

## Chapter 2

### MOBILE5 INPUTS

#### 2.0 INTRODUCTION

The reader is encouraged to refer to the examples in Chapter 5 when reading this chapter. These examples provide illustrations of the use of MOBILE5 options and data input requirements. However, reference to the examples in Chapter 5 cannot substitute for a thorough reading of this chapter.

MOBILE5 utilizes an input file that provides program control information and the data describing the scenarios for which emission factors are to be estimated. The input information consists of three distinct sections: the Control section, the One-time Data section, and the Scenario section.

The Control section is the portion of the input file that controls the input, output, and execution of the program. For example, the Control section indicates whether MOBILE5 will require the user to supply additional input data, or analyze a scenario that includes an inspection and maintenance program, or output the emission factors in a format suitable for visual inspection or in a format suitable as input to another program.

Some parameters used in the emission factor calculations have internal values built into MOBILE5. The One-time Data section is the portion of the input that allows the user to define parameter values different from those internal to MOBILE5, which will be used in the calculations for all of the scenarios within a given run. For example, in the One-time Data section the user can specify alternate annual mileage accumulation rates or registration distributions by age for each vehicle type. In addition, the One-time Data section allows the user to specify further control program parameters, such as description(s) of inspection and maintenance program(s). Information supplied in the One-time Data section is specified once and applied to all scenarios.

The Scenario section is the portion of the MOBILE5 input that details the individual scenarios for which emission factors are to be calculated. For example, in the Scenario section the user specifies the calendar year of evaluation and the average speed(s) to be assumed. Each MOBILE5 run can include many scenarios, and each scenario can have different scenario parameters.

In a few cases, the placement of data in either the One-time Data section or the Scenario section is determined by the setting assigned to a flag in the Control section of the input. In these cases, discussion of the variable(s) involved is provided once (usually in the One-time Data section), and then is referenced in the other section.

The Control section specifies values for variables termed flags. In section 2.1 each flag is named, and the range of possible settings for that flag and the resulting action is noted. In the One-time Data and Scenario sections (sections 2.2 and 2.3 respectively), the following general format is used. (Depending on the variable being discussed, not every item noted below is included for every variable.)

**Description:** A brief description of what the variable means, and how it is used by MOBILE5.

**Options:** A summary of choices available to the MOBILE5 user.

**Use in MOBILE5:** A description of the value(s) used in MOBILE5 for the variable(s) if the user does not input locality-specific information, where applicable, and discussion of how the information is used in the emission factor calculations.

**Required Information:** A specific description of exactly what information is required of the user, where applicable, including format specifications.

**Changes Since MOBILE4.1:** A statement summarizing exactly what changes have been made in the variable since MOBILE4.1. Not every variable has been revised. For those that have changed, this section highlights exactly what is different in MOBILE5 relative to MOBILE4.1 (options, format requirements, or use within the model). These sections are particularly important in finding and understanding the new options that are available in MOBILE5 (e.g., California LEV program, reformulated gasoline). In order to maintain compatibility between MOBILE4.1 and MOBILE5 input files to the maximum extent feasible, new options in MOBILE5 are generally accessed through either the addition of new values for existing flags, or by optional additional flags that appear at the end of distinct records (lines) in the input file. As was done in the introduction of new options for MOBILE4.1 (such as the oxygenated fuels program), these new optional values are located and interpreted in such a way that if they are missing, the program interprets the value as "not applicable to this case". This allows MOBILE4.1 input files to be used to run MOBILE5, although not every option available in MOBILE5 can be accessed using an old MOBILE4.1 input file.

**Changes Since MOBILE5a:** The following changes have been made. Onboard refueling vapor recovery now occurs automatically, where before it had to be explicitly requested. See section 2.2.7.1. Detergent Gasoline effects also occur automatically. See section 2.2.16.2. The user can now model Retest Based Hybrid I/M, functional pressure, or functional purge programs. See sections 2.2.5.2 and 2.1.11.3. Technician Training and Certification (TTC) credits may be used in I/M programs. See section 2.2.5.2. Alternate test-and-repair effectiveness values may now be set by the user to apply to I/M, ATP, functional pressure, or functional purge programs. These effectiveness values determine how test-only credits are discounted to provide test-and-repair credits. Previously, test-and-repair credits were automatically 50% of test-only credits, corresponding to effectiveness values of 0.50 for I/M, functional pressure, and functional purge programs, and 0.00 for ATP. See sections 2.2.5.2 and 2.2.6.2. The user now has the option of choosing the Acceleration Simulation Mode (ASM) test type for I/M programs. See section 2.1.9.2.

**Guidance:** Where applicable, EPA's recommendations and suggestions with respect to the determination of user-supplied values for the variable(s) under discussion. Many users of MOBILE5 will be involved in developing (or recasting) base-year (1990) emission inventories as part of the State Implementation Plan (SIP) process. In many cases, there is no single correct answer or recommendation that will be the best answer for all areas. For those using MOBILE5 to estimate highway mobile source base-year emission inventories in response to the requirements of the Clean Air Act Amendments of 1990, it is important that the guidance provided in the emission inventory preparation guidance (see below) be followed, and that EPA Regional Office personnel be kept involved in decisions concerning questionable or controversial assumptions and steps in the modeling.

There are also two appendixes to this chapter. Appendix 2A discusses the terminology used to describe inspection and maintenance (I/M) programs and anti-tampering programs (ATPs) Appendix 2B, which was not included in previous distribution of this chapter, reproduces a memorandum from the Office of Mobile Sources to EPA Regional Office Air Division Directors that details the guidance for obtaining emission credits for State Implementation Plans (SIPs) based on adoption of the California low emission vehicle (LEV) program. The issuance of the guidance provided in Appendix 2B has led to revisions in the following sections of this chapter,.

relative to the version distributed with the release of MOBILE5a and previously available through the TTN BBS:

- 2.2.5 Inspection and Maintenance Programs
- 2.2.6 Anti-Tampering Programs
- 2.3.1 REGION (variable on scenario record)
- 2.3.7 LEV Program Parameter Record

With the exception of the changes resulting from issuance of this guidance, there have been no substantive changes to Chapter 2 of this User's Guide since its initial release.

Guidance on the determination of appropriate values for temperatures and fuel volatility (RVP) appears in the revised emission inventory guidance ("Procedures for Emission Inventory Preparation, Volume IV: Mobile Sources," EPA-450/4-81-026d (revised), July 1992).

Questions about this document, and suggestions as to how the MOBILE5 User's Guide may be made clearer and more useful, should be addressed to:

MOBILE5 User's Guide -- Comments  
Air Quality Analysis Branch  
2565 Plymouth Road  
Ann Arbor, MI 48105

The remainder of Chapter 2 is structured as it was in the User's Guide to MOBILE4.1. For the most part, the same section numbers correspond to the same inputs and discussions as in the previous User's Guide. Where applicable, new subsections have been added to clearly indicate changes relative to MOBILE4.1.

### **2.0.1 How to Read FORTRAN Format Specifications**

The descriptors used in the remainder of Chapter 2 to define and describe the input field specifications are FORTRAN format specifications. Following is a brief key for interpretation. Additional detail can be found in any FORTRAN manual.

<u>Descriptor</u>	<u>Definition and Interpretation</u>
<b>'Iw'</b>	The next <b>w</b> characters (columns; includes blank spaces) will be read in as an integer value. Leading blanks are ignored, but trailing blanks are read as zeroes; thus, integer input values should be "right-justified" within the input field (i.e., if a value of "2" is to be entered in a field specified as I2, the two columns should be filled in "blank,2", not "2,blank" which will be interpreted as "20").
<b>'Fw.d'</b>	The next <b>w</b> characters will be read in as a floating-point real number, where <b>d</b> is the number of digits to the right of (following) the decimal point. If the field contains an explicit decimal point, the value will be read as specified and the implied point specified by <b>d</b> in the descriptor will be overridden. The decimal point, if present, is considered a character in the overall field width, <b>w</b> .

- 'Aw'            The next **w** characters will be interpreted and stored as alphanumeric (i.e., labels, text; any keyboard character can be entered).
- 'wX'            The next **w** characters will be ignored; they are not read by MOBILE5.
- '/'              The field separator, used to indicate the end of one record (line of input). Input after the '/' will be read from the next record.

## 2.1 CONTROL SECTION

The first portion of the input stream for a MOBILE5 run consists primarily of a series of flag settings. These flags control the format (and in some cases the content) of the remainder of the input stream, influence the execution of the program, and determine the content and format of the program's output. Each flag is named, defined, and its possible values listed, along with the effect of each setting. Tables 2.1-1 and 2.1-2 summarize the information on Control flags.

### 2.1.1 PROMPT

#### 2.1.1.1 Description

This flag determines whether the user will be prompted for the remainder of the input stream, and the arrangement of the remaining Control section input.

#### 2.1.1.2 Values/Actions

This flag can be set to 1, 2, 3, or 4:

<u>Value</u>	<u>Action</u>
1	No prompting; after PROJID record (section 2.1.3), vertical format (one value per line/record) used for remainder of input
2	MOBILE5 prompts for each input; vertical format
3	No prompting; after PROJID record, horizontal format (all values on one line/record) used for remainder of input
4	MOBILE5 prompts for each input; horizontal format

In general, EPA recommends that the input data for a MOBILE5 run be provided in a line file rather than entered interactively. Particularly when the user is supplying optional input data to replace values contained in the model, such as registration distributions by age, it is very difficult to interactively enter the large quantity of data required without error; providing the data in a separate file, which can be printed and examined, facilitates the process of detecting and correcting input errors. The use of this flag has largely been superseded by the use of a program driver routine in MOBILE5, but it is retained to maintain compatibility with MOBILE4.1 input files.

#### 2.1.1.3 Changes Since MOBILE4.1

There have been no changes to the PROMPT flag since MOBILE4.1. Users of MOBILE4.1 will note that a prompting message for the value of this flag has been added to the dialogue, after the prompts for output file name.

### 2.1.2 IOUNEW

#### 2.1.2.1 Description

The IOUNEW flag allows reassignment of output unit device numbers. There are three different types

of program output (prompting messages, diagnostic messages, and the emission factor reports). This flag is only useful when the mainframe computer version of MOBILE5 (available on 9-track magnetic tape) is being operated. The desktop computer versions of MOBILE5 (for IBM PC machines and clones, or for Apple Macintosh computers) does not permit reassignment of I/O devices in this way.

#### 2.1.2.2 Values/Actions

The three types of program output are formatted reports (emission factor results), diagnostic messages (error and warning messages), and prompting messages (such as are issued if the value of the PROMPT flag is 2 or 4). Single integer values representing other I/O device numbers may be assigned for any or all of these, in the order listed. If no device reassignments are desired, these fields may be left blank. Users of the desktop computer versions of MOBILE5 should never attempt to reassign the input devices. See Chapter 4 for additional information.

Any of the values 1 through 9 are technically allowed by MOBILE5 for assignment of any of the three possible output units. However, the values of 3 and 4 are reserved as input device codes in MOBILE5 for reading I/M credit files, and thus may not be assigned by the user for any IOUNEW field. If an illegal or missing IOUNEW value is encountered, MOBILE5 will revert to the default value. The user is cautioned that IOUNEW values considered valid by MOBILE5 may not be appropriate for a given computer system, and should thus be changed in the source code before the program is compiled. The default values used in the mainframe version of MOBILE5 are:

IOUREP = 7

IOUERR = 7

IOUASK = 6

#### 2.1.2.3 Changes Since MOBILE4.1

There have been no revisions to IOUNEW since the release of MOBILE4.1.

### 2.1.3 **PROJID**

#### 2.1.3.1 Description

MOBILE5 provides an 80-character alphanumeric field for the user to input a descriptive title for the MOBILE5 run.

#### 2.1.3.2 Values/Action

The project title is an 80-column blank record. The user may use up to 80 characters for the title. The character string does not have to be left-justified. Whatever title is input by the user is echoed as the heading of the formatted reports section of the program output. If no title is desired, a blank record must be entered at this point in the input file.

#### 2.1.3.3 Changes Since MOBILE4.1

There have been no revisions to this record, or how it is input to or used by the model, since the release of MOBILE4.1.

## 2.1.4 **TAMFLG**

### 2.1.4.1 Description

This flag provides the option of supplying tampering rates that differ from those included in the MOBILE5 code.

### 2.1.4.2 Values/Action

This flag can be set to 1 or 2:

<u>Value</u>	<u>Action</u>
1	Use MOBILE5 default tampering rates
2	User supplies tampering rates for eight categories of tampering, for each of the four vehicle types affected by tampering (LDGV, LDGT1, LDGT2, HDGV)

The user-supplied tampering rate data, required if TAMFLG = 2, are placed in the One-time Data section. Section 2.2.1 discusses tampering rates as program input.

### 2.1.4.3 Changes Since MOBILE5

There have been no revisions to TAMFLG since the release of MOBILE4.1.

## 2.1.5 **SPDFLG**

### 2.1.5.1 Description

Exhaust and running loss emissions vary considerably with speed, and MOBILE5 requires that vehicle average speed be specified in the program input. This flag provides the option of specifying one speed for all eight vehicle types, or of specifying different speeds for each vehicle type. In both cases, the average speed(s) is(are) indicated on the Scenario data record. In addition, in MOBILE5 there are two values of SPDFLG that can be used to indicate that the user wishes to supply data on the distribution of trips by length (of time) for use in the estimation of running loss emission factors.

### 2.1.5.2 Values/Action

This flag can be set to 1, 2, 3, or 4:

<u>Value</u>	<u>Action</u>
1	User supplies one value of average speed for all vehicle types
2	User supplies eight values of average speed, one for each vehicle type
3	User supplies one value of average speed for all vehicle types, <u>and</u> a set of trip length distribution records for use in calculating running loss emission factors for each

- scenario, in the Scenario data section
- 4 User supplies one value of average speed for all vehicle types, and a single set of trip length distribution records for use in calculating running loss emission factors for all scenarios, in the One-time Data section

If the value of SPDFLG is 3 or 4, only a single speed input for all eight vehicle classes can be used (equivalent to SPDFLG = 1), and the user must supply information on the fraction of VMT that is accumulated in trips of different lengths. The alternate locality-specific VMT fractions by trip length may be placed in the One-time Data section, in which case those values will be used in all scenarios of the run (SPDFLG = 4), or in the Scenario section, in which case a separate set of values will be used for each scenario of the run (SPDFLG = 3). Sections 2.3.3 and 2.3.12 discuss speed and VMT fractions by trip length, respectively, as program input.

#### 2.1.5.3 Changes Since MOBILE4.1

There have been no revisions to SPDFLG since the release of MOBILE4.1.

### 2.1.6 VMFLAG

#### 2.1.6.1 Description

The setting of VMFLAG determines the vehicle miles traveled (VMT) mix (fraction of total VMT accumulated by vehicles of each of the eight types) that will be used in MOBILE5 to estimate the composite emission factor for a given scenario.

#### 2.1.6.2 Values/Action

This flag can be set to 1, 2, or 3:

<u>Value</u>	<u>Action</u>
1	Use MOBILE5 VMT mix
2	User supplies a different VMT mix for each scenario
3	User supplies a single VMT mix for all scenarios

If VMFLAG = 2, the VMT mix input data are placed in the Scenario section. If VMFLAG = 3, the VMT mix input data are placed in the One-time Data section. Section 2.2.2 discusses VMT mix as input.

#### 2.1.6.3 Changes Since MOBILE4.1

There have been no revisions to VMFLAG since the release of MOBILE4.1.

### 2.1.7 MYMREG

#### 2.1.7.1 Description

This flag controls the use of annual mileage accumulation rates by age and registration distributions by age.



These parameters define the composition and travel characteristics of the fleet, and so affect the resulting emission factors.

#### 2.1.7.2 Values/Action

This flag can be set to 1, 2, 3, or 4:

<u>Value</u>	<u>Action</u>
1	Use MOBILE5 (national average) annual mileage accumulation rates and registration distributions by age
2	User supplies annual mileage accumulation rates by age; use MOBILE5 registration distributions by age
3	User supplies registration distributions by age; use MOBILE5 annual mileage accumulation rates by age
4	User supplies both annual mileage accumulation rates and registration distributions by age

The input data required if MYMRFG = 2, 3, or 4 are placed in the One-time Data section. Section 2.2.3 discusses the input and use of annual mileage accumulation rates and registration distributions.

#### 2.1.7.3 Changes Since MOBILE4.1

There have been no revisions to MYMRFG since the release of MOBILE4.1.

### 2.1.8 NEWFLG

#### 2.1.8.1 Description

This flag provides the option of modifying the basic exhaust emission rates by model year. In MOBILE5, this flag also provides the user with several options for calculating projected (future year) emission factors. Additional information on these new options, which specify how the implementation of a new evaporative emission test procedure for gasoline-fueled vehicles is modeled and whether or not the new exhaust emission standards under the 1990 Clean Air Act Amendments are to be assumed in the modeling, is provided in section 2.2.4.2.

#### 2.1.8.2 Values/Action

This flag can be set to 1, 2, 3, 4, 5, or 6:

<u>Value</u>	<u>Action</u>
1	MOBILE5 basic exhaust emission rates are used
2	User supplies one or more modifications to the MOBILE5 basic exhaust emission rates in the One-time Data section
3	MOBILE5 basic exhaust emission rates are used, and user supplies information about the new evaporative emissions test procedure in the One-time Data section
4	User supplies one or more modifications to the MOBILE5 basic exhaust emission rates, and information about the new evaporative emissions test procedure, in the One-time

- |   |   |
|---|---|
|   | Data section  |
| 5 | MOBILE5 basic exhaust emission rates are used, and all new Clean Air Act requirements are disabled  |
| 6 | User supplies one or more modifications to the MOBILE5 basic exhaust emission rates in the One-time data section, and all new Clean Air Act requirements are disabled |

The user-supplied modifications to the basic emission rates (required if NEWFLG = 2, 4, or 6) are placed in the One-time Data section. Section 2.2.4.1 discusses basic exhaust emission rates and their modification by the user. Additional information on user modification of the details of the new evaporative emission test procedure, and on the disabling of all new Clean Air Act requirements, is provided in section 2.2.4.2.

2.1.8.3 Changes Since MOBILE4.1

Four new possible values (3, 4, 5, 6) of NEWFLG have been added in MOBILE5. In cases where NEWFLG = 1 or 2, this flag is unchanged in meaning or use since release of MOBILE4.1. The new features of specifying aspects of the new evaporative emission test procedure for gasoline-fueled vehicles and disabling all new Clean Air Act requirements are discussed in section 2.2.4.2.

In MOBILE5, for vehicle types LDGV, LDGT1, and LDGT2, the emission rates for LEVs (vehicles meeting the emission standards for the California low emission vehicle program) are calculated based, in part, on the emission rates for calendar year 1999 non-LEV vehicles of the corresponding vehicle type. Therefore, if NEWFLG is set to 2, 4, or 6 and new basic exhaust emission rates are entered for one of these vehicle types for calendar year 1999, users may notice a change in the emission factors reported for that vehicle type for any evaluation year in which vehicles of that type are modeled as LEVs.

2.1.9 IMFLAG

2.1.9.1 Description

This flag allows the option of having MOBILE5 include the emission benefits of operating (or planned) inspection and maintenance (I/M) program(s) on the emission factors.

2.1.9.2 Values/Action

This flag can be set to 1, 2, 3, 4, 5, or 6:

<u>Value</u>	<u>Action</u>
1	No I/M program is assumed to be operating
2	User specifies a single I/M program and MOBILE5 models its impact on emissions
3	User specifies two I/M programs and MOBILE5 models their impact on emissions
4	User specifies a single I/M program (same as IMFLAG = 2), and beginning in 1994, emission credits based on assuming a specific I/M program (as discussed below) for Tier 1 vehicles override the user-specified program for LDGVs and LDGTs
5	User specifies two I/M programs (same as IMFLAG = 3), and beginning in 1994, emission credits based on assuming a specific I/M program (as discussed below) for Tier 1 vehicles override the user-specified programs for LDGVs and LDGTs

- 6 User specifies information governing the I/M program(s) in the "I/M Control Flag Record" in the One-time Data section. See section 2.2.5 and Table 2.2-6.

Values of 4 or 5 are used to control the exhaust emission estimates for Tier 1 vehicles (the effect of setting this flag to 4 or 5 on Tier 1 vehicle emissions is the same, so the choice between 4 and 5 depends on the intended I/M program for older cars). Values of 4 or 5 may be used for IMFLAG if the I/M program applied to Tier 1 vehicles meets the criteria discussed in section 1.3.6 and Appendix 2B for I/M testing of vehicles under the California low emission vehicle (LEV) program.

If values of 4 or 5 are used, this specific I/M program overrides the exhaust portion of any I/M program specified in the One-time Data section for model years that contain Tier 1 LDGVs and LDGTs. However, in order to receive credit for the evaporative emissions benefits of functional pressure and purge tests of the evaporative emission control system, these tests still must be specified in the One-time Data section (see sections 2.1.11 and 2.2.6).

The value 6 is used primarily to include the effects of Technician Training and Certification (TTC) on the I/M program(s). Further information about TTC is available in section 2.2.5.

The data specifying I/M program(s), required if IMFLAG = 2, 3, 4, 5, or 6, are placed in the One-time Data section. Section 2.2.5 and Appendixes 2A and 2B discuss the specification of I/M program parameters and their use in MOBILE5.

#### 2.1.9.3 Changes Since MOBILE4.1

The handling of complex I/M program designs, such as the addition of a transient I/M test (like the IM240), is now performed through the use of additional values for the IMFLAG. In MOBILE4.1, an IM240 transient I/M program was handled by the appending of additional values to the end of the I/M program descriptive record; this feature has been extensively revised, as noted here and in section 2.2.5.

In MOBILE5b, users are able to specify the effectiveness of test-and-repair I/M programs and test-and-repair ATP and functional pressure and purge check programs by setting a flag on the I/M program descriptive record. If this flag is set, a new record, the program effectiveness record, must be included in the One-time Data section. The program effectiveness record and the new flag field in the I/M program descriptive record are described in section 2.2.5.3.

MOBILE5b also supports two new I/M program variables. One of these is a new I/M program type, the Retest Based Hybrid program. The other is a new I/M test procedure, the Acceleration Simulation Mode test (ASM). Input requirements for both these new variables are discussed in section 2.2.5. MOBILE5b is also now capable of modeling the effect of Technician Training and Certification (TTC) on I/M programs. This option is also discussed in section 2.2.5.

### 2.1.10 ALHFLG

#### 2.1.10.1 Description

This flag provides the ability to have MOBILE5 adjust some exhaust emission factors to account for certain conditions: air conditioning (A/C) usage, extra loading, trailer towing, and humidity. These additional corrections apply only to exhaust emission factors (HC, CO, and NOx), and only to the light-duty gasoline-fueled vehicle types (LDGVs, LDGT1s, and LDGT2s), with the exception that the humidity correction affects only NOx emission factors and is also

applied to motorcycle emissions.

2.1.10.2 Values/Action

This flag can be set to 1, 2, or 3:

<u>Value</u>	<u>Action</u>
1	Do not apply these additional correction factors (no additional inputs required)
2	Apply one or more additional correction factors; six (6) additional input values required
3	Apply one or more additional correction factors; ten (10) additional input values required

The additional data required if ALHFLG = 2 or 3 are placed in the Scenario data section. The specific inputs required when ALHFLG = 2 or 3 are discussed in section 2.3.13.

2.1.10.3 Changes Since MOBILE4.1

There have been no revisions to ALHFLG since the release of MOBILE4.1.

**2.1.11 ATPFLG**

2.1.11.1 Description

This flag allows for the benefits of an operating anti-tampering program (ATP) to be included in the emission factor calculations. In MOBILE5, this flag is also used to indicate the use of functional purge and/or pressure tests of the evaporative emission control system as part of a periodic vehicle inspection/maintenance program.

2.1.11.2 Values/Action

This flag can be set to 1, 2, 3, 4, 5, 6, 7, or 8:

<u>Value</u>	<u>Action</u>
1	No ATP is assumed
2	User specifies an ATP, and MOBILE5 accounts for its impact on emissions
3	User specifies functional pressure check of the evaporative emission control system and MOBILE5 accounts for its impact on emissions
4	User specifies functional purge check of the evaporative emission control system and MOBILE5 accounts for its impact on emissions
5	User specifies an ATP, and functional pressure check of the evaporative emission control system; and MOBILE5 accounts for their impact on emissions
6	User specifies an ATP, and functional purge check of the evaporative emission control system; and MOBILE5 accounts for their impact on emissions
7	User specifies functional pressure and purge checks of the evaporative emission control system, and MOBILE5 accounts for their impact on emissions
8	User specifies an ATP, and functional pressure and purge checks of the evaporative emission control system, and MOBILE5 accounts for their impact on emissions

The data specifying the characteristics of the ATP to be modeled (required when ATPFLG = 2, 5, 6, or 8), are placed in the One-time Data section. The data specifying the characteristics of the functional pressure check (required if ATPFLG = 3, 5, 7, or 8), or of the functional purge check (required if ATPFLG = 4, 6, 7, or 8), are also placed in the One-time Data section. Section 2.2.6.3.1 and Appendix 2A discuss user specification of ATPs. Sections 2.2.6.3.2 and 2.2.6.3.3 discuss user specification of functional pressure and purge checks of evaporative emission control systems.

#### 2.1.11.3 Changes Since MOBILE4.1

This flag has been revised since the release of MOBILE4.1 to allow six additional values (3, 4, 5, 6, 7, 8). For ATPFLG = 1 or 2, this flag and the associated data input requirements (ATP descriptive record) are the same as in MOBILE4.1. The six additional possible values of ATPFLG allow for any combination of ATP, functional evaporative emission control system pressure check, and functional evaporative emission control system purge check to be specified. The pressure and/or purge checks were modeled by MOBILE4.1 based on the values of the last two (optional) flags on the I/M program descriptive record; in MOBILE5, these functional evaporative emission control system checks are modeled based on the value of ATPFLG, and additional input information is required in the One-time Data section (section 2.2.6).

Both ATP and functional pressure and purge check programs can be operated as test-only programs which completely separate the inspection and repair of vehicles or as test-and-repair programs which allow inspection stations to perform repairs on the vehicles they test. MOBILE5 discounts the benefits for ATP and functional pressure and purge check programs if they are implemented as test-and-repair programs. However, MOBILE5b allows users to enter effectiveness rates for test-and-repair ATP and pressure and purge check programs. The effectiveness rates are entered on the program effectiveness record, which appears in the One-time Data section if the appropriate flag is set on the I/M program descriptive record. The program effectiveness record and the I/M program descriptive record are described in section 2.2.5.3.

MOBILE5b supports a new program type, the Retest Based Hybrid (RBH) program, for functional pressure and purge tests. The RBH program contains both evaporative and exhaust emission components. If a functional pressure or purge test is modeled and if the RBH program type is selected for those programs, then any I/M program that is modeled must also use the RBH program type. The effectiveness of functional pressure and purge tests under RBH programs is defined by the values in the data file PPEFF.D. This data file must be available to the program when RBH is selected for the functional pressure or purge tests or a program error will result. See section 2.2.6 for more information about functional pressure and purge tests.

### 2.1.12 RLFLAG

#### 2.1.12.1 Description

This flag controls whether and how MOBILE5 models refueling emissions (also referred to as Stage II emissions) from gasoline-fueled vehicles.

#### 2.1.12.2 Values/Action

This flag can be set to 1, 2, 3, 4, or 5:

<u>Value</u>	<u>Action</u>
--------------	---------------

- 1 Use refueling emission rates reflecting the mandatory onboard vapor recovery system (VRS) phase-in for all gasoline-fueled vehicles and all model years
- 2 Model the impact of a Stage II ("at-the-pump") VRS requirement on refueling emissions in addition to the mandatory onboard VRS.
- 3 Originally to model the impact of an onboard VRS requirement on refueling emissions. This option has the same effect in MOBILE5b as RLFLAG=1.
- 4 Originally to model the impact of both onboard VRS and Stage II requirements on refueling emissions. This option has the same effect in MOBILE5b as RLFLAG=2.
- 5 Zero-out refueling emissions completely (in this case, refueling emissions must be accounted for in the stationary source portion of SIP emission inventories)

The data describing the characteristics of Stage II vapor recovery systems (required if RLFLAG = 2 or 4) are placed in the One-time Data section. Since onboard VRS is now a mandatory rule and occurs automatically, the information in the Onboard VRS Input record (required when RLFLAG = 3 or 4) is now ignored when using MOBILE5b. Refueling emissions and their modeling in MOBILE5 are discussed in section 2.2.7.

2.1.12.3 Changes Since MOBILE4.1

There have been no revisions to this flag since the release of MOBILE4.1. However, flag options 3 and 4 are no longer necessary, since onboard VRS is now a mandatory rule and occurs automatically when using MOBILE5b.

**2.1.13 LOCFLG**

2.1.13.1 Description

This flag controls the input by the user of the local area parameter (LAP) record. This record contains seven to ten fields: scenario name, fuel volatility class, minimum and maximum daily temperatures, "period 1" RVP, "period 2" RVP, "period 2" RVP start year, and optional values for OXYFLG, DSFLAG, and RFGFLG. The fuel volatility class, a version of which was a required part of the LAP record for MOBILE4 but not required in MOBILE4.1, is again a mandatory input for MOBILE5. It is required only for modeling of the effects of reformulated gasoline (RFG) on emissions. RFGFLG is a new flag in MOBILE5, indicating whether or not the use of reformulated gasoline is to be assumed in the modeling.

However, the format of the remainder of the LAP record is unchanged, so that a MOBILE4 or MOBILE4.1 LAP record will function as MOBILE5 input. The three optional "flag" values (OXYFLG, DSFLAG, and RFGFLG) are used to indicate whether the user is inputting data on an oxygenated fuels program, alternate diesel sales fractions by model year, and specifying the use of reformulated gasoline, respectively. These flags follow the "period 2" RVP start year, and in each case if missing are interpreted by MOBILE5 as indicating that none of these three types of data are included. Thus, a LAP record from a MOBILE4 or MOBILE4.1 input file will work in MOBILE5, although MOBILE5 has options that cannot be accessed by an unchanged MOBILE4/4.1 LAP record.

2.1.13.2 Values/Action

This flag can be set to 1 or 2:

<u>Value</u>	<u>Action</u>
--------------	---------------

- 1 User enters a different LAP record for each scenario of the MOBILE5 run
- 2 User enters one LAP record to apply to all scenarios of the MOBILE5 run

If LOCFLG = 1, the LAP records are placed in the Scenario data section, with one LAP record required for each scenario being evaluated. If LOCFLG = 2, the single LAP record to be applied to all scenarios being evaluated is placed in the One-time Data section. The content of the LAP record is discussed in section 2.2.8, and the individual variables comprising the LAP record are discussed in sections 2.2.9 through 2.2.16. Table 2.2-12 provides a summary of and specifications for the LAP record in the MOBILE5 input stream.

2.1.13.3 Changes Since MOBILE4.1

There have been no revisions to LOCFLG since the release of MOBILE4.1. Revisions to the content of the LAP record are discussed in sections 2.2.8 through 2.2.16.

**2.1.14 TEMFLG**

2.1.14.1 Description

This flag controls the determination of temperatures to be used in the correction of the exhaust emission factors (HC, CO, and NOx), the hot soak and diurnal components of the evaporative HC emission factors, and the running loss and resting loss HC emission factors. All of these emissions are dependent on temperature.

2.1.14.2 Values/Action

This flag can be set to 1 or 2:

<u>Value</u>	<u>Action</u>
1	MOBILE5 will determine the temperatures to be used in correcting emission factors on the basis of the input values of minimum and maximum daily temperature. The input value of ambient temperature will <u>not</u> be used in calculating temperature corrections to emissions if TEMFLG = 1; it will be overridden by specific values calculated individually for exhaust HC, CO, and NOx, hot soak evaporative HC, running loss HC, and resting loss HC.
2	The input value of ambient temperature will be used in calculating the temperature corrections to all exhaust emissions, hot soak evaporative emissions, and running and resting loss emissions. The input values of minimum and maximum daily temperature will still be used to calculate diurnal evaporative emissions.

If TEMFLG = 1, the temperatures used to correct exhaust, hot soak evaporative, and running loss and resting loss emissions are determined in a way that accounts for both the variation in emission levels with daily variation in temperature, and the distribution of travel (vehicle miles traveled (VMT)) over the course of a day. Thus the use of TEMFLG = 1 is generally recommended for daily emission inventory preparation and SIP-related modeling by the States.

For those areas modeling emission factors on an hourly basis, whether required for input to other air quality models (such as Urban Airshed) or for some other purpose, the use of TEMFLG = 2 will be more appropriate. When

TEMFLG = 2, the input value of ambient temperature should be selected to represent conditions in the short time period (e.g., one hour) being modeled. This temperature will then be used to correct exhaust, hot soak evaporative, and running loss and resting loss emission factors. The input minimum and maximum temperatures are used only to calculate diurnal evaporative emissions when TEMFLG = 2.

The input of minimum/maximum temperatures is discussed in section 2.2.11. The input of ambient temperature is discussed in section 2.3.4. Additional guidance on the determination of appropriate values for use as temperature input to MOBILE5 when the model is being used for SIP-related emission inventory development and attainment planning is provided in "Procedures for Emission Inventory Preparation, Volume IV: Mobile Sources," EPA-450/4-81-026d (revised), July 1992.

#### 2.1.14.3 Changes Since MOBILE4.1

There have been no revisions to TEMFLG since the release of MOBILE4.1.

Table 2.1-1 summarizes the flags controlling the input requirements and execution of MOBILE5.

### 2.1.15 OUTFMT

#### 2.1.15.1 Description

This flag controls the format structure of the formatted output report. Different formats are appropriate depending on the intended use of the MOBILE5 output.

#### 2.1.15.2 Values/Action

This flag can be set to 1, 2, 3, 4, 5, or 6:

<u>Value</u>	<u>Action</u>
1	222-column numerical format
2	140-column numerical format
3	112-column descriptive format
4	80-column descriptive format
5	By-Model Year output (table of emission factors for vehicles of each model year provided, along with standard 112-column descriptive format)
6	"Spreadsheet" output format

The numerical formats (OUTFMT = 1 or 2) are generally used when the MOBILE5 output file is to be used as input for another program (e.g., air quality simulations). The descriptive formats (OUTFMT = 3 or 4) contain all of the same information, with more complete labels and headings for ease of visual inspection. The by model year output option (OUTFMT = 5) starts with the 112-column descriptive output report produced when OUTFMT = 3, then provides additional tables containing emission factors by individual model year. If the by model year option is selected, the user must supply an additional line of input specifying exactly what information is to be included in the output. This additional record, called the by model year inclusion vector, is discussed in section 2.2.18. The spreadsheet format (OUTFMT = 6) is new in MOBILE5, and provides the user with output in a form that facilitates transfer of the emission



factors to a spreadsheet program [e.g., Excel, Lotus 1-2-3 (version 3.0 or higher)] for further manipulation. The output is written in a comma-separated variable (CSV) format, with text indicated by quotation marks. Illustrative examples of output formats 4 and 5 are shown in Chapter 5 (MOBILE5 Examples). Examples of output formats 1, 2, and 3 are included on the MOBILE5 diskette (see section 5.1, "MOBILE5 Examples Index"). All possible output formats are described in Chapter 3.

If the by model year option is selected, additional input must be provided in the form of one additional record in the One-Time Data section. This additional record tells MOBILE5 which vehicle types the by-model year output is desired for, and is described in section 2.2.18 and Table 2.2-13.

#### 2.1.15.3 Changes Since MOBILE4.1

The first five options for output format are exactly as they were in MOBILE4.1. The last option (OUTFMT = 6) provides the user the ability to obtain the formatted emission factors report in the form of a "spreadsheet." This option is intended to facilitate transfer of the output into a spreadsheet program for additional manipulation, and is described in section 3.3.1.

### 2.1.16 **PRTFLG**

#### 2.1.16.1 Description

This flag determines which pollutants will have emission factor calculations performed, and thus will be included in the program output. This feature enables the user to avoid the time and expense of calculating all emission factors when the results for only one of the pollutants are all that is necessary for some applications.

#### 2.1.16.2 Values/Action

This flag can be set to 1, 2, 3, or 4:

<u>Value</u>	<u>Action</u>
1	Calculate and print HC (hydrocarbon) emission factors only
2	Calculate and print CO (carbon monoxide) emission factors only
3	Calculate and print NOx (oxides of nitrogen) emission factors only
4	Calculate and output emission factors for all three pollutants

#### 2.1.16.3 Changes Since MOBILE4.1

There have been no revisions to this flag since the release of MOBILE4.1. However, the program code has been modified so that if only CO (PRTFLG = 2) or only NOx (PRTFLG = 3) emission factors are requested, the subroutines that deal only with HC emissions (such as the calculation of evaporative, running loss, resting loss, and refueling emissions) will be bypassed in execution. This should result in shorter execution times for CO-only and NOx-only emission factor runs, relative to MOBILE4.1.

### 2.1.17 **IDLFLG**

2.1.17.1 Description

This flag controls the calculation and output of idle emission factors (emissions at idle in terms of mass pollutant per unit time (g/hr) for each pollutant).

2.1.17.2 Values/Action

This flag can be set to 1 or 2:

<u>Value</u>	<u>Action</u>
1	No idle emission factors calculated or printed (exhaust and evaporative emission factors only)
2	Idle emission factors calculated and printed (in addition to exhaust and evaporative emission factors)

2.1.17.3 Changes Since MOBILE4.1

Due to the complexity of modeling idle emissions, particularly with respect to the interactions with many of the new features of MOBILE5 (e.g., Tier 1 vehicles, LEV program, reformulated gasoline), this feature was disabled in MOBILE5 (and MOBILE5a). This flag should be set to "1" when running MOBILE5/5a. Modelers using MOBILE5/5a and requiring idle emission factors specifically should consult "MOBILE5 Information Sheet #2" (July 30, 1993), which is available through EPA's Technology Transfer Network (TTN) computer bulletin board system (see sections 4.2 and 6.0).

MOBILE5b will now calculate idle emission factors when IDLFLG is set to "2." MOBILE5b uses the same methodology described in the MOBILE5 User Information Sheet #2 to estimate the idle emission factors.

**2.1.18 NMHFLG**

2.1.18.1 Description

This flag determines which of five possible options for the hydrocarbon emissions factors will be used in the calculations: total hydrocarbons, including methane (THC); non-methane hydrocarbons, defined as THC minus methane (NMHC); volatile organic compounds, defined as NMHC minus ethane corrected for aldehydes (VOC); total organic gases, defined as THC corrected for aldehydes (TOG); or non-methane organic gases, defined as NMHC corrected for non-hydrocarbon reactive compounds, i.e., formaldehyde and acetaldehyde (NMOG). These are summarized below:

<u>Option</u>	<u>Compounds included in the emission factors</u>			
	<u>FID HC</u>	<u>Methane</u>	<u>Ethane</u>	<u>Aldehydes</u>
THC	Yes	Yes	Yes	No
NMHC	Yes	No	Yes	No
VOC	Yes	No	No	Yes
TOG	Yes	Yes	Yes	Yes
NMOG	Yes	No	Yes	Yes

In the table above, "FID HC" refers to the hydrocarbon emissions as measured by the flame ionization detector (FID) used in testing. The FID detects a portion (but not all) of the aldehydes emitted by the vehicle. Thus the first two options above (THC and NMHC) actually account for a portion of aldehyde emissions; the other options include a correction for that portion of aldehyde emissions not registered by the FID. This is not a change or revision to the model; total HC and NMHC emission factors produced by all previous versions of the MOBILE model included the portion of aldehyde emissions measured by the FID.

#### 2.1.18.2 Values/Action

This flag can be set to 1, 2, 3, 4, or 5:

<u>Value</u>	<u>Action</u>
1	Total hydrocarbon (THC) emission factors
2	Non-methane hydrocarbon (NMHC) emission factors
3	Volatile organic compound (VOC) emission factors
4	Total organic gases (TOG) emission factors
5	Non-methane organic gasses (NMOG) emission factors

For guidance on the most appropriate choice for the preparation of base year emission inventories, see "Procedures for Emission Inventory Preparation, Volume IV: Mobile Sources," EPA-450/4-81-026d (revised), July 1992. The use of the VOC option for hydrocarbon emission factors is normally used by air quality modelers and in SIP-related applications of MOBILE5.

#### 2.1.18.3 Changes Since MOBILE4.1

There have been no revisions to this flag since the release of MOBILE4.1.

### 2.1.19 **HCFLAG**

#### 2.1.19.1 Description

This flag determines whether the HC emission factors displayed in the output will include only the sum of all components of HC emissions (whichever composition option for these emissions is selected using NMHFLG) or will also include the various component emission factors (exhaust, evaporative, refueling, running loss, resting loss, and total HC emissions). This flag also allows the user to select an expanded printout of the various components of "evaporative" (non-tailpipe) HC emissions.

#### 2.1.19.2 Values/Action

This flag can be set to 1, 2, or 3:

<u>Value</u>	<u>Action</u>
1	No component emission factor output (print only the emission factor for the sum of all HC components in grams per mile)

- 2 Print sum and component (exhaust, evaporative, refueling, running loss, and resting loss HC) emission factors in grams per mile
- 3 Print sum and component (exhaust, evaporative, refueling, running loss, and resting loss HC) emission factors in grams per mile, and a detailed evaporative emission factor breakdown in grams. The emission factor for the sum of all HC components will not include refueling emissions (it will be the sum of exhaust, evaporative, running loss, and resting loss emissions)

When the detailed evaporative emission breakdown is requested (HCFLAG = 3), the units of the component emission factors are: grams per vehicle per event (trip end) for hot soak evaporative emissions, grams per vehicle per day (period of rising ambient temperature without trips) for diurnal evaporative emissions, grams per gallon of fuel dispensed for refueling emissions, and grams per vehicle per hour for resting losses. Running loss emission factors, which are only expressed in grams per mile, are not repeated in the expanded evaporative emission portion of the output.

#### 2.1.19.3 Changes Since MOBILE4.1

There have been no revisions to this flag since the release of MOBILE4.1.

Table 2.1-2 summarizes the flags controlling the output of MOBILE5.

### 2.1.20 Inter-Flag Dependencies

#### 2.1.20.1 Description

There are cases where the value assigned to one flag in the Control section either determines the value that must be assigned to another flag, or precludes the use of one or more possible values for another flag. Certain combinations of flag settings also impose requirements on other inputs in either the One-time Data or Scenario sections. While careful consideration of the input file prepared for a MOBILE5 run makes such situations clear, a short listing is provided here for the convenience of the user.

#### 2.1.20.2 List of Inter-Flag Dependencies

- 2.1.20.2.1 If TAMFLG = 2 (user-supplied tampering rates) and IMFLAG = 1 (no I/M program assumed), supply only one set of alternate tampering rates (non-I/M rates).
- 2.1.20.2.2 If TAMFLG = 2 and IMFLAG = 2, 3, 4, 5, or 6 (specify and model I/M program(s)), two sets of alternate tampering rates must be supplied (non-I/M and I/M rates).
- 2.1.20.2.3 If the user has set PRTFLG = 2 or 3 (CO emission factors only or NOx emission factors only), then the values assigned to NMHFLG and HCFLAG will have no effect.
- 2.1.20.2.4 In MOBILE5b, if the user has set IDLFLG = 2 and NEWFLG = 2, 4, or 6 (user supplies alternate basic emission rate equations), then idle emissions will be calculated using the same methodology as MOBILE5 User Information Sheet #2. The idle emission factors are calculated based on the basic

emission factors and will reflect any changes the user makes to them.

- 2.1.20.2.5 If the user has set HCFLAG = 3 (include expanded evaporative emission factor output table), then the output formats 3 or 5 must also be selected. If HCFLAG = 3 and OUTFMT = 1, 2, 4, or 6, a warning message will be issued and the expanded evaporative emission factor table will not be included in the output.
- 2.1.20.2.6 If the user has set DSFLAG = 2 (user supplies alternate diesel sales fractions for light-duty vehicles and light-duty trucks by model year), then LOCFLG = 1 (separate local area parameter record for each scenario) is mandatory. See section 2.2.10.
- 2.1.20.2.7 If the user has selected OUTFMT = 5 (requesting by model year output), then the month of evaluation must be January (month = 1 on required scenario record, section 2.3.6). By model year output is not available for July 1 evaluation dates.
- 2.1.20.2.8 If the user has chosen REGION = 3 or 4 (requesting that a California LEV program is to be included in the modeling; see section 2.3.1), and NEWFLG is set to 2, 4, or 6, the following is possible. There may be a change in the emission factors reported for one or more of LDGV, LDGT1, or LDGT2 for any evaluation year in which the first two or all of those vehicle types are modeled as LEVs, when new basic exhaust emission rates are entered for one or more of those types for calendar year 1999. This is because in MOBILE5, for these vehicle types, the emission rates for LEVs are calculated based in part on the emission rates for calendar year 1999 corresponding non-LEV vehicles.
- 2.1.20.2.9 If the user specifies a January evaluation using the Month flag set to 1 on the scenario record, and chooses Reformulated Gasoline (RFG) by setting the RFG flag in the Local Parameter record, MOBILE5 assumes wintertime RFG rules in determination of RFG emission effects, regardless of the user supplied temperatures. See Section 2.2.16.1.

This concludes the Control data section.

## **2.2 ONE-TIME DATA SECTION**

As suggested by its name, the One-Time Data section contains information which is input only once in a given MOBILE5 input file. This input information is used to alter MOBILE5 internal data to reflect alternate (i.e., locality-specific) data when such information is available for use. For example, a user can incorporate annual mileage accumulation rates and/or registration distributions by age that are specific to the area of concern. These records are all optional, their use being dictated by the values of some of the flags in the Control section. Thus, it is possible to run MOBILE5 without any "one-time data" being included in the input. If any of these records are included in the input, they follow immediately after the Control section and appear in the order in which they are listed below.

It is possible for the user to include comments or other descriptive information outside of the required MOBILE5 input parameters, in order to aid in documenting and interpreting MOBILE5 input files. This is illustrated in the example input files included in Chapter 5 and on the program diskette. Such comments on the Local Area Parameter input record must not begin before (to the left of) column 53. Comments on scenario section input records must not begin until at least 15 columns after (to the right of) the last input variable. These restrictions are necessary to avoid generating error messages that will occur as a result of internal diagnostic checks that use these spaces.

One-time Data must be included in the input whenever one or more of the following MOBILE5 options are selected:

1. The user supplies alternate tampering rates (TAMFLG = 2).
2. The user supplies one alternate VMT mix to be applied to all emission factor calculations (VMFLAG = 3).
3. The user supplies alternate annual mileage accumulation rates and/or registration distributions by age (MYMRFG = 2, 3, or 4).
4. The user modifies the basic exhaust emission rates used in the emission factor calculations (NEWFLG = 2, 4, or 6).
5. The user modifies the start year and/or the phase-in period for the new evaporative emission test procedure (NEWFLG = 3 or 4).
6. The user includes the effects of Technician Training and Certification or Remote Sensing Devices on an I/M program (IMFLAG=6).
7. The user includes the effects of one (or two) inspection/maintenance program(s) in the emission factor calculations (IMFLAG = 2, 3, 4, 5, or 6).
8. The user chooses to enter alternate effectiveness rates for test-and-repair I/M, ATP, or functional pressure and purge check programs by setting the alternate effectiveness rate flag on the I/M program descriptive record.
9. The user provides alternate I/M credit file names by setting the alternate I/M credit file flag(s) on the I/M program descriptive record.
10. The user includes the effects of an anti-tampering program in the emission factor calculations (ATPFLG = 2, 5, 6, or 8).

11. The user includes the effects of functional pressure and/or purge checks of the evaporative emission control system in the emission factor calculations (ATPFLG = 3, 4, 5, 6, 7, or 8).
12. The user includes the effects of Stage II and/or onboard vapor recovery systems on refueling emissions in the emission factor calculations (RLFLAG = 2, 3, or 4). (Note: If the user chooses RLFLAG = 3 or 4, even though onboard VRS is now automatic, for consistency with MOBILE5a, the Onboard VRS Input record is still required. See section 2.2.7.)
13. The user applies the same local area parameter (LAP) record input values to all scenarios in the MOBILE5 run (LOCFLG=2).
14. The user includes the effects of oxygenated fuel (OXYFLG=2 on the Local Area Parameter record).
15. The user overrides the default effects of gasoline detergent additives (DTGFLG=2 on the Local Area Parameter record).
16. The user supplies one alternate set of trip length distributions to be used in the calculation of running loss emissions for all scenarios (SPDFLG = 4).
17. The user supplies the by model year inclusion vector record (OUTFMT = 5).

Data in the One-time Data section are listed in the same order as the associated flags in the Control data section. The ordering of data in the One-time Data section is summarized in Table 2.4-1 at the end of this chapter.

## **2.2.1 TAMPERING RATES**

### **2.2.1.1 Description**

MOBILE5 calculates tampering rates as a piecewise linear function of accumulated mileage for each gasoline-fueled vehicle type (LDGV, LDGT1, LDGT2, and HDGV) and for eight types of tampering [air pump disablement, catalyst removal, overall misfueling, fuel inlet restrictor disablement, exhaust gas recirculation (EGR) system disablement, evaporative control system disablement, positive crankcase ventilation (PCV) system disablement, and missing gas caps]. These rates are combined with the corresponding fractions of vehicles equipped with the given control technology and the emissions impact rates to obtain the tampering offsets (the increase in emissions that results from the given type of tampering at the given rate). These offsets are later added to the non-tampered emission factors.

### **2.2.1.2 Options**

MOBILE5 uses tampering rates based on OMS analysis of multi-city tampering survey results, if no alternate (e.g., locality-specific) rates are supplied as input (TAMFLG = 1). The use of the rates included in MOBILE5 is recommended for most situations.

MOBILE5 provides the user the option of specifying alternate tampering rates as part of the program input (by setting TAMFLG = 2). EPA has determined through its tampering surveys that tampering rates are lower in areas with operating inspection and maintenance (I/M) programs than in areas without such programs. Thus, if TAMFLG = 2 and IMFLAG = 1, the user must supply one set of alternate tampering rates (representing the rates for an area where no I/M program is in effect). If TAMFLG = 2 and IMFLAG = 2, 3, 4, 5, or 6, the user must supply two sets of alternate

tampering rates (representing both the non-I/M and I/M cases). The non-I/M rates are used to account for tampering that occurs before the I/M program is in operation.

Before approving the use of alternate tampering rates in the development of base-year highway vehicle emission factors and mobile source emission inventories for State Implementation Plans (SIPs), EPA must review and approve of the tampering survey(s) on which such rates are based.

2.2.1.3 MOBILE5 Tampering Rates

MOBILE5 uses three or six rate equations for each type of tampering stored within the model, for each of the vehicle types subject to tampering (one each for pre-1981 model year vehicles, for 1981-83 model year vehicles, and for 1984 and later model year vehicles; for either the non-I/M case only, or for both the non-I/M and I/M cases). These rate equations are based on OMS analysis of national tampering survey data.

2.2.1.4 Required Information

The following information is required for input of alternate tampering rates: For each combination of vehicle model year group (pre-1981, 1981-83, 1984 and later model year), tampering type, and non-I/M or I/M case, the user must supply a zero-mile level (ZML) and deterioration rate (DR; the rate of increase in the tampering rate per 10,000 miles accumulated mileage). This deterioration rate defines the increase in tampering over the first 50,000 accumulated miles. MOBILE5 adjusts these deterioration rates internally to account for the rate of increase in tampering at mileages greater than 50,000 mi. All tampering rates are assumed to stop increasing after 130,000 accumulated miles. All input values must be in fractional units.

The order of the tampering types within each record is:

- 1) air pump disablement
- 2) catalyst removal
- 3) fuel inlet restrictor disablement
- 4) overall misfueling
- 5) EGR system disablement
- 6) evaporative control system disablement
- 7) PCV system disablement
- 8) missing gas caps.

A complete set of alternate tampering rate input data for the non-I/M case consists of a total of 24 records, and a complete set of inputs for both the non-I/M and I/M cases consists of 48 records. There are six records for each of the four gasoline-fueled vehicle types for each case (non-I/M, I/M). The six records required for each vehicle type are listed below. Each record listed occurs four times (once each for LDGVs, LDGT1s, LDGT2s, and HDGVs, in that order). Table 2.2-1 summarizes the complete alternate tampering rate input for both cases.

<u>Non-I/M Case Records</u>	<u>Non-I/M and I/M Records</u>	<u>Description</u>		<u>Format</u>
(1-4)	(1-4)	ZML for pre-1981 MY vehicles	(non-I/M)	8F8.4
(5-8)	(5-8)	ZML for 1981-83 MY vehicles	(non-I/M)	8F8.4
(9-12)	(9-12)	ZML for 1984+ MY vehicles	(non-I/M)	8F8.4



	(13-16)	ZML for pre-1981 MY vehicles	(I/M)	8F8.4
	(17-20)	ZML for 1981-83 MY vehicles	(I/M)	8F8.4
	(21-24)	ZML for 1984+ MY vehicles	(I/M)	8F8.4
(13-16)	(25-28)	DR for pre-1981 MY vehicles	(non-I/M)	8F8.4
(17-20)	(29-32)	DR for 1981-83 MY vehicles	(non-I/M)	8F8.4
(21-24)	(33-36)	DR for 1984+ MY vehicles	(non-I/M)	8F8.4
	(37-40)	DR for pre-1981 MY vehicles	(I/M)	8F8.4
	(41-44)	DR for 1981-83 MY vehicles	(I/M)	8F8.4
	(45-48)	DR for 1984+ MY vehicles	(I/M)	8F8.4

#### 2.2.1.5 Changes Since MOBILE4.1

The input of alternate tampering rates has not been revised since the release of MOBILE4.1.

#### 2.2.1.6 Guidance

The tampering rates built into MOBILE5 are the rates that should be used in all Clean Air Act (CAA) mandated development of mobile source emission inventories, including the base and projection year inventories required to be submitted as part of SIPs. Use of any other tampering rates in such work must be based on actual surveys of in-use tampering, and the surveys must be approved in advance by EPA. For guidance regarding EPA approval of local tampering surveys, contact the Office of Mobile Sources' Field Operations and Support Division (202/233-9000). For guidance on analysis of the data collected in a local tampering survey, contact OMS' Assessment and Modeling Division (313/668-4325).

### 2.2.2 **VEHICLE MILES TRAVELED MIX by vehicle type**

#### 2.2.2.1 Description

The vehicle miles traveled (VMT) mix specifies the fraction of total highway VMT that is accumulated by each of the eight vehicle types. The VMT mix is used in MOBILE5 only to calculate the composite (all vehicle, or fleetwide) emission factor for a given scenario on the basis of the eight vehicle class-specific emission factors.

#### 2.2.2.2 Options

The user can choose between the use of the MOBILE5 national VMT mix (VMFLAG = 1), the input of one alternate VMT mix (in One-time Data) for use in all scenarios of a given MOBILE5 run (VMFLAG = 3), or the input of a different alternate VMT mix (in Scenario data) for each scenario (VMFLAG = 2).

For SIP highway vehicle emission inventory development, EPA generally expects States to develop and use their own specific estimates of VMT by vehicle type. In such cases, VMT fractions based on those estimates of VMT by vehicle type should be calculated and used here as input. A VMT mix used as input should reflect the year for which emission factors are being calculated.

#### 2.2.2.3 MOBILE5 VMT Mix

MOBILE5 calculates a typical urban area VMT mix based on national data characterizing registration

distributions and annual mileage accumulation rates by age for each vehicle type, diesel sales fractions by model year (for LDVs and LDTs only), total HDDV registrations and annual mileage accumulations by weight class, the fraction of travel by each vehicle type that is typical of urban areas, and total vehicle counts (fleet size) by vehicle type. Considering the dependence of the calculated VMT mix on the annual mileage accumulation rates and registration distributions by age, the use of the MOBILE5 VMT mix is generally recommended in cases where the focus is on direct comparison of national or area-wide emission factors under different assumptions.

As noted above, for SIP highway vehicle emission inventory development, EPA expects that States will generally develop and apply their own estimates of VMT by vehicle type for specific highway facility types, sub-zones, times of day, and so on. The use of an alternate VMT mix can result in minor inconsistencies; for example, assumptions that are used in the emission factor calculations concerning the gas/diesel LDV sales fractions are not altered through the use of different VMT fractions for LDGVs and LDDVs. In part for this reason, MOBILE5 has the added capability for the user to also supply an alternate set of gas/diesel LDV and LDT sales fractions by model year, as discussed in section 2.3.10.

However, such inconsistencies will not significantly affect emission inventory construction unless the inventory is based only on the fleetwide composite emission factor and total mobile source VMT. Inventory construction based on vehicle-type-specific emission factors and VMT estimates, as EPA expects of States for SIP-related inventory development, will not use the composite fleetwide emission factor.

#### 2.2.2.4 Required Information

Each VMT mix supplied as input must consist of a set of eight fractional values, representing the fraction of total highway VMT accumulated by each of the eight vehicle types. All values must be between zero and one ( $0.0 \leq \text{VMT fraction for any vehicle type} \leq 1.0$ ), and the eight values must sum to 1.0 (MOBILE5 produces an error message and does not execute the run if these constraints are not met).

The format of the VMT mix record(s) is **8F4.3**. The values correspond to the eight vehicle types in this order: LDGV, LDGT1, LDGT2, HDGV, LDDV, LDDT, HDDV, and MC. An example of a VMT mix record specifying that 65% of all VMT is accumulated by LDGVs and that each of the other seven vehicle types accounts for 5% of all VMT is shown below. Note that this format does not include leading zeroes or blanks between the individual values.

.650.050.050.050.050.050.050.050

#### 2.2.2.5 Changes Since MOBILE4.1

There have been no revisions to how an alternate VMT mix is supplied to the program as input data since the release of MOBILE4.1.

#### 2.2.2.6 Guidance

States are generally required to develop estimates of VMT by vehicle type for use in construction of highway vehicle emission inventories for CAA-mandated and SIP-related purposes. Given such estimates of VMT by vehicle type, and thus of total highway VMT, it is straightforward to calculate a VMT mix and that mix should be used as input in MOBILE5 runs. Techniques for calculating estimated VMT by vehicle type (and thus, total VMT and the VMT mix fractions) from available data sources are described in Chapter 6 of the report "Techniques for Estimating MOBILE2 Variables."

### **2.2.3. ANNUAL MILEAGE ACCUMULATION RATES and/or REGISTRATION DISTRIBUTIONS by vehicle type and age**

#### 2.2.3.1 Description

MOBILE5's emission factor calculations rely in part on travel fractions for vehicles of each given age and type, which in turn are based on estimates of the average annual mileage accumulation by age (first year to 25th-and-greater years of operation) for each of the eight vehicle types, and the registration distribution by age (age 0-1 to age 24-25+) for each vehicle type, except motorcycles, for which annual mileage accumulation rates and registration distributions are only provided for the first to 12th-and-later years of operation (ages 0-1 to 11-12+).

#### 2.2.3.2 Options

MOBILE5 uses national average annual mileage accumulation rates and registration distributions by age, and has provisions allowing the input of alternate data for either or both of these. The use of the annual mileage accumulation rates by age included in MOBILE5 is strongly recommended. Users may develop registration distributions by age on the basis of locality-specific data, and States are strongly encouraged to do so in developing highway vehicle emission inventories for SIP purposes.

#### 2.2.3.3 MOBILE5 Mileage Accumulation Rates and Registration Distributions

If the user does not provide alternate mileage accumulation rates and/or registration distributions by age, MOBILE5 uses national average values.

This information is used for all calendar years evaluated. The annual mileage accumulation rates are based on analyses of information developed over a long period of time, and the registration distributions are based on analysis of calendar year 1990 registration data. Due to the importance of this information in characterizing the in-use fleet, the need to avoid basing such information on data collected over a short period of time (thereby increasing the risk of reflecting atypical or cyclical use or sale patterns), and the inherent difficulty of developing accurate locality-specific data describing annual mileage accumulation rates by age, the use of the MOBILE5 annual mileage accumulation rates by age is recommended. The use of locality-specific data to derive registration distributions by age is more appropriate for some applications, particularly those cases where such data reflect significant differences from the national average.

If local annual mileage accumulation rates or registration distributions are used, they normally should not change across calendar years. In particular, EPA will not accept modeling for SIPs that includes assumptions that the vehicle fleet will be newer (have a lower average age) in the future than is reflected in the registration distributions used for the base year emission factors and inventory development. Modeling that assumes no further aging of the fleet from the current characterization will be accepted by EPA for SIP purposes.

#### 2.2.3.4 Required Information

These records are required if MYMRFG is set to 2, 3, or 4 (section 2.1.7).

To use locality-specific annual mileage accumulation rates by age, a total of 200 input values are required: the estimated annual mileage accumulated by vehicles of each of the eight types for each of 25 ages (except 12 ages for motorcycles; use ".00000" as the annual mileage accumulation rate for motorcycles of ages 13 through 25). These values are input as miles divided by 100,000 (e.g., 12,637 miles is input as 0.12637).

To use locality-specific registration distributions by age, again a total of 200 input values are required. For each vehicle type, a set of 25 values (except 12 values for motorcycles; use ".000" as the registration distribution fraction for motorcycles of ages 13 through 25) are required to represent the fraction of all vehicles of the given type that are of a given age. These registration distributions should be based on July 1 of the year being modeled; MOBILE5 will use these distributions directly if July 1 emission factors are requested, or will convert them to January 1 distributions if January 1 emission factors are requested. (The choice of January 1 or July 1 emission factors is new in MOBILE5, and is discussed in section 2.3.6).

The sum of the registration distribution values for a given vehicle type must equal 1.0; if they do not, MOBILE5 normalizes the input values so that the sum for each vehicle type is equal to 1.0, and a warning message is issued for each occurrence. Any individual value in the registration distribution must be between zero and one. The same registration distribution by age must be entered for LDGVs and LDDVs, and for LDGT1s and LDDTs. MOBILE5 uses an internal function to separate these pairs of vehicle types into distinct gas and diesel distributions, based on diesel sales fractions by model year. The registration distributions entered for LDGVs and LDDVs, and for LDGT1s and LDDTs, should therefore be a combined gasoline and diesel distribution. (For information on user input of alternate diesel sales fractions by model year, see section 2.3.12.) If this constraint is not met, one or more error messages will be issued and the MOBILE5 run will not be executed.

In addition, in the case where the user supplies both annual mileage accumulation rates by age and registration distributions by age, the two sets of values must not contain internal inconsistencies. In other words, the annual mileage accumulation rate corresponding to any vehicle type/age combination accounting for a non-zero fraction of registrations must be positive (i.e., if vehicles of a certain type and age exist in the fleet, then they must accumulate some mileage), and the registration fraction corresponding to any vehicle type/age combination that has a non-zero mileage accumulation rate must be positive (i.e., if vehicles of a certain type and age are assumed to accumulate some mileage, then such vehicles must exist in the fleet). If these constraints are not met, MOBILE5 will generate one or more error messages and the run will not be executed.

The annual mileage accumulation rates are entered as 24 records, in sets of three records per vehicle type. The format of these records is (10F7.5/, 10F7.5/, 5F7.5/), repeated eight times. Registration distributions by age are also entered as 24 records, in sets of three records per vehicle type, format (10F5.3/, 10F5.3/, 5F5.3/). If both annual mileage accumulation rates and registration distributions are being supplied, the annual mileage accumulation rates precede the registration distributions [24 records, format (10F7.5/, 10F7.5/, 5F7.5/) repeated eight times, followed by 24 records, format (10F5.3/, 10F5.3/, 5F5.3/) repeated eight times].

In both cases, the 24 records represent three records per vehicle type for each of eight vehicle types in this order: LDGV, LDGT1, LDGT2, HDGV, LDDV, LDDT, HDDV, and MC. Each of the three records per vehicle type contains the annual mileage accumulation rate by age, or the registration distribution by age, as follows:

First record -	age 1, age 2, age 3, . . . , age 10
Second record -	age 11, age 12, age 13, . . . , age 20
Third record -	age 21, age 22, age 23, age 24, age 25.

Table 2.2-2 summarizes the input of alternate annual mileage accumulation rates, and Table 2.2-3 summarizes the input of alternate registration distributions by age. An example of one set of annual mileage accumulation rates and one set of registration distributions, in this case displaying the values that are contained in the MOBILE5 code for light-duty gas vehicles, is shown below. Note that the format of this input allows either a leading zero or a separating blank between entries, but not both. The example shown uses separating blanks between entries, including a blank space before the first entry on each line.

.13118 .12408 .11737 .11103 .10503 .09935 .09398 .08889 .08409 .07954  
 .07524 .07117 .06733 .06369 .06024 .05698 .05390 .05099 .04823 .04562  
 .04316 .04082 .03862 .03653 .03455

<annual mileage accumulation rates for the other seven vehicle types  
 must also be provided, following the LDGV annual mileage accumulation  
 rates and preceding the registration distributions by age>

.049 .079 .083 .082 .084 .081 .077 .056 .050 .051  
 .050 .054 .047 .037 .024 .019 .014 .015 .011 .008  
 .006 .005 .004 .003 .010

<registration distributions by age for the other seven vehicle types  
 must also be provided, following the LDGV distributions>

In the example above, LDGVs of age 1 constitute 4.9% of all LDGVs and average 13,118 miles annually, LDGVs of age 2 constitute 7.9% of the fleet and average 12,408 miles annually, and so on, with LDGVs of ages 25+ constituting 1.0% of the fleet and averaging 3455 miles annually.

#### 2.2.3.5 Changes Since MOBILE4.1

The input of alternate annual mileage accumulation rates and registration distributions by age has not been revised since the release of MOBILE4.1.

#### 2.2.3.6 Guidance

For most users in most applications, the use of the default annual mileage accumulation rates by age included in MOBILE5 is recommended. Most local sources of mileage accumulation rate by age data are subject to sampling bias or data entry errors, and the use of such data should be approached with caution. In the development of highway vehicle emission inventories for SIPs, States should obtain prior approval of alternate mileage accumulation rates and their derivation from the appropriate EPA Regional Office before using such rates in their modeling.

The use of locality-specific data to derive registration distributions by age is more appropriate for many applications, particularly those cases where such data reflect significant differences from the national average. In many situations, registration distributions by age may be developed from data available through State motor vehicle registration records. EPA encourages and recommends the use of actual locality-specific calendar year 1990 registration distributions by age in the development of SIP emission inventories. One exception to this would be areas having relatively few local HDDV registrations, but significant interstate trucking activity within the local area. Such areas may want to retain and use the MOBILE5 national registration distributions. EPA will issue additional guidance on how locality-specific calendar year 1990 registration distributions by age may be adjusted to reflect future years at a later date.

If local annual mileage accumulation rates or registration distributions are used, they normally should not change across calendar years. In particular, EPA will not accept SIP-related modeling that includes assumptions that the vehicle fleet will be newer (have a lower average age) in the future than is reflected in the registration distributions used for the base year emission factor modeling and inventory development. The use of registration distributions that indicates that the vehicle fleet is newer than that reflected in the MOBILE5 distributions will only be accepted if the area supplies adequate documentation to support this assumption. Modeling that assumes no further aging of the fleet from the current (base year) characterization will be accepted by EPA for SIP inventory purposes.

Methods for estimating the annual mileage accumulation rates by age and the registration distributions by

vehicle type and age are presented in Chapters 2 and 3, respectively, of the report "Techniques for Estimating MOBILE2 Variables."

## **2.2.4 BASIC EMISSION RATES; NEW EVAPORATIVE EMISSIONS TEST PROCEDURE; DISABLING NEW CLEAN AIR ACT REQUIREMENTS**

### **2.2.4.1 Basic Emission Rates**

#### **2.2.4.1.1 Description**

The basic emission rates (BERs) in MOBILE5 are expressed in the form of linear equations, consisting of a zero-mile level (ZML), or y-intercept, and one or two deterioration rates (DR), or slopes (increase in emissions per 10,000 miles accumulated mileage). Basic emission rates entered by the user, for all vehicle types except heavy-duty vehicles (HDGV, HDDV), are in units of grams per mile (g/mi) for the ZMLs and g/mi per 10,000 miles (g/mi-10K mi) for the DRs. For HDGVs and HDDVs, the units are grams per brake horsepower-hour (g/BHP-hr) for the ZML and grams per brake horsepower-hour per 10,000 miles [(g/BHP-hr)-10K mi] for the DR. There are different BER equations in MOBILE5 for each vehicle type/pollutant/model year group, with the model year groups defined on the basis of applicable emission standards and emission control technologies used.

For light-duty gas vehicles (LDGVs) and for model years 1991 and later (MY 1991+) light-duty trucks (LDGTs), there are two deterioration rates in each BER equation. In each such BER equation, there one DR is applicable to mileage accumulated between zero and 50,000 miles, and a second (higher) DR is applicable to mileage accumulated beyond 50,000 miles. This feature is applicable only to LDGVs and MY 1991+ LDGTs.

#### **2.2.4.1.2 Options**

MOBILE5 provides the capability to input alternate BER equations (by setting NEWFLG = 2, 4, or 6). However, the BERs in MOBILE5 accurately reflect all promulgated emission standards as of August 1992, and no changes to these equations are warranted for use in developing emission factors or inventories for SIP purposes. The option of alternate BERs is intended for use only in the situation where new or revised emission standards are promulgated by EPA after release of MOBILE5.

#### **2.2.4.1.3 MOBILE5 Basic Emission Rates**

The BER equations in MOBILE5 are based on the applicable Federal emission standards and the emission control technologies characterizing the fleet in various model years (for example, different types of catalytic converters exhibit different rates of deterioration). These equations are applicable for all non-California areas, both low- and high-altitude, and should not be altered by the user without EPA guidance. Since the size of any I/M credits (emission reductions due to inspection and maintenance programs) are dependent on these basic emission rates, entering alternate BER equations may render any I/M credit calculations used with the new emission rates inappropriate, unless alternate I/M credits derived from the new BER equations are also utilized.

In addition, the emission factors for LEVs for vehicle types LDGV, LDGT1, or LDGT2 depend, in part, on the 1999 emission rates for non-LEV vehicles of the same vehicle type. Changing the BERs for these vehicles for calendar year 1999 may cause a slight change in the emission factors calculated by the model for other evaluation years if any vehicles of the corresponding type are modeled as LEVs during that evaluation year.

#### 2.2.4.1.4 Required Information

If alternate BER equations are to be used, the information that must be supplied includes: the number of alternate BER equations that are to be entered, the region (low- or high- altitude) to which the alternate BERs apply, the vehicle type(s) affected, the first and last model years for which the alternate equations apply, the ZML (g/mi), and the DR (g/mi per 10K mi). If the vehicle type affected is HDGV or HDDV, units of g/BHP-hr must be used for the ZML and units of (g/BHP-hr)/10K mi must be used for the DR, since MOBILE5 will convert g/BHP-hr rates to g/mi rates internally.

If the vehicle type affected is LDGVs or MY 1991+ LDGTs, two deterioration rates must be supplied. The first is used to calculate emissions deterioration through 50,000 accumulated miles, and the second (higher) rate is applied to accumulated mileage beyond 50,000 mi.

The new BER input consists of a set of N+1 records, where N is the number of new BERs (records) that follow the first record. The maximum number of new BERs permitted in a MOBILE5 run is 100. In addition, for each combination of region/vehicle type/pollutant, no more than 12 new BERs are permitted.

The first required record is the total number of new BER equations to be read, entered in **I3/** format. The following BER input records each specify the region, vehicle type, pollutant, model year coverage, zero-mile emission level, and deterioration rate(s). The format of these records is **(3(I1,1X), 2(I2,1X), 2(F6.3,1X), F6.3/)**. The example below shows the input of a single alternate BER for low-altitude LDGT2 NOx emissions, applicable to model years 1981 through 1983:

```
001
1 3 3 81 83 01.120 00.070 00.070
```

Table 2.2-4 summarizes the format specifications, allowable ranges, and codes for these records.

#### 2.2.4.1.5 Changes Since MOBILE4.1

There have been no revisions to the content or format of user input alternate BERs since the release of MOBILE4.1.

#### 2.2.4.1.6 Guidance

No need exists for modification of the BERs in MOBILE5 in order to develop emission factors for any pollutant for any calendar year for SIP purposes. If the use of alternate BER equations in MOBILE5 is being contemplated, the Office of Mobile Sources (Emission Inventory Group, 313/668-4325) should be contacted for additional guidance.

### 2.2.4.2 **New Evaporative Emissions Test Procedure; Disabling Clean Air Act Requirements**

There are two optional features that are new to MOBILE5 and are accessed through setting the value of NEWFLG, which also controls the input of alternate basic emission rate equations as discussed above. Since these new features are accessed through the value assigned to NEWFLG (and since any associated One-time Data appears after any alternate BER equations and before any I/M program descriptive records), these new features are discussed here.

#### 2.2.4.2.1 New Evaporative Emissions Test Procedure

At the time that MOBILE5 was being prepared a revised and more stringent evaporative emissions test procedure, as required by the 1990 Clean Air Act Amendments, had been proposed but had not yet been finalized. The new evaporative emissions test procedure was modeled by MOBILE5 on the basis of the proposal, which includes a four-year phase-in of the new requirements beginning in the 1995 model year. The phase-in schedule assumed in MOBILE5 is 10% in model year (MY) 1995 (i.e., 10% of vehicles built in MY 1995 must comply with the new test procedure), 30% in MY 1996, 50% in MY 1997, and 100% in MY 1998 and beyond. Since the start year, the phase-in schedule, or both were subject to change in the final rulemaking, MOBILE5 includes provisions for the user to override the start year and phase-in schedule with alternate information. This permits the impact of the new evaporative emissions test procedure to be accurately modeled using MOBILE5 if these parameters of the new procedure differed between the proposed and final rules.

**NOTE:** The revised evaporative emissions test procedure was finalized in February 1993. The start year (first model year of applicability) was delayed one year from the proposal, to the 1996 model year (MY). The phase-in schedule was also revised. The revised phase-in schedule included in the final rule assumes 20% compliance in MY 1996, 40% in MY 1997, 90% in MY 1998, and 100% in MY 1999 and beyond. This schedule is included in MOBILE5a (March 26, 1993) and MOBILE5b. Users of MOBILE5 (December 4, 1992) should enter the final rule start year (MY 1996) and the phase-in schedule (20% in MY96, 40% in MY97, 90% in MY98, 100% in MY99+) as part of the input, following the instructions provided below. Users of MOBILE5a or MOBILE5b do not need to be concerned with altering the terms of the new evaporative emissions test procedure. In MOBILE5a or MOBILE5b, if NEWFLG is set to 3 or 4, the New Evaporative Emission Test Procedure record must be supplied, but the information in it will be ignored.

The user accesses this option by setting NEWFLG = 3 or 4 (section 2.1.8), depending on whether or not alternate BER equations are also being supplied by the user. To alter the modeling of the effects of the new evaporative emissions test procedure, the user must supply the start year (which must be MY 1995 or later) and the phase-in schedule (the phase-in period, which must be 1 to 4 years, and the percent of new vehicles that must comply with the new procedure in each model year of the phase-in period). This information must appear in the One-time data section, immediately following any alternate BERs (if used), and immediately preceding any I/M program descriptive records (if used).

This information consists of two to five records (lines) of input, and is summarized in Table 2.2-5. The first record is the number of years in the phase-in period, which also tells MOBILE5 how many additional records (lines) of input on the new evaporative emissions test procedure will follow. The format of this record is **II/**. The second and subsequent records (lines) give the model year(s) and percentage compliance for each model year in the phase-in period. The format of each of these records is **I2,F5.0/**. An example, reflecting the start year (1996) and phase-in schedule (10% in MY 1996, 40% in MY 1997, 90% in MY 1998, and 100% in MY 1999) included in the final rule, is shown below:

```
4
96 10.0
97 40.0
98 90.0
99 100.
```



#### 2.2.4.2.2 Disabling New Clean Air Act Requirements

MOBILE5 has been updated to include all new vehicle and fuel requirements mandated by the 1990 Amendments to the Clean Air Act. These include Tier 1 tailpipe exhaust emission standards and the new evaporative emissions test procedure. For some modeling purposes, emission factors for future years in the absence of the requirements imposed by the 1990 CAA amendments may be needed. By setting NEWFLG = 5 or 6 (depending on whether or not alternate BER equations are also being used), the user can "disable" the effects of the Tier 1 tailpipe exhaust emission standards, the cold CO exhaust emission standards, the 4.0 g/bhp-hr NOx standard for heavy-duty vehicles starting in model year 1998, the new evaporative emissions test procedure, onboard refueling vapor recovery, and Detergent Gasoline effects. Emission factors calculated with the new CAA requirements disabled will still include fleet turnover effects, and will still be based on the other information specified by the user. The use of this option does not require that any additional information be supplied in the One-time Data section.

### 2.2.5 INSPECTION AND MAINTENANCE PROGRAMS

#### 2.2.5.1 Description

Many areas of the country have implemented inspection and maintenance (I/M) programs as a means of further reducing mobile source air pollution. MOBILE5 has the capability of modeling the impact of one or two I/M programs on the calculated emission factors, based on user specification of certain parameters describing the program(s) to be modeled.

#### 2.2.5.2 Options

The user has the option of assuming that no I/M program is in effect for any year (IMFLAG = 1), of modeling the effects of a single I/M program, or of modeling the effects of two I/M programs. The addition of the ability to model two I/M programs provides the ability to model situations such as a conventional program for some model years' vehicles and an enhanced I/M program (i.e., the IM240) for later model years' vehicles.

Standard low-altitude area emission reduction credits for conventional programs and standard high-altitude area emission credits are included as separate files on the MOBILE5 diskettes and tapes. These files must be available if I/M program options are to be used. See Chapter 4 for more details. The model is also capable of accepting alternate credit matrices developed by EPA as input data.

A new program type, Retest Based Hybrid (RBH), is available in MOBILE5b. RBH programs are specified by setting the program type field on the I/M Program Descriptive record to 4. When an RBH program is specified, the alternate I/M credit file HYBRID.IMC must be used. Therefore, to model an RBH program, the alternate credit file flag for Tech IV+ vehicles must be set on the I/M Program Descriptive record and the file name HYBRID.IMC must be specified in the input stream. See section 2.2.5.3, below, for more details.

MOBILE5b is also capable of modeling the effect of Technician Training and Certification (TTC) on I/M programs. This option is accessed by setting the IMFLAG to 6. When IMFLAG = 6, a new record, the I/M Control Flag record must appear in the input before any other I/M program record. This record is described in section 2.2.5.3, below.

In MOBILE5b, the user may also specify alternate effectiveness rates for the test-and-repair (or inspection and repair) I/M programs that are modeled. The alternate rates apply to both manual and computerized programs. They are used in place of the default 50% value that is used in MOBILE5a to discount the emission reduction benefits of test-and-

repair I/M programs. Alternate effectiveness rates are provided on the Program Effectiveness Record that appears in the One-time Data section if the appropriate flag is set on the I/M Program Descriptive Record. This record is described in section 2.2.5.3 below.

2.2.5.3 Required Information

The first record described in this section, the I/M Control Flag record, appears in the input only when the IMFLAG = 6. It is used to model the effects of Technician Training and Certification on the I/M program or programs modeled. The next record to appear in the input if the IMFLAG = 2, 3, 4, 5, or 6 is the I/M program descriptive record. If the IMFLAG = 2 or 4, there will be only one of these records. If the IMFLAG = 3 or 5, there will be two I/M program descriptive records. If the IMFLAG = 6, the number of I/M program descriptive records is determined by the number in the first field of the I/M control flag record, which must be either 1 or 2. The presence of the remaining records described in this section is determined by the settings of various flag fields on the I/M program descriptive record. These fields are described in section 2.2.5.3.2, below, and the records are described in the following sections.

2.2.5.3.1 The I/M Control Flag Record

The I/M control flag record appears in the input when the IMFLAG = 6. This record comes immediately after the alternate BER and new evaporative emission records, if those records are present in the input file, and before any other I/M program record. Its main use in MOBILE5b is to specify whether Technician Training and Certification (TTC) effects are to be applied to the I/M program or programs modeled. In versions of the MOBILE model prior to MOBILE5b, the setting of the IMFLAG determined how many I/M programs were to be modeled and whether a Tier 1 program was assumed for those I/M programs. When the IMFLAG is set to 6 to include TTC effects on the I/M programs, this information must be supplied on the I/M control flag record.

The TTC effects will be added to the standard I/M program benefits for all 1981 and newer passenger cars and light duty trucks. The TTC effects depend on the test type. The TTC benefits for test-and-repair programs are discounted in exactly the same way that the I/M credits are discounted for those programs. (See section 2.2.5.3.3 for an explanation of I/M program credit discounts.) Retest Based Hybrid (RBH) programs will have their TTC benefits reduced slightly, reflecting the reduced level of repairs under an RBH program. TTC benefits are already assumed in the base credits for pre-1981 model year vehicles, and are not changed when TTC is specified.

The first field on the I/M control flag record specifies how many I/M program descriptive records will follow the I/M control flag record in the input. This value must be either one or two. The remaining three fields on the record are flag fields, which can each have the value 1 ("no") or 2 ("yes"). The first flag field determines whether Tier 1 will be assumed for the I/M program or programs modeled. The next flag field determines whether or not TTC effects will be applied to the I/M credits calculated by the model. The last flag field determines whether or not the I/M programs use RSD. The format of this record is:

**I1, 1X, I1, 1X, I1, 1X, I1**

An example of the I/M control flag record is shown below.

2 1 2 1

This record specifies that two I/M program descriptive records will follow in the input (2), that Tier 1 should not be assumed for the I/M programs (1), that TTC effects should be applied (2), and that RSD does not apply to the I/M programs modeled (1).

### 2.2.5.3.2 The I/M Program Descriptive Record

If the IMFLAG = 2, 3, 4, 5, or 6, either one or two I/M program descriptive records must appear in the input. If the IMFLAG = 2 or 4, only one record should appear. If the IMFLAG = 3 or 5, two records should appear. If the IMFLAG = 6, the number of I/M program descriptive records is determined by the value in the first field of the I/M control flag record, described in section 2.2.5.3.1 above. Each I/M program descriptive record contains the following parameters in the order shown. If two I/M programs are specified, then two I/M program descriptive records must be included, each containing the information listed below.

- Program start year (calendar year that program begins)
- Stringency level (percent)
- First (earliest) and last (latest) model years of vehicles subject to the requirements of the program
- Waiver rates (percent of failed vehicles; one rate for pre-model year 1981 vehicles and one rate for 1981 and later model year vehicles)
- Compliance rate (percent)
- Program type (inspection only; inspection and repair (computerized); inspection and repair (manual); or Retest Based Hybrid)
- Whether the user is specifying alternate effectiveness rates for inspection-and-repair I/M, ATP, or functional pressure and purge check programs. (This flag is optional in MOBILE5b.)
- Frequency of inspection (annual or biennial)
- Whether or not each of four gasoline-fueled vehicle types (LDGV, LDGT1, LDGT2, HDGV) are covered
- Test type (idle, 2500/idle, loaded/idle, transient test, or ASM)
- Whether or not the user is specifying non-default cutpoints
- Whether or not the user is specifying alternate I/M credit files for each of two technology groups (Tech I-II and Tech IV+)
- Cutpoints for HC, CO, and NOx, for model year 1981 thru 1993 passenger cars (LDGVs)

The format of this record is:

**4(I2,1X),2(F2.0,1X),F3.0,1X,I1,A1,I1,1X,4I1,1X,4I1,3(1X,F4.2)**

An example of this record is shown in section 2.2.5.4 below. The fields of the record are discussed in more detail in that section.

The I/M program descriptive record(s) required if IMFLAG = 2, 3, 4, 5, or 6 are summarized in Table 2.2-7, including the codes and allowable values for each field of the record. Appendix 2A provides more information on I/M

programs and terminology. Appendix 2B discusses the modeling of I/M programs applicable to California low emission vehicle (LEV) program vehicles.

#### 2.2.5.3.3 The Alternate Effectiveness Record

MOBILE5 uses the data in the I/M credit files to calculate benefits, or emission reduction credits, for I/M programs. In the case of test-and-repair programs, these benefits are reduced by 50% before they are applied to the emission factors calculated by the model. In other words, the model assumes that test-and-repair programs are only half as effective as test-only programs in reducing emissions. Using the default discounts for emission reduction credits, maximum I/M benefits are never available to test-and-repair I/M programs. Similar benefits are calculated by the model for Anti-Tampering (ATP) and functional pressure and purge check programs. Pressure and purge check program benefits, like I/M program benefits, are discounted if the program is a test-and-repair program to reflect the decreased effectiveness of test-and-repair programs as compared to test-only programs. The calculation of ATP program benefits is somewhat different. The model uses separate internal tables to calculate benefits for test-only and test-and-repair programs. In general, benefits are lower for test-and-repair programs.

In MOBILE5b, users can specify the effectiveness rates for test-and-repair I/M programs, as well as for test-and-repair ATP and functional pressure and purge check programs, by setting the effectiveness flag on the I/M program descriptive record as described above and by entering a program effectiveness record immediately after the last I/M program descriptive record. If there are two I/M program descriptive records, the flag may be set on either record. Regardless of whether the flag is set in both records or is set in one record, but not in the other, the program will expect to find one program effectiveness record immediately following the last I/M program descriptive record.

The program effectiveness record contains five numbers. Each number must be between zero (0.00) and one (1.00). The first three numbers specify the effectiveness of the I/M program in reducing HC, CO, and NOx emissions, respectively. A value of one (1.00) means a test-and-repair program receives 100% of the benefits that a test-only program receives. The default value for these effectiveness values is 0.50 for HC, CO, and NOx. The I/M program effectiveness rates are relevant only to test-and-repair programs. If they are supplied, they will be used to calculate I/M program credits for any test-and-repair I/M program modeled in the current run. Alternate effectiveness rates may be entered even when no test-and-repair I/M program is modeled, but this will not affect the emission factors calculated by the model. The next number in the record is the effectiveness of test-and-repair ATP programs, and the last number is the effectiveness of test-and-repair functional pressure and purge test programs. (There is only one number that is used for both pressure and purge check programs.)

For the I/M and for the functional pressure and purge check effectiveness rates, a value of zero means that the test-and-repair program has no effect in reducing emissions (receives no benefits) and a value of one (1.00) means that the program has the same effectiveness as a test-only program (receives 100% of the benefits that a test-only program would receive). The default value for both I/M and functional pressure and purge tests is 50%. That is, by default a test-and-repair program receives only half of the benefits that a test-only program would receive.

For ATP programs, the values have a slightly different meaning. A value of zero means that the program is no more effective in reducing emissions than a default test-and-repair program. (In general, benefits for test-and-repair programs are lower than they are for test-only programs.) A value of one means that the program receives the full benefits that would be awarded to a test-only program.

The ATP and the functional pressure and purge check effectiveness rates are optional on this record. Either field may be left blank, in which case default values will be used for the missing number. A value of 50% (0.50) will be used for the pressure and purge test effectiveness rate and a value of 0% (0.00) will be used for the ATP program

effectiveness rate.

The format for this record is:

**4(F4.2,1X),F4.2**

An example of this record appears in section 2.2.5.4 below.

#### 2.2.5.4 Changes Since MOBILE4.1

The I/M program descriptive record has been revised since the release of MOBILE4.1 to provide the user with the option of specifying two I/M programs, the option of providing cutpoints to be used in the calculation of emission reduction credits attributable to the I/M program(s), and to specify the alternate I/M credit file name(s) as part of the MOBILE5 input file. In addition, in MOBILE5b a new test type, Retest Based Hybrid, is available. The user also has the option of specifying alternate effectiveness rates for test-and-repair I/M, ATP, and functional pressure and purge test programs by setting the alternate effectiveness flag on the I/M program descriptive record and supplying an alternate effectiveness record, as described in section 2.2.5.3 above.

There have been no revisions since MOBILE4.1 to the first seven fields in the I/M program descriptive record (through and including the compliance rate). The program type field has been expanded to include a new program type, the Retest Based Hybrid (RBH) program type. If an RBH program is specified by setting the program type field to 4, the alternate I/M credit file **HYBRID.IMC** is required, as described below. The **HYBRID.IMC** credit file must be specified when the RBH program type is selected. If the standard I/M credit files are used, no error message will be generated by the program but the results calculated will not reflect the RBH program design. The RBH program contains an evaporative emissions component as well as an exhaust emissions component. If RBH is specified as the I/M program type, and if functional pressure and purge test programs are modeled, the program type must also be set to 3 (for RBH) in the functional pressure and purge test records (see section 2.2.6.3). Also note that when RBH is specified for the functional pressure or purge test type, the data file **PPEFF.D** must be available to the program, or an error will result when the program is run.

The next character after program type specifies whether the user will supply a program effectiveness record (described in section 2.2.5.3.3) immediately following the last I/M program descriptive record. This flag is optional in MOBILE5b. The field may be set to 1 to indicate that no program effectiveness record will be supplied, or to 2 to indicate that the record will be supplied. It may also be left blank, for compatibility with MOBILE4.1 inputs, in which case no program effectiveness record will be expected. If there are two I/M program descriptive records, the flag may be set on either or both records, regardless of the I/M program type described in that record. Alternate program effectiveness rates will be read only once, following the second I/M program descriptive record, whether the flag is set on the first, on the second, or on both I/M program descriptive records.

The next two fields (inspection frequency and which of the four gasoline-fueled vehicle types are subject to the requirements of the program) are unchanged in MOBILE5b. The test type field has been expanded to include two new test types, transient I/M testing (such as the IM240) and the Acceleration Simulation Mode (ASM) test procedure. (The ASM test type requires the use of an alternate I/M credit file, either **IMDATA3.D** or **HYBRID.IMC**, as described below.) The next integer input after test type specifies whether cutpoints are being supplied by the user (later in the descriptive record); this flag may be set to 1 only if the standard cutpoints are to be assumed for the idle, 2500/idle, or loaded idle tests, and should be set to 2 if the user is specifying alternate cutpoints. The user must specify the cutpoints to be used if either the transient IM240 test procedure or the ASM test procedure is chosen. The option to assume standard cutpoints was offered to allow compatibility with old MOBILE4.1 input files. Users are encouraged

to always specify the cutpoints to be used for all I/M test types. See Appendix 2A for a discussion of how to select I/M cutpoints for MOBILE5.

The next two integers indicate whether or not the user is supplying alternate I/M credit file names as input to the model. As in MOBILE4.1, the first integer applies to Tech I-II vehicles and the second to Tech IV+ vehicles, with "1" indicating use of the default credits and "2" indicating that an alternate credit file is to be used, for each technology group. If two I/M programs are modeled, the use of alternate I/M credit files can be indicated in the first, the second, or in both I/M Program Descriptive records. In any case, the I/M credits will be read from the credit files specified later in the input and the credits will be applied to both I/M programs.

MOBILE5 now always reads all I/M credits from a separate data file supplied with the model. This data file contains a standard set of all low- and high-altitude emission reduction credits for all test types. These credits are accessed by MOBILE5 using default file names. High-altitude areas now do not normally need to set the flags to read alternate credits, since default high-altitude area I/M credits are contained in the default I/M credit file.

In previous versions of the model, when the user specified that alternate credit file(s) are to be read for Tech I-II and/or Tech IV+ vehicles, that credit file had to be called M4IMC and was required to be available in the local directory. Normally, MOBILE5 always reads I/M credits from two files named **TECH12.D** and **IMDATA.D**. If the user wishes to supply alternate file names and sets the appropriate flags in the first or second I/M program descriptive record (or in both records), the alternate credit file names immediately follow the program effectiveness record, if that record is present in the input file. If that record is not present, the alternate credit file names immediately follow the I/M program descriptive record(s) in the input file. If there are two I/M programs specified, the credit file names follow the second I/M descriptive record. This option can also be used to access the standard I/M credit files when they are stored in a location in the computer other than the current (active) directory. This is accomplished by specifying a path, such as **C:\DATA\IMDATA.D**, to the default file names to indicate where the I/M credit files are stored.

Two new features in MOBILE5b require the use of alternate I/M credit files. If the program type field is set to 4 for the Retest Based Hybrid program, the alternate I/M credit file **HYBRID.IMC** must be specified for Tech IV+ vehicles. The alternate I/M credit file **IMDATA3.D** should be specified for Tech IV+ vehicles whenever the test type field is set to 5 to specify the ASM test procedure, except when the program type is RBH. The cutpoints for the ASM test procedure are included in the **HYBRID.IMC** credit file, so in this last case (when the program type is RBH and the test type is ASM), the **HYBRID.IMC** credit file should be used.

Entry of the I/M test cutpoints follow the last four integer inputs discussed (test type, supply alternate cutpoints, supply alternate credit file for Tech I-II vehicles, supply alternate credit file for Tech IV+ vehicles). The default cutpoints included in MOBILE5 are 220 for HC, 1.2 for CO, and 999. for NOx (in the default case, NOx emissions have no cutpoint assigned and are not tested). These cutpoints only apply to idle, 2500/idle, and loaded idle tests procedures. If the user specifies the transient IM240 test procedure or the ASM test procedure, then the user must specify the cutpoints to be used. If cutpoints are to be supplied, they follow in **F4.2** format, separated by single blank spaces. This format allows any four-digit number to be entered, provided that one of the four digits is a decimal point. For example: 0.80, .400, 999., and 20.0 are all valid entries for cutpoint values. (See section 2.0.1 for a description of FORTRAN format specifications.) These revisions are illustrated in the example below, which includes all of the options available to the user:

```
89 20 84 50 00 00 100 221 2222 1122
96 20 86 50 00 00 100 1 2 2111 4211 0.80 15.0 2.00
0.82 0.86 0.90 0.60 0.75
C:\DATA\TECH12.D
```

C:\DATA\IMDATA.D

The first I/M program (first line above) starts in 1989 (89), has a stringency level of 20% (20), 1984 model year is the first model year tested (84), 2050 is the latest model year tested (50), the waiver rate for pre-1981 vehicles is 0% (00), the waiver rate for 1981 and later vehicles is 0% (00), the compliance rate is 100% (100), the program type is test and repair (computerized) (2), alternate program effectiveness rates will be provided (2), the frequency of inspections is annual (1), all gasoline-fueled vehicle types (LDGV, LDGT1, LDGT2, HDGV) are subject to inspection (2222), the test type is idle test (the first 1 in 1122), alternate cutpoints are not supplied (the second 1 in 1122), an alternate credit file for Tech I-II vehicles is supplied (the first 2 in 1122), and an alternate credit file for Tech IV+ vehicles is supplied (the second 2 in 1122).

The second I/M program (second line above) starts in 1996 (96), has a stringency level of 20% (20), 1986 is the first model year tested (86), 2050 is the latest model year tested (50), the waiver rates are 0% for both pre-1981 and 1981-and-later vehicles (00 00), the compliance rate is 100% (100), the program type is centralized (1), the inspection frequency is biennial (2), only LDGVs (of the four gasoline-fueled vehicle types) are subject to inspection (2111), the test type is transient test (the 4 in 4211), and alternate cutpoints are supplied (the 2 in 4211). The flags to indicate alternate credit files for Tech I-II or Tech IV+ vehicles (the 11 in 4211) do not need to be set in the second I/M program descriptive record, because they are already set in the first program record. The values of the cutpoints to be assumed then follow: 0.80 for HC, 15.0 for CO, and 2.0 for NOx.

The next line is the program effectiveness record. In this test run, the effectiveness of test-and-repair I/M programs in reducing HC emissions is 82% (0.82), the effectiveness of test-and-repair I/M programs in reducing CO emissions is 86% (0.86), and the effectiveness of test-and-repair I/M programs in reducing NOx emissions is 90% (0.90). The test-and-repair ATP program effectiveness is 60% (0.60) and the effectiveness of test-and-repair functional pressure and purge check programs is 75% (0.75).

The next two lines are the file names of the alternate credit files to be read by the program, with the first (TECH12.D) applying to Tech I-II vehicles and the second (IMDATA.D) to Tech IV+ vehicles. The entry also indicates that the files are currently being stored in the DATA directory on drive C:\ of the computer.

#### 2.2.5.5 Guidance

Additional information on the modeling of I/M program benefits in MOBILE5 is provided in Appendices 2A and 2B to this chapter. As detailed in Appendix 2B, if the modeler is including the California LEV program and assuming that an I/M program meeting the criteria discussed in detail in Appendix 2B for such vehicles, the cutpoints (0.6/10/1.2) should **not** be entered as part of the I/M program descriptive record. The cutpoints entered on the I/M descriptive record are applicable to pre-Tier 1 vehicles (model years 1981-1993 for LDGVs). The cutpoints for Federal Tier 1 vehicles and for California LEV program vehicles are determined by the model on the basis of (i) the cutpoints entered for MY 1981-93 vehicles and (ii) the values assigned to the REGION variable on the Scenario data record (see sections 2.3.1) and the I/M program variable on the LEV program record (see section 2.3.7). Modelers including the California LEV program in the emission factor calculations should read Appendix 2B closely.

For cases where the emission reduction credit matrices included with MOBILE5 (shown in Table 1.3-1 in Chapter 1) are inappropriate for the I/M program(s) being modeled, contact the Office of Mobile Sources (313/668-4325) to obtain the required credit matrices.

Users who are interested in specifying alternate effectiveness rates for test-and-repair I/M programs or test-and-repair ATP or functional pressure and purge check programs should contact the EPA Office of Mobile Sources for assistance.

## **2.2.6 ANTI-TAMPERING PROGRAMS**

### **2.2.6.1 Description**

Some areas of the country have implemented anti-tampering programs (ATPs) to reduce the frequency and resulting emission impact of emission control tampering (e.g., misfueling, removal or disablement of catalytic converters). MOBILE5 allows the user to include the effects of such a program on the calculated emission factors.

### **2.2.6.2 Options**

You can choose to model the effects of an ATP on the emission factors, or to assume that no ATP is in effect. The information required of the user if the effects of an ATP on the emission factors are to be modeled is discussed below. MOBILE5 contains a subroutine that will generate the applicable emission factor credit matrices based on the information that is provided on the characteristics of the ATP.

In addition, the modeling of the effects of requiring functional pressure or purge tests of the vehicle evaporative emission control system are now accessed through the values of ATPFLG. The user has the ability to model any combination of conventional anti-tampering programs, functional pressure tests of evaporative emission control systems, and functional purge tests of evaporative emission control systems. (These features were accessed in MOBILE4.1 by appending additional information to the I/M program descriptive record, in the same way that transient (IM240) I/M tests were modeled.) A new program type, the Retest Based Hybrid (RBH) program, is available in MOBILE5b for functional pressure and purge tests. The RBH program contains both exhaust and evaporative emission control components. If this program type is selected for functional pressure or purge tests, any I/M program that is modeled must also specify this program type. See section 2.2.5 for more information about the input requirements for I/M programs. The data file PPEFF.D describes the effectiveness of functional pressure and purge tests under an RBH program. This data file must be available to the program if RBH is selected as the program type for functional pressure or purge tests. A copy of this file was distributed with MOBILE5b.

Alternate effectiveness rates may be specified in MOBILE5b for inspection and repair ATP programs and for inspection and repair functional pressure and purge check programs. The MOBILE model assumes that inspection and repair programs are not as effective in controlling emissions as inspection only programs and automatically discounts the emission reduction benefits if an ATP program or a functional pressure or purge check program is modeled as an inspection and repair program. The user-supplied effectiveness rates can be entered on the program effectiveness record that appears in the One-time Data section if the appropriate flag is set in the I/M program descriptive record. See sections 2.2.5.3 and 2.2.5.5 for more information about using the program effectiveness record to enter alternate effectiveness rates for inspection and repair ATP or functional pressure and purge test programs. If there is no I/M program to be modeled, but there is an ATP, or a functional pressure or purge check, and the user wants alternate effectiveness values, then a dummy I/M program descriptive record must be set up to set the alternate effectiveness flag. Note that one way to create a dummy I/M program record that does not model an I/M for the fleet is to set the program start date to 2050.

### **2.2.6.3 Required Information**



#### 2.2.6.3.1 ATP Information

The following must be specified by the user in order to have MOBILE5 model the effects of an ATP, in the order shown:

- Start year (calendar year in which the program begins)
- First (earliest) and last (most recent) model years of vehicles subject to the requirements of the program
- Whether or not each of four possible vehicle types (LDGV, LDGT1, LDGT2, HDGV) are covered by the program
- Program type (inspection only or inspection and repair)
- Frequency of inspection (annual or biennial)
- Compliance rate (percent)
- Inspections performed (air system, catalyst, fuel inlet restrictor, tailpipe lead deposit test, EGR system, evaporative system, PCV, gas cap)

The format of this record is:

**3(I2,1X),4I1,1X,2I1,1X,F4.0,1X,8I1**

The ATP descriptive input record, required if ATPFLG = 2, 5, 6, or 8, is summarized in Table 2.2-9, including the variable names, codes, and allowable values for each field of the record. See Appendix 2A for more information on anti-tampering programs and terminology.

#### 2.2.6.3.2 Functional Pressure Test Information

The following must be specified by the user in order to have MOBILE5 model the effects of a functional pressure test of vehicle evaporative emission control systems, in the order shown:

- Start year (calendar year in which the program begins)
- First (earliest) and last (most recent) model years of vehicles subject to the program
- Whether or not each of four gasoline-fueled vehicle types (LDGV, LDGT1, LDGT2, HDGV) are covered by the program
- Program type (inspection only, inspection and repair, or Retest Based Hybrid)
- Frequency of inspection (annual or biennial)
- Compliance rate (percent)

The format of this record is:

**3(I2,1X),4I1,1X,2I1,1X,F4.0**

Note that the format of this record and the information it contains is exactly like the ATP descriptive record, except that the final inclusion vector (eight integer values representing inspections performed) is not required.

The RBH program type is new in MOBILE5b. The data file PPEFF.D must be available to the program if the RBH program type is selected for the functional pressure test.

The functional pressure test input record (required if ATPFLG = 3, 5, 7, or 8), including the variable names, codes, and allowable values for each field of the record, is summarized in Table 2.2-10. See Appendix 2A for more information.

#### 2.2.6.3.3 Functional Purge Test Information

The following must be specified by the user in order to have MOBILE5 model the effects of a functional purge test of vehicle evaporative emission control systems, in the order shown:

- Start year (calendar year in which the program begins)
- First (earliest) and last (most recent) model years of vehicles subject to the program
- Whether or not each of four gasoline-fueled vehicle types (LDGV, LDGT1, LDGT2, HDGV) are covered by the program
- Program type (inspection only, inspection and repair, or Retest Based Hybrid)
- Frequency of inspection (annual or biennial)
- Compliance rate (percent)

The format of this record is:

**3(I2,1X),4I1,1X,2I1,1X,F4.0**

Note that the format of this record and the information it contains is exactly like the ATP descriptive record, except that the final inclusion vector (inspections performed, eight integer values) is not required.

The RBH program type is new in MOBILE5b. The data file PPEFF.D must be available to the program if the RBH program type is selected for the functional purge test.

The functional purge test input record (required if ATPFLG = 4, 6, 7, or 8), including the variable names, codes, and allowable values for each field of the record, is summarized in Table 2.2-10. See Appendix 2A for more information.

#### 2.2.6.3.4 Order of Input Records

These records, if used, appear in the One-time Data section. They appear in the location reserved for the ATP descriptive record in MOBILE4.1 (immediately after any I/M program descriptive records, if used, and immediately preceding any refueling vapor recovery system input records, if used). The order is ATP record (if used) first, followed by functional pressure test record (if used), followed by functional purge test record (if used).

#### 2.2.6.4 Changes Since MOBILE4.1

There have been no revisions to the information required to model the effect on emissions of an ATP, or to the format requirements of that data, since the release of MOBILE4.1, with the exception of the effectiveness rates that may be entered for inspection and repair ATP and functional pressure and purge test programs starting in MOBILE5b. The functional pressure and/or purge tests of vehicle evaporative emission control systems are now modeled using one or two additional input records, as described above, rather than by adding additional information to the I/M program descriptive record as was done in MOBILE4.1. Alternate effectiveness rates are entered on the new effectiveness record, which is described in section 2.2.5.3.3.

The Retest Based Hybrid program type is new in MOBILE5b for the functional pressure and purge tests. No additional user input is required if this program type is specified. However, the data file PPEFF.D, which contains the effectiveness rates for functional pressure and purge tests under an RBH program, must be available to the MOBILE5b program if the RBH program type is specified or an error will result.

#### 2.2.6.5 Guidance

MOBILE5 will only model an ATP with an evaporative system inspection (sixth in the list of inspections performed) and provide appropriate emission credits if a gas cap inspection (last in the list of inspections performed) is also included. If the user indicates that an evaporative system inspection is performed, but that a gas cap inspection is not performed, an error message will be issued and execution of the run will stop. The converse is not true: It is allowable to have a gas cap inspection without having an evaporative system inspection. Refer to the descriptions provided in Appendix 2A before choosing ATP parameters.

Additional information on ATP programs is provided in Appendix 2A. Enhanced I/M programs, including I/M programs for Federal Tier 1 and/or California LEV program vehicles meeting the criteria in Appendix 2B, must include the functional pressure and purge tests of the evaporative emission control system. (See Appendix 2B for additional information.) Further guidance on developing the information required to model the emissions impact of an ATP can be obtained by contacting the Office of Mobile Sources, Regional and State Programs Division (313/668-4374).

### **2.2.7 REFUELING EMISSIONS**

#### 2.2.7.1 Description

The refueling of gasoline-fueled vehicles results in the displacement of fuel vapor from the vehicle fuel tank to the atmosphere. There are two basic approaches to the control of vehicle refueling emissions, generally referred to as "Stage II" (at the pump) and "onboard" (on the vehicle) vapor recovery systems (VRS). MOBILE5 has the ability to model uncontrolled levels of refueling emissions (i.e., assuming no requirements for Stage II or onboard VRS systems), as well the impacts of the implementation of either or both types of VRS.

An EPA rulemaking requiring onboard VRS has been finalized. As a result, the phase-in of the onboard VRS requirement and its effect on refueling emissions has been added to MOBILE5b. The user must still provide the

Onboard VRS Input record when RLFLAG = 3 or 4, but the information it contains will be ignored in favor of the final rule defaults in MOBILE5b. The user may eliminate the effects of onboard VRS (along with other mandatory emission control effects) by disabling the Clean Air Act requirements by setting NEWFLG = 5 or 6 (Section 2.1.8)

#### 2.2.7.2 Options

There are five approaches available in MOBILE5 for the modeling of vehicle refueling emissions, depending on the value assigned to RLFLAG (section 2.1.12):

<u>Value</u>	<u>Action</u>
1	Model refueling emissions with onboard VRS for all gasoline-fueled vehicle types
2	Model refueling emissions with onboard VRS and a Stage II VRS requirement
3	Originally to model refueling emissions assuming an onboard VRS requirement. Same effect in MOBILE5b as RLFLAG=1.
4	Originally to model refueling emissions assuming both Stage II and onboard VRS requirements. Same effect in MOBILE5b as RLFLAG=2.
5	No refueling emission factors calculated by MOBILE5 (refueling emissions must be accounted for elsewhere in the inventory for SIP purposes)

Data describing the characteristics of Stage II vapor recovery systems (required if RLFLAG = 2 or 4) must be provided by additional user-supplied inputs in the One-time Data section. Although onboard VRS is now a mandatory rule and occurs automatically, user input for onboard VRS is still required (but ignored) for RLFLAG = 3 or 4 when using MOBILE5b (see Table 2.2-11). To include the effects of Stage II VRS requirements on refueling emissions, additional information must be provided by the user as detailed below.

#### 2.2.7.3 Refueling Emissions in MOBILE5

Uncontrolled refueling emission factors in MOBILE5 are based on vehicle test results which were used to develop a regression equation expressing refueling emissions as a function of fuel RVP, temperature of dispensed fuel, and difference in temperatures of dispensed and residual tank fuel. Each of these values is supplied by the model user, either directly (fuel RVP) or indirectly (the temperature of the dispensed fuel is estimated as a function of the input minimum and maximum temperatures, while the "delta T" temperature term is in turn a function of the dispensed temperature). This equation yields refueling EFs in terms of grams of vapor emitted per gallon of fuel dispensed (g/gal). To this value an estimate of spillage losses is added, also in g/gal. Combining this total g/gal emission factor with vehicle fuel economy data (mi/gal) yields refueling emission factors in grams per mile (g/mi).

If you wish to model the effect of a Stage II VRS requirement on these emissions, its in-use control efficiencies (for LDGVs and LDGTs, and for HDGVs) must be entered as input. There are no national average values for Stage II efficiency in MOBILE5.

In modeling an onboard VRS requirement, MOBILE5 assumes a 95 percent reduction in refueling emissions from uncontrolled levels from onboard-equipped vehicles. The effects of Onboard Refueling Vapor Recovery (ORVR) technology is phased in over several model years. For passenger cars, 40, 80, and 100 percent of 1998, 1999, and 2000 and newer model year cars respectively will have ORVR. For light duty trucks up to 6000 pounds gross vehicle weight, 40, 80, and 100 percent of 2001, 2002, and 2003 and newer model year trucks will have ORVR. For light duty trucks between 6000 and 8500 pounds gross vehicle weight, 40, 80, and 100 percent of 2004, 2005, and 2006 and newer

model year trucks will have ORVR. In MOBILE5b, user-supplied onboard parameters (required when RLFLAG = 3 or 4) are ignored in favor of the above final onboard rule defaults.

#### 2.2.7.4 Required Information

To model the effect of a Stage II VRS requirement, four inputs must be provided: the start year (calendar year in which the requirement takes effect), the phase-in period (number of years for Stage II VRS installation to be completed), and the system efficiency (in percent) at controlling refueling emissions from light-duty vehicles and trucks, and from heavy-duty vehicles.

The format of the Stage II VRS descriptive record is:

**I2,1X,I1,2(1X,F3.0)**

For example, the record below is for a Stage II VRS system requirement that takes effect in 1995, allows 3 years for full implementation, and reduces refueling emissions from LDGVs and LDGTs by 90% and from HDGVs by 80%:

95 3 90. 80.

In MOBILE5b, users must still provide the Onboard VRS Input record when RLFLAG = 3 or 4, even though the information will be overridden. Onboard effects occur automatically as specified in the final Onboard Refueling Vapor Recovery (ORVR) rulemaking. The user, however, may eliminate the effects of onboard VRS (along with other mandatory emission control effects) by disabling the Clean Air Act requirements using the NEWFLG (see section 2.1.8).

#### 2.2.7.5 Changes Since MOBILE4.1

There have been no revisions to the information required to model the effects of either type of VRS on refueling emissions, or to the format requirements of that information, since the release of MOBILE4.1. However, flag options 3 and 4 are no longer necessary, since onboard VRS is now a mandatory rule and occurs automatically when using MOBILE5b.

#### 2.2.7.6 Guidance

EPA recommends that States and others use MOBILE5 to model refueling emissions for highway vehicle emission inventory development. The refueling emission factors can be calculated in grams per gallon of dispensed fuel (g/gal) or in grams per mile (g/mi). (The g/gal emission factor is calculated and output when the expanded evaporative emission factor output (HCFLAG=3) is selected; see section 2.1.19.) The preferred approach is to calculate g/gal refueling emission factors using MOBILE5, reflecting Stage II VRS requirements as applicable, then multiplying the g/gal emission factor by total gasoline sales. This is the most accurate method of estimating the contribution of refueling emissions to the inventory, particularly for areas with good data on gasoline sales (e.g., through tax records). This method also accounts for refueling emissions generated when gasoline is purchased in an area, but consumed largely outside of the area, and does not include refueling emissions for through traffic that does not refuel in the area. When good data on gasoline sales is not available, the use of the g/mi refueling emission factor is more convenient and, while also more approximate, acceptable for SIP inventory development.

The overall effectiveness of Stage II VRS at controlling refueling emissions depends on a number of factors,

including the baseline efficiency of the system used, the portion of total area gasoline consumption handled by service stations exempt from Stage II requirements, and the frequency and stringency of enforcement programs. In general, the effectiveness of Stage II VRS at controlling refueling emissions will be greater for light-duty vehicles and trucks than for heavy-duty vehicles, since HDGVs are more likely to be refueled at locations (such as private refueling depots) that will be exempted from Stage II requirements. For assistance in developing such information, contact EPA's Office of Air Quality Planning and Standards (919/541-5397).

An EPA rulemaking requiring onboard VRS has been finalized. As a result, the phase-in of the onboard VRS requirement and its effect on refueling emissions have been added to MOBILE5b. The user must no longer specify onboard parameters, since they will occur automatically in MOBILE5b. However, the user may eliminate the effects of onboard VRS (along with other mandatory emission control effects) by disabling the Clean Air Act requirements using the NEWFLG (Section 2.1.8). It is not possible to easily model the final ORVR rulemaking effects using MOBILE5/5a and, therefore, users who wish to properly model these effects are encouraged to switch to using MOBILE5b.

Stage II reduces refueling emissions from all gasoline-fueled vehicles, while onboard systems require a number of years for fleet turnover to result in most vehicles' refueling emissions being controlled. MOBILE5 can model both requirements simultaneously; where Stage II is in place and onboard-equipped vehicles begin to enter the fleet, the control is dominated by onboard, which is generally more effective than Stage II.

If the user does not model refueling emissions using MOBILE5 (RLFLAG = 5), then these emissions must be accounted for in the stationary source portion of the inventory in the development of the base and projected emission inventories for SIPs. EPA recommends that States and others use MOBILE5 to model refueling emissions for highway vehicle emission inventory development.

## **2.2.8 LOCAL AREA PARAMETER RECORD**

### 2.2.8.1 Description

The local area parameter (LAP) record consists of seven, eight, nine, or ten locality-specific input variables. This record must be included at least once in every MOBILE5 run.

### 2.2.8.2 Options

The modeler can use one LAP record for all scenarios (LOCFLG = 2) or a different LAP record for each scenario (LOCFLG = 1). With the possible exception of the scenario name (section 2.2.9), the same LAP generally would be used for all scenarios (e.g., different evaluation years) for the same locality.

### 2.2.8.3 Content of the LAP

The following variables comprise the LAP record:

- 1) Scenario name
- 2) Fuel volatility class
- 3) Minimum daily temperature
- 4) Maximum daily temperature
- 5) "Period 1" RVP

- 6) "Period 2" RVP
- 7) "Period 2" RVP start year
- 8) \* OXYFLG
- 9) \* DSFLAG
- 10) \* RFGFLG
- 11) \* DTGFLG

The last four variables, indicated by asterisks, are optional. Each variable is discussed in sections 2.2.9 through 2.2.16 below. Table 2.2-12 summarizes the LAP record, including the content, variable name, codes, and allowable values for each field of the record.

The format of the LAP record is:

**4A4,1X,A1,2F5.0,2F5.1,1X,I2,4(1X,I1)**

For example, the LAP record below is for an fuel volatility class "B" area with minimum and maximum temperatures of 68°F (20°C) and 77°F (25°C), "period 1" RVP of 10.5 psi, "period 2" RVP of 9.0 psi (starting in 1992), no oxygenated fuels program, no locality-specific diesel sales fractions being supplied as input, no reformulated gasoline effects to be included in the emission factors, and default detergent gas effects to be included in the emission factors:

Example LAP rcrd C 68. 77. 10.5 9.0 92 1 1 1 1

It is possible for the user to include comments or other descriptive information outside of the required MOBILE5 input parameters, in order to aid in documenting and interpreting MOBILE5 input files. This is illustrated in the example input files included in Chapter 5 and on the program diskette. Such comments on the Local Area Parameter input record must not begin before (to the left of) column 53. This restriction is necessary to avoid generating error messages that will occur as a result of internal diagnostic checks that use these spaces.

#### 2.2.8.4 Changes Since MOBILE4.1

There have been three revisions to the LAP record since the release of MOBILE4.1. First is the addition of the "fuel volatility class" variable. This variable is only used in the emission factor calculations if the effects of reformulated gasoline on emission factors is to be modeled (RFGFLG = 2, see below). Although this variable is in the same position as the "ASTM Class" variable used in MOBILE4, it is not the same variable. See section 2.2.10. The second change is the addition of a third optional flag value to the LAP record after the diesel sales fraction flag. This flag, RFGFLG, is used to indicate whether the user wishes to model the effects of reformulated gasoline on the emission factors. The third change is the addition of a fourth optional flag value at the end of the LAP record. This flag, DTGFLG, is used to indicate whether the user wishes to alter the effects of detergent gasoline on the emission factors. The four optional flags are discussed in sections 2.2.14, 2.2.15, and 2.2.16.

## 2.2.9 SCENARIO NAME

### 2.2.9.1 Description

A field of 16 character spaces is available for entering an identifying label for each scenario within a run. This label is echoed as part of the output. Nothing about the scenario name and its use has been revised since the release of MOBILE4.1.

### 2.2.9.2 Guidance

If no scenario name is desired, a blank field must be entered here. This field is typically used to define the most important characteristics distinguishing the scenario from others within the same MOBILE5 run (e.g., calendar year of evaluation, with or without an operating I/M program, average speed assumed).

## 2.2.10 **FUEL VOLATILITY CLASS**

### 2.2.10.1 Description

This variable represents the gasoline volatility class assigned to a given area for a given month under EPA's final (Phase 2) volatility control regulations (55 FR 23658, June 11, 1990). It is not the same as the ASTM Class, which was used in MOBILE4 as a surrogate for actual fuel volatility level (RVP) in certain calculations (refueling emissions), and was not used in MOBILE4.1. However, in order to minimize the need for reformatting of input data files prepared for use with MOBILE4, the space on the LAP record that contained the ASTM Class was retained in MOBILE4.1, but could be left blank. In MOBILE5, this space continues to be used, and a value of fuel volatility class must be provided **if** the effects of reformulated gasoline on the emission factors is to be modeled (that is, if RFGFLG = 2 on the LAP record - see section 2.2.16).

Since the release of MOBILE4/4.1, EPA has issued regulations controlling summertime fuel volatility and detailing the requirements for reformulated gasoline. The fuel volatility class to be entered here should be determined by reference to the Final Rulemaking (FRM) for "Volatility Regulations for Gasoline and Alcohol Blends Sold in Calendar Years 1992 and Beyond," 55 FR 23658, June 11, 1990. That rule divided the nation into two "VOC Control Regions," each of which has certain specifications for reformulated gasoline. The appropriate EPA Regional Office should also be able to provide the correct fuel volatility class code for a given State or region. The impact of the value entered for fuel volatility class on the calculated emission factors is discussed under Reformulated Gasoline (section 2.2.16). If reformulated gasoline is not being assumed in the emission factor calculations, then the value entered here will have no effect on the emission factors produced by MOBILE5.

### 2.2.10.2 Options

If the effect of reformulated gasoline on emissions **is** to be modeled, then a valid fuel volatility class value (single capital letter: A, B, C, D, or E) **must** be specified. Areas that are defined as part of "VOC Control Region 1" in the FRM referenced above should use B (entering A will give the same result), while those areas defined in the FRM as being part of "VOC Control Region 2" should use C (entering D or E will give the same result) -- MOBILE5 will correctly interpret any of these five letters in modeling the effects of reformulated gasoline. This is discussed in section 2.2.16. If reformulated gasoline is **not** being assumed in the modeling, then either a valid value for fuel volatility class, or a blank space, must still appear in order to maintain the positions of the remaining variables on the LAP record.

## 2.2.11 **MINIMUM and MAXIMUM DAILY TEMPERATURE**

### 2.2.11.1 Description

The minimum and maximum daily temperatures are used directly in MOBILE5 in the calculation of the diurnal portion of evaporative HC emissions, and in estimating the temperature of dispensed fuel for use in the calculation of refueling emissions. The temperatures used in calculating the temperature corrections to exhaust HC, CO, and NOx



emissions, the hot soak portion of evaporative emissions, and resting loss and running loss HC emissions are calculated by MOBILE5 on the basis of the minimum and maximum temperatures input here, unless overridden by the user.

#### 2.2.11.2 Options

The user must input values for the minimum and maximum ambient temperatures. The minimum temperature must be between 0°F and 100°F (-18° to 38°C), and the maximum temperature must be between 10°F and 120°F (-12° to 49°C), inclusive. The maximum temperature must be greater than or equal to the minimum temperature.

#### 2.2.11.3 Use in MOBILE5

Diurnal emissions in MOBILE5 are adjusted for the minimum and maximum temperatures provided as input, based on evaporative emission testing over a number of temperature ranges. The basic exhaust emission rates for HC, CO, and NOx are based on the nominal standard test temperature of 75°F (24°C). MOBILE5 calculates a temperature for each pollutant representing average emissions over the course of the day (based on the input minimum and maximum daily temperatures, a representative curve of temperature as a function of time of day, and the typical distribution of travel over the course of the day), and adjusts the exhaust emission factors for temperature effects accordingly.

Hot soak emissions at FTP conditions are based on a temperature of 82°F (28°C). MOBILE5 can calculate a temperature for the hot soak emissions, based on the minimum and maximum temperatures input here, and adjust the basic hot soak emission rates for temperature effects accordingly. Resting loss and running loss HC emissions are also dependent on temperature. As in the cases of exhaust and hot soak emissions, MOBILE5 can calculate appropriate average temperatures for use in estimating resting loss and running loss emissions, weighted to account for differing emission levels at different temperatures in the range of the minimum and maximum daily temperatures and the variation in travel frequency over the course of the day.

The model should be operated in this mode if the desired result is total daily emissions (emission factors representing entire days). The algorithm used in MOBILE5 to determine temperatures for correction of the above types of emissions on the basis of the input minimum and maximum temperatures takes into account both the typical 24-hour diurnal temperature profile for a day having the specified minimum and maximum, and the typical distribution of travel over the course of 24 hours. Thus the emission factors calculated in this way are appropriately weighted for both trips and emissions at different temperatures, resulting in factors that can be multiplied by daily vehicle miles traveled (VMT) when total daily emissions are the desired result.

The input value of ambient temperature can also be used to determine the temperature corrections for exhaust HC, CO, and NOx emissions, hot soak evaporative emissions, dispensed fuel temperature in the refueling emissions calculations, and resting loss and running loss emissions, through the use of the control flag TEMFLG (section 2.1.14). This is not recommended unless the modeling of a short time period, such as an hour, is being performed. Refueling emissions should always be modeled using the "full day" approach, not with hourly temperatures. Diurnal emissions can only be modeled by the "full day" approach, as the algorithm used is inaccurate over the very small temperature rises (1 to 5 °F) typical of a single hour.

If the input minimum temperature is less than 25°F (-4°C), or the calculated hot soak temperature is less than 40°F (4°C), evaporative emission factors will not be calculated. EPA does not have sufficient data to estimate evaporative emissions at low temperatures, and there is evidence that such emissions approach zero when temperatures are sufficiently low. The MOBILE5 output will include a warning message noting the lack of evaporative emission factor calculations if either of these temperature conditions occur. If the calculated running loss temperature is less than or equal to 40°F (4°C), no running loss emission factors will be calculated for similar reasons. Refueling emissions

will be calculated for any valid input temperatures. Finally, if the calculated exhaust emission correction temperature is less than or equal to 45°F (7°C), the exhaust emission factors will not be corrected for the effects of fuel volatility (RVP).

#### 2.2.11.4 Required Information

Minimum and maximum daily temperatures (°F).

#### 2.2.11.5 Changes Since MOBILE4.1

There have been no revisions to the temperature input data requirements since the release of MOBILE4.1.

#### 2.2.11.6 Guidance

The temperatures to be used here depend on the intended application of the results. Restrictions on these temperatures are: the minimum daily and the ambient temperatures must be between 0°F (-18°C) and 100°F (38°C), the maximum daily temperature must be between 10°F (-12°C) and 110°F (43°C), the maximum daily temperature must be greater than or equal to the minimum daily temperature, and the ambient temperature must be between the minimum and maximum daily temperatures (minimum ≤ ambient ≤ maximum). Guidance on the determination of appropriate temperatures for use in development of emission inventories for nonattainment areas appears in "Procedures for Emission Inventory Preparation, Volume IV: Mobile Sources," EPA-450/4-81-026d (revised), 1992.

### 2.2.12 **"PERIOD 1" RVP**

#### 2.2.12.1 Description

Evaporative and refueling emissions (and exhaust emissions, to a lesser extent) vary with fuel volatility. EPA's vehicle certification program and much of its emission factor testing use gasoline with volatility [as measured by Reid vapor pressure (RVP)] of 9.0 psi. MOBILE5 adjusts the emission factors to account for the effects of fuel with other than 9.0 psi RVP.

The value to be used for "period 1" RVP is the average in-use RVP of gasoline in the area to be modeled in the time before a volatility control program takes effect, or the years preceding a change in the controlled RVP level (such as occurred in most areas in 1992, when EPA's Phase I volatility control program was superseded by Phase II volatility control limits). The major function of having two RVP values as input, "period 1" and "period 2", is to allow the user to define a step change in fuel volatility as of a specific calendar year.

#### 2.2.12.2 Options

The value used for "period 1" RVP can be anywhere between 7.0 psi and 15.2 psi inclusive. However, for accurate and meaningful results, the guidance provided below should be followed.

#### 2.2.12.3 Use in MOBILE5

The "period 1" RVP is used in MOBILE5, for calendar years of evaluation prior to the user-specified "period 2" start year, to account for the effects of fuel volatility on emissions. Thus, the use of the appropriate value of RVP allows the construction of more accurate emission factors and a more accurate emission inventory. If the calendar year

of evaluation is the same or later than the specified "period 2" start year, then the "period 1" RVP input is ignored (in the sense that it will not have any impact on the emission factors for the evaluation year).

#### 2.2.12.4 Required Information

A value of RVP (in psi) representing the prevailing average fuel volatility for the geographic area of interest, either in the absence of volatility control requirements or before more stringent control requirements takes effect.

#### 2.2.12.5 Changes Since MOBILE4.1

There have been no revisions since the release of MOBILE4.1 to the definition or input requirements for this variable.

#### 2.2.12.6 Guidance

As with the temperature inputs discussed above, the intended use of the MOBILE5 run determines the season for which the average RVP should be ascertained. For ozone-related (summer season) modeling, use summer (July) RVP. For CO (winter season) modeling, use winter (January) RVP. Note that MOBILE5 does not model effects of RVP on exhaust emissions at temperatures of less than 45°F (7°C), and that no effects of fuel volatility greater than an RVP of 11.7 psi are modeled. If modeling of emission factors is being performed on a month-by-month basis, the value of RVP appropriate to each of the specific months being modeled should be used. It is not correct to average RVP values from different months or seasons together (since the effect of RVP on emissions is non-linear), or to use RVP from a season other than that used to determine the temperatures used in the emission factor modeling.

Further guidance on the determination of the appropriate values to use as input for fuel RVP is provided in "Procedures for Emission Inventory Preparation, Volume IV: Mobile Sources," EPA-450/4-81-026d (revised), 1992.

### **2.2.13 "PERIOD 2" RVP and "PERIOD 2" START YEAR**

#### 2.2.13.1 Description

EPA has issued rules requiring that fuel RVP during the ozone season be limited to 10.5 psi RVP in most parts of the country (roughly corresponding to ASTM Class C areas) during the summer ozone-season months in 1989-91 (Phase I volatility control), and to 9.0 psi RVP during the summer ozone-season months in 1992 and later (Phase II control), with generally proportional reductions in summer fuel maximum RVP in other States (roughly corresponding to ASTM Class A and B areas). MOBILE5 provides the ability to model the effects of an RVP control program, or a step-function change in RVP for any other reason, through specification of the "Period 2" RVP limit and the calendar year in which the requirement is effective.

#### 2.2.13.2 Options

The user must input values for the "period 2" RVP and "period 2" start year. The RVP value can be between 6.5 and 15.2 psi inclusive. The earliest allowable "period 2" start year is 1989.

#### 2.2.13.3 Required Information

The RVP level to be assumed for "period 2" and the first calendar year in which this RVP level is effective.

#### 2.2.13.4 Changes Since MOBILE4.1

There have been no revisions in the input or formatting of these two variables since the release of MOBILE4.1.

#### 2.2.13.5 Guidance

To model the effects of the Federal volatility control program issued by EPA, in which volatility is limited in the summer months (May through September), see the relevant Federal Register notices (54 FR 11868, March 22, 1989 for Phase I control and 55 FR 23658, June 11, 1990 for Phase II control), or contact your EPA Regional Office to determine the applicable RVP limits for a specific State and month. The interim (Phase I) controls were in effect during 1989, 1990 and 1991, and the final (Phase II) controls took effect beginning in the summer of 1992.

EPA will accept the use of the Federal RVP limits for a given area as the fuel RVP for the highway vehicle emission factors and inventory. However, greater accuracy is possible by using the results of local fuel survey RVP measurements, or by adjusting the regulated RVP limit to reflect the degree to which typical fuel RVP fall below the limits effective for areas and months with fuel survey data. For areas without fuel survey data, typical commercial fuel subject to an RVP limit of 9.0 psi can be assumed to have 8.7 psi RVP. For RVP limits of 7.8 psi or lower, no "margin of safety" should be assumed, since the cost of creating a safety margin at these lower volatility levels is greater. The margin can be estimated through interpolation for RVP limits between 7.8 and 9.0 psi. It is not correct to use the actual RVP limit in the base year and then to include a safety margin in modeling the projection years.

The effects of local (State, regional) fuel volatility control programs, which may be more stringent and/or take effect sooner than Federal controls, can be modeled by appropriate selection of values for "period 2" RVP and start year. To model the effect of a fuel volatility control program, use the proposed RVP limit as the value of "period 2" RVP, and the year in which the program takes effect as the "period 2" start year.

If no changes in fuel volatility are to be assumed, then the value of "period 1" RVP should be used for "period 2" RVP as well. In this case, with no change in RVP between "period 1" and "period 2," the period 2 start year should be set at 2050 (50).

### 2.2.14 OXYFLG

#### 2.2.14.1 Description

There are three optional flag settings that appear as the last three variables of the LAP record. The first of these is OXYFLG, a flag that tells MOBILE5 whether or not the user intends to model the impact of oxygenated fuels on emissions. If this flag is missing, MOBILE5 will interpret its value as "1", assume no oxygenated fuels, and will not expect to see additional oxygenated fuel input data.

#### 2.2.14.2 Options

This flag has two possible values, 1 and 2. If OXYFLG = 2, then the user must supply an additional input record containing data on the average oxygen content of two types of oxygenated fuels (gasoline/alcohol and gasoline/ether blends), the market penetration of each type of oxygenated fuel, and whether or not an RVP waiver, or allowance, (+1.0 psi) for alcohol-based oxygenated fuels is in effect in the area being modeled. See section 2.3.9 for information on the placement and content of this record.

If OXYFLG = 1, then the model assumes that no oxygenated fuel information will be included in the remainder of the input data file, and no effects of fuel oxygen content on emissions will be modeled. If this flag is missing, it will be interpreted as "1" by MOBILE5, and no oxygenated fuels program will be assumed in the modeling.

#### 2.2.14.3 Required Information

No information is required; as noted above, if this flag is not present at the end of the LAP record (following the "period 2" RVP start year), it is interpreted as being set to 1. If the effects of an oxygenated fuels program on exhaust emissions are to be included in the modeling, this flag must be present and set to 2.

#### 2.2.14.4 Use in MOBILE5

The use of oxygenates in gasoline, whether in the form of alcohols or ethers, can affect both exhaust and evaporative emissions. MOBILE5 incorporates the effects of fuel oxygen content, as specified by the modeler, on emissions. If an RVP waiver is in effect for alcohol-based oxygenated fuels, such that the volatility limit for such fuels is higher than that for straight gasoline, then this "RVP boost" will also result in slight changes in exhaust HC, CO, and NOx emission factors relative to the case where no waiver is in effect.

#### 2.2.14.5 Changes Since MOBILE4.1

The location and values of the OXYFLG are unchanged since the release of MOBILE4.1. The effects of oxygenate content on exhaust emission factors and on the composition of evaporative emissions is modeled by MOBILE5 (only the effects on exhaust CO emissions were modeled in MOBILE4.1).

#### 2.2.14.6 Guidance

If oxygenated fuels are known to have two percent or greater market penetration in the area being modeled, then this should be reflected in the highway vehicle emission factors and emission inventories prepared by States (or local or regional entities) for SIPs in response to the requirements of the 1990 CAA amendments. If reformulated gasoline is also being assumed in the modeling, then some of the user inputs detailing the oxygenated fuels program may be overridden by reformulated gasoline assumptions, particularly in the summer season. Additional information on the modeling of reformulated gasoline effects on emissions, and the interaction of oxygenated fuels programs and reformulated gasoline assumptions in the modeling, is provided in section 2.2.16.

### 2.2.15 DSFLAG

#### 2.2.15.1 Description

The second optional flag at the end of the LAP record is DSFLAG, which instructs MOBILE5 as to whether the user is supplying alternate diesel sales fractions by model year for LDVs and LDTs. As in the case of OXYFLG, if this flag is missing it will be interpreted as having a value of "1," and the model will not expect to find alternate diesel sales fractions as part of the model input data.

#### 2.2.15.2 Options

This flag has two possible values, 1 and 2. If DSFLAG = 2, then the user must supply 50 diesel sales fractions (25 each for LDVs and LDTs, for model years from the calendar year of evaluation to 25+ model years ago) for each

scenario of the run. The placement of these fractions, format requirements, and additional information appear in section 2.3.12.

**NOTE:** If the user wishes to supply alternate diesel sales fractions by model year for LDVs and LDTs, then the entire LAP record must appear in the Scenario data section for each scenario of the run. In other words, if DSFLAG = 2 is selected, LOCFLG = 1 must be selected. The reasons for this are discussed in section 2.3.10. If the input file violates this condition by including DSFLAG = 2 on the LAP record, but contains only one LAP record for all scenarios, an error message will be produced and the run will not be executed.

#### 2.2.15.3 Required Information

No information is required; as noted above, if this flag is not present at the end of the LAP record (following the "period 2" RVP start year and the value of OXYFLG), it will be interpreted as being set to 1. If alternate diesel sales fractions by model year for LDVs and LDTs are to be included in the modeling, this flag must be present and set to 2, and the entire LAP record must appear in the Scenario data section.

#### 2.2.15.4 Use in MOBILE5

MOBILE5, like earlier versions of the model, uses a single set of registration distributions by age and annual mileage accumulation rates to describe all LDVs (gasoline and diesel vehicles combined), and another such set to describe all LDTs. The use of model-year-specific diesel sales fractions allows MOBILE5 to internally split the LDVs and LDTs into gas and diesel sub-categories, which have distinctly different emission rates and behaviors.

#### 2.2.15.5 Changes Since MOBILE4.1

There have been no changes to the user input of alternate diesel sales fractions by model year since the release of MOBILE4.1.

#### 2.2.15.6 Guidance

Sales of diesel powered light-duty vehicles and trucks underwent a surge in the late 1970s and early 1980s, peaking at 5.9 percent of LDV sales nationwide in the 1981 model year, and at 9.3 percent of LDT sales nationwide in the 1982 model year. Since then diesel sales have fallen precipitously, to virtually zero for LDVs (less than 0.05 percent of all LDV sales in model years 1988 through 1990) and to about 0.2 percent of LDTs since the 1988 model year.

To assist those areas having access to vehicle registration data that distinguishes between gas and diesel LDVs and LDTs, provisions exist in MOBILE5 to allow the user to input alternate (locality-specific) diesel sales fractions by model year. These data must be supplied for every calendar year of evaluation: Since they apply to vehicles of ages 1, 2, 3, ..., to 25+, different sets of fractions are required for each calendar year for which emission factors are to be modeled.

The input of alternate diesel sales fractions is discussed in section 2.3.10. Areas having the necessary information for development of these sales fractions by model year are encouraged to incorporate their own diesel sales fractions by model year for use in the construction of the base year inventories. EPA will accept the use of the built-in national average diesel sales fractions in modeling emission factors for use in constructing the mobile source portion of the base and projection year emission inventories developed for SIP purposes.

## **2.2.16 ADDITIONAL FUEL PARAMETER FLAGS**

### 2.2.16.1 Reformulated Gasoline

#### 2.2.16.1.1 Description

The third optional flag at the end of the LAP record is RFGFLG, which instructs MOBILE5 as to whether the user is modeling the impact of reformulated gasoline (RFG) on the emission factors. As in the case of OXYFLG and DSLFLG, if this flag is missing it will be interpreted as having a value of "1" and no reformulated gasoline effects will be included in the modeling.

The effects of RFG on the calculated emission factors in MOBILE5 are based on the "simple model" developed for the RFG rulemaking supporting analyses. Future MOBILE models may be updated to correspond to the provisions of the "complex" model. In MOBILE5, the principal RFG effects are based on fuel volatility (RVP) reductions and oxygen content. Another effect representing the impact of other fuel parameters (e.g., sulfur content) is also applied to the exhaust emission factors.

The adjustments in MOBILE5a were made to reflect the proposed rule for reformulated gasoline. The adjustments in MOBILE5b are made to reflect the final rule for reformulated gasoline. When the user specifies that RFG is to be assumed in the emission factor calculations, both Phase 1 and Phase 2 RFG are modeled, starting in calendar years 1995 and 2000 respectively. The volatility limits are 7.1 and 8.0 psi RVP under Phase 1 for control regions 1 and 2 (fuel volatility classes A/B and C/D/E respectively), and 6.7 psi RVP under Phase 2 for both regions. The user specifying RFG must specify the fuel volatility class (see section 2.2.10), which is used to determine the RVP level for both Phase 1 and 2 RFG. The minimum oxygen content (2.1%) is the same for all areas. The effects of other fuel parameters on emissions are greater under Phase 2 RFG. The user is encouraged to consult the final rulemakings for fuel volatility controls and for RFG for additional information.

#### 2.2.16.1.2 Options

If the effects of reformulated gasoline on emissions are to be included in the modeling, this flag must be set equal to 2. If reformulated gasoline is not to be assumed in the modeling, this flag can be set to 1 or left blank (which will be interpreted by MOBILE5 as being set to 1).

#### 2.2.16.1.3 Required Information

The modeling of the effects of reformulated gasoline on emissions is handled entirely within MOBILE5. No additional input data (beyond entering the correct fuel volatility class on the LAP record as described in section 2.2.10) is required when RFGFLG = 2.

#### 2.2.16.1.4 Changes Since MOBILE4.1

This flag is new in MOBILE5.

#### 2.2.16.1.5 Guidance

Those areas required to be supplied with reformulated gasoline under the 1990 amendments to the Clean Air

Act should account for this in projection year emission factor modeling by setting RFGFLG = 2. The effects of reformulated gasoline on emissions are a function of season -- the effects are different in summer and winter. The season assumed is controlled by the selected month of evaluation (January = winter season, July = summer season), which can be specified by the MOBILE5 user in the Scenario section of the input data (see section 2.3.6).

In summer (July) emission factor scenarios, the user input RVP and assumed mix of alcohol and ether blends are not important, since the RVP and oxygen content of reformulated gasoline are regulated. When RFG is modeled and the season is summer (July emission factors), the user-supplied RVPs and oxygenated fuel data are overridden by the provisions of the RFG rules.

In winter (January emission factor) scenarios, however, RVP is not regulated. The user-specified RVP is used in winter (January), but is increased based on the assumed market share of alcohol blends, which are assumed to receive an RVP waiver (i.e., to be permitted to have RVP that exceeds by up to 1.0 psi that specified by the user for straight gasoline). In winter (January) emission factor scenarios, the default MOBILE5 market share assumed for alcohol blends and the assumption of an RVP waiver for such blends that is used in modeling the effects of reformulated gasoline can be overridden by the user through use of the OXYFLG on the LAP record and the input of an oxygenated fuels descriptive record. The average oxygen content input by the user for reformulated gasoline areas in this situation must be at least 2.1% and have a net 100% market share.

#### 2.2.16.2 Detergent Gasoline

##### 2.2.16.2.1 Description

As required by Section 211(l) of the Clean Air Act, EPA established a regulatory program that requires all gasoline in the U.S. to contain detergent additives that are effective in controlling the impact of fuel injector deposits (PFID) and intake valve deposits (IVD) on vehicle exhaust emissions. These deposits increase exhaust emissions by interfering with the normal control and delivery of the fuel and air mixture to the combustion chamber. The detergent program is to be implemented in a step-wise fashion. The interim requirements, effective since January 1, 1995, required the use of detergents in all gasoline, and established the basic recordkeeping and other enforcement-related requirements of the detergent program (59 FR 54678, November 1, 1994). However, the interim program did not include rigorous performance tests and standards. The detergent certification program requires that, beginning August 1, 1997, all gasoline must contain detergents that satisfy specific vehicle-based performance testing criteria, using industry-standard test procedures and EPA-specified standards, to demonstrate the effective control of IVD and PFID (61 FR 35310, July 5, 1996). Because of the less stringent requirements under the interim program, it is expected to result in 50 percent of the total emissions benefits which will be realized under the certification program.

In MOBILE, the phase-in of the detergent program is assumed to begin January 1, 1995. In that year, and until the certification program becomes mandatory on August 1, 1997, it is assumed that 50 percent of the total detergent program benefits will be achieved. Beginning August 1, 1997, all gasoline is assumed to contain fully effective PFID/IVD control additives, resulting in the realization of the full emissions benefits of the detergent program.

The effects of the use of inadequately-additized gasoline on exhaust emissions are determined from the combination of the number of vehicles affected by deposits and the emissions effects of deposits on those vehicles. In MOBILE, it is assumed that, before the implementation of regulatory controls, 1.9% of vehicles with fuel injection systems experienced deposits on their injectors which increased exhaust emissions. These injector deposits were estimated to increase HC, CO, and NO<sub>x</sub> emissions by 2.5%, 1.65%, and 0%, respectively. Also, it is assumed that, before the implementation of regulatory controls, 18% of vehicles experienced deposits on their intake valves which increased exhaust emissions. These valve deposits were estimated to increase HC, CO, and NO<sub>x</sub> emissions by 5.4%,



6.5%, and 11.8%, respectively. It is assumed that the use of detergent additives in gasoline will eliminate these deposits.

#### 2.2.16.2.2 Options

The effects of gasoline detergent additives on emissions are automatically assumed to begin phasing in starting in calendar year 1995. If the default effects of gasoline detergent additives on emissions are to be assumed in the modeling, this flag (DTGFLG) can be set to 1 or left blank (which will be interpreted by MOBILE5 as being set to 1). However, if the user wishes to specify the detergent gasoline parameters, the DTGFLG must be set to 2. In this case, the user must include all of the detergent gasoline parameters in the Detergent Gasoline Parameter record as part of the Scenario section.

#### 2.2.16.2.3 Required Information

No information is required; as noted above, if the DTGFLG is not present at the end of the LAP record, (following the value of RFGFLG), it will be interpreted as being set to 1. If alternate gasoline detergent additive parameters are to be included in the modeling, the DTGFLG must be present and set to 2. In this case, the user must include all of the detergent gasoline parameters in the Detergent Gasoline Parameter record as part of the Scenario section.

#### 2.2.16.2.4 Changes Since MOBILE4.1

This flag is new in MOBILE5b.

#### 2.2.16.2.5 Guidance

The requirement to include detergent additives in all gasoline will reduce emissions from mobile sources. The default values in MOBILE5b reflect the detergent gasoline final rule (61 FR 35309, July 5, 1996).

### **2.2.17 TRIP LENGTH DISTRIBUTION RECORD**

The trip length distribution record, required if SPDFLG = 3 or 4 (see section 2.1.5), is discussed in section 2.3.12. This record must appear in the One-time Data section if SPDFLG = 4 (one set of trip length distributions applied for all scenarios in the MOBILE5 run), or, in the Scenario section if SPDFLG = 3 (a different trip length distribution record is applied for each scenario within the MOBILE5 run). The information provided in section 2.3.12 applies in both cases. This record is not required if SPDFLG = 1 or 2.

### **2.2.18 BY MODEL YEAR INCLUSION VECTOR**

#### 2.2.18.1 Description

If the user chooses to have MOBILE5 provide additional output tables showing the relative contribution of vehicles of each model year to the average fleet emission factor, for each vehicle type, then an additional input record that tells MOBILE5 which vehicle types the additional output is requested for and what additional information is requested must appear in the One-Time Data section of the input. This option is selected by setting the value of OUTFMT to 5 (see section 2.1.15). This record is essentially a string of "yes/no" flags, as described below. If used,

it appears as the last input record in the One-Time Data section.

#### 2.2.18.2 Options

If the "by model year" option has been selected, then the modeler must specify for which vehicle types the additional output information is desired. (Since running MOBILE5 in the "by model year" mode slows program execution and increases the output file size dramatically, it is suggested that the modeler carefully consider the need for the information provided before electing this option, and only select only those vehicle types and pollutants for which the model year-specific information is desired.)

The user also has the option of selecting two kinds of "by model year" output: One consisting only of the model year-specific emission factors, and one which also provides model year-specific I/M credits (assuming that an I/M program has been included in the modeling).

#### 2.2.18.3 Required Information

If by model year output is requested, then the last record in the One-Time Data section consists of ten integer flags, each having a value of "1" or "2." The first eight instruct MOBILE5 whether by model year emission factor output is to be included in the output (2) or not (1) for each vehicle type, in this order: LDGV, LDGT1, LDGT2, HDGV, LDDV, LDDT, HDDV, and MC. The last flag instructs MOBILE5 whether the by model year output for I/M program effects is desired, coded such that 1 = "No" and 2 = "Yes."

The format of this record is:

**8I1,1X,I1**

An example is shown below:

22211111 2

In this example, by model year emission factors and I/M credit information are requested for light-duty gas vehicles and both classes of light-duty gas trucks; no by model year information is requested for the other five vehicle types.

#### 2.2.18.4 Changes Since MOBILE4.1

The by model year option in MOBILE5 has been revised to eliminate the option for tables summarizing tampering rates and offsets on a model year-specific basis. However, using a MOBILE4.1 input file containing a value for the eliminated flag will not affect the running of MOBILE5.

#### 2.2.18.5 Guidance

This option is provided for special modeling purposes. There is no need for this option to be exercised in the development of mobile source emission factors and inventories. Due to the increased computations and output required to exercise this option, selecting it results in a dramatic increase in the time necessary to execute MOBILE5 runs and in the size of the output files produced. The contents of the additional by model year output are described in detail in section 3.3.5, and are illustrated by an example in Chapter 5. Modelers with a need for such information, and desiring further information than is provided in this section, are advised to contact EPA for assistance.

This concludes the One-time Data section.

### 2.3 SCENARIO SECTION

The Scenario data follow the One-time Data in the MOBILE5 input stream, and are used to assign values to those variables that specifically define each of the scenarios to be evaluated. It consists of one to ten records (depending on the values assigned to the flags in the Control section, to the optional flags OXYFLG and DSFLAG on the LAP record, and to the "region" variable on the scenario descriptive record).

The user can calculate emissions for one or more scenarios. Each scenario is associated with one group of Scenario section records. Each MOBILE5 run must contain at least one scenario record. The program terminates execution upon detecting an end-of-file condition.

The first record, consisting of those variables discussed in sections 2.3.1 through 2.3.6, must be included for every scenario of every MOBILE5 run. The second possible record, required only if the value assigned to "region" on the first scenario record is 4, specifies information on the California low emission vehicle (LEV) program for the area being modeled. The third possible record, required only if LOCFLG = 1, consists of local area parameters to be applied for this scenario only (see sections 2.1.13 and 2.2.8 through 2.2.16). The fourth possible record, required only if the user has elected to model the effects on exhaust emissions of an oxygenated fuel program by setting OXYFLG = 2 on the LAP record, consists of the oxygenated fuels descriptive record (see section 2.3.9). The fifth through seventh possible records, required only if the user has chosen to input diesel sales fraction data for LDVs and LDTs by setting DSFLAG = 2 on the LAP record, contain the alternate diesel sales fractions (see section 2.3.10). The eighth possible record, required only if VMFLAG = 2, consists of the VMT mix to be applied for this scenario only (see sections 2.1.6 and 2.2.2). The ninth possible record, required if SPDFLG = 3, consists of the alternate trip length distribution records to be applied for this scenario only (see section 2.3.12). The tenth and last possible record, required only if ALHFLG = 2 or 3, consists of either six or ten additional input values used to correct certain exhaust emission factors (see sections 2.1.10 and 2.3.13).

The first scenario record, called the scenario descriptive record, is mandatory for all MOBILE5 runs. It contains the following information:

1)	Region (1, 2, 3, or 4)	See section 2.3.1
2)	Calendar year of evaluation	See section 2.3.2
3)	Average speed(s)	See section 2.3.3
4)	Ambient temperature	See section 2.3.4
5)	Operating mode fractions	See section 2.3.5
6)	Month of evaluation	See section 2.3.6

The standard format for this record, when only one value of average speed is specified and is applied to all eight vehicle types (SPDFLG = 1, 3, or 4), is:

**I1,1X,I2,5(1X,F4.1),2X,I1**

The alternate format, used when different average speeds are specified for each of the eight vehicle types (SPDFLG = 2), is:

**I1,1X,I2,12(1X,F4.1),2X,I1**

It is possible for the user to include comments or other descriptive information outside of the required MOBILE5 input parameters, in order to aid in documenting and interpreting MOBILE5 input files. This is illustrated

in the example input files included in Chapter 5 and on the program diskette. Such comments on the Local Area Parameter input record must not begin before (to the left of) column 53. Comments on scenario section input records must not begin until at least 15 columns after (to the right of) the last input variable. These restrictions are necessary to avoid generating error messages that will occur as a result of internal diagnostic checks that use these spaces.

Table 2.3-1 summarizes the Scenario section input record(s), including the variable names, codes, and allowable values for each field.

### 2.3.1 REGION

#### 2.3.1.1 Description

The first specification required in the first record of the Scenario data section is the region for which emission factors are to be calculated.

#### 2.3.1.2 Options

MOBILE5 provides four options for region: low-altitude (value of 1) and high-altitude (value of 2) are the same as in MOBILE4.1. Low-altitude emission factors are based on conditions representative of approximately 500 feet above mean sea level (+500 ft MSL), and high-altitude factors are based on conditions representative of approximately +5500 ft MSL. When high-altitude region emission factors are requested by setting REGION = 2, MOBILE5 also includes vehicles that were built to meet specific high-altitude area emission standards. Values of 3 or 4 are used to indicate that the California LEV program is to be included in the modeling, and are applicable for low-altitude areas only.

MOBILE5 does not calculate California emission factors. Two additional options have been added to the REGION input variable, both dealing with the California Air Resources Board's vehicle program in which the introduction of transitional low emission vehicles (TLEVs), low emission vehicles (LEVs), ultra low emission vehicles (ULEVs), and zero emission vehicles (ZEVs) is required beginning in the late 1990s. Both of these new options are applicable to low-altitude areas only. The options for REGION are summarized below:

<u>Value</u>	<u>Action</u>
1	Low-altitude
2	High-altitude
3	California LEV program, with emission credits based on assuming a specific I/M program (as discussed below and in Appendix 2B) for LEVs
4	California LEV program, with emission credits based on an I/M program other than as described below and in Appendix 2B, and/or with a different start year for the phase-in of LEVs to begin

Values of 3 or 4 are used to control the exhaust emission estimates for California LEV program vehicles. A value of 3 may be used if (1) the user wishes to have the LEV program begin in the 1994 model year, and (2) the I/M program applied to these LEV program vehicles will meet the specific requirements outlined in section 1.3.6 and Appendix 2B.

If the value used for region is 3, this specific I/M program overrides the exhaust portion of any I/M program

specified in the One-time Data section for the LEV program vehicles in the model years that are affected by the LEV program. However, in order to receive credit for the evaporative emissions benefits of functional pressure and purge tests of the evaporative emission control system, these tests must still be specified in the One-time Data section (see sections 2.1.11 and 2.2.6). In addition, the I/M program descriptive input record is still required in order to correctly account for the impact of I/M on pre-Tier 1 vehicles.

A value of 4 should be used for region if (1) the user desires to have the LEV program start later than the 1994 model year, regardless of the type of I/M program, or (2) the user wishes to estimate emission factors based on assuming that an I/M program not meeting the specific description of Appendix 2B (or an equivalent program as determined by EPA) is in place. In this case, I/M program credits are based on the I/M program specified by the user in the One-time Data section. If a value of 4 is used for region, the user must also include an LEV program parameter record, as discussed in section 2.3.7.

It is important to note that if the user specifies the California LEV program be modeled, by setting the value of this variable to 3 or 4, only future vehicles meeting the California program standards are assumed in the modeling. In other words, specifying the California LEV program does **not** include modeling of California standards for vehicles for any model years preceding the beginning of the LEV program. Thus emission factors for California areas cannot be modeled using MOBILE5.

#### 2.3.1.3 Use in MOBILE5

The region selected determines whether the MOBILE5 emission factor calculations will be based on low-altitude or high-altitude basic emission rates, and if applicable whether low-altitude or high-altitude I/M credits will be used. (Low- and high-altitude I/M credits are supplied in a separate input file of alternate credits. See section 2.2.5.) With the addition of two levels, the region selected also determines if the California LEV program is to be modeled, and if so, with what assumptions regarding I/M credits for those vehicles.

#### 2.3.1.4 Required Information

A value of 1 (low-altitude), 2 (high-altitude), 3 (low-altitude, California LEV program, and I/M credits based on the specific program discussed in Appendix 2B or an approved equivalent), or 4 (low-altitude, California LEV program, and I/M credits based on a program other than the specific program discussed in Appendix 2B or an approved equivalent) must be entered for the region. If "4" is selected as the value of the region variable, the user must also include an LEV Program Parameter Record, which will immediately follow the mandatory scenario descriptive record (region, calendar year, speed, etc.) and is described in section 2.3.7.

#### 2.3.1.5 Changes Since MOBILE4.1

There have been no revisions to how or where the REGION variable is input to the model since the release of MOBILE4.1. Values of 1 and 2 for REGION are exactly the same as in MOBILE4.1. The addition of values of 3 or 4, for modeling the impact of the California LEV program, is new in MOBILE5.

In MOBILE5, for vehicle types LDGV, LDGT1, and LDGT2, the emission rates for LEVs (vehicles meeting the emission standards for the California low emission vehicle program) are calculated based, in part, on the emission rates for calendar year 1999 non-LEV vehicles of the corresponding vehicle type. Therefore, if NEWFLG is set to 2, 4, or 6 and new basic exhaust emission rates are entered for one of these vehicle types for calendar year 1999, users may notice a change in the emission factors reported for that vehicle type for any evaluation year in which vehicles of that type are modeled as LEVs (REGION variable 3 or 4).

### 2.3.1.6 Guidance

For the majority of MOBILE5 applications, low-altitude is the appropriate choice. For those areas designated as high-altitude by EPA for mobile source regulatory purposes only, generally those counties that lie "substantially" above +4000 ft MSL, high-altitude should be selected. A list of those counties EPA has designated as high-altitude appears in §86.088-30, paragraphs (a)(5) (ii) and (iv), Code of Federal Regulations.

The use of the California LEV program options in MOBILE5 is discussed further in section 2.3.7 and in Appendix 2B. Areas that opt-in to the LEV program will use values of 3 or 4 for the region variable in projection year inventories, depending on the I/M program to be operated. Again, the selection of one of the California LEV options will not affect the emission rates and other information used in calculating emission factors for vehicles of model years 1993 or earlier. In other words, selecting a California LEV option here will not provide emission factors for the California fleet -- the emission factors will be based on a Federally-certified fleet through model year 1993, with LEV program vehicles being phased in after the 1993 model year.

## 2.3.2 CALENDAR YEAR

### 2.3.2.1 Description

The value used for calendar year in MOBILE5 defines the year for which emission factors are to be calculated. It is frequently referred to as the calendar year of evaluation.

### 2.3.2.2 Options

MOBILE5 has the ability to model emission factors for the years 1960 through 2050 inclusive.

### 2.3.2.3 Required Information

A value [the last 2 digits of the calendar year of evaluation (range 60-99 and 00-50)] must be entered.

### 2.3.2.4 Changes Since MOBILE4.1

There have been no revisions to this variable or how it is input to the model since the release of MOBILE4.1.

### 2.3.2.5 Guidance

Different uses of the emission factors calculated by MOBILE5 require special treatment. The base year (1990) inventories are to be based on a typical day in the pollutant season, most commonly summer for ozone and winter for CO. MOBILE5 provides the option for calculating emission factors as of January 1 or July 1 of the calendar year specified. This eliminates the need (in most cases) to interpolate between the results of two MOBILE runs in order to obtain representative summertime emission factors. Special care must be taken, however, in using interpolated results from the model, especially when estimating July emission factors in a calendar year that is followed immediately by a major change in some control program element (such as fuel volatility, or I/M program specification). Users should consult the guidance provided in section 2.3.6 (MONTH) before using interpolated emission factors.

CO inventories generally should be based on emission factors from a single calendar year of evaluation. For example, if the three-month period for which CO emissions are being modeled was December 1989 and January and

February 1990, the use of 1990 for calendar year would be appropriate. If that three-month period is instead November 1990 - January 1991, then calendar year 1991 emission factors would be more appropriate. Questions regarding the best calendar year to use for CO modeling, if not addressed by the examples above, should be addressed to the appropriate EPA Regional Office.

Similar instructions apply to the development of reasonable further progress (RFP) inventories. For modeling of specific episode days, the best results will be obtained by interpolating exactly to the day being modeled. In attainment demonstrations, it is acceptable to account for fleet turnover through November 15 of the year being modeled (which can be done by interpolation of emission factors for January 1 of the year being modeled and January 1 of the following year).

### **2.3.3 SPEED**

#### **2.3.3.1 Description**

Emission factors vary considerably with the average speed assumed. The value(s) input for speed in MOBILE5 will have a significant impact on the resulting emission factors for exhaust and running loss emissions. The speed correction factors have been revised since MOBILE4.1 for the mid-range of speeds (between 19.6 and 55 mph). The general curve describing HC and CO emission rates as functions of speed displays very high g/mi emission rates at very low speeds, with emissions decreasing (sharply at first, then more slowly) as average speed increases, until minimum emissions are reached at around 48 mph. In MOBILE5, the same emissions are assumed for all speeds from 48 to 55 mph for HC and CO. Above 55 mph, further increases in speed result in increased emissions. The behavior of NO<sub>x</sub> emissions as a function of speed have also been revised in MOBILE5.

In MOBILE5, "speed" refers to the average speed of vehicles over trips. This speed is simply the total trip distance divided by the total trip time. All trips in MOBILE5 assume a mix of idle, accelerations, decelerations, and cruises. Lower average trip speeds assume more stop-and-go driving, with more idle time and less steady-speed cruise time. Higher average speeds assume increased cruise operation, with decreased idle time and stop-and-go travel. As a result, MOBILE model results are most applicable to scenarios where vehicles are being operated over a variety of modes and are least appropriate for conditions where all vehicle operation is in a single mode (e.g., cruise) at a given speed.

EPA is continuing to evaluate new information on the behavior of exhaust emissions as a function of speed. The revisions in MOBILE5 have the effect of flattening the slope of the emissions-vs.-speed curves in the 19.6-48 mph range of speed for HC and CO emissions; in other words, the decrease in emissions with increasing speed is less pronounced in MOBILE5 than in MOBILE4.1. This revision agrees well with the data EPA has evaluated on emissions at different average speeds.

#### **2.3.3.2 Options**

One average speed can be specified for all vehicle types (SPDFLG = 1), or eight average speeds, one for each vehicle type, can be specified (SPDFLG = 2). MOBILE5 will calculate emission factors for average speeds of 2.5 to 65.0 mph, in increments of 0.1 mph. If a speed below 2.5 mph is input, a warning message is issued by MOBILE5 and 2.5 mph is used in the calculations. Similarly, if a speed above 65 mph is input, a warning message is issued and 65.0 mph is used in the calculations. The range of average speeds for which emission factors can be calculated (2.5 to 65 mph) is the same as that used in MOBILE4.1.



### 2.3.3.3 Use of Average Speed in MOBILE5

The data base on which all emission factor calculations are based is developed from vehicle test results at FTP conditions, including the average speed of 19.6 mph. MOBILE5 adjusts the emission factors for speeds other than 19.6 mph (20 mph for HDGVs and HDDVs) through the use of speed correction factors. Running loss HC emissions also vary with average speed, and that variation is reflected in the running loss emission factors produced by MOBILE5.

### 2.3.3.4 Required Information

The modeler must supply either a single value of average speed which is assumed to apply to all vehicles (if SPDFLG = 1, 3, or 4), or eight values of average speed (one for each regulated vehicle class, if SPDFLG = 2) in the following order: LDGV, LDGT1, LDGT2, HDGV, LDDV, LDDT, HDDV, MC.

### 2.3.3.5 Changes Since MOBILE4.1

The choices available (one average speed or eight vehicle-specific average speeds) and the associated data format requirements are unchanged from MOBILE4.1. As noted above (section 2.3.3.1), the correction factors applied to the emission factors for average speeds in the "mid-speed" range of 19.6-48 mph have been revised for MOBILE5. This also has the effect of changing the speed correction factors for average speeds of 48 to 65 mph.

### 2.3.3.6 Guidance

The driving cycle is intended to be representative of driving conditions typical of a standard commute in an urban area. Thus the use of 19.6 mph as the average speed applicable to all vehicle types is appropriate for approximate analysis of emissions from traffic in urban areas as a whole. However, such an approach is not suitable for SIP-related inventory preparation. Instead, vehicle miles traveled (VMT) should be consolidated into at least three average speed categories, and MOBILE5 used to estimate emission factors for each of those categories.

The average speed of the transient test cycle used for heavy-duty engine certification is 20 mph, which is representative of urban driving overall for these vehicles. Use of 19.6 mph as the average speed for all vehicles therefore leads to application of a very small speed correction factor to the HDGV and HDDV emission factors.

For some applications of MOBILE5, a single value other than 19.6 mph for average speed might be most appropriate. For example, to model emission factors typical of limited access highways, the use of a speed in the 55 to 65 mph range for all vehicle types would be appropriate.

When, as in SIP-related inventory preparation, MOBILE5 runs are required using speed(s) representative of certain areas (e.g., subsets of urban areas, specific highway links) or of certain times of day, there are often speed data available from local, regional, or State transportation planning agencies. The prediction of average speeds in the future is difficult, and may be a critical factor in some areas' ability to project compliance with SIP commitments and air quality standards. A discussion of how average speeds can be estimated from available data sources and additional guidance on the determination of average speeds for use in highway vehicle emission inventory development is provided in "Procedures for Emission Inventory Preparation, Volume IV: Mobile Sources," EPA-450/4-81-026d (revised), 1992.

## 2.3.4 AMBIENT TEMPERATURE

### 2.3.4.1 Description

Emissions vary considerably with ambient temperature. The value of temperature used to calculate the temperature correction factors for exhaust emissions, hot soak evaporative emissions, refueling emissions, and resting loss and running loss emissions will significantly affect the resulting emission factors.

If TEMFLG = 1 (see section 2.1.14), the temperature used to adjust the exhaust emission factors for all three exhaust pollutants, the hot soak component of evaporative emissions, the displacement component of refueling emissions, and resting loss and running loss emission factors will be calculated by MOBILE5 on the basis of the input minimum and maximum daily temperatures. The ambient temperature specified here will not be used. However, in all cases the value of ambient temperature must be between the values of minimum and maximum daily temperature.

If TEMFLG = 2, the value of ambient temperature specified here will be used as the basis of the temperature correction factors for all exhaust emissions, hot soak evaporative emissions, refueling emissions, and resting loss and running loss emissions. The input values for minimum and maximum daily temperatures will still be used in calculating the diurnal component of evaporative emissions. If the specified ambient temperature is inconsistent with the minimum and maximum daily temperatures (e.g., 20°F ambient with 60° minimum and 84°F maximum), an error message will result and processing of the current scenario will be stopped.

#### 2.3.4.2 Options

The ambient temperature specified can range from 0°F (-18°C) to 110°F (43°C). If a temperature less than 0°F is input, a warning message will be issued, and 0°F will be used in the calculations (if TEMFLG = 2). Similarly, if a temperature greater than 110°F is input, a warning is issued, and 110°F is used in the calculations (if TEMFLG = 2).

#### 2.3.4.3 Use of Ambient Temperature in MOBILE5

The basic emission rates that underlie the emission factor calculations are developed from emission data from vehicles tested at FTP conditions, at a nominal test temperature of 75°F (24°C). MOBILE5 uses temperature correction factors to correct exhaust emission factors to temperatures other than 75°F. Temperature corrections are also applied to the hot soak component of evaporative HC emissions. Refueling, resting loss, and running loss emissions are all functions of temperature. If the value of TEMFLG = 2, the value input here for ambient temperature is used to determine these correction factors.

#### 2.3.4.4 Required Information

A value of ambient temperature in degrees Fahrenheit (°F).

#### 2.3.4.5 Changes Since MOBILE4.1

There have been no revisions to this variable's use or input data format requirements since the release of MOBILE4.1.

#### 2.3.4.6 Guidance

EPA generally recommends that the minimum and maximum daily temperatures be used to determine the temperatures for corrections to the emission factors if daily average emissions are to be estimated, rather than hour-by-hour emissions.

If this ambient temperature is used instead, the value specified depends in large measure on the purpose for which MOBILE5 is being used. Additional information and guidance on the determination of appropriate temperature values for use in SIP-related emission inventory preparation appears in "Procedures for Emission Inventory Preparation, Volume IV: Mobile Sources," EPA-450/4-81-026d (revised), 1992.

The ambient temperature logically must be between the minimum and maximum temperatures. This is particularly important when HC emission factors are being modeled, since minimum and maximum temperatures are used in the evaporative emission component of those calculations, and the evaporative and exhaust components of the emission factor should be estimated on a consistent basis. Modeling of CO emission factors is more likely to focus on times with cooler temperatures, when most violations of the National Ambient Air Quality Standard (NAAQS) for CO occur.

### **2.3.5 OPERATING MODES (PCCN, PCHC, PCCC)**

#### 2.3.5.1 Description

One important determinant of emissions performance is the mode of operation. EPA's emission factors are based on testing over the FTP cycle, which is divided into three segments (referred to as "bags"), each with differing associated emissions performance. The bags correspond to operating modes:

<u>Bag</u>	<u>Operating Mode</u>
1	Cold start
2	Stabilized
3	Hot start

Emission data from each of these bags reflect the fact that emissions generally are highest when a vehicle is in cold-start mode: the vehicle, engine, and emission control equipment (particularly the catalytic converter) are all at ambient temperature and thus not performing at optimum levels. Emissions are generally somewhat lower in hot start mode, when the vehicle is not yet completely warmed up but was not sitting idle for sufficient time to have cooled completely to ambient temperatures. Finally, emissions generally are lowest when the vehicle is operating in stabilized mode, and has been in continuous operation long enough for all systems to have attained relatively stable, fully "warmed-up" operating temperatures.

Vehicle operating modes (cold start, hot start, and stabilized operation) are determined in MOBILE5 by allocating the amount of vehicle travel to each of the three corresponding "bags" of the FTP described above. Emission factors for each bag are the cumulative emissions of that segment of the FTP averaged over the distance traveled during that segment. The cold-start bag (bag 1) is represented by the first 3.5 miles (approximately) traveled by a vehicle after a "cold-start," and the hot-start bag (bag 3) is represented by the first 3.5 miles of operation after a "hot-start."

The three variables PCCN, PCHC, PCCC are sufficient to completely define the percent VMT accumulated in each of the three operating modes by vehicles in each of two basic emission control configurations, non-catalyst and catalyst-equipped. Thus the input of values for percent VMT accumulated in hot start mode by non-catalyst vehicles, or in stabilized mode by non-catalyst or catalyst-equipped vehicles, is not required as input. MOBILE5 calculates these quantities from the three values entered.

The definitions of the three variables and how they together define the six vehicle type/operating mode combinations are shown below:

<u>Vehicle Type</u>	<u>Operating Mode</u>	<u>Defined in MOBILE5 as:</u>
Non-catalyst	Cold-start	PCCN
Catalyst	Hot-start	PCHC
Catalyst	Cold-start	PCCC
Catalyst	Stabilized	1.0 - PCCC - PCHC
Non-catalyst	Stabilized	1.0 - PCCC - PCHC (assumed equal to the stabilized VMT fraction for catalyst-equipped vehicles)
Non-catalyst	Hot-start	PCCC - PCCN + PCHC

The user should not expect the sum of PCCN + PCHC + PCCC to be 100 percent. While it is true that (percent VMT in cold-start mode) + (percent VMT in hot-start mode) + (percent VMT in hot stabilized mode) always equals 100 percent, for both catalyst-equipped and non-catalyst vehicles, the variables PCCN, PCHC, and PCCC are not equivalent to these variables.

The values of PCHC, PCCC, and PCCN are used in the calculation of the bag-dependent correction factors (such as temperature and volatility) for LDV, LDT, and MC emission factors. It is assumed that all diesel vehicles and all motorcycles are non-catalyst.

2.3.5.2 Options

The three specified values must all be expressed as percentages (not as fractions). Each value must lie between 0.0 and 100.0. The sum of PCHC + PCCC must not exceed 100 percent. The value of PCCN logically should not be greater than that of PCCC, for the reasons discussed above.

2.3.5.3 MOBILE5 Standard (FTP) Operating Mode Fractions

The values of the three variables corresponding to the conditions of the FTP cycle are:

PCCN	20.6 %
PCHC	27.3 %
PCCC	20.6 %

These values reflect the same assumptions and conditions that are reflected in other aspects of the Federal Test Procedure.

2.3.5.4 Required Information

Three percentage values, reflecting the percentage of VMT (not the percentage of vehicles) accumulated by non-catalyst vehicles in cold-start mode (PCCN), by catalyst-equipped vehicles in hot-start mode (PCHC), and by catalyst-equipped vehicles in cold-start mode (PCCC).

2.3.5.5 Changes Since MOBILE4.1

There have been no revisions in the definitions or in the use or format requirements of these variables since the release of MOBILE4.1.

#### 2.3.5.6 Guidance

EPA historically has defined cold starts to be any start that occurs at least four hours after the end of the preceding trip for non-catalyst vehicles and at least one hour after the end of the preceding trip for catalyst-equipped vehicles. Hot starts are those starts that occur less than four hours after the end of the preceding trip for non-catalyst vehicles and less than one hour after the end of the preceding trip for catalyst-equipped vehicles. The shorter time interval associated with the cold/hot start definition for catalyst-equipped vehicles reflects the fact that catalytic converters do not operate at intended efficiency until they are fully warmed up (to operating temperatures in the 600°F (316°C) range); thus catalyst-equipped vehicles reflect "cold-start" emissions performance after a much shorter off time than do non-catalyst vehicles, which do not depend on attainment of such high temperatures for stabilization of emissions performance.

In the absence of supporting data for values other than those listed above, EPA believes that the values reflecting FTP conditions are appropriate in many cases. This is particularly true when the emission factors being modeled are intended to represent a broad geographic area (Metropolitan Statistical Area, entire State) and/or time period (days, months). When the modeling is intended to represent highly localized conditions (specific highway links) or very limited periods of time (as single hours), it may be possible to develop more representative values for these variables. Areas known to have average trip lengths significantly shorter or longer than 7.5 miles may also merit the use of alternate values.

Thus for SIP-related modeling, EPA will accept the use of the FTP operating mode values except for small scale scenarios where their use would clearly be inappropriate. EPA will not accept SIP-related modeling that includes different operating mode fractions for the base and projection years without adequate quantitative written justification.

There are several ways of approximating the percentage of VMT accumulated in each mode for each type of vehicle, although highly accurate determinations are not readily obtainable. Guidance on three possible methods for determining the cold-start/hot-start VMT fractions for non-catalyst and catalyst-equipped vehicles, including references to generally available data sources, appears in Chapter 8 of the report "Techniques for Estimating MOBILE2 Variables."

Some transportation emissions modeling approaches are based on the concepts of trip-start emissions and running emissions, rather than the method described above. MOBILE5 does not directly mesh well with this approach, but can be manipulated to do so. Modelers should contact EPA to discuss the suitability of this approach and for assistance in using MOBILE5 to develop the appropriate emission factors.

### 2.3.6 MONTH

#### 2.3.6.1 Description

MOBILE5 provides the user with the option of calculating emission factors for January 1 or July 1 of the calendar year of evaluation. This option is exercised by the addition of a value for "month" at the end of the mandatory scenario record, following the operating mode percentages. This feature is new in MOBILE5.

#### 2.3.6.2 Options

Emission factors can be calculated as of January 1 or July 1 of the calendar year specified.

#### 2.3.6.3 Month in MOBILE5

MOBILE4.1 always calculated emission factors on the basis of the fleet composition as of January 1 of the calendar year of evaluation. MOBILE5 allows the choice of January 1 or July 1. The month specified will affect the calculated emission factors in two ways: By changing the composition of the fleet (July 1 emission factors will reflect an additional six months of fleet turnover, or replacement of older vehicles by new vehicles), and how the effects of reformulated gasoline (RFG) are modeled. If the month selected is January, winter season RFG rules will be applied, while if the month selected is July, summer season RFG rules will be applied (see section 2.2.16).

The value of month is independent of temperature, fuel volatility, and other inputs, which still must be selected by the user in a way that is consistent with the intended application of the results. Section 2.3.6.6 provides cautions concerning the use of the July 1 option.

#### 2.3.6.4 Required Information

The value of month is optional: If no value is supplied, January is assumed (equivalent to MOBILE4.1 modeling). To specify January or July, a value of 1 (January) or 7 (July) is entered here. No other values for month can be entered. The value of month is a single integer digit (format **II**), and it follows after the operating mode fractions and two blank spaces.

#### 2.3.6.5 Changes Since MOBILE4.1

This is a new feature of MOBILE5.

#### 2.3.6.6 Guidance

This option has two primary functions. For the modeling of summertime emission factors, the user formerly had to interpolate between two consecutive calendar years' emission factors calculated using the same summer condition inputs (such as temperature and fuel volatility). For example, July 1, 1990 emission factors were calculated as the average of calendar year (CY) 90 (1/1/90) and CY 91 (1/1/91) MOBILE4.1 runs. This option allows July 1 emission factors to be directly calculated by MOBILE5. In addition, the value of month provided here serves to determine the season for the modeling of reformulated gasoline effects on emissions, with January indicating winter season and July indicating summer season. The choice of January or July emission factors should be made in a logical way.

The July 1 emission factors are determined by simple interpolation between the results of two January 1 evaluations, just as though the calculations were performed using the results of two separate MOBILE5 runs. As a result, all of the cautions necessary when interpolating between two sets of January 1 MOBILE5 runs will apply when setting the model inputs. Since the interpolation is done automatically, there is a greater danger that MOBILE5 will misinterpret the intent of the user.

For example, consider the case where a user specifies that the fuel RVP (Reid vapor pressure) will change from 11.5 psi to 10.5 psi in 1989, and then evaluates summer emission factors for calendar years 1988, 1989, and 1990 using the July 1 option for month. Since the model interpolates between January 1 evaluations, the July 1 1988 emission factors are simply an interpolation of January 1 1988 and January 1 1989 emissions. Unfortunately, the January 1989 emission factors are calculated assuming 10.5 psi RVP fuel, since this change in RVP is specified to start in 1989. This

means that the interpolated emission factors will be lower than they should be, since only 11.5 psi RVP fuel was actually available in July of 1988. The correct July 1988 emission factors can only be determined if both the January 1988 and January 1989 RVP levels match the RVP of fuel available in July of 1988. In this case, the July 1988 case should be run separately with a single RVP input (11.5 psi).

It is important to consider, when using the July month option, whether the user inputs will be properly interpreted by MOBILE5 for all specified calendar years of evaluation. The simple rule is to make sure that the conditions specified for the January 1st before and after the July 1 of interest both have the conditions you wish to assume for the July 1 date. The most common problems will involve conditions that change abruptly, such as fuel RVP. Conditions that phase in slowly, such as changes in an inspection and maintenance (I/M) program, will not cause similar problems, since few if any vehicles are immediately affected by I/M program changes on the first day of their implementation (January 1st).

### **2.3.7 LEV PROGRAM PARAMETER RECORD**

#### 2.3.7.1 Description

This record, which is required only if the value selected for "region" in the scenario descriptive record is "4" (see section 2.3.1), provides the user the ability to include the effects of opting in to the California low emission vehicle (LEV) program on a different schedule than is to be used in California, or of including LDGT2 (see Appendix 2A, section 2A.1.9 for a description of the LDGT2 classification) vehicles with the LEV program, or of assuming an I/M program for LEV program vehicles that does not meet the criteria for maximum emission reductions described in Appendix 2B.

#### 2.3.7.2 Options

This record provides the user the ability to select a start year for the phase-in of California LEV program that is later than 1994, and/or the ability to select the LEV program for LDGT2 vehicles, and/or to have the I/M emission credits for LEV program vehicles be based on an I/M program other than as described in section 2.3.1 and in Appendix 2B.

#### 2.3.7.3 Required Information

This record, if used, specifies the start year for phase in of LEVs and whether the I/M program assumed to apply to LEVs meets the criteria given in section 2.3.1 and in Appendix 2B. The format of this record is **I2,IX,I1,IX,I1**. The first value entered is the last two digits of the year that LEVs begin to be phased in, the second is a flag indicating what assumptions are to be made regarding the I/M program for LEVs, and third is a flag that specifies whether the LEV program covers the vehicle type LDGT2.

Setting the first flag (second value in the record) to "1" means that an I/M program not meeting the criteria detailed in Appendix 2B will be applied to LEVs [i.e., the I/M program specified by the user in the One-time Data section; if no I/M program is specified in the One-Time Data section (IMFLAG = 1), then no I/M program will be applied to LEVs], while setting this flag to "2" means that the I/M program for LEVs fits the criteria discussed in Appendix 2B. Note that this means that if the value of region is set to 4, and the start year is 94 and the I/M flag is 2 on the LEV program parameter record, then the effect is identical to setting the value of region to 3 and not using the LEV program parameter record.

Setting the second flag (third value in the record) to "1" means that LDGT2 will not be included in the LEV program. Setting this flag to "2" means that LDGT2 vehicles will be included in the LEV program. If the field is left blank, the flag is assumed to be "1", and LDGT2 will not be included in the LEV program.

#### 2.3.7.5 Changes Since MOBILE4.1

This LEV Program Record is a new feature of MOBILE5; the LDGT2 LEV flag is a new feature in MOBILE5b.

#### 2.3.7.6 Guidance

The user is encouraged to read closely the sections on inspection/maintenance (I/M) programs (section 2.2.5), the "region" variable on the Scenario record (section 2.3.1), and Appendix 2B for additional information on the modeling of LEV programs and the interaction of LEV and I/M programs.

Areas that opt-in to the California LEV program will use values of 3 or 4 for the REGION variable (section 2.3.1). Since no areas outside of California will implement LEV program requirements with the same start year as California, the value of 4 generally will be used for REGION and the LEV program parameter record will be required. In order to set the value of the I/M flag on the LEV program parameter record to "2", the area must also implement an I/M program for LEVs that meets the criteria set forth in Appendix 2B: (i) The I/M program for LEVs must include a transient loaded test, such as the IM240, and functional purge and pressure testing of the evaporative emission control system (see section 2.2.6.2); (ii) the program must include automated checks of the onboard diagnostic (OBD) system and repair requirements based on the results of this check; and (iii) the SIP must include provisions for auditing the in-use performance of LEV program vehicles and correcting any shortfalls that may be discovered in such audits.

It is noted again here that an I/M program meeting the criteria detailed in Appendix 2B is modeled by setting the appropriate flag values, as discussed above. The I/M program descriptive record (section 2.2.5) is not applied to LEV program vehicles if an I/M program meeting the criteria in Appendix 2B (or its equivalent as approved by EPA) is indicated. Note that this also means that the cutpoints to be used in an I/M program for LEVs *that meets the criteria detailed in Appendix 2B* are not entered on the I/M program descriptive record(s).

### **2.3.8 LOCAL AREA PARAMETER RECORD**

The local area parameter (LAP) record was discussed in sections 2.2.8 through 2.2.16, and is summarized in Table 2.2-12. It must appear in the Scenario data section if a different LAP record is to be applied to each scenario (LOCFLG = 1), and must appear in the One-time Data section if the same LAP record is to be applied for all scenarios (LOCFLG = 2). If the user elects to supply diesel sales fractions by model year as input data by setting DSFLAG = 2 on the LAP record, then the LAP record must be included for each scenario. The information provided in sections 2.2.8 through 2.2.16 is applicable in either case. This record must be supplied, in either the One-time data section or the Scenario data section, for every MOBILE5 run.

### **2.3.9 ADDITIONAL FUEL PARAMETER RECORDS**

#### 2.3.9.1 Oxygenated Fuels Descriptive Record

##### 2.3.9.1.1 Description



If the user chooses to model the effects of the use of oxygenated fuels on exhaust emissions, then the value of OXYFLG on the LAP record must be 2 (section 2.2.14). If this option is chosen, then a record describing the market share and average oxygen content of oxygenated fuels in the time and area being modeled must be provided. This record must immediately follow the LAP record. Thus if the user is applying a single LAP record for all scenarios (LOCFLG = 2), this record will appear immediately after the LAP record and before any other One-Time Data that may also be included. If the user is applying a distinct LAP record for each scenario (LOCFLG = 1), then the LAP record is the second scenario record for each scenario, and this record immediately follows as the third scenario record for each scenario.

If the user is modeling reformulated gasoline (RFG), RFG provisions will take precedence over the provisions of any oxygenated fuels descriptive record input. This means that if RFG is assumed (RFGFLG = 2) and oxygenated fuels are assumed (OXYFLG = 2), the fuel oxygen content used in the emission factor calculations will be that defined by RFG and the oxygen content specified on this record will be overridden.

#### 2.3.9.1.2 Options

The user has the choice of not accounting for the effects of oxygenated fuel use (by setting OXYFLG = 1 or leaving the space for OXYFLG blank), or of accounting for the effects of such fuels on exhaust emissions (by setting OXYFLG = 2).

#### 2.3.9.1.3 Use in MOBILE5

If the user chooses to model the effects on exhaust emissions of the use of oxygenated fuels, the information detailed below is supplied and MOBILE5 uses it to estimate the reductions in exhaust emissions that result for gasoline-fueled vehicle types (LDGV, LDGT1, LDGT2, HDGV, and MC).

#### 2.3.9.1.4 Required Information

If the user has set OXYFLG = 2, then the record containing this information must immediately follow the LAP record in the input data file. If the LAP record is in the One-Time Data section, then this record immediately follows it and precedes any other One-Time Data records that are being supplied. If the LAP records are in the Scenario section, then this record immediately follows each LAP record (as the third Scenario data record for each scenario).

The record consists of the following five variables:

- Ether blend market share (expressed as a fraction)
- Alcohol blend market share (expressed as a fraction)
- Average oxygen content of ether blend fuels (% weight, expressed as a fraction)
- Average oxygen content of alcohol blend fuels (% weight, expressed as a fraction)
- RVP waiver switch [integer value indicating whether alcohol-based oxygenated fuels must meet the same RVP limit as straight gasoline (value = 1), or have been granted a 1.0 psi waiver (value = 2)]

The format of this record is:

**4(F4.3,1X),I1**

To illustrate, the following oxygenated fuel input data record states that 3.5 percent of the fuel sold in the area is ether blends having an average oxygen content of 2.7 percent weight, that 12.9 percent of the fuel sold in the area is alcohol blends having an average oxygen content of 3.1 percent by weight, and that an RVP waiver is in effect allowing the volatility of the alcohol-based oxygenated fuels to be up to 1.0 psi RVP greater than the limit applicable to straight gasoline:

.035 .129 .027 .031 2

#### 2.3.9.1.5 Changes Since MOBILE4.1

There have been no revisions to the oxygenated fuels input data since the release of MOBILE4.1.

#### 2.3.9.1.6 Guidance

Areas that are known to have significant market penetration (two percent or greater market share) of ether blends and/or alcohol blends should attempt to accurately characterize the relative market shares and oxygen content of these fuel blends, and account for it in their emission factor modeling for SIP purposes. Areas having insignificant market penetration of both types of oxygenated fuels may safely disregard oxygenated fuels in their modeling.

EPA should be contacted for assistance in modeling the effects of oxygenated fuels if any of the following situations apply: (i) the fuels available in an area include blends containing both ether(s) and alcohol(s) in the same fuel, or (ii) an RVP waiver greater than 1.0 psi is applicable to oxygenated fuels in an area, or (iii) no RVP waiver is in effect but the volatility of base gasoline is currently below the regulated limit, or (iv) if two or more types of alcohol blends are marketed under different RVP waiver treatment. Additional guidance may be obtained through contacting the appropriate EPA Regional Office or the Office of Mobile Sources.

If the user has specified that reformulated gasoline (RFG) is to be accounted for in the emission factors by setting RFGFLG = 2 (see sections 2.2.8 and 2.2.16) and the season for which emission factors are being modeled is summer (indicated by value of 7 (July) for month on the scenario record, see section 2.3.6), then the oxygen content of the fuel is controlled by the provisions of the RFG regulations and any user input for average oxygen content is ignored. If the user specifies RFG and the season is winter (indicated by value of 1 (January) for month), the user-input oxygen content will be used rather than the default RFG oxygen content. Oxygen content of RFG is mandated in summer but not in winter. See section 2.2.16 for additional information.

#### 2.3.9.2 Gasoline Detergent Additive Parameter Record

##### 2.3.9.2.1 Description

MOBILE5b assumes that, starting January 1, 1995, a sufficient fraction of gasoline sold will contain detergent additives for the prevention of fuel injector and intake valve deposits such that exhaust emissions due to these deposits will be cut in half. On August 1, 1997 and thereafter, MOBILE5b assumes that all gasoline sold will contain sufficient additives to prevent these deposits. The phase-in of the regulations and the estimate of the impact of these deposits on emissions are based on the detergent gasoline final rule (61 FR 35309, July 5, 1996). The user may override these default values by setting the DTGFLG on the Local Area Parameter (LAP) record to 2 (section 2.2.16.2). If DTGFLG is set to 2, the Gasoline Detergent Additive Parameter record is required. This record immediately follows the Oxygenated Fuels Descriptive record, if there is one. Otherwise, it immediately follows the Local Area Parameter record. (See Table 2.4-1.)

2.3.9.2.2 Options

The user has the option to use the default gasoline detergent additive effects (described in section 2.2.16.2) by setting the DTGFLG to 1, or to specify these effects by using the Gasoline Detergent Additive Parameter record. The user calls for the Gasoline Detergent Additive Parameter record by setting the DTGFLG to 2.

2.3.9.2.3 Use in MOBILE5

If the user chooses to override the default effects of gasoline detergent additives on exhaust emissions, the information described below is supplied by the user. It is used by MOBILE5b instead of the default values to estimate the reductions in exhaust emissions that result for gasoline-fueled vehicle types (LDGV, LDGT1, LDGT2, HDGV, and MC).

2.3.9.2.4 Required Information

If the user has set the DTGFLG = 2, then the record containing the gasoline detergent additive parameters must be entered as part of a series of records following the LAP record. The Gasoline Detergent Additive Parameter record immediately follows the Oxygenated Fuels Descriptive record, if there is one. Otherwise, it immediately follows the Local Area Parameter record. (See Table 2.4-1.)

The Gasoline Detergent Additive Parameter record contains the following ten parameters.

- 1) Detergent gasoline phase-in end year (the start year is always 1995)
- 2) Percentage of all detergent gasoline which is sold during the phase-in of the new regulation
- 3) Percentage of all fuel injected vehicles with fuel injector deposits
- 4) Percent increase effect of fuel injector deposits on exhaust HC emissions
- 5) Percent increase effect of fuel injector deposits on CO emissions
- 6) Percent increase effect of fuel injector deposits on NOx emissions
- 7) Percentage of vehicles with intake valve deposits
- 8) Percent increase effect of intake valve deposits on exhaust HC emissions
- 9) Percent increase effect of intake valve deposits on CO emissions
- 10) Percent increase effect of intake valve deposits on NOx emissions

The detergent gasoline phase-in end year is entered as a four digit integer. All percents are entered as decimal numbers (with a decimal point) between zero and 100.

The format for this record is:

**I4,9(1X,F5.2)**

An example (showing the default values) appears below. The second row of numbers indicates the column location of the data.

```
1998 50.00 01.90 02.50 01.65 00.00 18.00 05.40 06.50 11.80
1234567890123456789012345678901234567890123456789012345678
```

The above detergent gasoline input data record states that the phase-in end year for detergent gas is 1998 (January, 1998 is the first time following August 1, 1997 that MOBILE5b can calculate emissions factors), the phase-in

factor is 50%, the percentage of vehicles with fuel injector deposits is 1.9%; the reductions of HC, CO, and NOx emissions from the detergent gas effect on fuel injector deposits are 2.5%, 1.65%, and 0%, respectively; the percentage of vehicles with intake valve deposits is 18%; and the reductions of HC, CO, and NOx emissions from the detergent gas effect on intake valve deposits are 5.4%, 6.5%, and 11.8%, respectively.

2.3.9.2.5 Changes Since MOBILE4.1

This is a new feature in MOBILE5b.

2.3.9.2.6 Guidance

The requirement to include detergent additives in all gasoline will reduce emissions from mobile sources. The default values in MOBILE5b reflect the detergent gasoline final rule (61 FR 35309, July 5, 1996). However, the user may use the option in MOBILE5b to override the default values.

When the user overrides the default values for detergent gasoline parameters in MOBILE5, the following warning message will be printed along with other messages generated from the one-time data entry input fields (except when NEWFLG=5 or 6):

Effects of the Detergent Gasoline Additive Rulemaking have been altered by the user:

PIEY	Pct	FI%	FINC	FICO	FINO	IV%	IVHC	IVCO	IVNO
xxxx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx	xx.xx

**2.3.10 DIESEL SALES FRACTIONS**

2.3.10.1 Description

In section 2.2.15, the use of diesel sales fractions by model year for LDVs and LDTs in MOBILE5 is discussed. These fractions represent the share of all LDV (LDT) sales in a given model year which are diesel-powered, rather than gasoline-fueled, vehicles.

2.3.10.2 Options

The user can choose to supply sets of diesel sales fractions by model year for both LDVs and LDTs that are locality-specific (and different from the national sales fractions that are included in MOBILE5), or to use the national sales fractions. The options are exercised through the value assigned to DSFLAG, the second of the three optional flags at the right end of the LAP record. As noted previously, if the user is supplying diesel sales fraction data, it must be included in the Scenario data section and the LAP record(s) must also appear in the Scenario data section.

2.3.10.3 Use in MOBILE5

MOBILE5, like earlier versions of the model, uses a single set of registration distributions by age and annual mileage accumulation rates to describe all LDVs (gasoline and diesel combined), and another such set to describe all LDTs. This is due in part to the fact that it is nearly impossible to develop such information for gas and diesel vehicles separately, and in part since there is little evidence to suggest that typical use patterns, mileage accumulation rates, and

so forth are different for gas and diesel vehicles. The use of model-year-specific diesel sales fractions allows MOBILE5 to internally split the LDVs and LDTs into gas and diesel sub-categories, which have distinctly different emission rates and behaviors.

MOBILE4 contained forecasts of increasing diesel sales. MOBILE5 assumes that diesel sales after 1990 will show essentially no increase from current very low levels.

#### 2.3.10.4 Required Information

If the user is supplying alternate diesel sales fractions as input to the model, then the information immediately follows the LAP record and the oxygenated fuels descriptive record and the gasoline detergent additive parameter record (if either the oxygenated fuels descriptive record or the gasoline detergent additive parameter record is present).

For each scenario, the user must supply the fractions of LDV and LDT sales that were diesel for each model year from the calendar year of evaluation back to 24+ model years ago. For example, if the calendar year of evaluation is 1990, then diesel sales fractions for model year 1990, 1989, 1988, ..., 1967, and 1966-and-older LDVs and LDTs must be provided. If two different scenarios are being run, both for the same calendar year but with other differences, then the same set of diesel fractions would have to be supplied again as part of the second scenario. If a scenario with calendar year 1995 was also being run, then the diesel sales fractions would represent model year 1995, 1994, ..., 1972, and 1971-and-older vehicles. The same values would be used for the model years in common to the two sets of sales fractions, but the five oldest model year values would "drop off the end" of the sequence and be replaced by sales fractions for the five most recent model years.

The 50 diesel sales fractions, 25 each for LDVs and LDTs, will constitute the next three records. The format of these records is:

**(20F4.3/  
20F4.3/  
10F4.3/)**

The values are entered in pairs: The first two values on the first record are the diesel sales fractions for LDVs and LDTs of age 1 (model year = calendar year of evaluation), the second two values are the sales fractions for LDVs and LDTs of age 2 (model year = one year before calendar year of evaluation), and so on, with the last two values on the third record being the sales fractions for age 25+ LDVs and LDTs (model year = 24+ years before calendar year of evaluation).

Note that there are no leading zeros or spaces in these input records. The fractions should be listed to three decimal places, one after another, with the values paired to represent cars then light trucks of each age. The MOBILE5 diesel fractions, formatted according to the requirements above, appear below (these fractions are for calendar year 1990, and represent model years 1990 through 1976-and-older).

.000.002.000.002.000.002.003.003.003.007.009.011.017.023.021.047.047.093.059.056  
.044.035.021.018.009.008.005.000.003.000.002.000.003.000.002.000.002.000.001.000  
.000.000.000.000.000.000.000.000.000.000

#### 2.3.10.5 Changes Since MOBILE4.1

There have been no revisions to the input or application of alternate diesel sales fractions since the release of

## MOBILE4.1.

2.3.10.6 Guidance

This option is provided in MOBILE5 for two reasons. First, some users performing highway vehicle emission factor modeling may have access to vehicle registration data, or data from other sources, enabling them to characterize diesel sales of LDVs and LDTs in the area being modeled. Particularly if these sales fractions differ significantly from those included in MOBILE5, it will enhance the accuracy of the emission factors and inventory to use those sales fractions as model input. Second, as can be seen by the sharp rise and equally sharp fall of diesel sales in the late 1970s and early 1980s, it is extremely difficult to forecast diesel sales fractions for future model years. This provision will allow modelers to account for future increases in diesel sales, if such increases occur.

**2.3.11 VEHICLE MILES TRAVELLED MIX by vehicle type**

The VMT mix by vehicle type was discussed in section 2.2.2. This record must appear in the Scenario data section if different VMT mixes are to be applied to each scenario (VMFLAG = 2), and must appear in the One-time data section if the same VMT mix is to be applied to all scenarios (VMFLAG = 3). The information provided in section 2.2.2 applies in both cases. This record is not required if the MOBILE5 VMT mix is to be used (VMFLAG = 1).

**2.3.12 TRIP LENGTH DISTRIBUTION**2.3.12.1 Description

EPA has determined through its running loss emission test programs that the level of running loss emissions depends on several variables: the average speed of the travel, the ambient temperature, the volatility (RVP) of the fuel, and the length of the trip. "Trip length" as used here refers to the duration of the trip (how long the vehicle has been traveling), not on the distance traveled in the trip (how far the vehicle has been driven). Test data show that for any given set of conditions (average speed, ambient temperature, and fuel volatility), running loss emissions are zero to negligible at first, but increase significantly as the duration of the trip is extended and the fuel tank, fuel lines, and engine become heated.

The additional data obtained since the development of MOBILE4.1 allow running loss emissions to be modeled as a direct function of the input temperature, fuel volatility, and average speed. While an internal weighting of trip lengths (durations) is included in the model and is used to estimate the running loss emission factors, the user now has the option of supplying an alternate trip length distribution for use in estimating running loss emissions. If this option of specifying trip length distributions is not selected, then MOBILE5 will calculate the running loss emission factors on the basis of an internal assumed trip length distribution.

2.3.12.2 Options

The user can let MOBILE5 estimate running loss emission factors using the internal trip length distributions (SPDFLG = 1 or 2), or can supply a set of trip length distributions (SPDFLG = 3 or 4).

2.3.12.3 Use in MOBILE5

For each combination of vehicle type and trip length category (see below), a value representing running loss

emissions at the standard test speed, temperature, and volatility is contained in the coded data. This information, if supplied, is used in weighting these factors together to derive the fleet average emission factor, which then is corrected for average speed, temperature, and fuel volatility.

#### 2.3.12.4 Required Information

If a modeler has the necessary information, a separate input data record of trip length distribution can be supplied as input and used in the calculation of running loss emission factors. This record must list the percentage of all travel (VMT) being accumulated over the time period that the emission factors apply for, in trips of the following lengths (durations):

Under 10 minutes  
 11 to 20 minutes  
 21 to 30 minutes  
 31 to 40 minutes  
 41 to 50 minutes  
 51 minutes and longer

The six percentage values specified must sum to 100%. The format of this record is:

**6(1X,F4.1)**

The record may appear in the One-Time data section or in each Scenario data section, depending on value of SPDFLG specified by the user.

#### 2.3.12.5 Changes Since MOBILE4.1

There have been no changes made to the input of these variables or their interpretation and used by the model since the release of MOBILE4.1.

#### 2.3.12.6 Guidance

Solid data on trip length distributions is not likely to be available in most cases. Thus for base year emission inventory development by States and others, EPA will accept the use of the internal trip length distributions for the estimation of running loss HC emission factors. The use of trip length distributions other than that included in MOBILE5 in the development of required base year emission estimates must be adequately documented for acceptance by EPA. Where the transportation modeling process can produce reliable inputs for trip length distribution, it will allow more accurate estimates of the benefits attributable to SIP measures which shorten average trip lengths without eliminating entire trips.

### **2.3.13 ADDITIONAL CORRECTION FACTORS FOR LIGHT-DUTY GASOLINE-FUELED VEHICLE TYPES**

#### 2.3.13.1 General Description

MOBILE5 provides the capability of applying four additional correction factors to the exhaust emission factors for LDGVs, LDGT1s, and LDGT2s. These factors are used to represent conditions not typically assumed in MOBILE5

runs, which is why they are segregated from other correction factors (such as speed and temperature).

These factors allow for exhaust emission factors only to be adjusted to account for the emissions impact of air conditioning (A/C) usage, extra loading, and trailer towing. There is also a humidity correction factor, which applies only to exhaust NO<sub>x</sub> emissions and is also applied to motorcycles.

### 2.3.13.2 Options

Depending on the value assigned to the ALHFLG flag controlling the application of these additional correction factors, six or ten input values may be required.

When ALHFLG = 2, six values are required:

- 1) One A/C usage fraction (for all LDGVs and LDGTs)
- 2-4) Three extra load usage fractions (for LDGVs, LDGT1s, LDGT2s)
- 5) One trailer towing fraction (for all LDGVs and LDGTs)
- 6) One humidity level (for all LDGVs and LDGTs plus motorcycles)

The format of this record in the case where ALHFLG = 2 is:

**F4.2,3F4.2,F4.2,F4.0**

When ALHFLG = 3, ten values are required:

- 1) One A/C usage fraction (for all LDGVs and LDGTs)
- 2-4) Three extra load usage fractions (for LDGVs, LDGT1s, LDGT2s)
- 5-7) Three trailer towing fractions (for LDGVs, LDGT1s, LDGT2s)
- 8) One humidity level (for all LDGVs and LDGTs plus motorcycles)
- 9-10) Dry and wet bulb temperatures (used to calculate an A/C usage fraction for LDGVs and LDGTs).

The format of this record in the case where ALHFLG = 3 is:

**F4.2,3F4.2,3F4.2,F4.0,2F4.0**

Each of these five types of input (A/C, extra load, trailer towing, humidity, and temperature) is discussed below.

### 2.3.13.3 A/C Usage Fraction

#### 2.3.13.3.1 Description

If you wish to include the effect on the exhaust emission factors of A/C usage, enter a nonzero value for this variable and appropriate dry and wet bulb temperatures, as explained below.

#### 2.3.13.3.2 Options

This fractional value must be between zero and one ( $0.0 \leq AC \leq 1.0$ ).



In the six-value option (ALHFLG = 2), no correction factor for A/C usage will be applied, regardless of the value that is entered. Entering 0.0 as the value is recommended in this case.

In the ten-value option (ALHFLG = 3), this variable acts as a flag, and the A/C usage fraction will be calculated on the basis of the dry bulb and wet bulb temperatures (see section 2.3.13.7). If 0.0 is entered, no correction factor will be applied, although values of dry and wet bulb temperature must still be provided. To have a correction factor for A/C usage calculated and applied, enter a nonzero value ( $0.0 < AC \leq 1.0$ ) and appropriate values for dry and wet bulb temperatures.

#### 2.3.13.4 Extra Load Usage Fractions

##### 2.3.13.4.1 Description

These values are used to model the exhaust emissions impact of vehicles carrying an extra 500 lb (227 kg) load. If you wish to include this effect, three fractional values are entered (one each for LDGVs, LDGT1s, and LDGT2s), representing the fraction of all vehicles of the given type carrying such an extra load.

##### 2.3.13.4.2 Options

These values must all lie between zero and one. If the value entered is zero, no correction for the effects of extra load is applied.

#### 2.3.13.5 Trailer Towing Usage Fraction

##### 2.3.13.5.1 Description

These values are used to model the impact on exhaust emissions of vehicles towing trailers. If you wish to include this effect in your modeling, one or three fractions are entered representing the fraction of vehicles of a given type that are to be assumed to be towing trailers.

##### 2.3.13.5.2 Options

Any value for this fraction must lie between zero and one. If the value entered is zero, no correction for the effect of trailer towing is applied.

In the six-value option (ALHFLG = 2), one value is entered and is applied to LDGVs, LDGT1s, and LDGT2s. In the ten-value option (ALHFLG = 3), three values are entered, to be applied to LDGVs, LDGT1s, and LDGT2s.

#### 2.3.13.6 NOx Humidity Correction

##### 2.3.13.6.1 Description

This value is used to correct exhaust NOx emission factors for absolute humidity. The value entered is the absolute (specific) humidity, expressed as grains water per pound of dry air.

#### 2.3.13.6.2 Options

The value entered for absolute humidity must lie between 20 and 140. If the value entered is 75, corresponding to the absolute humidity condition of the FTP, then no correction will be applied.

#### 2.3.13.7 Dry and Wet Bulb Temperatures

##### 2.3.13.7.1 Description

MOBILE5 will calculate the fraction of A/C-equipped vehicles actually using their air conditioning on the basis of a "discomfort index," which in turn is calculated from the dry bulb and wet bulb temperatures.

##### 2.3.13.7.2 Options

The value of each of these temperatures must be between 0° and 110°F (-18° and 43°C), inclusive. In addition, the wet bulb temperature must be less than or equal to the dry bulb temperature. If any of these conditions are not met, an error message will be issued by MOBILE5.

These values (in °F) will be used to calculate the A/C usage fraction on the basis of the discomfort index only if the ten-value option is selected (ALHFLG = 3) and a nonzero value is entered for the variable AC. If used, this calculated value overrides the value read in for AC as part of the input.

#### 2.3.13.8 Changes Since MOBILE4.1

There have been no revisions to any of the variables discussed in this section, or to how they are supplied to the model as input data, since the release of MOBILE4.1.

#### 2.3.13.9 Guidance

In most areas, ozone pollution episodes occur during summer months and very warm to hot temperatures. It is reasonable to assume that vehicle air conditioning usage is high under such conditions. The basic emission rates in MOBILE5 already include additional loading intended to simulate the use of air conditioning. The additional air conditioning correction factors that are calculated in MOBILE5 are of uncertain accuracy. The emissions impact for late model year vehicles of operating the air conditioner is not well quantified, and the fraction of vehicles equipped with air conditioning is substantially higher for the vehicle fleet of the late 1980s and beyond than it was for the fleet of the late 1970s. Thus the use of the air conditioning corrections to the emission factors is acceptable, but is not required, in the development of SIP inventories. EPA will accept SIP inventories that do not attempt to explicitly account for vehicle air conditioning use. The same approach that is taken in developing the base year inventory must also be used for projection inventories.

The humidity correction for NO<sub>x</sub> emissions accounts for the fact that when "excess" water vapor is present, some of the heat of combustion heats water vapor rather than enhancing NO<sub>x</sub> formation. As with the air conditioning correction, EPA will accept SIP inventories that do not attempt to account for local humidity. If the humidity correction is applied in the base year, the derivation of the value used, including sources of data, must be detailed in the emission inventory supporting documentation, and it must also be used in any projection inventories.

If you believe that conditions applying to a specific application of MOBILE5 warrant the use of one or more of the correction factors described in this section, and desire guidance beyond that provided above, contact EPA for additional information (Regional and State Programs Division, 313/668-4417).

This completes the Scenario data section.

## **2.4 SUMMARY OF MOBILE5 INPUT SEQUENCE**

The following tables summarize the input sequence required for a MOBILE5 run, in the order required by the program. Records listed in parentheses are optional, and are only required if certain flags have been assigned specific values in the Control section, or if certain other options have been selected.

Table 2.1-1

**FLAGS CONTROLLING INPUT TO AND EXECUTION OF MOBILE5**

<u>Record Number</u>	<u>Variable Name</u>	<u>Content and Codes</u>	<u>Format</u>	<u>Refer to Section</u>
1	<b>PROMPT</b>	Flag indicating whether user is to be prompted for remaining input data  1 = No prompting, vertical format 2 = Prompting, vertical format 3 = No prompting, horizontal format 4 = Prompting, horizontal format	I1,3A1	2.1.1
	<b>IOUNEW</b>	Optional reassignments of output units (used in mainframe version only):  1 - Formatted reports unit (IOUREP) = 7 2 - Diagnostic messages unit (IOUERR) = 7 3 - Prompting messages unit (IOUASK) = 6  (Allowable values for each unit are 1, 2, 5, 6, 7, 8, or 9. Units 3 and 4 are reserved for reading I/M credit files.)		2.1.2
2	<b>PROJID</b>	80 characters for title to be echoed in output	20A4	2.1.3
3	<b>TAMFLG</b>	Flag for optional input of tampering rates  1 = Use MOBILE5 tampering rates 2 = Input alternate tampering rates <sup>1</sup>	I1	2.1.4
4	<b>SPDFLG</b>	Flag indicating how average speed is being input (one value for all vehicle types or eight values, one for each vehicle type); also used to indicate whether alternate trip length distribution data are supplied as input  1 = One average speed for all vehicle types <sup>2</sup> 2 = Eight average speeds, one for each vehicle type <sup>2</sup> 3 = One average speed for all vehicle types, plus one alternate set of trip length distribution data per scenario <sup>3</sup> 4 = One average speed for all vehicle types, plus one alternate set of trip length distribution data for all scenarios <sup>4</sup>	I1	2.1.5

Table 2.1-1 (continued)

**FLAGS CONTROLLING INPUT TO AND EXECUTION OF MOBILE5**

<u>Record Number</u>	<u>Variable Name</u>	<u>Content and Codes</u>	<u>Format</u>	<u>Refer to Section</u>
5	<b>VMFLAG</b>	Flag indicating VMT mix by vehicle type to be used in calculating all-vehicle emission factor from eight vehicle-class-specific emission factors  1 = Use MOBILE5 VMT mix 2 = Input one VMT mix for <u>each</u> scenario <sup>2</sup> 3 = Input one VMT mix for <u>all</u> scenarios <sup>1</sup>	I1	2.1.6
6	<b>MYMRFG</b>	Flag indicating optional input of annual mileage accumulation rates and/or registration distributions by age  1 = Use MOBILE5 values 2 = Input annual mileage accumulation rates <sup>1</sup> 3 = Input registration distributions by age <sup>1</sup> 4 = Input both annual mileage accumulation rates and registration distributions <sup>1</sup>	I1	2.1.7
7	<b>NEWFLG</b>	Flag indicating optional input of modifications to basic exhaust emission rates (BERs)  1 = Use MOBILE5 BERs 2 = Input one or more alternate BERs <sup>1</sup> 3 = Use MOBILE5 BERs and specify new evap test procedure <sup>1</sup> 4 = Input one or more alternate BERs <sup>1</sup> and specify new evap test procedure <sup>1</sup> 5 = Use MOBILE5 BERs and disable all new Clean Air Act requirements 6 = Input one or more alternate BERs <sup>1</sup> and disable all new Clean Air Act requirements	I1	2.1.8     2.2.4.2 2.2.4.2 2.2.4.2 2.2.4.2

Table 2.1-1 (continued)

**FLAGS CONTROLLING INPUT TO AND EXECUTION OF MOBILE5**

<u>Record Number</u>	<u>Variable Name</u>	<u>Content and Codes</u>	<u>Format</u>	<u>Refer to Section</u>
8	<b>IMFLAG</b>	<p>Flag indicating whether effect of one (or two) I/M program(s) on emission factors is to be included in the emission factor calculations</p> <p>1 = No I/M program is assumed to be operating            2 = User specifies a single I/M program and MOBILE5 models its impact on emissions<sup>1</sup>            3 = User specifies two I/M programs and MOBILE5 models their impact on emissions<sup>1</sup>            4 = User specifies a single I/M program (same as IMFLAG = 2), and beginning in 1994, emission credits based on assuming a specific I/M program* for Tier 1 vehicles override the user-specified program for LDGVs &amp; LDGTs<sup>1</sup>            5 = User specifies two I/M programs (same as IMFLAG = 3), and beginning in 1994, emission credits based on assuming a specific I/M program* for Tier 1 vehicles override the user-specified program for LDGVs &amp; LDGTs<sup>1</sup>            6 = User specifies information governing the I/M program(s) in the "I/M Control Flag Record" in the One-time Data section.            See Table 2.2.6</p>	I1	2.1.9, 2A.1, 2B
9	<b>ALHFLG</b>	<p>Flag indicating whether exhaust emission factors (gasoline-fueled vehicles only) are to be corrected for one or more of the following:</p> <p>(a) air conditioning usage, (b) extra vehicle load, (c) trailer towing, (d) humidity (NOx only)</p> <p>1 = No corrections            2 = Input six values<sup>2</sup>            3 = Input ten values<sup>2</sup></p>	I1	2.1.10

\* See sections 2.2.5, 2.3.1, 2.3.7, and Appendix 2B for additional information on the specific I/M program that is assumed for Tier 1 vehicles when IMFLAG is set to 4 or 5.

Table 2.1-1 (continued)

**FLAGS CONTROLLING INPUT TO AND EXECUTION OF MOBILE5**

<u>Record Number</u>	<u>Variable Name</u>	<u>Content and Codes</u>	<u>Format</u>	<u>Refer to Section</u>
10	<b>ATPFLG</b>	Flag indicating whether effects of anti-tampering program (ATP), and/or of functional pressure and/or purge checks of evaporative emission control system, are to be included in emission factor calculations  1 = No ATP modeled 2 = ATP modeled <sup>1</sup> 3 = Functional pressure check of evap system modeled <sup>1</sup> 4 = Functional purge check of evap system modeled <sup>1</sup> 5 = ATP and functional pressure check of evap system modeled <sup>1</sup> 6 = ATP and functional purge check of evap system modeled <sup>1</sup> 7 = Functional pressure and purge checks of evap system modeled <sup>1</sup> 8 = ATP and functional pressure and purge checks of evap system modeled <sup>1</sup>	I1	2.1.11, 2A.2
11	<b>RLFLAG</b>	Flag indicating whether, and how, refueling emission factors are calculated  1 = Calculate refueling emission factors using onboard VRS refueling emission rates 2 = Calculate refueling emission factors using onboard VRS and assuming the use of the Stage II vapor recovery system (VRS) <sup>1</sup> 3 = Same effect in MOBILE5b as RLFLAG=1. See section 2.2.7 <sup>1</sup> 4 = Same effect in MOBILE5b as RLFLAG=2. See section 2.2.7 <sup>1</sup> 5 = No refueling emission factors calculated	I1	2.1.12
12	<b>LOCFLG</b>	Flag indicating user input of local area parameter (LAP) record  1 = One LAP record input for <u>each</u> scenario <sup>2</sup> 2 = One LAP record input for <u>all</u> scenarios <sup>1</sup>	I1	2.1.13



Table 2.1-1 (continued)

**FLAGS CONTROLLING INPUT TO AND EXECUTION OF MOBILE5**

<u>Record Number</u>	<u>Variable Name</u>	<u>Content and Codes</u>	<u>Format</u>	<u>Refer to Section</u>
13	<b>TEMFLG</b>	<p>Flag indicating how temperatures to be used in correcting emission factors for effects of temperature will be determined from input (daily minimum/ maximum and ambient) temperatures</p> <p>1 = MOBILE5 calculates trip- and emission-weighted temperatures to be used in correcting emission factors from the input values of minimum and maximum daily temperature; the input value of ambient temperature is overridden by the calculated values</p> <p>2 = The input value of ambient temperature is used to correct emission factors for temperature effects</p>	I1	2.1.14

**NOTE:** This flag controls the temperatures used to correct exhaust, running loss, resting loss, and hot soak emissions only. Diurnal evaporative emissions and refueling emissions are always corrected for temperature on the basis of the input daily minimum and maximum temperatures.

<sup>1</sup> Record(s) must appear in One-time data section.

<sup>2</sup> Record(s) must appear in Scenario data section.

<sup>3</sup> Speed value(s) appear in usual location(s) on first Scenario data record; alternate trip length distributions appear as additional Scenario section data records.

<sup>4</sup> Speed value(s) appear in usual location(s) on first Scenario data record; alternate trip length distribution appears as additional One-Time data section record.

Table 2.1-2

**FLAGS CONTROLLING OUTPUT OF MOBILE5**

<u>Record Number</u>	<u>Variable Name</u>	<u>Content and Codes</u>	<u>Format</u>	<u>Refer to Section</u>
14	<b>OUTFMT</b>	Flag selecting the structure of the formatted emission factor output report  1 = 222-column numerical 2 = 140-column numerical 3 = 112-column descriptive 4 = 80-column descriptive 5 = 112-column descriptive, plus "by model year" tables 6 = Spreadsheet (CSV) output	I1	2.1.15
15	<b>PRTFLG</b>	Flag indicating pollutants for which emission factors are to be calculated and included in output  1 = Hydrocarbons (HC) only 2 = Carbon monoxide (CO) only 3 = Oxides of nitrogen (NOx) only 4 = All three pollutants	I1	2.1.16
16	<b>IDLFLG</b>	Flag indicating whether idle emission factors are to be calculated and included in output  1 = No idle EFs            2 = Include idle EFs	I1	2.1.17
17	<b>NMHFLG</b>	Flag indicating choice of composition for "hydrocarbon" emission factors  1 = Total hydrocarbons (THC) 2 = Non-methane hydrocarbons (NMHC) 3 = Volatile organic compounds (VOC) 4 = Total organic gasses (TOG) 5 = Non-methane organic gasses (NMOG)	I1	2.1.18
18	<b>HCFLAG</b>	Flag indicating how HC emission factors are presented in output  1 = No component EFs printed (sum of HC emissions only) 2 = Component and total EFs printed 3 = Component and total EFs printed, with detailed evaporative emission breakdown in grams (sum of HC emissions will exclude refueling)	I1	2.1.19

Table 2.2-1

**SUMMARY OF ALTERNATE TAMPERING RATE RECORDS**

(required if TAMFLG = 2)

See section 2.2.1 for additional information.

**NON-I/M CASE (IMFLAG = 1)**

<u>Record</u>	<u>Field</u>	<u>Content and Description</u>	<u>Format</u>	<u>Allowable Values</u>
1-4 <sup>1</sup>	1-8 <sup>2</sup>	ZML for pre-1981 MY vehicles	8F8.4/	0.0 - 1.0
5-8 <sup>1</sup>	1-8 <sup>2</sup>	ZML for 1981-83 MY vehicles	8F8.4/	0.0 - 1.0
9-12 <sup>1</sup>	1-8 <sup>2</sup>	ZML for 1984 and later MY vehicles	8F8.4/	0.0 - 1.0
13-16 <sup>1</sup>	1-8 <sup>2</sup>	DR for pre-1981 MY vehicles	8F8.4/	0.0 - 1.0
17-20 <sup>1</sup>	1-8 <sup>2</sup>	DR for 1981-83 MY vehicles	8F8.4/	0.0 - 1.0
21-24 <sup>1</sup>	1-8 <sup>2</sup>	DR for 1984 and later MY vehicles	8F8.4/	0.0 - 1.0

**I/M CASE (IMFLAG = 2, 3, 4, 5, or 6)**

<u>Record</u>	<u>Field</u>	<u>Content and Description</u>	<u>Format</u>	<u>Allowable Values</u>
1-4 <sup>1</sup>	1-8 <sup>2</sup>	Non-I/M ZML for pre-1981 MY vehicles	8F8.4/	0.0 - 1.0
5-8 <sup>1</sup>	1-8 <sup>2</sup>	Non-I/M ZML for 1981-83 MY vehicles	8F8.4/	0.0 - 1.0
9-12 <sup>1</sup>	1-8 <sup>2</sup>	Non-I/M ZML for 1984 and later MY vehicles	8F8.4/	0.0 - 1.0
13-16 <sup>1</sup>	1-8 <sup>2</sup>	I/M ZML for pre-1981 MY vehicles	8F8.4/	0.0 - 1.0
17-20 <sup>1</sup>	1-8 <sup>2</sup>	I/M ZML for 1981-83 MY vehicles	8F8.4/	0.0 - 1.0
21-24 <sup>1</sup>	1-8 <sup>2</sup>	I/M ZML for 1984 and later MY vehicles	8F8.4/	0.0 - 1.0
25-28 <sup>1</sup>	1-8 <sup>2</sup>	Non-I/M DR for pre-1981 MY vehicles	8F8.4/	0.0 - 1.0
29-32 <sup>1</sup>	1-8 <sup>2</sup>	Non-I/M DR for 1981-83 MY vehicles	8F8.4/	0.0 - 1.0
33-36 <sup>1</sup>	1-8 <sup>2</sup>	Non-I/M DR for 1984 and later MY vehicles	8F8.4/	0.0 - 1.0
37-40 <sup>1</sup>	1-8 <sup>2</sup>	I/M DR for pre-1981 MY vehicles	8F8.4/	0.0 - 1.0
41-44 <sup>1</sup>	1-8 <sup>2</sup>	I/M DR for 1981-83 MY vehicles	8F8.4/	0.0 - 1.0
45-48 <sup>1</sup>	1-8 <sup>2</sup>	I/M DR for 1984 and later MY vehicles	8F8.4/	0.0 - 1.0

<sup>1</sup> Records are in sets of four -- one each for LDGVs, LDGT1s, LDGT2s, and HDGVs, in that order.<sup>2</sup> Fields 1-8 hold the ZML or DR of the tampering rate equation for the following components, in order:

- 1 Air pump disablement
- 2 Catalyst
- 3 Fuel inlet restrictor disablement
- 4 Overall misfueling
- 5 EGR system disablement
- 6 Evaporative emission control system disablement
- 7 PCV system disablement
- 8 Missing gas cap

Table 2.2-2

**SUMMARY OF ANNUAL MILEAGE ACCUMULATION RATES RECORDS**(required if MYMRFG = 2 or 4)<sup>1</sup>

See section 2.2.3 for additional information.

<u>Record</u>	<u>Field</u>	<u>Content and Description</u>	<u>Format</u>	<u>Allowable Values</u>
1	1-10	Average annual mileage accumulation <sup>2</sup> for LDGVs of ages 1, 2, ..., 10	10F7.5/	≥ 0.0
2	1-10	Average annual mileage accumulation <sup>2</sup> for LDGVs of ages 11, 12, ..., 20	10F7.5/	≥ 0.0
3	1-5	Average annual mileage accumulation <sup>2</sup> for LDGVs of ages 21, 22, ..., 25+	5F7.5/	≥ 0.0
4	1-10	Average annual mileage accumulation <sup>2</sup> for LDGT1s of ages 1, 2, ..., 10	10F7.5/	≥ 0.0
5	1-10	Average annual mileage accumulation <sup>2</sup> for LDGT1s of ages 11, 12, ..., 20	10F7.5/	≥ 0.0
6	1-5	Average annual mileage accumulation <sup>2</sup> for LDGT1s of ages 21, 22, ..., 25+	5F7.5/	≥ 0.0
7-9 <sup>3</sup>		Average annual mileage accumulation <sup>2</sup> for LDGT2s		
10-12 <sup>3</sup>		Average annual mileage accumulation <sup>2</sup> for HDGVs		
13-15 <sup>3</sup>		Average annual mileage accumulation <sup>2</sup> for LDDVs		
16-18 <sup>3</sup>		Average annual mileage accumulation <sup>2</sup> for LDDTs		
19-21 <sup>3</sup>		Average annual mileage accumulation <sup>2</sup> for HDDVs		
22-24 <sup>3,4</sup>		Average annual mileage accumulation <sup>2</sup> for MCs		

1 If both annual mileage accumulation rates and registration distributions by age are being input (MYMRFG = 4), the two sets of values must be internally consistent (see section 2.2.3.4).

2 Values as input as miles/100,000 (e.g., 24,358 miles is input as .24358).

3 Records continue in sets of three per vehicle type, following the structure shown above for LDGVs and LDGT1s.

4 For motorcycles only, values of .00000 should be used for ages 13 thru 25+ (see section 2.2.3.4).

Table 2.2-3

**SUMMARY OF REGISTRATION DISTRIBUTION BY AGE RECORDS**(required if MYMRFG = 3 or 4)<sup>1</sup>

See section 2.2.3 for additional information.

<u>Record</u>	<u>Field</u>	<u>Content and Description</u>	<u>Format</u>	<u>Allowable Values</u>
1	1-10	Registration distribution fractions <sup>2</sup> for LDGVs <sup>3</sup> of ages 1, 2, ..., 10	10F5.3/	0.0 - 1.0
2	1-10	Registration distribution fractions <sup>2</sup> for LDGVs <sup>3</sup> of ages 11, 12, ..., 20	10F5.3/	0.0 - 1.0
3	1-5	Registration distribution fractions <sup>2</sup> for LDGVs <sup>3</sup> of ages 21, 22, ..., 25+	5F5.3/	0.0 - 1.0
4	1-10	Registration distribution fractions <sup>2</sup> for LDGT1s <sup>3</sup> of ages 1, 2, ..., 10	10F5.3/	0.0 - 1.0
5	1-10	Registration distribution fractions <sup>2</sup> for LDGT1s <sup>3</sup> of ages 11, 12, ..., 20	10F5.3/	0.0 - 1.0
6	1-5	Registration distribution fractions <sup>2</sup> for LDGT1s <sup>3</sup> of ages 21, 22, ..., 25+	5F5.3/	0.0 - 1.0
7-9 <sup>4</sup>		Registration distribution fractions <sup>2</sup> for LDGT2s		
10-12 <sup>4</sup>		Registration distribution fractions <sup>2</sup> for HDGVs		
13-15 <sup>4</sup>		Registration distribution fractions <sup>2</sup> for LDDVs <sup>3</sup>		
16-18 <sup>4</sup>		Registration distribution fractions <sup>2</sup> for LDDTs <sup>3</sup>		
19-21 <sup>4</sup>		Registration distribution fractions <sup>2</sup> for HDDVs		
22-24 <sup>4,5</sup>		Registration distribution fractions <sup>2</sup> for MCs		

- 1 If both annual mileage accumulation rates and registration distributions by age are being input (MYMRFG = 4), the two sets of values must be internally consistent (see section 2.2.3.4).
- 2 Values must sum to 1.0 for each vehicle type. The registration distribution entered as data for MOBILE5 should be based on July 1; MOBILE5 will convert them to a January 1 distribution if emission factors for January 1 are requested.
- 3 The same set of registration distribution fractions must be entered for LDGVs and LDDVs, and the same set for LDGT1s and LDDTs (see section 2.2.3.4).
- 4 Records continue in sets of three per vehicle type, following the structure shown above for LDGVs and LDGT1s.
- 5 For motorcycles only, values of .000 should be used for ages 13 thru 25+ (see section 2.2.3.4).

Table 2.2-4

**SUMMARY OF ALTERNATE BER RECORDS**

(required if NEWFLG = 2, 4, or 6)

See section 2.2.4 for additional information.

<u>Record</u>	<u>Field</u>	<u>Content, Description, and Codes</u>	<u>Format</u>	<u>Allowable Values</u>
1	1	Number of BER records to follow	I3/	1 to 100
2 thru N+1	1	Code for region new BER applies to:  1 = low-altitude 2 = high-altitude	I1,1X	1 or 2
	2	Code for vehicle type new BER applies to:  1 = LDGV    5 = LDDV 2 = LDGT1   6 = LDDT 3 = LDGT2   7 = HDDV 4 = HDGV    8 = MC	I1,1X	1 to 8
	3	Code for pollutant new BER applies to:  1 = HC      2 = CO      3 = NOx	I1,1X	1 to 3
	4	First model year new BER applies to (last 2 digits)	I2,1X	60-99, 00-50
	5	Last model year new BER applies to (last 2 digits)	I2,1X	60-99, 00-50
	6	New Zero-mile level (ZML)*	F6.3,1X	≥ 0.0
	7	New Deterioration rate (or DR1)*	F6.3,1X	≥ 0.0
	8	New DR2*	F6.3/	≥ 0.0

\* DR2 for model year 1981 and later HC, CO, and NOx BERs for LDGVs, LDGT1s, and LDGT2s only. Field 8 is blank for all pollutant BERs for other vehicle types. HDGV and HDDV inputs must be in grams per brake-horsepower hour.

Table 2.2-5

**SUMMARY OF NEW EVAPORATIVE EMISSION TEST PROCEDURE RECORDS**

(required if NEWFLG = 3 or 4)

**Note:** The new evaporative emission test procedure is assumed in MOBILE5a and MOBILE5b. Old input files using this can still be used as inputs, but the values in this record will not be used by MOBILE5a or MOBILE5b in calculating emission factors. See section 2.2.4.2.1 for additional information.

<u>Record</u>	<u>Field</u>	<u>Content, Description, and Codes</u>	<u>Format</u>	<u>Allowable Values</u>
1	1	Number of records to follow, specifying new evaporative emission test procedure phase-in schedule (equal to number of model year steps in phase-in schedule)	I1/	1 to 4
2 thru N+1 <sup>1</sup>	1	Model year of vehicles in phase-in schedule for new evaporative emission test procedure	I2	95-99 or 00-50
	2	Percentage compliance with new evaporative emission test procedure required in this model year	F5.0/	0.0-100.0

<sup>1</sup> Model years must be listed in order; percentages must not decrease from one year to the next.

Table 2.2-6

**I/M PROGRAM CONTROL FLAG RECORD**

(required if IMFLAG = 6)

**NOTE:** This record is required if the user wishes to include the effects of Technician Training and Credit on the I/M program that is modeled.

See section 2.2.5.3 for additional information.

<u>Field</u>	<u>Content, Description, Codes</u>	<u>Format</u>	<u>Allowable Values</u>	<u>Refer to Section</u>
1	Number of I/M Program Descriptive records to follow	I1,1X	1-2	2.2.5.3
2	Code for override of user specified I/M for Tier 1 vehicles (Tier 1 flag)  1 = User specified I/M program(s) not overridden. 2 = User specifies one or two I/M program(s), and beginning in 1994, emission credits based on assuming a specific I/M program* for Tier 1 vehicles override the user specified program for LDGVs and LDGTs.	I1,1X	1-2	2.2.5.3
* See sections 2.2.5, 2.3.1, 2.3.7, and Appendix 2B for additional information on the specific I/M program that is assumed for Tier 1 vehicles when IMFLAG is set to 4 or 5.				
3	Code for Technician Training and Certification benefits (TTC flag)  1 = Do not apply TTC credits to the I/M program(s) 2 = Apply TTC credits to the I/M program(s)	I1,1X	1-2	2.2.5.3
4	Code for Remote Sensing Device inspections (RSD flag)  1 = Do not include RSD inspections as part of the I/M program(s) 2 = Include RSD inspections as part of the I/M program(s)	I2	1-2	2.2.5.3



Table 2.2-7

**SUMMARY OF I/M PROGRAM DESCRIPTIVE INPUT RECORD(S)**

(required if IMFLAG = 2, 3, 4, 5, or 6)

**NOTE:** MOBILE5 will model the effects of one or two I/M programs on emission factors. If two I/M programs are to be modeled, an I/M Program Descriptive Record must be entered for each program.

See section 2.2.5 and Appendixes 2A and 2B for additional information.

<u>Field</u>	<u>Content, Description, Codes</u>	<u>Format</u>	<u>Allowable Values</u>	<u>Refer to Section</u>
1	Program start year  (Last 2 digits of first calendar year of program operation)	I2,1X	60-99,00-50	2A.1.2
2	Stringency level (percent)	I2,1X	10 to 50	2A.1.3
3	First model year  (Last 2 digits of oldest model year of vehicles included in program)	I2,1X	52-99,00-50	2A.1.4
4	Last model year  (Last 2 digits of latest model year of vehicles included in program)	I2,1X	52-99,00-50	2A.1.5
5	Waiver rate for pre-1981 model year vehicles (%)	F2.0,1X	0 to 50	2A.1.6
6	Waiver rate for 1981 and later model year vehicles (%)	F2.0,1X	0 to 50	2A.1.6
7	Compliance rate (%)	F3.0,1X	0 to 100	2A.1.7
8	Program type  1 = Test only 2 = Test and Repair (Computerized) 3 = Test and Repair (Manual) 4 = Retest Based Hybrid	I1	1 to 4	2A.1.12 2A.1.13 2A.1.14 2A.1.15

Table 2.2-7 (continued)

**SUMMARY OF I/M PROGRAM DESCRIPTIVE INPUT RECORD(S)**

(required if IMFLAG = 2, 3, 4, 5, or 6)

<u>Field</u>	<u>Content, Description, Codes</u>	<u>Format</u>	<u>Allowable Values</u>	<u>Refer to Section</u>
9	Alternate effectiveness rates flag  1 = Do not supply alternate effectiveness rates 2 = Alternate effectiveness rates will be supplied	A1	1, 2	2.2.5.3
10	Inspection frequency  1 = Annual                      2 = Biennial	I1,1X	1 or 2	2A.1.8
11	Vehicle types subject to inspections  Enter 1 (not subject to inspection) or 2 (subject to inspection) for each vehicle type, in this order: LDGV, LDGT1, LDGT2, HDGV	4I1,1X	1 or 2 (in each column)	2A.1.9
12	Test type  1 = Idle test 2 = 2500/Idle test 3 = Loaded Idle test 4 = Transient (IM240) test (user <u>must</u> specify cutpoints) 5 = ASM test (user <u>must</u> specify cutpoints)	I1	1 to 5	2A.1.10
13	Flag to indicate whether user is supplying non-default cutpoints (if test type = 4 or 5, this flag <u>must</u> be set to 2)	I1	1 or 2	1.3.5 & 2A.1.16 2.2.5.4
14-15	Flags to indicate whether alternate I/M credits are to be supplied by the user  Enter 1 (use MOBILE5 I/M credits) or 2 (read in alternate I/M credits from logical I/O device units 3 and 4, for Tech I-II and Tech IV+ vehicles, respectively). The filenames of the alternate I/M credit files must be entered immediately following the program effectiveness record (if present), or following the I/M program descriptive record(s).	2I1	1 or 2	2A.1.11 2A.1.18

Table 2.2-7 (continued)

**SUMMARY OF I/M PROGRAM DESCRIPTIVE INPUT RECORD(S)**

(required if IMFLAG = 2, 3, 4, 5, or 6)

16	User-supplied cutpoint for HC	1X,F4.2	0. to 999.	1.3.5
17	User-supplied cutpoint for CO	1X,F4.2	0. to 999.	&
18	User-supplied cutpoint for NOx	1X,F4.2	0. to 999.	2A.1.16

User specification of cutpoints is mandatory if the IM240 or ASM test types are specified, but is optional for the other test types (idle, loaded idle, 2500/idle). Default cutpoints of 220 for HC, 1.2 for CO, and 999. for NOx are assumed in MOBILE5 for the idle, loaded idle, and 2500/idle test procedures.

Table 2.2-8

**SUMMARY OF PROGRAM EFFECTIVENESS RECORD**  
(required if Program Effectiveness Flag on I/M Program Descriptive Record = 2)

See section 2.2.5.5 for additional information.

<u>Field</u>	<u>Content, Description, Codes</u>	<u>Format</u>	<u>Allowable Values</u>	<u>Refer to Section</u>
1	Effectiveness rate for test-and-repair I/M programs in controlling HC emissions	F4.2,1X	0.00-1.00	2.2.5.3
2	Effectiveness rate for test-and-repair I/M programs in controlling CO emissions	F4.2,1X	0.00-1.00	2.2.5.3
3	Effectiveness rate for test-and-repair I/M programs in controlling NOx emissions	F4.2,1X	0.00-1.00	2.2.5.3
4	Effectiveness rate for test-and-repair ATP programs. Note: Unlike the four other effectiveness rates in this record where a rate of 0.50 corresponds to the default test-and-repair program, an effectiveness rate here of 0.00 corresponds to the default test-and-repair ATP program.	F4.2,1X	0.00-1.00	2.2.5.3
5	Effectiveness rate for test-and-repair functional pressure and purge check programs	F4.2	0.00-1.00	2.2.5.3

Table 2.2-9

**SUMMARY OF ATP DESCRIPTIVE INPUT RECORD**

(required if ATPFLG = 2, 5, 6, or 8)

See section 2.2.6 for additional information.

<u>Field</u>	<u>Content, Description, Codes</u>	<u>Format</u>	<u>Allowable Values</u>	<u>Refer to Section</u>
1	Program start year  (Last 2 digits of first calendar year of ATP operation)	I2,1X	60-99,00-50	2A.1.2
2	First model year  (Last 2 digits of oldest model year vehicles included in ATP)	I2,1X	60-99,00-50	2A.1.4
3	Last model year  (Last 2 digits of latest model year vehicles included in ATP)	I2,1X	60-99,00-50	2A.1.5
4	Vehicle types subject to ATP inspections  Enter 1 (not subject to inspection) or 2 (subject to inspection) for each vehicle type, in this order: LDGV, LDGT1, LDGT2, HDGV	4I1,1X	1 or 2 (in each column)	2A.1.9
5	Program type  1 = Test only 2 = Test and repair	I1	1 or 2	2A.1.12 2A.1.13
6	Inspection frequency  1 = annual 2 = biennial	I1,1X	1 or 2	2A.1.8
7	Compliance rate (percent)	F4.0,1X	0 to 100	2A.1.7

Table 2.2-9 (continued)

**SUMMARY OF ATP DESCRIPTIVE INPUT RECORD**

(required if ATPFLG = 2, 5, 6, or 8)

<u>Field</u>	<u>Content, Description, Codes</u>	<u>Format</u>	<u>Allowable Values</u>	<u>Refer to Section</u>
8	Inspections performed	811	1 or 2 (in each column)	

Enter 1 (inspection is not performed) or 2 (inspection is performed) for each type of inspection, in this order:

Air pump system	2A.2.3
Catalyst	2A.2.4
Fuel inlet restrictor	2A.2.5
Tailpipe lead deposit test	2A.2.6
EGR system	2A.2.7
Evaporative emission control system	2A.2.8
PCV system	2A.2.9
Gas cap	2A.2.10

Table 2.2-10

**SUMMARY OF FUNCTIONAL PRESSURE and/or PURGE TEST INPUT RECORD(S)**

(required if ATPFLG = 3, 4, 5, 6, 7, or 8)

See section 2.2.6.3 for additional information.

Pressure test information record required if ATPFLG = 3, 5, 7, or 8. Purge test information record required if ATPFLG = 4, 6, 7, or 8. If both are used, pressure test record precedes purge test record in input file.

<u>Field</u>	<u>Content, Description, Codes</u>	<u>Format</u>	<u>Allowable Values</u>	<u>Refer to Section</u>
1	Start year  (Last 2 digits of first calendar year of program operation)	I2,1X	60-99,00-50	2A.1.2
2	First model year  (Last 2 digits of oldest model year vehicles subject to functional pressure or purge testing)	I2,1X	60-99,00-50	2A.1.4
3	Last model year  (Last 2 digits of latest model year vehicles subject to functional pressure or purge testing)	I2,1X	60-99,00-50	2A.1.5
4	Vehicle types subject to functional pressure or purge testing  Enter 1 (not subject to testing) or 2 (subject to testing) for each vehicle type, in this order: LDGV, LDGT1, LDGT2, HDGV	4I1,1X	1 or 2 (in each column)	2A.1.9
5	Program type  1 = Test only 2 = Test and repair 3 = Retest Based Hybrid	I1	1 to 3	2A.1.12 2A.1.13 2A.1.15
6	Inspection frequency  1 = annual                      2 = biennial	I1,1X	1 or 2	2A.1.8
7	Compliance rate (percent)	F4.0	0 to 100	2A.1.7

Table 2.2-11

**SUMMARY OF STAGE II AND ONBOARD VRS DESCRIPTIVE INPUT RECORDS**

(required if RLFLAG = 2, 3, or 4)

See section 2.2.7 for additional information.

**Stage II VRS Input Record** (required if RLFLAG = 2 or 4)

<u>Field</u>	<u>Content, Description, Codes</u>	<u>Format</u>	<u>Allowable Values</u>
1	Stage II start year  (Last 2 digits of calendar year in which Stage II requirement is first effective)	I2,1X	89-99,00-50
2	Phase-in period  (Number of years allowed for all stations subject to Stage II requirement to complete installation)	I1	1 to 9
3	Percent efficiency of Stage II VRS at controlling refueling emissions from LDGVs and LDGTs	1X,I3	0 to 100
4	Percent efficiency of Stage II VRS at controlling refueling emissions from HDGVs	1X,I3	0 to 100

**Onboard VRS Input Record** (required if RLFLAG = 3 or 4)

Note: Onboard Refueling Vapor Recovery systems are assumed in MOBILE5b. The values on this record will not be used by the model in calculating emission factors. See section 2.2.7.

<u>Field</u>	<u>Content, Variable Name, Codes</u>	<u>Format</u>	<u>Allowable Values</u>
1	Onboard start year  (Last 2 digits of first model year vehicles are subject to onboard VRS requirement)	I2,1X	89-99,00-50
2	Vehicle types covered  Enter 1 (not covered) or 2 (covered) for each vehicle type, in this order: LDGV, LDGT1, LDGT2, HDGV	4I1	1 or 2 (in each column)



Table 2.2-12

**SUMMARY OF THE LOCAL AREA PARAMETER RECORD**

<u>Field</u>	<u>Content, Description, Codes</u>	<u>Format</u>	<u>Allowable Values</u>	<u>Refer to Section</u>
1	Scenario name	4A4,1X		2.2.9
2	Fuel volatility class	A1	A,B,C,D,E	1.4.2, 2.2.10, 2.2.16
3	Minimum daily temperature (°F)	F5.0	0.-100.	2.2.11
4	Maximum daily temperature (°F)	F5.0	10.-120.	2.2.11
<p>These temperatures are used to calculate diurnal evaporative and refueling HC emissions. If TEMFLG = 1, they are also used to calculate the temperatures used in correction of exhaust HC, CO, and NOx, hot soak evaporative, refueling, resting loss, and running loss emissions.</p>				
5	"Period 1" RVP (psi)  (Average fuel volatility for the area being modeled, for years prior to "Period 2" start year.)	F5.1	7.0-15.2	2.2.12
6	"Period 2" RVP (psi)  (Average fuel volatility for the area being modeled, for "Period 2" start and later years.)	F5.1,1X	7.0-15.2	2.2.13
7	"Period 2" start year  (Last 2 digits of first calendar year for which "Period 2" RVP is to be assumed)	I2	89-99,00-50	2.2.13
8	Oxygenated fuel flag*  (Indicates whether effect of oxygenated fuels on emissions is to be modeled)	1X,I1	1 or 2	2.2.14
9	Diesel sales fraction flag*  (Indicates whether user is supplying alternate LDV and LDT diesel sales fractions) <u>Note:</u> This flag is not applicable when LOCFLG = 2.	1X,I1	1 or 2	2.2.15

Table 2.2-12 (continued)

**SUMMARY OF THE LOCAL AREA PARAMETER RECORD**

<u>Field</u>	<u>Content, Description, Codes</u>	<u>Format</u>	<u>Allowable Values</u>	<u>Refer to Section</u>
10	Reformulated gasoline flag* (Flag indicates whether effect of reformulated gasoline on emissions is to be modeled)	1X,I1	1 or 2	2.2.16
11	Detergent Gasoline flag* (Indicates whether effect of detergent gasoline additives on emissions is to be modeled)	1X,I1	1 or 2	2.2.16

\* Flag is optional. Settings are 1 = No and 2 = Yes. If missing, assumed to be "1".

Table 2.2-13

**SUMMARY OF BY MODEL YEAR INCLUSION RECORD**

(required if OUTFMT = 5)

See section 2.2.18 for additional information.

<u>Field</u>	<u>Content, Description, and Codes</u>	<u>Format</u>	<u>Allowable Values</u>
1-8	Whether or not by model year output is desired for each of eight vehicle types, in this order:  LDGV, LDGT1, LDGT2, HDGV, LDDV, LDDT, HDDV, MC  1 = No                      2 = Yes	8I1	1 or 2
9	Whether or not by model year output of inspection and maintenance (I/M) program effects on emission factors is desired  1 = No                      2 = Yes	1X,I1	1 or 2

Table 2.3-1

**SUMMARY OF THE SCENARIO RECORD(S)****Record 1: Scenario Descriptive Record (MANDATORY)**

<u>Field</u>	<u>Content, Description, Codes</u>	<u>Format</u>	<u>Allowable Values</u>	<u>Refer to Section</u>
1	Region for which emission factors are to be calculated  1 = low-altitude 2 = high-altitude 3 = low-altitude; California low emission vehicle (LEV) program with specific I/M program (as described in Appendix 2B) assumed 4 = low-altitude; California LEV program with start year other than 1994 model year and/or specific I/M program (as described in Appendix 2B) <u>not</u> assumed (user must enter LEV program parameter record)	I1,1X	1, 2, 3, or 4	2.3.1 Apdx 2B
2	Calendar year of evaluation  (Last 2 digits of calendar year for which emission factors are to be calculated)	I2	60-99,00-50	2.3.2
3	Average speed(s) to be used in emission factor calculations  If SPDFLG = 1, one average speed is used for all vehicle types  <b>or</b>  If SPDFLG = 2, eight average speeds are used, one for each vehicle type, in this order: LDGV, LDGT1, LDGT2, HDGV, LDDV, LDDT, HDDV, MC	1X,F4.1  <b>or</b>  8(1X,F4,1)	2.5-65.0	2.3.3
4	Ambient temperature (°F)  (If TEMFLG = 2, this temperature is used to correct exhaust, hot soak evaporative, resting loss, and running loss emission factors to temperatures other than 75°F)	1X,F4.1	0.0-110.	2.3.4
5	Operating mode fractions  [Percent of VMT accumulated by (1) non-catalyst vehicles in cold-start mode (PCCN), (2) catalyst-equipped vehicles in hot-start mode (PCHC), and (3) catalyst-equipped vehicles in cold-start mode (PCCC)]	3(1X,F4.1)	0.0-100.	2.3.5

Table 2.3-1 (continued)

**SUMMARY OF THE SCENARIO RECORD(S)****Record 1: Scenario Descriptive Record (MANDATORY)** (continued)

<u>Field</u>	<u>Content, Description, Codes</u>	<u>Format</u>	<u>Allowable Values</u>	<u>Refer to Section</u>
6	Month of evaluation  Optional input to indicate month for which emission factors are to be calculated. Values of 1 (January) or 7 (July) are permitted. If missing, assumed to be "1". <b>NOTE:</b> There are certain conditions that the user should be aware of when using the July 1 option. Please read section 2.3.6 before using the July 1 option.	2X,11	1 or 7	2.3.6

**Record 2: LEV Program Parameter Record (OPTIONAL)**  
(required only if REGION = 4 on Scenario Descriptive Record)

<u>Field</u>	<u>Content, Description, Codes</u>	<u>Format</u>	<u>Allowable Values</u>	<u>Refer to Section</u>
1	Start year for phase-in of LEVs  Last two digits of first year of LEV phase-in	I2,1X	93-99,00-50	2.3.7
2	Flag indicating whether an I/M program meeting the criteria in Appendix 2B is to be assumed in modeling  1 = Standard or no I/M program assumed 2 = "Maximum benefit" I/M program meeting the criteria of Appendix 2B assumed	I1	1 or 2	2.3.7 Apdx 2B
3	Flag indicating whether LDGT2 vehicles are subject to the LEV program  1 = No LEV program assumed for LDGT2 2 = LEV program covers LDGT2 vehicles	I1	1 or 2 Apdx 2B	2.3.7

Table 2.3-1 (continued)

**SUMMARY OF THE SCENARIO RECORD(S)****Record 3: LAP record -- for this scenario only (OPTIONAL)**

(required only if LOCFLG = 1)

See Table 2.2-12

**Record 4: Oxygenated fuels descriptive record (OPTIONAL)**

(Required only if OXYFLG = 2 on LAP record. Appears immediately following LAP record in One-time Data section if LOCFLG=2; appears immediately following each LAP record in Scenario section if LOCFLG=1.)

<u>Field</u>	<u>Content, Description, Codes</u>	<u>Format</u>	<u>Allowable Values</u>	<u>Refer to Section</u>
1	Ether blends market share	F4.3,1X	0.0-1.0	2.3.9.1
2	Alcohol blends market share	F4.3,1X	0.0-1.0	2.3.9.1
3	Average oxygen content of ether blend fuels (by weight)	F4.3,1X	0.0-0.027	2.3.9.1
4	Average oxygen content of alcohol blend fuels (by weight)	F4.3,1X	0.0-0.035	2.3.9.1
5	RVP waiver switch (Flag indicating whether oxygenated fuels are allowed to exceed regulated RVP limit by 1.0 psi: 1 = No, 2 = Yes)	I1	1 or 2	2.3.9.1

**Record 5: Gasoline detergent additive parameter record (OPTIONAL)**

(Required only if DTGFLG = 2 on LAP record. Appears immediately following Oxygenated fuels record in One-time Data section if LOCFLG=2; appears immediately following each Oxygenated fuels record in Scenario section if LOCFLG=1.)

<u>Field</u>	<u>Content, Description, Codes</u>	<u>Format</u>	<u>Allowable Values</u>	<u>Refer to Section</u>
1	Detergent gasoline phase-in end year	I4	1996-2050	2.3.9.2
2	Detergent gasoline phase-in factor	1X,F5.2	0.-100.	2.3.9.2
3	Percentage of vehicles with fuel injector deposits	1X,F5.2	0.-100.	2.3.9.2

Table 2.3-1 (continued)

**SUMMARY OF THE SCENARIO RECORD(S)****Record 5: Gasoline detergent additive parameter record (OPTIONAL)** (continued)

<u>Field</u>	<u>Content, Description, Codes</u>	<u>Format</u>	<u>Allowable Values</u>	<u>Refer to Section</u>
4	Reduction of HC resulting from detergent gas effect on fuel injector deposits	1X,F5.2	0.-100.	2.3.9.2
5	Reduction of CO for same reason as above	1X,F5.2	0.-100.	2.3.9.2
6	Reduction of NOx for same reason as above	1X,F5.2	0.-100.	2.3.9.2
7	Percentage of vehicles with intake valve deposits	1X,F5.2	0.-100.	2.3.9.2
8	Reduction of HC resulting from detergent gas effect on intake valve deposits	1X,F5.2	0.-100.	2.3.9.2
9	Reduction of CO for same reason as above	1X,F5.2	0.-100.	2.3.9.2
10	Reduction of NOx for same reason as above	1X,F5.2	0.-100.	2.3.9.2

**Records 6-8: Diesel sales fractions (OPTIONAL)**

(Required only if DSFLAG = 2 on LAP record and LOCFLG = 1)

Three records containing fractions of LDV/LDT sales by model year that were diesel, starting with model year = calendar year of evaluation and ending with model year = (calendar year - 25)-and-older.

<u>Field</u>	<u>Content, Description, Codes</u>	<u>Format</u>	<u>Allowable Values</u>	<u>Refer to Section</u>
1-20	LDV age 1, LDT age 1, LDV age 2, LDT age 2, . . . , LDV age 10, LDT age 10	20F4.3/	0.0-1.0	2.3.10
21-40	LDV age 11, LDT age 11, LDV age 12, LDT age 12, . . . , LDV age 20, LDT age 20	20F4.3/	0.0-1.0	2.3.10
41-50	LDV age 21, LDT age 21, LDV age 22, LDT age 22, . . . , LDV age 25+, LDT age 25+	10F4.3/	0.0-1.0	2.3.10

Table 2.3-1 (continued)

**SUMMARY OF THE SCENARIO RECORD(S)****Record 9: VMT mix by vehicle type record (OPTIONAL)**

(Required for each scenario if VMFLAG = 2; required in One-Time Data section if VMFLAG = 3)

<u>Field</u>	<u>Content, Description, Codes</u>	<u>Format</u>	<u>Allowable Values</u>	<u>Refer to Section</u>
1-8	VMT fraction accumulated by each of eight vehicle types, in this order: LDGV, LDGT1, LDGT2, HDGV, LDDV, LDDT, HDDV, MC	8F4.3	0.0-1.0	2.2.2

**Record 10: Trip Length Distribution record (OPTIONAL)**

(Required for each scenario if SPDFLG = 3; required in One-Time Data section if SPDFLG = 4)

<u>Field</u>	<u>Content, Description, Codes</u>	<u>Format</u>	<u>Allowable Values</u>	<u>Refer to Section</u>
	Percentage of total vehicle miles traveled (VMT) accumulated in trips of the following lengths of time (durations):			2.3.12
1	Under 10 minutes	1X,F4.1	0.0-100.0*	
2	11 to 20 minutes	1X, F4.1	0.0-100.0*	
3	21 to 30 minutes	1X, F4.1	0.0-100.0*	
4	31 to 40 minutes	1X, F4.1	0.0-100.0*	
5	41 to 50 minutes	1X, F4.1	0.0-100.0*	
6	51 minutes and longer	1X, F4.1	0.0-100.0*	

\* The sum of the six values entered must equal 100 percent.



Table 2.3-1 (continued)

**SUMMARY OF THE SCENARIO RECORD(S)****Record 11: Additional Correction Factor record (OPTIONAL)**

(Required only if ALHFLG = 2 or 3)

<u>Field</u>	<u>Content, Description, Codes</u>	<u>Format</u>	<u>Allowable Values</u>	<u>Refer to Section</u>
1	Air conditioning use fraction  (Percent of AC-equipped vehicles actually using AC)	F4.2	0.0-1.0	2.3.13.3 and 2.3.13.7
<p>Note: If ALHFLG = 2, no AC usage correction factor will be applied, and the input value of this variable should be 0.0. If ALHFLG = 3, the input value is overridden by the calculated value (see section 2.3.13.3); however, a nonzero value must be entered here in order for the AC correction factor be calculated and applied.</p>				
2-4	Extra load fractions  (Percent of vehicles assumed to be carrying additional 500 lb load; fractions apply to LDGVs, LDGT1s, and LDGT2s, in that order)	3F4.2	0.0-1.0	2.3.13.4
5 or 5-7	Trailer towing fraction(s) (Percent of vehicles assumed to be towing trailers)	F4.2 or 3F4.2	0.0-1.0	2.3.13.5
<p>Note: If ALHFLG = 2, one value is required and is used to calculate the correction factor for all three vehicle types. If ALHFLG = 3, three values are required and are used to calculate the correction factor for LDGV, LDGT1, and LDGT2, respectively.</p>				
6 or 8	Absolute humidity level  (Grains water per pound dry air, used to correct exhaust NOx emission factors)	F4.0	20.-140.	2.3.13.6
9, 10	Dry and wet bulb temperatures, in °F  If ALHFLG = 3 <u>only</u> , these temperatures are used to calculate a "discomfort index," which in turn is used to estimate an A/C usage fraction (which then overrides the value input in Field 1 of this record).	2F4.0	0.-110.	2.3.13.7

Table 2.4-1

**SUMMARY OF THE MOBILE5 INPUT RECORD SEQUENCE**

<u>Input Record Sequence</u>	<u>Input Type</u>	<u>Refer to Section</u>
1 <b>PROMPT</b> flag record	CONTROL	2.1.1
(1-3 <b>IOUNEW</b> values)*	CONTROL	2.1.2
1 <b>PROJID</b> record	CONTROL	2.1.3
1 <b>TAMFLG</b> flag record <sup>1</sup>	CONTROL	2.1.4
1 <b>SPDFLG</b> flag record <sup>1</sup>	CONTROL	2.1.5
1 <b>VMFLAG</b> flag record <sup>1</sup>	CONTROL	2.1.6
1 <b>MYMRFG</b> flag record <sup>1</sup>	CONTROL	2.1.7
1 <b>NEWFLG</b> flag record <sup>1</sup>	CONTROL	2.1.8
1 <b>IMFLAG</b> flag record <sup>1</sup>	CONTROL	2.1.9
1 <b>ALHFLG</b> flag record <sup>1</sup>	CONTROL	2.1.10
1 <b>ATPFLG</b> flag record <sup>1</sup>	CONTROL	2.1.11
1 <b>RLFLAG</b> flag record <sup>1</sup>	CONTROL	2.1.12
1 <b>LOCFLG</b> flag record <sup>1</sup>	CONTROL	2.1.13
1 <b>TEMFLG</b> flag record <sup>1</sup>	CONTROL	2.1.14
1 <b>OUTFMT</b> flag record <sup>1</sup>	CONTROL	2.1.15
1 <b>PRTFLG</b> flag record <sup>1</sup>	CONTROL	2.1.16
1 <b>IDLFLG</b> flag record <sup>1</sup>	CONTROL	2.1.17
1 <b>NMHFLG</b> flag record <sup>1</sup>	CONTROL	2.1.18
1 <b>HCFLAG</b> flag record <sup>1</sup>	CONTROL	2.1.19
(24 or 48 tampering records) <sup>2</sup>		
if <b>TAMFLG</b> = 2	ONE-TIME	2.2.1
(1 VMT mix record)		
if <b>VMFLAG</b> = 3	ONE-TIME	2.2.2
(24 mileage accumulation rate by age records)		
if <b>MYMRFG</b> = 2 or 4	ONE-TIME	2.2.3
(24 registration distribution by age records)		
if <b>MYMRFG</b> = 3 or 4	ONE-TIME	2.2.3
(1 to 100 basic emission rate records)		
if <b>NEWFLG</b> = 2, 4, or 6	ONE-TIME	2.2.4
(2 to 5 records for terms of the new evaporative emission test procedure phase-in schedule) <sup>5</sup>		
if <b>NEWFLG</b> = 3 or 4	ONE-TIME	2.2.4
(1 I/M control flag record)		
if <b>IMFLAG</b> = 6	ONE-TIME	2.2.5
(1 I/M program descriptive record)		
if <b>IMFLAG</b> = 2, 4, or possibly when 6	ONE-TIME	2.2.5
(2 I/M program descriptive records)		
if <b>IMFLAG</b> = 3, 5, or possibly when 6	ONE-TIME	2.2.5
(1 program effectiveness record)		
if the Alternate Effectiveness flag field = 2 on the I/M Program Descriptive Record	ONE-TIME	2.2.5

Table 2.4-1 (continued)

**SUMMARY OF THE MOBILE5 INPUT RECORD SEQUENCE**

<u>Input Record Sequence</u>	<u>Input Type</u>	<u>Refer to Section</u>
(1 or 2 alternate I/M credit file names) if specified in fields 13-14 of the I/M programs descriptive record	ONE-TIME	2.2.5
(1 ATP descriptive record) if ATPFLG = 2, 5, 6, or 8	ONE-TIME	2.2.6
(1 Pressure test information record) if ATPFLG = 3, 5, 7, or 8	ONE-TIME	2.2.6
(1 Purge test information record) if ATPFLG = 4, 6, 7, or 8	ONE-TIME	2.2.6
(1 or 2 refueling VRS descriptive records) <sup>3</sup> if RLFLAG = 2, 3, or 4	ONE-TIME	2.2.7
(1 Local Area Parameter record) <sup>4</sup> if LOCFLG = 2	ONE-TIME	2.2.8
(1 oxygenated fuel descriptive record) if LOCFLG = 2 and OXYFLG = 2	ONE-TIME	2.3.9.1
(1 gasoline detergent additive parameter record) if LOCFLG = 2 and DTGFLG = 2	ONE-TIME	2.3.9.2
(1 trip length distribution record) if SPDFLG = 4	ONE-TIME	2.3.12
(1 by model year inclusion vector record) if OUTFMT = 5	ONE-TIME	2.2.19
1 Scenario Descriptive Record	SCENARIO	2.3
(1 LEV Program Parameter Record) if REGION = 4 on Scenario Descriptive Record	SCENARIO	2.3.7
(1 Local Area Parameter record) <sup>4</sup> if LOCFLG = 1	SCENARIO	2.2.8
(1 oxygenated fuel descriptive record) if LOCFLG = 1 and OXYFLG = 2	SCENARIO	2.3.9.1
(1 gasoline detergent additive parameter record) if LOCFLG = 1 and DTGFLG = 2	SCENARIO	2.3.9.2
(3 diesel sales fraction by model year records) if LOCFLG = 1 and DSFLAG = 2	SCENARIO	2.3.10
(1 VMT mix record) if VMFLAG = 2	SCENARIO	2.2.2
(1 trip length distribution record) if SPDFLG = 3	SCENARIO	2.3.12
(1 additional correction factor record) if ALHFLG = 2 or 3	SCENARIO	2.3.13

\* Required only if reassignment of output device numbers is desired.

<sup>1</sup> These 16 flags are entered on one record (format I1, 15(1X,I1)) if PROMPT = 3 or 4.

<sup>2</sup> 24 records if IMFLAG = 1; 48 records if IMFLAG = 2, 3, 4, 5, or 6.

<sup>3</sup> Stage II record if RLFLAG = 2; onboard record if RLFLAG = 3; both records if RLFLAG = 4.

(Note: The onboard record will be ignored in MOBILE5b. See section 2.2.7.)

<sup>4</sup> The Local Area Parameter record must appear in either the One-Time or the Scenario data section.

<sup>5</sup> (Note: The new evaporative emission test procedure records will be ignored in MOBILE5b. See section 2.2.4.2.1.)

(this page intentionally blank)

## Appendix 2A

**INSPECTION/MAINTENANCE AND ANTI-TAMPERING PROGRAM TERMINOLOGY DEFINITIONS**

This appendix discusses the terminology used to describe inspection and maintenance (I/M) and anti-tampering (ATP) programs for purposes of modeling the emission benefits of such programs using MOBILE5. In general, MOBILE5 assumes that the I/M program is mandatory, periodic, and covers a well-defined group of vehicles. There are many details (e.g., instrument specifications) which are beyond the scope of this document. Program planners should consult with EPA (Regional and State Programs Division, 313/668-4417) if there are questions regarding I/M program requirements.

**2A.1 I/M PROGRAM TERMINOLOGY****2A.1.1 I/M**

I/M refers to "inspection and maintenance" programs, which are inspections of vehicles using a measurement of tailpipe emissions and which require that all vehicles with tailpipe emissions higher than emission levels specified by the program be repaired to pass a tailpipe emission retest. Inspections that are aimed at verifying the presence and proper connection of emission control devices and components are termed anti-tampering programs (ATPs). For convenience, such tailpipe I/M and ATPs are sometimes referred to collectively simply as "I/M programs" in other EPA documents.

**2A.1.2 Start Year**

The year in which the periodic inspection program first begins to require both inspection and repairs is called the start year. MOBILE5 only provides for a January 1st start date. Other start dates will require interpolation between two MOBILE5 runs to give accurate estimates of benefits. Separate and different start dates may be specified for a tailpipe I/M program and an ATP or other inspection program record. Changing program parameters (such as cutpoints, test type, etc.) generally does not change a program's start date. However, if a program makes such changes and wishes to evaluate the program before those changes have been fully implemented, program planners should consult EPA (Emission Inventory Group, 313/668-4325).

Since MOBILE5 has two I/M program descriptive records, there can be two input values of the I/M program start year. In most cases, this will require that both records use the same start year. If a different start year is used for the second record, the I/M program credits for the vehicles covered under that program's description will be assumed to have begun being tested as of that second start date. This option will be useful if new vehicle classes or model year [ranges] are added to the [second] I/M program, after the start date of the first program.

**2A.1.3 Stringency**

Stringency refers to the tailpipe emission initial test failure rate expected in an I/M program among pre-1981 model year passenger cars or pre-1984 light-duty trucks, based on the short test emission cutpoints. The expected failure rate can be determined by applying the program cutpoints to a representative sample of vehicles tested, using the appropriate test procedure, in a survey. Actual failure rates reported by a program can also be used to determine stringency, but only when there is no possibility of significant testing or data reporting errors and a determination can be made as to which tests were initial (first time) tests. MOBILE5 assumes that the failure rate remains fixed at the stringency level for each evaluation year. MOBILE5 does not allow a stringency less than 10% or greater than 50%.

#### **2A.1.4 First Model Year**

The first model year refers to the oldest model year vehicle which is always included in the inspection program. MOBILE5 assumes that all vehicle classes have the same model year coverage and does not allow for a separate coverage period for each vehicle class. Some programs do not fix the model years covered by the program, and instead use a coverage "window" to define which vehicles must be inspected. For example, such a program may cover only vehicles 15 years old or younger. Such programs cannot be modeled accurately using MOBILE5 without special assistance.

#### **2A.1.5 Last Model Year**

The last model year refers to the youngest (newest) model year vehicle which is always subject to the inspection program. This allows for a program to cover only particular model years. Most programs routinely include new model year vehicles in the program as they reach one year of age. It is recommended that the maximum allowable last model year (2050) be input as the last model year, unless a special case requires some other input. MOBILE5's calculation of I/M credits already assumes that vehicles less than one year old are exempt from inspection, so input of the maximum last model year allows for maximum flexibility. For example, if vehicles are exempt from inspection until they are three years old, the last model year should be set equal to the calendar year of evaluation minus three.

#### **2A.1.6 Waiver Rates**

Many I/M programs waive the requirement to pass a retest if certain defined criteria are met. Waivers are often granted in I/M programs for vehicles whose owners have spent over a set dollar limit in attempting to comply with the program retest requirement.

The waiver rate inputs to MOBILE5 reduce the estimated benefit of the I/M program design. The waiver rates are always calculated as a percent of non-duplicate initial test failures. Waiver rates must be provided for pre-1981 and for 1981 and later model year light-duty vehicles. MOBILE5 assumes that tampered or misfueled vehicles cannot receive waivers, and so does not reduce the ATP benefit based on the waiver rate.

#### **2A.1.7 Compliance Rate**

Compliance rate refers to the level of compliance with the inspection program. For example, assume a program required that all passenger cars be inspected each year, and that 100,000 passenger cars were registered in the area covered by the program. If in a given year only 95,000 passenger cars completed the inspection process to the point of receiving a final certificate of compliance or waiver, it could be assumed that the remaining 5,000 vehicles had avoided the inspection requirement. The compliance rate for this program would then be 95%. The number of initial inspections should not be used to calculate the compliance rate, since some cars may drop out after failing one or more tests. The compliance rate input is also used to account for vehicles which are waived from compliance without any testing (e.g., vehicles with special testing problems or vehicles owned by certain types of owners).

MOBILE5 uses a single compliance rate to reduce both the I/M and ATP portions of the program benefits. The reduction in benefit is not linear. The benefit loss per vehicle assumes that the failure rate among non-complying vehicles will be larger than the expected failure rate in the fleet. As the rate of non-compliance increases, the non-complying failure rate will approach and finally equal the expected failure rate.

The following table shows the loss of benefit assumed for the enforcement fraction:

<u>Compliance Rate</u>	<u>Non-Compliance Rate</u>	<u>Non-Complier Failure Rate Adjustment</u>	<u>Fraction Benefit Loss</u>	<u>Fraction Benefit Remaining</u>
100%	0%	2.0	.000	1.000
99%	1%	2.0	.020	.980
98%	2%	2.0	.040	.960
97%	4%	2.0	.080	.920
95%	5%	1.5	.095	.905
90%	10%	1.4	.169	.831
85%	15%	1.3	.238	.762
80%	20%	1.2	.302	.698
75%	25%	1.1	.361	.639
70%	30%	1.0	.415	.585
50%	50%	1.0	.615	.385

### **2A.1.8 Inspection Frequency**

MOBILE5 allows for two inspection frequencies. "Annual" means that all covered vehicles must be inspected once each year. "Biennial" means that each vehicle is inspected once every two years, such that half of the vehicles of each model year are inspected each calendar year. Any other inspection frequency would require alternate I/M credits provided by EPA.

### **2A.1.9 Vehicle Classes**

MOBILE5 program benefits are calculated separately for each gasoline-fueled vehicle class. No emission benefits are estimated for diesel vehicles or motorcycles. The vehicle class designations are based on the certification standard definitions:

**LDGV:** light-duty gasoline-fueled vehicles (passenger cars).

**LDGT1:** light-duty gasoline-fueled trucks up to 6000 lbs gross vehicle weight (lighter pick-up trucks and vans).

**LDGT2:** light-duty gasoline-fueled trucks over 6000 lbs, and up to 8500 lbs GVW (heavier pick-up trucks and vans, and many commercial trucks).

**HDGV:** heavy-duty gasoline-fueled vehicles over 8500 lbs GVW (heavier commercial trucks, including highway hauling trucks).

Many areas do not use the same vehicle class designations in their vehicle registration data as are used in MOBILE5. In these cases care must be taken not to claim coverage for too many vehicles.

### **2A.1.10 I/M Test Types**

There are four I/M test types allowed in MOBILE5. These test types only apply to the inspection of 1981 and newer model year passenger cars and 1984 and newer light-duty trucks. If pre-1981 model year vehicles are covered by either I/M program descriptive record, the benefits (emission reductions) determined for pre-1981 model year vehicles will be determined solely on the basis of the stringency (failure rate) value input. The stringency value is independent of test type.

Therefore the test type assumed to apply for pre-1981 model year vehicles can be different than that indicated on the I/M program descriptive record(s). The test type chosen by the user is assumed to be applied to all 1981 and newer passenger cars and 1984 and newer light-duty trucks both at the initial inspection and the retest. It is assumed that the default cutpoints used for the inspections are 1.2 percent CO and 220 ppm HC in all tests except for the IM240 test procedure.

**Idle Test** refers to a measurement of HC and CO emission concentrations of a fully warmed vehicle as it idles in neutral or park.

**2500/idle Test** refers to a measurement of HC and CO emission concentrations of a fully warmed vehicle at 2500 rpm in neutral or park, and again at idle. The vehicle must pass both at idle and at 2500 rpm in order to pass the test.

**Loaded/Idle Test** refers to a measurement of HC and CO emission concentrations of a fully warmed vehicle on a chassis dynamometer at a constant load, and again at idle in neutral or park. The vehicle must pass both at idle and at load in order to pass the test.

**Transient Exhaust Emission (IM240) Test** refers to a measurement of exhaust HC, CO and, in some cases, NO<sub>x</sub> emissions from a fully warmed vehicle on an inertial-weighted chassis dynamometer. The vehicle is operated over a transient driving cycle containing periods of acceleration, deceleration, idle, and cruise. The emissions and exhaust volume are measured and integrated over the 240 seconds of the testing cycle to give a composite score in grams emissions per mile of travel. The vehicle must pass emission level cutpoints for both HC and CO (and in some cases, NO<sub>x</sub>) in order to pass the test. The cutpoints and the test speed cycle determine the stringency of the test. Vehicles failing the transient test are required to be repaired such that they will be able to pass a transient retest using the same cutpoints.

**Acceleration Simulation Mode (ASM) Test** refers to measurement of HC, CO and in some cases NO<sub>x</sub> emissions from a fully warmed vehicle on a chassis dynamometer at a constant load in one (or more) modes. Two currently used modes are:

ASM 5015 - Vehicle operated at 15 miles per hour with the dynamometer set to simulate 50% of the power required to accelerate the vehicle being tested at 3.3 mph/second at 15 miles per hour.

ASM 2525 - Vehicle operated at 25 miles per hour with the dynamometer set to simulate 25% of the power required to accelerate the vehicle being tested at 3.3 mph/second at 25 miles per hour.

The vehicle must pass the HC and CO (and NO<sub>x</sub>, if applicable) emission level cutpoints within each mode and must pass both modes if more than one mode is used. A procedure that uses both modes is referred to as an ASM2 test and using only one mode is referred to as an ASM1 test.

#### **2A.1.11 Alternate I/M Credits**

In special cases where the design of the I/M program to be modeled does not fit into any of the categories defined in MOBILE5 (e.g., semi-annual or tri-annual inspection frequency), the model allows the user to supply a set of factors that will be used to determine the I/M program benefits. Normally these factors will be supplied by EPA at the request of the program manager or air quality planner.

#### **2A.1.12 Test Only Programs**



Test only (or inspection only) station inspection programs refer to those programs which completely separate the inspection of vehicles from the repair of vehicles. Usually high-volume inspection stations, run either by the local agency itself or by a contractor, will perform all initial tests and retests after repair. Garages and other repair facilities are not allowed to perform official tests. Independent, inspection only station programs are the standard used to determine the emission benefits for I/M and ATP program designs.

#### **2A.1.13 Test and Repair Programs (Manual Inspection)**

Test and repair (or inspection and repair) station inspection programs refer to those programs where the local program agency licenses service stations and garages to perform official inspections and reinspections. These licensed inspection stations are allowed to perform repairs on the vehicles they inspect. The number of licensed inspection stations in inspection and repair station programs is larger and the volume per station is smaller than for inspection only station programs.

Test and repair station programs have been found to be less effective than test only station programs. As a result, MOBILE5 reduces the emission benefits, relative to a test only station program design, by 50 percent for the I/M (tailpipe test) portion and 50 percent for the ATP portion of the program if the test and repair station program design is chosen. The 50 percent reduction in benefits from the tailpipe portion of the test includes the loss due to waivers, if any. Areas which can demonstrate that a currently operating network achieves greater emission reductions should contact EPA for assistance.

MOBILE5b allows the user to adjust the discount in the effectiveness of test and repair programs used by the model.

#### **2A.1.14 Test and Repair Programs (Computerized Inspection)**

Some test and repair station I/M programs require the use of computerized emission analyzers. These analyzers contain small computers which keep track of all official inspection activity, automatically calibrate the instrumentation, and prompt the inspector during the inspection procedure. The computer also prepares a machine-readable record of all official inspections and calibrations, and will not allow inspections whenever it determines the instrumentation to be out of calibration.

MOBILE5 assumes that the I/M portion of a test and repair station computerized inspection program will be 50 percent as effective as a test only station program of similar stringency (i.e., the benefits of the program are discounted by 50 percent). As noted above, this benefit reduction includes the impact of waivers, if any, and is not applied on top of a waiver-related loss of potential benefits. Any area that has data to support the contention that a specific test and repair station computerized program is more efficient than this (i.e., that the program should have its benefits discounted by less than 50 percent relative to the benefits of a test only station program) is encouraged to contact EPA for assistance in verifying that contention and in modeling the impact of that program on the in-use emission factors. Test and repair station computerized inspection programs will also have the benefits from the ATP portion of the program reduced by 50 percent.

MOBILE5b allows the user to adjust the discount in the effectiveness of test and repair programs used by the model.

#### **2A.1.15 Retest Based Hybrid Programs**

Hybrid programs are periodic inspection programs which allow for some vehicle owners to be inspected using one network type and others using another network type. Hybrid programs are only a concern to users of MOBILE5 if the effectiveness of network types to be modeled are different.

A common form of hybrid I/M is "age based", where vehicles in a specified age range (or model year range) are required to be inspected at test and repair stations and the others are required to be inspected at test only stations. This type of hybrid program can be modeled using MOBILE5 by describing each element of the program separately using the two I/M Descriptive Records.

A more complex form of I/M is the "retest based" hybrid. In this program all vehicles are initially inspected at test only stations. Vehicles that fail the initial test may choose to get a retest after repairs at a licensed test and repair facility if, and only if, they did not fail the initial test in the previous test cycle. Vehicles that did fail the initial test in the previous test cycle must return to a test only station for any official retests after repairs. This variety of hybrid I/M minimizes any emission losses due to network type within the hybrid system.

I/M benefits for a retest based hybrid I/M program can be estimated using MOBILE5b if a special set of alternate I/M benefits (contained in the data file **HYBRID.IMC**) are available.

### **2A.1.16 Cutpoints**

The term "cutpoints" refers to the numeric values of the emission levels used to determine the pass/fail status of a vehicle, as compared to the measured emission test results, under a given I/M test procedure. Exceeding the cutpoint(s) is considered as failing the emission test. A separate cutpoint is normally chosen for each pollutant of interest in the program. When more than one cutpoint is used (such as one for HC emissions and one for CO emissions), exceeding either or both cutpoints will cause the vehicle to fail the test. The combination of the emission test procedure used and the cutpoint(s) applied will determine the test failure rate.

In MOBILE5, the user-specified tailpipe emission cutpoints are used to determine the stringency of the I/M inspection for 1981 thru 1993 model year passenger cars (light-duty vehicles). Benefits for passenger car model years before 1981, and for light-duty truck model years before 1984, are determined by the "stringency level" input field on the I/M program descriptive record. The magnitude of I/M benefits for heavy-duty gas vehicles (HDGVs) is unaffected by user cutpoint inputs. There is no additional user input to indicate cutpoints for other, later model year groupings or for other vehicle classes (such as LDTs). Instead, MOBILE5 assumes that all 1994 and later model year passenger cars and 1984 and later model year light-duty trucks, which have different emission standards and in-use emissions performance, will be inspected using cutpoints that will result in similar reductions as are estimated for the 1981 thru 1993 model year passenger cars.

As a result, if the user intends to model these other model years and vehicle classes in such a way as to result in similar stringency as indicated by the choice of cutpoints for the 1981-1993 model year passenger cars, no further user-supplied information about stringency or cutpoints is required. For example, the set of cutpoints indicated in the recent enhanced I/M rulemaking were chosen to result in a similar stringency for each model year grouping and vehicle class. Therefore, to model the program indicated by the rulemaking, the user needs only to specify the cutpoints indicated for the 1981-1993 model year passenger cars as input to MOBILE5. The benefits for all other vehicle classes and model year groupings will be taken from that input. No further user input is required.

If the user intends that some later model years or vehicle classes are to have stringencies that are different than for the 1981-1993 model year passenger cars, then it may be necessary to perform multiple MOBILE5 runs, separately for each stringency. In this case, the user should consult with EPA on how best to choose cutpoint inputs for MOBILE5 to achieve the appropriate stringency for these other groups.

### **2A.1.17 Multiple I/M Programs**

Caution must be used when using the option to enter multiple I/M program designs to model mid-stream changes

in an area's I/M program. There are two parts to the emission reduction benefits achieved by I/M programs. First is the reduction achieved by repairs of vehicles identified by the tailpipe exhaust emission inspection. This reduction is determined by user specifications in the I/M Program Descriptive Record. The amount of the emission reduction for pre-1981 model year passenger cars and pre-1984 model year light-duty trucks will vary somewhat depending on the start date of the I/M program. For these vehicles, MOBILE5 assumes that there is residual benefit that accumulates the longer these vehicles have been involved in the I/M program. The benefit for 1981 and newer model year passenger cars, 1984 and newer light-duty trucks and all heavy-duty trucks is unaffected by the start date of the I/M program.

The second part of the emission reduction attributed to I/M programs is a reduction achieved by deterrence of tampering. This deterrence occurs when vehicle owners perform needed maintenance on their vehicles rather than risk failing the periodic tailpipe I/M inspection. Vehicle owners who may deliberately disable emission control components on their vehicles or inappropriately use leaded fuel may also be deterred by the risk of failing their I/M inspection. This deterrence is not related to or affected in any way by the addition of explicit visual inspections included in anti-tampering programs or the functional pressure and purge system checks. The benefits of these specific program elements are calculated separately.

MOBILE5 assumes that this deterrent effect begins when the I/M program first begins and is unaffected by the stringency of the I/M inspection. This means that an I/M program that starts in an earlier calendar year will have a greater overall effect on emissions than an equally stringent program started at a later date. In order for an I/M program to get all of the benefits to which it is entitled, care should be given to make the start date of the program indicated in the MOBILE5 I/M Program Descriptive Record input match the actual calendar year in which those vehicles were first inspected. If the user specifies two I/M program designs, both I/M Descriptive Records should indicate the same I/M program start date, unless the second I/M program description covers model years or vehicle classes that were not covered in the original I/M program design.

For example, a program will begin using the IM240 test procedure in 1994, covering all 1986 and newer vehicles. The original Idle Test-based I/M program began in 1984. This program can be modeled in MOBILE5 by describing the original I/M program design in the first I/M Program Descriptive Record and describing the IM240 portion of the program in the second I/M Program Descriptive Record, covering only 1986 and newer vehicles. However, since some of the benefit for the 1986 and newer model year vehicles comes from tampering deterrence, indicating a 1994 I/M program start date in the second I/M Descriptive Record will cause those vehicles to have less tampering deterrence benefit than they should, since these vehicles were always subject to I/M inspection. Since the repair part of the I/M benefit for these vehicles does not depend on the start date of the I/M program, the correct way to model the benefit for the 1986 and newer vehicles is to enter the 1984 start date for the original I/M program into the second I/M Descriptive Record as well. If, however, the original I/M program design did not include light-duty trucks and the program change beginning in 1994 now includes these vehicles, then a separate MOBILE5 run will be required to model the benefits for the light-duty trucks, indicating their actual 1994 I/M program start date.

**2A.1.18 Tech I-II and Tech IV+**

The calculation of I/M benefits for MOBILE5 was done by technology group, which can roughly be determined by model year for each vehicle type. These technology groups have come to be referred to by numbers. Within the Tech IV group, I/M credits are developed separately for each model year of LDGVs, with model year mapping to LDGTs based on similarity of emission control technology used. The table below summarizes the technology groupings used in MOBILE5 and their respective application to gasoline-fueled passenger cars and light trucks.

<u>Technology Grouping</u>	<u>LDGV</u>	<u>Model Years Covered</u>	
		<u>LDGT1</u>	<u>LDGT2</u>
I	Pre-1975	Pre-1975	Pre-1979

II	1975-80	1975-83	1979-83
IV+	1981+	1984+	1984+

Sets of alternate I/M credits may contain both Tech I and II credits, or Tech IV+ credits. This is usually indicated in the header block of the alternate I/M credit deck. Two data files (TECH12.D and IMDATA.D) provided with MOBILE5 contain the default set of I/M credits.

#### **2A.1.19 Evaporative Canister Purge System Check**

As part of a vehicle inspection program, the flow rate of the canister purge portion of the evaporative control system can be monitored during transient engine operation on a vehicle chassis dynamometer using a flow measurement device. Cutpoints for minimum flow rate can be set and used to determine vehicles passing and failing a purge system check. Vehicles failing the purge check are required to have the canister purge system repaired such that the vehicle will be able to pass a canister purge system retest.

For MOBILE5, vehicles were tested for canister purge using a flow sensor installed in the hose connecting the evaporative canister to the engine at the canister end. Cumulative flow was measured, in liters, over the IM240 transient speed cycle. Any vehicle with a cumulative flow of less than one liter was failed.

As with other tests, MOBILE5 reduces the benefits of the evaporative purge system check by 50 percent when either a test and repair station manual or computerized I/M program is chosen.

MOBILE5b allows the user to adjust the discount in the effectiveness of test and repair programs used by the model.

#### **2A.1.20 Evaporative System Pressure Check**

As part of a vehicle inspection program, the evaporative control system can be checked for leaks by pressurizing the fuel tank and related hoses and pipes. The pressure loss is monitored over time. Cutpoints for the maximum rate for which pressure can be lost can be set and used to determine vehicles passing and failing a pressure check. Vehicles failing the pressure check are required to have the evaporative system repaired such that the vehicle will be able to pass an evaporative system pressure retest.

For MOBILE5, vehicles were tested for pressure leaks by slowly introducing nitrogen to the evaporative system through the hose connecting the evaporative canister to the fuel tank at the canister end. When a stable reading of 14 inches of water (about 0.5 pounds per square inch) was reached, the pressure was monitored for two minutes. Any vehicle with a pressure of less than 8 inches of water after two minutes was failed.

As with other tests, MOBILE5 reduces the benefits of the evaporative purge system check by 50 percent when either a test and repair station manual or computerized I/M program is chosen.

MOBILE5b allows the user to adjust the discount in the effectiveness of test and repair programs used by the model.

## **2A.2 ATP TERMINOLOGY**

This section discusses the terminology used to describe ATP inspections for purposes of modeling the emission benefits of such programs using MOBILE5. In general, it is assumed that the program is mandatory, periodic, and covers a well-defined group of vehicles. A program which inspects for tampering only when a vehicle has failed its tailpipe I/M inspection, or only when a vehicle owner requests a test waiver, is not considered as an ATP in MOBILE5.

It is also assumed that the inspections are primarily visual rather than functional, and involve no disassembly or disconnection to gain access to hidden components (other than removal of the gas cap to view the fuel inlet restrictor). However, program planners are encouraged to define failure in broad enough terms of visual damage and proper operating condition so that any emission control component determined by the inspector to be non-functional can be properly failed and repaired. There are many details (such as replacement catalyst specifications) which are beyond the scope of this discussion. Program planners should consult with EPA's Office of Mobile Sources (Regional and State Programs Division, 313/668-4367) if there are questions regarding the requirements of ATP inspections.

### **2A.2.1 Anti-Tampering Programs (ATPs)**

Anti-tampering programs (ATPs) are periodic inspections of vehicles to detect damage to, disablement of, or removal of emission control components. Owners are required to restore the vehicle's emission control system and have the vehicle reinspected. Note that programs that inspect for tampering only those vehicles failing an I/M tailpipe test are not considered for MOBILE5 modeling purposes to have an ATP, and should not attempt to derive ATP emission reduction credits.

### **2A.2.2 Tampering and Misfueling**

Any physical damage to, or disablement or removal of, an emission control component is considered tampering in MOBILE5. This does not limit tampering only to deliberate disablements or only to those disablements of which the vehicle owner is aware. As a result, tampering can often be a result of poor maintenance as opposed to some action by the vehicle owner or a service mechanic.

Misfueling is the use of leaded fuel in any vehicle which is equipped with a catalytic converter. This includes inadvertent use of leaded fuel without the knowledge of the vehicle owner.

### **2A.2.3 Air Pump Inspection**

Air pump systems supply fresh air needed by the catalytic converter to reduce engine emissions before they leave the tailpipe. Inspectors should check for missing belts and hoses and proper connection at the exhaust manifold. Sometimes the entire pump and its plumbing are removed. A valve is sometimes used to route air away from the exhaust stream during certain operating modes. This valve should be checked for proper hose and wire connections. Often the air is injected directly into the catalytic converter underneath the vehicle. If so, this connection should be checked. Any missing, damaged or altered components of the air pump system should be replaced.

### **2A.2.4 Catalyst Inspection**

The catalytic converter, sometimes referred to simply as the catalyst, oxidizes excess hydrocarbon and carbon monoxide from the engine exhaust into water and carbon dioxide. Newer catalysts also reduce oxides of nitrogen in the exhaust. The metals which accomplish this task are most commonly coated on a ceramic honeycomb inside the stainless

steel shell of the catalyst. The catalyst resembles a muffler in some ways, but would not be confused with a muffler because it is farther forward on the vehicle, and its stainless steel shell will not rust.

Some cars will have more than one catalyst, so the number of catalysts expected should be determined before the inspection begins. Some catalysts are located very near the exhaust manifold, so the inspector should be sure to check the entire length of the exhaust piping from the exhaust manifold to the muffler before determining that the catalyst is not present.

Emission credit should not be claimed using MOBILE5 unless regulations provide a mechanism to assure that failed cars are correctly repaired with original equipment manufacturer (OEM) or approved aftermarket replacements. Program planners should consult with EPA to avoid incorrectly claiming credit.

### **2A.2.5 Fuel Inlet Restrictor Inspection**

Vehicles requiring the use of only unleaded gasoline have been equipped with fuel inlets that only allow use of narrow fuel nozzles. Leaded fuel is required to be dispensed only from pumps using wider nozzles. Any vehicle found to have a fuel inlet which allows a leaded fuel nozzle to be inserted, such as having the nozzle size restriction removed, is assumed to have used leaded fuel. Leaded fuel permanently reduces the ability of the catalytic converter to reduce emissions. Therefore, vehicles found with a fuel inlet which allows insertion of a leaded fuel nozzle should be required to replace the catalytic converter. In addition, the vehicle's fuel inlet should be repaired to only allow the insertion of unleaded fuel nozzles.

Repair of the fuel inlet restrictor only is not considered a repair which will reduce the emissions of the vehicle. The damage to the emission control of the vehicle occurs in the catalyst. It is the catalyst which must be replaced to result in any substantial emission reduction. The inlet restrictor must be replaced simply as protection for the new catalyst. No credit is given by MOBILE5 for a fuel inlet restrictor inspection unless an explicit check for the presence of the catalytic converter is also made. This catalyst inspection must be indicated as part of the ATP descriptive record in order to receive benefits.

MOBILE5 assumes that inspectors are not allowed to skip this inspection for such reasons as that the fuel inlet is concealed by a locked door.

### **2A.2.6 Tailpipe Lead Detection Test**

Leaded fuel permanently reduces the ability of the catalytic converter to reduce engine emissions before they leave the tailpipe. Therefore, vehicles found to have used leaded fuel should be required to replace the catalytic converter. EPA has allowed for the use of a lead detection test in the vehicle tailpipe as a method to detect the use of leaded fuel. Since this is a chemical test, care must be taken to assure that the test is properly conducted and that the results are properly interpreted.

Vehicles with evidence of lead deposits in the tailpipe have used leaded fuel. The damage to the emission controls of the vehicle occurs in the catalyst, thus the catalyst must be replaced to result in any substantial emission reduction. The tailpipe should also be replaced simply to avoid failing the test at the next inspection. ATPs which require failure of both the fuel inlet restrictor inspection and the tailpipe lead detection test before requiring replacement of the catalyst get credit for neither in MOBILE5, and should not indicate either inspection on the input records.

No credit is given by MOBILE5 for a tailpipe lead detection test unless an explicit check for the presence of the catalytic converter is also made. This catalyst inspection must be indicated as part of the ATP descriptive record in order to receive benefits.

### **2A.2.7 EGR Inspection**

The exhaust gas recirculation (EGR) system reduces oxides of nitrogen by routing some of the exhaust back into the intake manifold. The primary component of the system is the valve which controls the flow between the exhaust and intake manifolds, however, most systems are quite complex with various sensors and valves which control the operation of the system. Hoses may be plugged, either deliberately or by neglect. Any system observed with missing or damaged components or misrouted or plugged hoses and wires should be failed and repaired.

#### **2A.2.8 Evaporative Control System**

The evaporative control system collects gasoline vapors from the gas tank and carburetor bowl and stores them in a charcoal canister. During certain engine operations, the canister purges, releasing the vapors which are routed to the engine to be burned. In addition to the evaporative canister itself, the system includes varying numbers of hoses, wires and control valves. Hoses may be plugged, either deliberately or by neglect. Any system observed with missing or damaged components or misrouted or plugged hoses and wires should be failed and repaired. This inspection flag is not used to indicate any functional purge or pressure testing of the evaporative emission control system. Emission reductions resulting from such testing must be calculated separately.

Vapors from the vehicle fuel tank will not be routed to the evaporative emission control system canister if the gas cap is leaking or missing. Therefore MOBILE5 will not give credit for an evaporative emission control system inspection unless there is also an explicit requirement for checking that a gas cap is present. This gas cap check must be indicated as part of the ATP descriptive record in order to receive benefits.

#### **2A.2.9 PCV Inspection**

The positive crankcase ventilation (PCV) system routes the vapors from the crankcase to the intake manifold where they can be burned by the engine. The PCV system has two major loops. The most critical connects the crankcase with the throttle or the intake manifold with a hose and usually contains a valve. Another hose connects the crankcase with the air cleaner to provide the crankcase with filtered fresh air. Any system observed with damaged or missing components or with hoses misrouted or plugged, should be failed and repaired.

#### **2A.2.10 Gas Cap Inspection**

Gas caps are actually part of the evaporative control system. Without a properly operating gas cap, fuel vapors from the gas tank would escape. On some vehicles, a missing gas cap will also cause the evaporative system canister to purge incorrectly. Inspectors should examine the fuel inlet area of each vehicle to determine that the gas cap is present. If not, the vehicle should be failed and the gas cap replaced. Inspectors should not be allowed to skip this inspection for such reasons as that the fuel inlet is concealed by a locked door.

Appendix 2B

**MEMORANDUM ON EMISSION REDUCTION CREDITS  
FOR CALIFORNIA LOW EMISSION VEHICLES (LEVs)**

This appendix reproduces a memorandum issued by the Office of Mobile Sources (OMS) in April 1994 concerning the emission credits that can be attributed to implementation of the California low emission vehicle (LEV) program. The guidance in this memo is applicable to all MOBILE5 emission factor modeling that is to be used as part of the State Implementation Plan (SIP) process.

---

April 8, 1994

**MEMORANDUM**

Subject: Emission Reduction Credits for California Low Emission Vehicles (LEV's)

To: Director, Air Management Division, Region 1  
Director, Air and Waste Management Division, Region 2  
Director, Air, Radiation, and Toxics Division, Region 3  
Director, Air, Pesticides, and Toxics Management Division, Region 4  
Director, Air and Radiation Division, Region 5  
Director, Air, Pesticides, and Toxics Division, Region 6  
Director, Air and Toxics Division, Regions 7, 8, 9, and 10

From: Phil Lorang, Director  
Emission Planning and Strategies Division

This memo explains EPA's policy for the calculation of SIP credits for the California LEV program. This memo also addresses the issue of enhanced I/M options for LEV program vehicles, which was not discussed in the final rule on I/M program requirements.

**Background**

The state of California has adopted, and received an EPA waiver to implement, a Low Emission Vehicle (LEV) program. The LEV program consists of several sets of emission standards more stringent than the Tier 1 standards (TLEV, LEV, ULEV), a schedule of declining fleet average emission standards for non-methane organic gases (NMOG) which will drive the sales mix towards vehicles meeting the more stringent of the standard sets, and a sales mandate for zero-emitting vehicles (ZEVs). California has also adopted, and applied for an EPA waiver for, a requirement for advanced on-board diagnostic systems (OBD II) capable of detecting many emission defects causing vehicles to exceed their exhaust standards by as little as 50%. Other states have adopted or are considering the adoption of the California LEV program, including the OBD II requirements. These states require guidance regarding the amount of emission reductions that can be assumed for California vehicles in State Implementation Plans (SIP's).

September 1996



The EPA Office of Mobile Sources (OMS) has reviewed the provisions of the final LEV regulations and has consulted with CARB staff and automobile industry engineers regarding the developing technology for compliance with both the emission standards and OBD requirements. Based on this review, OMS has formulated the following guidance for the calculation of SIP credits for each non-ZEV vehicle category (TLEV, LEV, ULEV) in the LEV program.<sup>1</sup> The overall SIP credit will depend on the mix of TLEVs, LEVs, ULEVs, and ZEVs, which will vary by model year and may depend on whether the fleet NMOG standard has also been adopted.<sup>2</sup> The purpose of this memo is to explain this guidance and its application in SIP submittals. Since any other state adopting California standards under Section 177 of the Clean Air Act is constrained to copy the California new vehicle program, EPA will apply a consistent policy to such states and to California itself.

This guidance has been incorporated into MOBILE5a, EPA's emission factor model. Actual procedures for selecting the LEV options in MOBILE5a are described separately in the MOBILE5a documentation (see Section 2.3.1 of the final version of the MOBILE5a User's Guide, to be issued shortly).

### Guidance

#### 1. Adjustments for certification vs. commercial fuel differences

Gasoline-fueled California vehicles are allowed to demonstrate compliance with California emission standards on a reactivity-weighted basis while operating on a "California Phase 2 Reformulated Gasoline." This fuel is expected to have advantages relative to EPA's Federal certification test fuel with respect to both mass emissions of VOC's, NOx, and CO and the reactivity of the VOC mixture. The use of California reformulated fuel in certifying LEV compliance affects the stringency of the numerical standards that apply to each LEV category. In California, all commercial fuel will have to meet the Phase 2 composition specifications, but in other states gasoline will not have to meet these specifications unless the states adopt them as their own. MOBILE5a will therefore apply adjustments to properly estimate the in-use emission levels of California cars when operating on other fuels. (It should be noted that MOBILE5a corrects all emission factor output to reflect actual commercial fuel effects; previous versions, in effect, assumed that the certification and commercial fuel were identical.)

#### 2. Credits based on the expectation that LEV vehicles will achieve substantial emission reductions beyond those from Federal vehicles

The California LEV program relies on advanced emission control technologies, clean gasoline, and an on-board diagnostic (OBD) system, which together with enhanced I/M or its equivalent are designed to assure that in-use vehicles emit at levels close to their respective emission standards. For purposes of obtaining emission benefits in a SIP that reflect this expectation (accounting for differences between Federal and California fuel requirements as discussed above), EPA requires that the following three components be included in the SIP: periodic IM240 emission testing with specific cutpoints, automated OBD system checks, and SIP commitments for auditing and corrections.

---

<sup>1</sup> With respect to ZEVs, SIP emission inventory projections should of course account for utility emissions associated with in-area generation of electric power to charge ZEVs. This aspect of accounting for LEV program effects is not susceptible to uniform guidance since it depends on the local situation regarding the sources of the incremental electric power and the utility emission controls that will be in place. However, MOBILE5a does produce output that will assist local inventory analysts [to] determine total travel by ZEVs in a given calendar year, which will assist in the estimation of recharging-dependent emissions from utilities.

<sup>2</sup> Although the legal issue of whether the fleet NMOG standard must be adopted has not been finally determined, EPA believes that adoption of the NMOG standard is likely to be a necessary component of any state LEV program, consistent with Clean Air Act Section 177. Furthermore, the fleet composition consequences of not adopting it are not yet clear. States should consult with OMS on this aspect of the credit calculation for the latest guidance.

(a) Periodic IM240 emission testing with specific cutpoints

IM240 has been proven to be a practical and highly effective I/M test. EPA believes that a test-only I/M program that utilizes the IM240 test as described in the I/M Final Rule, with cutpoint modifications to match the lower emission standards for TLEV/LEV/ULEVs, is necessary to ensure the low in-use emissions described above. Therefore, EPA requires that such a program, or its approved equivalent as described below, must be included in order to obtain emission benefits in a SIP based on this assumption.

In order to ensure that TLEV/LEV/ULEVs will have substantially better in-use performance than Tier 1 vehicles, lower IM240 inspection cutpoints are both necessary and appropriate. IM240 cutpoints of 0.6 THC, 10 CO, and 1.2 NOx for light-duty vehicles in the LEV program (compared to Tier 1 cutpoints of 0.7 THC, 10 CO, and 1.4 NOx) are required in order to achieve the emission benefits discussed above. A full list of cutpoints for all vehicle classes is given in an attachment to this memo.

(b) Automated OBD system checks

California vehicles will be required to have second generation systems for on-board diagnosis (OBD) of emission control problems. These OBD systems are intended to help both owners and I/M program computers identify cars in need of repair, and to aid in their effective and economical repair. OBD systems offer the potential to identify the presence of excess emissions, including those associated with cold start control system malfunctions, engine problems causing dangerous stress on the catalyst, and damage to the catalyst itself. OBD systems will be required on Federal vehicles as well. However, the California program requires OBD systems to detect emission increases as small as 50% of the applicable exhaust standard for certain system failures. Since LEV standards are substantially tighter than the Federal Tier 1 standards, California OBD systems must be capable of detecting smaller degrees of malperformance than Federal OBD systems, which will help assure that deterioration will be minimized.

OBD systems will include a standardized system for incorporation into I/M testing, including a "ready code" to ensure OBD test validity. The Clean Air Act requires OBD checks as part of an Enhanced I/M program. EPA will propose in a forthcoming rulemaking that OBD checks be required in basic I/M program[s] as well. Automation and test-only requirements are also critical to the effectiveness of an I/M program for LEVs, and are a condition for these credits. In addition, the expectation of periodic OBD checks will help motivate vehicle owners to seek repair early, before further damage to the emission control system occurs, thus avoiding some operation of unrepaired vehicles between inspections.

(c) SIP provisions for auditing and corrections

In combination with the enhanced I/M and automated OBD check programs described above, TLEV/LEV/ULEVs have a high probability of achieving in-use emission levels at or close to vehicle standards. However, because of the uncertainty inherent in new technologies, such as those required to meet the LEV standards, EPA believes that it is reasonable and necessary to include additional safeguards in SIPs that take credit for the LEV program based on this assumption. EPA will only allow this SIP credit if the SIP also includes provisions for a specific program for auditing the performance of TLEV/LEV/ULEVs and a program to take appropriate SIP revision action to correct or compensate for any shortfall in emissions performance discovered in the future.

The SIP must include a list of additional measures that will be among those considered and a timeline for consideration and action following any audit finding by the state itself or notification by EPA that a shortfall exists. Measures in this list could include among others more stringent I/M inspection standards (for example, IM240 standards set 50% above the in-use emission level assumed in the SIP credits), methods of cost pooling or other mechanisms to ensure full repair of vehicles under the original or more stringent inspection standards, old vehicle retirement, or additional reductions from other sources. Since the merits of one of these measures versus another or versus other measures identified later will depend on the size and causes of a shortfall in emission reductions, the SIP is not required to commit to implement any specific

measures or number of measures. Of course, if California reaches similar audit findings and takes effective corrective action in its motor vehicle control program, other states that implemented the LEV program would have to follow, and would get the same benefits towards correcting their own shortfall.

If the three elements given above are part of the I/M SIP, EPA will approve SIP credit that is premised on a substantially reduced occurrence of in-use malfunctions and deterioration in the vehicle fleet, relative to that which has been observed on the most recent Federal and pre-LEV California production vehicles. The benefits would be essentially the same as those CARB itself has projected for the LEV program.

Credits for SIPs meeting these conditions have been included as an option in MOBILE5a. Details for modeling these options are given in the final MOBILE5a User's Guide (to be issued shortly). Sections 2.3.1 and 2.3.7 explain the procedures for modeling the LEV program with and without the I/M program described above. MOBILE5a users should be aware that due to the complexity of the model and the LEV and I/M programs, extra care must be taken when preparing input files to ensure that the desired programs are properly modeled. Users should note, for example, that an I/M program with the LEV program car cutpoints of 0.6/10/1.2 as described above is modeled by setting the values of specific flags, and not by changing the IM240 cutpoints in the I/M Program Descriptive Record.<sup>3</sup>

States may, if they choose, adopt an adequate combination of these additional measures initially, and not perform the audit program. In particular, adoption of IM240 cutpoints 50% above the in-use emission level assumed in the SIP credits is enough by itself to relieve a state from the requirement for an audit program.<sup>4</sup>

### 3. Evaporative emissions

MOBILE5a estimates that evaporative emissions from California and Federal vehicles will be the same, under a given fuel and inspection regime. This estimate may be revised in a subsequent version of the model, if differences in control technology and effectiveness are observed.

As in the case of all programs meeting EPA's enhanced I/M requirements, evaporative pressure and purge tests are also required in addition to the IM240 test, and the OBD system must be interrogated for emission control system fault codes, with the vehicle repaired as indicated by such codes. Inspections must be performed in a test-only format, to eliminate the possibility of error or evasion. Evaporative emissions would be the same as for Federal vehicles under the same inspection program.

### 4. Equivalent procedures

As always, OMS's intent is to achieve an emission control result rather than impose a design requirement. OMS

---

<sup>3</sup> The credits discussed here are the same as those that are currently obtained by setting the REGION flag in MOBILE5a to "3" or the I/M flag in the LEV Program Parameter Record to "2". EPA plans to modify MOBILE5a to simplify the selection of these credits.

The credits in the current version of MOBILE5a assume no cost waivers and 100% vehicle owner compliance with the inspection requirement. If the SIP extends the \$450 cost waiver to LEVs, an adjustment must be made to account for the expected number of vehicles that are not fully repaired. OMS will provide guidance or a revised MOBILE version to allow this adjustment. Similarly, if more than a trivial degree of owner noncompliance is expected, adjustments must be made to reflect that credit loss.

<sup>4</sup> EPA has taken a similar approach in the recent California FIP proposal. The FIP proposal does not include these auditing provisions because it includes the Enhanced In-Use Compliance Program (EIUCP). However, because the EIUCP is a recall program not available to the states, the more stringent IM240 cutpoints given here (i.e., cutpoints 50% above the in-use emission level) are an alternative the states could adopt.

will study vehicles meeting the California LEV requirements to determine the effectiveness of alternative inspection protocols for TLEV/LEV/ULEV vehicles which CARB or other states may submit in the future, and EPA will approve SIP revisions to the inspection protocol if the Administrator finds they are equivalent in effectiveness. As always, OMS will place great importance on the vehicle test fleet being representative of in-use vehicles and of the range of emission control system malfunctions to which they are subject in the real world, and on the technical appropriateness of the methods used to collect such data. Of course, EPA will apply a uniform policy to California and other states that have adopted California vehicle standards, and will consider data collected by all interested states.

5. Performance in the absence of the above-described periodic inspections

In most of the states considering adoption of the California emission standards, the largest ozone and CO nonattainment areas are classified as Serious or Severe, and are subject to the requirement for an enhanced I/M program. The I/M program described above will fit well into the enhanced I/M framework, although the cutpoints will be numerically lower. However, some areas receiving California vehicles will be subject to only a basic I/M program which will not be required to conduct three of the four high technology tests listed above (OBD checks will be required in all I/M programs), or will not have any periodic inspection program in operation. States may need to prepare emission inventories for such areas.

The exhaust emission factors in MOBILE5a for LEV's in areas with no inspection program, or with only an Idle Test, 2500/Idle Test, or steady-state loaded exhaust test are lower than those for Federal vehicles under the same inspection regime by an amount equal to EPA's estimate of the difference in emission rates from "zero-mile" California vehicles versus "zero-mile" Federal vehicles. In other words, the in-use deterioration of the two vehicle types will be assumed to be the same. This assumption is likely to be conservative with respect to emission reductions in some or all of these areas; for example, basic I/M programs with OBD checks for LEVs would be expected to get some additional benefits that we currently have no basis for quantifying. This is in contrast to the lower in-use emission deterioration rates (lower by approximately the ratio of the LEV to Tier 1 standards) for low emission vehicles subject to an inspection program using OBD II checks and the IM240 cutpoints specified above for LEVs.

Emission credits for IM240 programs that have less stringent cutpoints than the "maximum" I/M program can also be calculated in MOBILE5a in the same way as the no-I/M and Idle Test I/M cases.

6. Enhanced I/M performance standard for LEV's

Enhanced I/M programs are required to meet a performance standard which is defined by a particular program design listed in the I/M Final Rule. Any I/M program which would result in equivalent emission levels to this "enhanced performance standard" program would meet the requirements for enhanced I/M with respect to emission reductions. The description of the "enhanced performance standard" program in the I/M Final Rule includes cutpoints for both pre-Tier 1 and Tier 1 vehicles, but does not include cutpoints for LEV's.

At this point, EPA has not amended the I/M rule to specify what the "performance standard" program should be for LEV's. EPA has concluded, as guidance, that the "performance standard" cutpoints which define enhanced I/M for LEV program vehicles are the same as the cutpoints specified above as being needed to qualify for credits based on an assumption of vehicles meeting standards in use.

Attachment

Attachment to Emission Reduction Credits for California LowEmission Vehicles (LEV's)

<u>Vehicle Class</u>	<u>IM240 Cutpoints (g/mi)</u>		
	<u>HC</u>	<u>CO</u>	<u>NOx</u>
LDV	0.6	10	1.2
LDT1a (0-3750 lbs LVW)	0.6	10	1.2
LDT1b (3750-5750 lbs LVW)	0.6	11	1.4
LDT2 (>6000 lbs GVW)	0.7	12	2.0