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Inspection and Maintenance (I/M) Program Effectiveness Methodologies

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Note to: I/M Stakeholders and other readers

Attached is a copy of a guidance document outlining three alternative inspection and maintenance (I/M) program evaluation methodologies that are available for use by the states as they work to meet the Clean Air Act's biennial I/M program evaluation requirement. This guidance is being released in compliance with the schedule included in the January 9, 1998 I/M rule amendment revising the requirements for I/M program evaluations to allow for sound alternatives to the original, IM240-based approach called for by the 1992 I/M rule. The approved methods are:

* Sierra Research Method: This method relies on the statistical sampling and analysis of state I/M program data, modeling data, and correlation to a base I/M program that can be used as a benchmark for effectiveness. While this method does ultimately require correlation to the IM240, states are not required to perform their own IM240 tests on any of their in-use fleet. States can obtain the necessary data via contract or from some other source able to provide paired data correlating the chosen I/M test to the IM240.

* NYTEST (VMAS) Method: This method relies on less costly test equipment which has been found to reliably simulate the IM240 test for purposes of performing program evaluation measurements.

* RG240 Method: Like the NYTEST method above, the RG240 method relies upon a lower cost emissions measurement system which is capable of simulating the IM240 for purposes of program evaluation.

These three alternatives were among four proposed to EPA as part of a stakeholder process begun in August 1997. The fourth method--a remote sensing (RSD) based fleet characterization approach--has not been approved as of this guidance, due to inconsistencies in the reported results EPA has reviewed thus far. Nevertheless, we believe that the RSD approach warrants further investigation, which we will pursue in the coming year.

An electronic version of this guidance has been posted on the EPA web site, under the Office of Mobile Sources (OMS) section. The OMS area may be accessed by setting your browser to the following web address: http://www.epa.gov/OMSWWW.

We hope that you find this information helpful. If you have any questions concerning this document, please contact Dr. Jim Lindner of the EPA staff at (734)214-4558 or via e-mail at lindner.jim@epa.gov.

U.S. EPA
Office of Mobile Sources

Inspection and Maintenance (I/M) Program Effectiveness Evaluation Methodologies

Introduction:

Section 182(c)(3)(C) of the Clean Air Act (CAA) requires that all states subject to enhanced I/M "...biennially prepare a report to the Administrator which assesses the emissions reductions achieved by the program required under this paragraph based on data collected during inspection and repair of vehicles. The methods used to assess the emission reductions shall be those established by the Administrator." Based upon this authority, on November 5, 1992, EPA published in the Federal Register minimum, biennial program evaluation requirements for enhanced I/M programs under section 51.353 of 40 CFR Part 51, subpart S (henceforth referred to as the "1992 I/M rule"). As a cornerstone of this evaluation, states were required to perform an analysis based upon test data from "...a representative, random sample, taken at the time of initial inspection (before repair), of at least 0.1 percent of the vehicles subject to inspection in a given year. Such vehicles shall receive a state administered or monitored IM240 mass emissions test or equivalent..." The 1992 I/M rule also initially included the requirement that alternatives to the IM240, to be considered equivalent, would have to be mass emissions transient tests (also known as METTs).

As required by the Clean Air Act, EPA's 1992 I/M rule established a minimum performance standard for enhanced I/M programs. While certain elements of the performance standard were mandated by the Act -- for example, test frequency, network design, and vehicle coverage -- EPA was also allowed to use its discretion with regard to other elements, such as test type. As a result, the performance standard promulgated in the 1992 rule was based upon an annual, centralized, test-only program including IM240 tailpipe testing as well as purge and pressure evaporative system testing. It is important to note that states were not required to adopt this performance standard program; instead, states simply had to demonstrate that the programs they did adopt would get the same level of emission reduction as would the performance standard program under similar conditions. For the purpose of developing and submitting the required I/M State Implementation Plans (SIP), states were to include a modeling demonstration showing that the program met the performance standard using EPA's MOBILE emission factor model. Among other things, one of the goals of the program evaluation requirement was to determine the extent to which emission reductions projected for the program in the SIP were actually being achieved in the real world.

Although the 1992 I/M rule allowed states a certain amount of flexibility when it came to things like testing frequency and vehicle model year coverage, as a practical matter, EPA believed that it was unlikely that states would be able to design an enhanced I/M program that would meet the performance standard without including a significant fraction of test-only IM240 testing. Given the assumption that all enhanced I/M programs would include some amount of IM240 testing (and therefore the necessary equipment and expertise would be readily available), requiring additional IM240 testing for evaluation purposes on 0.1 percent of the subject vehicle population did not seem an unreasonable or unduly burdensome requirement at the time the I/M rule was adopted.

As states began dealing with the practical and political realities of getting I/M programs started, however, it became obvious that more flexibility was desired than was provided by the 1992 I/M rule. For example, some areas required to implement enhanced I/M were able to meet their attainment or other CAA goals with substantially less stringent I/M programs than would be required under the original I/M rule. Therefore, in 1995 and 1996, EPA revised its I/M rule to include alternative enhanced I/M performance standards aimed at providing greater flexibility to those areas that did not need substantial emission reductions from I/M to meet their CAA goals. EPA also revisited its credit calculations for the non-METT, alternative test known as the Acceleration Simulation Mode (ASM) test and incorporated these revised credits in its MOBILE model. Furthermore, in 1995, with passage of the National Highway System Designation Act (NHA) Congress afforded I/M states even more flexibility by barring EPA from automatically discounting I/M programs on the basis of network design (i.e., centralized vs. decentralized).

The greater flexibility provided by the above changes led a significant number of enhanced I/M areas to develop and implement programs that did not include any IM240 or equivalent METT testing. As a result, the program evaluation requirement calling for 0.1 percent IM240/METT testing that seemed reasonable back in 1992 suddenly became a more significant burden for those states using ASM or some other non-METT-based alternative for their regular I/M program. In effect, those states would be required to purchase, lease or otherwise acquire IM240 testing equipment for the sole purpose of meeting the program evaluation requirement -- a requirement which, while it quality controlled the credit levels previously claimed by the state, did not itself produce any emission reductions. In addition, states with test-and-repair programs faced a significantly more difficult time obtaining random vehicles for testing than was contemplated at the time of the 1992 I/M rule, with greater owner inconvenience and/or government costs. The states complained, EPA listened, and in January 1998 (63 FR 1362, January 9, 1998), the Agency finalized revisions to its program evaluation requirements, removing the provision that alternative program evaluation methodologies must be based upon mass emission, transient testing. The previous METT requirement was replaced with the stipulation that alternative methodologies be simply "sound," "approved by EPA," and "capable of providing accurate information about the overall effectiveness of an I/M program."

The January 1998 Federal Register notice included a schedule for determining and assessing candidate, alternative program evaluation methodologies, which is outlined below:

August 11, 1997: Stakeholder's meeting held by EPA for states, contractors, vendors, and all interested parties for the purpose of seeking input regarding which alternative methods to investigate.

September 15, 1997: Candidate methodologies identified for further investigation.

May 31, 1998: Data gathering on candidate methodologies completed.

October 15, 1998: Data review and analysis completed.

October 31, 1998: Policy memo and guidance on approved program evaluation methodologies released.

EPA identified four alternative program evaluation methodologies as part of its stakeholder process. These methods were: 1) The Sierra Research method, a method that relies on state I/M program data, modeling data, and correlation to a base I/M program that can be used as a benchmark for effectiveness; 2) The VMAS method, a low-cost method for measuring exhaust flow for the purpose of converting concentration measurements into mass emissions measurements; 3) The California Analytical Bench method, a low-cost method using one type of repair-grade IM240 (also known as RG240); and 4) The RSD fleet characterization method, which relies on remote sensing (RSD) data. As part of its evaluation, EPA reviewed the available data and literature on the respective methods, including whatever additional information was provided by the proponents of the various methods. As a result of this review, EPA has concluded that several of these methods show sufficient promise to warrant additional investigation, which the Agency intends to pursue in the coming months. It is likely, therefore, that today's guidance will be supplemented as developments warrant.

This document represents EPA's findings and guidance to date with regard to the four alternatives identified above. Specifically, EPA is currently approving the first three of these alternatives as sound methodologies capable of providing accurate information about the overall effectiveness of I/M programs, while reserving judgement on the RSD fleet characterization method, which requires further study. Approval of these alternative methodologies is for the purpose of program evaluation only. Specifically, this guidance does not address the separate issue of assigning I/M program credit to alternative tests, which is a wholly different analysis. Furthermore, it is important to note that today's guidance is not intended to be exhaustive, nor does it represent EPA's "last word" on acceptable alternatives. Should states or other interested stakeholders have methodologies they wish to explore which are not addressed by today's guidance, EPA encourages those stakeholders to propose such alternatives for our review and consideration. However, states should be aware that under the revised I/M rule an alternative method must be approved by the Administrator as sound prior to its incorporation in a SIP submittal.

Lastly, today's guidance also addresses an issue faced by all attempts to evaluate I/M program effectiveness -- namely, the need to establish a basis for comparison. The most reliable and direct approach for determining the emission reductions achieved by an I/M program would be to start by characterizing the pre-program level of fleet emissions and then comparing this to the post-program emissions level. The difference between these two measurements equals the decrease in emissions that can be attributed to the program (i.e., the I/M program's effectiveness). Unfortunately, due to the fact that many areas required to implement enhanced I/M had pre-existing, basic I/M programs, it is not always possible for program evaluators to establish an accurate, non-I/M baseline. Today's guidance therefore begins by suggesting methods for determining the magnitude of an I/M program's effectiveness when it is not possible to clearly establish a non-I/M baseline.

Section 1: Estimating Baseline Fleet Emissions

The determination of the actual emission reductions associated with a given enhanced I/M program is frequently complicated at the outset due to the difficulty or impossibility of establishing a no-I/M baseline for comparison. Specifically, most enhanced I/M program areas have pre-existing, basic I/M programs which will have already lowered average fleet emissions below what would be expected under a no-I/M scenario. This, in turn, will lead to understating the impact of the new I/M program. As a result, direct measurement of I/M program effectiveness becomes essentially impossible once any I/M program has begun operation, since the opportunity to define the no-I/M case through direct measurement will have been permanently precluded. Under such circumstances, the best one can hope for is a reasonable basis for estimating what the no-I/M emission levels would have been, since direct measurement is no longer possible. Of course, the uncertainty inherent in any estimation methodology will ripple throughout all subsequent numbers based upon a comparison to that initial estimate. Therefore, it is important to choose estimation methods carefully.

The EPA is aware of two, possible methods states could potentially use for addressing the need to estimate baseline fleet emissions. The first approach precludes the need for a no-I/M baseline by comparing the program under evaluation to a benchmark program taken to be the reference standard for effectiveness; the second would rely upon RSD measurements to provide a basis for estimating pre-I/M fleet emissions. The latter is not yet something EPA can support until RSD issues raised later in this guidance have been resolved.

Section 1.1 Using Benchmark Comparison When a No-I/M Baseline is No Longer Possible

One method for estimating program effectiveness when it is not possible to establish a no-I/M baseline is to compare the program-in-question to an existing IM240 program which can serve as a benchmark for effectiveness. Although arguments can be made regarding the choice of which (if any) IM240 program should serve as a benchmark, EPA recommends using the Phoenix, Arizona program, since it is one of the most mature IM240 programs in operation, and most closely resembles EPA's recommended program design. The comparison of the program-in-question to the benchmark program is facilitated through use of the MOBILE model. An effort has been made to remove the impact of the model's assumptions on the final comparison of effectiveness by using MOBILE as a common denominator that essentially cancels itself out as part of the overall analysis. The following steps are provided to illustrate the general benchmark comparison concept in the context of the Arizona program:

(1) Calculate the projected effectiveness of the Arizona benchmark program by modeling the Arizona program using the MOBILE model and all the Arizona local area parameters (LAP) for fleet distribution, fuel type, average temperature, etc., then compare the resulting projected emission factor (EF) to the actual EF established as a result of the Arizona program evaluation. The difference between the modeled EF and the actual EF equals the effectiveness of the Arizona program, which, in turn, establishes the upper boundary of what is able to be accomplished in an IM240 program.

(2) Calculate the projected relative effectiveness of the program-in-question by modeling that program using the area-in-question's LAP for fleet distribution, fuel, temperature,

etc. and compare this modeled EF to the "actual" EF derived through one of the alternative program evaluation methodologies described elsewhere in this guidance.

(3) Correct for the impact of LAP differences between the program-in-question and the Arizona program by comparing the modeled EFs for the benchmark program using first the Arizona LAP and then again, using the area-in-question's LAP. There is no need for a no-I/M baseline using this method since program effectiveness is being derived as a percent of the program effectiveness of the benchmark program.

Section 1.2 Using RSD to Estimate a No-I/M Baseline

Theoretically, the program methodology described in Section 5 below may also be used to obtain fleet average baseline data, providing the data is collected prior to the start of the I/M program. In the event that the area-in-question already has a pre-existing basic I/M program, this method would likely underestimate the benefits of the new program for the same reasons discussed above. However, it may be possible to use a RSD-based fleet characterization approach to estimate a no-I/M baseline by measuring the fleet emissions from an otherwise comparable area without an I/M program as a no-I/M surrogate (once outstanding issues are resolved).

Section 2: Sierra Research Methodology for Estimating Program Benefits[1]

The methodology developed by Sierra Research under contract to EPA provides two options for performing I/M program evaluations. The first assumes the current operating program is the IM240 or some other, equivalent METT. The second method assumes the current operating program is an ASM or Idle test and utilizes a METT sample for correlation purposes. If a state has access to correlation data generated by another source using comparable testing conditions and specifications to those used by the program to be evaluated, then this METT correlation sample need not be generated by the state performing the program evaluation (i.e., paired correlation data can be "borrowed" from an outside source).

EPA has contracted two independent peer reviews of this work since its completion to address both the statistical validity of the method as well as the concept of using "in-program" data to quantify the effectiveness of an I/M program. Although EPA has not received the final peer review on the statistical method developed by Sierra, preliminary discussions with the reviewer indicate the statistical theory behind the method is correct[2]. The second review raised a number of operational issues with the Sierra method with regard to sampling bias, stratification of vehicle technology groups, sample recruitment, and the uncertainties surrounding the use of the MOBILE model for both predicting the emission reductions of a benchmark program and

[1]Radian International performed a similar analysis for the California Bureau of Automotive Repair. This report was titled "Methodology for Estimating California Fleet FTP Emissions" and was dated December 3, 1997. However, because this method focused on the use of ASM road-side pullover testing which is unique to California, it was not believed this would be a feasible program evaluation methodology for other states to implement.

[2]Private conversation, Dr. J. Lindner, US EPA, with Dr. E. Rothman, Director, Center for Statistical Consultation and Research-University of Michigan.

adjusting the measured emissions of the program under evaluation to account for differences between it and the benchmark program outlined in Section 1.1 above[3]. Some of the issues identified by Wenzel and Sawyer in this second review are inherently difficult to solve when using "in-program" data for program evaluation; however, EPA will address these issues to the extent they can be addressed in the forthcoming technical guidance on program evaluations. As a result of the operational shortcomings inherent in an evaluation based on "in-program" data, the second review recommends the use of RSD as a program evaluation tool. EPA's response to this last issue is addressed below in Section 5.

Section 2.1: IM240 Method

In an IM240 program, the Sierra Research method requires a random sample of a prescribed number of vehicles. On 1981 and newer model year vehicles, tailpipe emissions are measured using the IM240 while on pre-1981 vehicles idle emissions are measured and then converted to IM240-equivalents using existing correlation equations cited in the Sierra Research report entitled "Development of a Proposed Procedure for Determining the Equivalency of Alternative Inspection and Maintenance Programs." Once the data are collected, a model year based weighted average is determined for the fleet and adjusted to correct for the local variables such as fuel differences between the program-in-question and the benchmark, Arizona program discussed above. The program evaluation is then made by a direct comparison between the state IM240 program and the weighted average IM240 emissions from the benchmark program.

The methods used to obtain a suitable sample may include, but are not limited to, the following: Vehicles may be obtained by allowing a computer to randomly select vehicles at a test-only inspection facility; by randomly denying registration renewal to a sample of vehicles until they have been submitted for program evaluation testing; or by using law enforcement officers to select random vehicle samples for evaluation at a demographically balanced number of roadside locations. Regardless of the recruitment option selected, however, evaluation testing must be done in a manner that prevents the personnel involved in the official inspection and repair cycle from knowing whether a vehicle has been selected for such testing until the inspection and repair cycle has been completed.

Section 2.2 ASM/Idle Method

In an ASM or Idle program, the Sierra Research method requires development of a correlation between the IM240 and the program's ASM or Idle test on a prescribed number of 1967 and later model year vehicles. Once this correlation has been established, the program can be evaluated by recruiting a prescribed number of 1967 and later model year vehicles from the fleet and testing them per the ASM or Idle test procedure. The number of vehicles needed for the evaluation will be dependent on the variability of the alternative test.[4]

The IM240-to-ASM/Idle correlations are then used to convert the ASM or Idle

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[3]"Review of Sierra Research Report 'Development of a Proposed Procedure for Determining the Equivalency of Alternative Inspection and Maintenance Programs'", T. Wenzel & Dr. R. Sawyer, Lawrence Berkeley National Laboratory, September 23, 1998.

[4]EPA will work with states desiring to use this method to determine the appropriate sample size needed for this step of the evaluation in each state.

measurements to IM240-equivalents for each vehicle. At this point, the emission measurements will be treated in the same manner as the IM240 program emissions measured in Section 2.1 above. That is, a model year based weighted average is determined for the fleet and adjusted to correct for the LAP differences between the program-in-question and the benchmark, Arizona program. The program evaluation is then made by a direct comparison between the state ASM or idle program and the weighted average IM240 emissions from the benchmark program.

Recruitment options and testing provisions used under the ASM/Idle Method should be the same as those described above for the IM240 Method.

Section 3: Estimating Program Benefits Using VMAS Data

VMAS is a patented technology developed by Sensors Inc. of Saline, Michigan and is currently being pilot tested by the New York Department of Environmental Conservation (NY DEC). It is used in conjunction with a BAR97 analysis system that consists of an internal tailpipe probe, gas analyzers, and computer. The unit provides second-by-second as well as cumulative tailpipe mass emissions measurements over a defined test period. On a second-by-second basis, VMAS measures tailpipe exhaust flow, receives raw pollutant concentrations from the BAR97 system, and computes real-time mass emissions from the tailpipe flow and concentration data. The test period may be steady-state, transient, unloaded or loaded; however, the only mode studied to date has been the transient IM240 cycle. When used in this fashion, i.e. VMAS/BAR97 with an IM240 drive cycle run on a BAR97 certified dynamometer, the I/M test is referred to as the NYTEST.

Although VMAS technology has the potential to be applied to I/M emission tests other than the NYTEST, to date EPA has only focused on evaluating the system as used in the NYTEST procedure. NYTEST/IM240 correlation data have been collected to date on 99 vehicles and the results are very encouraging. Furthermore, NY DEC is in the process of collecting data on an additional 5,100 vehicles[5]. Based upon these preliminary findings, EPA is currently approving the VMAS system operated according to the NYTEST protocol as equivalent to the IM240, with regard to its use as a program evaluation measurement tool. States choosing to use the VMAS/NYTEST protocol for program evaluation purposes should be aware, however, that this approval may be withdrawn should subsequent data collection and analysis dictate. The random sample recruitment and benchmark comparison provisions discussed previously also apply to this alternative program evaluation methodology.

Other states and/or vendors may submit VMAS-based correlation data to EPA using configurations other than those specified for the NYTEST discussed above. However, prior to embarking on a test program, such states should have their test and analysis plan reviewed by EPA.

Section 4: Estimating Program Benefits Using RG240 Data

There are currently no standard equipment specifications for RG240 technology. Therefore,

[5]At this time, EPA has not yet verified the credit levels associated with using NYTEST, but will work with NY DEC to establish the appropriate level of credit based on the results of NY's test program.

when the term "RG" is used, it does not unequivocally define a specific analyzer, dynamometer, and flow measurement system. The RG240 system referred to here is that developed by California Analytical, Inc. and utilizes analyzer and flow measurement technology similar to that specified in EPA's IM240 and Evap Technical Guidance. The dynamometer used must be equivalent to the BAR97 dynamometer used for the ASM to be considered an RG240 system for the purposes of this guidance.

The paired IM240/RG240 correlation data submitted to EPA thus far has been limited to a 100 vehicle pilot study performed by Rhode Island. To supplement this data, EPA is currently working to obtain correlation data on an additional 2,000 IM240/RG240 vehicles, including paired Federal Test Procedure (FTP) data on 200 of these vehicles. The collection and analysis of this data will be performed in FY99. Based upon its preliminary findings, however, EPA is currently approving the specified RG240 configuration as equivalent to the IM240, with regard to its use as a program evaluation measurement tool. States choosing to use this RG240 approach for program evaluation purposes should be aware, however, that this approval may be withdrawn should subsequent data collection and analysis dictate. The random sample recruitment and benchmark comparison provisions discussed previously also apply to this alternative program evaluation methodology.

Other states and/or vendors may submit RG240 correlation data to EPA using RG240 configurations other than the one identifed above. However, prior to embarking on a test program, they should have their test and analysis plan reviewed by EPA.

Section 5: Estimating Program Benefits Using RSD Data

There has been much discussion within the I/M community over the accuracy and utility of RSD technology in I/M programs. Improvements in site selection criteria and measurement technology have led to RSD gaining acceptance by EPA with regard to the technology's use as a clean-screening methodology. Interest has also been shown in RSD's potential as a program evaluation tool, and today's guidance focuses on this particular RSD application. As is the case with most alternative testing methodologies, if RSD-measured fleet average emissions can be correlated back to the IM240, then this method (albeit non-METT) will be as valid a program effectiveness methodology as the IM240-based methods previously advocated. The question remains, however, whether or not such a correlation is possible.

In evaluating this approach, EPA looked at two different I/M program evaluations which have been performed using RSD technology by separate researchers.[6,7] The details of these studies with regard to site selection, data collection, etc. may be found in the literature; however, future EPA program evaluation guidance (which will be issued should EPA find RSD methods to be sound for evaluation purposes) will also provide more detailed information on these topics since these are critical to ensuring that RSD-measured fleet average emissions can be correlated with IM240 or other METT data.

The first study (Stedman, et al.) used RSD-based measurements to evaluate Denver's current

[6]Stedman, Bishop, and Slott, Environmental Science & Technology, 31(3), 927, 1997.

[7]Rogers, DeHart-Davis, Lorang, Atmospheric Environment, submitted for publication.

IM240-based I/M program which has been in operation since 1995. The study concluded that the program was achieving a 4-7% carbon monoxide (CO) benefit, while no hydrocarbon (HC) or oxides of nitrogen (NOx) benefits were detected. These values are well below the benefits predicted by the MOBILE model for an IM240-based program, which is typically projected to yield benefits in the range of 12-16% HC, 23-29% CO, and 7-11% NOx (assuming national defaults for vehicle age distribution, fuels, and average temperature). In considering these conclusions, however, it is important to note that the Denver area also had a pre-existing basic I/M program in place, which had been operating since 1981 until it was replaced by the IM240 program in 1995. Furthermore, the Denver program is unusual among I/M programs, in that it was designed primarily as a CO control measure, as opposed to ozone control.

The second study (Rogers, et al.) examined the Atlanta program, and -- in sharp contrast to the Stedman study -- concluded that Atlanta's hybrid idle-based I/M program achieved emission reductions greater than those predicted by MOBILE for light-duty cars (109% of the projected benefit), while somewhat below the MOBILE prediction for light-duty trucks (72% of the projected benefit). It seems improbable that a centralized IM240 program would fare so much worse than predicted relative to a hybrid idle test program, regardless of the geographic and fleet characteristic differences between the Atlanta and Denver areas. Furthermore, the disparity cannot be written off as the result of Denver's having had a pre-existing basic program, since Atlanta, too, has operated a basic I/M program since 1982. Therefore, the reasons for this range in RSD-calculated program evaluation results must be investigated further before EPA can make a more definitive statement regarding the viability of RSD as a sound program evaluation method. EPA is investigating this issue with the authors of both studies and will include the results of this effort in any subsequent program evaluation guidance relating to RSD that EPA may publish in the future.

If they so desire, states and/or vendors are invited to submit to EPA RSD-based data in support of this program evaluation methodology. However, prior to embarking on a test program, they should have their test and analysis plan reviewed by EPA. Due to the uncertainties which remain EPA is not approving RSD fleet characterization as a sound program evaluation method as part of today's guidance, though it is still possible that we may approve this method at some future date.

Section 6: Program Evaluation Data Format Specifications

Though states are free to submit program evaluation data to EPA in whatever format is most convenient for them, we do have a recommended data format which is included below for states' consideration:

Vehicle Data Items

State
City
VIN
Fuel Type (Gas or Diesel)
Make
Model Year
GVWR

Curbweight

Test Data For Gram/Mile Tests

Test Purpose (Baseline, Correlation, Program Evaluation)
Submitter's Test Identification (optional)
Test Procedure (IM240, RG240, NYTEST)
Test Date
Odometer
Total Hydrocarbon Emissions (HC) (expressed in grams/mile)
Carbon Monoxide Emissions (CO) (expressed in grams/mile)
Carbon Dioxide Emissions (CO2) (expressed in grams/mile)
Oxides of Nitrogen Emissions, corrected for humidity (expressed in grams/mile)
- OR, for NYTEST,
Nitric Oxide Emissions (NO), corrected for humidity, (expressed in grams/mile)

Test Data For Concentration Tests

Test Purpose (Baseline, Correlation, Program Evaluation)
Submitter's Test Identification (optional)
Test Procedure (ASM-5015, ASM-2525, RSD, IDLE)
Test Date
Odometer
Total Hydrocarbon Emissions (HC) (expressed in concentration units)
Carbon Monoxide Emissions (CO) (expressed in concentration units)
Carbon Dioxide Emissions (CO2) (expressed in concentration units)
Nitric Oxide Emissions (NO), corrected for humidity, (expressed in concentration units)

EPA further recommends that these data items be submitted as either 1) tab-delimited ASCII text files or 2) .DBF files. Any widely used media may be used, such as 3.5 inch diskette, CD-ROM, "ZIP", "JAZ"). There should be one file for the vehicle data items and one or two files for test data items depending on the test procedures used. The following field naming and data types are recommended:

Vehicle Data Items:

STATE (Character, length 2)
CITY (Character, length 20)
VIN (Character, length 17)
FUELTYPE (Character, length 4, containing either GAS or DIES)
MAKE (Character, length 12)
MODEL_YR (Numeric, length 4)
GVWR (Numeric, length 6)
CURBWEIGHT (Numeric, length 6)

GM/Mile Test Data Items:

PURPOSE (Character, length 10, containing BASELINE, CORRELATE, or PROGEVAL)

TEST_ID (Character, length 12)
TEST_PROC (Character, length 5, containing IM240, RG240, or NYTST)
TEST_DATE (Date, or Character length 6 containing MMDDYY)
ODOMETER (Numeric, length 6)
THC (Numeric, length 7 with 3 decimals)
CO (Numeric, length 8 with 3 decimals)
CO2 (Numeric, length 8 with 3 decimals)
NOX or NO (Numeric, length 7 with 3 decimals)

Concentration Test Data Items:

PURPOSE (Character, length 10, containing BASELINE, CORRELATE, or PROGEVAL)
TEST_ID (Character, length 12)
TEST_PROC (Character, length 5, containing ASM50, ASM15, RSD, or IDLE)
TEST_DATE (Date, or Character length 6 containing MMDDYY)
ODOMETER (Numeric, length 6)
C_THC (Expressed as parts per million, Numeric, length 4,)
C_CO (Expressed as percentage, Numeric, length 6 with 2 decimals)
C_CO2 (Expressed as percentage, Numeric, length 6 with 2 decimals)
C_NO (Expressed as parts per million, Numeric, length 4)