United States Environmental Protection Agency

Air and Radiation

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Description and Documentation for Interim Vehicle Clean Screening Credit Utility

DRAFT REPORT

May 7, 1998

Transmittal of the Draft "Description and Documentation for Interim Vehicle Clean Screening Credit Utility"

EPA is today releasing draft guidance on the interim use of clean screening methodologies in state Inspection and Maintenance (I/M) programs. The purpose of the guidance is to share technical information with states and other interested parties, and to advise them of certain types of I/M changes EPA is inclined to approve, should states choose to incorporate them into existing or planned I/M programs. The draft guidance is in the form of two documents and a computer program. One document addresses concepts and documents the derivation of the credit loss estimates. The other document provides detailed steps for use of the FORTRAN utility program which is executed before executing MOBILE5b.

The clean screening concepts described in the draft guidance are potentially of considerable importance to those involved in I/M planning and implementation. In general, clean screening is aimed at making I/M programs more cost effective by focusing inspections on cars more likely than others to be high emitters in need of repair. Clean screening can be used to reduce the number of cars required to be inspected each year--with less than a proportional loss of emission reduction benefit--which can lead to a more cost-effective I/M program.

Please note that all credit estimates in this draft guidance are not final, and may change as a result of new data or insights brought to EPA's attention during this review and comment process. Credit loss estimates for vehicle emitter profiling will change, as EPA continues to make refinements to this part its analysis. Even once finalized, EPA may from time to time revise the guidance to reflect the best available data and understanding of clean screening options.

The draft guidance outlines three broad concepts which could be used to excuse likely low emitters from traditional I/M testing: remote sensing, vehicle emitter profiling, and model year exemptions. The guidance provides brief background and summary information on each of the three concepts, comments on the practical application of clean screening in an operating or planned I/M program, analyses of the probable credit ramifications associated with each approach based on data sets currently available to EPA, instructions on how to calculate rough estimates of the credit loss each methodology would likely cause in a specific I/M program, and a list of references EPA used to prepare the draft guidance.

In preparing this draft guidance, EPA considered a variety of sources and data sets currently available, which are listed in the "References" section of the guidance. The majority of information available comes from analytical studies, pilot programs, and modeling exercises aimed at predicting the immediate credit effect states could expect to experience when choosing to implement clean screening in an I/M program. While two of the concepts outlined in the guidance (RSD and model year exemption) are not new, they have not yet been used as a clean screen in any I/M program. Consequently, there is no large body of real-world application data. Likewise, utilizing vehicle emitter profiling to identify clean vehicles is fairly new concept as a

clean screening option, rather than a tried and true approach. In addition, EPA has had to develop a modeling approach for using information on immediate credit effects to predict credit effects in future years when the mix and condition of cars on the road will be different. For these reasons, EPA is particularly interested in receiving comments on the following:

- additional data sets and analysis not referenced in the draft documents
- the analytical approaches used in determining the modeling protocol for both RSD and vehicle emitter profiling, and any alternatives which may be useful
- options on how to keep an a vehicle emitter profile up to date for a given area without compromising the technical foundation of the profile
- how EPA and states should approach the ongoing evaluation of clean screening programs in operation

EPA is soliciting comment on the draft guidance for 60 days, until July 11, 1998. Comments can be submitted electronically, by mail, or by FAX, at the following locations:

Electronically, to Joe Somers at: somers.joseph@epa.gov

By mail: Joe Somers
U.S. EPA
Assessment and Modeling Division
2000 Traverwood Drive
Ann Arbor, MI 48105
Phone: 734/214-4321

By FAX: 734/214-4821

Additionally, EPA will make every effort to include a discussion of the clean screen guidance at any EPA/stakeholder meetings which occur during the comment period. Once EPA has reviewed the comments and incorporated them appropriately, we will finalize the guidance for release and immediate use. We expect this to take place in the fall of 1998.

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1.0 Summary and Concept Descriptions

The purpose of this document is to provide interim guidance on use of clean screening to excuse the low emitting fraction of vehicles from some inspection maintenance (I/M) testing that would otherwise be required. There are several clean screening options states can use for this purpose.

This guidance is intended to assist states in developing whatever clean screening program they believe is appropriate as part of their I/M programs and in modifying their state implementation plans (SIPs) accordingly.

This guidance document will not be an exhaustive summary of all that is known about clean screening. Readers are urged to obtain and read all the listed references, many of which have been posted on the world wide web as described in the body of the document.

This document is presently in draft form. With respect to remote sensing device clean screening, the estimates and methods included here are those EPA intends to incorporate into the final version, unless public and peer review surfaces superior information or persuades EPA of a better analytical and modeling approach. With respect to low emitter profile clean screening, EPA is planning on doing further analysis to replace the estimates given here with ones that are more disaggregated by model year. In addition, EPA is particularly open to reviewer comments on alternative analytical approaches, as the modeling issues are not straightforward. However, the model year exemption approach is much more straightforward, and can be performed now using MOBILE5.

This guidance, now and when finalized, is based on the best information available at the time of its preparation. It is subject to change as more information becomes available. Readers and users should be aware of the possibility of revisions.

1.1 Introduction and Overview

In September 1996, EPA released a document entitled “User Guide and Description For Interim Remote Sensing Program Credit Utility” [1]. That document contained guidance for use of remote sensing device (RSD) technology as part of a vehicle inspection maintenance (I/M) program. The guidance dealt primarily with the use of RSD to identify vehicles as probable high emitters, for purposes of requiring unscheduled I/M testing at regular inspection stations. The guidance only briefly mentioned the concept of using RSD to excuse probable low emitters from scheduled inspections -- the clean screening concept. It did promise more guidance later on clean screening which is why EPA is releasing this draft version now. EPA and others have been evaluating the following three different methodologies for excusing vehicles from inspection:

1) Remote sensing device (RSD) clean screening;

2) Vehicle emitter profile (VEP) including high emitter profile (HEP) and low emitter profile (LEP); and

3) Model year exemptions.

This document contains additional, interim guidance on how these three methodologies can be used. It does not revise the September 1996 EPA guidance on RSD for identifying high emitting vehicles, but a revision of that earlier guidance is planned for a later date.

The present guidance for clean screening is interim at present for several reasons. The data on which the guidance is based are limited in nature. For example, the emission results for RSD are from only a single study although generally corroborated by another published study. Information on emission results with the low emitter profile are especially limited. While one reference provides an emissions estimate for the current in-use fleet, no information is available on emission losses in distant years when vehicles from the 1990 and newer model years have aged considerably. In addition, the best ways to use clean screening and the emission credit implications of using it will certainly become clearer with the benefit of state experience actually using clean screening concepts in I/M programs. At present, there has been no real world experience, just pilot programs. When and if states decide to adopt clean screening and obtain full scale program data, this interim guidance will be further revised to reflect states' experience and data.

This document constitutes EPA guidance and is not a final action or policy. It is intended to share technical information with states on certain types of I/M program options. It is not EPA's intention to limit states to considering only the types of changes described here, although a state interested in other types of changes may need to develop technical information regarding any other types of changes. Final EPA action on a State Implementation Plan (SIP) revision changing an I/M program to incorporate clean screening will be made with formal notice and opportunity for comment. All information available at that time will be considered.

1.2 Summary of 1996 Interim Guidance on Remote Sensing Devices

Remote sensing devices can be used to measure instantaneous exhaust hydrocarbon (HC), carbon monoxide (CO), and nitrogen oxide (NOx) emissions when vehicles pass through the RSD measurement beam while operating on the road. The RSD system is set up at various locations, such as along roadsides or at expressway entrance/exit ramps, to measure these emissions as vehicles pass. The system retains a video license plate recording of each vehicle which enables the state or local government to trace the vehicle registration and notify the owner of the need for further action such as immediate I/M testing.

Additional equipment is used in conjunction with the remote sensing device instrumentation to measure instantaneous vehicle speed and acceleration. Vehicle acceleration is especially important since high acceleration rates (and the resultant high load) can lead to

enrichment events and high instantaneous emissions that may not be representative of a vehicle's overall emissions. Deceleration is also important since it can result in unrepresentative (possibly low) instantaneous emissions. These additional measurements can be used to help decrease false passes and failures associated with RSD.

Since RSD measures only a vehicle's instantaneous emissions, which are frequently not indicative of emissions over a wide range of operating conditions, a vehicle with high RSD emissions should receive a confirmatory I/M test to determine if the vehicle has high emissions or not. RSD can be useful in pinpointing vehicles with high emissions that should undergo full I/M tests in advance of the next scheduled I/M test. Used in this fashion, RSD will result in additional HC, CO, and NOx credits for a state's I/M program because of the early identification and repair of high emitting vehicles. The 1996 guidance considered the use of RSD only as a means of identifying high emitters, and thus focused on the additional benefit a state could receive through using RSD in this way.

The fraction of the vehicle fleet measured by RSD (coverage) is a critical factor in determining its benefit. The 1996 EPA guidance gives three methodologies for a state to determine how much of its fleet is covered by RSD. The first option is to specify the number of RSD readings annually from which the RSD utility will calculate a fleet coverage based on the coverage obtained by the California Bureau of Automotive Repairs in its 1995 RSD demonstration program in Sacramento [2]. The second is for a state to specify what percent of the fleet by model year it will have measured by RSD considering local traffic patterns; the state must then assure adequate resources are devoted to obtaining this coverage. The third is for a state to commit to use RSD to find a specific number of failures on the confirmatory I/M test. A state using this option must be sure RSD will, in fact, find the number of I/M failures to which the state commits. The guidance also has an option for use of RSD by itself for an area without a regular I/M program in which only the vehicles that fail RSD would be sent for a regular I/M test and the vehicles that pass RSD would not be tested. Areas not needing to implement basic or enhanced I/M may find this option of interest, especially since it may generate additional SIP credits.

An important point to note regarding the 1996 EPA guidance is that it was based only on RSD measurements of CO. The CO measurements were used to determine which vehicles were high emitters and needed a more highly supervised and/or annual instead of biennial I/M test. The excess exhaust HC, CO, and NOx emissions for the vehicles identified as high CO emitters by RSD were based on IM240 test results obtained from the same vehicles the same day and were used to determine the credits given in the 1996 guidance.

However, the newer studies on which this clean screening guidance document is based utilized cutpoints for all of HC, CO, and NOx. IM240 measurements were made at the time of the regularly scheduled I/M inspections, later in time than the RSD measurements, as they would be in a real clean screening program. As such, these studies provide more realistic data than was available for the preparation for the earlier RSD guidance.

1.3 Newer Concepts for Clean Screening to Reduce Vehicle Inspection Volume

This draft guidance focuses on three concepts for clean screening: 1) RSD, 2) vehicle emitter profiling, and 3) model year exemption. Since the 1996 EPA guidance on remote sensing, two organizations have conducted projects quantifying credit for clean screening by obtaining excess emission values from IM240 data. This work [3,4] on the use of RSD for clean screening has been done by Remote Sensing Technologies, Inc. (RTSi) and Applied Analysis, a contractor and subcontractor for the Colorado Department of Public Health and Environment. Additionally, a recent report prepared for the California Inspection and Maintenance Review Committee [5] discusses the use of RSD. Radian International LLC and de la Torre Klausmeier Consulting conducted a study on the use of vehicle emitter profiling for clean screening using data from Arizona's I/M program.[5] The third option for clean screening is model year exemption of newer model year vehicles from I/M testing which states can already use as a clean screening tool. Credit values for model year exemption can be calculated by use of MOBILE5 as discussed later in Section 4.0.

1.3.1 Remote Sensing Clean Screening

The 1996 EPA remote sensing guidance also acknowledged that clean screening of vehicles is another option on which guidance would be provided later. In this concept, roadside remote sensing is used to excuse some vehicles passing remote sensing from their next annual or biennial I/M test. This approach has obvious owner convenience and cost advantages; more specifically, clean screening can reduce the workload for I/M stations, reduce vehicle owner costs, and increase I/M program acceptance. After skipping one scheduled test, vehicles would have to get the next one, unless they again pass a remote sensing test. In practical application, vehicles would have to pass two different remote sensing tests, at different times or places, and within a limited timeframe (as discussed in Section 1.6.1) in order to be excused from each I/M test.

Use of RSD for clean screening in general will reduce the SIP credit for I/M because some vehicles which are high emitting on the day they are excused from I/M testing will have appeared clean with RSD. The analyses performed to date indicate that with 80 percent fleet coverage by RSD, using HC and CO RSD cutpoints that excuse about 50 percent of vehicles from I/M testing results in credit losses for exhaust HC, CO, and NOx of roughly 7 percent, 6 percent, and 22 percent respectively. These numbers are from Figure IV-10 of a recent report to the Colorado Department of Public Health and the Environment.[4] The loss of NOx credit can be reduced to about 6 percent by the addition of an RSD NOx cutpoint which will also reduce the HC and CO loss, but fewer vehicles will be excused from testing.

Local pilot studies with RSD clean screening will add confidence to estimates of the credit losses it will create. Data from properly conducted local studies should be used in preference to credit loss estimates presented in this guidance.

There is no convincing evidence that RSD helps to identify low versus high emitting vehicles with respect to evaporative HC emissions. However, older vehicles have a much higher incidence of evaporative problems than newer vehicles, and RSD clean screening tends to fail most older vehicles for exhaust emissions. Therefore, the loss of evaporative HC credits from excusing a large portion of the fleet from evaporative and tailpipe I/M testing is much less than the portion of the fleet excused. However, the loss of evaporative emissions HC credits may be as or more significant than the loss of tailpipe credit. This loss only applies to I/M program that perform evaporative system checks in their scheduled inspections.

1.3.2 Vehicle Emissions Profiling Clean Screening

Vehicle emissions profiling (VEP) is a method of ranking vehicles for the likelihood that they need I/M testing and vehicle repairs.[5,6,7] It uses statistics on the historic failure rate of vehicles of very similar design. For example, failure rates of vehicle models in the Arizona IM240 program can be used to predict whether a certain group of nearly homogeneous vehicles in another state will have a high or low failure rate. This information can be used in either or both of two ways. In low emitter profiling (LEP), the vehicle ranking would be used as a clean screening tool to determine what vehicles to excuse from I/M testing. In high emitter profiling HEP), the ranking is used to require some type of special test regime for the vehicles most likely to need repair as judged from previous I/M records for an individual vehicle and/or the composite records for a particular model. This additional testing could involve: 1) special testing stations with more state supervision or higher qualification standards, or 2) annual instead of biennial testing. It is possible to add other information into the ranking process, for example, remote sensing readings. Generally, extra information (such as RSD or previous I/M records on that particular vehicle) can improve the ranking's accuracy, and thereby reduce the credit loss from screening out a given number of vehicles from their next regular I/M test.

In general, recent studies indicate that, for the fleet now in operation, vehicle profiling has roughly the same emission credit ramifications as RSD, depending on the specific profiling used by the state. Low emitter profiling carries a credit loss, due to the fact that some vehicles will be incorrectly clean screened out of traditional I/M testing. (On the other hand, high emitter profiling requires some vehicles to be repaired earlier or better than they would with a traditional I/M testing thus achieving additional emission reductions and, therefore, resulting in additional emission reduction credits.) Unlike remote sensing device readings, vehicle emissions profiling can, in principle, target vehicles likely to fail evaporative emission tests as well as exhaust emission tests, if the necessary database on evaporative emissions is available. For this guidance, though, we are assuming the vehicle emissions profiling does nothing to target vehicles with high evaporative emissions.

This document does not provide guidance on the use of HEP to increase I/M credit by requiring special I/M testing, or the use of HEP in the absence of a periodic I/M program. Instead, it gives guidance on use of LEP for clean screening.

1.3.3 Model Year Exemption Clean Screening

This approach excuses vehicles from I/M tests until they reach a certain age, on the premise that virtually all vehicles are clean when sold and most remain clean for at least several years. Many states now wait until a vehicle is four or five years old before the first required inspection, with a small loss in I/M credit for the years the vehicle is not tested. Some other states give the owner the option of paying a fee in lieu of inspection during these years. It is the state's choice whether to assess a program fee on new vehicles while they are exempt from testing.

Again, the effect of model year exemption varies, given the fleet mix (i.e., vehicle age distribution) in a specific area. EPA has suggested that states consider exempting vehicles from testing until they are at least four years old. Overall, the loss of credit for exempting the four newest model years is small, and EPA believes most states can find ways to compensate for it if needed to keep the SIP approvable.

1.4 Calculating Effect on I/M Credits

The effect on I/M credit using any of these three approaches for clean screening can be modeled using MOBILE5a and MOBILE5b with the revised utility that can be obtained from the remote sensing section of the EPA home page for vehicle and engine emission modeling software at the following site:

http://www.epa.gov/OMSWWW/models.htm

This site also has the MOBILE model and the 1996 RSD utility discussed in Section 1.2.

An explanation of the type of information that has been used to develop the credit utility for clean screening is given in Section 2, specifically, Sections 2.1, 2.2, 2.3, and in Section 3.0.

1.4.1 RSD Clean Screening

To use the utility to estimate the I/M credit effect of RSD clean screening, the user must provide information on what portion of the fleet will be measured by the RSD testing program, what cutpoints the RSD program will use to declare a car low emitting, and some information on the regular I/M program. The utility then accesses stored default effects estimates to calculate the overall fleet effect. The utility also allows the user to override the default estimates, to accommodate any better estimates developed from future research or pilot programs or more extended analysis of the existing databases. Section 5 more fully explains what information the user interested in RSD clean screening must supply to use the new clean screening utility. There is also a more detailed Clean Screening Program User Guide For Interim Remote Sensing Program Credit Utility [8] that describes how it is used.

1.4.2 LEP Clean Screening

Making the calculations to show the credit effect of a Low Emitter Profile clean screening program will be more complicated than for RSD clean screening. The utility that accompanies this guidance is programmed to be able to perform the mechanics of the calculation. It does so by applying estimates of LEP clean screening credit losses by model year to MOBILE output. However, the utility has not been programmed with any default or alternative values for the credit losses by model year. The user must provide values for those losses by model year. The final version of this guidance document will provide values that can be used, but even once available in the final version they should be used with more caution than is the case for the default estimates of RSD clean screening losses. This draft version also provides values, but at this point they are not values that EPA believes satisfactory for immediate use because they are based on a more aggregate analysis of model year groups than EPA intends to use for the final document. The purpose in providing these draft values is to make the methodology and proposed derivations for estimating credit losses with LEP clean screening easier to understand and comment upon during the review process.

EPA has reviewed published analyses by one consultant team of a particular, Arizona-based LEP clean screening method.[6,10] EPA found no apparent defects in this particular approach to clean screening, and believes it is a good place for other areas to start in their own thinking. The consultant team provided certain information on the emission reduction impacts of this approach to LEP clean screening. However, EPA believes that LEP clean screening is significant and complicated enough that any state seriously interested in using it ought to do an individualized study, develop an individualized approach including a long-term plan for keeping the profile current as the fleet evolves, and estimate credit losses for that specific approach. EPA is available to meet with states to plan how they can approach these tasks.

While EPA favors the eventual development of locale-specific LEP plans and more elaborately and carefully developed estimates of LEP clean screening effects, we do want to provide states with a way of making at least ball park estimates of the credit effects they might expect. Therefore, we have extended the consultant team's analysis to derive credit loss estimates for use with the utility. In this draft document, these estimates are for four model year ranges, rather than being fully model year specific. The coarseness of this level of aggregation is less than satisfying. However, EPA believes the estimates in this draft are adequate for the immediate purpose of obtaining peer and state review of the methodology itself. EPA is not sure that the use of these draft estimates will correctly predict the credit loss. EPA does intend to obtain and include a finer disaggregation of model years for the final guidance document, which should improve the certainty in predictions. EPA urges states and interested other parties to undertake research and experimentation in this area. Depending on resources and the level of state interest, EPA may undertake new work itself. New work and publications may lead to revisions in the credit estimates to be presented in this document.

Meanwhile, it is EPA's intention once this guidance is final that should a state wish to adopt the specific type of LEP clean screening that was developed and analyzed as described in the Radian International LLC/de la Torre Klausmeier Consulting analysis [10] and submit a SIP revision before any better information is developed, and if other requirements of this guidance are met, EPA would propose approval of it based on the credit estimates that can be made with the final guidance. However, EPA would expect the SIP to contain a commitment to make changes to or abandon the clean screening approach if future program evaluations demonstrate that more credits were being lost than had been anticipated.

1.4.3 Model Year Exemptions

The credit effect of model year exemptions in specific I/M areas can be estimated using existing features of MOBILE5b. States with a simple system of scheduling inspections on the anniversary of the new vehicle sales date should have no difficulty analyzing scenarios for themselves. States with more complex scheduling may need to consult EPA. For example, an inspection schedule tied to driver birth dates requires some special manipulation of MOBILE5 inputs and outputs.

1.5 Choosing Among Clean Screening Options

EPA has no recommendations on which (if any) of the three clean screening options a state should use as part of its I/M program. The state must examine its particular I/M program and decide whether one of the clean screening options should be incorporated into its I/M program. The options have varying program complexities and costs which a state must carefully consider versus the benefit in cost and size of the I/M program associated with excusing a specific fraction of vehicles using clean screening. With RSD clean screening, the most important consideration will likely be the task of establishing and operating the RSD testing program. With LEP clean screening, the most important consideration will be how to keep acquiring data to keep the screening profile current and accurate for the local area. In all three types, businesses currently engaged in inspections may face investment recovery issues if fewer vehicles need a regular I/M test.

The three approaches may also differ in the perceived equity of vehicle owners' contribution to cleaner air. Model year exemptions can be perceived to favor high income owners who typically purchase new vehicles frequently. LEP clean screening may convey a "guilt by association" implication to some. RSD clean screening comes closest to making the exemption decision depend only on a vehicle's own emission performance, although some may perceive caprice or bias in the location of the RSD testing sites.

While EPA itself has no specific privacy misgivings with RSD, privacy concerns have been raised by others in the past when discussions of RSD or similar technologies have arisen. At the very least, states considering RSD clean screening should carefully plan their outreach to the public and press, before misunderstandings can occur.

All three approaches allow a state to choose how many vehicles are excused from inspection, subject to the requirement that not too much credit be lost overall. EPA's own very general assessment is that the three approaches to clean screening do not appear at this time to differ a great deal from one another in terms of how much credit is lost per vehicle that is excused from inspection. The three options do differ somewhat in this regard, and states should use the utility and MOBILE5b to investigate these differences for their local situation. However, it is critical to note that the credits in the utility are based on data that are available as of now. These data are limited, and more limited for LEP clean screening than for RSD clean screening. If a state chooses to implement a clean screening option, the state must continually evaluate the program. For example, a state should have a mechanism such as a random I/M emission test sampling of the fleet as a whole to assess the actual emissions of the vehicles clean screened versus those that get sent for full I/M testing.

In addition, as more data become available, the emission credit losses given in the clean screening utility will be revised. States that have already submitted SIPs to adopt clean screening would not necessarily be expected to revise and resubmit them after such a revision in the EPA guidance.

A state may choose to target high emitters either with RSD as discussed in the September 1996 EPA Interim Guidance [1] or with the high emitter profiling model (although this guidance does not have data to provide specific emission benefits for the high emitter profiling option). States wishing to use RSD to simultaneously identify high emitters to send them to special I/M testing and low emitters to excuse them from their next scheduled I/M test should contact EPA, since EPA has no generic guidance for this case. In addition, states wishing to further explore using high emitter profiling by itself or in combination with low emitter profiling should contact EPA.

The three types of clean screening will have different indirect benefits with respect to general program assessment and management. The continually operating remote sensing testing that is an inherent part of RSD clean screening can provide information on the frequent presence in a nonattainment area of high emitting vehicles registered elsewhere. These may be vehicles which have illegally evaded the I/M program, or which could be brought into the I/M program through a rule change. The steady flow of remote sensing data can also allow at least a qualitative indication of the trend in fleet emissions, which may be useful for clean air planning and I/M program evaluation and improvement. The other two methods of clean screening do not produce the same type of data flow. Model year exemptions obviously result in no data on the exempted vehicles. LEP clean screening does require a random sample of vehicles to be tested on a regular basis, but with more opportunity for the owner to influence whether the vehicle actually appears for testing at all and in its typical emissions condition.

As a general note, a draft OMS reassessment of in-use deterioration of cars and light-duty trucks will begin wide review shortly. This reassessment is part of the process for creating MOBILE6, which will replace MOBILE5 in mid-1999. To the extent that MOBILE6, which will

use this reassessment, alters I/M credits in general, the I/M credit loss from the three clean screening options (remote sensing, low emitter profiling, and model year exemption) will be affected. For example, exemptions of vehicles more than four years old may have less credit loss than would be calculated with the current MOBILE5b. The latest status and reports [11,12,13, 14] related to the in-use deterioration assessment are made available on the home page of the MOBILE6 emissions model. The home page address follows:

http://www.epa.gov/OMSWWW/m6.htm

1.6 Program Requirements for Use of These Credits

States wishing to use RSD, vehicle emitter profiling, or model year exemption for clean screening as part of their I/M program must adjust their I/M credits to reflect these new program elements. Use of model year exemptions (as discussed in Section 2.3) is generally relatively simple and adjustments to the I/M SIP and any SIP portions depending on I/M reductions can be handled by using appropriate inputs for MOBILE5. The following sections specifically cover RSD and vehicle emitter profiling for clean screening. Clean screening programs not designed to meet the requirements given below are not necessarily disallowed, but will require individual discussion with EPA; the state has the burden of establishing and supporting credits for the alternative programs.

1.6.1 RSD Clean Screening

In general, states adopting remote sensing device clean screening must either offset the credit loss on a one to one basis or show that their I/M SIP and any other previously approved SIP portions depending on emission reductions from I/M (e.g., the 15 percent rate of progress plan or attainment demonstration) remain approvable with respect to required emission reductions even with the credit loss caused by RSD clean screening. States may find this adjustment possible, or may be able to achieve sufficient compensating emission reductions from other control programs. Demonstrating such approvability involves modeling for all future years in which emission reduction requirements are defined such as the rate of progress showing needed for 2002. This modeling can be accomplished by using the utility program that accompanies this guidance.

States should be advised that the remote sensing clean screening credits depend on vehicle fleet mix in a way that causes the percentage loss (but not necessarily the tons loss) in I/M credits due to clean screening to be larger in the future than at present. Therefore, it may be more difficult to show that the SIP revision for clean screening is acceptable with respect to 2005 than for 1999, for example. The reason for this increase in credit loss over time is that available information based on current RSD equipment and techniques shows that the percentage credit loss is larger for 1990 and newer model year vehicles than for earlier vehicles. However, refinements in remote sensing may occur that offset this trend; for example, improved test accuracy that allows for more stringent remote sensing cutpoints without causing false failures

may compensate for this increase. However, at this time, a state should not depend on hypothetical improvements. A state may depend on tighter RSD cutpoints for 1990 and new vehicles than for older cars, as a way to reduce the credit loss in future years.

Remote sensing clean screening credits are provided in the utility for two cases distinguished by the type of regular I/M inspection performed on an annual or biennial basis: 1) IM240 testing with the EPA-recommended phase-in cutpoints, and 2) IM240 testing with the stricter EPA-recommended final cutpoints.[4] I/M credit losses in percentage terms are larger with the final cutpoints. Programs scheduled to adopt the final cutpoints must show that their SIP remains acceptable when analyzed on that basis. Programs not using the IM240 tests must select between the two available credit cases, or must develop and support customized credit adjustments for their specific tests. Generally, states with other test types and cutpoints should select the IM240 cutpoint case that is closest to the state's actual program in terms of the failure rate of the fleet. For example, a state with an Acceleration Simulation Mode (ASM) I/M test should estimate the local failure rate with that test and its cutpoints, and with the IM240 with each of its cutpoints, and select whichever IM240 case is closer in overall fleet failure rate. This comparison does not necessarily have to be done using a local vehicle sample. EPA will even consider demonstrations based on use of one sample to determine the IM240 failure rate and another sample to determine the ASM failure rate.

Two valid RSD tests with all three pollutants on each test are required to make a clean screening determination. If a valid reading for one pollutant is not obtained, it must be assumed that the vehicle failed for that pollutant and is not yet excused from I/M testing. However, if a state decides not to use NOx cutpoints, valid NOx data are not required. Tests must be at different sites or on different days. Two RSD units in close proximity do not count as two separate tests. The two most recent tests meeting these conditions must be used. (Two clean RSD tests followed by a dirty RSD test showing high emissions do not permit a vehicle to be excused from scheduled testing.) It is acceptable for a state to set a reasonable cutoff date ahead of each vehicle's scheduled I/M test (generally a month), and to stop looking for more recent RSD data after that date. This cutoff allows a state time to match RSD tests, to identify which vehicles are excused, and to notify vehicle owners ahead of the scheduled I/M test. The older test of the two separate RSD tests, though, may not be more than 12 months prior to the scheduled I/M test. This time period is roughly that used in the Colorado Department of Public Health and Environment Studies. Further research may alter EPA guidance on the question of this time period.

As discussed earlier in Section 1.2 and later in Section 2.1, remote sensing sites must be selected using good engineering practice in terms of traffic flow, road grade, acceleration, speed, and other appropriate items. While there are no specific EPA requirements in this guidance, EPA reserves the right to reject unreasonable site selection practices. Generally, however, it is EPA's conclusion from available research that poor site selection can result in high readings on vehicles which deserve to be excused from testing. The falsely high readings can prevent having two clean RSD tests on a vehicle, or can come after the two clean tests and, thereby, preclude the vehicle from being excused from its I/M test. Since poor site selection generally does not usually

cause a low remote sensing reading on a high emitting vehicle, it does not cause a significant loss of emission credit, but does partially defeat the very purpose of RSD clean screening which is to excuse vehicles from I/M testing. In addition to good site selection, as mentioned in Section 1.2, EPA encourages the use of speed and acceleration limits to define a valid test, as these can also help achieve the goal of excusing clean vehicles from regular I/M testing. Sites that avoid vehicles still in cold start mode are also recommended.

Remote sensing units must be designed, programmed, maintained, calibrated, and quality assured in keeping with good engineering practice. EPA does not certify remote sensing equipment or RSD contractors, but reserves the right to disapprove a SIP that does not provide for reasonable data quality. EPA invites consultation with states if they are considering innovative approaches that lack a performance record. Data recording and storage must allow any given remote sensing record being used to excuse a vehicle from regular I/M testing to be traced to a specific date, site, and testing unit. License plate decoding and matching a particular vehicle to its owner must be accurate, so that the right vehicles are excused from I/M testing. Relevant data used to excuse a vehicle from its next I/M test must be stored for a reasonable period. The SIP must address and demonstrate that this matching will occur accurately. The California Bureau of Auto Repair has prepared material relevant to quality control in RSD testing.

Remote sensing sites must be selected and rotated to achieve broad vehicle coverage. The studies done to date have used multiple RSD sites [2, 3, 4]. While there are no specific requirements established in this guidance, EPA reserves the right to accept or reject site selection plans. The goal is that owners of clean vehicles should not be able to voluntarily present their vehicles for remote sensing while owners of dirty vehicles (or vehicles that have not received recent maintenance) avoid remote sensing. For example, a site selection system that facilitates vehicles obtaining remote sensing measurements soon after passing one scheduled I/M test and then avoiding remote sensing for the following 11-12 months is not acceptable.

A state can announce remote sensing sites or use one or more of its sites consistently, so that vehicle owners who believe their vehicles are clean can choose to get tested. This approach can achieve increased vehicle coverage, and thereby allow more vehicles that deserve to be excused to actually be excused. These announced or repeated sites must be on-road sites, rather than special lanes set up off road, unless the special lanes are demonstrated to give RSD readings representative of on-road sites selected with good engineering practice. If vehicle owners are given an opportunity to present their vehicles for remote sensing intentionally, the program must have safeguards to make it difficult for owners to defeat the program by altering their vehicles just for the two test days, or by temporarily switching license plates. One approach is to also operate sites likely to capture a true cross section of the fleet. EPA does not rule out other approaches, but details need to be discussed with EPA to be sure that the system over all will have an effectiveness as good as the system that produced the data upon which these credits have been based. The idea is to try to preclude vehicle owners from adjusting their vehicles just for the remote sensing test (“clean for only a day”) and make readjustments afterwards.

A random sample of the vehicles which would normally be excused from I/M testing based on their remote sensing tests must instead be required to get their regularly scheduled I/M test. This sample is needed to provide data to assess and ensure on a continuing basis that the remote sensing system is correctly identifying high and low emitting vehicles, to identify remote sensing sites that need to be reconsidered, etc. To assure these vehicles are truly random and not specially altered for the I/M testing, owners of these vehicles may not be informed of their special status. The size of the random sample is not set by this guidance, but needs EPA approval on a case by case basis. These data should be used to evaluate the credit losses with RSD clean screening and, as needed, to adjust them to better reflect the local situation in a state. The SIP must contain details on how this random sample will be obtained and used to evaluate RSD clean screening.

States may conduct local pilot studies to improve, update, or customize any of the parameters that determine the I/M credit adjustments. For example, failure rates by age of vehicles may be different than estimated in the default credits. These failure rates are important in determining evaporative emissions adjustments.

States that have committed in their SIPs to conduct evaporative system purge or pressure testing but are awaiting EPA guidance on practicable methods for such testing may adopt clean screening for tailpipe emissions. If these states have an approved SIP which assumed credit for an evaporative emission test, the state may adopt RSD clean screening for the tailpipe test with no adjustment in the evaporative emission credits used in the SIP until the EPA guidance on evaporative methods is provided and triggers a request for the state to fulfill the SIP commitment for evaporative inspections. States which are currently conducting or which, in the future, begin to conduct the type of evaporative inspections specified in their SIP must account for the effect of clean screening on evaporative emission credits using the provisions of this new RSD clean screening utility.

1.6.2 Vehicle Emitter Profiling Clean Screening

As with remote sensing clean screening, states adopting low emitter profiling for clean screening must either offset the credit loss on a one-to-one basis or show that their I/M SIP and any other previously approved SIP portions depending on I/M (e.g., the 15 percent rate of progress plan or attainment demonstration) remain approvable with respect to required emission reductions even with the credit loss from use of the low emitter profiling. States may be able to achieve needed compensating emission reductions from other control programs. With RSD clean screening, all future years in which emission reduction requirements are defined must be modeled in order to determine the approvability of an LEP clean screening plan**.**

There appears to be a model year dependence for low emitter profiling that also shows increasing percentage credit loss for later model year vehicles with RSD. If this is true, then it will be somewhat harder to show SIP approval for a 2005 evaluation date than for the evaluation date of 1999, for example. Actual events may differ from this apparent trend, but until a showing

otherwise, a SIP revision must calculate credits accordingly. States can decrease the LEP clean screening exemption rates to limit the percent credit loss in future calendar years. EPA suspects that the credit losses that appear in this draft version of the guidance may overstate the credit loss in future years, so users should at present consider this an area of some uncertainty.

Since EPA intends the estimates of LEP clean screening credit loss in this guidance to be more illustrative than definitive for an extended period, and since these estimates rely on a single study with limited if any peer review so far, these estimates have not been made default values in the clean screening utility for low emitter profiling. States will have to enter the values given in Section 2.2 by hand. The final utility issued after peer review and public comment may be modified to incorporate these values as defaults.

An LEP clean screening State Implementation Plan (SIP) must state how and when the initial profile for credit losses will be updated and revised as more data become available. As with RSD clean screening, a random sample of vehicles excused from I/M testing based on the low emitter profiling must get their regular I/M test. Testing on this random sample of vehicles will provide data for evaluating whether the profiling is correctly identifying high and low emitting vehicles. If it is large enough, it will also provide information to help update the profile algorithm or list.

Evaporative emissions credits should be handled as discussed in Section 1.6.1.

2.0 Detail on Remote Sensing Device, Vehicle Emitter Profiling, and Model Year Exemptions

There are three possibilities for use of clean screening in conjunction with an I/M program to excuse low emitting vehicles from I/M testing:

1. Use of RSD to excuse low emitters;

2. Use of low emitter profiling to excuse low emitters; and

3. Use of model year exemption for recent model year vehicles.

Each of these options is discussed in detail in the following sections.

The guidance on RSD clean screening was developed primarily on the basis of two studies by the Colorado Department of Public Health and Environment [3,4] in Greeley and Denver. The guidance on low emitter profiling for clean screening was developed from work by Radian International LLC and de la Torre Klausmeier Consulting.[5,6,7,8,10]

The RSD clean screening guidance covers eight specific scenarios with four different RSD cutpoints for HC, CO, and (as applicable) NOx with either of two sets of I/M program

standards (interim and final IM 240). EPA is open to states using other cutpoints but expects those states to propose and support credits developed in a manner consistent with or superior to the approach used for the eight scenarios. The software with the RSD clean screening utility can accommodate customized credits.

The credit impact information for the low emitter profile is limited to a single approach to LEP clean screening, that presented by Radian International LLC and de la Torre Klausmeier Consulting, with some conceptual variation to accommodate the evolution of the fleet mix through the future. The starting point is a list in which every "engine family" is ranked by the frequency with which vehicles belonging to it have failed the IM240 test.

The credit loss for model year exemption can be calculated using MOBILE5.

2.1 Detail on Remote Sensing Device Options for Clean Screening

Use of RSD for clean screening results in specific vehicles being excused from their next annual or biennial I/M test because they pass the remote sensing cutpoints. Obviously, this has owner convenience and cost advantages. Use of RSD results in some I/M credit loss since some high emitting vehicles may appear clean with RSD and will be excused from the confirmatory I/M testing and repair for that I/M cycle.

There are some steps states can take to improve the tradeoff between the convenience and emission reduction loss. As mentioned in Section 1.6.1, vehicles should be required to pass two different RSD tests at different times or places which is the basis for the numbers in the EPA clean screening utility. Careful RSD siting practices and good quality control and monitoring can give clean vehicles the greatest chance of passing while minimizing the passing of dirty vehicles. The credits given in this guidance assume all these features are implemented. Even with these features, RSD is not highly accurate in predicting the emission levels of vehicles with only moderately high emissions. To avoid allowing moderately high emitting vehicles to escape a high quality periodic I/M test, RSD cutpoints would be set to produce a lower pass percentage than the normal I/M program cutpoints. Typically, about 50 percent or fewer of vehicles from the fleet as a whole tested by RSD would be considered passes and would be excused from the regular periodic I/M test requirement. The other 50 percent would be required to take their I/M test, which some vehicles will fail and some will pass.

Because I/M programs are designed to address repairable emissions problems and such problems are strongly correlated with vehicle age, it is not surprising that RSD clean screening will excuse many more younger vehicles than older ones. In the Colorado study, 24 percent of vehicles 15 to 18 years old were exempt compared to 63 percent of vehicles younger than 8 yeas, when an overall 50 percent of the fleet was excused. In concept, a state could decide to impose some constraint on the exemption pattern that would tend to occur naturally. For example, the state could decide that in every model year, the engine families representing the cleanest 10

percent of the vehicles of that age will be exempt. Conversely, a state could decide that among vehicles that have reached some age, none will be exempt.

The RSD pass rate and the loss of credit due to errors in passing high emitter vehicles in the current vehicle fleet varies with model group (or age cohort) as shown in the Colorado Department of Public Health and Environment reports, specifically Figures IV-10 and IV-13 of reference.[4] These figures as well as other figures used directly from the different references are given in Appendix A. One of the trends observable is that the percent I/M credit retained varies with the model year grouping of the vehicles. For example, the exhaust emission HC I/M credit retained with RSD cutpoints of 200 ppm HC, 0.5 percent CO, and 1500 ppm NOx is 97 percent, 95 percent, and 90 percent for 1982-85, 1986-89, and 1990 and later model year vehicles respectively.

For this interim guidance, the assumption is made that the variation in the loss of credit in percentage terms is a function of technology differences among the model year groups rather than specific vehicle age. In other words, a cohort of 1990 and newer vehicles will have one value for the percentage of emission credits retained regardless of its age. While MOBILE5 shows increasing emissions of a given vehicle model year with increasing age due to deterioration, the same percentage of emission credit retained is applied to the increased emissions. Thus, in the distant years beyond 1998 when most of the fleet consists of 1990 and newer model year vehicles, the excess emission credit retained will be the smaller percentage shown for these vehicles rather than the larger percentage for the earlier model year vehicles. This assumption is one that should be examined and revised, as appropriate, when additional RSD clean screening data become available. EPA does not rule out that a higher credit retention might naturally occur on these vehicles as they age. EPA is open to evidence to that effect which could be used to revise or depart from this guidance. Additionally, it seems reasonable to suppose that even more stringent RSD cutpoints than those given in this guidance would increase the credit retention rate and may be practical to implement, especially if RSD technology continues to improve. EPA is open to additional data, but for now believes states should not presume greater credits than estimated by the utility.

Strictly speaking, it is appropriate to use the data from the RSD study in Colorado in the way this guidance does use it only if vehicle owners do not often repair their cars in anticipation of the initial IM240 test. If a car in Colorado passed RSP despite having an emissions defect, or prior to developing one, but the owner pre-emptively obtained an effective repair prior to the IM240 test, that car would not play any role in the calculation of the credit retention/loss factors in this report. In actuality, if such a car were exempted based on its RSD tests the owner might not get the repair, and the I/M program benefit would be less. EPA invites reviewers of this draft guidance to comment or offer specific data relevant to this uncertainty.

Vehicles cannot be clean screened out of regular I/M testing if they are unsuccessfully tested by RSD. Getting two RSD readings on a large fraction of the vehicle fleet within a 12-month period is not simple, and requires multiple testing units moving among many sites. The

1995 California RSD pilot program in Sacramento demonstrated a 47 percent vehicle coverage for a single RSD reading with 26 percent of the fleet being measured more than once.[1] The more recent Colorado Department of Public Health and Environment work in Greeley, though, shows a 72 percent coverage of the vehicle fleet. However, the fraction of the vehicle fleet receiving two or more RSD readings was only 45 percent.[3, 16] Fleet coverage above 50 percent should be possible, but will require more resources unless owners begin to seek out the RSD test. The rough estimates for credit impact given later are only for purposes of illustration.

Since achieving a certain coverage can be a complicated issue, states need to be careful in making estimates on coverage to assure that the coverage assumed can be obtained with reasonable resources. States need to consider the number of practical remote sensing locations (and the associated traffic flows), the number of RSD devices available, the staffing levels to operate these devices, how many hours they will be operated, and the quality of the readings obtained. The selection and achievement of a coverage rate is the responsibility of the state; EPA will approve a state estimate or commitment used based on the weight of evidence for it.

The clean screening utility allows a state two options for fleet coverage. The first option is commitment to a level of effort in which a state commits to a specific number of vehicles with valid RSD tests (i.e., two valid readings of HC/CO and NOx if a NOx cutpoint is used on each vehicle, valid recording of license plate, ability to contact vehicle owners for any required I/M test) in a given time period. The RSD clean screening utility will internally convert the number of RSD tests to fleet coverage assuming the vehicles to be eligible for clean screening must receive two or more valid RSD tests. The second option is commitment to a specific fleet coverage (e.g., a certain percentage of the fleet will receive two or more valid RSD tests). The coverage is specified by a separate fraction for each age of vehicle from new vehicles to those that are 25 years old.

Some additional information from Applied Analysis [15] shows that, at a given overall fleet coverage with RSD, the RSD coverage is greater for the newer vehicles and lower for older vehicles. For example, the RSD coverage for the 1990-97 model year vehicles is greater than the overall average coverage for the entire vehicle fleet in the Denver study. Correspondingly, the coverage for the pre-1990 vehicles in the Denver RSD study is less than that of the overall fleet average. This phenomenon is expected due to the different use pattern of newer vehicles (which have a greater annual “vehicle miles traveled” per vehicle than older vehicles) and, thus, are more likely to be seen by RSD units along roadways.

The first option for RSD coverage can be used to demonstrate what individual model year coverage and overall fleet coverages would be achieved by a given level of testing. Calculations were done for level of effort programs that achieve 30 percent, 50 percent, and 70 percent overall fleet coverage. The individual model year coverages for these three fleet coverages are given in the User Guide [9] which also explains how the individual model year coverages need to be entered for the second option. Using cutpoints of 200 ppm HC, 0.5 percent CO, and no NOx cutpoint, the percent of the fleet excused from I/M testing is 16 percent, 27

percent, and 37 percent for the 30 percent, 50 percent, and 70 percent fleet coverage. If a NOx cutpoint is also used, these percentages are lower.

The loss of I/M credit associated with RSD falsely passing dirty vehicles depends on the cutpoints chosen. This EPA interim guidance provides credits for cutpoints of only 200 ppm HC and 0.5 percent CO; other HC/CO cutpoints are not included since no analysis was done for other HC/CO cutpoints in the Colorado Department of Public Health and Environment study. Additionally, the utility provides an analysis of I/M credit impacts without any NOx cutpoint or NOx cutpoints of 1,000, 1,500, or 2,000 ppm. Choosing a NOx cutpoint (especially more stringent ones such as 1,000 ppm versus 2,000 ppm) reduces the fraction of vehicles that will pass clean screen but, also, reduces the I/M credit loss since there will be few vehicles falsely passing RSD.

The Colorado work [4] is the basis for the EPA interim credits for clean screening. The published report shows the percent of excess emission credit retained for the following three groupings of model years:

1. 1990 and later model year vehicles;

2. 1986-89 model year vehicles; and

3. 1982-85 model year vehicles.

The EPA clean screening RSD utility uses these three model year groupings, and also assumes that the pre-1982 model year vehicles have the same I/M credit retained as the 1982-85 model years. Excess emissions are defined as those emissions over either the looser phase-in or stricter final IM240 cutpoints. Figures IV-2 and IV-3 of the Colorado Department of Public Health and Environment report lists the phase-in IM240 cutpoints and the final IM240 cutpoints for light-duty vehicles (LDVs) (passenger cars) and light-duty trucks (LDTs) (both LDT-1 and LDT-2 categories).

A total of 594 vehicles with two RSD readings for all three pollutants and matched IM240 values were in the Colorado Department of Public Health and Environment study. The percent or overall excess emissions retained among these 594 vehicles (taken directly from Figures IV-9 and IV-12 of the Colorado report) with clean screening found in this study are given in Tables 1 and 2 for both the phase-in and final EPA IM240 cutpoints, for the four possible sets of RSD cutpoints. Since the phase-in cutpoints are significantly higher than the final cutpoints, the percent of excess emissions retained is higher when using the phase-in IM240 cutpoints rather than the stricter final cutpoints. This point is very important for states to consider as they determine what clean screening programs are appropriate for their use when modeling future years in which the SIP commits to final IM240 standards.

Table 1

RSD Clean Screening Effectiveness on a Sample of Vehicles in Denver, Assuming the Regular I/M Program Uses Interim EPA IM240 Standards

Clean Screening Cutpoints	Vehicles Tested	% Vehicles Passing Clean Screen	HC (% excess exhaust emission credit retained)	CO (% excess emission credit retained)	NOx (% excess emission credit retained)
HC 200 ppm CO 0.5% NOx - none	594	51%	98%	93%	77%
HC 200 ppm CO 0.5% NOx 2,000 ppm	594	40%	98%	93%	88%
HC 200 ppm CO 0.5% NOx 1,500 ppm	594	37%	99%	100%	89%
HC 200 ppm CO 0.5% NOx 1,000 ppm	594	29%	99%	100%	93%

Table 2

RSD Clean Screening Effectiveness on a Sample of Vehicles in Denver, Assuming the Regular I/M Program Uses Final EPA IM240 Standards

Clean Screening Cutpoints	Vehicles Tested	% Vehicles Passing Clean Screen	HC % excess exhaust emission credit retained	CO % excess emission credit retained	NOx % excess emission credit retained
HC 200 ppm CO 0.5% NOx - none	594	51%	91%	93%	72%
HC 200 ppm CO 0.5% NOx 2,000 ppm	594	40%	94%	95%	85%
HC 200 ppm CO 0.5% NOx 1,500 ppm	594	37%	95%	99%	88%
HC 200 ppm CO 0.5% NOx 1,000 ppm	594	29%	96%	99%	93%

The excess emissions retention values in Tables 1 and 2 are based on all 594 vehicles. The model year distribution that occurred in the 594-vehicle sample may not be representative of the particular model year distribution found in any given state's fleet. It surely does not represent the distribution that will exist in future years. However, the utility treats the several model year groupings as distinct, and MOBILE5 will recombine them according to the mix implied by the state's vehicle registration distribution input. More details, including the more detailed credit retention values for each of the three model year categories, for each scenario of IM240 standards, are shown in Figures IV-10 and IV-13 of the Colorado Department of Health and Environment Report.[4]

A critical note is that the credits should be revised as additional data beyond these 594 vehicle become available. In particular, as states obtain additional data relating RSD and I/M values and from the random full IM240 tests being done, these credits should be updated. In addition, results ideally should be obtained for individual model years rather than continuing to use model year groupings such as the three model year groups shown above. The use of individual model year results should lessen any large discontinuities when going from one model year group to another. The 594-vehicle sample itself is in EPA's opinion too small to allow reliable estimates for individual model years.

In determining the total credit loss for HC, the exhaust component mentioned above must be considered along with the evaporative HC as discussed in Section 1.6.1. Sections 1.3.1 and 1.6.1 discussed evaporative emissions and RSD clean screening. The clean screening utility assumes that RSD clean screening operates randomly with respect to evaporative emissions malfunctions. If 50 percent of vehicles of a given age pass the RSD cutpoints, 50 percent of the potential evaporative benefit of I/M is lost. The clean screening utility is programmed to make these calculations on a model year by model year basis and to give a composite result.

2.2 Vehicle Emissions Profiling

This section covers a general conceptual overview of how vehicle emissions profiling would be used and the changes in I/M credits associated with it.

2.2.1 General Aspects

Vehicle emitter profiling (VEP) is a concept which centers upon ranking vehicles for the likelihood that they would fail the I/M test and need emission repairs, using statistics on the historic failure rate of other vehicles of very similar design [14]. Those who have been active in this concept to date have considered vehicles to be "of very similar design" if they match at least on all of model year, make, model, engine size, and fuel metering system (e.g., carbureted vs. fuel injection). Those that do match are said to be in the same "engine family," a term borrowed from EPA's regulatory program but used here in not precisely the same way. The ranked list and the failure probability for each engine family is called the profile. Once ranked, the engine families with the lowest probability of failing the I/M test are categorically excused from testing, even though some individual vehicles in those engine families would fail if tested. The state can decide how far to go down the list when exempting engine families, but the credit loss per car excused increases rapidly beyond the point at which one-half of the fleet is excused.

Because I/M programs are designed to address repairable emissions problems and such problems are strongly correlated with vehicle age, it is not surprising that a typical clean screening profile will excuse many more younger cars than older. In the example in the references, virtually all vehicles aged one or two years old were excused, but only 10 percent of 10-year-old cars, when overall 50 percent of the fleet was excused. In concept, a state could decide to impose some constraint on the exemption pattern that would tend to occur naturally.

For example, the state could decide that in every model year, the engine families representing the cleanest 10 percent of the vehicles of that age will be exempt. Or, a state could decide that among cars that have reached some age, none will be exempt.

Vehicle emissions profiling requires a very large and broad database of historical information on in-use vehicle emissions to be successful. This database needs to be continually updated with more recent information since the profile will change in future calendar years. It is preferable that the new data come from within the area of the I/M program doing the profiling, so that it reflects emissions of vehicles as actually affected by the local I/M program and repair industry. It is essential that within an "engine family," the sample be a true random cross section of vehicles operating in the I/M area.

Experts consulted by EPA/OMS believe that the database needs to be on the order of, roughly, one million vehicle records for a 1- or 2-year period; EPA has not confirmed this. With a database of this size, even engine families with low market share will have enough records to allow failure rates to be estimated with reasonable accuracy. With a smaller database as might be obtained with random I/M testing of only a small portion of the fleet, vehicle models with too few vehicles present in the data would have to be excluded from any possibility of exemption since there is no way to know with any type of certainty that such vehicles would have low emissions. However, states can concentrate the random testing on vehicle models needed to provide updates to the profile. For example, instead of testing many more vehicles of a popular model than needed to update the profile, fewer numbers of these vehicles could be tested. The state could then concentrate testing on vehicle models where there would be too few on a random basis to update the model. Also, states may want to investigate increasing sample sizes in the portion of the fleet for which errors would cause the greatest credit loss.

More complicated forms of LEP clean screening would use information other than engine family and that family's I/M failure rate to make the exemption decision, in particular information about an individual vehicle such as data from any recent RSD encounters or data from the vehicle's own last I/M test. Conceivably, information about the vehicle owner or the vehicle's place of registration could play a role. Assuming the underlying data is good and kept up to date, in principle any extra complication has at least the potential to make the screening program more efficient, in terms of reducing the credit loss per vehicle excused from testing. Some of the references discuss some of these concepts, but this guidance does not address them further.

By definition, vehicle emitter profiling covers 100 percent of the vehicles for a given model year, so "coverage" is much simpler than for RSD clean screening.

2.2.2 Credit Losses Estimation

The credit loss estimates in this guidance have been developed by extending an available analysis by Radian International LLC and de la Torre Klausmeier Consulting. They analyzed

IM240 data from the Arizona I/M program to develop a LEP clean screening profile. IM240 failure rates were determined for each engine family. The list ranks engine families from lowest to highest for most recent failure rate on the IM240 test. In actual use in an I/M program, the managing agency would use the vehicle identification number (VIN) of each car in the fleet, in conjunction with Radian International LLC's VIN Decoder or its equivalent, to match the vehicle to its engine family and thereby determine its place on this exemption ranking.

To help evaluate the validity of its approach to creating the ranked list and the usefulness of an Arizona-based list across different state programs, Radian International LLC applied the list developed on the Arizona data to the Colorado fleet. The performance of the model in identifying high, very high, and super emitters is almost the same for both the Arizona and Colorado fleets as judged by comparing model predictions to the actual IM240 data in each state. For both states, the cleanest 50 percent of the fleet contain less than 10 percent of the IM240 failures.

Table 3 below gives the emission impacts of clean screening for the Arizona fleet now in operation using the low emitter profile for the full range overall fleet exemption rates. Excess exhaust emissions are defined as those above the final IM240 cutpoints. The model predicts that excusing 50 percent of the current fleet from I/M testing results in losses of exhaust I/M credits for HC, CO, and NOx of 5.5 percent, 5.7 percent, and 6.8 percent respectively. This table is taken directly from an analysis done by de la Torre Klausmeier Consulting.[14]

Table 3

Emission Impacts on the Current Arizona Fleet of Targeting with the Low Emitter Profile

Vehicle Fraction Excused	% Excess Emissions in Excused Fraction		
	Exhaust HC	CO	NOx
0%	0.00%	0.00%	0.00%
10%	0.23%	0.30%	0.26%
20%	0.65%	0.80%	0.73%
30%	1.45%	1.75%	1.57%
40%	2.93%	3.58%	3.41%
50%	5.46%	5.71%	6.79%
60%	10.98%	10.28%	12.32%
70%	24.90%	23.21%	25.90%
80%	37.72%	35.10%	38.98%
90%	57.69%	53.08%	62.30%
100%	100%	100%	100%

The values in Table 3 can give a general sense of the potential for LEP clean screening to reduce I/M test volume with relatively minor loss of I/M exhaust emission reduction. (To this credit loss must be added some loss in evaporative HC credits, which generally will be larger in percentage terms than the loss in exhaust HC credits. Instructions for calculating evaporative HC credit losses are at the end of this subsection.) However, these are overall fleet results for Arizona, in a recent period. Caution is in order before conclusions are reached for other times and places. These overall fleet averages obscure any differences among model year groups in how well low emitter profiling works. Such differences would affect the credit impacts in other areas with a different mix of model year groups, and even areas with a different I/M program design since I/M program type can affect how much each model year contributes to overall program benefit. To help EPA determine whether such differences do exist and, if so, to allow EPA to develop a flexible method for estimating credit losses in other areas and in future years, Radian International LLC and De la Torre Klausmeier Consulting provided EPA some previously unpublished analysis of the data, which is summarized and further analyzed below. This analysis is in the list of references and is available on the web [14].

The data analysis supplied to EPA showed that the Vehicle Emitter Profile (VEP) was based on the following number of vehicles in different model year categories:

1982-85 model year	73,052 vehicles
1986-89 model year	132,359 vehicles
1990+ model year	190,007 vehicles.

Information was also submitted showing how many vehicles of each model year category were included in the different emitter categories. Emitter categories were defined using the EPA classification of normal, high, very high, and super emitters for HC/CO and normal and high emitters for NOx. The IM240 emission limits for these categories as defined by EPA (CARB definitions are slightly different) for HC and CO are shown below:

Normal emitters:

Less than two times the FTP HC standard for HC
Less than three times CO standard for CO

High emitters:

Between two and four times the FTP exhaust HC standard for HC
Between two and four times the FTP CO standard for CO

Very high emitters:

Over four times the FTP HC standard, but below 10 g/mile for HC
Over four times the FTP CO standard, but below 150 g/mile for CO

Super emitters:
Over 10 g/mile for HC
Over 150 g/mile for CO.

For NOx, these categories are defined based on IM240 NOx emissions as follows:

Normal emitters:
Under 2 g/mile NOx

High emitters:
Over 2 g/mile NOx.

Table 4 below (taken from information provided by Radian International LLC and de la Torre Klausmeier Consulting) shows the distribution of the almost 400,000 vehicles used in the low emitter configuration of the vehicle emitter profile in 10 percent increments starting with vehicles in engine families deemed least likely to fail the I/M test and thus most deserving of being exempted.

For example, when 50 percent of the overall fleet is exempted, 162,120 vehicles in the 1990 and new model year group are exempted, and these are 85 percent of all 190,007 vehicles which were 1990 or newer. In contrast, only 27 percent of cars in the 1986 to 1989 age group and essentially zero percent of vehicles in the 1982 to 1985 group would be among the engine families most deserving of being exempt.

Table 4 also provides information on the exemption fate of the vehicles that had “very high” HC and/or CO and those that had “high” NOx in the IM240 test. While there are additional categories of emitters, these two categories account for most of the vehicles and most of the excess emissions of their respective pollutants, and are useful for understanding the patterns that develop with LEP clean screening. Ideally, few of these would be exempted even when lots of vehicles in a model year group are being exempted. For example, when 50% of the fleet is exempted, only 2,922 of the very high HC/CO cars of 1986 to 1989 vintage are exempted, which is only 11 percent of all 25,645 cars in that age group that had very high HC/CO. This compares well with the 27 percent exemption rate for all vehicles in this age group.

Further comparisons among columns and rows of Table 4 show that the model year groups do display differences in how they are affected by clean screening. Their exemption rates for any given fleet exemption rate differ, as do the exemption rates for their very high HC/CO emitters and their high NOx emitters. Furthermore, even when different rows (i.e., different scenarios for overall fleet exemption rate) are chosen to try to equalize the exemption rates among the model year groups, the exemption rates among their high emitters are still different. Radian also supplied figures for the exemption rates of the other emitter categories: high HC/CO and super HC/CO.

Table 4

Characteristics and Number of Arizona Vehicles Used in Low Emitter Profile

Percent of overall fleet exempted as probable low emitters	Number of vehicles exempted as probable low emitters	1990+ Model Vehicles			1986-89 Model Year Vehicles			1982-85 Model Year Vehicles		
		Number of vehicles exempted as probable low emitters	Number of exempted vehicles which have very high HC/CO	Number of exempted vehicles which have high NOx	Number of vehicles exempted as probable low emitters	Number of exempted vehicles which have very high HC/CO	Number of exempted vehicles which have high NOx	Number of vehicles exempted as probable low emitters	Number of exempted vehicles which have very high HC/CO	Number of exempted vehicles which have high NOx
10%	39,542	39,117	497	122	425	41	44	0	0	0
20%	79,082	78,097	1,206	493	987	93	51	0	0	0
30%	118,826	114,486	2,403	1,179	4,340	289	174	0	0	0
40%	158,168	137,917	3,371	1,849	20,251	1,444	1,049	0	0	0
50%	197,708	162,120	4,929	2,981	35,561	2,922	2,490	27	4	2
60%	237,252	178,690	7,322	3,882	57,957	6,306	5,371	605	183	82
70%	276,794	181,577	7,737	4,076	83,128	12,263	9,858	12,089	7,334	2,797
80%	316,336	188,084	8,758	4,901	110,665	18,936	14,854	17,587	10,439	4,338
90%	355,878	190,003	9,160	5,086	128,144	23,854	19,450	37,731	23,776	11,111
100%	395,418	190,007	9,160	5,086	132,359	25,645	20,422	73,052	51,805	25,060

One striking observation from Table 4 is that, as expected, the bulk of vehicles excused from I/M testing by the low emitter profile are 1990 and newer model years. With 50 percent of the fleet exempted, 85 percent of these newer vehicles are exempted. As the fleet turns over, however, maintaining an overall 50 percent exemption rate will require that a smaller fraction of these newer cars be exempted, since the older vehicles with higher exemption rates will gradually disappear from the fleet. EPA's task in developing a method for estimating credit losses was to account for this type of program evolution. A related question concerns how the aging process will affect the profiling characteristics of any of the age groups shown in the table. At present an 85 percent exemption rate among 1990 and newer vehicles (which occurs at a 50 percent exemption rate for the overall fleet in the table above) corresponds to a 54 percent exemption among the very high HC/CO vehicles in that group. This indicates some tendency for very high HC/CO cars to have appeared in particular engine families, causing them to stand out and be disqualified for exemption. As the vehicles age, will age be the equalizer and make engine families more similar to one another? The discussion and tables that follow walk the reader through the method devised by EPA to temporarily address these issues, and the steps that a modeler should follow to estimate credit loss. As stated in Section 1.4.2, the goal of this effort was to provide states with at least ball park estimates--but better than simply using Table 3 directly -- pending the development of better methods and assumptions.

The basic concept in the approach recommended in this guidance is to estimate credit losses within each of the three model year groups, using the exemption rate within that model year group as the measure of exemption level. Only at end of the calculation process, which will happen within the utility and MOBILE5b, would these pieces be reassembled into an overall fleet effect.

EPA's first step has been to use the information in Table 4 to estimates the credit retention within each model year group when a certain fleetwide exemption rate is used. The results appear in Table 5 below. These numbers are based on the number of very high HC/CO and high NOx vehicles in the excused sample fraction versus the total number in each model year group. (High and super emitters for HC/CO were not considered. Use of only the very high emitters is an expedient approximation to the strictly proper approach of using individual vehicle data to express the retention directly in terms of retention of excess emissions. For the final version of this guidance, EPA's goal is to switch to the latter approach. Meanwhile, the values in Table 5 are approximate.) Excusing 20% of the overall fleet from I/M testing results in 1,206 of 9,160 very high HC/CO emitters for the 1990 and newer model years in the profile being excused. Excusing this number of vehicles results in an I/M exhaust credit loss of 13.17 percent or a credit retention of 86.83 percent for this model year grouping. Again, the assumptions in these calculations are simplistic and do not consider the actual amount of emissions contained and do not consider that vehicles other than very high emitters for HC/CO and high emitters for NOx contribute to I/M failures and benefits.

Table 5

I/M Exhaust Emission Credits Retained with Low Emitter Profile for Specific Model Year Groupings With Specific Exemption Rates for Overall Current Fleet

Percent overall fleet excused from I/M testing	Vehicle Model Year Groupings							
	Pre-1982		1982-85		1986-89		1990+	
	Pollutant							
	HC/CO	NOx	HC/CO	NOx	HC/CO	NOx	HC/CO	NOx
0%	100%	100%	100%	100%	100%	100%	100%	100%
10%	100%	100%	100%	100%	99.84%	99.78%	94.57%	97.60%
20%	100%	100%	100%	100%	99.64%	99.75%	86.83%	90.31%
30%	100%	100%	100%	100%	98.87%	99.15%	73.77%	76.82%
40%	100%	100%	100%	100%	94.37%	94.86%	63.20%	63.65%
50%	99.99%	99.99%	99.99%	99.99%	88.61%	87.81%	46.19%	41.39%
60%	99.65%	99.67%	99.65%	99.67%	75.41%	73.70%	20.07%	23.67%
70%	85.84%	88.84%	85.84%	88.84%	52.18%	51.73%	15.53%	19.86%
80%	79.85%	82.69%	79.85%	82.69%	26.16%	27.26%	4.39%	3.64%
90%	54.10%	55.66%	54.10%	55.66%	6.98%	4.76%	0%	0%
100%	0%	0%	0%	0%	0%	0%	0%	0%

Next, EPA calculated the exemption rate within each model year group that occurs with each possible fleetwide exemption rate. Table 6 below shows in percentage terms how fleet exemption rates in the Arizona sample corresponded to exemption rates within model year groups. For example, when the fleet exemption rate is 30 percent, no pre-1982 or 1982-85 vehicles would be exempted. Table 5 is derived from the "number of vehicles exempted as probable low emitters" columns of Table 4 by simple divisions, with the 100% exempt line in Table 4 as the denominator.

Table 6

Exemption Rates by Model Year Group

Percent of total fleet excused from I/M test	Percent Within Model Year Groupings Excused From I/M Test			
	1990+	1986-89	1982-85	Pre-1982
0%	0%	0%	0%	0%
10%	20.59%	0.32%	0%	0%
20%	41.10%	0.75%	0%	0%
30%	60.25%	3.28%	0%	0%
40%	72.59%	15.30%	0%	0%
50%	85.32%	26.87%	0.04%	0.04%
60%	94.04%	43.79%	0.83%	0.83%
70%	95.56%	62.80%	16.55%	16.55%
80%	98.99%	83.61%	24.07%	24.07%
90%	100%	96.82%	51.65%	51.65%
100%	100%	100%	100%	100%

The next step by EPA was to combine Tables 5 and 6 to express model year group-specific credit retention as a function of model year group-specific exemption rates. This required interpolation to obtain results at regular intervals of exemption rate. The results are shown in Table 7 below. The table below gives these numbers for HC/CO and NOx.

Table 7

I/M Exhaust Emission Credits Retained with Low Emitter Profile for Specific Model Year Groupings Versus Specific Exemption Rates for Those Model Year Groupings

Percent of model year group excused from I/M testing	Vehicle Model Year Groupings							
	Pre-1982		1982-85		1986-89		1990+	
	Pollutant							
	HC/CO	NOx	HC/CO	NOx	HC/CO	NOx	HC/CO	NOx
0%	100%	100%	100%	100%	100%	100%	100%	100%
10%	92%	93%	92%	93%	96%	97%	98%	99%
20%	83%	86%	83%	86%	92%	92%	96%	98%
30%	75%	77%	75%	77%	86%	86%	92%	95%
40%	66%	68%	66%	68%	79%	77%	87%	91%
50%	56%	57%	56%	57%	68%	67%	80%	85%
60%	45%	46%	45%	46%	56%	55%	74%	77%
70%	34%	35%	34%	35%	44%	44%	66%	68%
80%	23%	24%	23%	24%	31%	32%	55%	52%
90%	12%	12%	12%	12%	17%	16%	34%	32%
100%	0%	0%	0%	0%	0%	0%	0%	0%

With these results, an LEP clean screening planner can proceed to analyze any future year. The planner presumably will want to begin with an intended overall fleet exemption volume, since this affects the needed capacity in the I/M network and the number of vehicle owners who can look forward to exemption. This target exemption volume needs to be assigned among three model year groups: 1990 and newer, 1986 to 1989, and pre-1986. (EPA intends to re-divide and increase the number of groups in the final guidance.) In a real application of clean screening, the ranking of engine families based on a local random sample will cause this assignment. For modeling purposes now, some supposition is required. A starting point is the Arizona case.

The LEP clean screening planner should start by applying the group-specific percentages from one line of Table 6 (corresponding to the intended fleetwide exemption percentage) to the expected vehicle population in that group for the area and calendar year of interest, and determine whether the resulting number of exempted vehicles matches the exemption volume target. If the calendar year of interest is close to the present, the match may be close, but for future years it will be considerably off. The planner then needs to make adjustments to achieve a match. We recommend that if the calculated exemption volume needs to be reduced, the exemption rates for pre-1986 vehicles should be set to zero if not already zero, that two initially exempted 1990 and newer vehicles be "de-exempted" for every additional retention of a 1986 to 1989 car that is "de-exempted" (until no 1986 to 1989 cars remain exempt), and the remaining adjustment be made to the 1990 and newer group. This algorithm is not necessarily optimized, and experimentation may show some other way of balancing exemptions that has a smaller credit loss. For future years, this process will tend to make the 1990 and newer exemption rate about equal to the target overall fleet exemption rate, since 1990 and newer cars will be the large majority of the projected fleet mix.

Once the exemption rate within each model year group is selected, Table 7 can be used to find the credit retention fraction that should be input into the utility for all ages of vehicles that fall within that model year group in the calendar year to be evaluated. If the exemption rate is not a multiple of 10 percent, it will be necessary to linearly interpolate the between the entries in Table 7.

For example, if the clean screening planner wants to calculate the effect in 2005 of a clean screening approach that exempts 50 percent of 1990 and newer vehicles and does not exempt any older vehicles, the credit retention factor for vehicle ages 1 through 16 should be set at 80 percent for each of HC and CO, and at 85 percent for NOx. The credit retention factor for ages 17 through 25 should be 100 percent for all three pollutants.

EPA recognizes that the use of a single 1990 and newer model year group causes a coarseness in the modeling that is not satisfying to the careful analyst particularly for evaluation years as far into the future as 2005. EPA intends to solve this problem in the final version of this guidance by treating each model year separately.

Despite the shortcoming just described in the numbers available in this draft guidance, EPA believes the method described for the final guidance will provide good ball park estimates of credit losses. EPA hopes reviewers of this document will exercise the utility with the numbers available in the above tables. Doing this will make the mechanics of the process clearer, allowing more informed comment regarding the appropriateness of the method proposed for the final guidance.

Vehicle emissions profiling can affect evaporative emissions I/M benefits just as RSD clean screening affects evaporative emissions I/M benefits. Thus, the utility for emission profiling assumes, as does the RSD-based clean screening utility, that clean screening will reduce the benefits of evaporative emissions control system checks by the fraction of vehicles in that vehicle age exempted from inspection. Again, this credit loss is calculated on a model year specific basis. For example, if 40 percent

f vehicles of a given age are exempted by low emitter profiling, the benefits of the evaporative system checks for that vehicle age are reduced by 40 percent.

The utility requires the exemption rate to be input by individual vehicle age in order to calculate the evaporative credit loss. For the older three of the four model year groups in Table 6, the span of model years is small and the exemption rates among the individual model years will not be great, and it would not be unreasonable to use a single exemption rate for all the model years in the group. However, this is again a degree of coarseness that may not be satisfying. For the 1990 and newer group it definitely should not be satisfying, especially for future evaluation dates when this group will span a wide age ranges. In the final version of this document, EPA will provide a more fully researched method of setting exemption rate by individual model year. Meanwhile, EPA believes a user of this draft guidance can reasonably approximate the age/model year dependence of exemption rate within the 1990 model year group by making exemption rate a linear function of age, starting at 100 percent for the newest vehicles within the group and decreasing for older vehicles. Some trial and error may be needed to obtain the desired overall exemption rate, accounting for different vehicle populations within the model years. Also, for exemption rates of less than 50 percent, it may be necessary to have zero exemptions for several of the oldest model years in the group.

As an example, Table 8 shows one plausible pattern of exemption rate by model year in the year 2005, for a case in which the exemption rate for 1990 and newer vehicles overall is selected to be 40 percent.

Table 8

Example of Exemption Rates in 2005 by Model Year for 1990 and Newer Vehicles

Model Year	Age in 2005	Registrations	Exemption Rate	Exempted Vehicles
2005	1	136,000	1.0	136,000
2004	2	133,929	0.9	120,635
2003	3	146,314	0.8	117,051
2002	4	144,213	0.7	100,949
2001	5	142,955	0.6	85,773
2000	6	143,549	0.5	71,774
1999	7	143,081	0.4	57,232
1998	8	141,251	0.3	42,375
1997	9	137,323	0.2	27,464
1996	10	135,431	0.1	13,543
1995	11	131,864	0.1	13,186
1994	12	121,600	0.1	12,160
1993	13	106,705	0.0	0
1992	14	89,243	0.0	0
1991	15	75,257	0.0	0
1990	16	61,671	0.0	0
Total 1990+ Vehicles		1,990,386		
Total Exempted Vehicles				798,045
1990+ Group Exemption Rate		40%		

In actual practice, a clean screening planner would use some sample of vehicles spanning all model years to determine the ranking of the many engine families, and this ranking would imply an exemption rate in each model year. However, for making estimates of future credit losses, some method

of assigning exemption rates to each model year is needed. The method just described is reasonably consistent with the clean screening case in the references, in which exemption rates did generally follow a linear trend downward reaching zero exemptions at age 11 or 12.

2.3 Model Year Exemptions

This is the simplest of the clean screening options and requires almost no extra effort on the part of the state. This approach exempts vehicles from I/M testing until they reach a certain age, on the premise that virtually all vehicles are low emitting when sold and remain so for at least several years. Many states now wait until a vehicle is four or five years old before the first I/M test, with a small loss in credit for the years without testing. Some other states give the owner the option of paying a fee instead of I/M testing during the exempted years. It is the state's choice whether to assess a program fee on new vehicles during the exemption period. EPA has suggested that states consider exempting vehicles from I/M testing until they are at least four years old.

The effect of model year exemption varies from area to area, given the fleet mix and travel characteristics (i.e., vehicle age distribution, local vehicle miles traveled, even mix of cars/trucks). Overall, the loss of I/M credit for excusing the four or so newest model years is small; EPA believes most states can find ways to compensate for it if needed to keep the state implementation plan (SIP) approvable. However, model year exemptions do result in some high emitting new vehicles being excluded and some older model year clean vehicles being tested.

The effect of model year exemption in specific I/M areas can be estimated using existing features of MOBILE5b. States with a simple system of scheduling inspections on the anniversary of the new vehicle sales date should have no difficulty analyzing scenarios for themselves. States with more complex scheduling (such as requiring I/M tests during the month of the vehicle owner's birthday) may need to consult EPA to assure the credit adjustment is correctly apportioned considering the time period the vehicle would operate before the first scheduled inspection.

Generally, model year exemptions result in under 10 percent exhaust HC credit loss with up to the five newest model years being exempted.

3.0 Input/Output Features of the Clean Screening Credit Utility

The Clean Screening User Guide [18] provides complete step by step details on how to use the clean screening credit utility. This purpose of this section is to provide an overview of the information needed for the RSD and vehicle emitter profiling options.

As mentioned in Section 2.3, determining the I/M credit loss for model year exemptions is straight forward and can generally be easily done with MOBILE5 without further guidance. Thus, neither the detailed User Guide nor this summary provides further guidance on model year exemptions. However, if there are specific questions on how to calculate the change in I/M credits with model year exemptions, the state should contact EPA.

The basic formula for determining the new I/M credit with clean screening is as follows.

$$\text{New Credit}_{m,p} = \text{Old Credit}_{m,p} * F_m * E_{m,p}$$

Where:

Old Credit = I/M credit from the periodic inspection program

F = Adjusted fraction of the inspected fleet eligible for clean screening.

E = Effectiveness of clean screening at identification of clean vehicles.

m = Quantity is a function of vehicle model year; and

p = Quantity is a function of pollutant (i.e., HC, CO, or NOx).

In the equation, the influence of the underlying I/M program is represented by the variable Old $\text{Credit}_{m,p}$ which is chosen from the already-released I/M credits used with the MOBILE5 model. The variables F_m and $E_{m,p}$ in the equation represent the clean screening fleet coverage and effectiveness. The fleet coverage is determined as explained in the September 1996 user guide and summarized briefly in Section 3.1. Only coverage options 1 and 2 are allowed for clean screening scenarios.

The clean screening utility adjusts the I/M credit to account for the I/M credit loss from high emitting vehicles that pass the clean screening test and are exempted from further I/M testing.

3.1 Input/Output Features of the RSD Portion of the Clean Screening Utility

The first item needed as an input is fleet coverage which is the fraction of the fleet for which there are two or more valid RSD readings. There are two options for fleet coverage as explained in Section 2.1:

1) Commitment to a level of effort; and

2) Commitment to a specific fleet coverage.

The first is for a specific number of valid RSD tests which the RSD clean screening converts internally to a fraction of the fleet receiving two or more valid RSD tests. The second option is simply for the user to provide this fraction directly on a model year basis.

The next input needed is for the standard I/M credit data files. Each of these files has an automatic default value. The record descriptions for the input files (discussed in more detail in the Users Guide itself) follow:

1981 and newer model year credits
1981 and newer model year retest-hybrid credits
Pre-1981 model year credits
Pre-1981 model year retest-hybrid credits
Standard pressure/purge credits
Retest-hybrid pressure/purge credits.

The utility adjusts these credit files to account for clean screening.

The age at which vehicles first become eligible for targeting by remote sensing must be given which allows the state to apply clean screening only to vehicles older than a given age (e.g., 1-3 years old). Using a specific age at which clean screening is allowed means that vehicles newer than that age would not be subject to any I/M test requirements. In a way, this combines model year exemption with clean screening. The default input is 1-year old, meaning all vehicles 1-year old and greater are eligible for exemption from I/M testing with clean screening.

The user can also determine which model years of vehicles will be included in the clean screening program. The user has the following model year groupings from which to select:

Clean screening for Pre-1975 model year vehicles
Clean screening for 1975-80 model year vehicles
Clean screening for 1981-85 model year vehicles
Clean screening for 1986-89 model year vehicles
Clean screening for 1990 and newer model year vehicles.

The user also has one of four RSD cutpoints from which to select as follows:

0.5%/200 ppm/1000 ppm	CO/HC/NOx cutpoints
0.5%/200 ppm/1500 ppm	CO/HC/NOx cutpoints
0.5%/200 ppm/2000 ppm	CO/HC/NOx cutpoints
0.5%/200 ppm	CO/HC cutpoints (no NOx cutpoint).

The RSD clean screening utility provides default values for clean screening effectiveness as a function of model year and RSD cutpoints chosen. In addition, the user has an option of an alternate RSD clean screening scenario where the user supplies the effectiveness numbers based on data that the user would have developed such as from an RSD pilot program similar to the one run by the Colorado Department of Public Health and Environment.

3.2 Input/Output Features for Low Emitter Profiling (LEP)

The input features for the low emitter profiling (LEP) are somewhat different than those for the RSD clean screening option.

Low emitter vehicle profiling, by definition, covers 100 percent of the fleet. There are three

default exemption rates for low emitter profiling: 30 percent, 40 percent, and 50 percent. These percentages can be on a model year basis instead of the overall fleet. For example, these defaults can be selected for different vehicle ages increasing the exemption rate for newer vehicles where a larger fraction of the vehicles are low emitting. However, presently, the credit adjustments have been developed only for a single percentage number for the overall fleet.

A major input for the clean screening utility for low emitter profiling is the effectiveness or percent of the I/M emissions remaining for the fleet once a certain number of vehicles have been excused from I/M testing. The effectiveness numbers are also for vehicle age going from 1 to 25 years. A number of 1.00 means that the profile is fully effective in screening out only vehicles for that model year that would pass the confirmatory I/M test. If, for example, 5 percent of the excess I/M 240 emissions would be in the excused fraction for a particular model year, the effectiveness for that model year would be 0.95.

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12.** "Analysis of Emissions Deterioration Using Ohio and Wisconsin IM240 Data," EPA Report No. M6.EXH.002 (complete; will be posted on the web page imminently).

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* References available on EPA web page titled "Clean Vehicle Screening & Remote Sensing - Vehicle Profiling & Remote Sensing Device (RSD) Issues" at following address:

http://www.epa.gov/omswww/rsd.htm

** References available on EPA web page titled "MOBILE6 Vehicle Emission Modeling Software" at following address:

http://www.epa.gov/OMSWWW/m6.htm