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A Program to Calculate Size Specific Particulate Emissions for Mobile Sources — A User's Guide

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A Program to Calculate Size Specific Particulate Emissions for Mobile Sources — A User's Guide

by

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I. INTRODUCTION

This report is provided as documentation to a program which calculates the total areawide lead and particulate emissions from gasoline and diesel fueled on-road vehicles, trucks and motorcycles for particle sizes up to 10 microns. The program provides a large amount of default (normal) data and also many options to tailor the conditions to each locality. The period of interest spans 1980 to 1995. (Years later than 1995 can be calculated but there is no data specific to years later than 1995).

The methodology and sources of data for this program are described in detail in the report Size Specific Total Particulate Emission Factors for Mobile Sources prepared August 1984, for EPA by EEA. That report describes the calculation of particulate emission factors for each of the six vehicle classes used in this program. The vehicle classes are: 1) light duty vehicles, 2) light duty trucks 6000 pounds or less, 3) light duty trucks more than 6000 pounds, 4) heavy duty gasoline trucks, 5) heavy duty diesel trucks, and 6) motorcycles. It also provides the emission factors for each major type of particulate (lead, organic, sulfate, and diesel composite). A brief summary of the methods used for the calculation is given in Section 2.

The program inputs and format are designed to parallel those found in MOBILE 3. The normal user inputs include the scenario year, the vehicle speed, the driving conditions and the particle size cutoff (i.e., the largest particle size to be included in the total emissions). By setting control flags, the user can elect to replace the default data used in calculations with locality specific data. These include tampering rates for catalyst equipped light duty vehicles and trucks, misfueling rates, the VMT mix, mileage accumulation rates, registration fraction by age, the lead content of gasoline and the implementation of an I/M program. A description of each input is given in Section 3.

The output report gives a breakdown of particulate emission factors type for each vehicle class as well as totals and fractions of the total that each

particulate contributes. The output report and any error and diagnostic messages that are generated are described in Section 4.

The program structure is described in Section 5. A dictionary of subroutines and common blocks of interest to programmers wishing to make changes to the program is included. Users may skip this section.

Section 6 provides example runs of the program with various options. Use of the program in both batch and interactive modes are shown.

The appendices include a source code listing and a listing of the data file containing the default data.

2. OVERVIEW OF METHODOLOGY

Particulate emissions consists of lead, organic and sulfate emissions. Different types of vehicles emit varying amounts of each particulate type depending upon fuel type, emission control technology and operating mode. Lead particulates consist mainly of lead salts rather than lead alone. Organic emissions include elemental carbon and soluble organics. Particulate emissions from diesel vehicles are a composite particulate having elements of the three other types but consisting largely of organic emissions.

The calculations seek to model the particulate emissions from all types of on-road vehicles. The procedure is to calculate the emissions factor for each type of particulate from each vehicle class and then sum over all vehicle classes to get the total emission factor in grams per mile traveled. For any given year the procedure may be expressed mathematically

$$EF_{pm,n,s} = \sum_{i=1}^{6} t_{i,n} EF_{i,n,s} + EF_{brakes}(M_B) + EF_{tires}$$

where $EF_{pm,n,s}$ = size specific all-vehicle class total particulate emission factor on January 1 of calendar year n at vehicle speed s (g/mile)

i = vehicle class designator; 1=light-duty vehicles (LDV), 2=light-duty trucks I (LDT1), 3=light-duty trucks II (LDT2), 4=heavy-duty gas vehicles (HDGV), 5-heavy-duty diesel vehicles (HDDV), 6=motorcycles (MC)

s = vehicle speed; avg. Federal Test Procedure (FTP) = 19.6, avg. Sulfate Emissions Test (SET) = 34.8 (miles/hr); (Note: The FTP and SET are driving cycles used for the determination of emission factors.)

$t_{i,n}$ = area travel fraction of vehicle class i in calendar year n

$EF_{i,n,s}$ = particulate emission factor for vehicle class i in calendar year n at vehicle speed s (g/mile)

EF_{brakes} = airborne brake wear particulate emission factor component = 0.002 grams/mile; this emission factor

component is assumed to be the same for all vehicle classes, vehicle speeds and calendar years (all i,s, and n) due to lack of separate information for each i,s, and n

EF_{tires} = airborne tire wear particulate emission factor component = 0.002 grams/mile; this emission factor component is assumed to be the same for all vehicle classes, vehicle speeds and calendar years (all i,s, and n) due to lack of separate information for each i,s, and n

M_B = fraction of airborne particles less than a user-specified size cutoff (0.1=10 m) that are attributable to vehicle brake wear, from Table 2-20 or Figure 2-4

Calculating the emissions factor for each vehicle class requires knowledge of emissions factors and numbers of each type of vehicle within the class. For instance, light-duty vehicles includes leaded, unleaded and diesel vehicles each with different emission characteristics.

The emissions factors required are given in the report Size Specific Total Particulate Emission Factors of Mobile Sources prepared for EPA by EEA. The emissions factors are functions of vehicle class, model year, fuel type, catalyst type (for sulfates), vehicle speed (for lead and sulfates), misfueling and catalyst tampering rates (for unleaded vehicles). Changes in emissions factors from model year differences occur because of changes in fuel economy, emission control technology and the shift from leaded to unleaded gasoline.

Each vehicle class is modeled as a fleet of vehicles including vehicles up to 20 years old. The fraction of vehicles by age within each class favors newer vehicles since older vehicles wear out and are taken out of service. Newer vehicles also have higher mileage accumulation rates than older vehicles. Misfueling rates increase with age since there is more opportunity to misfuel the vehicle over a long period of time. For each vehicle class the registration fraction, mileage accumulation rate and misfueling rate are assumed to vary year by year up to 20 years of age. Vehicles 20 years old and older are modeled as a single age.

For a given scenario year, the total emission factor from a vehicle class is a sum of the emissions factors over the previous 20 model years weighted by the fleet fraction of vehicle class. The total emission factor from all

vehicle classes are further weighted by the areawide travel fraction (i.e. the ratio of vehicle miles traveled by a vehicle class to the total traveled by all vehicle classes in the area).

The final results of the calculation are given in grams per mile traveled. The total emissions can be calculated by multiplying the composite emission factor by the total number of miles traveled by all classes of vehicles.

3. INPUTS

Inputs to the program allow the user to specify and change the scenario conditions to fit the locality being modeled. Like MOBILE 3, the various input options and scenario options are set by using control flags. The sections of user provided data are divided into a control section, one time data section and parameter section just like MOBILE 3. Section 3.1 describes the control section, Section 3.2 describes the one time data section and Section 3.3 describes the parameter section.

3.1 THE CONTROL SECTION

The control section contains the control flags necessary to select the various options available to the user. All of the flags must be present and have valid values for the program to run. Inputting "1" for each flag will result in the program using the default values and options built into the program. Table 3-1 summarizes the control flags.

3.1.2 The Flags

3.1.2.1 IPROMT

This flag works exactly as it does in MOBILE 3. It is used to select whether prompts are required and whether horizontal or vertical format is used for further flag inputs. Horizontal format has all the control flags in a single record. Vertical format has each flag in a separate record. No prompt is issued for this input since its purpose is to determine if prompts are required. (Format = I1). The options are:

1 - No prompting; use vertical format
2 - Program prompts; use vertical format
3 - No prompting; use horizontal format
4 - Program prompts; use horizontal format

TABLE 3-1

FLAGS CONTROLLING INPUT AND EXECUTION

Record Number	Variable	Description	FMT	Value	Action
1	IPROMT	Flag for prompting of input	II,3AI	IXYZ	No prompts vertical format
	IOUNEW	Values for output units 1) X=report 2) Y=diagnostic error reports 3) Z=prompt messages (Default for these units is 6)		2XYZ	prompt vertical format
				3XYZ	no prompts horizontal format
				4XYZ	prompts horizontal format
2	PROJID	80 character title used as output header	20A4		
3	TAMFLG	Flag for optional input of tampering rates	II		1=normal 2=user data in one-time section
4	VMFLAG	Selects optional user supplied VMT mix among vehicle types	II		1=MOBILE 3 VMT mix 2=user VMT mix for each scenario in parameter section 3=user VMT mix for all scenarios in one-time section

Record Number	Variable	Description	FMT	Value	Action
5	MYMRFG	Selects optional mileage accumulation and registration versus age	I1		1=normal 2=user supplied mileage accumulation rates in one-time section 3=user supplied registration in one-time section 4=user supplied mileage accumulation and registration rates in one-time section
6	MISFLG	Flag for optional input of misfueling rates	I1		1=normal 2=user data for LDV, LDT1, LDT2 in one-time section 3=use "simple" rates
7	SPCFLG	Selects optional lead content in leaded and unlead gasoline	I1		1=normal MOBILE 3 lead content 2=user supplied lead content
8	IMFLAG	Indicates I/M program	I1		1=no I/M 2=I/M

IOUNEW

This variable allows the user to change the output units for the results, messages and prompts. The default value for all of these is 6. IOUNEW must be part of the same record as IPROMT and immediately follows it.

Value = XYZ Format = 3A1
Options:

X = Results unit

Y = Diagnostic messages

Z = Prompting messages

3.1.2.2 PROJID

This is an 80 character title to be used as a header.

3.1.2.3 TAMFLG

This flag allows the user to input alternate catalyst tampering rates if desired for light duty vehicles and trucks. If user supplied tampering rates are selected, the user needs to specify tampering rates only for the case selected by IMFLAG (i.e., I/M program or no I/M program).

Options: 1 - normal tampering rates

2 - user supplied tampering rates in one-time section (3 values)

3.1.2.4 VMFLAG

This flag selects the areawide vehicle miles traveled fraction. The default fractions come from MOBILE 3. User supplied fractions should have one value for each vehicle class.

Options: 1 - use MOBILE 3 VMT mix

2 - user supplied VMT mix for each scenario

3 - user supplied VMT mix for all scenarios in this run (one-time data)

3.1.2.5 MYMRFG

This flag selects the mileage accumulation rate and registration versus age. The rates and registration fractions cover ages up to 20 years and are

specified for each vehicle class. User supplied data can be used to replace the default data for any or all vehicle classes.

Options: 1 - normal mileage accumulation rates and registration fraction
2 - user supplied mileage accumulation rates (one time data)
3 - user supplied registration fraction (one time data)
4 - user supplied mileage accumulation rates and registration fractions (one time data)

3.1.2.6 MISFLG

This flag selects the misfueling rates desired. The program normally uses a set of misfueling rates that varies according to vehicle class and age. The user supplied rates are generated for each vehicle class from a slope and intercept with mileage as the dependent variable.

The simple rates are a set of misfueling rates that have been averaged over vehicle age; hence, only the vehicle class matters.

Options: 1 - normal misfueling rates
2 - user supplied slope and zero mile intercept
3 - "simple" misfueling rates, vehicle class dependent only

3.1.2.7 SPCFLAG

This flag selects normal or user supplied lead content of leaded and unleaded gasoline. The lead content can be changed for any number of years with the default lead content used for those years previous to the changes.

Options: 1 - normal MOBILE 3 lead content
2 - user supplied lead content of gasoline

3.1.2.8 IMFLAG

This flag indicates whether an inspection maintenance program is in effect in the area.

Options: 1 - no I/M program
2 - I/M program in effect

3.2 ONE TIME DATA SECTION

This section contains data only if the flags in the control section have been set to expect user supplied data here. This data is input only once and is used for all scenarios of the run. The data in this section concerns locality dependent variables.

The one time data section is included only in the following cases in the order listed.

1) The user wishes to input local catalyst tampering rates (TAMFLG = 2)
2) The user wishes to use an alternate VMT mix for all scenarios (VMFLAG = 3)
3) The user wishes alternate registration and/or mileage accumulation rates (MYMRFG = 2, 3 or 4)
4) The user wishes to input alternate misfueling rates (MISFLG = 2)
5) The user wishes alternate lead content in gasoline for a range of years (SPCFLG = 2)

The order of the data in this section is the same as the order of flags in the control section.

3.2.1 Alternate Catalyst Tampering Factors

The data to be entered are the tampering rates for LDV, LDT1 and LDT2. This data should be appropriate for the IMFLAG chosen, i.e. if there is no I/M program in effect, enter the rates for no I/M program. The format is 3(F4.3,1X).

3.2.2 Alternate VMT Mix

The data to be entered is the areawide vehicle miles traveled fraction for each vehicle class. The sum of the fractions should equal one. If not, a warning message will be printed and the VMT fractions will be normalized. There is one record with format 6(F5.3,1X).

3.2.3 Alternate Registration and Mileage Accumulation

This section allows changes to the registration and mileage accumulation rates for any or all vehicle classes. Since LDV, LDT1 and LDT2 include diesel vehicles with different registration and mileage accumulation rates,

the fuel type must also be specified when indicating which vehicle class the user wishes to change. For HDGV, HDDV and MC the fuel type that is input is ignored. The registration and mileage accumulation rates for leaded and unleaded vehicles are automatically set to be equal; when the user chooses leaded or unleaded as the fuel type, the registration and mileage accumulation for the type that was not chosen are set to the same value as the type chosen.

3.2.3.1 Alternate Registration

The data is entered in three records for each vehicle class. The first record has format (I1,1X,I1) where the data to be entered is the vehicle class (1-6) and fuel type (1 or 2 = gasoline, 3 = diesel). The second record contains the registration information for the first ten years of age in format (10 F5.3). The third record contains the registration information for years 11 to 20 years or more (11-20+) in format 10 F5.3.

There can be as many sets of three records as desired. After the last set, there should be a card with three zeroes ('000') to signal the end of registration information.

3.2.3.2 Alternate Mileage Accumulation Rate

The data is entered in three records for each vehicle class in the same fashion as the registration data. The first record has format (I1,1X,I1) where the data is be entered is the vehicle class (1-6) and fuel type (1 or 2 = gasoline, 3 = diesel). The second record contains the mileage accumulation rate for the first 10 years in format 10(I5,1X). The third record contains the mileage accumulation rate for the years 11 to 20 or more (11-20+) in format 10(I5,1X).

There can be as many sets of three records as desired. After the last set, there should be a card with three zeroes ('000') to signal the end of the mileage accumulation information.

3.2.4 Alternate Misfueling Rates

The data to be entered is the zero mile misfueling rate and the slope for the four vehicle classes LDV, LDT1, LDT2 and HDGV1. A negative slope or

intercept will produce an error message. There is one record for each class with format (F8.6,1X,F8.6).

3.2.5 Alternate Lead Content in Gasoline

The data entered replaces the default lead content information for future years. For years prior to the starting year, the default information is used. The first record gives the starting year for the user supplied data and the last year in format (I4,1X,I4). Subsequently, there is one record for each year giving the leaded and unleaded lead content in grams per gallon in format F5.3,1X,F5.3. The data on the last record is used for the last year and all later years.

3.3 PARAMETER SECTION

This section contains data that is changed for each scenario. There can be as many scenarios as required in a single run of the program. Each scenario consists of four records (five, if VMFLAG = 3). The first record has the year of the scenario in I4 format. The second record has the vehicle speed in F4.1 format. The third record specifies the driving conditions in I1 format where a '1' indicates transient or cyclic driving and a '2' indicates a steady cruise. The fourth record contains the particle size cutoff in mirons in F5.2 format. The particle size cutoff is the largest size of particle to be included in the calculations. None of the four records have default values; all of them must be correctly specified. If VMFLAG is equal to three there is a fifth record to each scenario giving the VMT mix. The format is described in Section 3.2.2.

3.4 SUMMARY OF USER INPUTS

The user inputs are summarized in Table 3-2.

3.5 PROGRAM DATA FILE

The default data file contains all of the data necessary to run the program under standard conditions except for scenario year, vehicle speed, driving conditions and particle size cutoff. The subroutine EMFIN and associated subroutines reads the file in its entirety. User supplied data which supplants the default data is read in afterwards from the one time data section or parameter section.

TABLE 3-2

INPUT RECORD SEQUENCE SUMMARY

Input Record Sequence		Section
1	IPROMT Flag	Control
1	PROJID	Control
1	TAMFLG+	Control
1	VMFLAG+	Control
1	MYMRFG+	Control
1	MISFLG+	Control
1	SPCFLG+	Control
1	IMFLAG+	Control
(1	Tampering record if TAMFLG=2)	One-time
(1	VMT mix record if VMFLAG=3)	One-time
(3/class	Alternate registration if MYMRFG=3 or 4)	One-time
(1	Alternate registration end card if MYMRFG=3 or 4)	One-time
(3/class	Alternate mileage accumulation if MYMRFG=2 or 4)	One-time
(1	Alternate mileage accumulation end card if MYMRFG=2 or 4)	One-time
(4	Misfueling records if MISFLG=2)	One-time
(1	Starting and ending years for lead content of gasoline if SPCFLG=2)	One-time
(-	Lead content of gasoline cards if SPCFLG=2)	One-time

1	Year of scenario	Parameter++
1	Vehicle Speed	Parameter
1	Driving conditions	Parameter
1	Particle size cutoff	Parameter
(1	VMT mix if VMFLAG=2)	Parameter

Notes +: May be on single record if horizontal format is chosen

++: Parameter section may be repeated as many times as desired

The default data file structure is shown in Table 3-3. If changes to the data file are made care should be taken to change the corresponding array dimensions in the program. The program comments include references to tables in the original report to aid making changes.

TABLE 3-3

DEFAULT DATA FILE SEQUENCE

1. LDV LDT1 LDT2 Organic Emission Factors
   a) no. of records - Format (I2)
   b) catalyst type, fuel type, emission factor - Format=(I4, 3X, I1, 1X, I1, 1X, F5.3)
      see note 1

2. LDV LDT1 LDT2 Sulfate Emission Factors
   a) no. of records - Format (I2)
   b) year, catalyst type, fuel type, vehicle speed, emission factor - Format=(I4, 3X, I1, 1X, I1, 1X, F4.1, 1X, F5.3)
      see note 1

3. LDDV Diesel Emission Factors
   a) no. of records - Format (I2)
   b) year, emission factor - Format=(I4, 1X, F5.3)
      see note 1

4. LDDT Diesel Emission Factors
   a) no. of records - Format (I2)
   b) year, emission factor - Format=(i4, 1X, F5.3)
      see note 1

5. HDGV Organic Emission Factors
   a) no. of records - Format=(I2)
   b) year, catalyst type, fuel type, emission factor - Format=(I4, 3X, I1, 1X, I1, 1X, F5.3)
      see note 1

6. HDGV Sulfate Emission Factors
   a) no. of records - Format (I2)
   b) year, catalyst type, fuel type, emission factor - Format=(I4, 3X, I1, 1X, I1, 1X, F5.3)
      see note 1

7. HDDT Diesel Emission Factors
   a) no. of records - Format (I2)
   b) year, emission factor - Format=(I4, 1X, F5.3)
      see note 1

8. LDV LDT1 Lead Emission Factors
   a) no. of records - Format (I2)
   b) year, fuel type, emission factor - Format=(I4, 1X, I1, 1X, F5.3) see note 1

9. LDT2 Lead Emission Factors
   a) no. of records - Format (I2)
   b) year, fuel type, emission factor - Format=(I4, 1X, I1, 1X, F5.3)

10. Lead Content of Gasoline by Year
   a) no. of records - Format (I2)
   b) year, lead content of leaded, lead content of unleaded - Format=(I4, 1X, I1, 1X, F5.3) see note 1

11. LDV Fraction of Fleet by Emission Control Type see note 2

12. LDV Fleet Sales Fractions by Fuel Type see note 3

13. LDV Travel Weighting (Registration and Mileage Accumulation Rates) see note 4

14. City/Highway Fuel Economy
   a) no. of records - Format (Iw)
   b) year, fuel economy for LDV, LDT1, LDT2, HDGV1, HDGV2, HDGV

15. Fuel Economy Speed Corrections
   a) no. of records - Format (I2)
   b) speed, transient driving speed correction, steady driving speed correction

16. LDT1 Fraction of Fleet by Emission Control Type see note 2

17. LDT1 Fleet Sales Fraction by Fuel Type see note 3

18. LDT1 Travel Weighting (Registration and Mileage Accumulation Rates) see note 4

19. LDT2 Fraction of Fleet by Emission Control Type see note 2

20. LDT2 Fleet Sales Fraction by Fuel Type see note 3

21. LDT2 Travel Weighting (Registration and Mileage Accumulation Rate)
see note 4

22. LDDT Travel Weighting (Registration and Mileage Accumulation Rates)
see note 4

23. HDGV Fleet Sales Fraction by Fuel Type
see note 3

24. HDGV Travel Weighting (Registration and Mileage Accumulation Rates)
see note 4

25. HDDT Registration

a) no. of records - Format (I2)

b) registration fraction of total fleet by age (repeat)

26. MC Travel Weighting (Registration and Mileage Accumulation Rate)
see note 4

27. Simple Misfueling Rates
I/M program in effect, no I/M program
5 records for LDV, LDT1, LDT2, HDGV, MC
Format=(5X, F4.2, 1X, F4.2)

28. Misfueling by Age

a) no. of records - Format (I2)

b) each record contains misfueling rates for:

LDV with I/M
LDV w/o I/M
LDT1 with I/M
LDT1 w/o I/M
LDT2 with I/M
LDT2 w/o I/M
HDGV1 with I/M
HDGV1 w/o I/M

Format=3X, 8 F4.2

29. Particle Cumulative Fraction by Size

a) Particle Sizes

b) particle cumulative fractions

report a) and b) for leaded, unleaded with catalyst, unleaded w/o catalyst, diesel, brakes
Format - 5(F5.2, 1X)

30. Low Altitude HDDV Conversion Factors

a) no. of records

b) model year, conversion factor report as specified in 30a)

31. Fraction of Lead Exhausted
non-misfueled, 1975-1980 misfueled
1981+ misfueled vehicles
Format = 3(F4.2, 1X)

32. LDV, LDT1, LDT2 Tampering Rate (Catalyst Removal)

a) LDV w/o I/M
LDT1 w/o I/M
LDT2 w/o I/M

b) LDV with I/M
LDT1 with I/M
LDT2 with I/M

Format = 3(F5.3, 1X)

33. HDDT Mileage Accumulation by Age and Weight Class

a) no. of records - Format (I2)

b) each record contains mileage accumulation for class 2B, Light, Medium and Heavy HDDT - Format=(3X, 3(I5, 1X), I5)
repeat as specified in a)

34. HDDT Fleet Sales Fraction by Year and Weight Class

a) no. of records - Format (I2)

b) each record contains year and sales fraction for 2B, light, medium and heavy HDDT - Format=(I4, 1X, 4(F5.3, 1X))

35. VMT Mix

1 record with the fraction of VMT miles traveled by LDV, LDT1, LDT2, HDGV, HDDT and MC. This data has been taken from MOBILE 3 except that LDDT VMT have been split evenly between LDT1 and LDT2 since MOBILE 3 does not distinguish the two classses of LDDT.

Note 1: repeat this record as many times as specified in a). The "year" is the earliest year for which the emission factor applies.

Note 2: These records are read by the subroutine GTEMCT. Each set of records consists of:

a) This record gives the number of years each of the following records contains. The first year is automatically 1974 and earlier, the second is 1975, the third is 1976 etc. the last year is that year and later. Format =I2

b) Fraction of leaded, no catalyst by year

c) Fraction of unleaded, no catalyst by year

d) Fraction of unleaded, oxid. catalyst/no air by year

e) Fraction of unleaded oxid. catalyst/air by year

f) Fraction of unleaded 3 way catalyst by year

g) Fraction of unleaded 3 way + oxid. catalyst by year

h) Fraction of diesels by year

j) Fraction of unleaded with catalysts by year

k) Fraction of unleaded with catalysts/no air by year

l) Fraction of unleaded with catalysts/air by year

Format = 15(F5.3, 1X)

Note 3: Each set of records is read by subroutine FLTSLE and contains:

a) number of records Format = I2

b) model year, unlead sales fraction, leaded sales fraction, diesel sales fraction
repeat b) as specified in a)
Format = I4, 1X 3(F5.3, 1X)

Note 4: Each set of records is read by subroutine TRAVWT and contains 20 records. Each record contains age, registration fraction and mileage accumulation rate by age. Format = (I4, 1X, F5.3, 1X, I5)

4. OUTPUTS

Output from the program consists of prompting messages, error messages and the report on results. The report includes information on the scenario and the calculated emissions from each type of vehicle. The diagnostic messages inform the user about errors and warn about data errors that are non-fatal. Prompt messages are available if IPROMT is set to 2 or 4 in the control section. These messages prompt the user to input data in the correct sequence. In the CONTROL section there are two formats vertical flag input(2) and horizontal flag input (4). The prompt messages are the same in either case.

4.1 REPORT

Example reports are shown in Section 6. The report is divided into three sections. The first section provides scenario information. The second section gives the emission factors and the last section gives the fraction of the total particulates from each vehicle class and the fractions within each class.

The scenario information reflects information entered in the control section and parameter section. The first item is the project identification (title) which was entered as part of the control section. Next the scenario year and vehicle speed is presented. The flag settings and the driving conditions are shown next. The flag settings indicate whether the user provided data or whether the normal default data was used. In the case of the I/M flag, where there is no default value, the flag indicates whether there is an I/M program in effect.

In the second section the results of the calculations are shown. The results show the contribution of the four types of particulates to exhaust emissions from each vehicle class. For light duty vehicles, both gasoline and diesel vehicles are included in the same classes. However, it is easy to separate the contributions from diesels, since only diesel vehicles emit diesel particulates. The totals show the total grams per mile of all particulates

emitted by vehicles of each class. The VMT weighted totals are the same totals weighted by the areawide VMT travel fraction. These values are important for gauging the relative contribution from each class since there are different numbers of vehicles in each class. Particulates from brake and tire wear are added to the VMT weighted totals from exhaust emissions to get the total VMT weighted emissions.

The last section shows the fractional contribution of each particulate to the total for each vehicle class.

4.2 DIAGNOSTIC AND ERROR MESSAGES

Messages are of three types: error messages, warning messages and comments. Error messages can be fatal or non-fatal. Fatal errors cause the program to halt. Fatal errors are caused by user supplied data that the program does not understand or which is invalid and cannot be corrected by the program. Non-fatal errors are errors that do not stop execution. There occur where values are out of bounds. In some cases, the program adjusts the out of bound values to be in bounds. The program execution will halt when there are 50 non-fatal errors. Scenarios with non-fatal errors should be carefully checked for errors. Comments are useful statements about options taken. They do not affect the calculations and are present for informational purposes only. The meanings of the messages are presented in Table 4-1 for fatal errors, Table 4-2 for non-fatal errors and Table 4-3 for warnings and comments. The error number given in the tables is the code passed to the QUITER subroutine which writes the message.

TABLE 4-1

FATAL ERROR MESSAGES

Error Number	
1	**"Message Code '#'"** This is an unknown of out of bounds message it should never occur. # is the unknown message number
2	**"IPROMT Flag Out Of Bounds - Prompt Mode Type (1 to 4) Must be Corrected Before Your Next Run"** This message occurs if IPROMT is not equal to 1, 2, 3 or 4
3-8	**"'Value' Out of Bounds for 'Name of Flag' Flag"** This message indicates that the flag named has a value that is out of bounds. It should be corrected for the next run.
16	**"Range of Years for Lead Content by Year Cannot be Negative or Zero"** This message occurs when the user has set SPCFLG=2 and incorrectly specifies the range of years on the first card of the lead content of gasoline data.
17	**"'Value' intercept must be positive"** This error occurs when MISFLG=2 and the user has entered a negative zero mile misfueling rate
22	**"You Must Correct All Flags Before You Run Again"** This message occurs when one or more of the control flags is out of bounds. It ends the run. This message occurs in conjunction with errors 3-8.
23	**"End of File in OUTGEN Data File"** This error occurs when there is no more data in unit IOUGEN when the program was expecting data. This message will occur only when using a data file for user supplied data.
31	**"End of File in IOUDAT Data File"** This error occurs when the program finds an end of file in the default data file. This error occurs only when the default data has been changed.

35 **"Driving Condition Flag Must Be 1 or 2 Cannot be 'Value'"**

The user has incorrectly entered the driving conditions. Entering 1=transient or cyclic, a 2=cruise

36 **"Year Cannot Be 'Value'--Must Be Later Than 1979"**

The scenario year must be later than 1979

37 **"No Such Vehicle Class 'Value' For Registration Data"**

This error occurs when MYMRFG=3 or 4 and an incorrect vehicle class has been entered. The vehicle class must be a number between one and six.

38 **"No Fuel Type 'Value' for Registration Data"**

This error occurs when MYMRFG=3 or 4 and an invalid fuel type has been entered. The fuel type must be between one and three. (1=leaded, 2=unleaded, 3=diesel).

39 **"No Vehicle Class 'Value' for Mileage Accumulation Data"**

This error occurs when MYMRFG=2 or 4 and an invalid vehicle class has been entered. The vehicle class must be between one and six (1=LDV, 3=LDT2, 4=HDGV, 5=HDDT, 6=MC).

40 **"No Fuel Type 'Value' for Mileage Accumulation Data"**

This error occurs when MYMRFG=2 or 4 and an invalid fuel type has been entered. The fuel type must be between one and three (1 or 2=gasoline, 3=diesel)

TABLE 4-2

NON-FATAL ERROR MESSAGES

Error Number	
10	**" 'Value' Out of Bounds for VMT Mix (0. to 1.)**
	The user has specified an incorrect VMT fraction. The VMT weighted totals in the results will be incorrect.
11	**" 'Value' Sum of VMT Mix is not Equal to 1."**
	The user has specified one or more incorrect VMT fractions. The sum of the fractions does not add up to one. The VMT weighted totals in the results will be incorrect.
12	**" 'Value' Negative Model Year Mileage"**
	The user has set MYMRFG=2 or 4 and has entered a negative mileage accumulation rate. The results for this vehicle class and fuel type will be incorrect.
13	**" 'Value' Negative Model Year Registration"**
	This message occurs when MYMRFG=3 or 4 and a negative registration fraction has been entered. The results for this vehicle class will be incorrect.
19	**" 'Value' Speed Must be Positive"**
	The speed for this scenario is less than zero. The program will take the absoute value and continue execution.
28	**"Lead Content of Leaded Gas Cannot Be 'Value' for Year 'Value of Year' "**
	This message occurs when the user has set SPCFLG=2 and incorrectly specifies a negative lead content for the given year. The program makes the value positive and continues.
29	**"Lead Content of Unleaded Gas Cannot be 'Value' for Year 'Value of Year' "**
	This message occurs when the user has set SPCFLG=2 and incorrectly specifies a negative lead content for the given year. The program makes the value positive and continues.
30	**" 'Value' Tampering Rate Must be Positive or Zero"**
	This message occurs when TAMFLG=2 and the tampering rate is negative. The program sets the tampering rate to zero and continues execution.

32 **"Argument Out of Bounds in Function 'Name of Function' "**

This error indicates a bad argument was passed to the named function. This error should not occur. Contact technical assistance.

TABLE 4-3

WARNING AND COMMENT MESSAGES

Message Number	
9	**" 'Value' Speed Reduced to 55 M.P.H. Maximum"**
	The speed for the scenario was reduced to 55 mph.
14	**" 'Value' Registration with Zero Mileage"**
	This error will occur only when MYMRFG=2, 3 or 4. There is a vehicle class with a registration fraction but no mileage accumulation.
15	**" 'Value' Mileage with Zero Registration"**
	This error will occur only when MYMRFG-2, 3 or 4. There is a vehicle class with mileage accumulation but no registration fraction.
18	**" 'Value' Negative Slope for Ageing Vehicles"**
	This error will occur only when MISFLG=2 and the user has entered a negative slope, (i.e. less misfueling with mileage accumulation). Where the derived misfueling rate is negative, it is set equal to zero.
20	**" 'Value' MYR Sum not = 1. (Will Normalize)"**
	This message will occur only if MYMRFG=3 or 4 and the sum of the registration fractions do not sum to one. The program will renormalize the fractions so that they do sum to one.
21	**" 'Value' Speed Increased to 5 M.P.H. Minimum"**
	The scenario speed was less than 5 mph. The program increases it to 5 mph before proceeding.
26	**" 'Value' Particle Size Cutoff Increased to 0.1 Microns"**
	The scenario particle size cutoff was less than 0.1 microns. The program set the particle size cutoff to 0.1 microns before continuing execution.
27	**" 'Value' Particle size Cutoff Decreased to 10 Microns"**
	The scenario particle size cutoff was greater than 10 microns. The program set the particle size cutoff to 10 microns before continuing execution.

33 **"Vehicle Speed = 'Value' Less Than 19.6 M.P.H. for Sulfate Cal."**

This message simply warns that the sulfate calculations for light duty vehicles are being extrapolated.

34 **"Vehicle Speed = 'Value' Greater than 34.8"**

Same as message 33.

5. PROGRAM STRUCTURE AND NOTES

This section describes the program I/O unit assignments. It also documents the setup of the default data file which is read in prior to each run.

5.1 The Program I/O Unit Assignments

The MAIN program contains the default input and output unit numbers. The input unit numbers are stored in the variables IOUDAT and IOUGEN. IOUDAT is the unit number assigned to the deault data file. It is normally unit 4. IOUGEN is the unit designated for user input. It is normally unit 5. These assignments cannot be changed unless the MAIN program is altered. The output unit numbers are stored as IOUREP, IOUERR and IOUASK. They are the output unit for reports, error and warning messages and user prompts respectively. They are all normally assigned to unit 6. The user can change any or all output unit numbers by using the IPROMT flag to specify new numbers (see control section inputs). All of the I/O unit assignments are stored in the common block IOUCOM.

5.2 PROGRAM STRUCTURE

Figure 5-1 diagrams the program structure in terms of subroutines. The subroutines are described in Table 5-1. Each subroutine is called by the routine to the left of it on the diagram.

5.3 COMMON BLOCKS

The common blocks and the subroutines that use them are listed in Table 5-2.

5.4 GLOBAL VARIABLES

Global variables are not global in the sense that they are available to all parts of the program but are global in useage. The variables always have the same meaning wherever they appear. They are most often used as indices to arrays or as pointers. They are shown in Table 5-3.

FIGURE 5-1
PROGRAM STRUCTURE

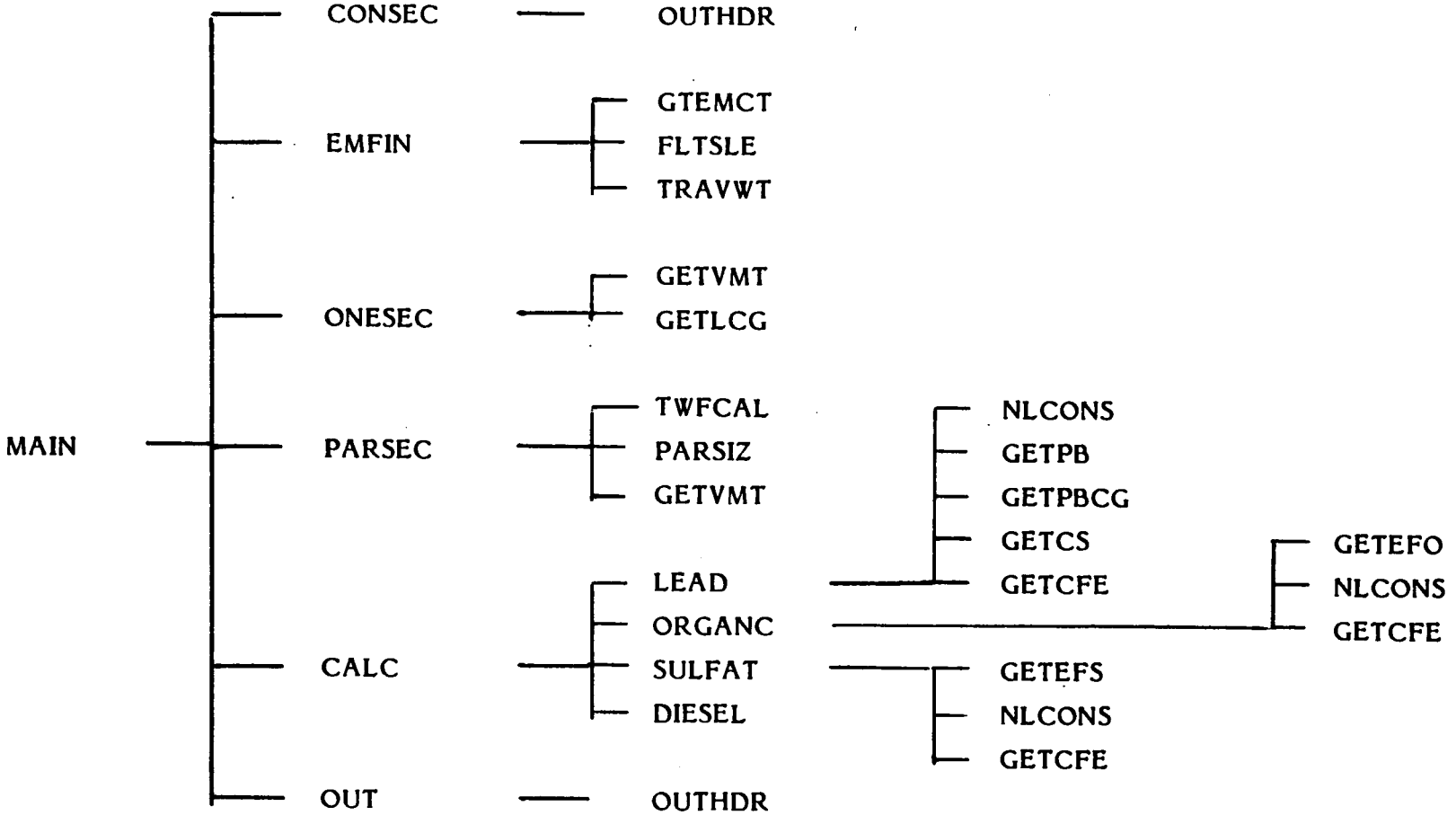

TABLE 5-1

PROGRAM MODULE DICTIONARY

MAIN	Controls overall execution of the program
CONSEC	Reads and verifies control flags
EMFIN	Reads all default data
ONESEC	Reads and verifies one time data
PARSEC	Reads parameters for each scenario
GTEMCT	Reads fractions of given vehicle class with various types of emission control technology
FLTSLE	Reads fleet sales fractions by fuel type for a given vehicle class
TRAVWT	Reads and verifies registration and mileage accumulation by age for a given vehicle class
GETVMT	Reads and verifies VMT fractions by vehicle class for area (also known as even travel fraction)
GETLCG	Reads user supplied lead content of gasoline by year
TWFCAL	Calculates travel weighting function for all vehicle classes and sets default fleet sales functions for those not previously read
PARSIZ	Calculates fraction of each particulate type which is below particle size cutoff
LEAD	Calculates total lead emission for given vehicle class, year and fuel type
NLCONS	Finds unleaded emissions factors for given year and vehicle class
GETPB	Finds leaded emissions factor for given vehicle class and year
GETPBCG	Finds amount of lead in gasoline for given year and fuel type
GETCS	Finds speed dependent correction factor for given speed
GETCFE	Finds combined city/highway fuel economy (miles per gallon) for given year and vehicle class
ORGANC	Calculates total organic emissions for given vehicle class, year and fuel type

GETEFO	Finds organic emission factor for given year, vehicle class, catalyst and fuel type
SULFAT	Calculates total sulfate emission for given vehicle class, year, speed and fuel type
GETEFS	Finds sulfate emission factor for given year, vehicle class, catalyst type, fuel and speed
DIESEL	Calculates diesel particulates for given vehicle class
OUT	Outputs results
OUTHDR	Outputs project name

TABLE 5-2

COMMON BLOCKS

Name of BLOCK	Description
1. **ANSWER**	Contains particulate totals by type and vehicle class PBSUM (6) = lead totals ORGSUM (6) = organic particulate totals SULSUM (6) = sulfate particulate totals DIESUM (6) = diesel particulate totals CLSSUM (6) = particulate totals by class BRKSUM = brake wear particulate TIRSUM = tire wear particulate SUMALL = sum of all particulates Block Used by CALC and OUT
2. **CONST**	Contains fraction of lead burned that is exhausted FPB = fraction of lead exhausted by non-catalyst vehicles FPBE = 1975-1980 misfueled vehicles FPBL = 1981+ misfueled vehicles Block used by LEAD, EMFIN
3. **EMCT**	Contains fraction of fleet with emission control devices and catalyst removal rates FPBEMC (15,6) - fraction of leaded vehicles FNLEMC (15,6,8) - fraction of non-leaded vehicles with catalyst type FDIEMC (15,6) - fraction of diesel vehicles IEMCYR (15) - model year IEMCT - number of model years TAMPER (3,2) - catalyst removal rates for LDV, LDT1 and LDT2 For first four variables 1st index = year pointer 2nd index = vehicle class 1=LDV, LDDV 4=HDGV, HDDT 2=LDT1, LDDT1 5=HDGV2 3=LDT2, LDDT2 6=MC 3rd index = catalyst type (non-leaded only) 1=LDV, LDDV 4=HDGV1, HDDT 2=LDT1, LDDT 5=HDGV2 3=LDT2 6=MC

For TAMPER

1st index = vehicle class
2nd index = I/M flag

Block used by FREMCT, GTEMCT, ONESEC, NLCONS, SULFAT

4. **EMDIE** Contains Diesel Emission Factors

IDIEYR (20) - year
IDIEVH (20) - vehicle class
EFDP (20) - emission factor
NDITDT - no. of entries

Block used by EMFIN, DIESEL

5. **EMORG** Contains organic emission factors

IORGYR (20) - year
IORGFT (20) - fuel type
IORGCT (20) - catalyst type
IORGVH (20) - vehicle class
EFO (20) - emission factor
NORTDT - no. of entries

Block used by EMFIN, GETEFO

6. **EMPB** Contains lead emission factors

EFLEAD (20) - lead emission factor
IPBYR (20) - year
IPBVH (20) - vehicle class
IPBFT (20) - fuel type
NPBTDT - no. of entries

Block used by EMFIN, GETPB

7. **EMSUL** Contains sulfate emission factors

ISULYR (20) - year
ISULFT (20) - fuel type
ISULCT (20) - catalyst type
ISULVH (20) - vehicle class
EFS (20,2) - emission factor, speed
NSUTDT - no. of entries

Block used by EMFIN, GETEFS

8. **FLAGSI** Contains control flags (see control section)

Block used by CONSEC, EMFIN, ONESEC, PARSEC, GETLCG, GETVMT, NLCONS, OUT

9. FLEET Contains fleet sales fractions and VMT mix

FSF (26,6,3) - fleet sales fractions
- 1st index = index
- 2nd index = vehicle class
- 3rd index = fuel type

IFSFYR (26,6) = model year
- 1st index = index
- 2nd index = model year

IFSF (6) = highest index by vehicle class
VMT (6) = VMT fraction by vehicle class

Block used by TWFCAL, FLTSLE, GETVMT, CALC, FRFLT, OUT, EMFIN

10. GAS Contains lead content of gasoline, city/highway, fuel economy and vehicle speed correction

LCGSIZ - no. of lead content entries
LCGYR (20) - year for lead content
PBCG (20,2) - lead content of gasoline
- 1st index = index
- 2nd index = fuel type 1=leaded, 2=unleaded

NCFEYR (27) - Year for fuel economy
CFE (27,6) - miles per gallon by vehicle class
- 1st index = index
- 2nd index = vehicle class

1=LDV 4=HDGV1
2=LDT1 5=HDGV2
3=LDT3 HDGV

ICFESZ - no. of entries for city/highway fuel economy
IFECSZ - no. of entries for speed corrections
FECUS (13) - vehicle speed
FEC (13,2) - speed correction
- 1st index = index
- 2nd index = driving conditions
  - 1=cyclic
  - 2=steady

Block used by EMFIN, GETUCG, GTPBCG, GETCS, GETCFE

11. HDDT Contains heavy duty diesel truck mileage accumulation

IHTRG - no. of entries
IHDDTMA (20,4) - HDDT mileage accumulation rate
- 1st index = age
- 2nd index = wt class

1=2B 3=med HDDT
2=Lt. HDDT 4=heavy HDDT

IHDDYR (21) - calendar year
HDDTRG (21,4) - registration fraction
- 1st index = index
- 2nd index = wt. class

12. **HDDV** Contains HDDT low altitude g^m/bhp-hr to g^m/mile conversion factors

IHDDMY (13) - model year
HDDVCF (13) - conversion factor

Block used by EMFIN, DIESEL

13. **MSFL** Contains misfueling rates

RMISFL (20,4,2) - misfueling
1st index = age
2nd index = vehicle class
3rd index = IMFLAG
TMISFL (6,2) = simple misfueling rates
1st index = vehicle class
2nd index = IMFLAG

Block used by EMFIN, ONESEC and NLCONS

14. **PROJCM** Contains project title

PROJID - title

Block used by CONSEC, OUT, OUTHDR

15. **PSIZE** Contains particle size cumulative fraction for chosen particle size cutoff

PSZCUT = particle size cutoff
PSL = cumulative fraction for leaded vehicles
PSNL = cumulative fraction for non-leaded vehicles w/o catalyst
PSNLCT = cumulative fraction for non-leaded vehicles with catalyst
PSDIE = cumulative fraction for diesel vehicles
PSBRK = cumulative fraction for brake wear
PSTIRE = cumulative fraction for tire wear

Block used by ONESEC, PARSEC, PARSIZ, LEAD, ORGANC, SULFAT, DIESEL, CALC, OUT

16. PSDIST Contains particle size distribution

PSDIST (5,2,6) - particle size distribution
- 1st index = index
- 2nd index = 1=size
  2=cumulative fraction
- 3rd index = source
  1=leaded
  2=unleaded with catalyst
  3=unleaded w/o catalyst
  4=diesel
  5=brake
  6=tire

Block used by EMFIN, PARSIZ

17. SCENR Contains scenario variables

IYEAR - scenario year
VEHSPD - vehicle speed
IDRIV - driving conditions
1=cyclic or transient
2=steady cruise

Block used by EMFIN, PARSEC, CALC, OUT

TABLE 5-3

GLOBAL VARIABLES

Name	Range	Purpose
IAGE	1-20	Age of vehicle in years
IFT	1-3	Fuel Type 1=leaded gas 2=unleaded gas 3=diesel
IVHCLS	1-6	Vehicle class 1=LDV, LDDV 2=LDT1, LDDT1 3=LDT2, LDDT2 4=HDGV, HDDT 5=HDGV2 6=MC
	Note that this scheme is slightly different than the vehicle classes the user uses to input data and interpret results.	
IYRPTR	1980+	Calendar Year

5.5 OTHER PROGRAM NOTES

The vehicle classes inside the program are defined differently in comparison to the vehicle classes as defined in the original report. In the report the classes were defined as: 1) LDV and LDDV, 2) LDT1 and LDDT1, 3) LDT2 and LDDT2, 4) HDGV, 5) HDDT, and 6) MC. As far as the user is concerned the program treats vehicle classes in the exact same way as the report.

Inside the program, the vehicle classes are defined in terms of vehicle class and fuel type. The first three classes are unchanged and motorcycles are still the sixth class. However, HDDT are now part of the fourth class when the emissions factors are called and calculations done. HDGV2 are considered as the fifth class since they have different fuel economy than HDGV. This split in the definition at vehicle classes lasts until the subroutine CALC is called. CALC changes the definitions back to those found in the orignal report.

6. EXAMPLES

The following examples were run on the Ann Arbor MTS system to demonstrate both interactive and batch use of the program. The compiled source code was in the file "-load" and the associated data file was "partic.ef.da". The examples are:

1. No tampering (catalyst removal) scenario for 1985 and 1990 with transient driving conditions, vehicle speed 25 mph and including particles up to 10 microns in size. Program run interactively with prompts for user input.
2. No misfueling scenario for 1990 and 1995 with transient driving conditions, vehicle speed 25 mph and including particle size cutoffs of 10 microns for both years and 5 microns for 1990. Program run interactively with prompts for user input.
3. Alternate lead content of gasoline for1985 to 1990. A 1990 example with vehicle speed 25 mph transient driving conditions and a 10 micron size cutoff was run. Program was run interactively.
4. A user specified VMT mix is used for each scenario. Three cases are run for 1985 with vehicle speed 30 mph, transient driving conditions and a particle size cutoff of 10 microns for the first two cases and 5 microns for the last case. The program was run in batch mode with no prompts printed. The user specified data was a a file "example 1" assigned to unit 5. The normal exit is flagged by the message "END OF FILE IN IOUGEN DATA FILE".
5. Alternate tampering rates, LDV registration and mileage accumulation with age and alternate misfueling rates scenario. The user data is in file "example 2". The tampering rates for LDV, LDT1 and LDT2 are set to .100, .100 and 0.150 respectively in line 4. Gasoline powered LDV registration rates are altered in lines 5-8 and gasoline LDV mileage accumulation rates are altered in lines 9-12. The zero mileage misfueling rates and slopes with mileage for LDV, LDT1, LDT2 and HDGV1 are given in lines 13-16. The program was run for 1987 with vehicle speed 25 mph, cruising driving conditions and particle size cutoff 5 microns.

```
$run -load 4=partic.ef.da
4000                                                    EXAMPLE 1

Enter project id:
test example -- no tampering
ENTER TAMFLG, VMFLAG, MYMRFG, MISFLG, SPCFLG, IMFLAG
2 1 1 1 1 1

ENTER FRACTION OF CATALYST EQUIPPED VEHICLES WITH
CATALYST REMOVED FOR LDV, LDT1 AND LDT2 FORMAT=3(F4.3,1X)
NO I/M PROGRAM IN IN EFFECT
.000 .000 .000


ENTER YEAR FOR THIS RUN -- (FORMAT = I4)
1985
ENTER VEHICLE SPEED -- (FORMAT = F4.1)
25.00
ENTER DRIVING CONDITIONS (1= TRANSIENT, 2= CRUISE)
1
ENTER PARTICLE SIZE CUTOFF (0.1-10.) -FORMAT(F5.2)
10.00


TEST EXAMPLE -- NO TAMPERING

CALCULATIONS FOR YEAR 1985  SPEED  25.0 MPH   PARTICLE CUTOFF =10.00 MICRONS

FLAG SETTINGS:
 TAMPERING RATES    = USER   MISFUELING RATES  = NORM    VMT MIXTURE         = NORM
 MILEAGE & REGIST.  = NORM   I/M PROGRAM       =  NO     SPECIAL CONDITIONS = NORM
 DRIVING CONDITIONS = TRAN

          PARTICULATE EMISSIONS (GRAMS/MILE) BY VEHICLE CLASS

VEH.CLASS   LEAD    ORGANIC  SULFATE   DIESEL   TOTAL    VMT FRAC.  VMT WT. TOTAL
  LDV       0.0130   0.0234   0.0091   0.0128   0.0583     0.7845     0.0457
  LDT1      0.0243   0.0303   0.0066   0.0195   0.0808     0.0827     0.0067
  LDT2      0.0443   0.0286   0.0059   0.0195   0.0983     0.0470     0.0046
  HDGV      0.0987   0.1422   0.0023   0.0      0.2432     0.0419     0.0102
  HDDT      0.0      0.0      0.0      1.9198   1.9198     0.0354     0.0680
   MC       0.0311   0.0      0.0      0.0      0.0311     0.0085     0.0003
TOTAL BRAKE PARTICULATES = 0.0125
TOTAL TIRE PARTICULATES  = 0.0020
TOTAL VMT WEIGHTED PARTICULATE EMISSIONS =  0.1500

                  PARTICULATE FRACTION BY VEHICLE CLASS
VEH.CLASS   LEAD    ORGANIC  SULFATE  DIESEL
  LDV       0.2224   0.4019   0.1557   0.2200
  LDT1      0.3007   0.3753   0.0822   0.2417
  LDT2      0.4501   0.2912   0.0601   0.1985
  HDGV      0.4059   0.5846   0.0095   0.0
  HDDT      0.0      0.0      0.0      1.0000
   MC       1.0000   0.0      0.0      0.0


ENTER YEAR FOR THIS RUN -- (FORMAT = I4)
1990
ENTER VEHICLE SPEED -- (FORMAT = F4.1)
25.00
ENTER DRIVING CONDITIONS (1= TRANSIENT, 2= CRUISE)
1
ENTER PARTICLE SIZE CUTOFF (0.1-10.) -FORMAT(F5.2)
10.00
```

```
TEST EXAMPLE -- NO TAMPERING

CALCULATIONS FOR YEAR 1990  SPEED  25.0 MPH   PARTICLE CUTOFF =10.00 MICRONS

FLAG SETTINGS:
 TAMPERING RATES    = USER   MISFUELING RATES  = NORM    VMT MIXTURE        = NORM
 MILEAGE & REGIST.  = NORM   I/M PROGRAM       =  NO     SPECIAL CONDITIONS = NORM
 DRIVING CONDITIONS = TRAN

         PARTICULATE EMISSIONS (GRAMS/MILE) BY VEHICLE CLASS

VEH.CLASS   LEAD    ORGANIC  SULFATE   DIESEL   TOTAL    VMT FRAC.  VMT WT. TOTAL
  LDV       0.0057   0.0195   0.0085   0.0174   0.0512     0.7845     0.0401
  LDT1      0.0136   0.0234   0.0071   0.0434   0.0876     0.0827     0.0072
  LDT2      0.0236   0.0228   0.0078   0.0434   0.0976     0.0470     0.0046
  HDGV      0.0591   0.0938   0.0100   0.0      0.1478     0.0419     0.0070
  HDDT      0.0      0.0      0.0      1.7319   1.7319     0.0354     0.0613
   MC       0.0294   0.0      0.0      0.0      0.0294     0.0085     0.0003
TOTAL BRAKE PARTICULATES = 0.0125
TOTAL TIRE PARTICULATES  = 0.0020
TOTAL VMT WEIGHTED PARTICULATE EMISSIONS =  0.1351

                PARTICULATE FRACTION BY VEHICLE CLASS
VEH.CLASS   LEAD    ORGANIC  SULFATE  DIESEL
  LDV       0.1117   0.3817   0.1671   0.3395
  LDT1      0.1550   0.2677   0.0812   0.4961
  LDT2      0.2419   0.2335   0.0796   0.4449
  HDGV      0.3520   0.5887   0.0593   0.0
  HDDT      0.0      0.0      0.0      1.0000
   MC       1.0000   0.0      0.0      0.0

ENTER YEAR FOR THIS RUN -- (FORMAT = I4)
!
+Attention interrupt at 35385E
#$!
#Attn!
#
```

```
 $run -load 4=partic.ef.da
#Invalid MTS command
#$run -load 4=partic.ef.da
4 000
```

EXAMPLE 2

```
 Enter project id:
 test example -- no misfueling
 ENTER TAMFLG, VMFLAG, MYMRFG, MISFLG, SPCFLG, IMFLAG
 1 1 1 2 1 1
 ENTER FOR  LDV ZERO MILE MISFUELING RATE AND SLOPE       --FORMAT=F8.6,1X,F8.6
 0.000000 0.000000
 ENTER FOR LDT1 ZERO MILE MISFUELING RATE AND SLOPE       --FORMAT=F8.6,1X,F8.6
 0.000000 0.000000
 ENTER FOR LDT2 ZERO MILE MISFUELING RATE AND SLOPE       --FORMAT=F8.6,1X,F8.6
 0.000000 0.000000
 ENTER FOR HDT1 ZERO MILE MISFUELING RATE AND SLOPE       --FORMAT=F8.6,1X,F8.6
 0.000000 0.000000


 ENTER YEAR FOR THIS RUN -- (FORMAT = I4)
 1990
 ENTER VEHICLE SPEED -- (FORMAT = F4.1)
 25.000
 ENTER DRIVING CONDITIONS (1= TRANSIENT, 2= CRUISE)
 1
 ENTER PARTICLE SIZE CUTOFF (0.1-10.) -FORMAT(F5.2)
 10.000


 TEST EXAMPLE -- NO MISFUELING

 CALCULATIONS FOR YEAR 1990  SPEED  25.0 MPH   PARTICLE CUTOFF =10.00 MICRONS

 FLAG SETTINGS:
  TAMPERING RATES    = NORM   MISFUELING RATES  = USER    VMT MIXTURE         = NORM
  MILEAGE & REGIST.  = NORM   I/M PROGRAM       =  NO     SPECIAL CONDITIONS = NORM
  DRIVING CONDITIONS = TRAN

          PARTICULATE EMISSIONS (GRAMS/MILE) BY VEHICLE CLASS

 VEH.CLASS   LEAD    ORGANIC  SULFATE   DIESEL   TOTAL    VMT FRAC.  VMT WT. TOTAL
   LDV       0.0024   0.0159   0.0100   0.0174   0.0456     0.7845     0.0358
   LDT1      0.0046   0.0152   0.0109   0.0434   0.0741     0.0827     0.0061
   LDT2      0.0128   0.0152   0.0119   0.0434   0.0833     0.0470     0.0039
   HDGV      0.0591   0.0961   0.0121   0.0      0.1674     0.0419     0.0070
   HDDT      0.0      0.0      0.0      1.7319   1.7319     0.0354     0.0613
    MC       0.0294   0.0      0.0      0.0      0.0294     0.0085     0.0003
 TOTAL BRAKE PARTICULATES = 0.0125
 TOTAL TIRE PARTICULATES  = 0.0020
 TOTAL VMT WEIGHTED PARTICULATE EMISSIONS =  0.1290

                  PARTICULATE FRACTION BY VEHICLE CLASS
 VEH.CLASS   LEAD    ORGANIC  SULFATE  DIESEL
   LDV       0.0525   0.3481   0.2188   0.3806
   LDT1      0.0624   0.2047   0.1470   0.5859
   LDT2      0.1538   0.1820   0.1428   0.5213
   HDGV      0.3530   0.5745   0.0726   0.0
   HDDT      0.0      0.0      0.0      1.0000
    MC       1.0000   0.0      0.0      0.0
```

```
ENTER YEAR FOR THIS RUN -- (FORMAT = I4)
1995
ENTER VEHICLE SPEED -- (FORMAT = F4.1)
25.00
ENTER DRIVING CONDITIONS (1= TRANSIENT, 2= CRUISE)
1
ENTER PARTICLE SIZE CUTOFF (0.1-10.) -FORMAT(F5.2)
10.000


TEST EXAMPLE -- NO MISFUELING

CALCULATIONS FOR YEAR 1995  SPEED  25.0 MPH   PARTICLE CUTOFF =10.00 MICRONS

FLAG SETTINGS:
 TAMPERING RATES    = NORM   MISFUELING RATES  = USER    VMT MIXTURE         = NORM
 MILEAGE & REGIST.  = NORM   I/M PROGRAM       =  NO     SPECIAL CONDITIONS = NORM
 DRIVING CONDITIONS = TRAN

         PARTICULATE EMISSIONS (GRAMS/MILE) BY VEHICLE CLASS

VEH.CLASS   LEAD    ORGANIC  SULFATE   DIESEL    TOTAL    VMT FRAC.  VMT WT. TOTAL
  LDV       0.0007   0.0149   0.0088   0.0210   0.0454     0.7845     0.0356
  LDT1      0.0008   0.0124   0.0104   0.0670   0.0906     0.0827     0.0075
  LDT2      0.0031   0.0124   0.0126   0.0670   0.0951     0.0470     0.0045
  HDGV      0.0349   0.0680   0.0180   0.0      0.1209     0.0419     0.0051
  HDDT      0.0      0.0      0.0      1.6606   1.6606     0.0354     0.0588
   MC       0.0294   0.0      0.0      0.0      0.0294     0.0085     0.0003
TOTAL BRAKE PARTICULATES = 0.0125
TOTAL TIRE PARTICULATES  = 0.0020
TOTAL VMT WEIGHTED PARTICULATE EMISSIONS =  0.1262

                PARTICULATE FRACTION BY VEHICLE CLASS
VEH.CLASS   LEAD    ORGANIC  SULFATE  DIESEL
  LDV       0.0160   0.3278   0.1948   0.4614
  LDT1      0.0085   0.1370   0.1152   0.7394
  LDT2      0.0326   0.1303   0.1328   0.7043
  HDGV      0.2887   0.5622   0.1491   0.0
  HDDT      0.0      0.0      0.0      1.0000
   MC       1.0000   0.0      0.0      0.0
```

EXAMPLE 2 (cont)

```
 ENTER YEAR FOR THIS RUN -- (FORMAT = I4)
 1990
 ENTER VEHICLE SPEED -- (FORMAT = F4.1)
 25.000
 ENTER DRIVING CONDITIONS (1= TRANSIENT, 2= CRUISE)
 1
 ENTER PARTICLE SIZE CUTOFF (0.1-10.) -FORMAT(F5.2)
  5.00

 . . . .

 TEST EXAMPLE -- NO MISFUELING

 CALCULATIONS FOR YEAR 1990  SPEED  25.0 MPH   PARTICLE CUTOFF = 5.00 MICRONS

 FLAG SETTINGS:
  TAMPERING RATES    = NORM   MISFUELING RATES  = USER    VMT MIXTURE         = NORM
  MILEAGE & REGIST.  = NORM   I/M PROGRAM       =  NO     SPECIAL CONDITIONS = NORM
  DRIVING CONDITIONS = TRAN

          PARTICULATE EMISSIONS (GRAMS/MILE) BY VEHICLE CLASS

 VEH.CLASS   LEAD    ORGANIC  SULFATE   DIESEL    TOTAL    VMT FRAC.  VMT WT. TOTAL
   LDV       0.0020   0.0149   0.0095   0.0164   0.0428     0.7845     0.0336
   LDT1      0.0038   0.0141   0.0103   0.0411   0.0693     0.0827     0.0057
   LDT2      0.0103   0.0139   0.0113   0.0411   0.0766     0.0470     0.0036
   HDGV      0.0471   0.0783   0.0113   0.0      0.1367     0.0419     0.0057
   HDDT      0.0      0.0      0.0      1.6395   1.6395     0.0354     0.0580
    MC       0.0234   0.0      0.0      0.0      0.0234     0.0085     0.0002
 TOTAL BRAKE PARTICULATES = 0.0106
 TOTAL TIRE PARTICULATES  = 0.0010
 TOTAL VMT WEIGHTED PARTICULATE EMISSIONS =  0.1185

                 PARTICULATE FRACTION BY VEHICLE CLASS
 VEH.CLASS   LEAD    ORGANIC  SULFATE  DIESEL
   LDV       0.0470   0.3482   0.2209   0.3839
   LDT1      0.0547   0.2029   0.1490   0.5934
   LDT2      0.1349   0.1813   0.1471   0.5367
   HDGV      0.3444   0.5729   0.0827   0.0
   HDDT      0.0      0.0      0.0      1.0000
    MC       1.0000   0.0      0.0      0.0


 ENTER YEAR FOR THIS RUN -- (FORMAT = I4)
 !
+Attention interrupt at 35385E
#
```

[redacted] [redacted] [redacted]
Enter project ID:
test example -- alternate lead content for 1985 to 1990
ENTER TAMFLG, VMFLAG, MYMRFG, MISFLG, SPCFLG, IMFLAG
1 1 1 1 2 1

EXAMPLE 3

```
ALTERNATE LEAD CONTENT OF GASOLINE BY YEAR
ENTER FIRST AND LAST YEAR TO CHANGE - (I4,1X,I4)
1985 1990

ENTER LEAD CONTENT OF GASOLINE FOR  LEADED            AND UNLEADED -- FORMAT=F5.3,1X,F5.3
FOR YEAR  1985
1.050 0.010
FOR YEAR  1986
1.050 0.010
FOR YEAR  1987
1.050 0.005
FOR YEAR  1988
1.050 0.005
FOR YEAR  1989
1.050 0.005
FOR YEAR  1990
1.050 0.005


ENTER YEAR FOR THIS RUN -- (FORMAT = I4)
1990
ENTER VEHICLE SPEED -- (FORMAT = F4.1)
25.00
ENTER DRIVING CONDITIONS (1= TRANSIENT, 2= CRUISE)
1
ENTER PARTICLE SIZE CUTOFF (0.1-10.) -FORMAT(F5.2)
10.00
```



```
TEST EXAMPLE -- ALTERNATE LEAD CONTENT FOR 1985 TO 1990

CALCULATIONS FOR YEAR 1990  SPEED  25.0 MPH   PARTICLE CUTOFF =10.00 MICRONS

FLAG SETTINGS:
 TAMPERING RATES    = NORM   MISFUELING RATES  = NORM    VMT MIXTURE        = NORM
 MILEAGE & REGIST.  = NORM   I/M PROGRAM       =  NO     SPECIAL CONDITIONS = USER
 DRIVING CONDITIONS = TRAN

          PARTICULATE EMISSIONS (GRAMS/MILE) BY VEHICLE CLASS

VEH.CLASS   LEAD    ORGANIC  SULFATE   DIESEL   TOTAL    VMT FRAC.  VMT WT. TOTAL
  LDV       0.0052   0.0195   0.0085   0.0174   0.0506     0.7845     0.0397
  LDT1      0.0139   0.0234   0.0071   0.0434   0.0879     0.0827     0.0073
  LDT2      0.0237   0.0228   0.0078   0.0434   0.0977     0.0470     0.0046
  HDGV      0.0559   0.0988   0.0100   0.0      0.1647     0.0419     0.0069
  HDDT      0.0      0.0      0.0      1.7319   1.7319     0.0354     0.0613
   MC       0.0294   0.0      0.0      0.0      0.0294     0.0085     0.0003
TOTAL BRAKE PARTICULATES = 0.0125
TOTAL TIRE PARTICULATES  = 0.0020
TOTAL VMT WEIGHTED PARTICULATE EMISSIONS =  0.1346

                PARTICULATE FRACTION BY VEHICLE CLASS
VEH.CLASS   LEAD    ORGANIC  SULFATE  DIESEL
  LDV       0.1027   0.3856   0.1688   0.3429
  LDT1      0.1584   0.2666   0.0809   0.4941
  LDT2      0.2426   0.2333   0.0795   0.4445
  HDGV      0.3397   0.5999   0.0604   0.0
  HDDT      0.0      0.0      0.0      1.0000
  MC        1.0000   0.0      0.0      0.0
```

```
:Unexpected operand at end of command
:p *f *l
:      1     3
:      2     TEST EXAMPLE -- VMT MIX FOR EACH SCENARIO
:      3     1 2 1 1 1 1
:      4     1985
:      5     30.0
:      6     1
:      7     10.00
:      8     0.750 0.100 0.100 0.050 0.000 0.000
:      9     1985
:     10     30.0
:     11     1
:     12     10.00
:     13     0.600 0.100 0.100 0.050 0.150 0.000
:     14     1985
:     15     30.0
:     16     1
:     17      5.00
:     18     0.600 0.100 0.100 0.050 0.150 0.000
:$run -&oad 4=partic.ef.da 5=example1
```

TEST EXAMPLE -- VMT MIX FOR EACH SCENARIO

CALCULATIONS FOR YEAR 1985 SPEED 30.0 MPH PARTICLE CUTOFF =10.00 MICRONS

FLAG SETTINGS:
TAMPERING RATES = NORM MISFUELING RATES = NORM VMT MIXTURE = SCEN
MILEAGE & REGIST. = NORM I/M PROGRAM = NO SPECIAL CONDITIONS = NORM
DRIVING CONDITIONS = TRAN

PARTICULATE EMISSIONS (GRAMS/MILE) BY VEHICLE CLASS

VEH.CLASS	LEAD	ORGANIC	SULFATE	DIESEL	TOTAL	VMT FRAC.	VMT WT. TOTAL
LDV	0.0120	0.0234	0.0096	0.0128	0.0578	0.7500	0.0434
LDT1	0.0235	0.0303	0.0069	0.0195	0.0803	0.1000	0.0080
LDT2	0.0418	0.0286	0.0062	0.0195	0.0962	0.1000	0.0096
HDGV	0.0987	0.1422	0.0023	0.0	0.2432	0.0500	0.0122
HDDT	0.0	0.0	0.0	1.9198	0.0	0.0	0.0
MC	0.0311	0.0	0.0	0.0	0.0	0.0	0.0

TOTAL BRAKE PARTICULATES = 0.0125
TOTAL TIRE PARTICULATES = 0.0020
TOTAL VMT WEIGHTED PARTICULATE EMISSIONS = 0.0877

PARTICULATE FRACTION BY VEHICLE CLASS

VEH.CLASS	LEAD	ORGANIC	SULFATE	DIESEL
LDV	0.2077	0.4051	0.1655	0.2217
LDT1	0.2932	0.3776	0.0859	0.2432
LDT2	0.4350	0.2978	0.0643	0.2030
HDGV	0.4059	0.5846	0.0095	0.0
HDDT	0.0	0.0	0.0	0.0
MC	0.0	0.0	0.0	0.0

TEST EXAMPLE -- VMT MIX FOR EACH SCENARIO

CALCULATIONS FOR YEAR 1985 SPEED 30.0 MPH PARTICLE CUTOFF =10.00 MICRONS

FLAG SETTINGS:
TAMPERING RATES = NORM MISFUELING RATES = NORM VMT MIXTURE = SCEN
MILEAGE & REGIST. = NORM I/M PROGRAM = NO SPECIAL CONDITIONS = NORM
DRIVING CONDITIONS = TRAN

PARTICULATE EMISSIONS (GRAMS/MILE) BY VEHICLE CLASS

VEH.CLASS	LEAD	ORGANIC	SULFATE	DIESEL	TOTAL	VMT FRAC.	VMT WT. TOTAL
LDV	0.0120	0.0234	0.0096	0.0128	0.0578	0.6000	0.0347
LDT1	0.0235	0.0303	0.0069	0.0195	0.0803	0.1000	0.0080
LDT2	0.0418	0.0286	0.0062	0.0195	0.0962	0.1000	0.0096
HDGV	0.0987	0.1422	0.0023	0.0	0.2432	0.0500	0.0122
HDDT	0.0	0.0	0.0	1.9198	1.9198	0.1500	0.2880
MC	0.0311	0.0	0.0	0.0	0.0	0.0	0.0

TOTAL BRAKE PARTICULATES = 0.0125
TOTAL TIRE PARTICULATES = 0.0020
TOTAL VMT WEIGHTED PARTICULATE EMISSIONS = 0.3670

PARTICULATE FRACTION BY VEHICLE CLASS

VEH.CLASS	LEAD	ORGANIC	SULFATE	DIESEL
LDV	0.2077	0.4051	0.1655	0.2217
LDT1	0.2932	0.3776	0.0859	0.2432
LDT2	0.4350	0.2978	0.0643	0.2030
HDGV	0.4059	0.5846	0.0095	0.0
HDDT	0.0	0.0	0.0	1.0000
MC	0.0	0.0	0.0	0.0

TEST EXAMPLE -- VMT MIX FOR EACH SCENARIO
aM}wDwyl

CALCULATIONS FOR YEAR 1985 SPEED 30.0 MPH PARTICLE CUTOFF = 5.00 MICRONS

FLAG SETTINGS:
TAMPERING RATES = NORM MISFUELING RATES = NORM VMT MIXTURE = SCEN
MILEAGE & REGIST. = NORM I/M PROGRAM = NO SPECIAL CONDITIONS = NORM
DRIVING CONDITIONS = TRAN

PARTICULATE EMISSIONS (GRAMS/MILE) BY VEHICLE CLASS

VEH.CLASS	LEAD	ORGANIC	SULFATE	DIESEL	TOTAL	VMT FRAC.	VMT WT. TOTAL
LDV	0.0096	0.0204	0.0090	0.0121	0.0512	0.6000	0.0307
LDT1	0.0188	0.0253	0.0065	0.0185	0.0691	0.1000	0.0069
LDT2	0.0333	0.0238	0.0058	0.0185	0.0814	0.1000	0.0081
HDGV	0.0785	0.1130	0.0018	0.0	0.1933	0.0500	0.0097
HDDT	0.0	0.0	0.0	1.8174	1.8174	0.1500	0.2726
MC	0.0247	0.0	0.0	0.0	0.0	0.0	0.0

TOTAL BRAKE PARTICULATES = 0.0106
TOTAL TIRE PARTICULATES = 0.0010
TOTAL VMT WEIGHTED PARTICULATE EMISSIONS = 0.3397

PARTICULATE FRACTION BY VEHICLE CLASS

VEH.CLASS	LEAD	ORGANIC	SULFATE	DIESEL
LDV	0.1881	0.3983	0.1766	0.2369
LDT1	0.2719	0.3666	0.0940	0.2675
LDT2	0.4096	0.2920	0.0713	0.2271
HDGV	0.4059	0.5846	0.0095	0.0
HDDT	0.0	0.0	0.0	1.0000
MC	0.0	0.0	0.0	0.0

```
$edit example2
:p *f *1
:      1      3
:      2      TEST EXAMPLE - ALT. TAMPERING, LDV REG.&MILEAGE, MISFUELING
:      3      2 1 4 2 1 1
:      4      .100 .100 .150
:      5      1 1
:      6       .100 .100 .100 .100 .050 .050 .050 .050 .050 .050
:      7       .030 .030 .030 .030 .030 .030 .030 .030 .030 .030
:      8      0 0
:      9      1 1
:     10      15000 14000 13000 12000 11000 10000 10000 10000 10000 10000
:     11       9000  8000  7000  6000  5000  4000  4000  4000  4000  4000
:     12      0 0
:     13      0.050000 0.000100
:     14      0.060000 0.000200
:     15      0.070000 0.000200
:     16      0.070000 0.000200
:     17      1987
:     18      25.00
:     19      2
:     20       5.00
:
```

```
TEST EXAMPLE - ALT. TAMPERING, LDV REG.&MILEAGE, MISFUELING

CALCULATIONS FOR YEAR 1987  SPEED  25.0 MPH   PARTICLE CUTOFF = 5.00 MICRONS

FLAG SETTINGS:
 TAMPERING RATES    = USER   MISFUELING RATES  = USER    VMT MIXTURE          = NORM
 MILEAGE & REGIST.  =  M+R   I/M PROGRAM       =  NO     SPECIAL CONDITIONS = NORM
 DRIVING CONDITIONS = CRSE

        PARTICULATE EMISSIONS (GRAMS/MILE) BY VEHICLE CLASS

VEH.CLASS   LEAD     ORGANIC  SULFATE   DIESEL   TOTAL    VMT FRAC.  VMT WT. TOTAL
  LDV       0.0167   0.0343   0.0011    0.0146   0.0667     0.7845     0.0523
  LDT1      0.0199   0.0320   0.0007    0.0272   0.0799     0.0827     0.0066
  LDT2      0.0304   0.0297   0.0007    0.0272   0.0881     0.0470     0.0041
  HDGV      0.0762   0.1097   0.0018    0.0      0.1876     0.0419     0.0079
  HDDT      0.0      0.0      0.0       1.7342   1.7342     0.0354     0.0614
   MC       0.0242   0.0      0.0       0.0      0.0242     0.0085     0.0002
TOTAL BRAKE PARTICULATES = 0.0106
TOTAL TIRE PARTICULATES  = 0.0010
TOTAL VMT WEIGHTED PARTICULATE EMISSIONS =  0.1442

                PARTICULATE FRACTION BY VEHICLE CLASS
VEH.CLASS   LEAD     ORGANIC  SULFATE  DIESEL
  LDV       0.2510   0.5138   0.0164   0.2188
  LDT1      0.2497   0.4003   0.0094   0.3406
  LDT2      0.3449   0.3377   0.0085   0.3089
  HDGV      0.4059   0.5846   0.0095   0.0
  HDDT      0.0      0.0      0.0      1.0000
   MC       1.0000   0.0      0.0      0.0


**ERROR 23:
          END OF FILE IN IOUGEN DATA FILE
#
```

APPENDIX A

SOURCE CODE LISTING

```
      C THIS IS PROGRAM CALCULATES LEAD, ORGANIC, SULFATE AND
      C PARTICULATE EMISSIONS.  IT IS DESIGNED TO BE SIMILIAR IN
      C FORMAT TO MOBILE3.
      C
      C PREPARED FOR E.P.A. BY:  ENERGY AND ENVIRONMENTAL ANALYSIS
      C                          1655 NORTH FORT MEYER DRIVE
      C                          ARLINGTON VA 22209
      C
      C
      C MAIN PROGRAM
            COMMON/IOUCOM/IOUREP,IOUERR,IOUASK,IOUDAT,IOUGEN
      C
      C DEFAULT UNIT ASSIGNMENTS
      C DATA FILE (DEFAULT EMISSION FACTORS)
            IOUDAT=4
      C USER SUPPLIED DATA
            IOUGEN=5
      C OUTPUT REPORT
            IOUREP=6
      C C ERROR REPORT
            IOUERR=6
      C PROMPTS
            IOUASK=6
      C
      C READ CONTROL SECTION
            CALL CONSEC(&99)
      C READ DATA TABLES
            CALL EMFIN
            INERR=0
      C READ ONETIME DATA
            CALL ONESEC(INERR,&99)
            IF(INERR.GT.50)GOTO 20
      C READ PARAMETER SECTION (SCENARIOS)
         10 CALL PARSEC(INERR,&99)
            IF(INERR.GT.50)GOTO 20
      C CALCULATIONS
            CALL CALC
      C OUTPUT
            CALL OUT
            GOTO 10
         99 STOP
         20 WRITE(IOUERR,1000)
       1000 FORMAT('0','EXCESS DATA ERRORS PREVENT FURTHER ANALYSIS')
            END
      C
      C ***************************************
      C * INPUT ROUTINES                      *
      C ***************************************
      C
      C
            SUBROUTINE CONSEC(*)
      C
      C  CONSEC reads in and validates the Control Section flags.  It also sets the
      C  input mode for the run, resets the output units (if requested) and reads in
      C  and stores the run title.
      C
      C  Called by MAIN.
      C
```

```
C  Calls MOD (FORTRAN library function), OUTHDR and QUITER.
C
C  Input on call:
C
C    common blocks:
C
C  Output on return:
C
C    common blocks:
C    /IOUCOM/ IOUREP,IOUERR,IOUASK
C    /PROJCM/ PROJID
C
C  Local array subscripts:
C
C  IOUCHG(9)  -  IOUCHG ( JU )
C  IOUOLD(3)  -  IOUOLD ( JOU )
C  IOUREF(9)  -  IOUREF ( JU )
C  NAMFLG(13) -  NAMFLG ( IFG )
C
C  Local variable / array dictionary:
C
C   Name   Type              Description
C  ------  ----  ------------------------------------------------------
C  FLGERR   I    number of flag values found to be out of range
C  INFORM   I    dummy variable: QUITER call purpose is to write out run
C                'inform'ation, not an error or a warning message
C  IOUCHG   I    user entered changes to output unit assignments
C  IOUOLD   I    output unit numbers to be used this run
C  IOUREF   I    character representations of i/o unit numbers 1 - 9
C  IOUSUM   I    sum of acceptable changed i/o unit numbers
C  IPRSAV   I    backup of entered IPROMT - used in QUITER if out of range
C  JUNIT    I    potential numeric match to entered character for unit change
C  MDEFLG   I    decides prompt & read format for Control Section flags:
C                  1 = vertical format     2 = horizontal format
C  NAMFLG   R*8  flag names for prompts
C
C
      INTEGER TAMFLG,SPCFLG,VMFLAG
C
      COMMON/FLAGS1/IPROMT,TAMFLG,SPCFLG,VMFLAG,MYMRFG,IMFLAG,MISFLG
      COMMON/IOUCOM/IOUREP,IOUERR,IOUASK,IOUDAT,IOUGEN
      COMMON /PROJCM/ PROJID(20)
C
      INTEGER FLGERR
      DIMENSION IOUREF(9),IOUOLD(3),IOUCHG(3)
      REAL*8 NAMFLG(13),NAMFNC(2)
C
      EQUIVALENCE
     *   (IOUOLD(1),IOUREP),   (IOUOLD(2),IOUERR),   (IOUOLD(3),IOUASK)
C
      DATA FLGERR/0/
      DATA IOUREF/
     *   '1   ','2   ','3   ','4   ','5   ','6   ','7   ','8   ','9   '/
C
      DATA NAMFLG/' TAMFLG:',' VMFLAG:',' MYMRFG:',
     &           ' MISFLG:',' SPCFLG:',' IMFLAG:'/
     &,NAMFNC/' FREMCT ',' FRFLT  '/
C
```

```
117      C  Read in prompt/mode flag and output unit changes (if any).
118      C
119           READ(IOUGEN,100,END=99) IPROMT,IOUCHG
120         100 FORMAT(I1,3A1)
121      C
122      C  Output unit numbers parsed here.
123      C
124      C  Change alphanumeric to numeric values.
125      C
126           DO 20 JOU=1,3
127      C
128      C  Test for allowed values (no input units).
129      C
130           DO 10 JU=1,9
131           IF(JU.EQ.IOUGEN)GOTO 10
132           IF(JU.EQ.IOUDAT)GOTO 10
133           JUNIT=JU
134           IF(IOUCHG(JOU).EQ.IOUREF(JU)) GOTO 15
135         10 CONTINUE
136      C
137      C  Set default for unrecognized value.
138      C
139           JUNIT=0
140         15 IOUCHG(JOU)=JUNIT
141         20 CONTINUE
142      C
143      C  Assign output units.
144      C
145           IOUSUM=0
146           DO 25 JOU=1,3
147           IOUSUM=IOUCHG(JOU)+IOUSUM
148           IF(IOUCHG(JOU).GT.0) IOUOLD(JOU)=IOUCHG(JOU)
149         25 CONTINUE
150      C
151      C  Parse prompt/mode flag here.
152      C
153      C  Save input flag for future possible abort.
154      C
155           IPRSAV=IPROMT
156           IF(IPROMT.GE.1.AND.IPROMT.LE.4) GOTO 30
157      C
158      C  Abort will happen due to prompt/mode flag error.
159      C  Collect title for id of possible multiple units.
160      C
161           IPROMT=1
162           WRITE(IOUASK,210)
163           READ(IOUGEN,110,END=99) PROJID
164           GOTO 60
165      C
166      C  Parse prompt/mode flag.
167      C
168         30 MDEFLG=1
169           IF(IPROMT.GE.3)MDEFLG=2
170           IPROMT=MOD(IPROMT-1,2)+1
171      C
172      C  Read title.
173      C
174         55 IF(IPROMT.EQ.2) WRITE(IOUASK,210)
```

```
  210 FORMAT('0','Enter project id:')
      READ(IOUGEN,110,END=99) PROJID
  110 FORMAT(20A4)
C
C  If error unit no longer same as report unit, write run title to it.
C
   60 IF(IOUREP.NE.IOUERR) CALL OUTHDR(IOUERR)
C
C  Display unit number values if changed.
C
      IF(IOUSUM.GT.0) CALL QUITER(0.,0,71,INFORM)
      IF(IPROMT.EQ.2.AND.IOUASK.NE.IOUREP.AND.IOUASK.NE.IOUERR)
     *   CALL OUTHDR(IOUASK)
C
C  Reset INITPR so that subsequent branch check in OUTPUT will succeed.
C
      INITPR=1
C
C  Test IPRSAV (= entered IPROMT value).  Out-of-range => run stops.
C
      IF(IPRSAV.LT.1.OR.IPRSAV.GT.4) CALL QUITER(0.,IPRSAV,2,FLGERR)
C
      IF(MDEFLG.EQ.2) GOTO 65
C
C  Read flags via vertical input mode.
C
      IF(IPROMT.EQ.2) WRITE(IOUASK,220)NAMFLG(1)
      READ(IOUGEN,120,END=99) TAMFLG
      IF(TAMFLG.LT.1.OR.TAMFLG.GT.2) CALL QUITER(0.,TAMFLG,3,FLGERR)
      IF(IPROMT.EQ.2)WRITE(IOUASK,220)NAMFLG(2)
      READ(IOUGEN,120,END=99) VMFLAG
      IF(VMFLAG.LT.1.OR.VMFLAG.GT.3) CALL QUITER(0.,VMFLAG,5,FLGERR)
      IF(IPROMT.EQ.2) WRITE(IOUASK,220)NAMFLG(3)
      READ(IOUGEN,120,END=99) MYMRFG
      IF(MYMRFG.LT.1.OR.MYMRFG.GT.4) CALL QUITER(0.,MYMRFG,6,FLGERR)
      IF(IPROMT.EQ.2) WRITE(IOUASK,220)NAMFLG(4)
      READ(IOUGEN,120,END=99)MISFLG
      IF(MISFLG.LT.1.OR.MISFLG.GT.3) CALL QUITER(0.,MISFLG,4,FLGERR)
      IF(IPROMT.EQ.2) WRITE(IOUASK,220)NAMFLG(5)
      READ(IOUGEN,120,END=99) SPCFLG
      IF(SPCFLG.LT.1.OR.SPCFLG.GT.3)CALL QUITER(0.,SPCFLG,7,FLGERR)
      IF(IPROMT.EQ.2) WRITE(IOUASK,220)NAMFLG(6)
      READ(IOUGEN,120,END=99) IMFLAG
      IF(IMFLAG.LT.1.OR.IMFLAG.GT.2) CALL QUITER(0.,IMFLAG,8,FLGERR)
C
  120 FORMAT(I1)
  220 FORMAT(' ','Enter',A8)
C
      GOTO 70
C
C  Read flags in via horizontal mode.
C
   65 IF(IPROMT.EQ.2) WRITE(IOUASK,230)
  230 FORMAT(' ','ENTER TAMFLG, VMFLAG, MYMRFG, MISFLG, SPCFLG, IMFLAG')
      READ(IOUGEN,130,END=99) TAMFLG,VMFLAG,MYMRFG,MISFLG,SPCFLG,IMFLAG
  130 FORMAT(I1,12(1X,I1))
      IF(TAMFLG.LT.1.OR.TAMFLG.GT.2) CALL QUITER(0.,TAMFLG,3,FLGERR)
      IF(MISFLG.LT.1.OR.MISFLG.GT.3) CALL QUITER(0.,MISFLG,4,FLGERR)
```

```
      IF(VMFLAG.LT.1.OR.VMFLAG.GT.3) CALL QUITER(0.,VMFLAG,5,FLGERR)
      IF(MYMRFG.LT.1.OR.MYMRFG.GT.4) CALL QUITER(0.,MYMRFG,6,FLGERR)
      IF(SPCFLG.LT.1.OR.SPCFLG.GT.2) CALL QUITER(0.,SPCFLG,7,FLGERR)
      IF(IMFLAG.LT.1.OR.IMFLAG.GT.2) CALL QUITER(0.,IMFLAG,8,FLGERR)
C
C  1 or more flag values out of range => warn user & then stop run.
C
   70 IF(FLGERR.GT.0) CALL QUITER(0.,0,53,FLGERR)
      RETURN
C
C  EOF on any attempted read => take alternate return 1 => run aborts.
C
   99 RETURN1
      END
      SUBROUTINE QUITER(RVALUE,IVALUE,MESSAG,INERR)
C
C  QUITER prints error and warning messages on unit IOUERR.
C
C  CALLED BY CONSEC, PARSEC, ONSEC, GETVMT, GETLCG, FREMCT, FRFLT
C
C  Input on call:
C
C    parameter list: RVALUE,IVALUE,MESSAG,INERR
C    common blocks:
C    /IOUCOM/ IOUREP,IOUERR,IOUASK
C
C  Output on return:
C
C    parameter list: INERR
C
C  Warning: there is a conditional branch to STOP at statement number 98.
C
C  Local array subscripts:
C
C  IOBMSG(5)  -  IOBMSG ( ICH )
C  NAMFLG(15) -  NAMFLG ( ICH )
C  NAMFNC(16) -  NAMFNC ( ICH )
C  NAMVEH(8)  -  NAMVEH ( IV )
C
C  Local variable / array dictionary:
C
C   Name   Type              Description
C  ------  ----  ------------------------------------------------------
C  IOBMSG   I    character string vector: 'out of bounds for'
C  MAXMES   I    maximum message code value ( = 83 in MOBILE3 release version)
C  MCODE    I    = MESSAG = message code, unless < 0 or > MAXMES => = 1
C  NAMFLG   R*8  control flag names + 'Unknown'
C  NAMFNC   R*8  function names (to identify subprogram source of error)
C  NAMVEH   R*8  vehicle type names
C
C
C
      COMMON/IOUCOM/IOUREP,IOUERR,IOUASK,IOUDAT,IOUGEN
C
      DIMENSION IOBMSG(5)
C
      REAL*8 NAMFLG(8),NAMVEH(6),NAMFNC(2)
C
```

```
      DATA NAMFLG/
     *    ' Unknown',
     *    ' IPROMT ',
     *    ' TAMFLG ',
     *    ' MISFLG ',
     *    ' VMFLAG ',
     *    ' MYMRFG ',
     *    ' SPCFLG ',
     *    ' IMFLAG '/
C
      DATA NAMVEH/
     *    'LDV     ',
     *    'LDT 1   ',
     *    'LDT 2   ',
     *    'HDGV    ',
     *    'HDDT    ',
     *    'MC      '/
C
      DATA NAMFNC/'FREMCT  ','FRFLT   '/
C
      DATA IOBMSG/
     *    '  ou','t of',' bou','nds ','for '/
C
      DATA MAXMES/40/
C
      MCODE=MESSAG
C
C  Trap unknown errors.
C
      IF(MCODE.LT.1.OR.MCODE.GT.MAXMES) MCODE=1
C
C  Test for warnings.
C
      IF(MCODE.NE.9.AND.MCODE.NE.14.AND.MCODE.NE.15.AND.MCODE.NE.18
     *              .AND.MCODE.NE.20.AND.MCODE.NE.21.AND.MCODE.NE.25
     *              .AND.MCODE.NE.26.AND.MCODE.NE.27.AND.MCODE.NE.28
     *              .AND.MCODE.NE.29.AND.MCODE.NE.33.AND.MCODE.NE.34
     *  )WRITE(IOUERR,300)MCODE
  300 FORMAT('-','**ERROR ',I2,':')
C
C  Branch to the appropriate error / warning message.
C
      GOTO(
     *     10,11,11,11,11,11,11,11,16,17,
     *     18,19,20,21,22,29,30,31,39,49,
     *     52,53,60,61,71,72,73,74,75,76,
     *     77,78,79,80,81,82,83,84,85,86
     *        ),MCODE
C
   10 WRITE(IOUERR,310) MESSAG,NAMFLG(MCODE)
  310 FORMAT('+',10X,'Message code ',I4,A8)
      GOTO 98
   11 WRITE(IOUERR,311) IVALUE,IOBMSG,NAMFLG(MCODE)
  311 FORMAT('+',10X,I4,5A4,'flag',A8)
      IF(MCODE.EQ.2) WRITE(IOUERR,312)
  312 FORMAT(' ','Prompt/mode type (1 to 4) must be corrected before',
     *       ' your next run.')
      GOTO 98
```

```
      16 WRITE(IOUERR,316) RVALUE
     316 FORMAT(' ','Warning: ',G10.3,' speed reduced to 55 m.p.h.',
        *  ' maximum')
         GOTO 99
      17 WRITE(IOUERR,317) RVALUE,IOBMSG
     317 FORMAT('+',10X,G10.3,5A4,'VMT MIX (0. to 1.)')
         GOTO 98
      18 WRITE(IOUERR,318) RVALUE
     318 FORMAT('+',10X,G10.3,' sum of VMT MIX is not equal to 1.')
         GOTO 98
      19 WRITE(IOUERR,319) IVALUE
     319 FORMAT('+',10X,G10.3,' negative model year mileage')
         GOTO 98
      20 WRITE(IOUERR,320) RVALUE
     320 FORMAT('+',10X,G10.3,' negative model year registration')
         GOTO 98
      21 WRITE(IOUERR,321) RVALUE
     321 FORMAT(' ','Warning: ',G10.3,' registration with zero mileage')
         GOTO 99
      22 WRITE(IOUERR,322) RVALUE
     322 FORMAT(' ','Warning: ',G10.3,' mileage with zero registration')
         GOTO 99
      29 WRITE(IOUERR,329)
     329 FORMAT('+',10X,' RANGE OF YEARS FOR LEAD CONTENT CANNOT BE <= 0')
         GOTO 98
      30 WRITE(IOUERR,330) RVALUE
     330 FORMAT('+',10X,G10.3,' intercept must be positive')
         GOTO 98
      31 WRITE(IOUERR,331) RVALUE
     331 FORMAT(' ','Warning: ',G10.3,' negative slope for ageing vehicle')
         GOTO 99
      39 WRITE(IOUERR,339) RVALUE
     339 FORMAT('+',10X,G10.3,' speed must be positive')
         GOTO 98
      49 WRITE(IOUERR,349) RVALUE
     349 FORMAT(' ','Warning: ',G10.3,' MYR sum not = 1. (will normalize)')
         GOTO 99
      52 WRITE(IOUERR,352) RVALUE
     352 FORMAT(' ','Warning: ',G10.3,' speed increased',
        *                             ' to 5 m.p.h. minimum')
         GOTO 99
      53 WRITE(IOUERR,353)
     353 FORMAT('0','You must correct all flags before you run again.')
         GOTO 98
      60 WRITE(IOUERR,360)
     360 FORMAT('+',10X,' END OF FILE IN IOUGEN DATA FILE')
         GOTO 98
      61 WRITE(IOUERR,360) INERR,NAMFNC(IVALUE)
     361 FORMAT('+',10X,' DEFAULT USED FOR',I5,' IN INDEX FUNCTION',A8)
         GOTO 98
      71 WRITE(IOUERR,371) IOUREP,IOUERR,IOUASK
     371 FORMAT(' ','COMMENT: CURRENT OUTPUT UNIT NUMBERS ARE ',
        *' IOUREP=',I1,' IOUERR=',I1,' IOUASK=',I1)
         GOTO 99
      72 WRITE(IOUERR,372) RVALUE
     372 FORMAT('+',10X,G10.3,' PARTICLE SIZE CUTOFF INCREASED TO 0.1 MICRONS')
         GOTO 98
      73 WRITE(IOUERR,373) RVALUE
```

```
407        373 FORMAT('+',10X,G10.3,' PARTICLE SIZE CUTOFF IS DECREASED TO 10 MICRONS')
408            GOTO 98
409         74 WRITE(IOUERR,374)RVALUE,IVALUE
410        374 FORMAT('+',10X,' LEAD CONTENT OF LEADED GAS CANNOT BE ',G10.3,
411           &' FOR YEAR',I5)
412            GOTO 98
413         75 WRITE(IOUERR,375)RVALUE,IVALUE
414        375 FORMAT('+',10X,' LEAD CONTENT OF UNLEADED GAS CANNOT BE ',G10.3,
415           &' FOR YEAR',I5)
416            GOTO98
417         76 WRITE(IOUERR,376) RVALUE
418        376 FORMAT('+',10X,G10.3,' TAMPERING RATE MUST BE POSITIVE OR ZERO --',G10.3)
419            GOTO 98
420         77 WRITE(IOUERR,377)
421        377 FORMAT('+',10X,' END-OF-FILE IN IOUDAT DATA FILE')
422            GOTO 99
423         78 WRITE(IOUERR,378)NAMFNC(IVALUE)
424        378 FORMAT('+','ARGUMENT OUT OF BOUNDS IN FUNCTION ',A8)
425            GOTO 98
426         79 WRITE(IOUERR,379) RVALUE
427        379 FORMAT(' ','WARNING: VEHICLE SPEED =',G10.3,' LESS THAN 19.6 MPH FOR SULFATE CAL.')
428            GOTO 98
429         80 WRITE(IOUERR,380) RVALUE
430        380 FORMAT(' ','WARNING: VEHICLE SPEED =',G10.3,' MORE THAN 34.8 MPH FOR SULFATE CAL.')
431            GOTO 98
432         81 WRITE(IOUERR,381)IVALUE
433        381 FORMAT('+',10X,'DRIVING CONDITION FLAG MUST BE 1 OR 2 CANNOT BE ',I2)
434            GOTO 98
435         82 WRITE(IOUERR,382) IVALUE
436        382 FORMAT('+',10X,'YEAR CANNOT BE ',I4,' -- MUST BE LATER THAN 1979')
437            GOTO 98
438         83 WRITE(IOUERR,383) IVALUE
439        383 FORMAT('+',10X,'NO SUCH VEH. CLASS ',I2,' FOR REGISTRATION DATA')
440            GOTO 98
441         84 WRITE(IOUERR,384) IVALUE
442        384 FORMAT('+',' NO SUCH FUEL TYPE ',I4,' FOR REGISTRATION DATA')
443            GOTO 98
444         85 WRITE(IOUERR,385) IVALUE
445        385 FORMAT('+',10X,'NO VEH. CLASS ',I4,' FOR MILEAGE ACCUMULATION DATA')
446            GOTO 98
447         86 WRITE(IOUERR,386) IVALUE
448        386 FORMAT('+',10X,'NO FUEL TYPE ',I4,' FOR MILEAGE ACCUMULATION DATA')
449            GOTO 98
450       C
451           98 IF(MCODE.EQ.1.OR.MCODE.EQ.2.OR.MCODE.EQ.10.OR.MCODE.EQ.12
452             &              .OR.MCODE.EQ.16.OR.MCODE.EQ.17.OR.MCODE.EQ.19
453             &              .OR.MCODE.EQ.22.OR.MCODE.EQ.23
454             &              .OR.MCODE.EQ.30.OR.MCODE.EQ.31.OR.MCODE.EQ.35
455             &              .OR.MCODE.EQ.36.OR.MCODE.EQ.37.OR.MCODE.EQ.38
456             &              .OR.MCODE.EQ.39.OR.MCODE.EQ.40) STOP
457              INERR=INERR+1
458       C
459           99 RETURN
460              END
461       C
462              SUBROUTINE EMFIN
463       C
464       C READ DATA TABLES FROM UNIT IOUDAT
```

```
      C
            COMMON/IOUCOM/IOUREP,IOUERR,IOUASK,IOUDAT,IOUGEN
            COMMON/FLAGS1/IPROMT,TAMFLG,SPCFLG,VMFLAG,MYMRFG,IMFLAG,MISFLG
            COMMON/EMORG/IORGYR(20),IORGFT(20),IORGCT(20),IORGVH(20),
           &EFO(20),NORTOT
            COMMON/EMSUL/ISULYR(20),ISULFT(20),ISULCT(20),ISULVH(20),
           &EFS(20,2),NSUTOT
            COMMON/EMDIE/IDIEYR(20),IDIEVH(20),EFDP(20),NDITOT
            COMMON/EMPB/EFLEAD(20),IPBYR(20),IPBVH(20),IPBFT(20),NPBTOT
            COMMON/GAS/LCGSIZ,LCGYR(20),PBCG(20,2),NCFEYR(27),CFE(27,6),
           &ICFESZ,IFECSZ,FECVS(13),FEC(13,2)
            COMMON/MSFL/RMISFL(20,4,2),TMISFL(6,2)
            COMMON/PSTEMP/PSDIST(5,2,6)
            COMMON/SCENR/IYEAR,VEHSPD,IDRIV
            COMMON/CONST/FPB,FPBE,FPBL
            COMMON/TWF/TWFREG(20,6,3),ITWFMA(20,6,3)
            COMMON/HDDT/IHTRG,IHDDMA(20,4),IHDDYR(21),HDDTRG(21,4)
            COMMON/HDDV/IHDDMY(13),HDDVCF(13)
            COMMON/EMCT/FPBEMC(15,6),FNLEMC(15,6,8),FDIEMC(15,6),IEMCYR(15),
           &IEMCT,TAMPER(3,2)
            COMMON/FLEET/FSF(26,6,3),IFSFYR(26,6),IFSF(6),VMT(6)
      C
      C LDV LDT1 LDT2 ORGANIC  - 6 RECORDS
       1001 FORMAT(I2)
            READ(IOUDAT,1001)NORG1
            NORTOT=NORG1
       1000 FORMAT(I4,3X,I1,1X,I1,1X,F5.3)
            DO 10 I=1,NORG1
            READ(IOUDAT,1000,END=999)IORGYR(I),IORGCT(I),IORGFT(I),EFO(I)
         10 IORGVH(I)=1
      C
      C LDV LDT1 LDT2 SULFATES 13 RECORDS
      C
       1010 FORMAT(I4,3X,I1,1X,I1,1X,F4.1,1X,F5.3)
            READ(IOUDAT,1001)NSUL1
            NSUTOT=NSUL1
            DO 20 I=1,NSUL1
            READ(IOUDAT,1010,END=999)ISULYR(I),ISULCT(I),ISULFT(I),
           &EFS(I,2),EFS(I,1)
         20 ISULVH(I)=1
      C
      C LDDV  DIESEL 3 RECORDS
      C
            READ(IOUDAT,1001)NDIES1
            NDITOT=NDIES1
       1020 FORMAT(I4,1X,F5.3)
            DO 30 I=1,NDIES1
            READ(IOUDAT,1020,END=999)IDIEYR(I),EFDP(I)
            IDIEVH(I)=1
         30 CONTINUE
      C
      C LDDT  DIESEL 3 RECORDS
      C
            READ(IOUDAT,1001)NDIES2
            NDITOT=NDITOT+NDIES2
            NDINXT=NDIES1+1
            DO 40 I=NDINXT,NDITOT
            READ(IOUDAT,1020,END=999)IDIEYR(I),EFDP(I)
```

```
523           IDIEVH(I)=2
524          40 CONTINUE
525       C
526       C HDGV   ORGANIC   4 RECORDS
527       C
528           READ(IOUDAT,1001)NORG2
529           NORNXT=NORTOT+1
530           NORTOT=NORTOT+NORG2
531           DO 50 I=NORNXT,NORTOT
532           READ(IOUDAT,1000,END=999)IORGYR(I),IORGCT(I),IORGFT(I),EFO(I)
533          50 IORGVH(I)=4
534       C
535       C HDGV  SULFATE  3 RECORDS
536       C
537           READ(IOUDAT,1001)NSUL2
538           NSUNXT=NSUTOT+1
539           NSUTOT=NSUTOT+NSUL2
540           DO 60 I=NSUNXT,NSUTOT
541           READ(IOUDAT,1025,END=999)ISULYR(I),ISULCT(I),ISULFT(I),EFS(I,1)
542        1025 FORMAT(I4,3X,I1,1X,I1,1X,F5.3)
543           ISULVH(I)=4
544          60 EFS(I,2)=0.0
545       C
546       C HDDT  DIESEL  1 RECORD
547       C
548           READ(IOUDAT,1001)NDIES3
549           NDINXT=NDITOT+1
550           NDITOT=NDITOT+NDIES3
551           DO 70 I=NDINXT,NDITOT
552           READ(IOUDAT,1020,END=999)IDIEYR(I),EFDP(I)
553          70 IDIEVH(I)=4
554       C
555       C LDV LDT1    LEAD   6 RECORDS
556       C
557           READ(IOUDAT,1001,END=999)IPB
558        1030 FORMAT(I4,1X,I1,1X,F5.3)
559           NPBTOT=IPB
560           DO 80 I=1,NPBTOT
561           IPBVH(I)=1
562          80 READ(IOUDAT,1030,END=999)IPBYR(I),IPBFT(I),EFLEAD(I)
563       C
564       C LDT2   LEAD    6 RECORDS
565       C
566           READ(IOUDAT,1001,END=999)IPB
567           NPBNXT=NPBTOT+1
568           NPBTOT=NPBTOT+IPB
569           DO 90 I=NPBNXT,NPBTOT
570           READ(IOUDAT,1030,END=999)IPBYR(I),IPBFT(I),EFLEAD(I)
571          90 IPBVH(I)=3
572       C
573       C MC   LEAD   2 RECORDS
574       C
575           READ(IOUDAT,1001,END=999)IPB
576           NPBNXT=NPBTOT+1
577           NPBTOT=NPBTOT+IPB
578           DO 95 I=NPBNXT,NPBTOT
579           READ(IOUDAT,1030,END=999)IPBYR(I),IPBFT(I),EFLEAD(I)
580          95 IPBVH(I)=6
```

```
      C
      C READ TABLE 2-2 LEAD CONTENT OF GASOLINE BY YEAR
      C
            READ(IOUDAT,1001,END=999)LCGSIZ
       1040 FORMAT(I4,1X,F4.2,1X,F5.3)
            DO 300 I=1,LCGSIZ
        300 READ(IOUDAT,1040,END=999)LCGYR(I),(PBCG(I,IFT),IFT=1,2)
      C
      C READ TABLE 2-3  LDV EMCT
      C
            CALL GTEMCT(1)
      C
      C READ TABLE 2-4  LDV FLEET SALES FRACTIONS
      C
            CALL FLTSLE(1)
      C
      C READ TABLE 2-5  LDV TRAVEL WEIGHTING
      C
            CALL TRAVWT(1,1)
      C
      C READ TABLE 2-6  CITY/HIGHWAY FUEL ECONOMY
      C
            READ(IOUDAT,1001,END=999)ICFESZ
       1050 FORMAT(I4,1X,4(F4.1,1X),2(F3.1,1X))
            DO 310 I=1,ICFESZ
            READ(IOUDAT,1050)NCFEYR(I),(CFE(I,IVC),IVC=1,6)
            IF(NCFEYR(I).LE.1986)CFE(I,4)=CFE(I,6)
        310 CONTINUE
      C
      C READ TABLE 2-7  FUEL ECONOMY SPEED CORRECTIONS
      C
            READ(IOUDAT,1001,END=999)IFECSZ
       1060 FORMAT(F4.1,1X,F5.3,1X,F5.3)
            DO 320 I=1,IFECSZ
        320 READ(IOUDAT,1060,END=999)FECVS(I),(FEC(I,ID),ID=1,2)
      C
      C READ TABLES FOR LDT1 AND LDT2
      C
            DO 330 IVHCLS=2,3
             CALL GTEMCT(IVHCLS)
             CALL FLTSLE(IVHCLS)
             CALL TRAVWT(IVHCLS,1)
        330 CONTINUE
      C
      C READ TABLE 2-14  LDDT TRAVEL WEIGHTING
      C
            CALL TRAVWT(2,3)
      C
      C READ TABLE 2-15  HDGV FLEET SALES
      C
            CALL FLTSLE(4)
      C
      C READ TABLE 2-16  HDGV TRAVEL WEIGHTING
      C
            CALL TRAVWT(4,1)
      C
      C READ TABLE 2-17 HDDT REGISTRATION VS AGE
      C
```

```
      READ(IOUDAT,1001,END=999)IHDDT
 1065 FORMAT(3X,F5.3)
      DO 335 IAGE=1,IHDDT
  335 READ(IOUDAT,1065)TWFREG(IAGE,4,3)
C
C READ TABLE 2-18 MOTORCYCLE TRAVEL WEIGHTING
C
      CALL TRAVWT(6,1)
C
C READ TABLE 2-19 MISFUELING
C
 1070 FORMAT(5X,F4.2,1X,F4.2)
      DO 350 IVHCLS=1,6
      IF (IVHCLS.EQ.5) GOTO 340
      READ(IOUDAT,1070,END=999)WRGIM,WRGNIM
  340 TMISFL(IVHCLS,1)=WRGNIM
      TMISFL(IVHCLS,2)=WRGIM
  350 CONTINUE
C
C READ TABLE 2-19A  MISFUELING
C
      READ(IOUDAT,1001,END=999)IRMIS
 1080 FORMAT(3X,8F4.2)
      DO 360 IAGE=1,IRMIS
      READ(IOUDAT,1080,END=999)((RMISFL(IAGE,J,K),K=1,2),J=1,4)
  360 CONTINUE
C
C READ TABLE 2-20  PARTICLE SIZE ML, MNL.C,MNL.NC,MD,MB
C
      DO 365 I=1,5
      DO 365 J=1,2
      DO 365 K=1,6
  365 PSDIST(I,J,K)=0.0
 2000 FORMAT(5(F5.2,1X))
      DO 370 J=1,3
      READ(IOUDAT,2000,END=999)(PSDIST(I,1,J),I=1,3)
      READ(IOUDAT,2000,END=999)(PSDIST(I,2,J),I=1,3)
  370 CONTINUE
      DO 380 J=4,5
      READ(IOUDAT,2000,END=999)(PSDIST(I,1,J),I=1,5)
      READ(IOUDAT,2000,END=999)(PSDIST(I,2,J),I=1,5)
  380 CONTINUE
      READ(IOUDAT,2000,END=999)(PSDIST(I,1,6),I=1,2)
      READ(IOUDAT,2000,END=999)(PSDIST(I,2,6),I=1,2)
C
C READ TABLE 2-21  HDDV CONVERSION FACTORS
C
      READ(IOUDAT,1001,END=999)IHDDT
 2010 FORMAT(I4,1X,F6.4)
      READ(IOUDAT,2010,END=999)(IHDDMY(I),HDDVCF(I),I=1,IHDDT)
C
C READ TABLE 2-22 FRACTION OF LEAD BURNED
C 1. NON-MISFUELED 2. 1975-1980 MISFUELED 3. 1981+ MISFUELED
C
 2020 FORMAT(3(F4.2,1X))
  800 READ(IOUDAT,2020,END=999)FPB,FPBE,FPBL
C
C READ TABLE 2-23 CATALYST REMOVAL RATE (TAMPERING)
```

```
      C
       2030 FORMAT(3(F5.3,1X))
            READ(IOUDAT,2030,END=999)((TAMPER(I,J),I=1,3),J=1,2)
      C
      C READ TABLE A-1 AVE ANNUAL MILEAGE FOR HDDT
      C
            READ(IOUDAT,1001,END=999)IHDTMA
       2040 FORMAT(3X,3(I5,1X),I5)
            DO 382 IAGE=1,IHDTMA
        382 READ(IOUDAT,2040,END=999)(IHDDMA(IAGE,IWT),IWT=1,4)
      C
      C READ TABLE A-2 PROJECTIONS OF HEAVY DUTY VEHICLES IN OPERATION
      C
            READ(IOUDAT,1001,END=999)IHTRG
       2050 FORMAT(I4,1X,4(F5.3,1X))
            DO 385 IYR=1,IHTRG
            READ(IOUDAT,2050,END=999)IHDDYR(IYR),(HDDTRG(IYR,IWT),IWT=1,4)
        385 CONTINUE
      C
      C READ DEFAULT VMT MIX
      C
            READ(IOUDAT,2060)(VMT(IVHCLS),IVHCLS=1,6)
       2060 FORMAT(6(F6.4,1X))
      C
      C SET OTHER DEFAULT FLEET SALES FRACTIONS
      C
            IFSF(6)=20
            DO 405 I=1,20
      C ALL HDDT USE DIESEL FUEL
            FSF(I,4,3)=1.
      C ALL MOTORCYCLES USE LEADED GAS
            FSF(I,6,1)=1.
            FSF(I,6,2)=0.0
            FSF(I,6,3)=0.0
            IFSFYR(I,6)=1900
        405 CONTINUE
            RETURN
        999 CALL QUITER(0.,0,31,INERR)
            RETURN
            END
      C
      C
            SUBROUTINE TWFCAL(IYEAR)
            COMMON/TWF/TWFREG(20,6,3),ITWFMA(20,6,3)
            COMMON/TWFRAC/TWFAC(20,6,3)
            COMMON/HDDT/IHTRG,IHDDMA(20,4),IHDDYR(21),HDDTRG(21,4)
            COMMON/FLEET/FSF(26,6,3),IFSFYR(26,6),IFSF(6),VMT(6)
            DIMENSION TWFSUM(6,3)
      C CALCULATE HDDT MILEAGE ACCUMULATION
      C
            IYRPTR=1
            DO 390 I=1,IHTRG
        390 IF(IHDDYR(I).GE.IYEAR.AND.IYRPTR.EQ.1)IYRPTR=I
            ITWFMA(1,4,3)=0
            DO 400 IAGE=2,20
            HDDTWT=0.0
            HDDSUM=0.0
            DO 395 IWT=1,4
```

```
      HDDTWT=HDDTWT+HDDTRG(IYRPTR,IWT)
  395 HDDSUM=HDDSUM+IHDDMA(IAGE-1,IWT)*HDDTRG(IYRPTR,IWT)
  400 ITWFMA(IAGE,4,3)=HDDSUM/HDDTWT
C
C CALCULATE TRAVEL FRACTION BY AGE
C
      DO 410 IVHCLS=1,6
      DO 410 IFT=1,3
      TWFSUM(IVHCLS,IFT)=0.0
      DO 410 IAGE=1,20
  410 TWFSUM(IVHCLS,IFT)=TWFREG(IAGE,IVHCLS,IFT)*
     CITWFMA(IAGE,IVHCLS,IFT)+TWFSUM(IVHCLS,IFT)
      DO 420 IVHCLS=1,6
      DO 420 IFT=1,3
      DO 420 IAGE=1,20
      IF(TWFSUM(IVHCLS,IFT).NE.0.0)
     &TWFAC(IAGE,IVHCLS,IFT)=TWFREG(IAGE,IVHCLS,IFT)*
     &ITWFMA(IAGE,IVHCLS,IFT)/TWFSUM(IVHCLS,IFT)
      IF(TWFSUM(IVHCLS,IFT).EQ.0.0)TWFAC(IAGE,IVHCLS,IFT)=0.0
  420 CONTINUE
      RETURN
      END
C
C
      SUBROUTINE TRAVWT(IVHCLS,IFT)
C READ TRAVEL WEIGHTING FACTOR BY VEH.CLASS AND FUEL TYPE
C
      COMMON/TWF/TWFREG(20,6,3),ITWFMA(20,6,3)
      COMMON/IOUCOM/IOUREP,IOUERR,IOUASK,IOUDAT,IOUGEN
 1300 FORMAT(I2,1X,F5.3,1X,I5)
      DO 10 I=1,20
   10 READ(IOUDAT,1300)IAGE,TWFREG(I,IVHCLS,IFT),ITWFMA(I,IVHCLS,IFT)
      IF(IFT.EQ.1)GOTO 40
      IF(IVHCLS.EQ.2.AND.IFT.EQ.3)GOTO 20
      GOTO 60
C SOME CLASSES HAVE EQUIV. WEIGHTING
C LDDT I AND LDDT II
   20 DO 30 I=1,20
      TWFREG(I,3,IFT)=TWFREG(I,IVHCLS,IFT)
   30 ITWFMA(I,3,IFT)=ITWFMA(I,IVHCLS,IFT)
      GOTO 60
   40 DO 50 I=1,20
C LDDV AND LDV
      IF(IVHCLS.EQ.1)TWFREG(I,IVHCLS,3)=TWFREG(I,IVHCLS,1)
      IF(IVHCLS.EQ.1)ITWFMA(I,IVHCLS,3)=ITWFMA(I,IVHCLS,1)
C HDGV1 AND HDGV2
      IF(IVHCLS.EQ.4)TWFREG(I,5,1)=TWFREG(I,IVHCLS,1)
      IF(IVHCLS.EQ.4)ITWFMA(I,5,1)=ITWFMA(I,IVHCLS,1)
C LEAD AND UNLEAD
      TWFREG(I,IVHCLS,2)=TWFREG(I,IVHCLS,1)
      ITWFMA(I,IVHCLS,2)=ITWFMA(I,IVHCLS,1)
   50 CONTINUE
   60 RETURN
      END
C
C
      SUBROUTINE GTEMCT(IVHCLS)
C READ FRACTION OF VEHICLES WITH VARIOUS EMISSION CONTROL DEVICES
```

```
      C
            COMMON/EMCT/FPBEMC(15,6),FNLEMC(15,6,8),FDIEMC(15,6),IEMCYR(15),
           &IEMCT,TAMPER(3,2)
            COMMON/IOUCOM/IOUREP,IOUERR,IOUASK,IOUDAT,IOUGEN
       1101 FORMAT(I2)
            READ(IOUDAT,1101)IEMCT
      C READ LEADED FRACTION
       1100 FORMAT(15(F5.3,1X))
            READ(IOUDAT,1100)(FPBEMC(I,IVHCLS),I=1,IEMCT)
      C UNLEADED FRACTIONS
            DO 20 I=1,5
         20 READ(IOUDAT,1100)(FNLEMC(J,IVHCLS,I),J=1,IEMCT)
      C DIESEL FRACTION
            READ(IOUDAT,1100)(FDIEMC(J,IVHCLS),J=1,IEMCT)
      C MORE UNLEADED FRACTIONS
            DO 30 I=6,8
         30 READ(IOUDAT,1100)(FNLEMC(J,IVHCLS,I),J=1,IEMCT)
            IEMCYR(1)=1900
            DO 40 I=2,15
         40 IEMCYR(I)=1973+I
            RETURN
            END
      C
      C
            SUBROUTINE FLTSLE(IVHCLS)
      C READ FLEET SALES
            COMMON/IOUCOM/IOUREP,IOUERR,IOUASK,IOUDAT,IOUGEN
            COMMON/FLEET/FSF(26,6,3),IFSFYR(26,6),IFSF(6),VMT(6)
            READ(IOUDAT,1200)NFSF
            IFSF(IVHCLS)=NFSF
       1200 FORMAT(I2)
       1210 FORMAT(I4,1X,3(F5.3,1X))
            DO 10 I=1,NFSF
            IF(IVHCLS.LE.3)READ(IOUDAT,1210)IFSFYR(I,IVHCLS),
           &FSF(I,IVHCLS,2),FSF(I,IVHCLS,1),FSF(I,IVHCLS,3)
            IF(IVHCLS.EQ.4)READ(IOUDAT,1210)IFSFYR(I,IVHCLS),
           &FSF(I,IVHCLS,2),FSF(I,IVHCLS,1)
         10 CONTINUE
         40 RETURN
            END
      C
      C
            SUBROUTINE ONESEC(INERR,*)
      C ONE TIME DATA SECTION
            INTEGER TAMFLG,SPCFLG,VMFLAG
            COMMON/FLAGS1/IPROMT,TAMFLG,SPCFLG,VMFLAG,MYMRFG,IMFLAG,MISFLG
            COMMON/EMCT/FPBEMC(15,6),FNLEMC(15,6,8),FDIEMC(15,6),IEMCYR(15),
           &IEMCT,TAMPER(3,2)
            COMMON/MSFL/RMISFL(20,4,2),TMISFL(6,2)
            COMMON/IOUCOM/IOUREP,IOUERR,IOUASK,IOUDAT,IOUGEN
            COMMON/PSIZE/PSZCUT,PSL,PSNL,PSNLCT,PSDIE,PSBRK,PSTIRE
            COMMON/TWF/TWFREG(20,6,3),ITWFMA(20,6,3)
      C
            DIMENSION CLSNM(6)
      C
            DATA CLSNM/' LDV','LDT1','LDT2','HDT1','HDT2',' MC '/
      C
      C ALTERNATE TAMPERING RATES
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871           IF(TAMFLG.EQ.1)GOTO 60
872           IF(IPROMT.EQ.2)WRITE(IOUASK,200)
873       200 FORMAT('0','ENTER FRACTION OF CATALYST EQUIPPED VEHICLES WITH'/
874          &'CATALYST REMOVED FOR LDV, LDT1 AND LDT2 FORMAT=3(F4.3,1X)')
875           IF(IMFLAG.EQ.1.AND.IPROMT.EQ.2.)WRITE(IOUASK,210)
876           IF(IMFLAG.EQ.2.AND.IPROMT.EQ.2.)WRITE(IOUASK,220)
877       210 FORMAT('NO I/M PROGRAM IN IN EFFECT')
878       220 FORMAT('I/M PROGRAM IS IN EFFECT')
879           READ(IOUGEN,225)(TAMPER(I,IMFLAG),I=1,3)
880       225 FORMAT(3(F4.3,1X))
881           DO 5 I=1,3
882           IF(TAMPER(I,IMFLAG).LT.0.0)CALL QUITER(TAMPER(I,IMFLAG),0,30,INERR)
883         5 IF(TAMPER(I,IMFLAG).LT.0.0)TAMPER(I,IMFLAG)=0.0
884     C
885     C ALTERNATE VEHICLE MILEAGE DISTRIBUTION
886     C
887          60 IF(VMFLAG.NE.3)GOTO 10
888           IF(IPROMT.EQ.2)WRITE(IOUASK,272)
889       272 FORMAT(' ENTER VMT FRACTIONS FOR LDV, LDT1, LDT2, HDGV, HDDT, MC
890          C -6(F5.3,1X)')
891           CALL GETVMT(INERR,&99)
892     C ALTERNATE REGISTRATION AND MILEAGE ACCUMULATION
893     C
894          10 IF(MYMRFG.EQ.1)GOTO 65
895           IF(MYMRFG.LT.3)GOTO 30
896           IF(IPROMT.EQ.2)WRITE(IOUASK,230)
897       230 FORMAT('0','ALTERNATE REGISTRATION '/
898          &' ENTER VEHICLE CLASS(1-6) & FUEL TYPE(1-3)  FORMAT -- I1,1X,I1'/
899          &' ENTER 0,0 AS LAST VEHICLE CLASS AND FUEL TYPE')
900           READ(IOUGEN,235)IVHCLS,IFT
901       235 FORMAT(I1,1X,I1)
902           IF(IVHCLS.LE.0)GOTO 30
903           IF(IVHCLS.LT.1.OR.IVHCLS.GE.6)CALL QUITER(0.,IVHCLS,37,INERR)
904           IF(IFT.LT.1.OR.IFT.GT.3)CALL QUITER(0.,IFT,38,INERR)
905           IF(IVHCLS.EQ.6)IFT=1
906           IF(IVHCLS.EQ.4)IFT=1
907           IF(IVHCLS.EQ.5)IFT=3
908           IF(IVHCLS.EQ.5)IVHCLS=4
909           IF(IPROMT.EQ.2)WRITE(IOUASK,240)CLSNM(IVHCLS)
910       240 FORMAT(' ENTER ',A4,' FRACTION OF REGISTRATION FOR AGES 1-10',
911          &'  FORMAT -- 10F5.3')
912           READ(IOUGEN,260,END=99)(TWFREG(IAGE,IVHCLS,IFT),IAGE=1,10)
913           IF(IPROMT.EQ.2)WRITE(IOUASK,250)CLSNM(IVHCLS)
914       250 FORMAT(' ENTER ',A4,' FRACTION OF REGISTRATION FOR AGES 11-20+',
915          &'  FORMAT -- 10F5.3')
916           READ(IOUGEN,260,END=99)(TWFREG(IAGE,IVHCLS,IFT),IAGE=11,20)
917       260 FORMAT(10F5.3)
918           CHKREG=0.0
919           DO 25 IAGE=1,20
920           IF(TWFREG(I,IVHCLS,IFT).LT.0.)
921          * CALL QUITER(TWFREG(I,IVHCLS,IFT),0,13,INERR)
922        25 CHKREG=CHKREG+TWFREG(IAGE,IVHCLS,IFT)
923           IF (ABS(CHKREG-1.).GE.0.001)CALL QUITER(CHKREG,0,20,INERR)
924           IF(ABS(CHKREG-1.).LT.001)GOTO 10
925           DO 27 IAGE=1,20
926           TWFREG(IAGE,IVHCLS,IFT)=TWFREG(IAGE,IVHCLS,IFT)/CHKREG
927           IF(IFT.EQ.1)TWFREG(IAGE,IVHCLS,2)=TWFREG(IAGE,IVHCLS,IFT)
928        27 IF(IFT.EQ.2)TWFREG(IAGE,IVHCLS,1)=TWFREG(IAGE,IVHCLS,IFT)
```

```
      GOTO 10
C
C ALTERNATE MILEAGE ACCUMULATION RATES
C
   30 IF(MYMRFG.NE.2.AND.MYMRFG.NE.4)GOTO 65
      IF(IPROMT.EQ.2)WRITE(IOUASK,265)
  265 FORMAT('0','ALTERNATE MILEAGE ACCUMULATION RATES'/
     &' ENTER VEHICLE CLASS(1-6) & FUEL TYPE(1-3)  FORMAT -- I1,1X,I1'/
     &' ENTER 0,0 AS LAST VEHICLE CLASS AND FUEL TYPE')
      READ(IOUGEN,235)IVHCLS,IFT
      IF(IVHCLS.LE.0)GOTO 65
      IF(IVHCLS.GT.6)CALL QUITER(0.,IVHCLS,39,INERR)
      IF(IFT.LT.1.OR.IFT.GT.3)CALL QUITER(0.,IFT,40,INERR)
      IF(IVHCLS.EQ.6)IFT=1
      IF(IVHCLS.EQ.4)IFT=1
      IF(IVHCLS.EQ.5)IFT=3
      IF(IVHCLS.EQ.5)IVHCLS=4
      IF(IPROMT.EQ.2)WRITE(IOUASK,270)CLSNM(IVHCLS)
  267 FORMAT(9(I5,1X),I5)
  270 FORMAT('0','ENTER ANNUAL MILEAGE ACCUMULATION FOR ',A4,
     &' AGES 1-10 FORMAT -- 10(I5,1X)')
  271 FORMAT('0','ENTER ANNUAL MILEAGE ACCUMULATION FOR ',A4,
     &' AGES 11-20+  FORMAT 10(I5,1X)')
      READ(IOUGEN,267,END=99)(ITWFMA(IAGE,IVHCLS,IFT),IAGE=1,10)
      IF(IPROMT.EQ.2)WRITE(IOUASK,271)CLSNM(IVHCLS)
      READ(IOUGEN,267,END=99)(ITWFMA(IAGE,IVHCLS,IFT),IAGE=11,20)
      DO 50 IAGE=1,20
      IF(ITWFMA(IAGE,IVHCLS,IFT).EQ.0.AND.TWFREG(IAGE,IVHCLS,IFT).NE.0.0)
     & CALL QUITER(TWFREG(IAGE,IVHCLS,IFT),0,14,INERR)
      IF(ITWFMA(IAGE,IVHCLS,IFT).NE.0.AND.TWFREG(IAGE,IVHCLS,IFT).EQ.0.0)
     & CALL QUITER(TWFREG(IAGE,IVHCLS,IFT),0,15,INERR)
   50 IF(ITWFMA(IAGE,IVHCLS,IFT).LT.0) CALL
     * QUITER(0.,ITWFMA(IAGE,IVHCLS,IFT),12,INERR)
      GOTO 30
C
C
C MISFUELING BY VEHICLE CLASS MILEAGE ACCUMULATION
C
   65 IF(MISFLG.EQ.1.OR.MISFLG.EQ.3) GOTO 80
      DO 70 IVHCLS=1,4
      IF(IPROMT.EQ.2)WRITE(IOUASK,275)CLSNM(IVHCLS)
  275 FORMAT('ENTER FOR ',A4,' ZERO MILE MISFUELING RATE AND SLOPE
     & --FORMAT=F8.6,1X,F8.6')
      READ(IOUGEN,280)RMISZM,RMISSL
  280 FORMAT(F8.6,1X,F8.6)
      IF(RMISZM.LT.0)CALL QUITER(RMISZM,0,17,INERR)
      IF(RMISSL.LT.0)CALL QUITER(RMISSL,0,18,INERR)
      ITMSUM=0.0
      DO 70 IAGE=1,20
      ITMSUM=ITMSUM+ITWFMA(IAGE,IVHCLS,2)
      RMISFL(IAGE,IVHCLS,IMFLAG)=RMISZM+RMISSL*ITMSUM
   70 IF(RMISFL(IAGE,IVHCLS,IMFLAG).GT.1.0)RMISFL(IAGE,IVHCLS,IMFLAG)=1.0
C
C
C ALTERNATE LEAD CONTENT OF GASOLINE
C
   80 IF(SPCFLG.EQ.2)CALL GETLCG(INERR,&99)
   90 RETURN
```

```
 987        99 RETURN1
 988           END
 989     C
 990     C
 991           SUBROUTINE PARSEC(INERR,*)
 992     C
 993     C PARAMETER SECTION AND NORMAL USER INPUTS
 994     C
 995           INTEGER TAMFLG,SPCFLG,VMFLAG
 996           COMMON/IOUCOM/IOUREP,IOUERR,IOUASK,IOUDAT,IOUGEN
 997           COMMON/SCENR/IYEAR,VEHSPD,IDRIV
 998           COMMON/PSIZE/PSZCUT,PSL,PSNL,PSNLCT,PSDIE,PSBRK,PSTIRE
 999           COMMON/FLAGS1/IPROMT,TAMFLG,SPCFLG,VMFLAG,MYMRFG,IMFLAG,MISFLG
1000     C READ YEAR FOR WHICH CALULATION IS TO BE DONE
1001        80 IF(IPROMT.EQ.2)WRITE(IOUASK,290)
1002       290 FORMAT('-','ENTER YEAR FOR THIS RUN -- (FORMAT = I4)')
1003           READ(IOUGEN,300,END=99)IYEAR
1004       300 FORMAT(I4)
1005           IF(IYEAR.LT.1980)CALL QUITER(0.,IYEAR,36,INERR)
1006           CALL TWFCAL(IYEAR)
1007     C READ VEHICLE SPEED
1008           IF(IPROMT.EQ.2)WRITE(IOUASK,310)
1009       310 FORMAT('ENTER VEHICLE SPEED -- (FORMAT = F4.1)')
1010           READ(IOUGEN,320,END=99)VEHSPD
1011       320 FORMAT(F4.1)
1012           IF(VEHSPD.LT.0.0)CALL QUITER(VEHSPD,0,19,INERR)
1013           IF(VEHSPD.LT.0.0)VEHSPD=-1.*VEHSPD
1014           IF(VEHSPD.LT.5.0)CALL QUITER(VEHSPD,0,21,INERR)
1015           IF(VEHSPD.LT.5.0) VEHSPD=5.0
1016           IF(VEHSPD.GT.55.0)CALL QUITER(VEHSPD,0,9,INERR)
1017           IF(VEHSPD.GT.55.0) VEHSPD=55.0
1018           IF(VEHSPD.GT.34.8)CALL QUITER(VEHSPD,0,34,INERR)
1019           IF(VEHSPD.LT.19.6)CALL QUITER(VEHSPD,0,33,INERR)
1020     C READ DRIVING CONDITIONS
1021        90 IF(IPROMT.EQ.2)WRITE(IOUASK,330)
1022       330 FORMAT(' ENTER DRIVING CONDITIONS (1= TRANSIENT, 2= CRUISE)')
1023           READ(IOUGEN,340,END=99)IDRIV
1024       340 FORMAT(I1)
1025           IF(IDRIV.LE.0.OR.IDRIV.GT.2) CALL QUITER(0.,IDRIV,35,INERR)
1026     C READ PARTICLE SIZE CUTOFF
1027       100 IF(IPROMT.EQ.2)WRITE(IOUASK,350)
1028       350 FORMAT(' ENTER PARTICLE SIZE CUTOFF (0.1-10.) -FORMAT(F5.2)')
1029           READ(IOUGEN,360,END=99)PSZCUT
1030       360 FORMAT(F5.2)
1031           IF(PSZCUT.LT.0.1)CALL QUITER(PSZCUT,0,26,INERR)
1032           IF(PSZCUT.LT.0.1)PSZCUT=0.1
1033           IF(PSZCUT.GT.10.)CALL QUITER(PSZCUT,0,27,INERR)
1034           IF(PSZCUT.GT.10.)PSZCUT=10.
1035           CALL PARSIZ
1036           IF(VMFLAG.NE.2) GOTO 95
1037           IF(IPROMT.EQ.2)WRITE(IOUASK,272)
1038       272 FORMAT(' ENTER VMT FRACTIONS FOR LDV, LDT1, LDT2, HDGV, HDDT, MC
1039          C -6(F5.3,1X)')
1040           CALL GETVMT(INERR,&99)
1041        95 RETURN
1042        99 CALL QUITER(0.,0,23,INERR)
1043           RETURN
1044           END
```

```
1045      C
1046      C
1047            SUBROUTINE PARSIZ
1048      C INTERPOLATES PARTICLE SIZE DISTRIBUTION
1049      C
1050            COMMON/PSIZE/PSZCUT,PSL,PSNL,PSNLCT,PSDIE,PSBRK,PSTIRE
1051            COMMON/PSTEMP/PSDIST(5,2,6)
1052      C
1053            DO 60 ISRC=1,6
1054            PS=0.0
1055            MXSIZE=5
1056            IF(PSZCUT.LE.PSDIST(1,1,ISRC))GOTO 40
1057            DO 10 I=1,5
1058           10 IF(PSDIST(I,1,ISRC).EQ.0.0)MXSIZE=I
1059            IF(MXSIZE.EQ.1)PS=PSDIST(1,2,ISRC)
1060            IF(PSZCUT.GE.PSDIST(MXSIZE,1,ISRC))PS=PSDIST(MXSIZE,2,ISRC)
1061            IF(PS.NE.0.0)GOTO 50
1062            SLOPE=0.0
1063            NPTR=1
1064            DO 20 I=2,MXSIZE
1065           20 IF(PSDIST(I,1,ISRC).GE.PSZCUT.AND.NPTR.EQ.1)NPTR=I
1066            SLOPE=(PSDIST(NPTR,2,ISRC)-PSDIST(NPTR-1,2,ISRC))/
1067             &(PSDIST(NPTR,1,ISRC)-PSDIST(NPTR-1,1,ISRC))
1068            PS=SLOPE*(PSZCUT-PSDIST(NPTR-1,1,ISRC))+PSDIST(NPTR-1,2,ISRC)
1069            GOTO 50
1070           40 SLOPE=(PSDIST(2,2,ISRC)-PSDIST(1,2,ISRC))/
1071             &(PSDIST(2,1,ISRC)-PSDIST(1,1,ISRC))
1072            PS=PSDIST(1,2,ISRC)-SLOPE*(PSDIST(1,1,ISRC)-PSZCUT)
1073           50 IF(ISRC.EQ.1)PSL=PS
1074            IF(ISRC.EQ.2)PSNLCT=PS
1075            IF(ISRC.EQ.3)PSNL=PS
1076            IF(ISRC.EQ.4)PSDIE=PS
1077            IF(ISRC.EQ.5)PSBRK=PS
1078            IF(ISRC.EQ.6)PSTIRE=PS
1079           60 CONTINUE
1080            RETURN
1081            END
1082      C
1083            SUBROUTINE GETLCG(INERR,*)
1084      C CHANGE LEAD CONTENT OF GASOLINE
1085            COMMON/GAS/LCGSIZ,LCGYR(20),PBCG(20,2),NCFEYR(27),CFE(27,6),
1086           &ICFESZ,IFECSZ,FECVS(13),FEC(13,2)
1087            COMMON/IOUCOM/IOUREP,IOUERR,IOUASK,IOUDAT,IOUGEN
1088            COMMON/FLAGS1/IPROMT,TAMFLG,SPCFLG,VMFLAG,MYMRFG,IMFLAG,MISFLG
1089            IF(IPROMT.EQ.2)WRITE(IOUASK,190)
1090          190 FORMAT('0','ALTERNATE LEAD CONTENT OF GASOLINE BY YEAR')
1091            IF(IPROMT.EQ.2)WRITE(IOUASK,195)
1092          195 FORMAT(' ENTER FIRST AND LAST YEAR TO CHANGE - (I4,1X,I4)')
1093            5 READ(IOUGEN,196,END=99)ISTART,IFIN
1094          196 FORMAT(I4,1X,I4)
1095            IF(ISTART.LT.1974.OR.ISTART.GT.IFIN)CALL QUITER(0.,0,16,INERR)
1096            IPTR=1
1097            DO 6 I=1,LCGSIZ
1098            6 IF(LCGYR(I).LT.ISTART)IPTR=I
1099            LCGSIZ=IPTR
1100            IF(IPROMT.EQ.2)WRITE(IOUASK,200)
1101          200 FORMAT('0','ENTER LEAD CONTENT OF GASOLINE FOR  LEADED
1102             & AND UNLEADED -- FORMAT=F5.3,1X,F5.3')
```

```
1103            DO 20 IYR=ISTART,IFIN
1104             10 IF(IPROMT.EQ.2)WRITE(IOUASK,210)IYR
1105            210 FORMAT(' FOR YEAR ',I5)
1106            LCGSIZ=LCGSIZ+1
1107            LCGYR(LCGSIZ)=IYR
1108            READ(IOUGEN,220,END=99)(PBCG(LCGSIZ,IFT),IFT=1,2)
1109            220 FORMAT(F5.3,1X,F5.3)
1110            IF(PBCG(LCGSIZ,1).LT.0.0)CALL QUITER(PBCG(LCGSIZ,1),IYR,28,INERR)
1111            IF(PBCG(LCGSIZ,1).LT.0.0)PBCG(LCGSIZ,1)=-1.*PBCG(LCGSIZ,1)
1112            IF(PBCG(LCGSIZ,2).LT.0.0)CALL QUITER(PBCG(LCGSIZ,2),IYR,29,INERR)
1113            IF(PBCG(LCGSIZ,2).LT.0.0)PBCG(LCGSIZ,2)=-1.*PBCG(LCGSIZ,2)
1114             20 CONTINUE
1115            RETURN
1116             99 RETURN1
1117            END
1118      C
1119            SUBROUTINE GETVMT(INERR,*)
1120      C
1121      C  GETVMT gets the fleet vehicle miles travelled (vmt) mix by vehicle type.
1122      C
1123      C  Called by ONESEC and PARSEC.
1124      C
1125      C  Calls QUITER.
1126      C
1127      C  Input on call:
1128      C
1129      C    parameter list: INERR
1130      C    common blocks:
1131      C    /FLAGS1/ IPROMT
1132      C    /IOUCOM/ IOUGEN,IOUASK
1133      C
1134      C  Output on return:
1135      C
1136      C
1137      C  Local variable / array dictionary:
1138      C
1139      C   Name   Type              Description
1140      C   ------  ----  ------------------------------------------------------
1141      C  VMTCHK    R     vmt mix check: sum of the vmt fractions = 1.0 +/- 1.E-6
1142      C                 (i.e., a normalized vmt distribution has been entered)
1143      C
1144      C  Notes:
1145      C
1146      C  GETVMT is a new subprogram (added for MOBILE3).
1147      C
1148      C
1149            INTEGER TAMFLG,SPCFLG,VMFLAG
1150      C
1151            COMMON/FLAGS1/IPROMT,TAMFLG,SPCFLG,VMFLAG,MYMRFG,IMFLAG,MISFLG
1152            COMMON/IOUCOM/IOUREP,IOUERR,IOUASK,IOUDAT,IOUGEN
1153            COMMON/FLEET/FSF(26,6,3),IFSFYR(26,6),IFSF(6),VMT(6)
1154      C
1155            IF(IPROMT.EQ.2) WRITE(IOUASK,200)
1156            200 FORMAT('0','Enter VMT split:')
1157            READ(IOUGEN,100,END=99) VMT
1158            100 FORMAT(6(F5.3,1X))
1159      C
1160            VMTCHK=0.0
```

```
1161            DO 10 IV=1,6
1162            VMTCHK=VMT(IV)+VMTCHK
1163            IF(VMT(IV).LT.0.0.OR.VMT(IV).GT.1.)
1164           *       CALL QUITER(VMT(IV),0,10,INERR)
1165         10 CONTINUE
1166            IF(VMTCHK+1.E-6.LT.1..OR.VMTCHK-1.E-6.GT.1.)
1167           *  CALL QUITER(VMTCHK,0,11,INERR)
1168      C
1169            RETURN
1170      C
1171      C  EOF on any attempted read => take alternate return 1 => run aborts.
1172      C
1173         99 RETURN1
1174            END
1175      C
1176      C ***************************************************************
1177      C *                                                             *
1178      C * LEAD EMISSION FACTOR SUBROUTINES                            *
1179      C *                                                             *
1180      C ***************************************************************
1181            SUBROUTINE LEAD(IYEAR,IYRPTR,IVHCLS,IFT,VEHSPD,IDRIV,EF)
1182      C CALCULATES LEAD EMISSION FACTOR FOR GIVEN VEHICLE.CLASS, YEAR,
1183      C FUEL TYPE AND VEHICLE SPEED
1184      C
1185            COMMON/PSIZE/PSZCUT,PSL,PSNL,PSNLCT,PSDIE,PSBRK,PSTIRE
1186            COMMON/CONST/FPB,FPBE,FPBL
1187      C
1188            EF=0.0
1189            PBRAT=1.557
1190            IF(IFT.GT.2)GOTO 99
1191            AS=FPB
1192            AMIS=FPBE
1193            IF(IYRPTR.GE.1981)AMIS=FPBL
1194            CALL GTPBCG(IYEAR,1,PBL)
1195            CALL GTPBCG(IYEAR,2,PBNL)
1196            CALL GETCS(IVHCLS,VEHSPD,IDRIV,CS)
1197            CALL GETCFE(IYRPTR,IVHCLS,FLECON)
1198            IF (IVHCLS.GT.3)GOTO 20
1199      C LEADED LDV, LDT1, LDT2
1200            IF(IFT.EQ.2)GOTO  10
1201            CALL GETPB(IYRPTR,IVHCLS,1,EFPB1)
1202            CALL GETPB(IYRPTR,IVHCLS,2,EFPB2)
1203            EF=(PBL*EFPB1*PSL+PBNL*EFPB2*PSNL)*AS*PBRAT/(FLECON*CS)
1204            GOTO 99
1205      C UNLEADED LDV, LDT1, LDT2
1206         10 IF(IYRPTR.LT.1975)GOTO 99
1207            CALL NLCONS(IYEAR,IYRPTR,IVHCLS,TAMFRC,RMIS)
1208            FNOCAT=FREMCT(IYRPTR,IVHCLS,2,1)
1209            FCAT=FREMCT(IYRPTR,IVHCLS,2,6)
1210            EF=PBNL*(1.-RMIS)*PSNLCT*AS+(PBL*RMIS*PSL*AS)*(FNOCAT+TAMFRC*FCAT)
1211           &+PBL*RMIS*PSL*(1.-TAMFRC)*FCAT*AMIS
1212            EF=EF*PBRAT/(FLECON*CS)
1213            GOTO 99
1214      C HDGV
1215         20 IF(IVHCLS.GT.5)GOTO 40
1216            IF(IFT.EQ.2)GOTO 30
1217      C LEADED HDGV
1218            EF=AS*PBL*PBRAT*PSL/FLECON
```

```
      GOTO 99
C UNLEADED HDGV 1987+
   30 IF(IYRPTR.LT.1987.OR.IVHCLS.EQ.5)GOTO 99
      CALL NLCONS(IYEAR,IYRPTR,VEHSPD,TAMFRC,RMIS)
      EF=((1.-RMIS)*AS*PBNL*PBRAT*PSNLCT/FLECON)+(RMIS*AMIS*PBL*
     &PBRAT*PSL/FLECON)
      GOTO 99
C MOTORCYCLES
   40 CALL GETPB(IYRPTR,IVHCLS,1,EFL)
      EF=EFL*PSL
   99 RETURN
      END
C
C
      SUBROUTINE GTPBCG(IYRPTR,IFT,PBCON)
C GET LEAD CONTENT OF LEADED AND UNLEADED GASOLINE
C
      COMMON/GAS/LCGSIZ,LCGYR(20),PBCG(20,2),NCFEYR(27),CFE(27,6),
     &ICFESZ,IFECSZ,FECVS(13),FEC(13,2)
C
      PBCON=0.0
      NPTR=1
      DO 10 I=1,LCGSIZ
   10 IF(IYRPTR.GE.LCGYR(I))NPTR=I
      PBCON=PBCG(NPTR,IFT)
      RETURN
      END
C
C
      SUBROUTINE GETPB(IYRPTR,IVHCLS,IFT,EFPB)
C FIND LEADED EMISSION FACTORS
C
      COMMON/EMPB/EFLEAD(20),IPBYR(20),IPBVH(20),IPBFT(20),NPBTOT
C
      EFPB=0.0
      IVH=IVHCLS
      IF(IVHCLS.EQ.2)IVH=1
      DO 10 I=1,NPBTOT
      IF(IVH.NE.IPBVH(I))GOTO 10
      IF(IFT.NE.IPBFT(I))GOTO 10
      IF(IYRPTR.GE.IPBYR(I))EFPB=EFLEAD(I)
   10 CONTINUE
   30 RETURN
      END
C
C
      SUBROUTINE GETCS(IVHCLS,VEHSPD,IDRIV,CS)
C GET SPEED DEPENDENT CORRECTION FACTOR
      COMMON/GAS/LCGSIZ,LCGYR(20),PBCG(20,2),NCFEYR(27),CFE(27,6),
     &ICFESZ,IFECSZ,FECVS(13),FEC(13,2)
C
      CS=0.0
      IF(IVHCLS.GT.3)GOTO  30
      IF(VEHSPD.LE.FECVS(1))CS=FEC(1,IDRIV)
      IF(VEHSPD.GE.FECVS(IFECSZ))CS=FEC(IFECSZ,IDRIV)
      IF(CS.NE.0)GOTO  30
      NPTR=1
      DO 10 I=2,IFECSZ
```

```
1277          10 IF(FECVS(I).GE.VEHSPD.AND.NPTR.EQ.1)NPTR=I
1278             SLOPE=(FEC(NPTR,IDRIV)-FEC(NPTR-1,IDRIV))/
1279            &(FECVS(NPTR)-FECVS(NPTR-1))
1280             CS=FEC(NPTR-1,IDRIV)+SLOPE*(VEHSPD-FECVS(NPTR-1))
1281          30 RETURN
1282             END
1283      C
1284      C
1285             SUBROUTINE GETCFE(IYRPTR,IVHCLS,FLECON)
1286      C GET COMBINED CITY/HIGHWAY FUEL ECONOMY
1287      C
1288             COMMON/GAS/LCGSIZ,LCGYR(20),PBCG(20,2),NCFEYR(27),CFE(27,6),
1289            &ICFESZ,IFECSZ,FECVS(13),FEC(13,2)
1290      C
1291             FLECON=0.0
1292             NPTR=1
1293             IVH=IVHCLS
1294             IF(IVHCLS.EQ.5.AND.IYRPTR.LT.1987)IVH=4
1295             IF(IVHCLS.EQ.6)GOTO  40
1296             DO 10 I=1,ICFESZ
1297          10 IF(IYRPTR.GE.NCFEYR(I))NPTR=I
1298             FLECON=CFE(NPTR,IVH)
1299          40 RETURN
1300             END
1301      C
1302      C
1303      C
1304             SUBROUTINE NLCONS(IYEAR,IYRPTR,IVHCLS,TAMFRC,RMIS)
1305      C UNLEADED EMISSIONS FACTORS CONSTANTS
1306      C
1307             INTEGER TAMFLG,SPCFLG,VMFLAG
1308             COMMON/FLAGS1/IPROMT,TAMFLG,SPCFLG,VMFLAG,MYMRFG,IMFLAG,MISFLG
1309             COMMON/MSFL/RMISFL(20,4,2),TMISFL(6,2)
1310             COMMON/EMCT/FPBEMC(15,6),FNLEMC(15,6,8),FDIEMC(15,6),IEMCYR(15),
1311            &IEMCT,TAMPER(3,2)
1312      C
1313             TAMFRC=0.0
1314             RMIS=0.0
1315             IAGE=IYEAR-IYRPTR
1316             IF(IYRPTR.LT.1975)GOTO 20
1317      C UNLEADED LDV, LDT1,LDT2, HDGV
1318             IF(IVHCLS.LE.3)TAMFRC=TAMPER(IVHCLS,IMFLAG)
1319          10 IF(IVHCLS.GT.4)RMIS=0.0
1320             IF(IVHCLS.LE.4)RMIS=RMISFL(IAGE,IVHCLS,IMFLAG)
1321             IF(MISFLG.EQ.3.AND.IVHCLS.LE.3)RMIS=TMISFL(IVHCLS,IMFLAG)
1322             IF(IVHCLS.EQ.4.AND.IYRPTR.LT.1987)RMIS=0.0
1323             IF(RMIS.LT.0.0)RMIS=0.0
1324          20 RETURN
1325             END
1326      C *******************************************************
1327      C *                                                     *
1328      C * ORGANIC EMISSION FACTORS SUBROUTINES                *
1329      C *                                                         *
1330      C *******************************************************
1331      C
1332      C
1333             SUBROUTINE ORGANC(IYEAR,IYRPTR,IVHCLS,IFT,EFORG)
1334      C FIND ORGANIC EMISSIONS FACTORS
```

```
      C
            COMMON/PSIZE/PSZCUT,PSL,PSNL,PSNLCT,PSDIE,PSBRK,PSTIRE
      C
            EFORG=0.0
            IF(IFT.GT.2)GOTO  99
            IF(IVHCLS.GT.3)GOTO 20
            IF(IFT.EQ.2)GOTO 10
      C LEADED LDV, LDT1, LDT2
            CALL GETEFO(IYRPTR,IVHCLS,1,1,EF)
            EFORG=EF*PSL
            GOTO 99
      C UNLEADED LDV, LDT1, LDT2
         10 IF(IYRPTR.LT.1975)GOTO 99
            CALL NLCONS(IYEAR,IYRPTR,IVHCLS,TAMFRC,RMIS)
            FCAT=FREMCT(IYRPTR,IVHCLS,2,6)
            FNOCAT=FREMCT(IYRPTR,IVHCLS,2,1)
            CALL GETEFO(IYRPTR,IVHCLS,6,2,EFNLCT)
            CALL GETEFO(IYRPTR,IVHCLS,6,1,EFLCAT)
            CALL GETEFO(IYRPTR,IVHCLS,1,2,EFNL)
            EFORG=(1.-RMIS)*FCAT*EFNLCT*PSNLCT+RMIS*FCAT*EFLCAT*PSL+
           &FNOCAT*EFNL*PSNL
            GOTO 99
      C HDGV
         20 IF(IVHCLS.GT.5)GOTO  99
            CALL GETCFE(IYRPTR,IVHCLS,FLECON)
            IF(IVHCLS.EQ.4.AND.IYRPTR.GE.1987.AND.IFT.EQ.2)GOTO 30
            IF(IVHCLS.EQ.4.AND.IYRPTR.GE.1987.AND.IFT.NE.2)GOTO 99
            IF(IVHCLS.EQ.5.AND.IYRPTR.LT.1987)GOTO 99
            IF(IVHCLS.EQ.4.AND.IYRPTR.GE.1987.AND.IFT.NE.2)GOTO 99
      C ALL LEADED HDGV
            CALL GETEFO(IYRPTR,IVHCLS,1,1,EFL)
            EFORG=EFL*PSL*5.0/FLECON
            GOTO 99
      C UNLEADED HDGV 1987+
         30 IF(IYRPTR.LT.1987.OR.IVHCLS.EQ.5)GOTO 99
            CALL NLCONS(IYEAR,IYRPTR,IVHCLS,TAMFRC,RMIS)
            CALL GETEFO(IYRPTR,IVHCLS,8,2,EFNLCT)
            CALL GETEFO(IYRPTR,IVHCLS,8,1,EFLCAT)
            EFORG=((1.-RMIS)*EFNLCT*PSNLCT+RMIS*EFLCAT*PSL)*5.0/FLECON
         99 RETURN
            END
      C
      C
            SUBROUTINE GETEFO(IYRPTR,IVHCLS,ICAT,IFT,EF)
      C GET ORGANIC EMISSION FACTOR
      C
            COMMON/EMORG/IORGYR(20),IORGFT(20),IORGCT(20),IORGVH(20),
           &EFO(20),NORTOT
      C
            EF=0.0
            IVH=IVHCLS
            IF(IFT.GT.2)GOTO 10
            IF(IVHCLS.EQ.5)IVH=4
            IF(IVHCLS.LE.3)IVH=1
            DO 10 I=1,NORTOT
            IF(IVH.NE.IORGVH(I))GOTO 10
            IF(ICAT.NE.IORGCT(I))GOTO 10
            IF(IFT.NE.IORGFT(I))GOTO 10
```

```
1393           IF(IYRPTR.GE.IORGYR(I))EF=EFO(I)
1394          10 CONTINUE
1395           RETURN
1396           END
1397      C
1398      C
1399      C ***********************************************************
1400      C*                                                          *
1401      C * SULFATE EMISSION FACTORS SUBROUTINES                    *
1402      C *                                                         *
1403      C ***********************************************************
1404      C
1405           SUBROUTINE SULFAT(IYEAR,IYRPTR,IVHCLS,VEHSPD,IFT,EF)
1406      C FIND SULFATE EMISSIONS BY YEAR, VEHICLE.CLASS, AND FUEL TYPE
1407      C
1408           COMMON/EMCT/FPBEMC(15,6),FNLEMC(15,6,8),FDIEMC(15,6),IEMCYR(15),
1409          &IEMCT,TAMPER(3,2)
1410           COMMON/PSIZE/PSZCUT,PSL,PSNL,PSNLCT,PSDIE,PSBRK,PSTIRE
1411           EF=0.0
1412           IF(IFT.GT.2)GOTO  99
1413           IF(IVHCLS.GT.3)GOTO  20
1414           IF(IFT.EQ.2)GOTO  10
1415      C LEADED NOCAT LDV, LDT1, LDT2
1416           CALL GETEFS(IYRPTR,IVHCLS,1,1,VEHSPD,EF)
1417           EF=EF*PSL
1418           GOTO 99
1419      C UNLEADED 1975+ LDV, LDT1, LDT2
1420          10 IF(IYRPTR.LT.1975)GOTO 99
1421           CALL GETEFS(IYRPTR,IVHCLS,7,2,19.6,EFNOAR)
1422           CALL GETEFS(IYRPTR,IVHCLS,8,2,19.6,EFAIR)
1423           CALL GETEFS(IYRPTR,IVHCLS,1,2,19.6,EFNOCT)
1424           CALL GETEFS(IYRPTR,IVHCLS,6,1,19.6,EFMIS)
1425           CALL NLCONS(IYEAR,IYRPTR,IVHCLS,TAMFRC,RMIS)
1426           FNOAR=FREMCT(IYRPTR,IVHCLS,IFT,7)
1427           FAIR=FREMCT(IYRPTR,IVHCLS,IFT,8)
1428           FNOCAT=FREMCT(IYRPTR,IVHCLS,IFT,1)
1429           EFLO=(1.-RMIS)*(FNOAR*EFNOAR*PSNLCT+FAIR*EFAIR*PSNLCT+
1430          &FNOCAT*EFNOCT*PSNL)+RMIS*EFMIS*PSL
1431      C
1432           CALL GETEFS(IYRPTR,IVHCLS,1,2,34.8,EFNOCT)
1433           CALL GETEFS(IYRPTR,IVHCLS,2,2,34.8,EFOX)
1434           CALL GETEFS(IYRPTR,IVHCLS,4,2,34.8,EF3W)
1435           CALL GETEFS(IYRPTR,IVHCLS,3,2,34.8,EFOXAR)
1436           CALL GETEFS(IYRPTR,IVHCLS,5,2,34.8,EF3WOX)
1437           CALL GETEFS(IYRPTR,IVHCLS,6,1,34.8,EFMIS)
1438      C
1439           FOX=FREMCT(IYRPTR,IVHCLS,IFT,2)
1440           FOXAR=FREMCT(IYRPTR,IVHCLS,IFT,3)
1441           F3W=FREMCT(IYRPTR,IVHCLS,IFT,4)
1442           F3WOX=FREMCT(IYRPTR,IVHCLS,IFT,5)
1443      C
1444           EFHI=(1.-RMIS)*(FNOCAT*EFNOCT*PSNL+FOX*EFOX*PSNLCT+
1445          &F3W*EF3W*PSNLCT+FOXAR*EFOXAR*PSNLCT+F3WOX*EF3WOX*PSNLCT)+
1446          &RMIS*EFMIS*PSL
1447           SLOPE=(EFHI-EFLO)/(34.8-19.6)
1448           EF=SLOPE*(VEHSPD-19.6)+EFLO
1449           GOTO 99
1450      C HDGV
```

```
      20 IF(IVHCLS.GT.5)GOTO  40
         CALL GETCFE(IYRPTR,IVHCLS,FLECON)
         CALL GETEFS(IYRPTR,IVHCLS,1,1,VEHSPD,EFNOCT)
         IF(IFT.EQ.2)GOTO 30
         EF=EFNOCT*PSL*5.0/FLECON
         GOTO 99
C UNLEADED HDGV 1987+
      30 IF(IYRPTR.LT.1987.OR.IVHCLS.EQ.5)GOTO 99
         CALL NLCONS(IYEAR,IYRPTR,IVHCLS,TAMFRC,RMIS)
         CALL GETEFS(IYRPTR,IVHCLS,8,2,VEHSPD,EFCAT)
         EF=((1.-RMIS)*EFCAT*PSNLCT+RMIS*EFNOCT*PSL)*5.0/FLECON
         GOTO 99
C MOTORCYLES
      40 EF=0.0
      99 RETURN
         END
C
C
         SUBROUTINE GETEFS(IYRPTR,IVHCLS,ICAT,IFT,VEHSPD,EF)
C GETS SULFATE EMISSION FACTOR
C
         COMMON/EMSUL/ISULYR(20),ISULFT(20),ISULCT(20),ISULVH(20),
        &EFS(20,2),NSUTOT
C
         EF=0.0
         EF1=0.0
         EF2=0.0
         IVH=IVHCLS
         IF(IFT.GT.2)GOTO 99
         IF(IVHCLS.GE.6)GOTO 99
          IF(IVHCLS.LE.3)IVH=1
          IF(IVHCLS.EQ.5)IVH=4
         DO 10 I=1,NSUTOT
          IF(IVH.NE.ISULVH(I))GOTO 10
          IF(IFT.NE.ISULFT(I))GOTO10
          IF(ICAT.NE.ISULCT(I))GOTO 10
         IF(IVH.EQ.4.AND.IYRPTR.GE.ISULYR(I))EF=EFS(I,1)
         IF(EF.NE.0.0)GOTO 99
          IF(IYRPTR.GE.ISULYR(I).AND.EFS(I,2).LT.20.)EF1=EFS(I,1)
          IF(IYRPTR.GE.ISULYR(I).AND.EFS(I,2).GT.20.)EF2=EFS(I,1)
      10 CONTINUE
      20 IF(EF1.EQ.0.0.AND.EF2.EQ.0.0)GOTO 99
         SLOPE=(EF2-EF1)/(34.8-19.6)
         EF=EF1+SLOPE*(VEHSPD-19.6)
      99 RETURN
         END
C
         SUBROUTINE DIESEL(IYRPTR,IVHCLS,EF)
         COMMON/PSIZE/PSZCUT,PSL,PSNL,PSNLCT,PSDIE,PSBRK,PSTIRE
         COMMON/EMDIE/IDIEYR(20),IDIEVH(20),EFDP(20),NDITOT
         COMMON/HDDV/IHDDMY(13),HDDVCF(13)
         EF=0.0
         IVEH=IVHCLS
         IF(IVHCLS.EQ.3)IVEH=2
         IF(IVHCLS.GE.5)GOTO 99
         DO 10 I=1,NDITOT
         IF(IVEH.NE.IDIEVH(I))GOTO 10
         IF(IYRPTR.GE.IDIEYR(I))EF=EFDP(I)
```

```
      10 CONTINUE
         IF(IVHCLS.EQ.4)GOTO 20
         EF=EF*PSDIE
         GOTO 99
C HDDT
      20 DO 30 I=1,13
      30 IF(IYRPTR.GE.IHDDMY(I))CF=HDDVCF(I)
         EF=EF*PSDIE*CF
      99 RETURN
         END
C *******************************************************
C * FUNCTIONS                                           *
C *******************************************************
C
      `  FUNCTION FREMCT(IYRPTR,IVHCLS,IFT,ICAT)
         COMMON/EMCT/FPBEMC(15,6),FNLEMC(15,6,8),FDIEMC(15,6),IEMCYR(15),
        &IEMCT,TAMPER(3,2)
         IF(IVHCLS.LT.1.OR.IVHCLS.GT.6)CALL QUITER(0.,1,32,INERR)
         IF(IFT.LT.1.OR.IFT.GT.3)CALL QUITER(0.,1,32,INERR)
         IF(ICAT.LT.1.OR.ICAT.GT.8)CALL QUITER(0.,1,32,INERR)
         FREMCT=0.0
         NPTR=1
         DO 10 I=1,IEMCT
      10 IF(IYRPTR.GE.IEMCYR(I))NPTR=I
         IF(IFT.EQ.1)FREMCT=FPBEMC(NPTR,IVHCLS)
         IF(IFT.EQ.2)FREMCT=FNLEMC(NPTR,IVHCLS,ICAT)
         IF(IFT.EQ.3)FREMCT=FDIEMC(NPTR,IVHCLS)
         RETURN
         END
C
C
         FUNCTION FRFLT(IYRPTR,IVHCLS,IFT)
         COMMON/FLEET/FSF(26,6,3),IFSFYR(26,6),IFSF(6),VMT(6)
         IF(IVHCLS.LT.1.OR.IVHCLS.GT.6)CALL QUITER(0.,2,32,INERR)
         IF(IFT.LT.1.OR.IFT.GT.3)CALL QUITER(0.,2,32,INERR)
         FRFLT=0.0
         NPTR=1
         NFSF=IFSF(IVHCLS)
         DO 10 I=1,NFSF
      10 IF(IYRPTR.GE.IFSFYR(I,IVHCLS))NPTR=I
         FRFLT=FSF(NPTR,IVHCLS,IFT)
         RETURN
         END
C
C
C
C *******************************************************
C * CALCULATIONS                                        *
C *******************************************************
C
         SUBROUTINE CALC
C
         COMMON/TWFRAC/TWFAC(20,6,3)
         COMMON/PSIZE/PSZCUT,PSL,PSNL,PSNLCT,PSDIE,PSBRK,PSTIRE
         COMMON/FLEET/FSF(26,6,3),IFSFYR(26,6),IFSF(6),VMT(6)
         COMMON/ANSWER/PBSUM(6),ORGSUM(6),SULSUM(6),DIESUM(6),CLSSUM(6),
        &BRKSUM,TIRSUM,SUMALL
         COMMON/SCENR/IYEAR,VEHSPD,IDRIV
```

```
1567      C
1568      C START VEHICLE CLASS LOOP
1569            DO 10 IVHCLS=1,6
1570           10 CLSSUM(IVHCLS)=0.0
1571            DO 30 IVHCLS=1,6
1572            PBSUM(IVHCLS)=0.0
1573            ORGSUM(IVHCLS)=0.0
1574            SULSUM(IVHCLS)=0.0
1575            DIESUM(IVHCLS)=0.0
1576      C START 20-YEAR LOOP
1577            IFIRYR=IYEAR-19
1578            DO 20 IYRPTR=IFIRYR,IYEAR
1579            IAGE=IYEAR-IYRPTR+1
1580            IF(IAGE.GT.20)IAGE=20
1581      C FUEL TYPE LOOP (LEADED, UNLEADED)
1582            DO 15 IFT=1,2
1583            FR=FRFLT(IYRPTR,IVHCLS,IFT)
1584            TW=TWFAC(IAGE,IVHCLS,IFT)
1585            IF(IYRPTR.LT.1987.AND.IVHCLS.EQ.5)GOTO 15
1586            IF(IYRPTR.GE.1987.AND.IVHCLS.EQ.5.AND.IFT.EQ.2)GOTO 15
1587            IF(IYRPTR.GE.1987.AND.IVHCLS.EQ.4.AND.IFT.EQ.1)GOTO 15
1588            IF(IYRPTR.GE.1987.AND.IVHCLS.EQ.5.AND.IFT.EQ.1)FR=FRFLT(IYRPTR,4,1)
1589            CALL LEAD(IYEAR,IYRPTR,IVHCLS,IFT,VEHSPD,IDRIV,EFPB)
1590            PBSUM(IVHCLS)=PBSUM(IVHCLS)+EFPB*FR*TW
1591            CALL ORGANC(IYEAR,IYRPTR,IVHCLS,IFT,EFORG)
1592            ORGSUM(IVHCLS)=ORGSUM(IVHCLS)+EFORG*FR*TW
1593            CALL SULFAT(IYEAR,IYRPTR,IVHCLS,VEHSPD,IFT,EFSUL)
1594            SULSUM(IVHCLS)=SULSUM(IVHCLS)+EFSUL*FR*TW
1595            FRTW=FR*TW
1596           15 CONTINUE
1597            IFT=3
1598            CALL DIESEL(IYRPTR,IVHCLS,EFDIE)
1599            FR=FRFLT(IYRPTR,IVHCLS,IFT)
1600            DIESUM(IVHCLS)=DIESUM(IVHCLS)+EFDIE*FRFLT(IYRPTR,IVHCLS,IFT)*
1601          CTWFAC(IAGE,IVHCLS,IFT)
1602           20 CONTINUE
1603      C WEIGHT BY AREA TRAVEL FRACTION
1604            IF(IVHCLS.LE.3)CLSSUM(IVHCLS)=(PBSUM(IVHCLS)+ORGSUM(IVHCLS)+
1605           &SULSUM(IVHCLS)+DIESUM(IVHCLS))*VMT(IVHCLS)
1606            IF(IVHCLS.EQ.4.OR.IVHCLS.EQ.5)CLSSUM(4)=CLSSUM(4)+(PBSUM(IVHCLS)
1607           &+ORGSUM(IVHCLS)+SULSUM(IVHCLS))*VMT(4)
1608            IF(IVHCLS.EQ.4)CLSSUM(5)=DIESUM(4)*VMT(5)
1609            IF(IVHCLS.EQ.6)CLSSUM(6)=PBSUM(6)*VMT(6)
1610           30 CONTINUE
1611      C SHIFT HDGV2 TO HDGV
1612            PBSUM(4)=PBSUM(4)+PBSUM(5)
1613            ORGSUM(4)=ORGSUM(4)+ORGSUM(5)
1614            SULSUM(4)=SULSUM(4)+SULSUM(5)
1615            PBSUM(5)=0.0
1616            ORGSUM(5)=0.0
1617            SULSUM(5)=0.0
1618      C SHIFT HDDT TO CLASS FIVE
1619            DIESUM(5)=DIESUM(4)
1620            DIESUM(4)=0.0
1621      C
1622      C FIND TOTAL EMISSIONS
1623      C
1624            SUMALL=0.0
```

```
      DO 40 I=1,6
      SUMALL=SUMALL+CLSSUM(I)
   40 CONTINUE
      BRKSUM=PSBRK*0.0128
      TIRSUM=PSTIRE*0.002
      SUMALL=SUMALL+BRKSUM+TIRSUM
      RETURN
      END
C
C ************************************************
C * OUTPUT ROUTINES                              *
C ************************************************
C
      SUBROUTINE OUT
C
      INTEGER TAMFLG,SPCFLG,VMFLAG
      COMMON/PROJCM/PROJID(20)
      COMMON/IOUCOM/IOUREP,IOUERR,IOUASK,IOUDAT,IOUGEN
      COMMON/FLAGS1/IPROMT,TAMFLG,SPCFLG,VMFLAG,MYMRFG,IMFLAG,MISFLG
      COMMON/PSIZE/PSZCUT,PSL,PSNL,PSNLCT,PSDIE,PSBRK,PSTIRE
      COMMON/ANSWER/PBSUM(6),ORGSUM(6),SULSUM(6),DIESUM(6),CLSSUM(6),
     &BRKSUM,TIRSUM,SUMALL
      COMMON/FLEET/FSF(26,6,3),IFSFYR(26,6),IFSF(6),VMT(6)
      COMMON/SCENR/IYEAR,VEHSPD,IDRIV
C
      DIMENSION NAMTAM(2),NAMIM(2),NMYMR(4),NAMVM(3),NAMSPC(3),
     &NAMDRV(2),CLSNM(6),NAMMIS(3)
      DATA NAMTAM/'NORM','USER'/,
     &     NAMIM/' NO ',' YES'/,
     &     NMYMR/'NORM','MILE',' REG',' M+R'/,
     &     NAMVM/'NORM','SCEN','USER'/,
     &     NAMSPC/'NORM','USER'/,
     &     NAMDRV/'TRAN','CRSE'/,
     &     NAMMIS/'NORM','USER','SMPL'/,
     &     CLSNM/'LDV ','LDT1','LDT2','HDGV','HDDT',' MC '/
      CALL OUTHDR(IOUREP)
      WRITE(IOUREP,1030)IYEAR,VEHSPD,PSZCUT
 1030 FORMAT('0CALCULATIONS FOR YEAR ',I4,'  SPEED ',F5.1,' MPH',
     &'   PARTICLE CUTOFF =',F5.2,' MICRONS')
      WRITE(IOUREP,1000)NAMTAM(TAMFLG),NAMMIS(MISFLG),NAMVM(VMFLAG)
 1000 FORMAT('0FLAG SETTINGS: '/'  TAMPERING RATES    = ',A4,
     &'   MISFUELING RATES  = ',A4,'    VMT MIXTURE        = ',A4)
      WRITE(IOUREP,1010)NMYMR(MYMRFG),NAMIM(IMFLAG),NAMSPC(SPCFLG)
 1010 FORMAT('  MILEAGE & REGIST.  = ',A4,'   I/M PROGRAM       = ',
     &A4,'    SPECIAL CONDITIONS = ',A4)
      WRITE(IOUREP,1020)NAMDRV(IDRIV)
 1020 FORMAT('  DRIVING CONDITIONS = ',A4)
C PRINT BREAKDOWN
      WRITE(IOUREP,1025)
 1025 FORMAT('0',9X,'PARTICULATE EMISSIONS (GRAMS/MILE) BY VEHICLE CLASS')
      WRITE(IOUREP,1040)
 1040 FORMAT('0','VEH.CLASS',2X,' LEAD  ',2X,'ORGANIC',2X,'SULFATE',2X,
     &' DIESEL ',2X,'TOTAL',4X,'VMT FRAC.',2X,'VMT WT. TOTAL')
      DO 10 IVHCLS=1,6
      CLS=0.0
      IF(VMT(IVHCLS).NE.0.0)CLS=CLSSUM(IVHCLS)/VMT(IVHCLS)
   10 WRITE(IOUREP,1050)CLSNM(IVHCLS),PBSUM(IVHCLS),ORGSUM(IVHCLS),
     &SULSUM(IVHCLS),DIESUM(IVHCLS),CLS,VMT(IVHCLS),CLSSUM(IVHCLS)
```

```
 1683      1050 FORMAT(3X,A4,3X,2X,4(F7.4,2X),F7.4,4X,F7.4,4X,F7.4)
 1684           WRITE(IOUREP,1052)BRKSUM,TIRSUM
 1685      1052 FORMAT(' TOTAL BRAKE PARTICULATES = ',F6.4/
 1686          *' TOTAL TIRE PARTICULATES  = ',F6.4)
 1687           WRITE(IOUREP,1055)SUMALL
 1688      1055 FORMAT(' TOTAL VMT WEIGHTED PARTICULATE EMISSIONS = ',F7.4)
 1689     C OUTPUT FRACTIONS
 1690           WRITE(IOUREP,1060)
 1691      1060 FORMAT('0',18X,'PARTICULATE FRACTION BY VEHICLE CLASS')
 1692           WRITE(IOUREP,1070)
 1693      1070 FORMAT(1X,'VEH.CLASS',2X,' LEAD  ',2X,'ORGANIC',2X,'SULFATE',
 1694          &2X,'DIESEL ')
 1695           DO 20 IVHCLS=1,6
 1696           PB=0.0
 1697           ORG=0.0
 1698           SUL=0.0
 1699           DIE=0.0
 1700           IF(CLSSUM(IVHCLS).EQ.0.0)GOTO 20
 1701           PB=PBSUM(IVHCLS)*VMT(IVHCLS)/CLSSUM(IVHCLS)
 1702           ORG=ORGSUM(IVHCLS)*VMT(IVHCLS)/CLSSUM(IVHCLS)
 1703           SUL=SULSUM(IVHCLS)*VMT(IVHCLS)/CLSSUM(IVHCLS)
 1704           DIE=DIESUM(IVHCLS)*VMT(IVHCLS)/CLSSUM(IVHCLS)
 1705        20 WRITE(IOUREP,1050)CLSNM(IVHCLS),PB,ORG,SUL,DIE
 1706           RETURN
 1707           END
 1708           SUBROUTINE OUTHDR(IOUOUT)
 1709     C
 1710     C  OUTHDR writes the run title on unit IOUOUT.
 1711     C
 1712     C  CALLED BY CONSEC, OUT
 1713     C
 1714     C  Input on call:
 1715     C
 1716     C    parameter list: IOUOUT
 1717     C    common block: /PROJCM/ PROJID
 1718     C
 1719     C  Output on return:
 1720     C
 1721     C    common block: /SYSCOM/ INITPR
 1722     C
 1723     C
 1724           COMMON /PROJCM/ PROJID(20)
 1725     C
 1726           WRITE(IOUOUT,200) PROJID
 1727       200 FORMAT('1',20A4)
 1728     C
 1729           RETURN
 1730           END
 1731     C
 1732     C
 1733           BLOCK DATA
 1734           COMMON/EMORG/IORGYR(20),IORGFT(20),IORGCT(20),IORGVH(20),
 1735          &EFO(20),NORTOT
 1736           COMMON/EMSUL/ISULYR(20),ISULFT(20),ISULCT(20),ISULVH(20),
 1737          &EFS(20,2),NSUTOT
 1738           COMMON/EMDIE/IDIEYR(20),IDIEVH(20),EFDP(20),NDITOT
 1739           COMMON/EMPB/EFLEAD(20),IPBYR(20),IPBVH(20),IPBFT(20),NPBTOT
 1740           COMMON/GAS/LCGSIZ,LCGYR(20),PBCG(20,2),NCFEYR(27),CFE(27,6),
```

```
1741           &ICFESZ,IFECSZ,FECVS(13),FEC(13,2)
1742            COMMON/MSFL/RMISFL(20,4,2),TMISFL(6,2)
1743            COMMON/PSTEMP/PSDIST(5,2,6)
1744            COMMON/TWF/TWFREG(20,6,3),ITWFMA(20,6,3)
1745            COMMON/HDDT/IHTRG,IHDDMA(20,4),IHDDYR(21),HDDTRG(21,4)
1746            COMMON/HDDV/IHDDMY(13),HDDVCF(13)
1747            COMMON/EMCT/FPBEMC(15,6),FNLEMC(15,6,8),FDIEMC(15,6),IEMCYR(15),
1748           &IEMCT,TAMPER(3,2)
1749            COMMON/FLEET/FSF(26,6,3),IFSFYR(26,6),IFSF(6),VMT(6)
1750     C
1751            DATA IORGYR/20*0/,
1752           &     IORGFT/20*0/,
1753           &     IORGCT/20*0/,
1754           &     IORGVH/20*0/,
1755           &     EFO/20*0.0/,
1756           &     NORTOT/0/
1757     C
1758            DATA ISULYR/20*0/,
1759           &     ISULFT/20*0/,
1760           &     ISULCT/20*0/,
1761           &     ISULFT/20*0/,
1762           &     ISULVH/20*0/,
1763           &     EFS/40*0.0/,
1764           &     NSUTOT/0/
1765     C
1766            DATA IDIEYR/20*0/,
1767           &     IDIEVH/20*0/,
1768           &     EFDP/20*0.0/,
1769           &     NDITOT/0/
1770     C
1771            DATA EFLEAD/20*0.0/,
1772           &     IPBYR/20*0/,
1773           &     IPBVH/20*0/,
1774           &     IPBFT/20*0/,
1775           &     NPBTOT/0/
1776     C
1777            DATA LCGSIZ/0/,
1778           &     LCGYR/20*0/,
1779           &     PBCG/40*0.0/,
1780           &     NCFEYR/27*0/,
1781           &     CFE/162*0.0/,
1782           &     ICFESZ/0/,
1783           &     FECVS/13*0.0/,
1784           &     FEC/13*0.0/
1785     C
1786            DATA RMISFL/160*0.0/,
1787           &     TMISFL/12*0.0/
1788            DATA PSDIST/60*0.0/
1789     C
1790            DATA TWFREG/360*0.0/,
1791           &     ITWFMA/360*0/
1792     C
1793            DATA IHTRG/0/,
1794           &     IHDDMA/80*0/,
1795           &     IHDDYR/21*0/,
1796           &     HDDTRG/84*0.0/
1797     C
1798            DATA IHDDMY/13*0/,
```

```
1799          &     HDDVCF/13*0.0/
1800     C
1801           DATA FPBEMC/90*0.0/,
1802          &     FNLEMC/720*0.0/,
1803          &     FDIEMC/90*0.0/,
1804          &     IEMCYR/15/,
1805          &     IEMCT/0/,
1806          &     TAMPER/6*0.0/
1807     C
1808           DATA FSF/468*0.0/,
1809          &     IFSFYR/156*0/,
1810          &     IFSF/6*0/,
1811          &     VMT/6*0.0/
1812     C
1813           END
```

APPENDIX B

PROGRAM DATA FILE

```
 1      6
 2     1900 0 1 1 0.193
 3     1970 0 1 1 0.068
 4     1975 0 1 1 0.030
 5     1975 0 6 2 0.017
 6     1975 0 6 1 0.068
 7     1975 0 1 2 0.030
 8     13
 9     1900 S 1 1 19.6 0.002
10     1975 S 6 1 19.6 0.002
11     1974 S 1 1 34.8 0.001
12     1975 S 7 2 19.6 0.005
13     1975 S 8 2 19.6 0.016
14     1975 S 1 2 19.6 0.002
15     1975 S 1 1 34.8 0.001
16     1975 S 1 2 34.8 0.001
17     1975 S 2 2 34.8 0.005
18     1975 S 4 2 34.8 0.001
19     1975 S 3 2 34.8 0.020
20     1975 S 5 2 34.8 0.025
21     1975 S 6 1 34.8 0.001
22     3
23     1900 0.700
24     1981 0.300
25     1987 0.200
26     3
27     1900 0.800
28     1981 0.300
29     1987 0.260
30     4
31     1900 0 1 1 0.370
32     1987 0 8 2 0.054
33     1987 0 8 1 0.163
34     1987 0 1 1 0.370
35     3
36     1900 S 1 1 0.006
37     1987 S 8 2 0.048
38     1987 S 1 1 0.006
39     1
40     1900 0.700
41     6
42     1900 1 0.887
43     1900 2 0.113
44     1971 1 0.916
45     1971 2 0.084
46     1975 1 0.724
47     1975 2 0.276
48     6
49     1900 1 0.887
50     1900 2 0.113
51     1971 1 0.916
52     1971 2 0.084
53     1979 1 0.724
54     1979 2 0.276
55     2
56     1900 1 0.198
57     1978 1 0.046
58     17
```

```
1900 1.79 0.014
1975 1.82 0.014
1976 2.02 0.014
1977 2.03 0.014
1978 1.94 0.014
1979 1.85 0.014
1980 1.38 0.014
1981 1.15 0.014
1982 1.24 0.014
1983 1.14 0.014
1984 1.10 0.014
1985 1.10 0.014
1986 1.10 0.014
1987 1.10 0.014
1988 1.10 0.014
1989 1.10 0.014
1990 1.10 0.014
15
1.000 0.128 0.134 0.158 0.126 0.097 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000
0.000 0.081 0.020 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000
0.000 0.597 0.637 0.650 0.650 0.640 0.421 0.033 0.000 0.000 0.000 0.000 0.000 0.000 0.000
0.000 0.322 0.343 0.350 0.350 0.345 0.514 0.099 0.142 0.109 0.000 0.000 0.000 0.000 0.000
0.000 0.000 0.000 0.000 0.000 0.015 0.053 0.263 0.313 0.244 0.396 0.532 0.587 0.641 0.704
0.000 0.000 0.000 0.000 0.000 0.000 0.012 0.605 0.545 0.647 0.604 0.468 0.414 0.359 0.296
0.000 0.003 0.003 0.004 0.009 0.028 0.034 0.061 0.046 0.053 0.060 0.066 0.073 0.080 0.090
0.000 0.919 0.980 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000
0.000 0.597 0.637 0.650 0.650 0.655 0.474 0.296 0.149 0.194 0.237 0.381 0.450 0.518 0.554
0.000 0.322 0.343 0.350 0.350 0.345 0.526 0.704 0.851 0.806 0.763 0.691 0.587 0.482 0.446
22
1900 0.000 1.000 0.000
1975 0.869 0.128 0.003
1976 0.863 0.134 0.003
1977 0.838 0.158 0.004
1978 0.865 0.126 0.009
1979 0.875 0.097 0.028
1980 0.966 0.000 0.034
1981 0.939 0.000 0.061
1982 0.954 0.000 0.046
1983 0.947 0.000 0.053
1984 0.940 0.000 0.060
1985 0.934 0.000 0.066
1986 0.927 0.000 0.073
1987 0.920 0.000 0.080
1988 0.910 0.000 0.090
1989 0.900 0.000 0.100
1990 0.887 0.000 0.113
1991 0.887 0.000 0.113
1992 0.886 0.000 0.114
1993 0.886 0.000 0.114
1994 0.885 0.000 0.115
1995 0.885 0.000 0.115
01 0.028 12818 0358.9 0.038
02 0.107 12639 1352.4 0.142
03 0.100 11933 1193.3 0.125
04 0.094 11268 1059.2 0.111
05 0.088 10639 0936.2 0.098
06 0.080 10045 0803.6 0.084
07 0.075 09485 0711.4 0.075
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117     08 0.069 08955 0617.9 0.065
118     09 0.062 08455 0524.2 0.055
119     10 0.056 07983 0447.0 0.047
120     11 0.050 07538 0376.9 0.040
121     12 0.043 07117 0306.0 0.032
122     13 0.037 06720 0248.6 0.026
123     14 0.031 06345 0196.7 0.021
124     15 0.024 05991 0143.8 0.015
125     16 0.018 05657 0101.8 0.011
126     17 0.012 05341 0064.1 0.007
127     18 0.008 04043 0032.3 0.003
128     19 0.006 04762 0028.6 0.003
129     20 0.008 04496 0036.0 0.004
130     27
131     1900 13.9 10.6 07.9 00.0 0.0 6.5
132     1970 13.9 10.6 07.9 00.0 0.0 6.4
133     1971 13.2 10.4 07.7 00.0 0.0 6.4
134     1972 13.1 10.2 07.4 00.0 0.0 6.4
135     1973 12.9 09.9 07.0 00.0 0.0 6.5
136     1974 12.6 09.6 06.9 00.0 0.0 6.7
137     1975 13.5 11.6 08.8 00.0 0.0 6.8
138     1976 14.8 12.3 09.7 00.0 0.0 7.3
139     1977 15.5 13.0 09.4 00.0 0.0 7.7
140     1978 16.8 13.4 09.6 00.0 0.0 8.0
141     1979 17.2 14.2 09.8 00.0 0.0 8.2
142     1980 20.0 16.1 11.5 00.0 0.0 8.4
143     1981 21.4 17.7 13.3 00.0 0.0 8.6
144     1982 22.2 18.6 13.6 00.0 0.0 8.8
145     1983 22.2 19.2 13.7 00.0 0.0 8.9
146     1984 22.8 19.9 13.9 00.0 0.0 8.9
147     1985 23.2 20.7 14.0 00.0 0.0 9.0
148     1986 23.8 21.4 14.3 00.0 0.0 9.0
149     1987 24.3 23.0 14.5 09.5 5.6 9.0
150     1988 24.8 23.3 14.7 09.5 5.6 9.1
151     1989 25.2 23.1 14.9 09.6 5.6 9.2
152     1990 25.7 24.0 15.2 09.7 5.6 9.2
153     1991 26.2 24.5 15.4 09.7 5.7 9.3
154     1992 26.6 24.4 15.7 09.8 5.7 9.4
155     1993 27.2 25.3 15.9 09.8 5.7 9.4
156     1994 27.6 25.8 16.2 09.9 5.7 9.5
157     1995 29.0 26.2 16.4 10.1 5.8 9.6
158     13
159     05.0 0.323 0.467
160     10.0 0.553 0.709
161     15.0 0.692 0.997
162     20.0 0.790 1.153
163     25.0 0.885 1.248
164     30.0 0.963 1.294
165     32.7 1.000 1.303
166     35.0 1.022 1.303
167     40.0 1.053 1.288
168     45.0 1.073 1.256
169     50.0 1.078 1.210
170     55.0 1.063 1.159
171     60.0 1.023 1.104
172     15
173     1.000 0.188 0.088 0.038 0.027 0.030 0.021 0.026 0.021 0.022 0.000 0.000 0.000 0.000 0.000
174     0.000 0.123 0.225 0.083 0.069 0.034 0.027 0.011 0.000 0.000 0.000 0.000 0.000 0.000 0.000
```

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175     0.000 0.570 0.504 0.596 0.605 0.561 0.564 0.574 0.066 0.092 0.003 0.000 0.000 0.000 0.000
176     0.000 0.307 0.271 0.321 0.325 0.405 0.409 0.415 0.887 0.687 0.595 0.550 0.550 0.150 0.150
177     0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.027 0.054 0.126 0.150 0.150 0.350 0.350
178     0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.021 0.167 0.276 0.300 0.300 0.500 0.500
179     0.000 0.002 0.003 0.005 0.009 0.028 0.034 0.060 0.080 0.100 0.130 0.160 0.180 0.210 0.240
180     0.000 0.877 0.775 0.917 0.930 0.966 0.973 0.989 1.000 1.000 1.000 1.000 1.000 1.000 1.000
181     0.000 0.570 0.504 0.596 0.605 0.561 0.564 0.574 0.069 0.073 0.056 0.080 0.080 0.200 0.200
182     0.000 0.307 0.271 0.321 0.325 0.405 0.409 0.415 0.931 0.927 0.944 0.920 0.920 0.800 0.800
183     22
184     1900 0.000 1.000 0.000
185     1975 0.810 0.188 0.002
186     1976 0.909 0.088 0.003
187     1977 0.957 0.038 0.005
188     1978 0.964 0.027 0.009
189     1979 0.942 0.030 0.028
190     1980 0.945 0.021 0.034
191     1981 0.914 0.026 0.060
192     1982 0.899 0.021 0.080
193     1983 0.878 0.022 0.100
194     1984 0.870 0.000 0.130
195     1985 0.840 0.000 0.160
196     1986 0.820 0.000 0.180
197     1987 0.790 0.000 0.210
198     1988 0.760 0.000 0.240
199     1989 0.730 0.000 0.270
200     1990 0.706 0.000 0.294
201     1991 0.697 0.000 0.303
202     1992 0.688 0.000 0.312
203     1993 0.679 0.000 0.321
204     1994 0.670 0.000 0.330
205     1995 0.661 0.000 0.339
206     01 0.023 17394 0400.1 0.036
207     02 0.089 17079 1520.0 0.135
208     03 0.085 15839 1346.3 0.120
209     04 0.081 14690 1189.9 0.106
210     05 0.076 13624 1035.4 0.092
211     06 0.072 12636 0909.8 0.081
212     07 0.068 11719 0796.9 0.071
213     08 0.064 10868 0695.6 0.062
214     09 0.060 10080 0604.8 0.054
215     10 0.055 09348 0514.1 0.046
216     11 0.050 08670 0433.5 0.039
217     12 0.046 08041 0369.9 0.033
218     13 0.042 07457 0313.2 0.028
219     14 0.038 06916 0262.8 0.023
220     15 0.034 06415 0218.1 0.019
221     16 0.029 05949 0172.5 0.015
222     17 0.025 05517 0137.9 0.012
223     18 0.021 05117 0107.5 0.009
224     19 0.017 04746 0080.7 0.007
225     20 0.025 04402 0110.1 0.010
226     15
227     1.000 1.000 1.000 1.000 0.988 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000
228     0.000 0.000 0.000 0.000 0.000 0.008 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000
229     0.000 0.000 0.000 0.000 0.000 0.496 0.500 0.500 0.222 0.284 0.000 0.000 0.000 0.000 0.000
230     0.000 0.000 0.000 0.000 0.000 0.496 0.500 0.500 0.704 0.577 0.823 0.800 0.800 0.000 0.000
231     0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.012 0.003 0.000 0.000 0.020 0.020
232     0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.000 0.074 0.127 0.174 0.200 0.200 0.980 0.980
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233     0.000 0.000 0.000 0.000 0.012 0.025 0.050 0.050 0.080 0.113 0.147 0.180 0.194 0.208 0.222
234     0.000 0.000 0.000 0.000 0.000 0.992 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000 1.000
235     0.000 0.000 0.000 0.000 0.000 0.000 0.496 0.500 0.500 0.222 0.293 0.000 0.000 0.000 0.020 0.020
236     0.000 0.000 0.000 0.000 0.000 0.496 0.500 0.500 0.778 0.707 1.000 1.000 1.000 0.980 0.980
237     22
238     1900 0.000 1.000 0.000
239     1975 0.000 0.998 0.002
240     1976 0.000 0.997 0.003
241     1977 0.000 0.995 0.005
242     1978 0.000 0.991 0.009
243     1979 0.972 0.000 0.028
244     1980 0.966 0.000 0.034
245     1981 0.940 0.000 0.060
246     1982 0.920 0.000 0.080
247     1983 0.900 0.000 0.100
248     1984 0.870 0.000 0.130
249     1985 0.840 0.000 0.160
250     1986 0.820 0.000 0.180
251     1987 0.790 0.000 0.210
252     1988 0.760 0.000 0.240
253     1989 0.730 0.000 0.270
254     1990 0.706 0.000 0.294
255     1991 0.697 0.000 0.303
256     1992 0.688 0.000 0.312
257     1993 0.679 0.000 0.321
258     1994 0.670 0.000 0.330
259     1995 0.661 0.000 0.339
260     01 0.023 18352 0422.1 0.036
261     02 0.089 18001 1602.1 0.138
262     03 0.085 16622 1412.9 0.122
263     04 0.081 15348 1243.2 0.107
264     05 0.076 14172 1077.1 0.093
265     06 0.072 13087 0942.3 0.081
266     07 0.068 12084 0821.7 0.071
267     08 0.064 11158 0714.1 0.062
268     09 0.060 10303 0618.2 0.053
269     10 0.055 09514 0523.3 0.045
270     11 0.050 08785 0439.3 0.038
271     12 0.046 08112 0373.2 0.032
272     13 0.042 07491 0314.6 0.027
273     14 0.038 06917 0262.8 0.023
274     15 0.034 06386 0217.1 0.019
275     16 0.029 05897 0171.0 0.015
276     17 0.025 05446 0136.2 0.012
277     18 0.021 05028 0105.6 0.009
278     19 0.017 04643 0078.9 0.007
279     20 0.025 04287 0107.2 0.009
280     01 0.023 17552 0403.7 0.035
281     02 0.087 17230 1499.0 0.129
282     03 0.083 15964 1325.0 0.114
283     04 0.079 14791 1168.5 0.101
284     05 0.075 13705 1027.9 0.088
285     06 0.071 12699 0901.6 0.078
286     07 0.066 11766 0776.6 0.067
287     08 0.062 10901 0675.9 0.058
288     09 0.058 10101 0585.9 0.050
289     10 0.054 09359 0505.4 0.043
290     11 0.049 08671 0424.9 0.037
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 291      12 0.045 08035 0361.6 0.031
 292      13 0.041 07444 0305.2 0.026
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 294      15 0.033 06391 0210.9 0.018
 295      16 0.029 05921 0171.7 0.015
 296      17 0.025 05487 0137.2 0.012
 297      18 0.020 05084 0101.7 0.009
 298      19 0.016 04710 0075.4 0.006
 299      20 0.025 04364 0109.1 0.009
 300      20
 301      1900 0.000 1.000
 302      1977 0.000 1.000
 303      1978 0.000 1.000
 304      1979 0.000 1.000
 305      1980 0.000 1.000
 306      1981 0.000 1.000
 307      1982 0.000 1.000
 308      1983 0.000 1.000
 309      1984 0.000 1.000
 310      1985 0.000 1.000
 311      1986 0.000 1.000
 312      1987 0.823 0.177
 313      1988 0.824 0.176
 314      1989 0.825 0.175
 315      1990 0.826 0.174
 316      1991 0.828 0.172
 317      1992 0.829 0.171
 318      1993 0.833 0.167
 319      1994 0.837 0.163
 320      1995 0.840 0.160
 321      01 0.000 00000 0000.0 0.000
 322      02 0.148 19967 2955.1 0.227
 323      03 0.126 18077 2277.7 0.175
 324      04 0.107 16365 1751.1 0.134
 325      05 0.092 14815 1363.0 0.105
 326      06 0.078 13413 1046.2 0.080
 327      07 0.067 12143 0813.6 0.062
 328      08 0.058 10993 0637.6 0.049
 329      09 0.049 09952 0487.6 0.037
 330      10 0.041 09010 0369.4 0.028
 331      11 0.036 08156 0293.6 0.023
 332      12 0.030 07384 0221.5 0.017
 333      13 0.026 06685 0173.8 0.013
 334      14 0.022 06052 0133.1 0.010
 335      15 0.020 05479 0121.0 0.009
 336      16 0.016 04960 0079.4 0.006
 337      17 0.014 04490 0062.9 0.005
 338      18 0.012 04065 0048.8 0.004
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 344      03 0.138 61749 08521.4 0.182
 345      04 0.115 56155 06457.8 0.138
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 347      06 0.080 46457 03716.6 0.079
 348      07 0.067 42260 02831.4 0.060
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349     08 0.056 38447 02153.0 0.046
350     09 0.047 34982 01644.2 0.035
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352     11 0.033 28968 00955.9 0.020
353     12 0.027 26363 00711.8 0.015
354     13 0.023 23995 00551.9 0.012
355     14 0.019 21843 00415.0 0.009
356     15 0.015 19883 00298.2 0.006
357     16 0.013 18101 00235.3 0.005
358     17 0.011 16481 00181.3 0.004
359     18 0.009 15007 00135.1 0.003
360     19 0.008 13665 00109.3 0.002
361     20 0.034 12444 00423.1 0.009
362     01 0.000 0000 000.0 0.000
363     02 0.167 4100 685.7 0.356
364     03 0.159 2800 445.7 0.232
365     04 0.134 2100 281.0 0.146
366     05 0.142 1600 227.0 0.118
367     06 0.131 1200 157.8 0.082
368     07 0.080 0800 063.7 0.033
369     08 0.051 0600 030.4 0.016
370     09 0.028 0400 011.1 0.001
371     10 0.010 0200 002.1 0.010
372     11 0.098 0200 019.6 0.000
373     12 0.000 0200 000.0 0.000
374     13 0.000 0000 000.0 0.000
375     14 0.000 0000 000.0 0.000
376     15 0.000 0000 000.0 0.000
377     16 0.000 0000 000.0 0.000
378     17 0.000 0000 000.0 0.000
379     18 0.000 0000 000.0 0.000
380     19 0.000 0000 000.0 0.000
381     20 0.000 0000 000.0 0.000
382     LDV  0.09 0.20
383     LDT1 0.20 0.46
384     LDT2 0.21 0.47
385     HDGV 0.19 0.40
386     MC   0.00 0.00
387     20
388     01 .04 .04 .22 .13 .23 .13 .18 .12
389     02 .07 .05 .27 .14 .27 .15 .23 .13
390     03 .10 .06 .31 .16 .32 .16 .28 .15
391     04 .13 .07 .35 .17 .36 .17 .32 .16
392     05 .16 .08 .38 .18 .39 .18 .36 .17
393     06 .18 .09 .42 .19 .43 .19 .39 .18
394     07 .21 .09 .45 .20 .46 .20 .42 .19
395     08 .23 .10 .47 .21 .49 .21 .45 .20
396     09 .25 .11 .50 .21 .51 .22 .48 .21
397     10 .27 .11 .52 .22 .54 .23 .50 .22
398     11 .29 .12 .55 .23 .56 .23 .52 .22
399     12 .31 .12 .57 .24 .58 .24 .54 .23
400     13 .33 .13 .59 .24 .60 .25 .56 .23
401     14 .34 .13 .60 .25 .62 .25 .57 .24
402     15 .36 .14 .62 .25 .63 .26 .59 .24
403     16 .37 .14 .64 .26 .65 .26 .60 .25
404     17 .39 .15 .65 .26 .66 .26 .61 .25
405     18 .40 .15 .66 .26 .68 .27 .62 .25
406     19 .41 .15 .68 .27 .69 .27 .63 .25
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 407     20 .42 .16 .69 .27 .70 .28 .64 .26
 408      0.20  2.00 10.00
 409      0.23  0.43  0.64
 410      0.20  2.00 10.00
 411      0.87  0.89  0.97
 412      0.20  2.00 10.00
 413      0.42  0.66  0.90
 414      0.20  1.00  2.00  2.50 10.00
 415      0.73  0.86  0.90  0.92  1.00
 416      0.43  1.10  4.70  7.00 10.00
 417      0.09  0.16  0.82  0.90  0.98
 418      0.10 10.00
 419      0.01  1.00
 420     13
 421     1951 2.7420
 422     1963 2.7307
 423     1966 2.8267
 424     1969 3.0080
 425     1972 3.1917
 426     1975 3.1420
 427     1980 2.7780
 428     1982 2.5580
 429     1985 2.4700
 430     1986 2.4260
 431     1987 2.3600
 432     1993 2.3175
 433     1997 2.2970
 434     0.75 0.40 0.44
 435     0.045 0.195 0.195
 436     0.017 0.050 0.050
 437     20
 438     01 18352 45544 53370 82288
 439     02 16946 39671 46901 74984
 440     03 15648 34558 41190 68328
 441     04 14449 30092 36206 62263
 442     05 13342 26213 31812 56737
 443     06 12320 22834 27948 51700
 444     07 11376 19898 24556 47111
 445     08 10504 17332 21575 42930
 446     09  9700 15098 18956 39119
 447     10  8956 13152 16655 35647
 448     11  8270 11456 14632 32483
 449     12  7637  9979 12856 29599
 450     13  7052  8693 11296 26972
 451     14  6511  7572  9925 24578
 452     15  6012  6596  8719 22396
 453     16  5552  5746  7661 20408
 454     17  5126  5005  6728 18597
 455     18  4734  4360  5913 16946
 456     19  4371  3798  5196 15442
 457     20  4036  3308  4565 14071
 458     21
 459     1980 0.000 0.006 0.112 1.521
 460     1981 0.000 0.006 0.124 1.581
 461     1982 0.049 0.009 0.135 1.599
 462     1983 0.104 0.013 0.141 1.592
 463     1984 0.185 0.022 0.153 1.641
 464     1985 0.274 0.037 0.166 1.719
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465	1986	0.370	0.053	0.177	1.816
466	1987	0.475	0.071	0.185	1.927
467	1988	0.588	0.089	0.193	2.041
468	1989	0.707	0.106	0.201	2.151
469	1990	0.831	0.122	0.208	2.258
470	1991	0.960	0.137	0.215	2.362
471	1992	1.092	0.151	0.222	2.471
472	1993	1.225	0.165	0.229	2.581
473	1994	1.354	0.178	0.237	2.693
474	1995	1.480	0.190	0.245	2.807
475	1996	1.600	0.202	0.253	2.914
476	1997	1.712	0.212	0.261	3.015
477	1998	1.816	0.222	0.269	3.108
478	1999	1.912	0.230	0.276	3.194
479	2000	1.999	0.238	0.283	3.273
480	0.7845	0.0827	0.0470	0.0419	0.0354	0.0085