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Guidance for the Implementation of Accelerated Retirement of Vehicles Programs

Environmental Protection Agency

Office of Mobile Sources

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I. Forward

The Clean Air Act, as amended in 1990, mandates market-based approaches in certain Federal programs and encourages the use of such approaches at the Federal, State, and local levels, as well as by individual sources, to facilitate the attainment of required emission reduction milestones and goals of Title I of the Clean Air Act Amendments. In response to the Act, the Agency has proposed and issued rules and guidance that incorporate the use of market-based measures in Federal program areas such as acid rain reduction and clean fuel fleet vehicle purchases.

To facilitate the development of market-based programs that go beyond such Federal programs, the Agency is developing comprehensive rules and guidance for States and individual sources to follow in designing and adopting market-based programs in State Implementation Plans (SIP's). The pending Economic Incentive Program (EIP) Rule draws upon the general principles found in the 1986 Emission Trading Policy Statement (see 51 FR 43631 December 4, 1986), while providing a broad framework for the development and use of a wide variety of market-based control strategies. For States to take credit in their SIP's for emission reductions based upon such strategies, reductions must be quantifiable, enforceable, surplus to other Federal and State requirements, permanent within the timeframe specified by the program, and consistent with all other statutory and Federal regulatory requirements. The proposed EIP Rule is applicable to all types of sources, including stationary and mobile sources, and defines general regulatory elements (e.g., program baseline, auditing procedures, enforcement requirements) that should be included in the design of market-based control strategies.

In addition to this broadly applicable general rule, the Agency is also developing a more narrowly focused document entitled, "Guidance on the Generation of Mobile Source Emission Reduction Credits," specifically for the development of market-based programs involving emission reduction credits generated from mobile sources. Such mobile source emission reduction credits (MERC's) can be generated from surplus emission reductions over and above Federal mobile source program requirements and can potentially be used to substitute for stationary source emission reduction requirements. The general guidance on the generation of MERC's mentioned above addresses issues unique to emission reduction credits generated by mobile sources, including the calculation of emissions baselines for participating sources, the projection of future emissions levels, and the time-averaging of emission reduction credits that vary over time.

To exemplify how MERC's can be generated from a specific category of mobile sources, the following guidance addresses accelerated retirement of vehicles programs (also known as scrappage programs), and illustrates how the purchase of vehicles, and their removal from use, can generate emission

credits. While market-based mobile source programs must be consistent with the EIP Rule and the Guidance on the Generation of Mobile Source Emission Reduction Credits, EPA does not intend to limit flexibility and innovation beyond the requirements found in these documents.

The following guidance is intended to assist program sponsors in the design of scrappage programs, not to limit initiative, creativity, or flexibility in developing a program which best meets the sponsors' needs within the limits of good environmental policy. The examples that are used in this guidance to illustrate a methodology for calculating benefits and an administrative framework for such a program are not exhaustive. EPA encourages potential sponsors to maximize the cost-effectiveness of scrappage programs, for example, by targeting them towards vehicles which have already been identified as high emitters (see Section VIII-C) or by targeting the retirement bounty at vehicles equipped with the very oldest emission control technology (pre-1975 model year).

II. Introduction

The Clean Air Act Amendments of 1990 define "programs to encourage the voluntary removal from use and the marketplace of pre-1980 model year light duty vehicles and pre-1980 model light duty trucks" as a transportation control measure in Section 108(f). A scrappage program as described in EPA's recent information document[1], could be such a measure. Additionally, scrappage programs offer a cost-effective alternative to more expensive and difficult stationary source emission control measures. A scrappage program has the potential to create additional flexibility, for governments and industry alike, by allowing the generation of emission reduction credits from existing mobile sources that could be traded to stationary sources.

The purpose of this document is to provide guidance to States that are interested in developing criteria and procedures for the implementation and administration of scrappage programs. It discusses scrappage programs and specifies a base methodology for the calculation of MERCs from such programs. It also discusses some areas of uncertainty that program variations may amplify, and for which the Agency seeks additional information for the purpose of developing future guidance.

The document is divided into nine sections. Section III contains background information to provide the context from which this guidance should be viewed. Section IV discusses requirements that must be included in scrappage programs in order

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[1] See Transportation Control Measure Information Documents, Accelerated Retirement of Vehicles, U.S. EPA, Office of Mobile Sources, March 1992

for credits to be calculated from the methodology described in this document. Section V provides the base methodology for the calculation of MERCs, that if followed, would be readily acceptable to EPA. Section VI provides an example illustrating how to calculate MERCs using the base methodology. Section VII discusses some areas of uncertainty which may affect the emission reductions that are actually achieved. Section VIII describes program variations, which, if developed and addressed properly, could increase emission reductions and improve cost-effectiveness. Finally, Section IX defines the applicability of generated emission credits.

This document is an addendum to EPA's general guidance document, "Guidance on the Generation of Mobile Source Emission Reduction Credits." The requirements, discussions and examples are related only to the generation of emission reduction credits from scrappage programs. Guidance related to the use of emission reduction credits can be found in the general guidance document.

III. Background

Old automobiles with no or few emission controls are typically a source of high emissions. Newer vehicles possessing emission controls which have been tampered with, maintained improperly, have failed, or have otherwise been rendered ineffective are also significant contributors of emissions. While normal attrition of the fleet solves some of this emissions problem, some high emitting vehicles remain in operation and contribute to the problem for long periods of time. It is these vehicles which scrappage programs seek to remove from the fleet by providing an incentive for owners to retire these vehicles sooner than they would have in the absence of the program.

A State or local government can design a scrappage program as a SIP measure or, in conjunction with a private company, as a program to generate emission credits to satisfy existing or new source-specific requirements. Scrappage programs can be designed as either emission-limiting or market-response programs. An emission-limiting program would directly specify a level of emission reduction to be achieved (e.g., scrap vehicles until the desired reduction is achieved). In contrast, a market-response program would create an incentive to reduce emissions without directly stating a specific emission reduction target (e.g.,.set a price for certain vehicles and scrap those that respond). The proposed EIP rule provides guidance for both types of programs.

While the potential for variations such as those described in Section VIII exist, programs will basically work in the following way. A State or local government or company would advertise for the purchase of certain vehicles. Owners would then voluntarily sell their vehicles to the sponsor of the program and the vehicles would be removed from the fleet. The

sponsor would receive an emission credit for each car removed from operation equivalent to the difference between the emissions from the retired vehicle and the emissions from the replacement vehicle.

Although this guidance generally addresses light-duty vehicles, EPA recognizes that old light-duty trucks were also built without emission control equipment, and that the introduction of emission control components lagged behind those for cars. EPA encourages States to consider the application of this guidance to programs that include trucks.

As indicated above, scrappage programs must follow a number of general requirements that are detailed within other guidance and rules. The next section provides additional specific guidance relevant to scrappage programs.

IV. Requirements for Scrappage Programs

In order to ensure that scrappage programs yield the expected levels of emission reductions, minimum safeguards should be provided in order to receive tradeable credit. EPA therefore requires the following program design elements in scrappage programs as a condition to using the methodology contained in this document. If these elements are not present, EPA will consider the program particulars on a case by case basis, due to greater uncertainty of emission reduction claims.

1. Twelve month registration requirement

To ensure that vehicles are not imported into the area for the sole purpose of being sold in the program, eligible vehicles must have been registered by the owner at an address within the nonattainment area continuously for at least the previous twelve months prior to the date the vehicle is purchased by the program.

2. Vehicle must be operable and driven to site

Scrappage programs should seek to remove those high emitting vehicles which would have been operated in future years and not to attract vehicles which are inoperable or have little remaining useful life. Eligible vehicles are required to be operable and driven to the intake site to increase the probability that the scrappage program will attract in-use vehicles. In addition, they must undergo a physical inspection designed to assure that major body components have not been removed and that the vehicle could be readily used for normal transportation purposes.

3. Owner must be present and possess a valid title

The owner of the vehicle or his or her legal representative, or in the case of corporate owned vehicles, a certified agent, must be present to ensure proper passage of title, and verify the owner's intention to retire the vehicle. Since these vehicles will either be destroyed or dismantled for partial recycling, they cannot be returned to the owner if a mistake is made. The identification of the person delivering the vehicle, the Vehicle Identification Number (VIN) and the validity of the vehicle title must be verified.

4. Owner must have a valid I/M certificate (where applicable)

As a further assurance that the vehicle being retired is an in-use vehicle, scrappage programs must require the owners to present the I/M certificate (or waiver certificate if the car received a waiver) obtained from the previously required testing period (where I/M is applicable).

5. Environmentally Safe Disposal

A scrappage program will generate solid, liquid, and gaseous waste which must be disposed of or recycled in an environmentally sound manner. EPA requires that all retired vehicles be scrapped by facilities which are licensed and approved to dispose of all the types of waste created by the scrappage of vehicles or recycling of vehicle parts, where licensing requirements apply. In areas where such licensing requirements are not in place, programs must adhere to all applicable Federal, State, and local recordkeeping procedures and laws for disposal of vehicles. Where legal requirements are not in effect, all prudent environmental safeguards should be strictly followed to ensure that scrappage of vehicles does not result in environmental degradation.

EPA is considering whether to issue supplemental guidelines that States should follow to ensure that vehicles are disposed of or parts are recycled in an environmentally sound manner. The supplemental guidelines would include criteria for materials disposition that disposal facilities should be required to meet whether licensed or not. EPA is interested in receiving comments regarding what criteria might be included in those guidelines. Anyone wishing to submit comments on the criteria should send them in writing to: U.S. Environmental Protection Agency, Transportation Section, 2565 Plymouth Road, Ann Arbor, MI 48105.

The overall environmental and economic impact should be examined by program sponsors when considering the method of

vehicle disposal to be used. For non-emissions related parts, program sponsors may wish to make use of the broader environmental benefits of the automotive dismantling and recycling industry when economically feasible. The recycling of a vehicle's major body components and other non-emissions related parts could be allowed where proper safeguards are implemented to assure that emissions related parts are effectively destroyed.

6. Emission Estimates

The estimates used in the base methodology for calculating MERCs, described in Section V, come from the latest MOBILE model released by EPA[2]. The most recent version of the model must be used for program evaluations begun three months or more after the release of an updated model.

As an alternative to the MOBILE model's average emissions approach, program sponsors may choose to use actual tested emission levels as the basis for emission estimates. For the purpose of quantifying those emission levels, a transient mass exhaust emissions test, and if desired, an evaporative emissions test procedure[3] should be used. If this approach is used, other program design elements will be required to guard against the possibility of tampering to increase emissions and the resulting credits. This issue is discussed more fully in Sections VII and VIII.

7. Minimum data gathering requirements for programs over 2500 vehicles

Sponsors which retire more than 2500 vehicles within any twelve month period are subject to a minimum data gathering requirement. Sponsors must collect emissions data, using EPA's I/M240 mass emission test and evaporative purge and pressure tests, from a random sample of a statistically significant number of participating vehicles. Sponsors must also collect information on annual VMT, expected remaining useful life, and model year of replacement vehicle. The information will be provided to EPA for evaluation of program emission estimates and for the purpose of improving future guidance on emission reduction estimates for scrappage programs.

For California programs, the requirements of this section may be applied to the EMFAC model if currently accepted by EPA for use in SIP submittals.

If exhaust and evaporative emissions tests other than the Federal Test Procedure (FTP) are used, proof of correlation to the FTP must be submitted and approved by the EPA. The I/M240 is one such acceptable exhaust emissions test.

8. State Responsibility

States allowing MERCs for retirement programs are responsible for assuring that programs are implemented in accordance with this guidance. Since these programs have the potential to change fleet emissions characteristics, MERCs claimed for these programs must be properly accounted for in applicable State Implementation Plans. Baseline emissions projections must be adjusted to assure that double counting of the emission reductions has not occurred.

V. Base Methodology for Calculating MERCs

The base methodology, consisting of the eight basic steps described below, is designed to ensure that emission reduction credits can be reasonably determined without emission testing. The estimates of emission levels described in steps 5 and 6 are based on local fleet and ambient characteristics entered into EPA's MOBILE model. However, the use of emission tests, as described in Sections VII and VIII, to establish vehicle emission levels could be used as an alternative.

1. Determine or estimate the number of vehicles to be retired, by model year.

When the scrappage program has been executed, or partially executed, the number of vehicles retired by model year can be determined by simple counting. The following paragraphs address a situation in which an advance estimate of credit is desired or required[4].

A model year distribution for a scrappage program reflecting the model year distribution of eligible vehicles in the local area is required for accurate estimates of emission reductions. The first step is to estimate the model year distribution of vehicles expected to participate in the program. Determining this distribution requires information about the distribution of the eligible fleet. The eligible fleet is defined as the subset of model year vehicles from the area fleet that could potentially participate. The most reliable source of this information is actual vehicle registration data that can generally be obtained from a State's Department of Motor Vehicles (DMV) or equivalent agency.

The incentive offered to entice owners of old vehicles to participate, relative to the market value of the various model years and makes, will affect the actual distribution of

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[4] Advance estimates may be desired in order to evaluate program cost-effectiveness or to predict emission reductions for a State Implementation Plan. EPA does not intend to issue tradeable credits based upon predicted emission reductions from proposed future scrappage programs.

participating vehicles. Program sponsors must assure that incentives are sufficient to attract a level of participation that reflects the distribution estimates made in the analysis. If alternative incentives are offered, sponsors should modify the model year distribution accordingly.

Determining the number and model year of vehicles which will be retired depends on several factors, including the amount of money or other incentive which will be offered for each retired vehicle, the number of eligible vehicles that exist in the fleet, the method of advertising, and the convenience of the scrappage site to various groups of owners. Some insight on appropriate incentives and number of vehicles may be gleaned from a used car market value reference such as a "blue book," or a local newspaper's classified advertisements, and State DMV statistics

2. Estimate changes in fleet size

Determining the effect the program will have on the size of the fleet is important because fleet size affects evaporative emission totals, independent of vehicle miles traveled (VMT). Scrappage programs cause a portion of the fleet to be retired from use faster than it would have been without a program. While the drivers' need to travel may not have changed, vehicle replacement is uncertain. Some vehicles will be replaced, some of the owners may now choose to drive another car that they own more than before, and some may utilize alternative modes of transportation.

This methodology has made assumptions that total fleet VMT will remain the same before and after the program and that the VMT from the scrapped vehicles is redistributed to the remaining fleet in proportion to the travel fractions that exist for the entire fleet. These assumptions are discussed below in part (3) of this section. These assumptions imply that there would necessarily be fewer vehicles in the fleet, at least immediately after the program. This can be conceptualized by thinking of lower VMT vehicles being replaced by higher VMT vehicles, but holding total VMT constant. The result is fewer total cars. With time, fleet size is likely to return to a "natural" level, through increased new car purchases and slower retirement of existing vehicles.

Fewer but higher VMT vehicles, on average, would have lower diurnal evaporative emissions per mile of travel. Without adjusting mileage accumulation rates in the MOBILE model, this discrepancy cannot be addressed satisfactorily. The net effect on emission calculations is minor, and the effect on fleet size is likely to be only temporary. These considerations warrant taking the more conservative and simplified approach of ignoring the potential change in the total number of vehicles in the fleet.

3. Estimate changes in VMT

Two basic estimates need to be made: 1) What is the effect on total VMT in the area when older vehicles are scrapped; and 2) How are the VMT, which were attributed to the retired vehicles, redistributed in the remaining fleet? Estimates of these changes in VMT in the area as a result of the program are important because VMT affects numerous critical internal calculations and inputs to the MOBILE model. For instance, the MOBILE model assigns the number of trips made by vehicles based upon VMT. The number of trips is important within the MOBILE model since a significant portion of a trip's emissions is generated when a trip begins and the engine is cold.

It is reasonable to assume that scrappage programs will not change total VMT significantly because people's transportation needs will not necessarily change. However, data suggest that within the national fleet, newer vehicles travel farther than older vehicles[5]. Since the post-program fleet will be somewhat newer, it could be argued that there may be slightly more VMT. EPA believes that for most programs, any increase in total area VMT will be insignificant and that the methodology should assume that total VMT remains the same before and after the program. In effect, EPA is assuming that newer cars are used more because drivers with larger VMT needs can afford and choose the greater reliability, comfort, and fuel economy of newer cars. Their VMT needs are, however, basically fixed. EPA believes that this is a more reasonable assumption than an assumption that the driving performance of a newer car unleashes some previously pent up desire or need to travel.

Inherent in the determination of the change in VMT is the estimation of the redistribution of VMT from the retired vehicles. This estimation is difficult, and empirical data are scarce. States should assume that the VMT of the retired vehicles are absorbed by the remaining fleet in the same proportion that exists for the total fleet in the MOBILE model. If, for example, ten percent of the total fleet VMT are assigned to 1989 model year vehicles, then ten percent of the VMT of the retired vehicles are assigned to 1989 model year vehicles in the remaining fleet.

4. Estimate the expected years of remaining life for the retired vehicles.

The expected remaining useful life of any given group of vehicles will vary by geographic location. Differing estimates may be used if supported by accurate local or regional data on

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U.S. Department of Energy, Fuel Purchasing Patterns and Vehicle Use Trends from the NPD Research Gasoline Diary Data Base: October 1983 - September 1984 Data Display, January 1988.

remaining useful life, or by projections from related data sources.

Regardless of geographic location, annual VMT and the number of vehicles which "naturally" survive from any given starting group of vehicles decrease each year. Therefore, a program which scrapped typical vehicles from this fleet segment would earn the most credit in the first few years and earn smaller amounts of credit over time. A few vehicles in a group of scrapped vehicles could, in the absence of a scrappage program, continue to operate substantially longer than the average vehicle of that vintage. However, EPA anticipates that there is a possibility that the vehicles attracted by a scrappage program will not be typical or representative of the fleet. Instead, scrapped vehicles may be mechanically worse than average and may have shorter useful lives than others their age. Also, when some cars of a certain model year are removed from service through a scrappage program, the market value of the others in that age group will increase, which will tend to reduce their "natural" scrappage rate.

However, EPA remains open to the possibility that an area and program-specific remaining life assumption could be assumed for any group of scrapped vehicles if supporting information or program design elements were present. EPA will consider remaining life assumptions based upon such information including, but not limited to, data gathered from previous program studies, professional independent mechanical condition assessments, or information on the correlation between vehicle procurement incentives and the mechanical condition of participating vehicles.

Where such regional or local data, or other supporting program information or design elements are not present, three years of remaining useful life, estimated by EPA from national data on 1979 and earlier model year vehicles, should be used. EPA has evaluated the effect of age on useful life and remaining VMT based on national fleet data from the 1984 National Purchase Diary (adjusted to reflect FHWA 1990 total VMT estimates)[6] and from the Transportation Energy Data Book[7]. Our analysis indicates that if a vehicle were to travel at its age-specific VMT accumulation rate for three years, then it would accumulate all of the expected remaining VMT for an average vehicle of that vintage. EPA believes that this three year limitation is a reasonable policy choice on how long credit should be granted.

EPA analysis of the same data indicates that the 1979 and earlier model year segment of the fleet has an average annual retirement rate of about 20% (the average vehicle in this segment has a 20% chance of being retired in a given year). Therefore,

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U.S. Department of Transportation, FHWA, Highway Statistics, 1991

U.S. Department of Energy, Transportation Energy Data Book: Edition 11, Oak Ridge National Laboratory, January 1991.

within this three year window, the number of vehicles affected by the accelerated retirement event must be reduced by 20% per year. Likewise, where local or regional remaining life estimates are used, a comparable age-specific retirement rate derived from local or regional scrappage/survival statistics must be used to reduce the affected number of vehicles.

The calculation of a declining number of vehicles in the scrapped fleet and the truncation of emission credit at three years are policy choices to set a national default value for these parameters in the example program described in this guidance. These choices are made in light of the uncertainties and the possibility of biased recruitment in scrappage programs in cases where the data described above to support alternative estimates are unavailable or unreliable. They are not meant to establish precedents for remaining life estimates for scrappage programs which use vehicle specific data to estimate remaining useful life or other programs which might need such estimates in order to calculate benefits.

5. Estimate the average emission rate per year from the retired vehicles.

Estimates of the average emissions from the retired vehicles are calculated by the MOBILE model for each calender year, taking into account local characteristics such as model year mix, ambient temperature, fuel, average speeds, and any local control program. The MOBILE model should be run with a zero value entered for the registration distribution and mileage accumulation inputs for the non-retired model years. The average grams per mile will be indicated at the bottom of the column labeled FER on the MOBILE "By Model Year" output table.

6. Estimate the average emission rate per year from the replacement vehicles.

A determination of the emission characteristic of the replacement vehicles for each calender year is also needed. Consistent with the assumption about the redistribution of scrapped vehicle VMT, the replacement vehicle is assumed to be the average vehicle in the entire fleet, including older vehicles which were not scrapped. As in part (5), estimates of the average emissions from the entire post-program fleet are based on the local characteristics and are calculated by the MOBILE model. To estimate the average emissions of the replacement vehicles, the MOBILE model should be run for all model years. The average grams per mile will be indicated in the column labeled FER on the MOBILE "By Model Year" output table. It is optional whether to adjust age distribution at this step to account for the removal of some vehicles, since the effect may be too small to appear in the significant digits of the output.

7. Calculate the average yearly emissions benefit for each retired vehicle

The average yearly benefit of the program for each vehicle retired from the fleet is the difference between the average emission rate of the scrapped vehicles and the average emission rate of the replacement vehicles, multiplied by the average annual VMT of the scrapped vehicles. The average annual VMT of scrapped vehicles is the average annual mileage accumulation taken from the MOBILE model, for the model years of the vehicles being scrapped. Model years can be treated individually, or aggregated by the number of vehicles scrapped from each. This annual VMT value will decrease in accordance with the MOBILE model, for each successive year of the creditable three year period.

8. Calculate the total emission reduction in tons per year removed by the program.

To calculate the tons removed by the program, multiply the average yearly emissions benefit of each retired vehicle by the number of vehicles retired by the program and convert to tons. This calculation is done for each of the three creditable years As mentioned in part (4) of this section, the methodology assumes an annual "normal" retirement rate. The total number of vehicles represented in years two and three reflect this reduction. Since the MOBILE model reports emission levels in grams per mile per vehicle, the values need to be converted to tons.

VI. Example

The example used to illustrate the methodology is hypothetical and does not represent an Agency position on appropriate program size or design. The values used in the calculations are based upon data representing national fleet averages and may not be representative of any particular urban area.

Table 1 provides an estimate of the emission reductions that could be realized from a program operating in 1993, in which 10,000 pre-1980 model vehicles are retired.

Table 1.

Program to Retire 10,000 Vehicles in 1993

Year	Emission Reduction (tons)		
	VOC	NOx	CO
1993	343	115	2600
1994	272	91	2085
1995	216	72	1657
Total	831	278	6342
Avg/Yr	277	93	2114

All of the emission estimates were made using the mobile source emissions model, MOBILE4.1. Baseline and post-program scenarios use national average default values to describe the vehicle fleet, standard speeds, and typical summer temperatures. The scenarios assume a low altitude area with an ASTM class "C" fuel. The area is also assumed to have an existing "basic" Inspection/Maintenance program with an idle test covering all model years of vehicles.

A step by step description of the base methodology and how it was applied to the example follows and is shown in Table 2.

1. Estimate the model years and number of vehicles to be retired.

For this example, the model year distribution of the participating vehicles is assumed to be identical to that of the eligible fleet and is based upon national fleet model year distribution from the MOBILE4.1 model. It is assumed that 10,000 pre-1980 model year vehicles are scrapped on January 1, 1993.

2. Estimate changes in fleet size.

For this example, it is assumed the total number of vehicles

in the fleet remains the same as before the program was implemented.

3. Estimate changes in VMT.

EPA's approach keeps total VMT the same before and after the program. The values are determined by the annual mileage accumulation in the MOBILE model and are supported by data reported by Oak Ridge National Laboratory in the Transportation Energy Data Book: Edition 11, and also by data collected by UNOCAL during the demonstration program in Los Angeles during the summer of 1990. The average VMT per year per retired vehicle is 5182 miles in year 1, 4920 miles in year 2, and 4680 miles in year 3.

4. Estimate the expected number of years of use remaining for the retired vehicles.

The expected number of years of use remaining in the retired vehicles is three years.

5. Estimate the average emissions per year from the retired vehicles.

The average emissions from the retired vehicle were estimated by EPA's mobile source emissions model, MOBILE4.1, using national average characteristics for climate, geography, local control program, and vehicle fleet (altitude, fuel, I/M program, fleet, travel fraction, etc.). The MOBILE model was then run for three successive years, 1993, 1994, 1995. The average emissions were determined by running the model with zero registrations and zero mileage accumulation for 1980 and newer model years. The average grams per mile are indicated at the bottom of the column labeled FER on the MOBILE4.1 output table(See attachments 1, 2 and 3).

The emission levels for the retired vehicles in each of the three years were as follows: 8.87 g/mile in 1993, 9.06 g/mile in 1994, and 9.26 g/mile in 1995.

6. Estimate the average emissions per year from the replacement vehicles.

The estimates of the average emissions from the entire post-program fleet were based on the same national average characteristics mentioned in step (5). To estimate the average emissions of the replacement vehicles the MOBILE model should be run for all model years for 1993, 1994 and 1995. The average grams per mile will be indicated in the column labeled FER on the MOBILE4.1 output table(see attachments 4,5 and 6).

The emission levels for the replacement vehicles in each of

the three years were as follows: 2.20 g/mile in 1993, 2.09 g/mile in 1994, and 2.00 g/mile in 1995.

7. Calculate the average yearly emissions benefit for each retired vehicle.

Subtract the result of step 6 from the result of step 5 and multiply by the average VMT per scrapped vehicle, determined in step 3, for each calender year. The results are 34564 grams/vehicle in 1993, 34292 grams/vehicle in 1994, and 33977 grams/vehicle in 1995.

8. Calculate the total emission reduction in tons per year removed by the program

Multiply the average emissions benefit for each retired vehicle by the effective number of vehicles retired, and convert to tons for each calender year. To determine the effective number of vehicles for each year, reduce the number of scrapped vehicles by the "normal" retirement rate. For this example, the national rate of decline of 20% per year will be assumed, starting immediately after the scrappage event. Averaged over each of the three years, the effective number of vehicles for each year is 9000, 7200, and 5760 respectively.

Table 2.

Hydrocarbon Emission Reduction

Example: 10,000 pre-1980 model year vehicles scrapped on 1/1/93

		1993	1994	1995
HC/retired vehicle (g/mile)		8.87	9.06	9.26
HC/replacement vehicle (g/mile)	-	2.20	2.09	2.00
HC reduction/vehicle (g/mile)	=	6.67	6.97	7.26
VMT/year/retired vehicle	x	5182	4920	4680
Grams/vehicle/year	=	34564	34292	33977
Effective number of vehicles*	x	9000	7200	5760
Conversion (grams to tons)	x	.000001102	#	#
Tons per year	=	343	272	216

(*) The analysis assumes that all of the retired vehicles would have been scrapped within 3 years. This method assumes a 20% scrappage rate per year for three years, and provides for no reduction credit beyond the three year remaining life assumption.

VII. Areas of Uncertainty

Because there is a good correlation between the age of the vehicle and the level of emissions, the base methodology will be sufficient for estimating emission reductions from age-based programs. The base methodology was developed from empirical data and from careful consideration of areas of uncertainty. EPA recognizes that future scrappage programs offer the opportunity to gather better data and has set minimum data gathering requirements for sponsors that retire more than 2,500 vehicles within a twelve month period (see Section III-7). EPA encourages all program sponsors, regardless of size, to address the areas of uncertainty outlined below in their program designs and to gather data which can be used to update future guidance[8]. For now, EPA will consider alternatives to the assumptions for base methodology where there are sufficient supporting data and

[8] Recent work, related to the Environmental Defense Fund/General Motors scrappage proposal described later in this document, provides information on VMT and remaining life, aggregated by regions of the U.S.

information.

1. Tailpipe and evaporative emissions

Testing a vehicle's actual tailpipe emissions using a transient mass emissions test procedure may provide more accurate emissions reduction estimates, but if used to screen out clean cars or to quantify the credit for specific cars, it may also be an incentive to tamper with the vehicle to increase its emissions and credit value. EPA encourages the testing of participating vehicles to gather information on their actual emissions, but the test results should enter into a calculation of credits only if the vehicle owner and the scrappage sponsor are kept ignorant of the results, or if an EDF/GM-type approach to measurement pooling (see Below) is used. Simpler idle-type tests should not be used as a screen.

Evaporative emissions cannot practically be measured in a scrappage program, but physical inspection using pressure and purge tests is possible and allows a rough estimate of evaporative emission levels. Similar considerations apply as for tailpipe emissions.

Vehicles which are due for testing as part of a State I/M program raise additional concerns. If the vehicle is in a test failing condition at the time it enters a scrappage program, exhaust and evaporative emissions tests may yield emission estimates that are unrepresentative of that vehicle for future years, since required I/M repairs would likely reduce its emissions. Conversely, a vehicle with relatively low emissions at the time of scrappage, could have suffered a malfunction and produced higher emissions in the future. Section VIII-C discusses an appropriate approach for adjusting tested emission levels in areas that have I/M programs in operation. However, States may choose to allow only age-based average emission estimates for vehicles which are shortly due for their I/M test.

2. VMT Determination

The VMT of both the scrapped and replacement vehicles is critical to the calculation of the MERC, but due to the lack of available data, the base methodology uses age-based averages. EPA believes that, where actual data are unavailable, an estimate based on the MOBILE model is appropriate. EPA encourages data gathering to help clarify the actual annual VMT of scrapped vehicles and replacement vehicles. The Agency understands of course, that the data will be indirect in nature since, once scrapped, it is impossible to tell how any specific vehicle would have been kept and used.

3. Replacement Vehicle Determination

How the VMT of a scrapped vehicles is redistributed to the model years in the remaining fleet is necessary to calculate emission reductions. However, it is very difficult to pre-determine what type of vehicle, if any, will be used to replace the scrapped vehicle. The assumption made by EPA in the base methodology is derived from the data gathered from the Unocal study[9]. EPA encourages the sponsors of scrappage programs to gather information on the redistribution of VMT from scrapped vehicles. However, in light of the complexities of frequent and ongoing vehicle transfers, it will be difficult to be sure what vehicle(s) has actually been the supplier of replacement VMT.

4. Remaining life of scrapped vehicles

EPA limits the length of time emission reductions are creditable, based, in part, upon expected VMT within the remaining life of the average scrapped vehicle (see Section V.). The actual remaining life of participating vehicles may be influenced by program design. For instance, programs may attract a disproportionate number of vehicles which would have been retired soon on their own anyway. Programs offering very low incentives for vehicles would encourage the retirement of vehicles with little remaining life. While EPA will not require programs to offer a minimum incentive per vehicle, EPA encourages program sponsors to offer incentives that will attract a true cross section of vehicles within each age group, rather than just those with low market value or remaining useful life. Likewise, if people are aware that a scrappage program will be regularly repeated, there may be an incentive for them to hold on to their older vehicles longer since they can sell them to the program instead of selling or retiring them when they otherwise would have done. EPA encourages the gathering of data on the expected remaining life of participating vehicles and its relationship to the value of incentives or other program design elements.

VIII. Program Variations

Basic scrappage programs can be varied by changing the focus of vehicle selection from general model year eligibility to emissions level eligibility. EPA encourages scrappage programs to focus on high emitters and recognizes that there are many possible program variations that could assist in that regard. Some may require alternative assumptions or other modifications to the basic methodology for the calculation of emission reductions.

Fairbank,. Bregman and Maullin, "Final Summary Report of the Results of the Unocal SCRAP Program Post-Participation Survey," January, 1991

Program sponsors should give careful consideration to the effect that variations may have on effectiveness. Program variations require careful design and implementation in order to prevent fraud and misuse, and to decrease the effects of uncertainty. Some examples of possible variation are described below. These variations should be viewed only as points for discussion and should not substitute for local selection of program variations.

A. EDF/GM Test and Pool Approach

A scrappage program design proposal from the Environmental Defense Fund (EDF) and General Motors Corporation (GM) addresses some of the areas of uncertainty and is conducive to establishment of an ongoing program[10]. The EDF/GM design targets high-emitting vehicles regardless of age, awards emission reduction credits on the basis of emissions testing for each scrapped vehicle and creates an emissions reduction "pool" for the purpose of nullifying the incentive to tamper with individual vehicles. Under the program, vehicles are purchased for a negotiated amount reflecting the local market price for emission reduction credits in the area and generic information about the emissions and expected remaining life of the specific vehicle model and vintage. Presumably, in an active, ongoing program, private parties would accumulate and circulate such information, just as the retail market for used cars has created a "Blue Book," recording generic information about the transportation value of vehicles. Following purchase, the buyer would present the vehicle to an independent testing center where the emissions would be measured. The emission results, factored by projected annual VMT and remaining life, would be included in pools of the emission results of all cars purchased by scrappage sponsors in the area. Emission values would be reduced to reflect the emissions from replacement vehicles. Such pools would be created for each year of expected remaining life.

As an added assurance that the program provides net emission reductions, each year's emissions pool would be discounted by 10%. The remainder of the annualized emissions pool would be distributed in the form of transferable MERCs, to each scrappage sponsor on a pro-rata basis reflecting the sponsor's share of all scrapped vehicles whose emissions were included in the pool.

To bolster the pooling approach for minimizing the incentive for sponsors to tamper with vehicles to increase their emissions, local regulatory authorities would adopt an oversight procedure. By selling a "control" vehicle with known emissions to a scrappage sponsor and obtaining the emission test results from the independent test facility, tampering could be detected. Stiff penalties for tampering, including disqualifying the

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A copy of the EDF/GM white paper detailing the program is available from EDF. Those interested in obtaining a copy should contact EDF at their Washington, D.C. office.

sponsor from future scrappage programs and disallowing MERCs already generated by the sponsor would nullify the incentive to tamper, while also ensuring that any tampering already committed would not have an adverse effect on air quality.

B. Scrappage and Remote Sensing

Programs that use a remote sensing device (RSD) to target vehicles for participation in a scrappage program may reduce some of the uncertainty found in programs with eligibility based only on age and improve cost-effectiveness. Specifically, RSD may increase program cost-effectiveness by identifying older cars that are higher emitters than the average car of their age, and it may reduce credit overestimation by identifying vehicles which are actually in active service and not just being stored or used very infrequently. Scrapping only vehicles identified by on-road remote sensing should, therefore, produce more emission reductions per scrapped vehicle. EPA encourages consideration of this approach. However, if the emission estimates used for calculating the MERCs are to be increased over those predicted by the MOBILE model, transient mass emissions testing is required to determine how much larger the increases should be. Special program design elements should also be included to guard against intentional tampering for the purpose of increasing emissions and the resulting credits. An EDF/GM-type measuring approach is one solution. Interested parties should contact EPA to discuss any other ideas they may have.

C. Scrappage and I/M Programs

Adding a vehicle scrappage option to an I/M program is another way to improve program benefit and/or reduce costs. I/M programs require vehicles to pass an emissions test in order to be registered or licensed for operation. If a vehicle does not pass the test, owners are required to make repairs up to a certain dollar amount. If, after making the repairs, the vehicle still cannot pass the test, the owner may receive a waiver which allows the vehicle to be licensed for use until the next scheduled test.

Vehicles that fail an I/M test, and which have not yet been successfully repaired, or are known to need repairs costing greater than a predetermined amount, would become eligible for a scrappage program. Depending upon the estimated cost of repair, emission reduction credits would be based upon either the vehicles' emission levels from an I/M240 test, or emission estimates from the MOBILE model.

For example, vehicles requiring less than $300 in repairs would be assigned the MOBILE estimate of emission levels for the appropriate model year. Vehicles requiring $300-$450 in repairs would be assigned an emission level that is less than the initial

I/M240 test results, to reflect the repairs and the post-repair emission levels it would likely have reached in absence of the scrappage option. This post-repair emission level is derived from the TECH5[11] relationship between initial test emission levels and post-repair test emission levels. Vehicles requiring in excess of $450 would be assigned emission levels based upon their initial I/M transient test. It should be noted that serviceability and repair costs are difficult to predict without professional diagnosis. Furthermore, a conflict of interest could occur if the diagnosis were performed by someone whose judgment may be influenced by the sponsor of the scrappage program. Therefore, it is reasonable to require proof of an independent professional diagnosis that supports the cost estimate.

Scrappage program designs that incorporate an I/M element in this way will not only have greater assurance that they are retiring high emitting vehicles, but could possibly offer lower incentives since the vehicle owner is faced with immediate repair costs if the vehicle is not scrapped. EPA encourages this approach as a way to increase assurance of an environmental benefit, as a way of lowering incentives, and as an environmentally sound option to issuing a waiver to a high emitting vehicle. As with the EDF/GM approach and the remote sensing approach described above, special program features to guard against cheating or fraud would be required.

IX. Applicability of Credits

A program can be designed to produce emission reductions for a short-term or long-term period. A program could be conceived, which operates continuously or intermittently over the course of the attainment period, to produce essentially permanent emission reductions. Retired vehicles are assumed to have a finite remaining life that takes into account normal fleet turnover. Emission reduction credits will be applicable for future years in which the vehicle would have been in operation in absence of the program. In the example program, the retired vehicles are assumed to have a maximum remaining life expectancy of three years. Therefore, credit for the emission reductions are applicable for only three years. If a program sponsor desires emission reduction credits for use in additional future years, the retirement program will need to operate in additional future years and scrap more vehicles.

Any long-term or repeated scrappage program proposal raises issues concerning when a tradeable credit is actually created and granted, and how follow-through on the scrappage plan can be

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TECH5 is an EPA model that is used to predict the effect that I/M programs have on emission levels of passenger vehicles. A description of the Tech5 model can be found in the Technical Support Document for the I/M rule, "I/M Costs, Benefits, and Impacts", November 1992.

ensured if the credit is granted and used by another source before the scrappage event on which it is based is completed. In general, credit generation and trading should not result in a shift in enforcement liability to a party against which enforcement is more difficult. Readers should refer to the general guidance, to which this document is an addendum, for guidance on these issues.

1BTEST2.INP : Basic I/M (only 1969-1979 model years)

Light Duty Gas Vehicles
Jan 1, 1993

0Model Year	TF	Miles	HC BEF4	HC Tamper	HC SALHCF	HC Evapor	HC Refuel	HC Runnin	HC Restin	HC FER	CO BEF4	CO Tamper	CO SALHCF	CO FER	NOX BEF4	NOX Tamper	NOX SALHCF	NOX FER
1993	.0000	0.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1992	.0000	0.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1991	.0000	0.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1990	.0000	0.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1989	.0000	0.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1988	.0000	0.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1987	.0000	0.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1986	.0000	0.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1985	.0000	0.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1984	.0000	0.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1983	.0000	0.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1982	.0000	0.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1981	.0000	0.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1980	.0000	0.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1979	.2372	129594.	3.738	0.936	0.980	1.087	0.255	0.861	0.236	1.665	47.105	12.022	0.980	13.747	2.321	0.649	0.996	0.702
1978	.1798	135705.	3.809	1.039	0.980	1.127	0.259	0.861	0.249	1.303	48.090	13.103	0.980	10.784	2.370	0.675	0.996	0.546
1977	.1258	141485.	3.874	1.083	0.980	2.513	0.280	0.861	0.264	1.104	49.226	13.867	0.980	7.781	2.416	0.676	0.996	0.388
1976	.1278	146952.	3.927	1.201	0.984	2.582	0.294	0.861	0.279	1.158	50.094	15.810	0.986	8.306	2.680	0.791	1.009	0.448
1975	.0887	152125.	3.981	1.239	0.984	2.652	0.325	0.861	0.295	0.823	51.051	16.947	0.986	5.951	2.698	0.793	1.009	0.313
1974	.0610	157017.	4.783	0.184	0.981	2.725	0.359	0.861	0.312	0.557	49.747	5.217	0.981	3.287	2.873	0.260	1.006	0.192
1973	.0433	161645.	5.443	0.187	0.981	2.804	0.359	0.867	0.329	0.428	60.301	5.316	0.981	2.787	2.891	0.232	1.006	0.136
1972	.0341	166023.	5.527	0.063	0.986	2.884	0.353	0.872	0.348	0.340	62.996	1.803	0.982	2.173	3.873	0.000	1.008	0.133
1971	.0259	170164.	8.206	0.030	0.986	4.515	0.356	1.668	0.368	0.389	71.720	0.899	0.980	1.841	3.873	0.000	1.004	0.101
1970	.0184	174081.	8.391	0.031	0.987	3.872	0.344	1.668	0.389	0.268	74.914	0.913	0.979	1.364	3.873	0.000	1.004	0.071
1969	.0579	177787.	8.201	0.000	0.985	3.968	0.344	1.668	0.411	0.838	66.107	0.000	0.979	3.750	3.873	0.000	1.002	0.225
						2.146	0.294	0.944	0.281	8.873				61.771				3.254

1BTEST3.INP : Basic I/M (only 1970-1979 model years)

Light Duty Gas Vehicles
Jan 1, 1994

0Model Year	TF	Miles	HC BEF4	HC Tamper	HC SALHCF	HC Evapor	HC Refuel	HC Runnin	HC Restin	HC FER	CO BEF4	CO Tamper	CO SALHCF	CO FER	NOX BEF4	NOX Tamper	NOX SALHCF	NOX FER
1994	.0000	0.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1993	.0000	0.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1992	.0000	0.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1991	.0000	0.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1990	.0000	0.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1989	.0000	0.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1988	.0000	0.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1987	.0000	0.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1986	.0000	0.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1985	.0000	0.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1984	.0000	0.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1983	.0000	0.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1982	.0000	0.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1981	.0000	0.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1980	.0000	0.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1979	.2338	135705.	3.797	0.938	0.980	1.127	0.255	0.861	0.249	1.668	47.668	12.050	0.980	13.684	2.370	0.649	0.996	0.703
1978	.1650	141485.	3.855	1.039	0.980	1.169	0.259	0.861	0.264	1.212	48.443	13.103	0.980	9.950	2.416	0.675	0.996	0.508
1977	.1679	146952.	3.920	1.083	0.980	2.582	0.280	0.861	0.279	1.495	49.558	13.867	0.980	10.435	2.460	0.676	0.996	0.525
1976	.1167	152125.	3.962	1.201	0.984	2.652	0.294	0.861	0.295	1.071	50.411	15.810	0.986	7.621	2.698	0.791	1.009	0.411
1975	.0804	157017.	4.007	1.239	0.984	2.725	0.325	0.861	0.312	0.754	51.275	16.947	0.986	5.407	2.716	0.793	1.009	0.285
1974	.0570	161645.	5.443	0.184	0.981	2.800	0.359	0.861	0.329	0.562	60.819	5.217	0.981	3.688	2.891	0.260	1.006	0.180
1973	.0449	166023.	5.533	0.187	0.981	2.880	0.359	0.867	0.348	0.452	63.206	5.316	0.981	3.020	2.908	0.232	1.006	0.142
1972	.0340	170164.	5.626	0.063	0.986	2.963	0.353	0.872	0.368	0.346	64.950	1.803	0.982	2.230	3.873	0.000	1.008	0.133
1971	.0242	174081.	8.391	0.030	0.986	4.665	0.356	1.668	0.389	0.372	75.033	0.899	0.980	1.798	3.873	0.000	1.004	0.094
1970	.0762	177787.	8.571	0.000	0.987	3.968	0.344	1.668	0.411	1.132	77.024	0.000	0.979	5.751	3.873	0.000	1.004	0.296
						2.223	0.293	0.943	0.296	9.064				63.584				3.277

1BTEST4.INP : Basic I/M (only 1971-1979 model years)

Light Duty Gas Vehicles
Jan 1, 1995

0Model Year	TF	Miles	HC BEF4	HC Tamper	HC SALHCF	HC Evapor	HC Refuel	HC Runnin	HC Restin	HC FER	CO BEF4	CO Tamper	CO SALHCF	CO FER	NOX BEF4	NOX Tamper	NOX SALHCF	NOX FER
1995	.0000	0.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1994	.0000	0.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1993	.0000	0.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1992	.0000	0.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1991	.0000	0.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1990	.0000	0.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1989	.0000	0.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1988	.0000	0.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1987	.0000	0.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1986	.0000	0.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1985	.0000	0.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1984	.0000	0.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1983	.0000	0.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1982	.0000	0.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1981	.0000	0.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1980	.0000	0.	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
1979	.2136	141485.	3.842	0.938	0.980	1.169	0.255	0.861	0.264	1.545	48.095	12.050	0.980	12.588	2.416	0.649	0.996	0.652
1978	.2191	146952.	3.894	1.039	0.980	1.212	0.259	0.861	0.279	1.631	48.843	13.103	0.980	13.302	2.460	0.675	0.996	0.684
1977	.1526	152125.	3.955	1.083	0.980	2.652	0.280	0.861	0.295	1.377	49.862	13.867	0.980	9.531	2.501	0.676	0.996	0.483
1976	.1052	157017.	3.987	1.201	0.984	2.725	0.294	0.861	0.312	0.978	50.620	15.810	0.986	6.892	2.716	0.791	1.009	0.372
1975	.0747	161645.	5.080	1.239	0.984	2.799	0.325	0.861	0.329	0.787	64.580	16.947	0.986	6.007	2.732	0.793	1.009	0.266
1974	.0588	166023.	5.533	0.184	0.981	2.875	0.359	0.861	0.348	0.591	63.731	5.217	0.981	3.978	2.908	0.260	1.006	0.187
1973	.0446	170164.	5.632	0.187	0.981	2.958	0.359	0.867	0.368	0.457	65.269	5.316	0.981	3.085	2.924	0.232	1.006	0.141
1972	.0316	174081.	5.723	0.063	0.986	3.043	0.353	0.872	0.389	0.328	68.072	1.803	0.982	2.170	3.873	0.000	1.008	0.123
1971	.0998	177787.	8.571	0.000	0.986	4.754	0.356	1.668	0.411	1.561	77.265	0.000	0.980	7.559	3.873	0.000	1.004	0.388
						2.287	0.293	0.942	0.310	9.255				65.112				3.299

1BTEST1.INP : Basic I/M (all model years)

Light Duty Gas Vehicles
Jan 1, 1993

0Model Year	TF	Miles	HC BEF4	HC Tamper	HC SALHCF	HC Evapor	HC Refuel	HC Runnin	HC Restin	HC FER	CO BEF4	CO Tamper	CO SALHCF	CO FER	NOX BEF4	NOX Tamper	NOX SALHCF	NOX FER
1993	.0237	1640.	0.235	0.001	0.975	0.162	0.189	0.312	0.076	0.023	2.850	0.009	0.971	0.066	0.507	0.002	0.984	0.012
1992	.1133	9816.	0.269	0.005	0.975	0.162	0.189	0.312	0.077	0.114	3.408	0.038	0.971	0.379	0.527	0.004	0.984	0.059
1991	.1126	22403.	0.304	0.011	0.975	0.170	0.189	0.312	0.089	0.120	3.964	0.079	0.971	0.442	0.553	0.007	0.984	0.062
1990	.1053	34309.	0.337	0.015	0.975	0.204	0.186	0.336	0.092	0.122	4.521	0.109	0.971	0.474	0.581	0.010	0.985	0.061
1989	.1021	45572.	0.381	0.019	0.975	0.248	0.184	0.349	0.099	0.130	5.361	0.133	0.972	0.545	0.618	0.013	0.985	0.063
1988	.0931	56225.	0.438	0.023	0.975	0.289	0.181	0.388	0.113	0.132	6.420	0.155	0.971	0.595	0.640	0.016	0.985	0.060
1987	.0835	66303.	0.496	0.027	0.976	0.358	0.183	0.432	0.122	0.134	7.350	0.174	0.972	0.610	0.708	0.018	0.986	0.060
1986	.0574	75837.	0.535	0.031	0.981	0.436	0.185	0.476	0.149	0.103	7.861	0.209	0.976	0.452	0.756	0.021	0.987	0.044
1985	.0482	84854.	0.583	0.036	0.981	0.572	0.191	0.575	0.160	0.102	8.567	0.262	0.977	0.416	1.024	0.024	0.989	0.050
1984	.0461	93384.	0.658	0.039	0.977	0.688	0.196	0.672	0.177	0.111	10.147	0.279	0.975	0.469	1.123	0.026	0.989	0.052
1983	.0426	101452.	0.672	0.146	0.976	0.844	0.199	0.769	0.184	0.119	10.146	1.684	0.974	0.491	1.163	0.112	0.991	0.054
1982	.0424	109084.	1.049	0.200	0.977	1.023	0.199	0.848	0.195	0.148	16.817	2.395	0.976	0.795	1.441	0.141	0.994	0.067
1981	.0345	116304.	1.149	0.208	0.977	1.073	0.207	0.861	0.211	0.127	18.576	2.663	0.976	0.714	1.460	0.145	0.994	0.055
1980	.0261	123133.	0.960	0.725	0.977	1.047	0.221	0.861	0.223	0.104	9.331	9.131	0.976	0.470	2.396	0.864	0.994	0.085
1979	.0164	129594.	3.738	0.936	0.980	1.087	0.255	0.861	0.236	0.115	47.105	12.022	0.980	0.949	2.321	0.649	0.996	0.048
1978	.0124	135705.	3.809	1.039	0.980	1.127	0.259	0.861	0.249	0.090	48.090	13.103	0.980	0.744	2.370	0.675	0.996	0.038
1977	.0087	141485.	3.874	1.083	0.980	2.513	0.280	0.861	0.264	0.076	49.226	13.867	0.980	0.537	2.416	0.676	0.996	0.027
1976	.0088	146952.	3.927	1.201	0.984	2.582	0.294	0.861	0.279	0.080	50.094	15.810	0.986	0.573	2.680	0.791	1.009	0.031
1975	.0061	152125.	3.981	1.239	0.984	2.652	0.325	0.861	0.295	0.057	51.051	16.947	0.986	0.411	2.698	0.793	1.009	0.022
1974	.0042	157017.	4.783	0.184	0.981	2.725	0.359	0.861	0.312	0.038	49.747	5.217	0.981	0.227	2.873	0.260	1.006	0.013
1973	.0030	161645.	5.443	0.187	0.981	2.804	0.359	0.867	0.329	0.030	60.301	5.316	0.981	0.192	2.891	0.232	1.006	0.009
1972	.0024	166023.	5.527	0.063	0.986	2.884	0.353	0.872	0.348	0.024	62.996	1.803	0.982	0.150	3.873	0.000	1.008	0.009
1971	.0018	170164.	8.206	0.030	0.986	4.515	0.356	1.668	0.368	0.027	71.720	0.899	0.980	0.127	3.873	0.000	1.004	0.007
1970	.0013	174081.	8.391	0.031	0.987	3.872	0.344	1.668	0.389	0.018	74.914	0.913	0.979	0.094	3.873	0.000	1.004	0.005
1969	.0040	177787.	8.201	0.000	0.985	3.968	0.344	1.668	0.411	0.058	66.107	0.000	0.979	0.259	3.873	0.000	1.002	0.016
						0.521	0.197	0.493	0.134	2.202				11.183				1.009

1BTEST1.INP : Basic I/M (all model years)

Light Duty Gas Vehicles
Jan 1, 1994

0Model Year	TF	Miles	HC BEF4	HC Tamper	HC SALHCF	HC Evapor	HC Refuel	HC Runnin	HC Restin	HC FER	CO BEF4	CO Tamper	CO SALHCF	CO FER	NOX BEF4	NOX Tamper	NOX SALHCF	NOX FER
1994	.0237	1640.	0.235	0.001	0.975	0.162	0.189	0.312	0.076	0.023	2.850	0.009	0.971	0.066	0.507	0.002	0.984	0.012
1993	.1131	9816.	0.269	0.005	0.975	0.162	0.189	0.312	0.077	0.114	3.408	0.038	0.971	0.379	0.527	0.004	0.984	0.059
1992	.1124	22403.	0.303	0.011	0.975	0.171	0.189	0.312	0.081	0.119	3.935	0.079	0.971	0.438	0.557	0.007	0.984	0.062
1991	.1051	34309.	0.336	0.015	0.975	0.200	0.189	0.336	0.094	0.122	4.467	0.109	0.971	0.467	0.582	0.010	0.984	0.061
1990	.1019	45572.	0.369	0.019	0.975	0.224	0.186	0.349	0.098	0.126	5.014	0.133	0.971	0.509	0.609	0.013	0.985	0.062
1989	.0930	56225.	0.426	0.023	0.975	0.290	0.184	0.388	0.104	0.131	6.010	0.155	0.972	0.557	0.651	0.016	0.985	0.061
1988	.0836	66303.	0.488	0.027	0.975	0.330	0.181	0.432	0.119	0.131	7.137	0.174	0.971	0.594	0.675	0.018	0.985	0.057
1987	.0573	75837.	0.546	0.030	0.976	0.431	0.183	0.476	0.129	0.102	8.097	0.192	0.972	0.462	0.746	0.021	0.986	0.043
1986	.0484	84854.	0.581	0.034	0.981	0.547	0.185	0.575	0.158	0.100	8.537	0.226	0.976	0.414	0.790	0.024	0.987	0.039
1985	.0464	93384.	0.626	0.039	0.981	0.666	0.191	0.672	0.170	0.109	9.200	0.279	0.977	0.430	1.061	0.026	0.989	0.050
1984	.0427	101452.	0.702	0.042	0.977	0.826	0.196	0.769	0.187	0.116	10.834	0.296	0.975	0.464	1.163	0.028	0.989	0.050
1983	.0435	109084.	0.709	0.159	0.976	1.010	0.199	0.848	0.195	0.135	10.709	1.861	0.974	0.532	1.203	0.120	0.991	0.057
1982	.0348	116304.	1.099	0.214	0.977	1.065	0.199	0.861	0.206	0.126	17.634	2.596	0.976	0.688	1.494	0.148	0.994	0.057
1981	.0256	123133.	1.199	0.223	0.977	1.109	0.207	0.861	0.223	0.097	19.402	2.878	0.976	0.557	1.507	0.151	0.994	0.042
1980	.0160	129594.	0.979	0.751	0.977	1.087	0.221	0.861	0.236	0.065	9.423	9.569	0.976	0.296	2.442	0.887	0.994	0.053
1979	.0122	135705.	3.797	0.938	0.980	1.127	0.255	0.861	0.249	0.087	47.668	12.050	0.980	0.717	2.370	0.649	0.996	0.037
1978	.0086	141485.	3.855	1.039	0.980	1.169	0.259	0.861	0.264	0.063	48.443	13.103	0.980	0.521	2.416	0.675	0.996	0.027
1977	.0088	146952.	3.920	1.083	0.980	2.582	0.280	0.861	0.279	0.078	49.558	13.867	0.980	0.546	2.460	0.676	0.996	0.027
1976	.0061	152125.	3.962	1.201	0.984	2.652	0.294	0.861	0.295	0.056	50.411	15.810	0.986	0.399	2.698	0.791	1.009	0.022
1975	.0042	157017.	4.007	1.239	0.984	2.725	0.325	0.861	0.312	0.039	51.275	16.947	0.986	0.283	2.716	0.793	1.009	0.015
1974	.0030	161645.	5.443	0.184	0.981	2.800	0.359	0.861	0.329	0.029	60.819	5.217	0.981	0.193	2.891	0.260	1.006	0.009
1973	.0024	166023.	5.533	0.187	0.981	2.880	0.359	0.867	0.348	0.024	63.206	5.316	0.981	0.158	2.908	0.232	1.006	0.007
1972	.0018	170164.	5.626	0.063	0.986	2.963	0.353	0.872	0.368	0.018	64.950	1.803	0.982	0.117	3.873	0.000	1.008	0.007
1971	.0013	174081.	8.391	0.030	0.986	4.665	0.356	1.668	0.389	0.019	75.033	0.899	0.980	0.094	3.873	0.000	1.004	0.005
1970	.0040	177787.	8.571	0.000	0.987	3.968	0.344	1.668	0.411	0.059	77.024	0.000	0.979	0.301	3.873	0.000	1.004	0.016
						0.500	0.195	0.492	0.131	2.090				10.182				0.938

1BTEST1.INP : Basic I/M (all model years)
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Light Duty Gas Vehicles
Jan 1, 1995

0Model			HC								CO				NOX			
Year	TF	Miles	BEF4	Tamper	SALHCF	Evapor	Refuel	Runnin	Restin	FER	BEF4	Tamper	SALHCF	FER	BEF4	Tamper	SALHCF	FER
1995	.0237	1640.	0.235	0.001	0.975	0.162	0.189	0.312	0.076	0.023	2.850	0.009	0.971	0.066	0.507	0.002	0.984	0.012
1994	.1130	9816.	0.269	0.005	0.975	0.162	0.189	0.312	0.077	0.114	3.408	0.038	0.971	0.378	0.527	0.004	0.984	0.059
1993	.1123	22403.	0.303	0.011	0.975	0.171	0.189	0.312	0.081	0.119	3.935	0.079	0.971	0.438	0.557	0.007	0.984	0.062
1992	.1049	34309.	0.334	0.015	0.975	0.202	0.189	0.336	0.086	0.121	4.422	0.109	0.971	0.462	0.586	0.010	0.984	0.062
1991	.1017	45572.	0.367	0.019	0.975	0.219	0.189	0.349	0.100	0.125	4.940	0.133	0.971	0.501	0.609	0.013	0.984	0.062
1990	.0928	56225.	0.411	0.023	0.975	0.267	0.186	0.388	0.103	0.127	5.578	0.155	0.971	0.517	0.636	0.016	0.985	0.060
1989	.0835	66303.	0.473	0.027	0.975	0.331	0.184	0.432	0.110	0.129	6.654	0.174	0.972	0.554	0.683	0.018	0.985	0.058
1988	.0574	75837.	0.538	0.030	0.975	0.403	0.181	0.476	0.126	0.100	7.859	0.192	0.971	0.449	0.708	0.021	0.985	0.041
1987	.0484	84854.	0.594	0.034	0.976	0.543	0.183	0.575	0.137	0.099	8.810	0.209	0.972	0.424	0.781	0.023	0.986	0.038
1986	.0467	93384.	0.625	0.037	0.981	0.643	0.185	0.672	0.167	0.108	9.179	0.243	0.976	0.429	0.823	0.026	0.987	0.039
1985	.0430	101452.	0.666	0.042	0.981	0.806	0.191	0.769	0.179	0.114	9.793	0.296	0.977	0.424	1.095	0.028	0.989	0.048
1984	.0436	109084.	0.743	0.045	0.977	0.994	0.196	0.848	0.197	0.131	11.486	0.313	0.975	0.501	1.201	0.031	0.989	0.053
1983	.0357	116304.	0.745	0.172	0.976	1.053	0.199	0.861	0.206	0.115	11.245	2.039	0.974	0.462	1.240	0.127	0.991	0.048
1982	.0259	123133.	1.147	0.226	0.977	1.101	0.199	0.861	0.218	0.096	18.415	2.786	0.976	0.536	1.544	0.155	0.994	0.044
1981	.0157	129594.	1.246	0.236	0.977	1.147	0.207	0.861	0.236	0.061	20.169	3.081	0.976	0.356	1.552	0.158	0.994	0.027
1980	.0119	135705.	0.994	0.752	0.977	1.127	0.221	0.861	0.249	0.050	9.505	9.597	0.976	0.223	2.486	0.889	0.994	0.040
1979	.0085	141485.	3.842	0.938	0.980	1.169	0.255	0.861	0.264	0.062	48.095	12.050	0.980	0.502	2.416	0.649	0.996	0.026
1978	.0087	146952.	3.894	1.039	0.980	1.212	0.259	0.861	0.279	0.065	48.843	13.103	0.980	0.531	2.460	0.675	0.996	0.027
1977	.0061	152125.	3.955	1.083	0.980	2.652	0.280	0.861	0.295	0.055	49.862	13.867	0.980	0.380	2.501	0.676	0.996	0.019
1976	.0042	157017.	3.987	1.201	0.984	2.725	0.294	0.861	0.312	0.039	50.620	15.810	0.986	0.275	2.716	0.791	1.009	0.015
1975	.0030	161645.	5.080	1.239	0.984	2.799	0.325	0.861	0.329	0.031	64.580	16.947	0.986	0.240	2.732	0.793	1.009	0.011
1974	.0023	166023.	5.533	0.184	0.981	2.875	0.359	0.861	0.348	0.024	63.731	5.217	0.981	0.159	2.908	0.260	1.006	0.007
1973	.0018	170164.	5.632	0.187	0.981	2.958	0.359	0.867	0.368	0.018	65.269	5.316	0.981	0.123	2.924	0.232	1.006	0.006
1972	.0013	174081.	5.723	0.063	0.986	3.043	0.353	0.872	0.389	0.013	68.072	1.803	0.982	0.087	3.873	0.000	1.008	0.005
1971	.0040	177787.	8.571	0.000	0.986	4.754	0.356	1.668	0.411	0.062	77.265	0.000	0.980	0.302	3.873	0.000	1.004	0.015
						0.483	0.193	0.492	0.127	2.001				9.317				0.884