000207	0.000207	0.000000	0
08/11/92	224	4.48	4.80	0.000912	0.001005	0.000203	0.000210	-0.000006	-2
08/12/92	225	5.22	1.83	0.001076	0.000375	0.000206	0.000206	0.000000	0
08/13/92	226	3.41	2.94	0.000703	0.000612	0.000206	0.000208	-0.000002	-0
08/14/92	227	5.50	5.71	0.001123	0.001169	0.000204	0.000205	-0.000000	-0
08/17/92	230	4.69	4.69	0.000964	0.000964	0.000206	0.000206	0.000000	0
08/18/92	231	8.98	8.98	0.001871	0.001871	0.000208	0.000208	0.000000	0
08/19/92	232	10.32	3.93	0.002128	0.000823	0.000206	0.000209	-0.000003	-
08/20/92	233	5.92	10.96	0.001231	0.002266	0.000208	0.000207	0.000001	0
08/21/92	234	5.15	4.71	0.001071	0.000980	0.000208	0.000208	0.000000	0
08/24/92	237	7.58	7.58	0.001580	0.001580	0.000209	0.000209	0.000000	0
08/25/92	238	3.22	3.22	0.000876	0.000876	0.000273	0.000273	0.000000	
08/26/92	239	3.75	6.02	0.001020	0.001649	0.000272	0.000274	-0.000002	-

Table F-1. Daily Calibration Data Summary (Channel A)

Cal Date	Julian Cal Date	Initial Zero A.C.	Final Zero A.C.	Initial Zero ppmC	Final Zero ppmC	Initial Cal Factor	Final Cal Factor	Cal Factor Drift	Cal Factor % Drift
27/92	240	6.61	3.77	0.001797	0.001026	0.000272	0.000272	0.000000	0.020847
28/92	241	2.63	3.25	0.000708	0.000887	0.000270	0.000273	-0.000003	-1.249880
31/92	244	3.79	3.79	0.001036	0.001036	0.000274	0.000274	0.000000	0.000000
01/92	245	6.97	7.26	0.001908	0.001979	0.000274	0.000273	0.000001	0.342782
03/92	247	5.06	5.37	0.001396	0.001465	0.000276	0.000273	0.000003	1.237172
04/92	248	8.83	3.26	0.002429	0.000907	0.000275	0.000279	-0.000003	-1.252184
09/92	253	5.94	7.58	0.001633	0.002096	0.000275	0.000277	-0.000001	-0.514592
10/92	254	3.29	9.21	0.000898	0.002543	0.000273	0.000276	-0.000003	-1.039826
11/92	255	7.10	10.81	0.001948	0.003057	0.000274	0.000283	-0.000009	-3.119459
14/92	258	3.52	10.61	0.000966	0.002926	0.000275	0.000276	-0.000001	-0.301891
15/92	259	4.89	2.35	0.001346	0.000652	0.000275	0.000277	-0.000002	-0.664953
16/92	260	6.04	6.04	0.001670	0.001670	0.000277	0.000277	0.000000	0.000000
17/92	261	7.48	7.48	0.002012	0.002012	0.000269	0.000269	0.000000	0.000000
18/92	262	5.01	5.16	0.001366	0.001418	0.000273	0.000275	-0.000002	-0.665337
21/92	265	3.39	9.02	0.000936	0.002471	0.000276	0.000274	0.000002	0.754868
22/92	266	5.12	5.12	0.001408	0.001408	0.000275	0.000275	0.000000	0.000000
23/92	267	7.30	7.06	0.002020	0.001961	0.000277	0.000278	-0.000001	-0.373181
24/92	268	4.28	8.83	0.001171	0.002460	0.000274	0.000279	-0.000005	-1.800275
25/92	269	5.72	3.48	0.001576	0.000963	0.000276	0.000277	-0.000002	-0.551584
28/92	272	4.13	4.13	0.001153	0.001153	0.000279	0.000279	0.000000	0.000000
29/92	273	35.49	35.49	0.009770	0.009770	0.000275	0.000275	0.000000	0.000000
30/92	274	30.21	30.21	0.008300	0.008300	0.000275	0.000275	0.000000	0.000000
02/92	276	8.16	3.46	0.002228	0.000944	0.000273	0.000273	-0.000000	-0.069122
06/92	280	8.88	2.71	0.002434	0.000745	0.000274	0.000275	-0.000001	-0.493879
07/92	281	6.71	6.71	0.001831	0.001831	0.000273	0.000273	0.000000	0.000000
08/92	282	6.71	6.71	0.001837	0.001837	0.000274	0.000274	0.000000	0.000000
13/92	287	3.17	3.17	0.000863	0.000863	0.000273	0.000273	0.000000	0.000000

Table F-2. Daily Calibration Data Summary (Channel B)

Cal Date	Julian Cal Date	Initial Zero A.C.	Final Zero A.C.	Initial Zero ppmC	Final Zero ppmC	Initial Cal Factor	Final Cal Factor	Cal Factor Drift	C Fa %
06/02/92	154	4.33	4.33	0.001204	0.001204	0.000278	0.000278	0.000000	0.(
06/03/92	155	3.67	3.67	0.001015	0.001015	0.000277	0.000277	0.000000	0.(
06/04/92	156	0.98	0.98	0.000273	0.000273	0.000278	0.000278	0.000000	0.(
06/05/92	157	1.32	1.32	0.000364	0.000364	0.000277	0.000277	0.000000	0.(
06/08/92	160	1.18	1.18	0.000335	0.000335	0.000284	0.000284	0.000000	0.(
06/09/92	161	7.07	7.07	0.001976	0.001976	0.000280	0.000280	0.000000	0.(
06/10/92	162	4.29	4.29	0.001197	0.001197	0.000279	0.000279	0.000000	0.(
06/11/92	163	3.24	3.24	0.000906	0.000906	0.000280	0.000280	0.000000	0.
06/12/92	164	6.73	6.73	0.001852	0.001852	0.000275	0.000275	0.000000	0.
06/15/92	167	4.20	4.20	0.001172	0.001172	0.000279	0.000279	0.000000	0.
06/16/92	168	0.79	0.79	0.000228	0.000228	0.000288	0.000288	0.000000	0.
06/17/92	169	5.66	5.66	0.001590	0.001590	0.000281	0.000281	0.000000	0.
06/18/92	170	4.63	4.63	0.001305	0.001305	0.000282	0.000282	0.000000	0.
06/19/92	171	0.93	0.93	0.000264	0.000264	0.000285	0.000285	0.000000	0.
06/22/92	174	2.08	2.08	0.000584	0.000584	0.000281	0.000281	0.000000	0.
06/23/92	175	3.07	3.07	0.000856	0.000856	0.000279	0.000279	0.000000	0.
06/24/92	176	5.56	5.56	0.001564	0.001564	0.000281	0.000281	0.000000	0
06/25/92	177	0.82	0.82	0.000231	0.000231	0.000282	0.000282	0.000000	0
06/26/92	178	4.84	4.84	0.001348	0.001348	0.000279	0.000279	0.000000	0
06/29/92	181	4.40	4.40	0.001218	0.001218	0.000277	0.000277	0.000000	0
06/30/92	182	6.99	6.99	0.001944	0.001944	0.000278	0.000278	0.000000	0
07/01/92	183	4.60	4.60	0.001260	0.001260	0.000274	0.000274	0.000000	0
07/02/92	184	4.33	4.33	0.001180	0.001180	0.000273	0.000273	0.000000	0
07/06/92	188	4.80	4.80	0.001328	0.001328	0.000277	0.000277	0.000000	0
07/07/92	189	1.72	7.03	0.000471	0.001935	0.000275	0.000275	-0.000000	-0
07/08/92	190	0.97	0.97	0.000266	0.000266	0.000276	0.000276	0.000000	0
07/09/92	191	5.70	9.85	0.001545	0.002737	0.000271	0.000278	-0.000007	-2
07/10/92	192	10.42	10.42	0.002885	0.002885	0.000277	0.000277	0.000000	0
07/13/92	195	4.55	4.55	0.001243	0.001243	0.000274	0.000274	0.000000	0

Table F-2. Daily Calibration Data Summary (Channel B)

Cal Date	Julian Cal Date	Initial Zero A.C.	Final Zero A.C.	Initial Zero ppmC	Final Zero ppmC	Initial Cal Factor	Final Cal Factor	Cal Factor Drift	Cal Factor % Drift
15/92	197	7.29	7.29	0.001990	0.001990	0.000273	0.000273	0.000000	0.000000
16/92	198	9.68	9.68	0.002656	0.002656	0.000274	0.000274	0.000000	0.000000
17/92	199	10.42	10.42	0.002861	0.002861	0.000275	0.000275	0.000000	0.000000
21/92	203	14.78	14.78	0.004028	0.004028	0.000273	0.000273	0.000000	0.000000
27/92	209	15.29	15.29	0.004181	0.004181	0.000274	0.000274	0.000000	0.000000
29/92	211	14.04	14.04	0.003877	0.003877	0.000276	0.000276	0.000000	0.000000
30/92	212	5.81	5.81	0.001602	0.001602	0.000276	0.000276	0.000000	0.000000
31/92	213	7.56	7.56	0.001588	0.001588	0.000210	0.000210	0.000000	0.000000
03/92	216	8.95	0.00	0.001886	0.000000	0.000211	0.000210	0.000001	0.582858
04/92	217	6.47	9.59	0.001352	0.002015	0.000209	0.000210	-0.000001	-0.535905
05/92	218	6.39	6.93	0.001319	0.001449	0.000207	0.000209	-0.000003	-1.215426
06/92	219	3.68	3.68	0.000763	0.000763	0.000207	0.000207	0.000000	0.000000
07/92	220	9.38	5.58	0.001958	0.001158	0.000209	0.000208	0.000001	0.469112
10/92	223	10.45	10.45	0.002200	0.002200	0.000211	0.000211	0.000000	0.000000
12/92	225	5.90	9.33	0.001233	0.001948	0.000209	0.000209	0.000000	0.078676
13/92	226	10.06	10.90	0.002086	0.002282	0.000207	0.000209	-0.000002	-1.013913
14/92	227	7.09	7.09	0.001480	0.001480	0.000209	0.000209	0.000000	0.000000
17/92	230	10.47	10.47	0.002180	0.002180	0.000208	0.000208	0.000000	0.000000
19/92	232	12.00	12.00	0.002551	0.002551	0.000213	0.000213	0.000000	0.000000
20/92	233	5.88	12.05	0.001216	0.002494	0.000207	0.000207	-0.000000	-0.033503
21/92	234	6.46	9.67	0.001361	0.002035	0.000211	0.000211	0.000000	0.117231
24/92	237	7.63	7.63	0.001595	0.001595	0.000209	0.000209	0.000000	0.000000
25/92	238	6.67	6.67	0.001854	0.001854	0.000278	0.000278	0.000000	0.000000
26/92	239	4.16	6.64	0.001146	0.001823	0.000275	0.000275	0.000001	0.219098
27/92	240	9.36	6.45	0.002543	0.001776	0.000272	0.000276	-0.000004	-1.442559
28/92	241	5.40	5.17	0.001472	0.001395	0.000273	0.000270	0.000003	1.133507
31/92	244	11.62	12.87	0.003212	0.003741	0.000277	0.000291	-0.000014	-5.113906
01/92	245	7.09	5.20	0.001943	0.001425	0.000274	0.000274	-0.000000	-0.094796
03/92	247	9.65	6.67	0.002679	0.001834	0.000278	0.000275	0.000002	0.853152

Table F-2. Daily Calibration Data Summary (Channel B)

Cal Date	Julian Cal Date	Initial Zero A.C.	Final Zero A.C.	Initial Zero ppmC	Final Zero ppmC	Initial Cal Factor	Final Cal Factor	Cal Factor Drift	(Fa %
09/04/92	248	4.16	6.72	0.001153	0.001859	0.000278	0.000277	0.000001	0..
09/08/92	252	6.33	11.51	0.001745	0.003169	0.000276	0.000275	0.000000	0.
09/09/92	253	6.02	5.11	0.001660	0.001402	0.000276	0.000274	0.000002	0.
09/10/92	254	4.92	5.97	0.001360	0.001659	0.000276	0.000278	-0.000001	-0.
09/11/92	255	6.65	8.60	0.001840	0.002398	0.000277	0.000279	-0.000002	-0.
09/14/92	258	8.60	5.80	0.002360	0.001604	0.000275	0.000277	-0.000002	-0.
09/15/92	259	5.27	2.02	0.001466	0.000567	0.000278	0.000282	-0.000003	-1.
09/16/92	260	6.90	9.37	0.001908	0.002606	0.000277	0.000278	-0.000002	-0.
09/17/92	261	7.67	7.67	0.002127	0.002127	0.000278	0.000278	0.000000	0.
09/18/92	262	3.60	3.60	0.000995	0.000995	0.000276	0.000276	0.000000	0.
09/21/92	265	9.42	8.07	0.002577	0.002223	0.000274	0.000275	-0.000002	-0
09/22/92	266	5.79	5.79	0.001605	0.001605	0.000277	0.000277	0.000000	0
09/23/92	267	5.30	6.06	0.001465	0.001675	0.000277	0.000277	0.000000	0
09/24/92	268	3.04	9.96	0.000840	0.002777	0.000277	0.000279	-0.000002	-0
09/25/92	269	5.77	12.86	0.001605	0.003547	0.000278	0.000276	0.000002	0
09/28/92	272	6.65	6.65	0.001873	0.001873	0.000282	0.000282	0.000000	0
09/29/92	273	42.18	42.18	0.011795	0.011795	0.000280	0.000280	0.000000	0
09/30/92	274	31.47	31.47	0.008706	0.008706	0.000277	0.000277	0.000000	0
10/02/92	276	4.20	7.10	0.001156	0.001956	0.000275	0.000276	-0.000000	-0
10/06/92	280	6.78	5.43	0.001851	0.001538	0.000273	0.000283	-0.000010	-3
10/07/92	281	6.03	6.03	0.001667	0.001667	0.000276	0.000276	0.000000	0
10/08/92	282	10.44	10.44	0.002889	0.002889	0.000277	0.000277	0.000000	0
10/13/92	287	1.93	1.93	0.000521	0.000521	0.000271	0.000271	0.000000	0

Table F-3. Daily Calibration Data Summary (Channel C)

Cal Date	Julian Cal Date	Initial Zero A.C.	Final Zero A.C.	Initial Zero ppmC	Final Zero ppmC	Initial Cal Factor	Final Cal Factor	Cal Factor Drift	Cal Factor % Drift
'02/92	154	2.08	2.08	0.000568	0.000568	0.000274	0.000274	0.000000	0.000000
'03/92	155	0.00	0.00	0.000000	0.000000	0.000276	0.000276	0.000000	0.000000
'04/92	156	0.00	0.00	0.000000	0.000000	0.000274	0.000274	0.000000	0.000000
'05/92	157	0.00	0.00	0.000000	0.000000	0.000273	0.000273	0.000000	0.000000
'08/92	160	2.37	2.37	0.000653	0.000653	0.000275	0.000275	0.000000	0.000000
'09/92	161	0.52	0.52	0.000141	0.000141	0.000274	0.000274	0.000000	0.000000
'10/92	162	2.74	2.74	0.000746	0.000746	0.000273	0.000273	0.000000	0.000000
'11/92	163	1.29	1.29	0.000352	0.000352	0.000274	0.000274	0.000000	0.000000
'12/92	164	0.30	0.30	0.000081	0.000081	0.000271	0.000271	0.000000	0.000000
'15/92	167	1.50	1.50	0.000408	0.000408	0.000272	0.000272	0.000000	0.000000
'16/92	168	1.99	1.99	0.000554	0.000554	0.000279	0.000279	0.000000	0.000000
'17/92	169	0.82	0.82	0.000225	0.000225	0.000276	0.000276	0.000000	0.000000
'18/92	170	0.00	0.00	0.000000	0.000000	0.000275	0.000275	0.000000	0.000000
'19/92	171	0.29	0.29	0.000078	0.000078	0.000275	0.000275	0.000000	0.000000
'22/92	174	4.17	4.17	0.001165	0.001165	0.000279	0.000279	0.000000	0.000000
'23/92	175	0.40	0.40	0.000110	0.000110	0.000278	0.000278	0.000000	0.000000
'24/92	176	1.21	1.21	0.000339	0.000339	0.000281	0.000281	0.000000	0.000000
'25/92	177	0.00	0.00	0.000000	0.000000	0.000280	0.000280	0.000000	0.000000
'26/92	178	1.78	1.78	0.000492	0.000492	0.000276	0.000276	0.000000	0.000000
'29/92	181	0.91	0.91	0.000252	0.000252	0.000276	0.000276	0.000000	0.000000
'30/92	182	1.39	1.39	0.000379	0.000379	0.000273	0.000273	0.000000	0.000000
'01/92	183	3.90	3.90	0.001057	0.001057	0.000271	0.000271	0.000000	0.000000
'02/92	184	1.66	1.66	0.000448	0.000448	0.000270	0.000270	0.000000	0.000000
'06/92	188	0.00	0.00	0.000000	0.000000	0.000269	0.000269	0.000000	0.000000
'07/92	189	0.94	0.00	0.000253	0.000000	0.000269	0.000272	-0.000003	-0.963655
'08/92	190	1.27	4.89	0.000343	0.001328	0.000270	0.000272	-0.000002	-0.769565
'09/92	191	1.50	0.00	0.000404	0.000000	0.000270	0.000273	-0.000003	-1.262180
'10/92	192	0.36	0.36	0.000096	0.000096	0.000269	0.000269	0.000000	0.000000
'13/92	195	0.61	1.16	0.000165	0.000313	0.000270	0.000271	-0.000001	-0.469840

Table F-3. Daily Calibration Data Summary (Channel C)

Cal Date	Julian Cal Date	Initial Zero A.C.	Final Zero A.C.	Initial Zero ppmC	Final Zero ppmC	Initial Cal Factor	Final Cal Factor	Cal Factor Drift	F %
07/14/92	196	0.71	0.71	0.000190	0.000190	0.000267	0.000267	0.000000	0
07/15/92	197	0.62	0.62	0.000164	0.000164	0.000267	0.000267	0.000000	0
07/16/92	198	0.00	0.00	0.000000	0.000000	0.000267	0.000267	0.000000	0
07/17/92	199	0.12	0.00	0.000032	0.000000	0.000269	0.000269	-0.000000	-0
07/20/92	202	0.92	4.79	0.000247	0.001294	0.000268	0.000270	-0.000002	-0
07/21/92	203	0.00	0.00	0.000000	0.000000	0.000267	0.000267	0.000000	0
07/22/92	204	0.09	0.15	0.000023	0.000039	0.000269	0.000268	0.000002	0
07/23/92	205	0.53	0.53	0.000141	0.000141	0.000269	0.000269	0.000000	0
07/24/92	206	0.30	0.30	0.000081	0.000081	0.000270	0.000270	0.000000	0
07/25/92	207	0.12	0.12	0.000031	0.000031	0.000267	0.000267	0.000000	0
07/26/92	208	0.00	0.00	0.000000	0.000000	0.000271	0.000271	0.000000	0
07/27/92	209	0.00	0.00	0.000000	0.000000	0.000270	0.000270	0.000000	0
07/29/92	211	1.53	3.06	0.000415	0.000829	0.000271	0.000271	0.000001	0
07/30/92	212	0.00	0.00	0.000000	0.000000	0.000267	0.000271	-0.000004	-
07/31/92	213	0.80	4.53	0.000166	0.000942	0.000208	0.000208	-0.000000	-0
08/03/92	216	6.69	1.29	0.001374	0.000269	0.000206	0.000209	-0.000004	-
08/04/92	217	0.00	0.27	0.000000	0.000054	0.000203	0.000205	-0.000001	-0
08/05/92	218	0.00	0.00	0.000000	0.000000	0.000203	0.000208	-0.000005	-
08/06/92	219	0.39	5.27	0.000080	0.001090	0.000206	0.000207	-0.000001	-0
08/07/92	220	0.00	0.86	0.000000	0.000178	0.000207	0.000207	0.000000	0
08/10/92	223	0.60	0.60	0.000125	0.000125	0.000208	0.000208	0.000000	0
08/11/92	224	0.40	5.16	0.000080	0.001062	0.000204	0.000206	-0.000002	-
08/12/92	225	0.29	3.36	0.000058	0.000695	0.000204	0.000207	-0.000003	-
08/13/92	226	4.37	1.92	0.000887	0.000394	0.000203	0.000206	-0.000002	-
08/14/92	227	1.08	0.00	0.000219	0.000000	0.000203	0.000204	-0.000001	-
08/17/92	230	0.00	0.00	0.000000	0.000000	0.000206	0.000206	0.000000	
08/18/92	231	2.18	0.00	0.000445	0.000000	0.000205	0.000205	-0.000000	-
08/19/92	232	0.00	0.00	0.000000	0.000000	0.000204	0.000206	-0.000002	-
08/20/92	233	0.45	0.64	0.000092	0.000130	0.000205	0.000205	-0.000000	-

Table F-3. Daily Calibration Data Summary (Channel C)

Cal Date	Julian Cal Date	Initial Zero A.C.	Final Zero A.C.	Initial Zero ppmC	Final Zero ppmC	Initial Cal Factor	Final Cal Factor	Cal Factor Drift	Cal Factor % Drift
21/92	234	0.49	0.00	0.000099	0.000000	0.000205	0.000206	-0.000001	-0.640094
24/92	237	0.37	3.38	0.000075	0.000694	0.000204	0.000205	-0.000001	-0.534804
25/92	238	0.00	0.00	0.000000	0.000000	0.000271	0.000271	0.000000	0.000000
26/92	239	0.00	4.01	0.000000	0.001083	0.000268	0.000270	-0.000002	-0.784911
27/92	240	1.34	2.36	0.000358	0.000636	0.000268	0.000269	-0.000001	-0.407235
28/92	241	0.58	0.00	0.000155	0.000000	0.000267	0.000268	-0.000001	-0.190950
31/92	244	2.29	1.70	0.000614	0.000458	0.000269	0.000270	-0.000002	-0.567994
01/92	245	1.16	2.63	0.000310	0.000709	0.000268	0.000270	-0.000002	-0.771291
02/92	246	0.00	0.00	0.000000	0.000000	0.000268	0.000268	0.000000	0.000000
03/92	247	1.44	1.51	0.000386	0.000411	0.000269	0.000273	-0.000004	-1.611639
04/92	248	4.05	1.05	0.001102	0.000286	0.000272	0.000273	-0.000000	-0.098368
08/92	252	1.51	4.90	0.000414	0.001327	0.000275	0.000271	0.000004	1.591232
09/92	253	0.00	2.29	0.000000	0.000621	0.000270	0.000272	-0.000002	-0.816101
10/92	254	0.65	5.20	0.000174	0.001411	0.000269	0.000272	-0.000002	-0.919696
11/92	255	0.00	3.18	0.000000	0.000867	0.000270	0.000273	-0.000003	-1.259891
14/92	258	1.20	0.00	0.000320	0.000000	0.000267	0.000273	-0.000007	-2.497720
15/92	259	0.87	0.00	0.000235	0.000000	0.000271	0.000272	-0.000000	-0.109588
16/92	260	0.00	2.64	0.000000	0.000720	0.000272	0.000273	-0.000001	-0.280529
17/92	261	0.00	0.00	0.000000	0.000000	0.000273	0.000273	0.000000	0.000000
18/92	262	0.60	0.00	0.000160	0.000000	0.000269	0.000272	-0.000002	-0.852664
21/92	265	1.63	4.04	0.000440	0.001103	0.000270	0.000273	-0.000003	-1.251675
22/92	266	0.58	3.99	0.000157	0.001093	0.000273	0.000274	-0.000002	-0.637678
23/92	267	0.00	0.39	0.000000	0.000106	0.000273	0.000273	0.000001	0.225410
24/92	268	0.39	1.78	0.000105	0.000489	0.000274	0.000276	-0.000002	-0.690368
25/92	269	0.99	1.33	0.000270	0.000363	0.000273	0.000273	-0.000000	-0.020065
28/92	272	7.35	7.35	0.002041	0.002041	0.000278	0.000278	0.000000	0.000000
29/92	273	21.14	21.14	0.005766	0.005766	0.000273	0.000273	0.000000	0.000000
30/92	274	21.65	21.65	0.005835	0.005835	0.000270	0.000270	0.000000	0.000000
02/92	276	0.78	2.23	0.000207	0.000605	0.000267	0.000271	-0.000005	-1.693554

Table F-3. Daily Calibration Data Summary (Channel C)

Cal Date	Julian Cal Date	Initial Zero A.C.	Final Zero A.C.	Initial Zero ppmC	Final Zero ppmC	Initial Cal Factor	Final Cal Factor	Cal Factor Drift	C Fa %
10/05/92	279	1.89	1.89	0.000502	0.000502	0.000266	0.000266	0.000000	0.(
10/06/92	280	1.37	1.37	0.000370	0.000370	0.000270	0.000270	0.000000	0.(
10/07/92	281	5.15	5.15	0.001375	0.001375	0.000267	0.000267	0.000000	0.(
10/08/92	282	5.17	5.17	0.001385	0.001385	0.000268	0.000268	0.000000	0.(
10/12/92	286	0.65	0.65	0.000170	0.000170	0.000263	0.000263	0.000000	0.(
10/13/92	287	1.05	1.05	0.000281	0.000281	0.000267	0.000267	0.000000	0.(
10/14/92	288	0.75	0.75	0.000201	0.000201	0.000268	0.000268	0.000000	0.(
10/15/92	289	0.61	0.61	0.000160	0.000160	0.000265	0.000265	0.000000	0.(
10/16/92	290	1.63	1.63	0.000439	0.000439	0.000270	0.000270	0.000000	0.(

Table F-4. Daily Calibrationa Data Summary (Channel D)

Cal Date	Julian Cal Date	Initial Zero A.C.	Final Zero A.C	Initial Zero ppmC	Final Zero ppmC	Initial Cal Factor	Final Cal Factor	Cal Factor Drift	Cal Factor % Drift
02/92	154	1.98	1.98	0.000542	0.000542	0.000275	0.000275	0.000000	0.000000
03/92	155	1.36	1.36	0.000374	0.000374	0.000275	0.000275	0.000000	0.000000
04/92	156	0.89	0.89	0.000244	0.000244	0.000274	0.000274	0.000000	0.000000
05/92	157	1.17	1.17	0.000318	0.000318	0.000273	0.000273	0.000000	0.000000
08/92	160	4.58	4.58	0.001263	0.001263	0.000276	0.000276	0.000000	0.000000
09/92	161	0.00	0.00	0.000000	0.000000	0.000275	0.000275	0.000000	0.000000
10/92	162	1.93	1.93	0.000527	0.000527	0.000274	0.000274	0.000000	0.000000
11/92	163	2.19	2.19	0.000602	0.000602	0.000275	0.000275	0.000000	0.000000
12/92	164	0.00	0.00	0.000000	0.000000	0.000271	0.000271	0.000000	0.000000
15/92	167	2.88	2.88	0.000788	0.000788	0.000273	0.000273	0.000000	0.000000
16/92	168	0.00	0.00	0.000000	0.000000	0.000279	0.000279	0.000000	0.000000
17/92	169	0.87	0.87	0.000240	0.000240	0.000277	0.000277	0.000000	0.000000
18/92	170	2.20	2.20	0.000608	0.000608	0.000276	0.000276	0.000000	0.000000
19/92	171	0.00	0.00	0.000000	0.000000	0.000276	0.000276	0.000000	0.000000
22/92	174	0.81	0.81	0.000221	0.000221	0.000274	0.000274	0.000000	0.000000
23/92	175	3.04	3.04	0.000829	0.000829	0.000273	0.000273	0.000000	0.000000
24/92	176	2.57	2.57	0.000706	0.000706	0.000275	0.000275	0.000000	0.000000
25/92	177	5.65	5.65	0.001538	0.001538	0.000273	0.000273	0.000000	0.000000
26/92	178	3.15	3.15	0.000881	0.000881	0.000280	0.000280	0.000000	0.000000
29/92	181	0.14	0.14	0.000038	0.000038	0.000282	0.000282	0.000000	0.000000
30/92	182	1.97	1.97	0.000544	0.000544	0.000276	0.000276	0.000000	0.000000
01/92	183	0.55	0.55	0.000152	0.000152	0.000276	0.000276	0.000000	0.000000
02/92	184	0.00	0.00	0.000000	0.000000	0.000275	0.000275	0.000000	0.000000
06/92	188	0.00	0.00	0.000000	0.000000	0.000271	0.000271	0.000000	0.000000
07/92	189	0.00	0.75	0.000000	0.000207	0.000275	0.000278	-0.000003	-1.092018
08/92	190	1.05	1.72	0.000286	0.000476	0.000274	0.000276	-0.000003	-0.935503
09/92	191	0.00	2.09	0.000000	0.000578	0.000275	0.000276	-0.000002	-0.554654
10/92	192	0.09	0.09	0.000025	0.000025	0.000275	0.000275	0.000000	0.000000
13/92	195	0.57	5.52	0.000154	0.001497	0.000271	0.000271	-0.000001	-0.223776

Table F-4. Daily Calibrationa Data Summary (Channel D)

Cal Date	Julian Cal Date	Initial Zero A.C.	Final Zero A.C	Initial Zero ppmC	Final Zero ppmC	Initial Cal Factor	Final Cal Factor	Cal Factor Drift	C Fa %
07/14/92	196	2.41	2.41	0.000649	0.000649	0.000270	0.000270	0.000000	0.(
07/15/92	197	0.00	0.00	0.000000	0.000000	0.000268	0.000268	0.000000	0.(
07/16/92	198	0.67	0.67	0.000180	0.000180	0.000268	0.000268	0.000000	0.(
07/17/92	199	0.00	4.50	0.000000	0.001219	0.000271	0.000271	-0.000000	-0.(
07/20/92	202	0.00	0.00	0.000000	0.000000	0.000270	0.000273	-0.000003	-1.:
07/21/92	203	0.47	0.47	0.000127	0.000127	0.000271	0.000271	0.000000	0.(
07/22/92	204	0.00	1.32	0.000000	0.000358	0.000272	0.000272	0.000000	0.
07/23/92	205	0.00	0.00	0.000000	0.000000	0.000274	0.000274	0.000000	0.(
07/24/92	206	0.53	0.53	0.000142	0.000142	0.000271	0.000271	0.000000	0.
07/25/92	207	0.10	0.10	0.000026	0.000026	0.000274	0.000274	0.000000	0.
07/26/92	208	1.13	1.13	0.000322	0.000322	0.000285	0.000285	0.000000	0.
07/27/92	209	0.00	0.00	0.000000	0.000000	0.000274	0.000274	0.000000	0.
07/29/92	211	1.41	4.19	0.000385	0.001140	0.000273	0.000272	0.000001	0.
07/30/92	212	0.00	0.00	0.000000	0.000000	0.000266	0.000266	0.000000	0.
07/31/92	213	0.94	0.94	0.000196	0.000196	0.000210	0.000210	0.000000	0.
08/03/92	216	4.20	0.00	0.000880	0.000000	0.000209	0.000210	-0.000000	-0.
08/04/92	217	0.60	0.61	0.000125	0.000127	0.000208	0.000208	0.000000	0.
08/05/92	218	0.00	0.00	0.000000	0.000000	0.000206	0.000206	-0.000000	-0.
08/06/92	219	0.16	2.08	0.000033	0.000431	0.000208	0.000208	0.000000	0.
08/07/92	220	0.29	0.00	0.000060	0.000000	0.000208	0.000208	0.000000	0
08/10/92	223	1.25	1.31	0.000256	0.000273	0.000206	0.000208	-0.000003	-1
08/11/92	224	2.41	7.15	0.000494	0.001483	0.000205	0.000208	-0.000003	-1
08/12/92	225	0.00	0.00	0.000000	0.000000	0.000207	0.000207	-0.000001	-0
08/13/92	226	0.00	0.00	0.000000	0.000000	0.000205	0.000206	-0.000001	-0
08/14/92	227	1.60	0.00	0.000327	0.000000	0.000205	0.000205	0.000000	0
08/17/92	230	0.97	0.97	0.000197	0.000197	0.000205	0.000205	0.000000	0
08/18/92	231	1.00	2.91	0.000206	0.000605	0.000206	0.000208	-0.000002	-0
08/19/92	232	3.57	2.56	0.000730	0.000534	0.000205	0.000208	-0.000004	-1
08/20/92	233	0.00	1.16	0.000000	0.000241	0.000206	0.000208	-0.000002	-1

Table F-4. Daily Calibrationa Data Summary (Channel D)

Cal Date	Julian Cal Date	Initial Zero A.C.	Final Zero A.C	Initial Zero ppmC	Final Zero ppmC	Initial Cal Factor	Final Cal Factor	Cal Factor Drift	Cal Factor % Drift
'21/92	234	3.57	2.58	0.000733	0.000536	0.000206	0.000208	-0.000003	-1.282082
'24/92	237	1.51	0.00	0.000308	0.000000	0.000205	0.000207	-0.000002	-1.053166
25/92	238	3.42	3.42	0.000937	0.000937	0.000274	0.000274	0.000000	0.000000
26/92	239	0.81	5.62	0.000218	0.001529	0.000271	0.000272	-0.000002	-0.569480
27/92	240	0.42	0.58	0.000113	0.000156	0.000272	0.000271	0.000001	0.523855
28/92	241	3.83	1.29	0.001029	0.000345	0.000269	0.000269	-0.000000	-0.021671
31/92	244	6.00	5.69	0.001623	0.001551	0.000270	0.000273	-0.000002	-0.892551
01/92	245	3.68	7.17	0.000994	0.001949	0.000271	0.000272	-0.000002	-0.576051
'02/92	246	2.02	2.02	0.000546	0.000546	0.000270	0.000270	0.000000	0.000000
'03/92	247	2.21	6.89	0.000599	0.001899	0.000272	0.000276	-0.000004	-1.381388
'04/92	248	1.94	0.00	0.000531	0.000000	0.000274	0.000277	-0.000003	-0.935248
'08/92	252	7.13	4.67	0.001964	0.001269	0.000276	0.000272	0.000004	1.333280
'09/92	253	0.00	4.39	0.000000	0.001194	0.000272	0.000272	-0.000001	-0.214943
'10/92	254	1.61	7.15	0.000435	0.001940	0.000270	0.000272	-0.000002	-0.579074
'11/92	255	5.57	5.36	0.001506	0.001462	0.000270	0.000273	-0.000003	-0.952549
'14/92	258	1.74	4.43	0.000474	0.001201	0.000273	0.000271	0.000001	0.545389
'15/92	259	3.22	0.00	0.000873	0.000000	0.000271	0.000272	-0.000001	-0.514942
'16/92	260	0.95	1.49	0.000259	0.000406	0.000274	0.000273	0.000002	0.626497
'17/92	261	0.61	0.61	0.000166	0.000166	0.000275	0.000275	0.000000	0.000000
'18/92	262	4.48	0.16	0.001210	0.000043	0.000270	0.000271	-0.000001	-0.341539
'21/92	265	2.70	1.79	0.000736	0.000489	0.000273	0.000273	-0.000000	-0.124188
'22/92	266	2.64	5.76	0.000720	0.001587	0.000273	0.000276	-0.000003	-0.949977
'23/92	267	1.31	3.63	0.000358	0.000996	0.000273	0.000274	-0.000001	-0.460442
'24/92	268	4.97	2.60	0.001365	0.000716	0.000275	0.000275	-0.000001	-0.250487
'25/92	269	3.98	3.21	0.001089	0.000884	0.000274	0.000276	-0.000002	-0.701458
'28/92	272	3.59	3.59	0.000986	0.000986	0.000275	0.000275	0.000000	0.000000
'29/92	273	21.53	21.53	0.005904	0.005904	0.000274	0.000274	0.000000	0.000000
'30/92	274	21.63	21.63	0.005843	0.005843	0.000270	0.000270	0.000000	0.000000
'02/92	276	5.91	3.45	0.001590	0.000936	0.000269	0.000272	-0.000003	-0.934183

Table F-4. Daily Calibrationa Data Summary (Channel D)

Cal Date	Julian Cal Date	Initial Zero A.C.	Final Zero A.C	Initial Zero ppmC	Final Zero ppmC	Initial Cal Factor	Final Cal Factor	Cal Factor Drift	Fa %
10/05/92	279	2.61	2.61	0.000699	0.000699	0.000268	0.000268	0.000000	0.
10/06/92	280	0.17	0.17	0.000046	0.000046	0.000272	0.000272	0.000000	0.
10/07/92	281	1.70	1.70	0.000456	0.000456	0.000269	0.000269	0.000000	0.
10/08/92	282	4.22	4.22	0.001136	0.001136	0.000269	0.000269	0.000000	0
10/12/92	286	0.71	0.71	0.000187	0.000187	0.000266	0.000266	0.000000	0
10/13/92	287	0.00	0.00	0.000000	0.000000	0.000268	0.000268	0.000000	0
10/14/92	288	0.27	0.27	0.000072	0.000072	0.000267	0.000267	0.000000	0
10/15/92	289	2.05	2.05	0.000554	0.000554	0.000270	0.000270	0.000000	0
10/16/92	290	4.81	4.81	0.001298	0.001298	0.000270	0.000270	0.000000	0

APPENDIX G

1992 NMOC IN-HOUSE QUALITY CONTROL SAMPLES

Table G-1. NMOC In-house Quality Control Samples (Channel A)

Date Analyzed	Julian Date Analyzed	QC ID Number	Calculated NMOC ppmC	Measured NMOC ppmC	NMOC Bias ppmC	NMOC Percent Bias
10-Jul-92	192	1170	1.052	1.064	0.012	1.141
13-Jul-92	195	1359	0.869	0.950	0.081	9.321
14-Jul-92	196	1204	1.111	1.120	0.009	0.810
16-Jul-92	198	1242	1.411	1.380	-0.031	-2.197
20-Jul-92	202	1292	0.966	0.985	0.019	1.967
21-Jul-92	203	1313	0.985	1.020	0.035	3.553
27-Jul-92	209	1410	0.894	0.973	0.079	8.837
29-Jul-92	211	1481	0.865	0.886	0.021	2.428
04-Aug-92	217	1578	0.767	0.796	0.029	3.781
07-Aug-92	220	1652	0.754	0.772	0.018	2.387
10-Aug-92	223	1696	0.000	0.015	0.015	.
11-Aug-92	224	1723	1.157	1.170	0.013	1.124
12-Aug-92	225	1744	1.077	1.300	0.223	20.706
14-Aug-92	227	1791	1.022	1.040	0.018	1.761
17-Aug-92	230	1825	0.974	1.064	0.090	9.240
18-Aug-92	231	1797	0.693	0.732	0.039	5.628
19-Aug-92	232	1878	0.721	0.795	0.074	10.264
24-Aug-92	237	1958	0.654	0.703	0.049	7.492
25-Aug-92	238	2000	0.607	0.597	-0.010	-1.647
26-Aug-92	239	2035	0.703	0.696	-0.007	-0.996
04-Sep-92	248	2212	0.671	0.676	0.005	0.745

Table G-2. NMOC In-house Quality Control Samples (Channel B)

Date Analyzed	Julian Date Analyzed	QC ID Number	Calculated NMOC ppmC	Measured NMOC ppmC	NMOC Bias ppmC	NMOC Percent Bias
10-Jul-92	192	1170	1.052	1.083	0.031	2.947
13-Jul-92	195	1359	0.869	0.905	0.036	4.143
16-Jul-92	198	1242	1.411	1.466	0.055	3.898
21-Jul-92	203	1313	0.985	1.020	0.035	3.553
27-Jul-92	209	1410	0.894	0.973	0.079	8.837
29-Jul-92	211	1481	0.865	0.887	0.022	2.543
04-Aug-92	217	1578	0.767	0.814	0.047	6.128
07-Aug-92	220	1652	0.754	0.787	0.033	4.377
10-Aug-92	223	1696	0.000	0.034	0.034	.
12-Aug-92	225	1744	1.077	1.280	0.203	18.849
14-Aug-92	227	1791	1.022	1.040	0.018	1.761
17-Aug-92	230	1825	0.974	1.010	0.036	3.696
19-Aug-92	232	1878	0.721	0.772	0.051	7.074
24-Aug-92	237	1958	0.654	0.727	0.073	11.162
25-Aug-92	238	2000	0.607	0.602	-0.005	-0.824
26-Aug-92	239	2035	0.703	0.716	0.013	1.849
04-Sep-92	248	2212	0.671	0.692	0.021	3.130

Table G-3. NMOC In-house Quality Control Samples (Channel C)

Date Analyzed	Julian Date Analyzed	QC ID Number	Calculated NMOC ppmC	Measured NMOC ppmC	NMOC Bias ppmC	NMOC Percent Bias
10-Jul-92	192	1170	1.052	1.040	-0.012	-1.141
13-Jul-92	195	1359	0.869	0.904	0.035	4.028
14-Jul-92	196	1204	1.111	1.100	-0.011	-0.990
16-Jul-92	198	1242	1.411	1.400	-0.011	-0.780
20-Jul-92	202	1292	0.966	0.955	-0.011	-1.139
21-Jul-92	203	1313	0.985	1.010	0.025	2.538
27-Jul-92	209	1410	0.894	0.897	0.003	0.336
29-Jul-92	211	1481	0.865	0.881	0.016	1.850
30-Jul-92	212	1506	0.755	0.760	0.005	0.662
04-Aug-92	217	1578	0.767	0.784	0.017	2.216
07-Aug-92	220	1652	0.754	0.747	-0.007	-0.928
10-Aug-92	223	1696	0.000	0.005	0.005	.
11-Aug-92	224	1723	1.157	1.170	0.013	1.124
12-Aug-92	225	1744	1.077	1.160	0.083	7.707
14-Aug-92	227	1791	1.022	1.040	0.018	1.761
17-Aug-92	230	1825	0.974	0.992	0.018	1.848
18-Aug-92	231	1797	0.693	0.746	0.053	7.648
19-Aug-92	232	1878	0.721	0.741	0.020	2.774
24-Aug-92	237	1958	0.654	0.711	0.057	8.716
25-Aug-92	238	2000	0.607	0.592	-0.015	-2.471
26-Aug-92	239	2035	0.703	0.690	-0.013	-1.849
04-Sep-92	248	2212	0.671	0.652	-0.019	-2.832

Table G-4. NMOC In-house Quality Control Samples (Channel D)

Date Analyzed	Julian Date Analyzed	QC ID Number	Calculated NMOC ppmC	Measured NMOC ppmC	NMOC Bias ppmC	NMOC Percent Bias
10-Jul-92	192	1170	1.052	1.030	-0.022	-2.091
13-Jul-92	195	1359	0.869	0.872	0.003	0.345
14-Jul-92	196	1204	1.111	1.090	-0.021	-1.890
16-Jul-92	198	1242	1.411	1.382	-0.029	-2.055
20-Jul-92	202	1292	0.966	0.937	-0.029	-3.002
21-Jul-92	203	1313	0.985	1.020	0.035	3.553
27-Jul-92	209	1410	0.894	0.888	-0.006	-0.671
29-Jul-92	211	1481	0.865	0.838	-0.027	-3.121
30-Jul-92	212	1506	0.755	0.768	0.013	1.682
04-Aug-92	217	1578	0.767	0.764	-0.003	-0.391
07-Aug-92	220	1652	0.754	0.742	-0.012	-1.592
10-Aug-92	223	1696	0.000	0.004	0.004	.
11-Aug-92	224	1723	1.157	1.150	-0.007	-0.605
12-Aug-92	225	1744	1.077	1.200	0.123	11.421
14-Aug-92	227	1791	1.022	1.030	0.008	0.783
17-Aug-92	230	1825	0.974	0.998	0.024	2.464
18-Aug-92	231	1797	0.693	0.716	0.023	3.319
19-Aug-92	232	1878	0.721	0.787	0.066	9.154
24-Aug-92	237	1958	0.654	0.721	0.067	10.245
25-Aug-92	238	2000	0.607	0.601	-0.006	-0.988
26-Aug-92	239	2035	0.703	0.682	-0.021	-2.987
04-Sep-92	248	2212	0.671	0.661	-0.010	-1.490

APPENDIX H

1992 MULTIPLE DETECTOR SPECIATED THREE-HOUR SITE DATA SUMMARIES

TABLE H-1. MULTIPLE DETECTOR SPECIATED UATMP DATA SUMMARY FOR B1AL

Sample Date	8/12/92		9/01/92		9/10/92		9/15/92		9/15/92	
Sample ID	1977		2192		2320		2378D		2379D	
Compound	Concentration, ppbv									
Acetylene	<1.00		<1.00		<1.00		<1.00		<1.00	
Propylene	1.08	(H)	3.64	(L)	4.36	(H)	2.30	(H)	2.45	(H)
Chloromethane	<0.20		<0.20		<0.20		<0.20		<0.20	
Vinyl Chloride	<0.20		<0.20		<0.20		<0.20		<0.20	
1,3-Butadiene	<0.10		<0.10		<0.10		<0.10		<0.10	
Bromomethane	<0.20		<0.20		<0.20		<0.20		<0.20	
Chloroethane	<0.10		<0.10		<0.10		<0.10		<0.10	
Methylene Chloride	1.22	(M)	<0.11		<0.11		<0.11		<0.11	
trans-1,2-Dichloroethylene	<0.04		<0.04		<0.04		<0.04		<0.04	
1,1-Dichloroethane	0.25	(L)	1.05	(L)	1.08	(L)	0.44	(L)	0.44	(L)
Chloroprene	<0.06		<0.06		<0.06		<0.06		<0.06	
Bromochloromethane	<0.003		<0.003		<0.003		<0.003		<0.003	
Chloroform	0.14	(L)	0.25	(L)	0.27	(H)	0.26	(L)	0.22	(L)
1,2-Dichloroethane	1.08	(L)	<0.04		4.71	(L)	<0.04		<0.04	
1,1,1-Trichloroethane	0.54	(L)	1.47	(L)	1.36	(L)	0.95	(L)	0.92	(L)
Benzene	0.63	(H)	2.11	(H)	2.24	(L)	1.03	(H)	1.00	(H)
Carbon tetrachloride	0.12	(L)	0.13	(L)	0.14	(L)	0.14	(L)	0.13	(L)
1,2-Dichloropropane	<0.04		<0.04		<0.04		<0.04		<0.04	
Bromodichloromethane	<0.001		<0.001		<0.001		<0.001		<0.001	
Trichloroethylene	0.05	(L)	0.13	(L)	0.13	(L)	0.14	(L)	<0.004	
cis-1,3-Dichloropropylene	<0.04		<0.04		<0.04		<0.04		<0.04	
trans-1,3-Dichloropropylene	<0.04		<0.04		<0.04		<0.04		<0.04	
1,1,2-Trichloroethane	<0.04		<0.04		<0.04		<0.04		<0.04	
Toluene	1.55	(H)	4.82	(H)	5.58	(H)	2.61	(H)	2.63	(H)
Dibromochloromethane	<0.001		<0.001		<0.001		<0.001		<0.001	
n-Octane	<0.03		<0.03		<0.03		<0.03		<0.03	
Tetrachloroethylene	0.03	(L)	0.10	(L)	0.19	(H)	0.11	(H)	0.10	(L)
Chlorobenzene	0.04	(H)	<0.02		0.09	(H)	0.07	(H)	<0.02	
Ethylbenzene	0.24	(H)	0.96	(H)	1.03	(H)	0.72	(H)	0.70	(H)
m/p-Xylene/Bromoform	1.19	(L)	4.99	(L)	5.17	(L)	3.28	(L)	3.24	(L)
Styrene	0.11	(L)	0.64	(M)	0.69	(M)	0.30	(H)	0.27	(H)
o-Xylene/1,1,2,2-Tetrachloroethane	0.57	(L)	2.53	(L)	2.66	(L)	1.43	(L)	1.39	(L)
m-Dichlorobenzene	0.11	(H)	0.14	(M)	0.12	(M)	0.14	(H)	<0.02	
p-Dichlorobenzene	0.08	(L)	0.11	(H)	0.14	(H)	0.10	(L)	0.05	(H)
o-Dichlorobenzene	0.08	(M)	0.15	(H)	0.14	(H)	0.11	(L)	0.08	(L)

(H) High confidence level (M) Medium confidence level (L) Low confidence level (Continued)

D Duplicate sample

TABLE H-1. B1AL (Continued)

Sample Date	9/15/92		9/16/92		9/18/92		9/23/92		9/29/92	
Sample ID	2379R		1410		2462		2515		2595	
Compound	Concentration, ppbv									
Acetylene	<1.00		<1.00		<1.00		<1.00		<1.00	
Propylene	2.20	(L)	4.82	(L)	1.41	(H)	0.56	(L)	0.82	(H)
Chloromethane	<0.20		0.89	(L)	<0.20		0.42	(L)	<0.20	
Vinyl Chloride	<0.20		<0.20		<0.20		<0.20		<0.20	
1,3-Butadiene	<0.10		<0.10		<0.10		<0.10		<0.10	
Bromomethane	<0.20		<0.20		<0.20		<0.20		<0.20	
Chloroethane	<0.10		<0.10		<0.10		<0.10		<0.10	
Methylene Chloride	<0.11		4.52	(M)	<0.11		<0.11		<0.11	
trans-1,2-Dichloroethylene	<0.04		<0.04		<0.04		<0.04		<0.04	
1,1-Dichloroethane	0.44	(L)	0.68	(L)	0.64	(L)	0.12	(L)	0.16	(L)
Chloroprene	<0.06		<0.06		<0.06		<0.06		<0.06	
Bromochloromethane	<0.003		<0.003		<0.003		<0.003		<0.003	
Chloroform	0.21	(L)	0.17	(L)	0.14	(L)	0.09	(L)	0.07	(L)
1,2-Dichloroethane	3.06	(L)	<0.04		0.82	(L)	0.39	(L)	<0.04	
1,1,1-Trichloroethane	0.83	(L)	1.11	(L)	0.70	(H)	0.60	(M)	0.47	(L)
Benzene	0.98	(H)	1.60	(H)	0.69	(H)	0.36	(H)	0.36	(H)
Carbon tetrachloride	0.11	(L)	0.13	(L)	0.13	(L)	0.12	(L)	0.12	(L)
1,2-Dichloropropane	1.14	(L)	<0.04		<0.04		<0.04		<0.04	
Bromodichloromethane	<0.001		<0.001		<0.001		<0.001		<0.001	
Trichloroethylene	0.10	(L)	0.08	(L)	0.09	(L)	0.07	(L)	0.04	(L)
cis-1,3-Dichloropropylene	<0.04		<0.04		<0.04		<0.04		<0.04	
trans-1,3-Dichloropropylene	<0.04		<0.04		<0.04		<0.04		<0.04	
1,1,2-Trichloroethane	<0.04		<0.04		<0.04		<0.04		<0.04	
Toluene	2.45	(H)	4.04	(H)	1.80	(H)	1.30	(H)	0.77	(H)
Dibromochloromethane	<0.001		<0.001		<0.001		<0.001		<0.001	
n-Octane	<0.03		<0.03		<0.03		<0.03		<0.03	
Tetrachloroethylene	0.09	(H)	0.12	(L)	0.09	(L)	0.06	(M)	0.68	(L)
Chlorobenzene	<0.02		0.11	(M)	0.05	(H)	0.02	(H)	<0.02	
Ethylbenzene	0.65	(H)	1.00	(H)	0.28	(H)	0.14	(H)	0.12	(H)
m/p-Xylene/Bromoform	3.01	(L)	4.92	(L)	1.33	(L)	0.69	(L)	0.55	(L)
Styrene	0.24	(M)	0.54	(M)	0.20	(M)	0.11	(M)	0.04	(L)
o-Xylene/1,1,2,2-Tetrachloroethane	1.27	(L)	2.26	(L)	0.57	(L)	0.30	(L)	0.30	(L)
m-Dichlorobenzene	0.09	(L)	<0.02		0.13	(H)	0.09	(L)	<0.02	
p-Dichlorobenzene	0.06	(H)	<0.09		0.08	(H)	0.05	(M)	0.02	(H)
o-Dichlorobenzene	<0.02		<0.02		0.13	(M)	0.08	(M)	<0.02	

(H) High confidence level (M) Medium confidence level (L) Low confidence level

R Replicate analysis

TABLE H-2. MULTIPLE DETECTOR SPECIATED UATMP DATA SUMMARY FOR B2AL

Sample Date	8/20/92		8/24/92		8/26/92		8/28/92		9/02/92	
Sample ID	1976		2039		2061		2139		2223	
Compound	Concentration, ppbv									
Acetylene	<1.00		<1.00		<1.00		<1.00		<1.00	
Propylene	1.28	(L)	0.27	(L)	0.53	(H)	<0.10		1.21	(L)
Chloromethane	<0.20		<0.20		<0.20		<0.20		<0.20	
Vinyl Chloride	<0.20		<0.20		<0.20		<0.20		<0.20	
1,3-Butadiene	<0.10		<0.10		<0.10		<0.10		<0.10	
Bromomethane	<0.20		<0.20		<0.20		<0.20		<0.20	
Chloroethane	<0.10		<0.10		<0.10		<0.10		<0.10	
Methylene Chloride	1.02	(H)	<0.11		<0.11		<0.11		<0.11	
trans-1,2-Dichloroethylene	<0.04		<0.04		<0.04		<0.04		<0.04	
1,1-Dichloroethane	0.32	(L)	<0.04		<0.04		<0.04		<0.04	
Chloroprene	<0.06		<0.06		<0.06		<0.06		<0.06	
Bromochloromethane	<0.003		<0.003		<0.003		<0.003		<0.003	
Chloroform	0.08	(L)	0.10	(L)	0.07	(L)	0.08	(L)	0.08	(L)
1,2-Dichloroethane	0.37	(L)	0.08	(L)	0.11	(L)	<0.04		0.55	(L)
1,1,1-Trichloroethane	0.39	(L)	0.47	(L)	0.38	(L)	0.43	(L)	0.37	(L)
Benzene	0.36	(H)	0.17	(H)	0.15	(H)	0.19	(H)	0.56	(H)
Carbon tetrachloride	0.10	(L)	0.13	(L)	0.11	(L)	0.11	(L)	0.10	(L)
1,2-Dichloropropane	<0.04		<0.04		<0.04		<0.04		<0.04	
Bromodichloromethane	<0.001		<0.001		<0.001		<0.001		<0.001	
Trichloroethylene	0.01	(L)	0.02	(L)	0.04	(L)	0.02	(L)	0.02	(L)
cis-1,3-Dichloropropylene	<0.04		<0.04		<0.04		<0.04		<0.04	
trans-1,3-Dichloropropylene	<0.04		<0.04		<0.04		<0.04		<0.04	
1,1,2-Trichloroethane	<0.04		<0.04		<0.04		<0.04		<0.04	
Toluene	0.71	(H)	0.26	(H)	0.33	(H)	0.37	(H)	0.91	(H)
Dibromochloromethane	<0.001		<0.001		<0.001		<0.001		<0.001	
n-Octane	<0.03		<0.03		<0.03		<0.03		<0.03	
Tetrachloroethylene	0.01	(L)	0.01	(L)	0.01	(H)	0.02	(L)	0.01	(H)
Chlorobenzene	<0.02		<0.02		<0.02		0.02	(L)	0.02	(H)
Ethylbenzene	0.10	(L)	0.05	(H)	0.06	(H)	0.06	(L)	0.16	(H)
m/p-Xylene/Bromoform	0.52	(L)	0.22	(L)	0.25	(H)	0.26	(L)	0.80	(L)
Styrene	0.08	(H)	0.06	(M)	0.05	(H)	0.06	(L)	0.12	(L)
o-Xylene/1,1,2,2-Tetrachloroethane	0.21	(L)	0.03	(L)	0.08	(L)	0.11	(L)	0.38	(L)
m-Dichlorobenzene	0.04	(L)	0.08	(L)	0.07	(H)	0.03	(H)	0.04	(L)
p-Dichlorobenzene	0.03	(L)	0.04	(M)	0.04	(H)	0.03	(H)	0.03	(L)
o-Dichlorobenzene	<0.02		0.06	(H)	0.07	(L)	0.04	(L)	0.11	(L)

(H) High confidence level (M) Medium confidence level (L) Low confidence level (Continued)

TABLE H-2. B2AL (Continued)

Sample Date	9/03/92		9/03/92		9/03/92		9/17/92		9/29/92	
Sample ID	2226D		2227D		2227R		2419		2594	
Compound	Concentration, ppbv									
Acetylene	<1.00		<1.00		<1.00		<1.00		<1.00	
Propylene	1.03	(H)	0.92	(L)	1.19	(H)	2.62	(L)	0.39	(H)
Chloromethane	<0.20		0.62	(L)	0.94	(H)	<0.20		0.45	(L)
Vinyl Chloride	<0.20		<0.20		<0.20		<0.20		<0.20	
1,3-Butadiene	<0.10		<0.10		<0.10		<0.10		<0.10	
Bromomethane	<0.20		<0.20		<0.20		<0.20		<0.20	
Chloroethane	<0.10		<0.10		<0.10		<0.10		<0.10	
Methylene Chloride	<0.11		<0.11		0.44	(L)	<0.11		<0.11	
trans-1,2-Dichloroethylene	<0.04		<0.04		<0.04		<0.04		<0.04	
1,1-Dichloroethane	0.14	(L)	0.14	(L)	<0.04		<0.04		<0.04	
Chloroprene	<0.06		<0.06		<0.06		<0.06		<0.06	
Bromochloromethane	<0.003		<0.003		<0.003		<0.003		<0.003	
Chloroform	0.09	(L)	0.08	(L)	0.07	(L)	0.09	(L)	0.05	(L)
1,2-Dichloroethane	0.56	(L)	0.53	(L)	0.55	(L)	<0.04		<0.04	
1,1,1-Trichloroethane	0.47	(H)	0.38	(L)	0.36	(L)	0.50	(L)	0.29	(L)
Benzene	0.40	(H)	0.38	(H)	0.38	(H)	0.42	(H)	0.15	(H)
Carbon tetrachloride	0.13	(L)	0.14	(L)	0.12	(L)	0.12	(L)	0.09	(L)
1,2-Dichloropropane	<0.04		<0.04		<0.04		<0.04		<0.04	
Bromodichloromethane	<0.001		<0.001		<0.001		<0.001		<0.001	
Trichloroethylene	0.03	(L)	0.03	(H)	0.02	(L)	0.03	(L)	0.01	(L)
cis-1,3-Dichloropropylene	<0.04		<0.04		<0.04		<0.04		<0.04	
trans-1,3-Dichloropropylene	<0.04		<0.04		<0.04		<0.04		<0.04	
1,1,2-Trichloroethane	<0.04		<0.04		<0.04		<0.04		<0.04	
Toluene	0.74	(H)	0.93	(H)	0.92	(H)	0.89	(H)	0.14	(H)
Dibromochloromethane	<0.001		<0.001		<0.001		<0.001		<0.001	
n-Octane	<0.03		<0.03		<0.03		<0.03		<0.03	
Tetrachloroethylene	0.01	(L)	0.02	(L)	0.01	(L)	0.04	(L)	0.01	(L)
Chlorobenzene	<0.02		<0.02		0.02	(H)	<0.02		<0.02	
Ethylbenzene	0.14	(H)	0.14	(H)	0.12	(H)	0.12	(H)	0.02	(L)
m/p-Xylene/Bromoform	0.66	(L)	0.70	(L)	0.61	(L)	0.60	(L)	0.11	(L)
Styrene	0.12	(H)	0.13	(H)	0.10	(H)	0.10	(M)	0.03	(L)
o-Xylene/1,1,2,2-Tetrachloroethane	0.28	(L)	0.30	(L)	0.28	(M)	0.26	(L)	0.06	(L)
m-Dichlorobenzene	0.07	(M)	0.06	(M)	0.04	(M)	<0.02		<0.02	
p-Dichlorobenzene	0.04	(L)	0.04	(M)	0.04	(M)	0.04	(L)	<0.09	
o-Dichlorobenzene	0.07	(M)	0.12	(M)	0.10	(M)	0.06	(L)	<0.02	

(H) High confidence level (M) Medium confidence level (L) Low confidence level
R Replicate analysis D Duplicate sample

TABLE H-3. MULTIPLE DETECTOR SPECIATED UATMP DATA SUMMARY FOR B3AL

Sample Date	8/20/92		8/24/92		8/25/92		8/31/92		8/31/92	
Sample ID	1951		2011		2045		2132D		2133D	
Compound	Concentration, ppbv									
:etylene	<1.00		<1.00		<1.00		<1.00		<1.00	
·opylene	1.11	(M)	0.49	(H)	0.60	(M)	2.37	(H)	1.20	(H)
ıloromethane	1.44	(L)	<0.20		0.43	(L)	1.34	(L)	0.85	(L)
nyl Chloride	<0.20		<0.20		<0.20		<0.20		<0.20	
3-Butadiene	<0.10		<0.10		<0.10		<0.10		<0.10	
·omomethane	<0.20		<0.20		<0.20		<0.20		<0.20	
ıloroethane	<0.10		<0.10		<0.10		0.10	(L)	<0.10	
;thylene Chloride	<0.11		<0.11		<0.11		<0.11		<0.11	
·ans-1,2-Dichloroethylene	<0.04		<0.04		<0.04		<0.04		<0.04	
1-Dichloroethane	0.23	(L)	<0.04		<0.04		0.35	(L)	0.34	(L)
ıloroprene	<0.06		<0.06		<0.06		<0.06		<0.06	
·omochloromethane	<0.003		<0.003		<0.003		<0.003		<0.003	
ıloroform	0.13	(L)	0.09	(L)	0.08	(L)	0.26	(L)	0.23	(L)
.2-Dichloroethane	0.64	(L)	<0.04		<0.04		1.00	(L)	1.00	(L)
,1,1-Trichloroethane	0.76	(L)	0.33	(L)	0.32	(L)	1.32	(M)	1.34	(M)
;nzene	0.47	(H)	0.12	(H)	0.13	(H)	0.78	(H)	0.66	(H)
ırbon tetrachloride	0.10	(L)	0.10	(H)	0.10	(H)	0.15	(L)	0.13	(L)
,2-Dichloropropane	<0.04		<0.04		<0.04		<0.04		<0.04	
·omodichloromethane	<0.001		<0.001		<0.001		<0.001		<0.001	
·ıchloroethylene	0.02	(L)	0.01	(L)	<0.004		0.11	(L)	0.09	(L)
is-1,3-Dichloropropylene	<0.04		<0.04		<0.04		<0.04		<0.04	
·ans-1,3-Dichloropropylene	<0.04		<0.04		<0.04		<0.04		<0.04	
,1,2-Trichloroethane	<0.04		<0.04		<0.04		<0.04		<0.04	
ɔluene	0.97	(H)	0.17	(M)	0.19	(H)	1.87	(H)	1.40	(H)
ibromochloromethane	<0.001		<0.001		<0.001		<0.001		<0.001	
-Octane	<0.03		<0.03		<0.03		<0.03		<0.03	
;trachloroethylene	0.09	(H)	0.01	(L)	0.01	(L)	0.30	(H)	0.25	(H)
ılorobenzene	<0.02		<0.02		<0.02		<0.02		0.04	(M)
thylbenzene	0.12	(L)	0.02	(L)	0.02	(L)	0.34	(H)	0.22	(H)
/p-Xylene/Bromoform	0.59	(L)	0.10	(L)	0.11	(L)	1.47	(L)	1.06	(L)
tyrene	0.08	(L)	0.02	(L)	0.02	(L)	0.22	(H)	0.18	(H)
-Xylene/1,1,2,2-Tetrachloroethane	0.33	(L)	0.07	(L)	0.07	(L)	0.60	(M)	0.54	(L)
-Dichlorobenzene	<0.02		<0.02		<0.02		0.11	(L)	0.08	(H)
-Dichlorobenzene	<0.09		<0.09		<0.09		0.09	(L)	0.06	(H)
-Dichlorobenzene	<0.02		<0.02		<0.02		0.33	(H)	0.18	(L)

ı) High confidence level (M) Medium confidence level (L) Low confidence level (Continued)
Duplicate sample

TABLE H-3. B3AL (Continued)

Sample Date	8/31/92		9/02/92		9/08/92		9/25/92		9/29/92	
Sample ID	2132R		2258		2253		2530		2625	
Compound	Concentration, ppbv									
Acetylene	<1.00		<1.00		<1.00		<1.00		<1.00	
Propylene	2.23	(H)	1.72	(H)	1.35	(M)	0.34	(H)	0.67	(H)
Chloromethane	<0.20		0.78	(L)	0.65	(L)	0.22	(L)	0.54	(L)
Vinyl Chloride	<0.20		<0.20		<0.20		<0.20		<0.20	
1,3-Butadiene	<0.10		<0.10		<0.10		<0.10		<0.10	
Bromomethane	<0.20		<0.20		<0.20		<0.20		<0.20	
Chloroethane	<0.10		<0.10		<0.10		<0.10		<0.10	
Methylene Chloride	<0.11		<0.11		<0.11		<0.11		3.79	(H)
trans-1,2-Dichloroethylene	<0.04		<0.04		<0.04		<0.04		<0.04	
1,1-Dichloroethane	0.34	(L)	0.38	(L)	<0.04		<0.04		<0.04	
Chloroprene	<0.06		<0.06		<0.06		<0.06		<0.06	
Bromochloromethane	<0.003		<0.003		<0.003		<0.003		<0.003	
Chloroform	0.20	(L)	0.16	(L)	0.16	(L)	0.04	(L)	0.08	(L)
1,2-Dichloroethane	0.97	(L)	<0.04		<0.04		<0.04		<0.04	
1,1,1-Trichloroethane	1.21	(L)	0.87	(L)	0.98	(L)	0.34	(L)	0.55	(L)
Benzene	0.75	(H)	0.61	(H)	0.66	(H)	0.15	(H)	0.46	(H)
Carbon tetrachloride	0.14	(L)	0.11	(L)	0.11	(M)	0.10	(H)	0.12	(L)
1,2-Dichloropropane	<0.04		<0.04		<0.04		<0.04		<0.04	
Bromodichloromethane	<0.001		<0.001		<0.001		<0.001		<0.001	
Trichloroethylene	0.07	(L)	0.04	(L)	0.03	(L)	<0.004		0.04	(L)
cis-1,3-Dichloropropylene	<0.04		<0.04		<0.04		<0.04		<0.04	
trans-1,3-Dichloropropylene	<0.04		<0.04		<0.04		<0.04		<0.04	
1,1,2-Trichloroethane	<0.04		<0.04		<0.04		<0.04		<0.04	
Toluene	1.76	(H)	1.47	(H)	1.12	(H)	0.19	(H)	0.95	(H)
Dibromochloromethane	<0.001		<0.001		<0.001		<0.001		<0.001	
n-Octane	<0.03		<0.03		<0.03		<0.03		<0.03	
Tetrachloroethylene	0.26	(H)	0.10	(L)	0.29	(H)	0.01	(L)	0.04	(L)
Chlorobenzene	<0.02		<0.02		<0.02		<0.02		<0.02	
Ethylbenzene	0.30	(H)	0.14	(H)	0.15	(H)	0.03	(L)	0.09	(M)
m/p-Xylene/Bromoform	1.35	(L)	0.86	(L)	0.76	(L)	0.11	(L)	0.42	(L)
Styrene	0.18	(M)	0.13	(L)	0.14	(L)	0.02	(L)	0.07	(L)
o-Xylene/1,1,2,2-Tetrachloroethane	0.52	(L)	0.44	(L)	0.40	(L)	0.07	(L)	0.19	(L)
m-Dichlorobenzene	0.05	(L)	<0.02		<0.02		<0.02		0.08	(L)
p-Dichlorobenzene	0.05	(L)	<0.09		0.02	(L)	<0.09		0.04	(L)
o-Dichlorobenzene	0.06	(L)	<0.02		0.22	(L)	<0.02		0.07	(L)

(H) High confidence level (M) Medium confidence level (L) Low confidence level

R Replicate analysis

TABLE H-4. MULTIPLE DETECTOR SPECIATED UATMP DATA SUMMARY FOR NWNJ

Sample Date	7/21/92		7/27/92		7/31/92		8/26/92		8/26/92	
Sample ID	1404		1494		1569		2063D		2070D	
Compound	Concentration, ppbv									
Acetylene	<1.00		<1.00		<1.00		<1.00		<1.00	
Propylene	2.85	(H)	3.09	(H)	2.12	(H)	2.12	(H)	2.29	(H)
Chloromethane	0.73	(L)	0.90	(L)	<0.20		0.92	(L)	1.17	(L)
Vinyl Chloride	<0.20		<0.20		<0.20		<0.20		<0.20	
1,3-Butadiene	<0.10		<0.10		<0.10		<0.10		<0.10	
Bromomethane	<0.20		<0.20		<0.20		<0.20		<0.20	
Chloroethane	<0.10		<0.10		<0.10		<0.10		<0.10	
Methylene Chloride	2.86	(H)	3.03	(M)	<0.11		<0.11		<0.11	
trans-1,2-Dichloroethylene	<0.04		0.38	(L)	<0.04		<0.04		<0.04	
1,1-Dichloroethane	0.42	(L)	<0.04		<0.04		<0.04		0.48	(L)
Chloroprene	<0.06		<0.06		<0.06		<0.06		<0.06	
Bromochloromethane	<0.003		<0.003		<0.003		<0.003		<0.003	
Chloroform	0.20	(L)	0.20	(L)	0.19	(L)	0.38	(L)	0.38	(L)
1,2-Dichloroethane	1.33	(H)	1.18	(L)	0.95	(L)	1.73	(L)	1.76	(L)
1,1,1-Trichloroethane	253.06	(L)	7.49	(L)	4.46	(H)	7.44	(L)	7.65	(M)
Benzene	0.87	(H)	0.92	(H)	0.82	(H)	1.32	(H)	1.37	(H)
Carbon tetrachloride	0.16	(M)	0.14	(L)	0.14	(L)	0.14	(L)	0.14	(L)
1,2-Dichloropropane	1.34	(L)	<0.04		<0.04		<0.04		<0.04	
Bromodichloromethane	<0.001		<0.001		<0.001		<0.001		<0.001	
Trichloroethylene	0.24	(L)	0.26	(L)	0.17	(L)	0.37	(L)	0.39	(L)
cis-1,3-Dichloropropylene	<0.04		<0.04		<0.04		<0.04		<0.04	
trans-1,3-Dichloropropylene	<0.04		<0.04		<0.04		<0.04		<0.04	
1,1,2-Trichloroethane	<0.04		<0.04		<0.04		<0.04		<0.04	
Toluene	2.70	(H)	3.24	(H)	3.14	(H)	5.64	(H)	6.01	(H)
Dibromochloromethane	<0.001		<0.001		<0.001		<0.001		<0.001	
n-Octane	<0.03		<0.03		<0.03		<0.03		<0.03	
Tetrachloroethylene	0.12	(L)	0.26	(L)	0.27	(L)	0.90	(L)	0.92	(L)
Chlorobenzene	<0.02		0.07	(M)	0.18	(H)	0.10	(M)	0.13	(H)
Ethylbenzene	0.45	(H)	0.48	(H)	0.48	(H)	0.92	(H)	0.97	(H)
m/p-Xylene/Bromoform	1.97	(L)	2.24	(L)	2.20	(L)	4.44	(L)	4.59	(L)
Styrene	0.26	(M)	0.24	(L)	0.48	(L)	0.74	(M)	0.47	(L)
o-Xylene/1,1,2,2-Tetrachloroethane	1.07	(L)	1.12	(L)	1.05	(H)	2.14	(L)	2.19	(L)
m-Dichlorobenzene	<0.02		<0.02		0.21	(H)	<0.02		<0.02	
o-Dichlorobenzene	<0.09		0.15	(L)	0.11	(L)	0.18	(L)	0.20	(L)
p-Dichlorobenzene	<0.02		0.17	(H)	<0.02		0.23	(L)	<0.02	

(H) High confidence level (M) Medium confidence level (L) Low confidence level (Continued)

D Duplicate sample

TABLE H-4. NWNJ (Continued)

Sample Date	9/03/92		9/10/92		9/10/92		9/10/92		9/28/92	
Sample ID	2239		2326D		2327D		2326R		2551	
Compound	Concentration, ppbv									
Acetylene	<1.00		<1.00		<1.00		<1.00		<1.00	
Propylene	1.30	(H)	3.21	(H)	3.25	(H)	3.13	(H)	3.60	(H)
Chloromethane	0.57	(L)	0.72	(L)	0.63	(L)	0.93	(L)	1.19	(L)
Vinyl Chloride	<0.20		<0.20		<0.20		<0.20		<0.20	
1,3-Butadiene	<0.10		<0.10		<0.10		<0.10		<0.10	
Bromomethane	<0.20		<0.20		<0.20		<0.20		<0.20	
Chloroethane	<0.10		<0.10		<0.10		<0.10		<0.10	
Methylene Chloride	<0.11		<0.11		<0.11		<0.11		<0.11	
trans-1,2-Dichloroethylene	<0.04		<0.04		<0.04		<0.04		0.12	(L)
1,1-Dichloroethane	0.27	(L)	<0.04		<0.04		0.31	(H)	<0.04	
Chloroprene	<0.06		<0.06		<0.06		<0.06		<0.06	
Bromochloromethane	<0.003		<0.003		<0.003		<0.003		<0.003	
Chloroform	0.17	(L)	0.15	(L)	0.15	(L)	0.13	(L)	0.37	(L)
1,2-Dichloroethane	<0.04		1.01	(L)	0.92	(L)	0.94	(L)	1.61	(L)
1,1,1-Trichloroethane	4.42	(M)	5.36	(M)	5.20	(M)	4.77	(L)	13.29	(M)
Benzene	0.75	(H)	0.96	(H)	0.93	(H)	0.72	(H)	1.14	(H)
Carbon tetrachloride	0.14	(L)	0.15	(L)	0.15	(L)	0.13	(L)	0.15	(M)
1,2-Dichloropropane	<0.04		<0.04		<0.04		<0.04		<0.04	
Bromodichloromethane	<0.001		<0.001		<0.001		<0.001		<0.001	
Trichloroethylene	0.10	(L)	0.20	(L)	1.98	(L)	0.18	(L)	0.36	(L)
cis-1,3-Dichloropropylene	<0.04		<0.04		<0.04		<0.04		<0.04	
trans-1,3-Dichloropropylene	<0.04		<0.04		<0.04		<0.04		<0.04	
1,1,2-Trichloroethane	<0.04		<0.04		<0.04		<0.04		<0.04	
Toluene	2.14	(H)	3.28	(H)	2.80	(H)	2.02	(H)	5.04	(H)
Dibromochloromethane	<0.001		<0.001		<0.001		<0.001		<0.001	
n-Octane	0.31	(L)	<0.03		<0.03		<0.03		<0.03	
Tetrachloroethylene	0.13	(L)	0.08	(L)	0.07	(L)	0.05	(L)	0.37	(L)
Chlorobenzene	0.08	(H)	0.14	(M)	0.13	(M)	0.10	(H)	0.07	(H)
Ethylbenzene	0.36	(H)	0.71	(H)	0.75	(H)	0.59	(H)	0.67	(H)
m/p-Xylene/Bromoform	1.77	(L)	3.75	(L)	3.86	(L)	3.08	(L)	3.22	(L)
Styrene	0.44	(M)	0.43	(L)	0.52	(L)	0.35	(L)	0.71	(H)
o-Xylene/1,1,2,2-Tetrachloroethane	0.90	(L)	1.59	(H)	1.56	(H)	1.40	(H)	1.55	(L)
m-Dichlorobenzene	<0.02		<0.02		<0.02		0.20	(L)	<0.02	
p-Dichlorobenzene	0.15	(L)	0.13	(L)	0.12	(L)	0.14	(L)	0.14	(L)
o-Dichlorobenzene	<0.02		0.22	(H)	0.22	(M)	0.15	(H)	0.20	(L)

(H) High confidence level (M) Medium confidence level (L) Low confidence level

R Replicate analysis D Duplicate sample

TABLE H-5. MULTIPLE DETECTOR SPECIATED UATMP DATA SUMMARY FOR PLNJ

Sample Date	8/14/92		8/14/92		8/14/92		8/25/92		8/26/92	
Sample ID	1922D		1923D		1923R		2071		2065	
Compound	Concentration, ppbv									
cetylene	<1.00		<1.00		<1.00		<1.00		<1.00	
ropylene	0.98	(L)	1.68	(H)	1.47	(H)	7.89	(H)	4.85	(H)
nloromethane	0.68	(L)	0.55	(L)	0.60	(L)	<0.20		1.02	(L)
inyl Chloride	<0.20		<0.20		<0.20		<0.20		<0.20	
,3-Butadiene	<0.10		<0.10		<0.10		<0.10		0.11	(L)
romomethane	<0.20		<0.20		<0.20		<0.20		<0.20	
nloroethane	<0.10		<0.10		<0.10		<0.10		<0.10	
ethylene Chloride	<0.11		<0.11		<0.11		<0.11		<0.11	
rans-1,2-Dichloroethylene	<0.04		<0.04		<0.04		<0.04		<0.04	
,1-Dichloroethane	<0.04		<0.04		7.19	(L)	1.16	(L)	1.89	(L)
nloroprene	<0.06		<0.06		<0.06		<0.06		<0.06	
romochloromethane	<0.003		<0.003		<0.003		<0.003		<0.003	
nloroform	<0.006		0.12	(L)	0.14	(L)	0.33	(L)	0.76	(L)
,2-Dichloroethane	<0.04		<0.04		<0.04		<0.04		3.40	(H)
,1,1-Trichloroethane	1.06	(L)	1.20	(L)	1.14	(L)	3.49	(L)	4.67	(L)
enzene	3.84	(M)	4.33	(M)	4.11	(H)	2.46	(H)	1.46	(H)
arbon tetrachloride	0.12	(L)	0.13	(L)	0.14	(L)	0.14	(L)	0.28	(L)
,2-Dichloropropane	<0.04		<0.04		<0.04		<0.04		<0.04	
romodichloromethane	<0.001		<0.001		<0.001		<0.001		<0.001	
richloroethylene	<0.004		0.08	(L)	0.08	(L)	0.09	(L)	0.40	(L)
is-1,3-Dichloropropylene	<0.04		<0.04		<0.04		<0.04		<0.04	
rans-1,3-Dichloropropylene	<0.04		<0.04		<0.04		<0.04		<0.04	
,1,2-Trichloroethane	<0.04		<0.04		<0.04		<0.04		<0.04	
oluene	16.25	(M)	17.69	(L)	18.26	(H)	7.89	(M)	6.41	(M)
ibromochloromethane	<0.001		<0.001		<0.001		<0.001		<0.001	
-Octane	<0.03		<0.03		<0.03		<0.03		<0.03	
etrachloroethylene	0.57	(L)	0.60	(L)	0.58	(L)	0.33	(L)	0.14	(L)
nlorobenzene	<0.02		<0.02		<0.02		0.11	(M)	0.12	(M)
thylbenzene	3.07	(H)	3.95	(L)	3.83	(H)	1.21	(H)	0.94	(H)
/p-Xylene/Bromoform	16.41	(L)	20.79	(L)	20.46	(L)	5.79	(L)	4.89	(L)
tyrene	<0.02		<0.02		<0.02		0.39	(L)	0.81	(M)
-Xylene/1,1,2,2-Tetrachloroethane	9.13	(L)	11.26	(L)	9.98	(L)	3.12	(L)	2.68	(L)
-Dichlorobenzene	<0.02		<0.02		<0.02		<0.02		3.08	(L)
-Dichlorobenzene	<0.09		<0.09		<0.09		0.36	(H)	0.18	(L)
-Dichlorobenzene	<0.02		<0.02		<0.02		0.18	(H)	<0.02	

(H) High confidence level (M) Medium confidence level (L) Low confidence level (Continued)
Replicate analysis D Duplicate sample

TABLE H-5. PLNJ (Continued)

Sample Date	9/04/92		9/14/92		9/21/92		9/24/92		9/28/92	
Sample ID	2269		2400		2513		2518		2569	
Compound	Concentration, ppbv									
Acetylene	<1.00		<1.00		<1.00		<1.00		<1.00	
Propylene	6.52	(H)	8.96	(H)	5.58	(H)	1.39	(H)	5.77	(H)
Chloromethane	0.64	(L)	0.54	(L)	0.56	(L)	0.51	(L)	<0.20	
Vinyl Chloride	<0.20		<0.20		<0.20		<0.20		<0.20	
1,3-Butadiene	<0.10		<0.10		<0.10		0.09	(L)	0.41	(L)
Bromomethane	<0.20		<0.20		<0.20		<0.20		<0.20	
Chloroethane	<0.10		<0.10		<0.10		<0.10		<0.10	
Methylene Chloride	<0.11		<0.11		<0.11		1.02	(L)	<0.11	
trans-1,2-Dichloroethylene	<0.04		<0.04		<0.04		<0.04		<0.04	
1,1-Dichloroethane	0.87	(L)	1.46	(L)	0.79	(L)	0.16	(L)	0.84	(L)
Chloroprene	<0.06		<0.06		<0.06		<0.06		<0.06	
Bromochloromethane	<0.003		<0.003		<0.003		<0.003		<0.003	
Chloroform	0.32	(L)	0.60	(L)	0.26	(L)	0.11	(L)	0.17	(L)
1,2-Dichloroethane	<0.04		5.23	(L)	<0.04		0.54	(L)	<0.04	
1,1,1-Trichloroethane	2.40	(L)	3.78	(L)	2.62	(L)	0.84	(L)	0.97	(L)
Benzene	2.40	(H)	3.19	(H)	1.83	(H)	0.60	(H)	2.21	(H)
Carbon tetrachloride	0.15	(L)	0.14	(L)	0.13	(L)	0.13	(L)	0.13	(L)
1,2-Dichloropropane	<0.04		<0.04		<0.04		<0.04		<0.04	
Bromodichloromethane	<0.001		<0.001		<0.001		<0.001		<0.001	
Trichloroethylene	0.19	(L)	0.58	(L)	0.15	(L)	0.05	(H)	0.07	(L)
cis-1,3-Dichloropropylene	<0.04		<0.04		<0.04		<0.04		<0.04	
trans-1,3-Dichloropropylene	<0.04		<0.04		<0.04		<0.04		<0.04	
1,1,2-Trichloroethane	<0.04		<0.04		<0.04		<0.04		<0.04	
Toluene	7.05	(M)	9.59	(H)	4.79	(H)	1.50	(M)	5.03	(H)
Dibromochloromethane	<0.001		<0.001		<0.001		<0.001		<0.001	
n-Octane	<0.03		<0.03		<0.03		<0.03		<0.03	
Tetrachloroethylene	0.33	(L)	0.45	(L)	0.20	(L)	0.14	(L)	0.33	(L)
Chlorobenzene	0.52	(H)	<0.02		0.09	(H)	0.05	(M)	0.08	(H)
Ethylbenzene	1.12	(H)	1.58	(H)	0.85	(H)	0.22	(H)	0.97	(H)
m/p-Xylene/Bromoform	5.52	(L)	7.72	(L)	4.06	(L)	1.20	(L)	5.04	(L)
Styrene	0.35	(M)	0.50	(L)	0.25	(L)	0.19	(H)	0.37	(L)
o-Xylene/1,1,2,2-Tetrachloroethane	2.87	(L)	4.32	(L)	2.16	(L)	0.61	(L)	2.60	(L)
m-Dichlorobenzene	<0.02		<0.02		<0.02		<0.02		<0.02	
p-Dichlorobenzene	0.25	(H)	<0.09		0.20	(H)	0.09	(L)	0.25	(H)
o-Dichlorobenzene	<0.02		<0.02		0.13	(H)	0.21	(H)	0.13	(H)

(H) High confidence level (M) Medium confidence level (L) Low confidence level

APPENDIX I

EXTERNAL AUDIT RESULTS LETTERS

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
ATMOSPHERIC RESEARCH AND EXPOSURE ASSESSMENT LABORATORY
RESEARCH TRIANGLE PARK
NORTH CAROLINA 27711

December 14, 1992

MEMORANDUM

SUBJECT: Propane and Hydrocarbon Analysis Program

FROM: Howard L. Crist
QASB/QATSD/AREAL (MD-77B)

TO: Neil J.Berg, Jr.
OAQPS (MD-14)

The results of the VOCs analyses by Radian Corporation of audit canisters provided by our contractor (ManTech) is attached. The overall identification and quantification of the unknowns was excellent.

cc: Phyllis O'Hara - Radian Corporation
Terri Sampson - Radian Corporation
William J. Mitchell (MD-77B)

Propane Audit Canister Results

PPMC

Audit #	Spiked	Reported	Difference, %
2186	1.97	1.92	-2.5
2267	0.45	0.55	22
2402	0.45	0.46	2.2
2474	1.98	1.94	-2.0

Hydrocarbon Program
Audit Canister Results

Audit # 2185 ppbv

	Spiked	Reported	Difference, %
Ethane	18.9	15.1	-20
Propane	20.5	12.6	-39
Isobutane	20.4	18.4	-9.8
n-Butane	20.9	19.4	-7.2
Isopentane	20.3	19.6	-3.4
n-Pentane	20.4	19.8	-2.9
3-Methylpentane	20.0	19.4	-3.0
n-Hexane	20.0	19.4	-3.0
Benzene	20.7	19.8	-4.3
n-Heptne	20.0	19.7	-1.5
Toluene	19.9	19.3	-3.0
n-Octane	19.8	19.3	-2.5
o-Xylene	19.3	17.8	-7.8

Hydrocarbon Program
Audit Canister Results

Audit # 2403

	Spiked	Reported	Difference, %
Isopentane	5.0	5.2	4.0
3-methylpentane	4.8	5.0	4.2
Benzene	5.0	5.5	10
Toluene	4.7	5.3	13
m-Xylene	5.0	9.3[a]	-3.1[a]
p-Xylene	4.6	-	-
o-Xylene	4.9	4.5	-8.2

(a) m,p-Xylenes combined

Hydrocarbon Program
Audit Canister Results

Audit # 2580

	Spiked	Reported	Difference, %
Isobutane	5.0	4.6	-8.0
n-Butane	5.2	4.7	-9.6
Isopentane	4.6	4.9	6.5
n-Pentane	5.0	4.6	-8.0
n-Hexane	5.0	4.7	-6.0
n-Heptane	4.8	4.6	-4.2
n-Octane	4.3	4.0	-7.0

MANTECH

To: Phyllis O'Hara
From: Ron Bousquet
Subject: Audit Results
Date: January 13, 1992

Here is the information you requested concerning the NMOC audit results.

	Spiked Value	Analytical Value	Analytical Bias
Audit # 2186	1.97 ppmC	1.91 ppmC	- 3.0 %
Audit # 2267	0.45 ppmC	0.45 ppmC	0.0 %
Audit # 2402	0.45 ppmC	0.52 ppmC	+ 16%
Audit # 2474	1.98 ppmC	1.90 ppmC	- 4.0 %
Audit # 2185			
Methane	1470	*	NA
Ethane	18.9	*	NA
Propane	20.5	*	NA
i-Butane	20.4	*	NA
n-Butane	20.9	*	NA
i-Pentane	20.3	21.6	+ 6.4 %
n-Pentane	20.4	*	NA
3-Methylpentane	20.0	19.0	- 5.0 %
n-Hexane	20.0	*	NA
Benzene	20.7	18.6	- 10 %
n-Heptane	20.0	*	NA
n-Octane	19.8	*	NA
Toluene	19.9	17.4	- 13 %
o-Xylene	19.3	18.7	-3.1 %

All concentrations = ppb.
* = Not Analyzed
NA = Not Applicable

ManTech Environmental Technology, Inc.

P.O. Box 12313, 2 Triangle Drive, Research Triangle Park, North Carolina 27709 919-549-0611 FAX 919-549-4665

Audit # 2403

	Spiked Value	Analytical Value	Analytical Bias
i-Pentane	5.0	5.0	0.0 %
Methylpentane	4.8	4.9	+ 2.1 %
Benzene	5.0	5.8	+ 16 %
Toluene	4.7	6.5	+ 38 %
m-Xylene	5.0	4.6	- 8.0 %
p-Xylene	4.6	4.5	- 2.2 %
o-Xylene	4.9	4.9	0.0 %

The zero air analysis performed during this run of samples contained 0.6 ppb Benzene and 1.2 ppb Toluene.

Audit # 2380

Methane	1377	*	NA
i-Butane	5	5.0	NA
n-Butane	5	5.2	NA
i-Pentane	5	4.6	NA
n-Pentane	5	5.0	NA
n-Hexane	5	5.0	NA
n-Heptane	5	4.8	NA
n-Octane	5	4.3	NA

All concentrations nominally 5 ppb except methane which is 1377 ppb.
* = Not analyzed
NA = Not Applicable

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
ATMOSPHERIC RESEARCH AND EXPOSURE ASSESSMENT LABORATORY
RESEARCH TRIANGLE PARK
NORTH CAROLINA 27711

Mail Drop 84
Phone: (919) 541-2829

January 5, 1993

Ms. Terri Sampson
Radian Corporation
3200 E. Chapel Hill Blvd.
P. O. Box 13000
RTP, NC 27709

Dear Terri:

I have completed the analysis of the 10 canister samples delivered to us in November 1992. The results for 52 hydrocarbon compounds along with total nonmethane organic carbon (NMOC) are provided in Table 1. The compounds included were not selected from any basic criteria except to represent typical paraffinic, olefinic, and aromatic compounds found in ambient air. TNMOC represents the sum of all gc peaks including both identified and unidentified compounds. Atypical compound compositions were observed in a few of the samples. Sample P-090 contained an extremely large propane peak that contributed about 65% to the TNMOC. Sample 2453 has a 1,2,4-trimethyl benzene peak that is about a factor of five higher than expected based upon other aromatic hydrocarbons. In sample 2435 a peak identified as methyl tertiary butyl ether (MTBE) was observed at a concentration of 74 ppbC. The n-pentane peak in samples P-090 and 2622 was severely overlapped by a near co-eluting tailing peak. Consequently the n-pentane concentrations provided in Tables 1 for these two samples must be considered as estimates.

If you prefer, I can provide print files of all gc peaks measured in the 10 samples. Look over the Table and contact me if you have any questions.

Sincerely yours,

Bill Lonneman

William A. Lonneman
Research Chemist
Gas Kinetics & Photochemistry Research Branch

cc: N. Berg

TABLE 1 SELECTED HYDROCARBON COMPOUNDS FROM THE ANALYSIS OF 1992 RADIAN SAMPLE CANISTERS, ppbC

	B3AL 2154	EPTX ~~2538~~ 2553	FWTX 2581	B1AL 2141	NWYK P-090	B2AL 2190	CHNC 2453	DLTX 2314	JUMX 2622	BMTX 2435
68 Ethylene	10.19	54.96	14.73	9.83	8.18	10.10	21.89	9.57	25.54	2.63
71 Acetylene	7.31	64.43	12.54	4.95	4.02	8.49	10.94	8.10	27.16	1.83
00 Ethane	7.49	48.37	22.10	8.69	7.32	4.43	6.46	14.64	29.30	8.39
25 Propene	4.69	24.41	6.59	3.16	56.74	4.55	5.38	4.19	11.57	1.45
00 Propane	6.38	91.64	19.56	13.63	828.27	11.24	11.61	17.72	48.66	11.94
54 isoButane	5.85	32.86	7.06	1.81	24.79	1.28	5.77	5.45	12.51	10.27
85 1-Butene	4.07	21.78	3.91	1.94	3.21	2.79	3.73	2.56	6.48	2.15
.96 1,3-Butadiene	0.85	3.72	1.50	0.58	0.51	1.14	1.23	0.90	2.26	0.24
.00 n-Butane	22.52	69.21	19.95	3.56	9.37	3.72	11.12	10.67	28.15	22.90
.62 t-2-Butene	1.56	10.85	1.41	0.41	0.66	0.74	1.15	0.47	0.35	1.17
.95 c-2-Butene	1.74	7.63	0.91	0.33	0.51	0.35	0.78	0.36	1.17	1.66
.32 3-Methyl-1-Butene	0.86	2.40	0.79	0.14	0.22	0.27	0.54	0.34	0.64	1.16
.58 isoPentane	52.21	117.70	39.05	7.87	10.39	11.99	26.16	19.06	34.29	36.60
.27 1-Pentene	1.97	5.71	1.73	0.29	0.51	0.54	1.25	0.74	1.55	1.70
.14 2-Methyl-1-Butene	3.56	4.49	2.62	0.45	0.73	0.98	2.28	1.34	3.05	2.82
.00 n-Pentane	16.94	72.77	14.92	3.63	17.09	4.83	9.48	8.44	39.27	14.03
.69 t-2-Pentene	4.64	8.94	2.77	0.64	0.51	1.19	3.21	1.99	2.96	3.18
.28 c-2-Pentene	2.29	4.88	1.50	0.37	0.35	0.67	1.49	0.86	1.66	1.62
.92 2-Methyl-2-Butene	5.25	1.08	3.21	0.83	0.78	1.60	3.69	2.16	4.16	4.07
.41 Cyclopentene	0.58	1.13	0.52	0.16	0.15	0.24	0.66	0.33	0.67	0.39
.99 Cyclopentane	1.32	6.90	1.71	0.39	0.51	0.44	0.96	1.02	2.43	2.13
.11 2,3-DiMethylButane	3.65	11.53	3.96	1.19	0.87	1.33	3.02	2.11	5.18	2.31
.12 2-MethylPentane	11.88	35.68	11.01	2.92	3.13	3.99	8.23	6.54	14.58	11.83
.42 3-MethylPentane	8.35	24.48	8.06	3.27	2.88	3.36	6.16	5.02	9.33	6.85
.35 2-Methyl-1-Pentene	1.50	1.03	0.72	0.28	4.63	0.27	0.71	0.90	0.88	0.18
.00 n-Hexane	5.44	30.97	6.37	2.09	2.68	2.33	4.93	4.40	13.08	6.08
~~.24 t-3-Hexene~~	~~0.68~~	~~1.62~~	~~0.60~~	~~0.22~~	~~0.35~~	~~0.34~~	~~0.64~~	~~0.47~~	~~0.48~~	~~0.39~~
.89 t-2-Hexene	0.80	2.47	0.77	0.28	0.40	0.42	0.71	0.66	1.06	0.45
.70 MethylCycloPentane	3.50	21.04	3.85	1.28	1.26	1.47	2.94	2.59	7.29	3.34
.15 2,4-DiMethylPentane	1.99	12.30	2.53	1.13	0.89	1.31	2.59	1.79	6.33	1.46
.92 Benzene	7.98	37.19	8.97	15.99	4.27	6.02	8.89	6.01	18.43	3.69
.11 CycloHexane	0.93	9.54	0.51	0.29	0.55	0.26	0.41	0.91	3.37	1.66
.68 2-MethylHexane	2.17	12.40	3.72	1.12	1.44	1.49	3.00	2.24	5.85	2.14
.58 2,3-DiMethylPentane	2.82	25.16	2.49	1.42	1.65	1.70	3.30	1.77	12.40	1.76
.21 3-MethylHexane	3.51	13.71	4.79	2.42	3.11	2.49	4.24	4.43	7.68	3.34
.57 2,2,4-TriMethylPentane	7.24	29.74	11.71	3.25	0.10	4.08	9.14	5.00	14.42	4.20
.00 n-Heptane	1.65	11.18	2.54	0.80	1.43	0.83	2.34	1.92	5.44	2.01
.45 MethylCycloHexane	1.66	8.53	2.55	1.09	2.25	1.06	2.03	2.37	3.65	2.54
.41 2,3,4-TriMethylPentane	2.16	10.36	3.74	1.07	0.80	1.32	2.85	1.84	5.16	1.11
.76 Toluene	19.09	82.82	26.71	11.32	9.92	10.66	24.20	16.33	65.19	6.69
.53 2-MethylHeptane	0.88	5.42	1.47	0.57	0.77	0.59	0.98	0.95	2.34	0.74
.20 3-MethylHeptane	0.87	5.90	1.67	0.49	0.64	0.63	1.16	0.99	2.79	0.66
.00 n-Octane	0.57	6.36	1.34	0.64	1.05	0.52	1.03	1.01	2.80	0.90
.84 EthylBenzene	3.14	16.63	4.88	1.73	2.20	2.22	3.99	2.89	14.18	1.83
.55 m-&p-Xylene	9.99	45.58	16.23	6.17	6.59	6.79	12.75	8.81	49.22	4.37
.29 Styrene	1.79	4.08	1.99	1.67	1.97	1.57	3.15	3.12	6.35	1.34
.99 o-Xylene	3.84	16.64	6.07	2.33	6.24	2.80	5.20	3.66	15.90	1.70
.00 n-Nonane	0.49	4.65	0.86	0.49	1.29	0.38	0.76	0.80	2.44	0.50
.39 1,3,5-TriMethylBenzene	1.43	6.23	2.53	0.10	0.89	1.51	0.46	1.75	0.55	0.10
.00 1,2,4-TriMethylBenzene	6.95	19.39	8.93	7.14	4.67	7.17	46.11	8.21	21.73	9.40
.00 n-Decane	0.87	5.56	1.29	0.58	1.58	0.86	1.16	1.03	3.27	0.88
.93 1,2,3-TriMethylBenzene	1.78	5.08	2.12	0.81	1.20	1.34	3.07	1.46	3.06	0.87
TNMOC	436.66	1496.18	458.13	238.88	1300.60	248.52	507.51	365.00	877.33	419.28

MEMORANDUM

TO: Bill Lonneman

FROM: Terri Sampson

COPY: Distribution

DATE: February 15, 1993

SUBJECT: Canister Confirmation Analysis

This is some information for the 10 canisters to be used for hydrocarbon analysis comparisons by your lab. The first 9 samples were through the NMOC/Speciated Hydrocarbon Program, the last sample is a New York sample from the PAMS program containing high fluorocarbon contamination.

Site Code	Sample Date	Radian ID	Can #
DLTX	9-10-92	2314	767
FWTX	9-30-92	2581	908
EPTX	9-30-92	2583	552(stamped on bottom rim)
B1AL	8-28-92	2141	663
B3AL	9-01-92	2154	140
BMTX	9-21-92	2435	678
CHNC	9-22-92	2453	077
B2AL	9-01-92	2190	810
JUMX	9-28-92	2622	623
NWYK	9-27-92	P090	A103086(Bar code ID)

Let me know if you need any further information.

Distribution

Neil Berg (EPA)
Phyllis O'Hara
Ray Merrill
Joann Rice

APPENDIX J

SPECIATED NMOC ANALYSIS METHOD

06 MAR 199

RESEARCH PROTOCOL METHOD FOR ANALYSIS OF C_2-C_{12} HYDROCARBONS IN AMBIENT AIR BY GAS CHROMATOGRAPHY WITH CRYOGENIC CONCENTRATION

Prepared by

Robert L. Seila
U.S. Environmental Protection Agency
Research Triangle Park, North Carolina 27711

and

Donald A. Cox
Quality Assurance Data Services, Inc.
Boone, North Carolina 26807

Prepared for

U.S. Environmental Protection Agency
Atmospheric Chemistry and Physics Division
Atmospheric Sciences Research Laboratory
Research Triangle Park, North Carolina 27711

SEPTEMBER 1988

RESEARCH PROTOCOL METHOD FOR ANALYSIS OF C_2-C_{12} HYDROCARBONS IN AMBIENT AIR BY GAS CHROMATOGRAPHY WITH CRYOGENIC CONCENTRATION

Approvals

Robert L. Seila — 11/5/88
Robert L. Seila — Date
Author - User

William A. Lonneman — 11/15/88
William A. Lonneman — Date
Author - User

Ronald K. Patterson — 11/16/88
Ronald K. Patterson — Date
ASRL QA Officer

DISCLAIMER

The Research Protocol/Method (RPM) described herein should not be interpreted as a generally accepted standard or equivalent method or procedure. This RPM was developed for use within the Atmospheric Sciences Research Laboratory of EPA and may not be applicable to the needs of other organizations.

1.0 SCOPE AND APPLICATION

This recommended method is intended for analysis of C_2-C_{12} hydrocarbons (HC) in ambient air. The method's minimum quantification limit (MQL) is 0.12 ppb carbon; the method's minimum detection limit (MDL) is 0.04 ppb carbon. The MQL and MDL were determined by the method described by Knoll (reference 1).

2.0 SUMMARY OF METHOD

A known volume of gaseous sample is passed through a cryogenicaly cooled trap, cooled with liquid oxygen or liquid argon, cryogenicaly cooling traps out C_2 and heavier hydrocarbons without trapping methane. The trap containing the condensed HC's is warmed with hot water and its contents injected into a gas chromatograph (GC) capillary column where separation of the C_2-C_{12} hydrocarbons takes place. Detection of the hydrocarbon is by flame-ionization detector (FID), and the resultant peaks are quantified and recorded by an electronic integrator.

3.0 DEFINITIONS

3.1 Accuracy - The degree of agreement of the measurements with the true value of the propane Standard Reference Material (SRM) measured.

3.2 Precision - The repeatability of propane measurements from the same canister under essentially the same conditions.

4.0 INTERFERENCES

Any hydrocarbon compound that elutes with the same retention times as any of the C_2-C_{12} hydrocarbons and responds to flame ionization detection will interfere in this method.

5.0 PERSONNEL REQUIREMENTS

The researcher using this procedure is expected to be familiar with gas chromatographic practices and able to operated the instrument following the manufacturer's manual. Operator requirements will include daily startup procedures, instrument sensitivity adjustment, maintenance schedules, and other manufacturer's recommendations.

6.0 FACILITIES REQUIREMENTS

No special laboratory facilities are required.

7.0 SAFETY REQUIREMENTS

The calibration standards, collected sample, and most laboratory reagents used in this method pose no hazard to the researcher if normal laboratory safety practices are followed. Eye and hand protection are required when using liquid nitrogen and argon or other cryogens. Combustion is possible when using liquid oxygen, and its contact with all flammable materials must be avoided. In addition, electrical connections can also pose a hazard.

The American Chemical Society (ACS) guideline regarding the safe handling of chemicals used in this method is required.

7.1 EPA Safety Regulations

Information on EPA Safety Regulations are included in text.

7.2 Vacuum Systems

See page G9 of the EPA/RTP Safety Manual (ref. 2) for precautions.

7.3 Heated Surfaces

The GC injection ports, column, column oven, and detectors are maintained at temperatures high enough to cause burns. The researcher should exercise caution to avoid contact with these surfaces.

7.4 Immersion Heater

WARNING - The immersion heater must always be immersed in water, otherwise very high temperatures to be reached with the possible ignition of combustible materials and reduction of the operating life.

7.5 Compressed Gases

See pages F14 through F18 of the EPA/RTP Safety Manual (ref. 2) for safety precautions. The following are specific safety requirements for this method.

7.5.1 <u>Hydrogen</u>

Hydrogen gas cylinders used for FID fuel are not permitted in the RTP Tech Center. Hydrogen cylinders and their regulator must be secured outside the building, and a stainless steel pressure line run into the laboratory.

7.5.2 Cryogenic Liquids

See pages F18 through F20 of the EPA/RTP Safety Manual (reference 2) for precautions.

7.5.2.1 Liquid Oxygen (if used)

WARNING - Strong oxidant. Vigorously promotes combustion. Avoid contact with all flammable materials. Containers, lines, valves, and vents must be free of oil and grease. May cause severe frostbite. Wear eye and hand protection.

7.5.2.2 Liquid Nitrogen and Liquid Argon (if used)

WARNING - Cryogenic fluid. May cause severe frostbite. Wear eye and hand protection. Use with adequate room ventilation. Keep contact with air to a minimum to avoid buildup of liquid oxygen (see above).

8.0 APPARATUS AND EQUIPMENT

This section describes the instrument requirements for this method.

8.1 Gas Chromatograph

The gas chromatograph is equipped with a temperature programmed oven that holds the separation column, flame-ionization detector (FID), and electronic integrator. This method uses an HP 5880A Gas Chromatograph with the following specifications:

8.1.1 Gas Chromatograph Column

Type: fused silica capillary column.

Diameter: 0.32 mm ID.

Length: 60 m.

Liquid Phase: DB-1 bonded liquid phase (J&W Scientific Inc., Folsom, Calif.)

Liquid Phase Thickness: 1.0 um.

8.1.2 Inlet System

The inlet system is illustrated in Figure 1. The automatic six-port gas sampling valves (V4 and V5, Figure 1) are located on an aluminum block which is temperature regulated. All other valves are at ambient temperature.

8.1.2.1 Connection of Inlet System to Column

A 5" length of 1/4in. x 0.75 mm OD glass tube (Supelco,Inc.) is used to connect the gas sampling valve to the column. At the value end of the glass tube, there is a 1/4-in to 1/16-in Swagelok™ SS reducing union; at the column end is a 1/4-in to 1/16-in specially modified reducing union (Supelco, Inc.). Graphite/Vespel ferrules are used.

8.1.3 Trap

The sampling trap is constructed of clean, chromatographic grade, 3.2 mm (1/8 in) OD stainless steel tubing, 16 cm in length, which is bent into a U-shape approximately 7 cm from each end so that the U is approximately 2.2 cm in width. Clean, untreated 60/80 mesh glass beads are poured in the U tube to a height of approximately 3 cm. Silanized glass wool is used as a plug to the last cm of both ends. 1/16"-1/8" unions are added to each end for connection to the gas sampling valve.

8.2 Mass Flow Meter

A thermal conductivity mass flow meter (M1, Figure 2) (TYLAN Corp., model FM 360, 0 to 500 standard cm3/min or equivalent) is used to measure the flow rate through the cryogenic trap. See the following ASRL-ACPD-RPM-??? for mass flow meter operation instructions.

8.3 Pressure Gauge

A precision Bourdon gauge (P1, Figure 1), with a range of 0 to 200 Torr (absolute), is used. A gauge with a range of 0 to 400 Torr is also acceptable.

8.4 Vacuum Pump

An oil-less diaphragm pump (such as Thomas model 2106CA13-515-2) is used to evacuate the inlet system.

CAUTION: Due to the possibility of contamination, oil-sealed vacuum pumps should not be used.

8.5 Tubing and Connectors

All tubing is chromatographic grade stainless steel. All connections are stainless steel compression tube fittings (Swagelok™ or equivalent).

8.6 Regulators for compressed gases

Carrier gas, hydrogen, and air delivery pressures are controlled by two-stage regulators mounted at the tank.

NOTE: The H_2 regulator is outside of the building at RTP. Other gases have regulators on the inside line.

CAUTION: Due to the possibility of contamination by organic materials, only regulators with stainless-steel diaphragms should be used.

8.7 Immersion Heater

An immersion heater is used to heat a water bath that heats the trap, volatilizing the cryogenically trapped gases.

9.0 REAGENTS/MATERIALS

All gases used to operate the GC system are high quality grade and may vary in specifications with manufacture. Instrument calibration gases are obtained from the National Bureau of Standards (NBS) and are referred to as Standard Reference Materials (SRM). Use of reagent grade chemicals for all dilutions and standards materials is recommended.

9.1 Gases and Cryogens

The following is recommend for use with this method.

9.1.1 Helium Carrier Gas

High purity, minimum purity of 99.995 percent helium carrier gas is best, Bureau of Mines.

9.1.2 Detector Air

Linde zero grade with total hydrocarbons <1 ppm, or equivalent.

9.1.3 Detector Hydrogen

Prepurified grade 99.99 percent pure or equivalent.

9.1.4 Detector Makeup Nitrogen

Prepurified grade 99.99 percent pure (or equivalent).

9.1.5 Liquid Nitrogen (for GC oven cooling)

Commercial grade acceptable.

9.1.6 Liquid Oxygen (for trap cooling)

Commercial grade acceptable.

9.1.7 Liquid Argon (for trap cooling)

Liquid argon may be used instead of liquid oxygen for trap cooling. Although liquid argon is more expensive, it is inert, and its use eliminates the oxidant hazard associated with liquid oxygen. Commercial grade is acceptable.

9.1.8 Propane in Air (for calibration)

NBS SRM 1665, 3 ppm (nominal) propane in air.

9.1.9 Instrument Air Vacuum

The six-port gas sampling valves require clean filtered air at 350 kPa (35 psig) and a vacuum of approximately 20 in Hg for operation.

10.0 SAMPLE/SAMPLING PROCEDURE

This RPM is generally limited to the laboratory analysis but could also be used for field analysis. Field sampling and canister preparation procedures are covered separately (See reference 3.). Canister containing the sample are connected into the system as shown in Figure 1.

11.0 CALIBRATION AND STANDARDIZATION

11.1 Mass Flow Meter Calibration

For calibration see ASRL-ACPD-RPM XXX

11.2 Pressure Gauge Calibration

For calibration see ASRL-ACPD-RPM XXX

11.3 Gas Chromatograph Calibration

To perform a calibration in the parts per billion carbon (ppbC) range, the following procedure is utilized:

11.3.1 Instrument Optimization

A propane in air sample should be first analyzed and adjustments made to the carrier gas linear velocity such that the propane peak elutes at 3.105 min (3 min 6 sec) following injection. Using the capillary column and temperatures specified in this document, these C_2-C_{12} HC compounds should elute in the order of the retention times

given in Table 1. (This assumes that the carrier gas flow rate is pressure controlled). The actual eluting times should be determined by preparing and analyzing known samples of each compound and depends upon column length , carrier flow rate, column temperature, etc.

The flame-ionization detector and air flow rates are adjusted according to the manufacturer specifications for proper operation and optimum signal to noise ratio. These flow-rates for the HP5880 are 30 cm^3/min for hydrogen and 400 cm^3/min for air.

11.3.2 Calibration Using Propane

The response of the FID is assumed to be linear with respect to the number of carbon atoms present in the detected compound (reference 3). Thus, it is convenient to measure compound peak concentration (conc.) in terms of parts-per-billion-carbon (ppbC) where

Conc.,ppbC = (number of carbon atoms in compound)(Conc.,ppb)

For a fixed sample volume, the concentration is proportional to the area under the chromatographic peak. The area under the chromatographic peak is converted to ppbc concentrations by the integrator by the following calculation.

$$\text{Conc., ppbC} = (k)(\text{Area})$$

Area is given in integrator counts and k is an experimentally determined calibration constant (ppbC/count). The same value of k is used for all compounds. The calibration constant k is determined by analysis of an NBS SRM propane in air standard. The value of k is then given by:

$$k(\text{ppbC/count}) = \frac{3(\text{Conc.NBS Standard Propane,ppm})(1000\ \text{ppbC/ppm})}{\text{Median Area Count}}$$

Three to five concentration levels of the standard are needed to generate a suitable calibration curve. Two to three repeated sample injections per calibration level are made. Averaged values of K are calculated and recorded in the laboratory notebook, and the mean or median value taken. Example are given in Exhibit 1. below.

EXHIBIT 1. LABORATORY NOTEBOOK RECORD

Calibration of the HP-5880A GC equipped with J&W DB-1 fused silica column

Propane SRM: 2.83 ± 0.03 umole/mole(ppm)
8490 ppb as carbon

Cylinder Number : FF18831, Sample Number 85-51-E

Sample	Volume cm^3	Equivalent Propane Conc. (ppbC)	Area of Propane Peak	Response Factor Conc/Area
1a	420	8490	28014.4	0.303058
1b	420	8490		
1c	420	8490		
2a	316	6367.5	21191.7	0.300471
2b	316	6367.5		
2c	316	6367.5		
3a	210	4245	14013.5	0.302922
3b	210	4245		
3c	210	4245		
4a	105	2122.5	6861.1	0.309353
4b	105	2122.5		
4c	105	2122.5		

For this example: n=4 r2= 1.00 y=-0.139 + 3.328X. The mean ($\bar{X}$) is 0.30395 and 0.30299 is the median and conc. (ppbc) = 0.30048 x (area) + 0.042

Where Y = conc. (ppbc), M = 0.30048, X = area, B = 0.042 and Y = M x + B

11.3.3 Calibration Quality Control

It is assume that the NBS propane standard is reliable and valid for 2 years from date of purchase. Three to five different concentrations of the NBS standard and one zero standard are injected and the response factors are obtained, as discussed above. The percent difference of the response factor from the mean shall be no more than 5%. The percent difference is calculated by:

% Diff. = ((Response - Mean)/Mean) x 100

For example:

Response Factor	Mean	Difference	% Difference
0.303058	0.30395	0.000892	0.29
0.300471	0.30395	0.003479	1.14
0.302922	0.30395	0.001028	0.34
0.309353	0.30395	0.005403	1.78

Problems leading to a failure of the system to meet the above requirement for the response factors must be corrected before proceeding with the analysis. Minor variations from the proper value are probably due to operator error. However, large variations are probably attributable to equipment problems.

It is assumed that the response of the FID is linear with respect to the number of carbon atoms present (i.e., r^2 should be $\geq$ .95). This assumption has been previously verified (ref. 3) for several hydrocarbon compounds. The intercept should be not significantly different from zero at a =0.05. A positive intercept implies propane contamination.

Procedures for least-squares method of fitting a linear or nonlinear function to the calibration data set are found in appendix J of reference 4. The calculation for linear function is:

$$b = \frac{n(\sum xy) - (\sum x)(\sum xy)}{n(\sum x^2) - (\sum x)^2} = \text{slope of fitted line}$$

$$a = \frac{\sum y - b(\sum x)}{n-1} = \text{intercept of line}$$

Where n = number of points, x = area of propane peak, and y = equivalent propane conc.

11.3.3.1 Establishment of Standard Error of Estimate

After the calibration curve statistics has been calculated, the standard error of estimate or (Se) can be calculated using:

$$Se = \sqrt{(((\sum y^2 - a(\sum y) - b(\sum xy))/n-2)}$$

Whereas, a = y-intercept, b =slope and n= number of points in the calibration curve

A calibration will show variation in both slope and intercept over time and the SE will become larger. The Se has properties analogous to those of the standard deviation and can be used as an indicator of curve degradation. For data analysis, the SE will be used to compute the upper and lower limits for a single data observation (xobs) based on the calibration curve data using:

$$(a + (b\ xobs)) \pm ta/2 \times Se \times \sqrt{1 \pm \frac{1}{n} + \frac{n(xobs - \bar{x})2}{n(\sum x^2) - (\sum x)^2}}$$

Whereas ta/2 is obtained from the t distribution table at 95 % and the number of degrees of freedom is n-2.

11.3.3.2 Establishment of Initial Warning and Control limits

After the initial calibration curve has been constructed according to 11.3.2, reanalyze additional samples of the low and high concentration standards. Calculate the concentrations using the previously derived calibration curve. Repeat this procedure until at least ten determinations at each concentration level have been made. These additional high and low concentrations should be collected on ten different days to provide a realistic estimate of the method daily variability. Calculate standard deviation(s) at each concentration level (i.e., highest and lowest standard). Use the mean concentration as the mean value ($\bar{X}$) for determining the control limits. A warning limit of $\bar{X} \pm 2s$ (95 %) and a control limit of $\bar{X} \pm 3s$ (99 %) should be used.

11.4 STANDARDIZATION

Information to be supplied at a later date.

12.0 ANALYSIS PROCEDURES

The analysis procedure is divided into two stages: Sample preparation and gas chromatographic analysis.

12.1 Preparation Stage

The sample preparation steps are:

A. Adjust instrument gas flow rates.

1) Turn off the FID and FID heater - allow to cool to room temperature.

2) Attach a soap film flow meter to the detector chimney (see instrument instruction manual for an illustration this apparatus.

3) Set the carrier gas (Helium) pressure to 200 kPa (29 psia).

4) Set the hydrogen pressure to 250 kPa (35 psia).

<u>WARNING</u> - Hydrogen delivery pressure should be less than detector air pressure.

Adjust the hydrogen flow to 28-30 cm^3/min.

5) Set the detector air pressure to 300 kPa (45 psia). Adjust the detector flow to 430 cm^3/min $\pm$ 10 cm^3/min.

6) Set the makeup nitrogen pressure to 300 kPa (45 psia). Adjust the nitrogen makeup and carrier gas flow rate to a total flow of 30 cm^3/min.

NOTE: The above flow rates were optimized for the given column on an HP 5880A gas chromatograph with FID. If another gas chromatograph is used, adjust the flow rates to obtain maximum sensitivity according to the manufacturers instructions for that instrument.

B. Adjustment of Carrier Gas Flow Rate

Verify that the carrier gas (Helium) pressure is at 29 kPa. Refer to Section 1.11.1 for fine tuning of the carrier gas flow rate. Flow rate is dependent upon the column head pressure.

C. Set Up Detector

With the flow rates adjusted as in Step A, remove the adapter from the FID chimney and reset the detector temperature to 250°C. Light the detector with the ignitor and check that combustion is taking place.

D. Column and Value Temperatures

Detector = 250°C.

Initial Oven Temperature = -50°C.

Oven Temperature Programming Rate = 8°C/min (temperature programming started 2 minutes after time of injection).

Final Oven Temperature = 200°C.

Six-Port Valve Temperature = 60°C.

12.2 Analysis Stage

Preconcentration and injection of the sample is carried out as follows. Initial conditions are these: V2 is closed, vacuum pump is on, valves V3 and V6 are closed, gas sampling valves V4 and V5 are in the off position (Figure 1). Attach the canister to be analyzed to the inlet line. Open valves V3 and V6 to evacuate the system. When the vacuum gauge (P1) reaches 50 Torr or below, close valve V6. The system should remain at or very near 50 Torr. A rising pressure indicates a leak in the system.

The sample concentrating trap is immersed in a Dewar flask containing liquid oxygen (or liquid argon) sufficient to cover most of the "U" but placed so that the compression fittings are neither inside the flask nor touching the liquid cryogen. If the fittings are inside the flask, sample will condense in the fittings instead of on the trap. This could result in either plugged carrier gas flow due to ice forming in the fitting and/or improper sample plug injection of the trapped hydrocarbons.

Open valve V2 and adjust valve V1 to a flow of 100 cm3/min, using mass flow-meter M1. When the pressure gauge (P1, Figure 2) is at 60 Torr, actuate valve V4 (V4 is switched to one direction, see Figure 2). Adjust flow rate back to 100 cm^3/min, using valve V1, if necessary.

When P1 reads 140 Torr, inject sample onto column by actuating valve V5 (Figure 3), removing liquid oxygen flask from trap, immersing the U-trap in the hot water bath, and pressing start button on electronic integrator (and GC, if needed); deactivate valve V4 (Figure 3).

CAUTION: It is extremely important that V5 be closed before removing the liquid oxygen flask from the trap. Failure to observe this sequence will permit light hydrocarbons to be vented before injection.

At a time of 2 minutes into the run, deactivate valve V5. Stop the run manually or automatically after approximately 35 minutes or when the last compound of interest elutes. Identify sample peaks by their retention times, as determined in Section 11.3.2. An example chromatogram is shown as Figure 4.

At least one QC sample (Section 18.0) is run routinely. Upon completion of the sample run, calculate and review the QC results to determine if there are any significant differences. Any value falling outside the control limits is indicative of a system problem and requires corrective action (Section 15.0) before continuing analysis of samples.

13.0 CALCULATIONS

Using the calibration constant (k) determined in section 11.3.2, calculate the concentration of each compound (peak) as follows:

$$\text{Concentration, ppbC} = (k)(\text{Area})$$

where the area is in integrator counts. Most integrators may be programmed to perform this calculation and present results directly in units of concentration.

13.1 Ambient Data

To calculate the upper and lower limits of the concentration (i.e., Limits of prediction), the appropriate formula to calculate the limits of prediction are given in section 11.3.3.1

14.0 Data Reporting

The concentration of each C_2-C_{12} hydrocarbon should be reported. The integrator chart of sample and calibration standard should be saved as a record of analysis. Data tape from the integrator computer system should be identified, logged in the laboratory notebook, and stored. Sample run report should be recorded in the laboratory notebook in the following format:

Day Month
Notes: (e.g., QC, Standard, Duplicate, Replicate, etc.)

ID	SITE	DATE	CAN#	PEAKS	DB-1	TAPE	(COMPARISONS)

Other forms of computer data storage should be noted when they occur. It is recommended that all C_2-C_{12} hydrocarbon peak data be stored in a computer compatible format for ease of reporting and analysis.

15.0 Corrective Action

Corrective action should be taken whenever any of the following are observed:

- Internal QC checks exceeding limits.
- Variation of response, as shown by more than a ± 15 percent change in calibration constant.
- Variation of ±0.2% of retention times for specific peaks.
- Poor or ill-shaped peaks (wide or shallow).
- Fused or combined peaks.
- Presence of other peaks which elute with the compounds of interest (C_2-C_{12} hydrocarbons).
- Integrator failure to correctly recognize start time, stop time, or to correctly determine baseline and peak areas.

Determination of the proper corrective action requires a knowledge of chromatographic principles and instrumentation beyond the scope of this document.

16.0 METHOD PRECISION

Based on repeated analysis of NBS SRM propane in air Standards over a one year period, the variation of the calibration Constant (k) was found to be within ± 15 percent of the initial value. Replicate analysis of ambient air samples for total nonmethane organic compounds (NMOC) using a similar technique (reference 2) showed an analytical precision of approximately ± 12 percent. The precision for C_2-C_{12} hydrocarbons should be similar. Method precision will be determine from replicate analysis of the RTI canister or duplicate measurements made at concentration levels representative of the range experienced by routine samples. Operator and daily instrument precision will be determined from duplicate analyses of ambient canisters.

17.0 METHOD ACCURACY

Due to the lack of suitable NBS standards for the range of hydrocarbons, the accuracy for analysis of all hydrocarbons (C_2-C_{12}) cannot be directly determined using the propane standard. For this method, the propane SRM will be used to determine the accuracy. External audits are an essential part of the method QA program and performance audits may be used to determine instrument accuracy.

18.0 DAILY QUALITY CONTROL

This section specifies the daily QC program and discusses responsibilities for evaluation of the QC data. Calibration QC is discussed in section 11.3. These procedures require real-time review of analytical performance by the analyst, and QC review of all data directly after input to the data base.

18.1 QC Checks and Frequency

One sample of NBS SRM propane in air should be analyzed at the beginning of each day that a sample is run. One or more QC canisters will be run during the sampling day. Duplicates of the QC canisters will be run to detect procedural or operator bias as part of the real-time within-day QC review. Replicates will be run to detect variability in the instrument performance (day to day) and to determine the instrument precision.

18.1.1 Duplicates

Positive or negative differences of duplicate measurements are indicative of gross method error or procedural in-run operator bias. The data obtained from duplicate measurements will be used to determine when the GC is out of statistical control. The percent difference of the results should be no more than 10%.

The standard deviations used to generate the initial QC control limits (section 11.3.5) can be used to evaluate to the duplicate differences initially. Duplicate measurements should agree within $2\sqrt{2}\,s$ (or 2.83 times the s). After a reasonable period of time (i.e., ten or more duplicate measurements), the following procedure for calculating new duplicate control limits should be performed.

For duplicate measurements x and y, where x and y are the observation in the order obtained, the difference d = x -y is calculated and recorded. To determine duplicate control limits after ten to fifteen sets of duplicates, the formula for s is:

$$s = \sum d^2/2k$$

where k is the number of subgroups or pairs of duplicate analyses. The average range (R) for duplicates is:

$$\bar{R} = \sum \left| d \right| /k$$

Control limits can be reestablished based on the number of duplicates performed over a period of time. Control charts for differences and ranges can be constructed by $\pm 3\sqrt{2}s$ with the central line being 0; the limit for the range can be obtained from D4R (Ref. 4, Section H for D4 value).

18.1.2 Replicate Measurements

Positive or negative differences of analysis replicate measurements with respect to the initial value measured are indicative of a method error or operator day to day bias. The data obtained from these measurements will be use to determine when the measurement system is out of statistical control and to determine analytical precision.

Historical replicate data must first be combined as necessary to develop an assessment of precision that defines the expected standard deviation of replicates. The standard deviations used to generate the QC control limits (section 11.3.5) can be used initially. Recent and historical patterns are essential to evaluating the control status using replicate measurements. The number of replicate measurements needed for an experiment will be determined on the historical or recent variability of the system.

Given a series of repeated measurements (R1,R2,---Rn), the formula for s is:

$$s = \sum(D)^2/2k$$

where k is the number of replicate pairs and D is difference between the pair values. It is important that all replicates are determined under identical conditions and that the distribution of repeated results is approximately "normal" to establish the control limits. It is recommended that the standard deviation and range charts be used and the Control limits are set at 3s and 2s . A ratio greater than 1.3 between-run (replicates) and within-run (duplicates) should be considered "statistically significant" and corrective action taken. Reestablish new control limits whenever instrumental operation conditions are varied, calibrations performed, or QC constrictions are changed.

18.1.3 Control Chart for QC Canisters/Samples

The measured value of the QC sample is plotted on the control charts for the QC sample concentration differences or as an percent difference. The measured value (ppbC) should not differ by more than two times the standard deviation of NBS-certified value (ppb). If this occurs, the system should be checked for proper operation. If the condition persists, or if two successive QC measurements are outside of the $\pm$ 2s limits, or if the measured value exceeds the upper or lower control limit (three standard deviations, section 11.3.5), the detector should be cleaned and checked for correct operation. If the response remains outside the upper or lower control limit, then the instrument should be recalibrated and/or corrective action taken. Plot the data obtained from the QC measurements on a control chart for routine assessment of analytical bias and precision.

18.1.4 Control Chart for Daily NBS SRM

The measured value of the daily NBS SRM propane sample is plotted on a control chart. The measured value (ppbC) should not differ by more than two times the standard deviation of NBS-certified value (ppb) If this occurs, the system should be checked for proper operation. If the condition persists or the measured value exceeds the upper or lower control limit (three standard deviations, section 11.3.5), corrective action should be performed before any further sample analysis. This includes checking the sample preconcentration procedure and the GC analysis system for proper operation. If the response remains outside the upper or lower control limit), then the instrument should be recalibrated.

18.2 Performance Evaluations

Participation in performance evaluation studies is recommended for this method. The samples used for these performance audits should contain the species of interest at concentrations within the normal working range of this method. The true values should remain unknown to the analyst until the end of the study to prevent operator bias.

18.3 Systems Audits

This section contains the recommended procedure for performing an system audit for this method. The need for and scheduling of systems audits will be determine by the Project Officer. The basic scope of the system audit will be:

1. to verify the adherence to this research protocol/method; and

2. to verify the data flow and archiving process used for the computerized data base.

Organizations performing systems audits should review the following sections and the audit questionnaire (Appendix A). It is recommended that the independent audit plan be compared to this document and differences noted. In all cases, methods for assessing the data quality for this method must be approved by the organization being audited prior to starting the audit.

18.3.1 Audit Plan

1. Meet with organizational personnel, identify key personnel, identify the purpose of the audit, and review audit plan and questionnaire.

2. Collect all QC Documentation (i.e., QC Charts, forms, notebooks, etc.) and data base print outs.

3. Perform audit of sample analysis.

4. Perform audit of sample data processing activities.

5. Perform audit of data validation.

6. Perform audit of data base.

7. Complete audit questionnaire.

8. Hold audit review meeting and critique audit findings. Make corrections to audit findings or questionnaire if required. Discuss corrective action plans, if appropriate.

It is suggested that data quality might be assigned one of three levels according to the following guidelines:

1. Unknown quality - a vital piece of QC data is missing or can not be verified.

2. Questionable quality - generally all data and documents are in good order, but a secondary item needed to completely characterize the data is missing, e.g., a control chart to demonstrate that the method was in control over a given time interval.

3. Known quality - all documentation is in order, with data traceable from the final report to the date and time of the analysis.

18.3.2 Documents

The following documents will be reviewed at the time of the audit:

1. Laboratory notebooks or forms for method.

2. QC charts for duplicates or replicates

3. At least five previous calibration curves.

4. Instruction manuals and related SOP's or RPM's

5. Documents relating to quality of materials used.

6. All documentation for GC computer, data validation, and data storage

7. All documents related to compliance with ASRL QA plan requirements.

19.0 DATA VALIDATION

Data will be critically reviewed to identify and isolate errors. Data validation occurs at each step of the measurement process, beginning with the GC electronic integrator. Once data enters a computerized storage and retrieval system, a more detailed screening process is required.

20.0 QUALITY ASSURANCE REPORTS TO MANAGEMENT

Laboratory QC data and audit results are reported quarterly. A report will be submitted to management anytime for one or more of the following:

1. When a significant discrepancy is noted and an examination of the analytical procedure reveals not apparent reason for the discrepancy;

2. When the analysis comparing the commercial and NBS standards indicates serious deterioration of the commercial standard; and

3. When audit results or out-of-control situations are noted that indicate that the method is producing data of unknown quality.

21.0 PREVENTIVE MAINTENANCE

To be defined at later date.....

REFERENCES

1. Knoll, J. E., Journal of Chromatographic analyses, Vol. 23, p. 422, September 1987.

2. EPA/RTP Safety Manual, Support Services Office, Environmental Research Center, Research Triangle Park, NC 27711.

3. Dietz, W. A., Journal of Gas Chromatography, Vol. 5, pp. 68-71 (1967).

4. Quality Assurance Handbook for Air Pollution Measurements, Volume 1. Principles (EPA-600/9-76- 005 Dec 1984).

GLOSSARY

BIAS
- An error in a method that systematically distorts results.

REST TO BE DEFINED LATER

APPENDIX A

TABLE OF
HYDROCARBON IDENTIFICATIONS AND RETENTION TIMES

Clarins

Altera

TABLE 1. HYDROCARBON IDENTIFICATIONS AND RETENTION TIMES

HP5880 Calibration Table

CAL. NO.	Ret. Time	REF	Compound Name	CAL NO.	Ret. Time	REF	Compound Name
0	0.000	0	Uncalibrated	101	2.018	0	ETHANE
102	1.830	0	ETHYLENE	103	1.960	0	ACETYLENE
104	2.988	0	PROPENE	105	3.105	0	PROPANE
106	3.373	0	Unknown	107	3.540	0	PARAFFIN
108	4.017	0	OLEFIN	109	4.450	0	OLEFIN
110	5.105	1	ISOBUTANE	111	5.423	0	Unknown
112	5.661	0	Unknown	113	6.115	0	2-METHYLPROPYLENE
114	6.286	0	BUTENE-1	115	6.462	1	n-BUTANE
116	6.937	0	t-2-BUTENE	117	7.500	0	c-2-BUTENE
118	8.739	0	C4 OLEFIN	119	9.398	1	ISOPENTANE
120	9.652	0	C5 OLEFIN	121	10.000	0	1-PENTENE
122	10.086	0	C5 OLEFIN	123	10.272	0	2-METHYL-1-BUTENE
124	10.410	1	n-PENTANE	125	10.560	0	ISOPRENE
126	10.737	0	t-2-PENTENE	127	11.008	0	C5 OLEFIN
128	11.116	0	C5 OLEFIN	129	11.172	0	c-2-PENTENE
130	11.256	0	C5 OLEFIN	131	11.505	0	C6 PARAFFIN
132	11.551	0	C6 PARAFFIN	133	11.672	0	2,2-DIMETHYLBUTANE
134	11.994	0	C6 OLEFIN	135	12.252	0	C6 OLEFIN
136	12.486	0	C6 PARAFFIN	137	12.490	0	C6 OLEFIN
138	12.631	0	CYCLOPENTANE	139	12.763	0	2,3-DIMETHYLBUTANE
140	12.848	0	C6 OLEFIN	141	12.957	1	2-METHYLPENTANE
142	13.031	0	C6 OLEFIN	143	13.097	0	C6 OLEFIN
144	13.369	0	C6 OLEFIN	145	13.440	0	3-METHYLPENTANE
146	13.643	0	C6 OLEFIN	147	13.850	0	C6 OLEFIN
148	14.062	0	1 n-HEXANE	149	14.164	0	C7 PARAFFIN
150	14.240	0	C7 OLEFIN	151	14.317	0	C7 OLEFIN
152	14.406	0	C7 OLEFIN	153	14.543	0	C7 OLEFIN
154	14.605	0	C7 OLEFINN	155	14.750	0	C7 OLEFIN
156	14.898	0	METHYLCYCLOPENTANE	157	15.085	0	2,4-DIMETHYLPENTANE
158	15.177	0	C7 PARAFFIN	159	15.281	0	C7 OLEFIN
160	15.523	0	C7 OLEFIN	161	15.657	0	C7 PARAFFIN
162	15.681	1	BENZENE	163	15.878	0	3,3-DIMETHYLPENTANE
164	15.980	0	CYCLOHEXANE	165	16.056	0	C7 OLEFIN
166	16.320	0	2-METHYLHEXANE	167	16.358	0	2,3-DIMETHYLPENTANE
168	16.437	0	C7 PARAFFIN	169	16.507	0	C7 OLEFIN
170	16.592	0	3-METHYLHEXANE	171	16.785	0	C7 PARAFFIN
172	16.916	0	C7 PARAFFIN	173	17.007	0	2,2,4-TRIMETHYLPENTANE
174	17.316	0	C8 OLEFIN	175	17.358	0	n-HEPTANE
176	17.507	0	C8 PARAFFIN	177	17.667	0	C8 OLEFIN
178	17.762	0	C8 OLEFIN	179	17.984	0	METHYLCYCLOHEXANE
180	18.343	0	C8 PARAFFIN	181	18.407	0	C8 PARAFFIN
182	18.602	0	C8 PARAFFIN	183	18.816	0	C8 PARAFFIN
184	18.897	0	2,3,4-TRIMETHYLPENTANE	185	19.022	1	TOLUENE
186	19.170	0	C8 PARAFFIN	187	19.202	0	C8 PARAFFIN
188	19.257	0	C8 PARAFFIN	189	19.361	0	C8 PARAFFIN
190	19.408	0	C8 PARAFFIN	191	19.585	0	C8 PARAFFIN
192	19.701	0	C8 PARAFFIN	193	19.905	0	C8 PARAFFIN
194	20.001	0	C8 PARAFFIN	195	20.109	0	C8 PARAFFIN
196	20.180	0	C8 PARAFFIN	197	20.250	0	C8 PARAFFIN
198	20.330	0	n-OCTANE	199	20.377	0	C9 PARAFFIN
200	20.470	0	C9 PARAFFIN	201	20.662	0	C9 PARAFFIN

TABLE 1. HYDROCARBON IDENTIFICATIONS AND RETENTION TIMES (Continued)

HP5880 Calibration Table

CAL. NO.	Ret. Time	REF	Compound Name	CAL NO.	Ret. Time	REF	Compound Name
202	20.827	0	C9 P#RAFFIN	203	20.949	0	C9 OLEFIN
204	21.009	0	C9 PARAFFIN	205	21.123	0	C9 PARAFFIN
206	21.172	0	C9 PARAFFIN	207	21.223	0	C9 PARAFFIN
208	21.277	0	C9 PARAFFIN	209	21.369	0	C9 PARAFFIN
210	21.425	0	C9 PARAFFIN	211	21.524	0	C9 PARAFFIN
212	21.596	0	C9 PARAFFIN	213	21.744	0	ETHYLBENZENE
214	21.842	0	C9 PARAFFIN	215	21.973	1	m&p-XYLENE
216	22.140	0	C9 PARAFFIN	217	22.235	0	C9 PARAFFIN
218	22.322	0	C9 PARAFFIN	219	22.415	0	C9 PARAFFIN
220	22.462	0	C9 OLEFIN	221	22.518	0	C9 PARAFFIN
222	22.601	0	o-XYLENE	223	22.688	0	C9 PARAFFIN
224	22.733	0	C9 PARAFFIN	225	22.785	0	C9 PARAFFIN
226	22.860	0	C9 PARAFFIN	227	22.940	0	C9 PARAFFIN
228	23.034	0	n-NONANE	229	23.174	0	C10 PARAFFIN
230	23.243	0	C10 PARAFFIN	231	23.305	0	C10 PARAFFIN
232	23.455	0	C10 PARAFFIN	233	23.540	0	C10 PARAFFIN
234	23.635	0	C10 PARAFFIN	235	23.706	0	C10 PARAFFIN
236	23.824	0	C10 PARAFFIN	237	23.883	0	C10 PARAFFIN
238	23.940	0	C10 PARAFFIN	239	24.007	0	C10 OLEFIN
240	24.107	0	C10 OLEFIN	241	24.177	0	C10 PARAFFIN
242	24.212	0	n-PROPYLBENZENE	243	24.310	0	C10 PARAFFIN
244	24.386	0	p-ETHYLTOLUENE	245	24.447	0	m-ETHYLTOLUENE
246	24.578	0	C9 AROMATIC	247	24.632	0	C10 PARAFFIN
248	24.694	0	C10 PARAFFIN	249	24.852	0	o-ETHYLTOLUENE
250	24.979	0	C9 AROMATIC	251	25.051	0	C10 PARAFFIN
252	25.122	0	C10 OLEFIN	253	25.217	0	1,2,4-TRIMETHYLBENZENE
254	25.320	0	C9 AROMATIC	255	25.408	0	C10 PARAFFIN
256	25.520	0	n-DECANE	257	25.597	0	C9 AROMATIC
258	25.661	0	C9 AROMATIC	259	25.770	0	C9 AROMATIC
260	25.909	0	1,2,3-TRIMETHYLBENZENE	261	25.972	0	C11 PARAFFIN
262	26.043	0	C11 PARAFFIN	263	26.103	0	C11 PARAFFIN
264	26.218	0	C10 AROMATIC	265	26.379	0	C10. AROMATIC
266	26.497	0	C10 AROMATIC	267	26.567	0	C10 AROMATIC
268	26.710	0	C10 AROMATIC	269	26.807	0	C10 AROMATIC
270	26.842	0	C10 AROMATIC	271	26.877	0	C11 PARAFFIN
272	26.960	0	C10 AROMATIC	273	27.023	0	C11 PARAFFIN
274	27.142	0	C11 PARAFFIN	275	27.181	0	C10 AROMATIC
276	27.227	0	1,2-DIMETHYL-4-ETHYLBENZENE	277	27.363	0	C10 AROMATIC
278	27.421	0	C10 AROMATIC	279	27.601	0	C11 PARAFFIN
280	27.680	0	C10 AROMATIC	281	27.769	0	C10 AROMATIC
282	27.809	0	1,2-DIMETHYL-3-ETHYLBENZENE	283	27.953	0	C10 AROMATIC
284	28.040	0	1,2,4,5-TETRAMETHYLBENZENE				
285	28.116	0	1,2,3,5-TETRAMETHYLBENZENE				
286	28.193	0	C10 AROMATIC	287	28.244	0	C11 PARAFFIN
288	28.360	0	C10 AROMATIC	289	20.763	0	C9 PARAFFIN
290	28.623	0	C11 AROMATIC	291	28.662	0	C11 AROMATIC
292	28.730	0	C11 AROMATIC	293	28.845	0	C11 AROMATIC
294	28.923	0	C11 AROMATIC	295	29.056	0	C11 AROMATIC
296	29.120	0	C11 AROMATIC	297	29.199	0	C11 AROMATIC
298	29.270	0	C11 AROMATIC	299	29.350	0	C11 AROMATIC

TABLE 1. HYDROCARBON IDENTIFICATIONS AND RETENTION TIMES (Continued)
HP5880 Calibration Table

CAL. NO.	Ret. Time	REF	Compound Name	CAL NO.	Ret. Time	REF	Compound Name
300	29.570	1	C11 AROMATIC	301	29.695	0	C11 AROMATIC
302	29.840	0	C11 AROMATIC	303	29.888	0	C11 AROMATIC
304	29.939	0	C_{12} PARAFFIN	305	30.077	0	C11 AROMATIC
306	30.159	0	C11 AROMATIC	307	30.210	0	C11 AROMATIC
308	30.283	0	C11 AROMATIC	309	30.367	0	C11 AROMATIC
310	30.598	0	C11 AROMATIC	311	30.727	0	C11 AROMATIC
312	30.770	0	C12 PARAFFIN	313	30.821	0	C11 AROMATIC
314	30.908	0	C12 AROMATIC	315	31.070	0	C12 AROMATIC
316	31.162	0	C12 AROMATIC	317	31.253	0	C12 AROMATIC
318	31.305	0	C12 AROMATIC	319	31.383	0	C12 AROMATIC
320	31.471	0	C12 AROMATIC	321	31.617	0	C12 AROMATIC
322	31.667	0	C12 AROMATIC	323	31.924	0	C12 AROMATIC
324	31.983	0	C12 AROMATIC	325	32.095	0	C12 AROMATIC
326	32.210	0	C12 AROMATIC	327	32.340	0	C12 AROMATIC
328	32.380	0	C13 PRAFFIN	329	32.530	0	C12 AROMATIC
330	32.623	0	C12 AROMATIC	331	32.718	0	C12 AROMATIC
332	32.823	0	C12 AROMATIC	333	32.923	0	C12 AROMATIC
334	33.060	0	C12 AROMATIC	335	33.098	0	C13 PARAFFIN
336	33.147	0	C12 AROMATIC	337	33.450	0	C12 AROMATIC
338	33.802	0	C12 AROMATIC	339	33.817	0	C12 AROMATIC
340	36.057	0	C12 AROMATIC	341	7.340	0	C4 OLEFIN
342	8.227	0	C4 OLEFIN	343	8.350	0	C4 OLEFIN
344	13.673	0	C6 OLEFIN	345	15.493	0	C7 OLEFIN
346	16.156	0	C7 OLEFIN	347	16.637	0	C7 PARAFFIN
348	17.196	0	C7 OLEFIN	349	17.399	0	C8 OLEFIN
350	17.560	0	C8 OLEFIN	351	18.260	0	C8 OLEFIN
352	19.472	0	C8 PARAFFIN	353	20.063	0	C8 PARAFFIN
354	20.543	0	C9 OLEFIN	355	27.487	0	C11 OLEFIN
356	27.550	0	C10 AROMATIC	357	28.505	0	C10 AROMATIC
358	30.307	0	C11 AROMATIC	359	30.444	0	C11 AROMATIC
360	30.660	0	C11 AROMATIC	361	30.980	0	C12 AROMATIC
362	31.752	0	C12 AROMATIC	363	31.877	0	C12 AROMATIC
364	15.617	0	C7 OLEFIN	365	16.860	0	C7 PARAFFIN
366	18.080	0	C8 PARAFFIN	367	22.170	0	C9 PARAFFIN
368				369	13.310	0	C6 PARAFFIN
370	28.970	0	C10 AROMATIC	371	15.020	0	C7 OLEFIN
372	22.150	0	C9 PARAFFIN	373	27.125	0	C10 AROMATIC
374	28.460	0	C10 AROMATIC	375	3.926	0	C4 OLEFIN
376	13.520	0	C6 OLEFIN	377	29.413	0	C11 AROMATIC
378	35.220	0	C12 AROMATIC	379	28.550	0	C11 AROMATIC
380	29.032	0	C11 AROMATIC	381	33.376	0	C12 AROMATIC
382	3.293	0	C3 PARAFFIN	383	4.377	0	C3 PARAFFIN
384	7.206	0	C4 PARAFFIN	385	12.409	0	C6 PARAFFIN
386	14.953	0	C7 PARAFFIN	387	15.780	0	C7 OLEFIN
388	19.150	0	C8 PARAFFIN	389	20.760	0	C9 PARAFFIN
390	34.410	0	C12 AROMATIC	391	7.580	0	C4 PARAFFIN
392	8.850	0	C4 OLEFIN	393	9.700	0	C5 OLEFIN
394	10.120	0	C5 OLEFIN	395	11.790	0	C5 OLEFIN
396	12.150	0	C5 OLEFIN	397	18.650	0	C8 PARAFFIN
398	21.460	0	C9 PARAFFIN	399	21.890	0	C9 PARAFFIN

TABLE 1. HYDROCARBON IDENTIFICATIONS AND RETENTION TIMES (Continued)
HP5880 Calibration Table

CAL. NO.	Ret. Time	REF	Compound Name	CAL NO.	Ret. Time	REF	Compound Name
400	23.770	0	C10 PARAFFIN	401	26.630	0	C10 AROMATIC
402	27.310	0	C10 AROMATIC	403	27.850	0	C10 AROMATIC
404	32.460	0	C12 AROMATIC	405	34.590	0	C12 AROMATIC
406	35.870	0	C12 AROMATIC	407	13.140	0	C6 PARAFFIN
408	25.830	0	C9 AROMATIC	409	30.530	0	C11 AROMATIC
410	33.270	0	C12 AROMATIC	411	34.310	0	C12 AROMATIC
412	9.580	0	C5 OLEFIN	413	10.890	0	C5 OLEFIN
414	31.710	0	C12 AROMATIC	415	15.480	0	C7 OLEFIN
416	30.280	0	C11 AROMATIC				

APPENDIX B

GAS CHROMATOGRAPY
AUDIT QUESTIONNAIRE

		YES	NO
1)	Does the technician have a current copy of the RPM at or near the bench?	___	___
2)	Are gases traceable to, at a minimum, Research reagent grade gases?	___	___
3)	Are calibration results within 5% of the mean?	___	___
4)	Are outlying standards rejected? And is the rejection:	___	___
	a) documented?	___	___
	b) explained?	___	___
	c) reviewed?	___	___
5)	Are daily standards:		
	a) run immediately following the calibration?	___	___
	b) within ± 10% of known value?	___	___
6)	Are repeated measurements made of:		
	a) the highest standard?	___	___
	b) the lowest standard?	___	___
7)	Have the standard deviations for:		
	a) the highest standard been computed?	___	___
	b) the lowest standard been computed?	___	___
8)	Have the initial control limits been computed for:		
	a) daily standard measurements?	___	___
	b) duplicate measurements?	___	___
	c) replicate measurements?	___	___
9)	Are standards reanalyzed periodically?	___	___
10)	Are any samples analyzed in duplicate?	___	___
11)	Are replicate samples analyzed?	___	___
12)	Are QC samples analyzed?	___	___

		YES	NO
13)	Are QC sample control charts current?	___	___
14)	Are blinds analyzed?	___	___
15)	Are audit samples analyzed periodically?	___	___
16)	Are the following control samples analyzed:		
	a) spikes?	___	___
	b) interlaboratory?	___	___
	c) intralaboratory?	___	___
	d) old samples?	___	___
	e) other QC samples?	___	___
17)	Are NBS SRM samples analyzed regularly?	___	___
18)	Are accuracy measurements:		
	a) made on scheduled basis?	___	___
	b) within RPM specifications?	___	___
19)	Are precision measurements:		
	a) made on scheduled basis?	___	___
	b) within RPM specifications?	___	___
20)	Is GC preventive maintenance performed as required by RPM?	___	___
21)	Were corrective action procedures implemented as required?	___	___
22)	Are control charts and other QC records:		
	a) filled in an organized manner?	___	___
	b) recorded in laboratory notebook?	___	___
23)	Are computer printouts and reports spot-checked and validated?	___	___
24)	Have any of the following audits been performed in this laboratory?		
	a) Systems Audit?	___	___
	b) Performance audit?	___	___
25)	Are internal QC reports prepared on a timely basis to management?	___	___

APPENDIX C

FIGURES, FORMS AND EXAMPLES

TABLE 2. LEGEND FOR FIGURES 1, 2, AND 3

V1 = stainless steel needle valve

V2' V3' and V6 = shut-off valves (a)

V4 and V5 = 6-port electrically actuated gas sampling valve (attached to HP 5880A Gas Chromatograph).b)

M1 = 0 to 500 cm3/min mass flow meter

P1 = 0 to 200 Torr Wallace and Tierman Bourdon Gauge

(a) V2 is a stainless steel bellows valve on the canister. V3 and V6 are toggle valves; they may be stainless steel or brass.

(b) The gas sampling valve used should be capable of holding a vacuum down to 10 Torr for proper operation.

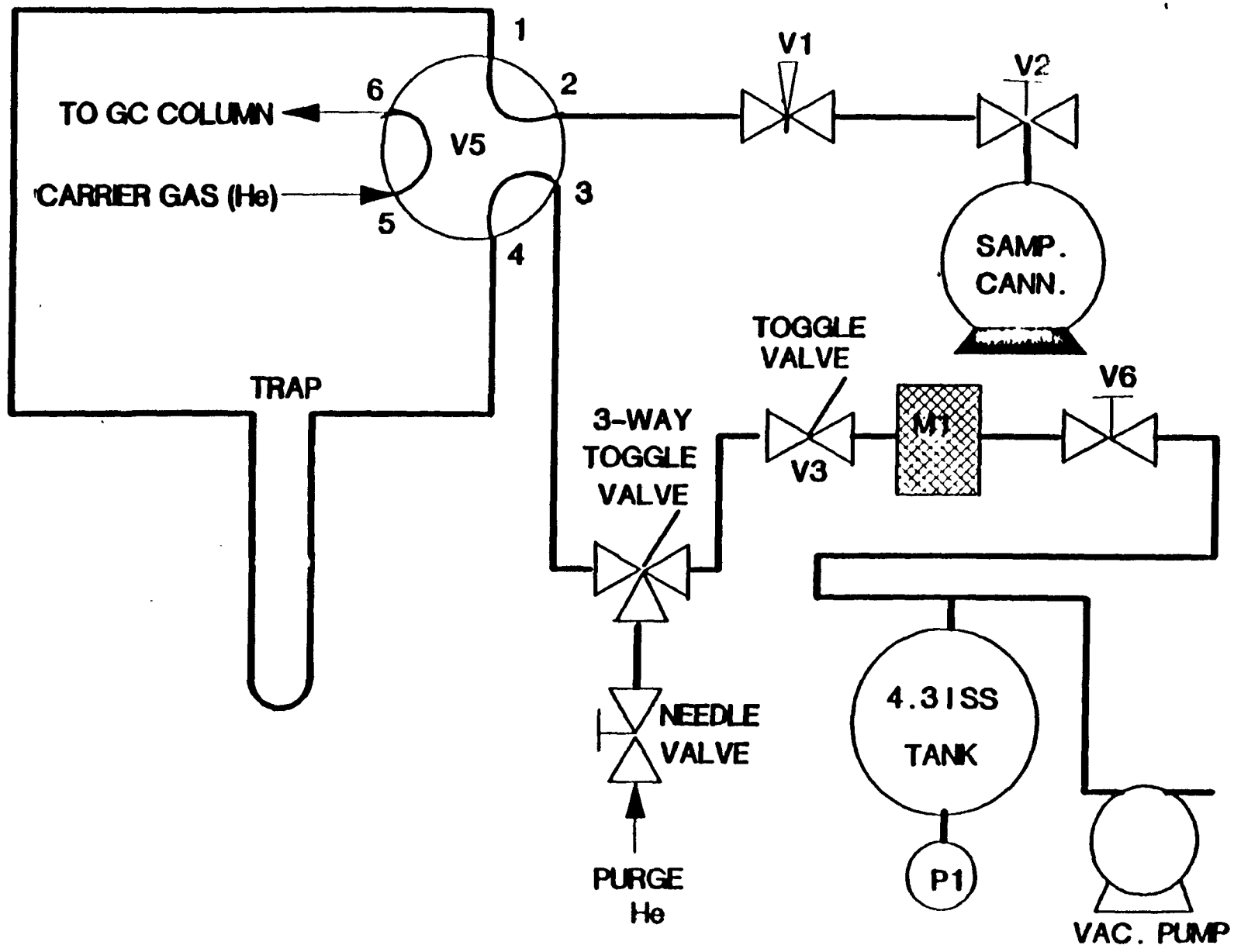


Figure 1. Inlet system—purge position.

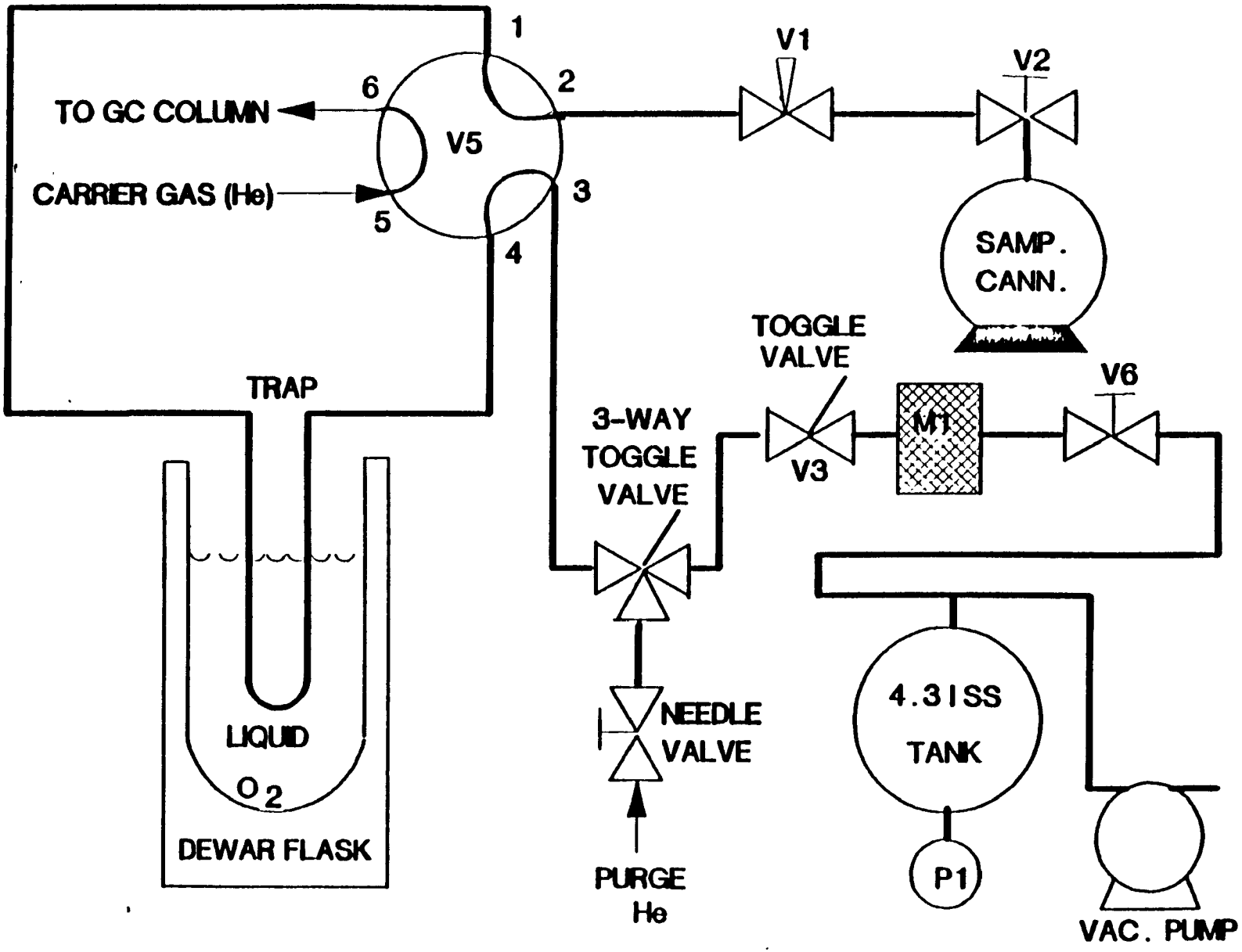
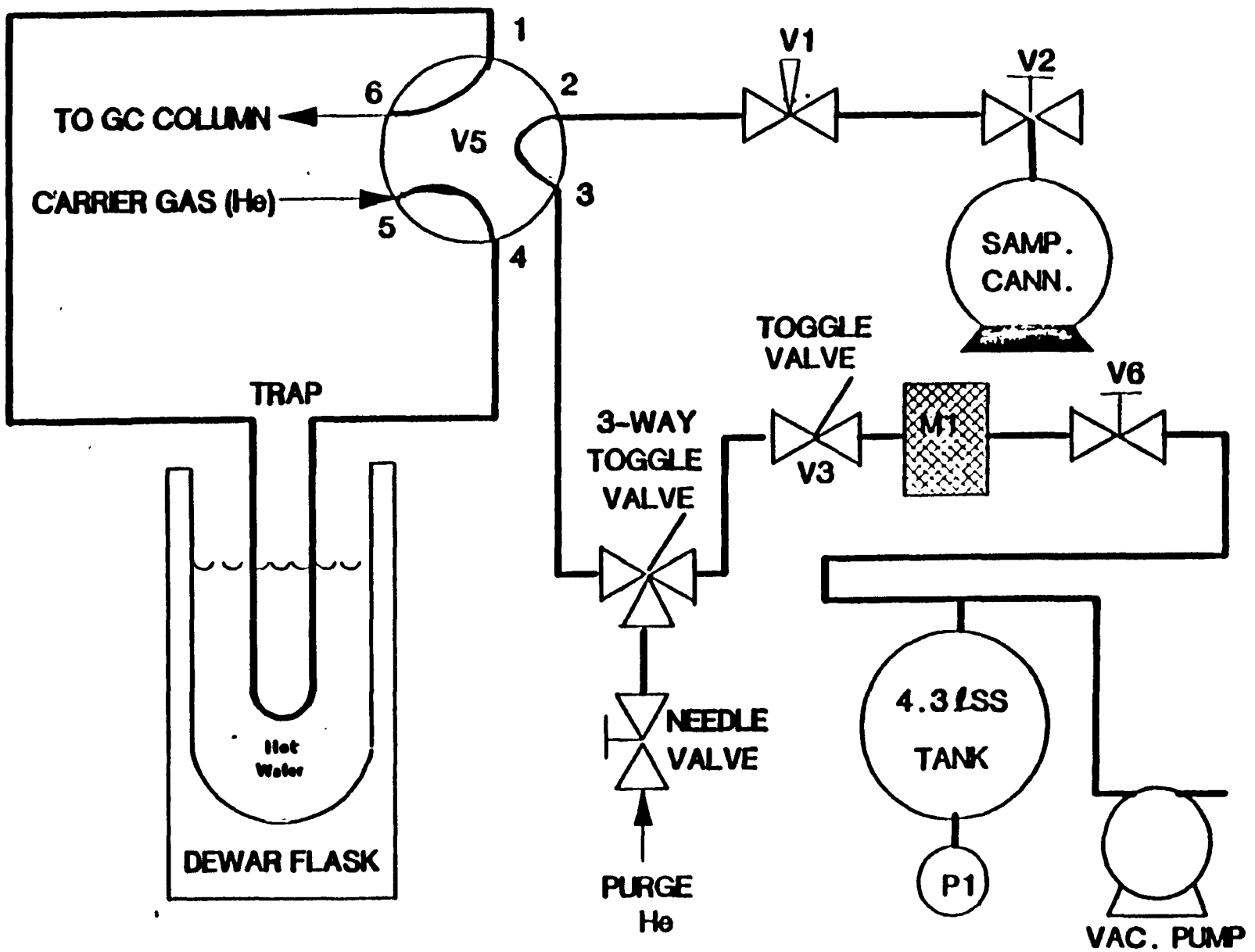


Figure 2. Inlet system—sample trapping position.


TO GC COLUMN
CARRIER GAS (He)
1
2
3
4
5
6
V5
V1
V2
SAMP.
CANN.
TOGGLE
VALVE
V6
M1
V3
3-WAY
TOGGLE
VALVE
TRAP
Hot
Water
DEWAR FLASK
NEEDLE
VALVE
PURGE
He
4.3 ℓSS
TANK
P1
VAC. PUMP

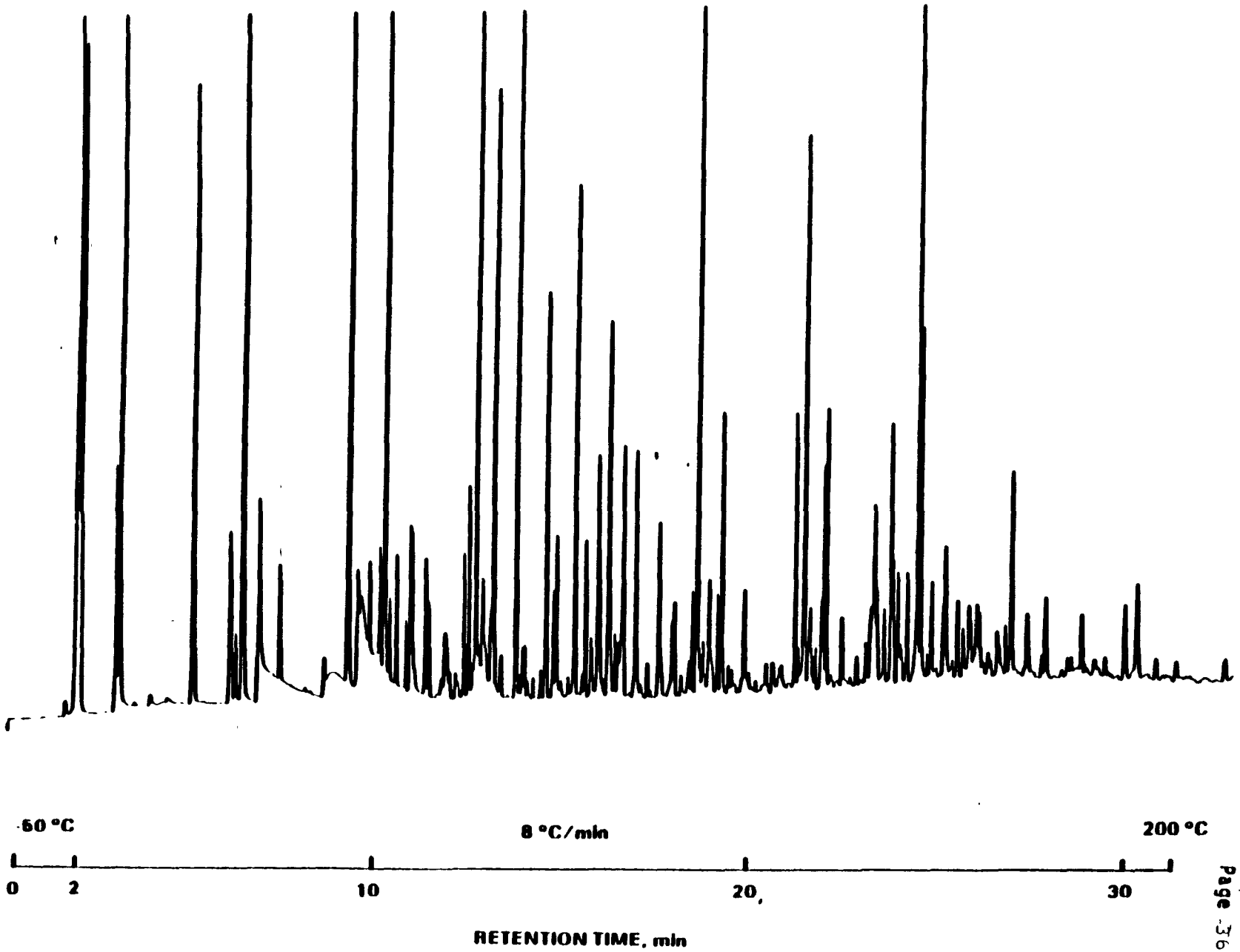


Figure 4. Gas chromatogram of ambient air C-2 to C-12 hydrocarbons separated on a DB-1 fused silica capillary column.

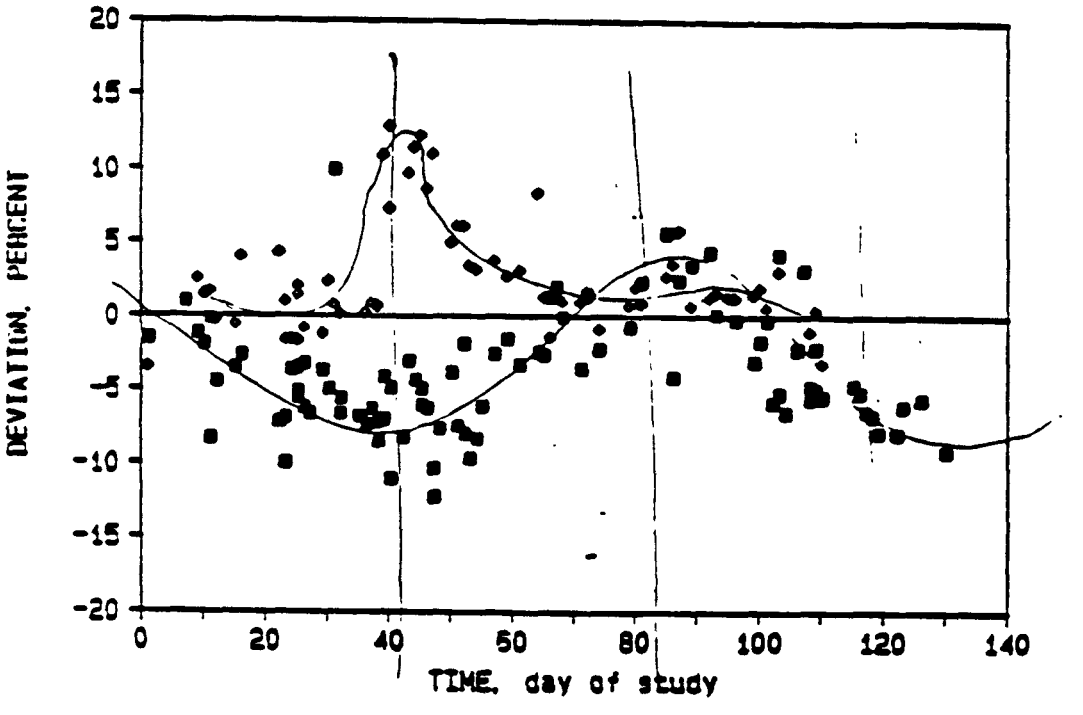


Figure 5. Deviation of measured NBS propane sample response from certified value (■) 1984 and (◇) 1985.

PROJECT _____ MEASUREMENT _____ UNITS _____

DATE																										
MEASUREMENT CODE 1																										
MEASUREMENT CODE 2																										
MEASUREMENT CODE 3																										
MEASUREMENT RESULT 1																										
MEASUREMENT RESULT 2																										
MEASUREMENT RESULT 3																										
SUM																										
$\bar{X}$																										
s																										
AVERAGES, $\bar{X}$																										
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	
STD DEV, s																										
COMMENTS (CORRECTIVE ACTION, ETC.)																										

MEASUREMENT		
RESULT	CODE	
1	1	
2	2	
3	3	
SUM		
$\bar{X}$		
R		

AVERAGES, $\bar{X}$ (10, 5, 0, -5, -10)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25

RANGES, R (5, 0, -5)

COMMENTS (CORRECTIVE ACTION, ETC.)

Department of Commerce
Philip M. Klutznick
Secretary

onal Bureau of Standards
rnest Ambler, Director

PROPANE 85-51-E

National Bureau of Standards

Certificate of Analysis

Standard Reference Material 1665b

Propane in Air

(Nominal Concentration 3 ppm)

(Mobile-Source Emission Gas Standard)

This Standard Reference Material is intended for use in the calibration of instruments used for the analysis of hydrocarbon in mobile-source emissions. It is not intended as a working standard, but rather as a primary standard to which the concentration of the daily working standards may be related.

Propane concentration: 2.83 ± 0.03 μmole/mole (ppm)

Cylinder Number: FF-18831 Sample Number: 85-51-E

The concentration of propane is relative to all other constituents of the gas. The uncertainty shown is the estimated upper limit of error of the propane concentration at the 95 percent confidence level. This uncertainty includes the inaccuracy of the gravimetric primary standard and the imprecision of intercomparison with the gravimetric standards. This sample is certified only for the concentration of propane. However, representative samples from the lot have been examined for the presence of other hydrocarbons. The estimated concentration of other hydrocarbons, expressed as propane, is 0.06 μmole/mole (ppm).

Each cylinder is individually analyzed and the concentration appearing above applies to the cylinder number and sample number identified on this certificate.

The original development and evaluation of the Propane in Air Series of these Standard Reference Materials was performed at the National Bureau of Standards by W. P. Schmidt and W. D. Dorko.

The overall direction and coordination of technical measurements leading to certification were performed in the Gas and Particulate Science Division under the chairmanship of E. E. Hughes and H. L. Rook.

The technical and support aspects involved in the preparation, certification, and issuance of this Standard Reference Material were coordinated through the Office of Standard Reference Materials by T. E. Gills.

Washington, D.C. 20234
January 31, 1980

George A. Uriano, Chief
Office of Standard Reference Materials

(over)

ge No.— HP-5880A with DBI Calibration

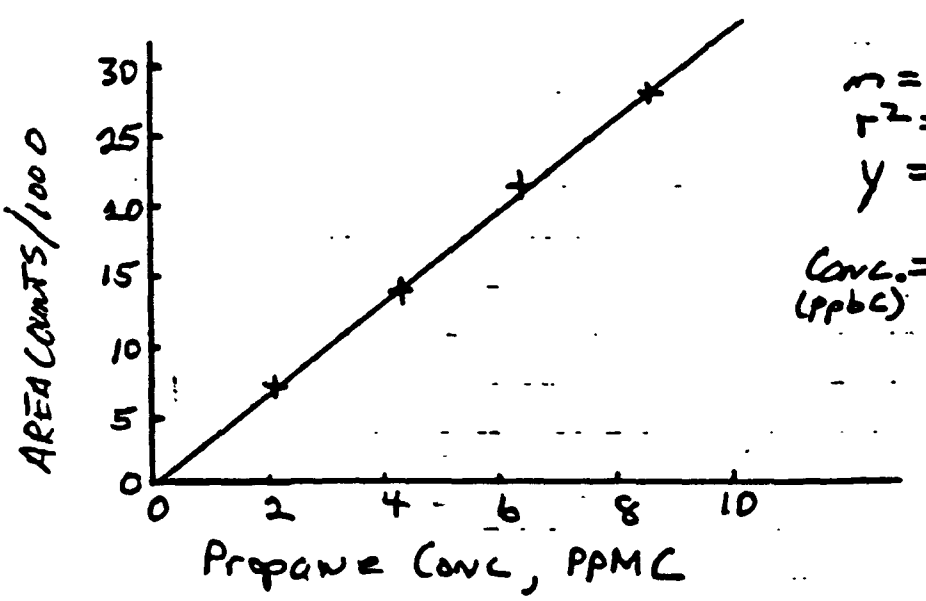
A propane in air SRM was sampled at four sample lumes to determine the FID response factor.

RM: Propane = 2.83 ± 0.03 umole/mole (ppm)
= 8490 ppb as carbon
Cylinder Number = FF18831, Sample Number = 85-51-E

Analysis Results

ample ze, torr	Equivalent Propane Conc. ppbC	Area of Propane Peak	Response Factor conc/area
~~80~~	~~28014.4~~		
80	8490	28014.4	0.303058
60	63675	21191.7	0.300471
40	4245	14013.5	0.302922
20	21225	6861.1	0.309353
			0.30395 mean
			0.30299 median

.304
.304



n = 4
r^2 = 1.000
y = -0.139 + 3.328 x

Conc. (ppbC) = 0.30048 • (AREA) + 0.04

To Page No

sed & Understood by me,	Date	Invented by	Date
		Recorded by	4/15/88

APPENDIX K

SPECIATED NMOC ANALYTICAL RESULTS
(Obtain from Neil Berg, U.S. EPA)

TECHNICAL REPORT DATA

(PLEASE READ INSTRUCTIONS ON THE REVERSE BEFORE COMPLETING)

EPORT NO. :PA-454/R-99-011	2.	3. RECIPIENT'S ACCESSION NO.
ITLE AND SUBTITLE 992 Nonmethane Organic Compound And Speciated Nonmethane)rganic Compound Monitoring Program		5. REPORT DATE 4/1/92
		6. PERFORMING ORGANIZATION CODE
UTHOR(S) :adian Corporation :esearch Triangle Park, NC 27709		8. PERFORMING ORGANIZATION REPORT NO.
ERFORMING ORGANIZATION NAME AND ADDRESS		10. PROGRAM ELEMENT NO.
		11. CONTRACT/GRANT NO. 68D80014
SPONSORING AGENCY NAME AND ADDRESS)ffice Of Air Quality Planning And Standards I.S. Environmental Protection Agency :esearch Triangle Park, NC 27711		13. TYPE OF REPORT AND PERIOD COVERED
		14. SPONSORING AGENCY CODE

SUPPLEMENTARY NOTES

ABSTRACT

N CERTAIN AREAS OF THE COUNTRY WHERE THE NATIONAL AMBIENT AIR QUALITY STANDARD (NAAQS) OR OZONE IS BEING EXCEEDED, ADDITIONAL MEASUREMENTS OF AMBIENT NONMETHANE ORGANIC OMPOUNDS (NMOC) ARE NEEDED TO ASSIST THE AFFECTED STATES IN DEVELOPING REVISED OZONE ONTROL STRATEGIES. BECAUSE OF PREVIOUS DIFFICULTY IN OBTAINING ACCURATE NMOC IEASUREMENTS, THE U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA) HAS PROVIDED MONITORING ND ANALYTICAL ASSISTANCE TO THESE STATES, BEGINNING IN 1984 AND CONTINUING THROUGH THE 992 NMOC MONITORING PROGRAM.

KEY WORDS AND DOCUMENT ANALYSIS

ESCRIPTORS	b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI FIELD/GROUP
)ZONE CONTROL STATEGIES ATIONAL AMBIENT AIR QUALITY STANDARDS ONMETHANE ORGANIC COMPOUND IONITORING ANALYSIS 992 NMOC MONITORING PROGRAM		
DISTRIBUTION STATEMENT NLIMITED		21. NO. OF PAGES 506
		22. PRICE