Emfac2001 / Emfac2002

version 2.08 **version 2.20**

Calculating emission inventories for vehicles in California

User's Guide

The purpose of this **draft** document is to familiarize new users with the Emfac model. Although the document refers to Emfac2001 version 2.08 model, the directions given also apply to Emfac2002 version 2.2. It provides:

- An overview of what pollutants and emission processes are modeled
- Introduces Burden, Emfac and Calimfac emission modes
- Sample output files
- Information on editing fundamental data

Table of Contents

Page #

1.0 INTRODUCING EMFAC2001 VERSION 2.08

The Air Resources Board (ARB) promotes and protects public health, welfare, and ecological resources by identifying ecological concerns, determining methods for efficient reduction of air pollutants, and making informed decisions based on the data at hand.

To help in this effort, the ARB developed an EMission FACtors (EMFAC) model to calculate emission rates from all motor vehicles, such as passenger cars to heavy-duty trucks, operating on highways, freeways and local roads in California. In the EMFAC model, the emission rates are multiplied with vehicle activity data provided by regional transportation agencies to calculate Statewide or regional emission inventories.

An emission inventory can be summarized as the product of an emission rate (e.g., grams of pollutant emitted over a mile) and vehicle activity (e.g., miles driven per day).

Hint: The following basic statement helps determine how emissions are calculated:

Emission Factor x Correction Factor x Travel Activity = Emissions in Tons Per Day

Over the years, tougher emission standards have been met with technological solutions of increasing complexity. As a result, the emission estimation models have also grown in size and complexity. The need for emission data to be accurate has not changed. However, these data can impact proposed regulations for California, and in some instances, the entire nation.

What Is Emfac2001?

Emfac2001 version 2.08 is the latest emission inventory model that calculates emission inventories for motor vehicles operating on roads in California. This model reflects the ARB's current understanding of how vehicles travel and how much they pollute. The Emfac2001 model can be used to show how California motor vehicle emissions have changed over time and are projected to change in the future. This information helps ARB weigh prospective control programs and determine the most effective, science-based proposals for protecting the environment.

The Emfac2001 model supercedes Emfac2000, which was released in November 2000. The Emfac2000 model was also an integrated model in that it combined emission rate data with vehicle activity to calculate an emission inventory.

About this document

The purpose of this **draft** document is to familiarize new users to the Emfac2001 version 2.08 model. It introduces new users of motor vehicle emissions models to concepts and basic terminology that will teach users how to run the model and make use of all the new features. However, this guide does not provide information on the data sources and details of the modeling equations used in generating the emission estimates. Further, this is a draft user's guide that will be handed out to the attendees of Emfac2001 workshops. This document will complement a real-time presentation given at these workshops. Staff intends on developing a complete user's guide later this year.

Section 2 provides an overview of the pollutants and emission processes currently modeled in Emfac2001. Section 3 introduces new users to basic terminology necessary for understanding the outputs from the model. Section 4 details the basic input data required for generating an emission inventory. Section 5 reviews the system requirements necessary for running the model. The remaining sections show the user how to start the model, and explain the three basic emission modes: Burden, Emfac and Calimfac. These sections also provide sample outputs for each of the emission modes. Section 8 shows users how to edit some of the fundamental data, such as vehicle population and vehicle miles traveled, and generate an emissions inventory using the edited data.

2.0 WHAT POLLUTANTS AND PROCESSES ARE MODELED

This section details the pollutants currently modeled in Emfac2001, and gives an overview of the emission processes. An emission process is tied to vehicle activity, for example when a vehicle is traveling down the freeway it emits emissions from the vehicle tailpipe. This process is labeled "running exhaust." For each pollutant the model calculates emissions from each emissions process. All the output reports show these emissions by emissions process.

Pollutants

The model calculates emission factors and emission inventories for the following primary pollutants:

- Hydrocarbons (HC). HC can be expressed as TOG (total organic gases), ROG (reactive organic gases), THC (total hydrocarbon), or CH4 (methane). The THC class includes compounds with H and C atoms only, carbonyls and halogens are not included in the class. The TOG class includes all organic gases emitted into the atmosphere. The ROG class is same as EPA's VOC (volatile organic compounds) definition and does not contain compounds exempt from regulation.

- Carbon monoxide (CO).

- Nitrogen oxides (NOx).

- Carbon dioxide (CO2).

- Particulate matter (PM). PM estimates are provided for total suspended particulate, particulate matter 10 microns or less in diameter (PM10), and particulate matter 2.5 microns or less in diameter (PM2.5).

- Fuel consumption. Although, this is not a pollutant, fuel consumption is calculated based on the emissions of CO, CO2 and THC using the carbon balance equation.

- Oxides of sulfur (SOx). Emissions of oxides of sulfur are a function of the sulfur content of fuel. The model calculates these emissions by multiplying the fuel consumption by the weight fraction of sulfur in a gallon of fuel.

- Lead (Pb). Lead emissions are also a function of the lead content in fuel. Hence, the model calculates lead by multiplying the fuel consumption by the number of grams of lead per gallon.

Note: Lead was phased out in 1992 and lead results will be zero for 1992 and newer calendar years.

Emission processes

Emissions (especially HC) emanate from a vehicle during all hours of the day. The magnitude of these emissions varies with what is happening to the vehicle. Was the vehicle just started, is it running on the road, is it idling at a loading zone or just sitting outside in the sun? An emissions process is tied to the vehicle diurnal activity such that all emissions are accounted for during normal daily activity. The types of emission processes are:

- Running exhaust—Emissions that come out of the vehicle tailpipe while it is traveling on the road.

- Idle exhaust—emissions that come out of the vehicle tailpipe while it is operating but not traveling any significant distance. This process captures emissions from heavy-duty vehicles that idle for extended periods of time while loading or unloading goods. Idle exhaust is only calculated for heavy-duty trucks.

- Starting exhaust—tailpipe emissions that occur as a result of starting a vehicle. These emissions are independent of running exhaust emissions and can be thought of as a slug of emissions associated with starting a vehicle. The magnitude of these emissions is dependent on how long the vehicle has been sitting prior to starting. (Starting emissions are only estimated for gasoline fueled vehicles).

- Diurnal—HC emissions that occur when rising ambient temperatures cause fuel evaporation from vehicles sitting throughout the day. These losses are from

leaks in the fuel system, fuel hoses, connectors, and as a result of breakthrough of vapors from the carbon canister. If a vehicle is sitting for a period of time, emissions from the first 35 minutes are counted as hot soak and emissions from the remaining period are counted as diurnal emissions, provided that the ambient temperature is increasing during the remaining period of time.

- Resting loss—these losses occur while the vehicle is sitting and are caused by fuel permeation through rubber and plastic components. Emissions are counted as resting loss emissions if the vehicle has not been operated for 35 minutes and vehicle is still stationary, but the ambient temperature is either constant or decreasing.

- Hot soak—evaporative HC emissions that occur immediately after a trip end due to fuel heating and the fact that the engine remains hot for a short time after being switched off. In older, carbureted vehicles these emissions are attributed to vapor losses from the carburetor float bowl. In newer, fuel-injected vehicles, these vapor losses come from leaky fuel injectors or from fuel hoses.

- Running losses—evaporative HC emissions that occur when hot fuel vapors escape from the fuel system or overwhelm the carbon canister while the vehicle is operating.

- Tire wear—particulate matter emissions from tires as a result of wear.

- Brake wear—particulate matter emissions from brake use.

3.0 OVERVIEW OF BASIC TERMINOLOGY

This section briefly introduces terminology and concepts that most users will need to understand such as vehicle class, fuel type, and vehicle activity. This is important since the output reports provide a breakdown of emissions by vehicle class and fuel type.

Vehicle fleet

"Vehicle fleet" refers to all the motor vehicles operating on roads in California. This fleet as currently modeled is broken into 13 categories called classes (for example, class 1, passenger cars). These classes are based on the type of vehicle, but they also take weight class and fuel type (i.e. gas, diesel, or electric) into account. The number of vehicles in each class is based on an analysis of Department of Motor Vehicles (DMV) registration data. These vary by calendar year and geographic area, so the make-up of the vehicle fleet is dependent on the calendar year and geographic area.

Vehicle class

The model performs separate calculations for each of the thirteen classes of vehicles, by fuel usage and each technology group. Each vehicle class contains numerous technology groups, which represent common emissions characteristics such as emission standards, technologies, or in-use emissions. The vehicle classes currently modeled are shown in Table 1, along with abbreviations used in the model.

Table 1 Vehicle Classes Modeled In Emfac2001

Vehicle Class	Fuel Type	Code	Description	Weight Class	Abbr.
1	All*	PC	Passenger Cars	All	LDA
2	All*	T1	Light-Duty Trucks	0-3750	LDT1
3	Gas, Diesel	T2	Light-Duty Trucks	3751-5750	LDT2
4	Gas, Diesel	T3	Medium-Duty Trucks	5751-8500	MDV
5	Gas, Diesel	T4	Light-Heavy-Duty Trucks	8501-10000	LHDT1
6	Gas, Diesel	T5	Light-Heavy-Duty Trucks	10001-14000	LHDT2
7	Gas, Diesel	T6	Medium-Heavy-Duty Truck	14001-33000	MHDT
8	Gas, Diesel	T7	Heavy-Heavy-Duty Trucks	33001-60000	HHDT
9	Gas, Diesel	T8	Line-Haul Vehicles	60001+	LHV
10	Diesel	UB	Urban Buses	All	UB
11	Gas	MC	Motorcycles	All	MCY
12	Gas, Diesel	SB	School Buses	All	SBUS
13	Gas, Diesel	MH	Motor Homes	All	MH

* gas, diesel, and electric

Fuel

Emfac2001 currently estimates emissions from gasoline, diesel and electrically powered vehicles. Table 1 shows the fuels modeled by vehicle class.

Technology group

The underlying assumption in Emfac2000 and Emfac2001 is that each vehicle class can be modeled by the individual behavior of unique technology groups. Each technology group represents vehicles from the same class but have distinct emission control technologies, have similar in-use deterioration rates, and respond the same to repair. A technology group can represent vehicles whose emissions standards are the same or those that have specific equipment installed on them (e.g., multi-port fuel injection, three-way catalyst, adaptive fuel controls, etc.) which makes them behave the same.

Appendices A-1 and A-2 list the technology groups used in modeling exhaust and evaporative emissions, respectively. Some report formats group vehicles into broader technology categories (catalyst, non-catalyst, and diesel). This is a remnant from older EMFAC models, which used to characterize vehicles into these broader technologies, and now is only used for reporting purposes. Gasoline vehicles are placed in the catalyst or non-catalyst categories based on technology group details. Electric vehicles are included in the catalyst category.

Model year

Emfac2001 contains emission factors and vehicle activity data for model years 1965 through 2040. Within each vehicle class, the model year is represented by a combination of technology groups. For example, a non-catalyst gasoline-fueled technology group (TG-1) and a diesel-fueled technology group (TG-170) represent the 1965 model year for passenger cars.

Activity

An emission inventory is simply a product of the emission rate (in grams per mile or grams per trip or grams per vehicle) and vehicle activity (miles per vehicle or number of trips or total number of vehicles). This requires estimates of vehicle population, vehicle miles traveled and trips for each vehicle class, by fuel type and geographic area. These terms are commonly referred to as vehicle activity.

Population

Vehicle population is determined through an analysis of DMV data. These data are used in developing vehicle age matrices for base years 1997 and 1998 for vehicle class, fuel type, geographic area, and vehicle ages 1 to 45 years. These matrices contain actual population estimates, which are used to back-cast and forecast vehicle populations for calendar years 1970 to 2040.

Vehicle miles traveled

Vehicle miles traveled (VMT) represents the total distance traveled on a weekday. Local planning agencies have developed regional transportation models, which output regional VMT for certain planning years. In the Emfac2001 model, VMT is calculated based on vehicle population and vehicle accrual. Vehicle accrual is the total number of miles a vehicle accumulates in a year, and varies by vehicle age. The regional estimates of VMT are matched by modifying either or both the vehicle population and accrual estimates.

The model also contains hourly distributions of VMT by vehicle class. These distributions are based on instrumented vehicle activity data.

Trips

The number of trips or starts per day is the same, and the terms can be used interchangeably. Both represent the number of separate trips made per weekday. In Emfac2000 and Emfac2001, the estimates for trips per day for vehicle classes 1 to 4 are based on travel surveys and vehicle instrumented data. These data show that trips per day decrease linearly with vehicle age from 6.56 at age 1 to 3.72 at age 45. The trips per day estimate for other vehicle classes are based on either instrumented data or an engineering judgement. The model calculates the total number of trips for a given calendar year, region and vehicle class by summing the product of model year populations and trips per day estimates.

4.0 BASIC DATA FOR A SCENARIO

This section explains the basic input data required for generating an emissions inventory. The basic scenario (input) data required for generating an emissions inventory are geographic area, calendar year, month or season selection, title (if default title is not appropriate), model years included in the calculation, inspection and maintenance (I/M) programs, emission mode and output options. A single scenario contains unique selections for the basic scenario data, for example:

Geographic Area – Los Angeles
Method – Simple Average
Calendar Year – User input of 2002
Season or Month – July
Title – Leave as default
Model Years Included – Leave as default
IM Programs – Leave as default

This section describes the choices available to the user for geographic area, calendar year, month or season selection, and model years included in the calculation. The choice of emission mode and output options is described in later sections.

Geographic area

In a single scenario, the model can estimate emissions for one of these four area types: statewide, air basin, air pollution control district, and county. Depending on the area type selection, the user can then select an area from a list of 15 air basins, 35 air pollution districts, and 58 counties.

The model contains activity data for 69 geographic areas. These areas include counties that are in more than one air basin or air pollution district. The Emfac2001 model estimates the emissions for each geographic area more

accurately, primarily because it uses area specific activity data such as vehicle population, mileage accrual, temperature, relative humidity, fuel RVP, and I/M programs.

Method—"simple average" or "do-each-sub-area" option

In Emfac2000, the use of area-specific data increased accuracy of modeled inventories but also resulted in longer execution times. For example, in a statewide run, the model would calculate inventories for each area and then total the individual inventories. In Emfac2000 this process, depending on the computer and calendar year, could take up to 20 hours for a single calendar year. To compensate for this, Emfac2001 gives the user the option of calculating emissions using either the "Simple-Average" or "Do-Each-Sub-Area" option.

The "Simple-Average" option uses area averaging to calculate averaged parameters for temperature, speed, relative humidity, and I/M. The "Simple-Average" option provides faster emission estimates. However, the "Do-Each-Sub-Area" option provides the most accurate emission estimates since it calculates inventories using area-specific parameters. Further, the "Do-Each-Sub-Area" option generates emission factors or inventories for each sub-area for the area selected. For example, if the area type selection is air basin, the air basin selection is Lake Tahoe, and the method is "Do-Each-Sub-Area." The model will output emission factors or inventories for the portions of El Dorado and Placer Counties that are in the Lake Tahoe air basin. In addition, the model will output the total inventory for the Lake Tahoe air basin.

Note: New users should select area averaging until they are familiar with the model. Sub-area runs provide more accurate results, but they require much longer execution times, and write much larger output files. New users should try the "Do-Each-Sub-Area" option after they become familiar with the output file formats.

Calendar year

The model can estimate emissions for any calendar year between 1970 and 2040. The user can only specify one calendar year per scenario. For example, a user seeking emission inventories for the Los Angeles County for 2000 to 2005 should create a file in which only basic scenario data are edited, and the file should have six scenarios. These six scenarios correspond to the calendar years 2000, 2001, 2002, 2003, 2004, and 2005.

Month or season

The model includes data for temperature, relative humidity, and characteristics for gasoline fuel sold (fuel RVP) that vary by geographic area, calendar year, and month and season. Season is defined as summer, winter, or annual average. The summer season represents an ozone-planning inventory. The summer temperatures and relative humidities have been determined using ambient data

for days that have resulted in the worst ozone levels. The fuel RVP is based on an average of the June, July and August months. Similarly, the winter season represents a CO-planning inventory. The winter temperature and relative humidities have been determined using ambient data for days that have resulted in high CO emission levels. The winter RVP is based on average of December, January, and February months. Annual average represents an average of all the monthly inventories. This inventory takes into account appropriate factors introduced by the monthly variation in temperature, relative humidity, and fuel RVP.

Model year range and model year specific options

When a user requests an emission inventory or emission factors for a given calendar year (e.g., 2010), Emfac2001 generates emission factors and vehicle activity for vehicles from 45 model years, from the current model year back 44 years. Emfac2001 uses this entire model year range in calculating a complete emission inventory or emission factor for a given calendar year.

If the calendar year is 2010, the starting and final model years are 1965 and 2010, respectively. If the scenario year is 2010 (e.g., earlier than 2000), the starting model year is 1965, because Emfac2001's emission factor data only goes back to the 1965 model year. Emfac2001 assumes that vehicles older than 1965 have the same emission rates as 1965 models.

The model year range also gives users the ability to estimate the emission contribution of either a specific model year or a range of model years to the total inventory for a given calendar year.

Hint: For example, say the user is charged with estimating the contribution of older vehicles (1980 and older) to the total inventory in calendar year 2010. The first scenario should specify the geographic area, calendar year, 2010, season, and other options necessary for a basic scenario. In the second scenario (created by "add scenario"), the user should change the model year range to 1965 to 1980 and leave the other options the same. The first scenario will generate an emission inventory for the 2010 calendar year that incorporates all model years back to 1965. The second scenario will generate an emission inventory for 1965 to 1980. You can use this feature to estimate model year specific inventories. To do so, you must set up an input file with 45 scenarios for a given calendar year.

Inspection and maintenance options

This button gives users the ability to change the I/M options for a given area. However, as with model year options, new users should not change the default I/M options until they have reviewed the advance modeling concepts. The model contains a data file, which describes the different types of I/M programs implemented during various calendar years and in various regions of the State. Emfac2001 uses these data in calculating regional emission inventories.

Hint: As vehicles age, their emissions increase as a result of vehicle defects, mal-maintenance, or tampering. One way to reduce in-use emissions is to have I/M programs that identify and repair defective vehicles. In California, the first I/M program was implemented in 1984. It was revised in 1990, 1996, 1998, and 2001. In the model, these I/M programs are modeled sequentially. As a result, emission deterioration rates from some vehicles may have been modified by I/M effects of up to five different programs.

If the user presses the I/M Options button a secondary form is displayed, titled "I/M Programs." This form displays the available I/M programs specific to the area being modeled, sub-programs for the currently active I/M program, the start date for the currently active I/M program and the type of I/M programs that have been implemented in the area that was selected.

5.0 SYSTEM REQUIREMENTS AND INSTALLATION

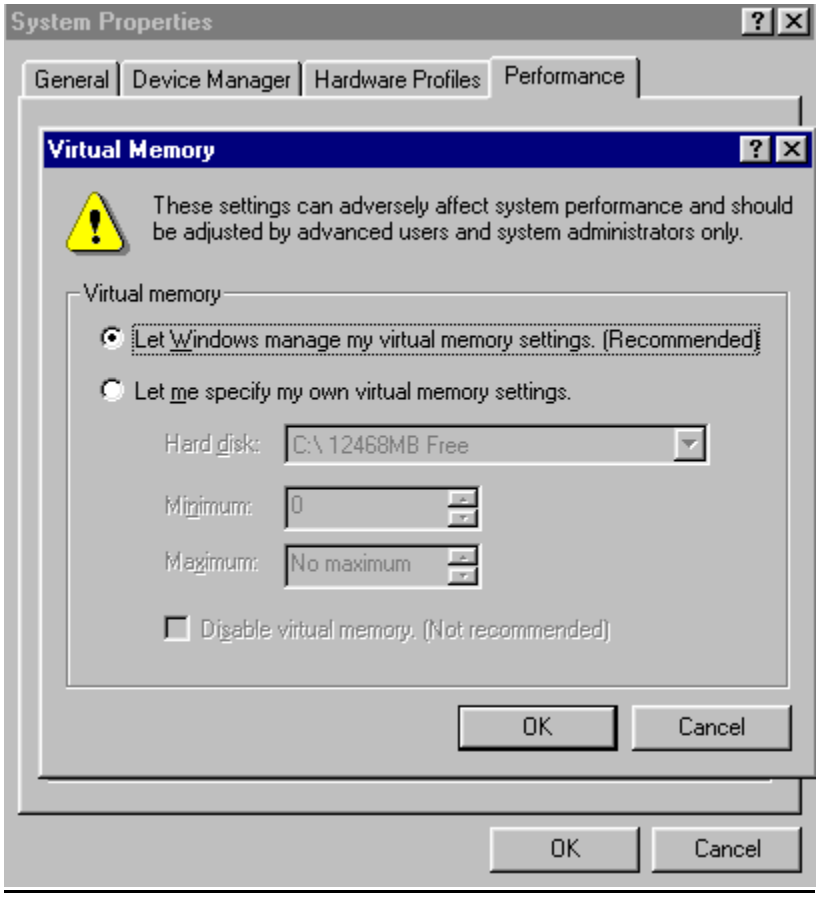
System requirements

The program will run on any Intel-based PC running Windows 95 or later, or Windows NT 4.0 or later. The installation will require 5 MB of disk space for the installation program and 35 MB of disk space for the installed files.

At least 64 MB of RAM is required. Calculations may run extremely slowly on systems with less than 128 MB of RAM.

Typical input files will require less than 1 MB. Depending on output options, the program may generate very large output files. During a run, the model may increase total virtual memory use by nearly 300 MB; the Windows virtual memory settings must allow for this. Your virtual memory setting should be defaulted to "Let Windows manage my virtual memory settings." For example, to check this setting with Windows 98, click on ***My Computer***, ***Control Panel***, ***System Properties***, and then the ***Performance Tab***. *(See figure 1)*

Figure 1 Windows 98 Example



Installation

- The program must be installed using the installation program provided by (ARB). The installation program is available on the ARB Web site, at http://www.arb.ca.gov/msei/msei.htm

During installation, you may install the "Main Program," the "Support Libraries," or both. *Most users will need to install both options*. You may bypass the "Support Libraries" only if the correct versions of Compaq Visual Fortran and the Compaq Array Visualizer are already installed on the workstation.

Removal

The program should be removed using the Windows "Add/Remove Programs" option on the Control Panel.

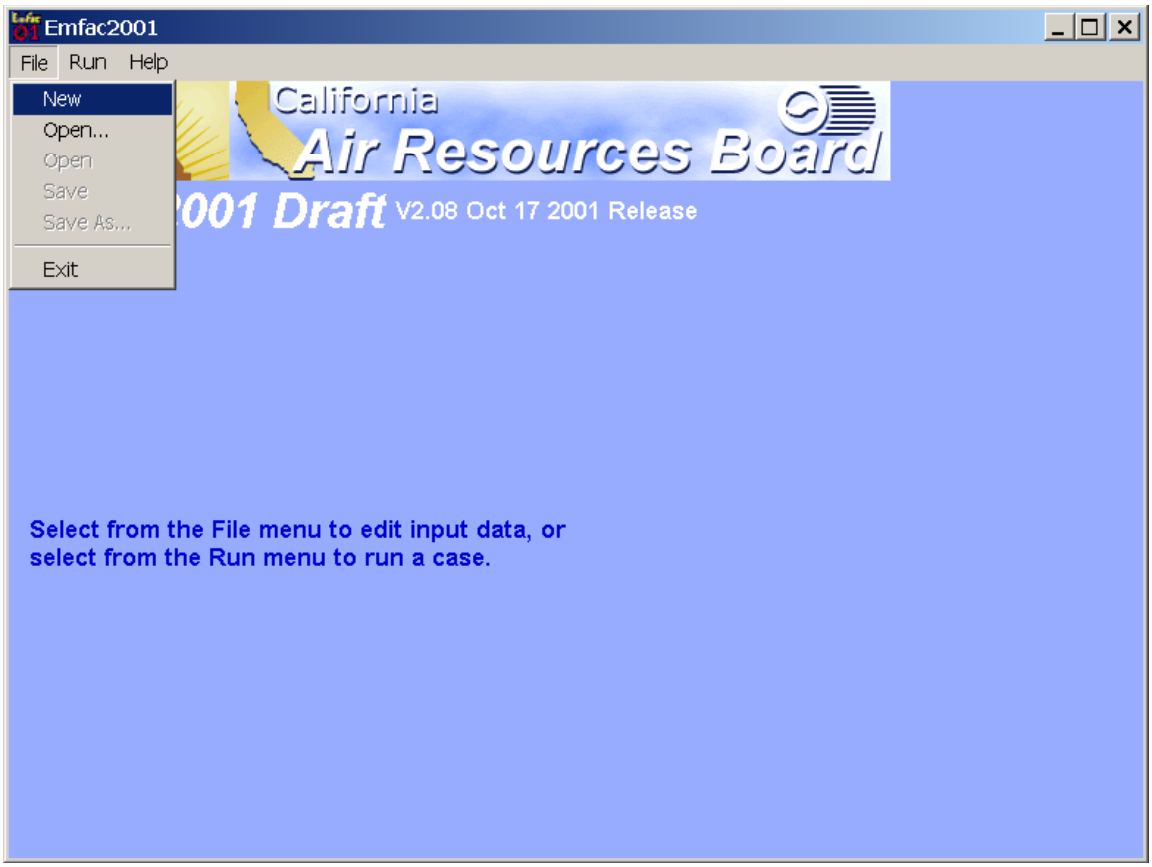
Note: Compaq and Visual Fortran users must take special care to the following: the "Support Libraries" installed include DLL files for the Compaq Visual Fortran run-time and for the Compaq Array Visualizer ActiveX control. If you have equivalent versions of Visual Fortran or the Array Visualizer installed, then you may need to re-install the DLLs and ActiveX control after removing Emfac2001.

6.0 RUNNING EMFAC2001

Starting the program

To begin, start the program by selecting the “Emfac2001” item on the Start/Programs menu, or by double-clicking the “Emfac2001” icon on the desktop. When the program starts, it opens up two windows, titled “Emfac2001” and “Emfac2001 Console.” The window labeled “Emfac2001 Console” accommodates older code in the model. This window will rarely contain any output. It should be minimized using the standard Windows minimize button. Depending on your computer, this window may automatically minimize on startup and require no action by the user. Figure 2 shows the first window.

Figure 2 Opening Dialog Window



The main menu bar offers three main selections: File, Run, and Help. This interface will be new to current users who are familiar with earlier versions of the Emfac application.

File menu

The new/open/save file menu items manipulate scenario files, such as any input files.

New: Clears some scenario default values and starts the input dialogs with no scenarios defined.

Open: Opens a file-open dialog. If the user selects a file, it is read in and the input dialogs are started.

Open filename: When enabled, this menu item re-opens the last file edited and start the input dialogs.

Save: Saves any pending changes to a file open for editing. Scenario file names must be valid Windows file names, using Windows 95 “long file name” syntax. Spaces are allowed; certain punctuation characters are not. Windows limits the length of the complete file name with path to about 255 characters.

Save as: Prompts for an alternate file name and saves the current data to the new name.

Exit: Exits the program. Prompts for confirmation if any edited data have not been saved. (The standard Windows “X” close button behaves the same way.)

Run Menu

Run: This menu item, when enabled, runs the file name displayed. (This will be the last file opened.) This item is disabled if there are unsaved editing changes, or if no file has been opened.

Run file: This menu item, when enabled, brings up a file dialog. If a file name is selected, the program reads the file and begins calculations.

Stop Run on Next Progress Report: This menu item is enabled while a run is executing. If it is selected, a flag is set, and the calculations quit the next time the flag is checked. Depending on when the Stop item is selected, it could be several seconds before the flag is examined and execution stops. The stop action closes all output files immediately. This means that all of the output files may be incomplete, even output data from scenarios that completed.

Warning: Users can’t resume once Stop is initiated.

Help Menu

About Emfac2001: Starts the About window, which displays version information.

The main screen

The second window (Figure 3) that opens when “New” or “Open” is selected from the file menu shows the file name (if known), a list of the scenarios in the file, and buttons that manipulate scenarios and files. This form is the starting point for entering scenarios in a file.

For a new file, the only buttons enabled when the form first opens are “Cancel”, “Finish”, and “Add New Scenario”. After the first scenario is added, the scenario title appears in the scenario list on the left, the scenario data box shows a summary of it, and the “Save As” and “Run” buttons are enabled. After the file is saved with “Save As”, the file name is included above the summary data, and the “Save” button is enabled.

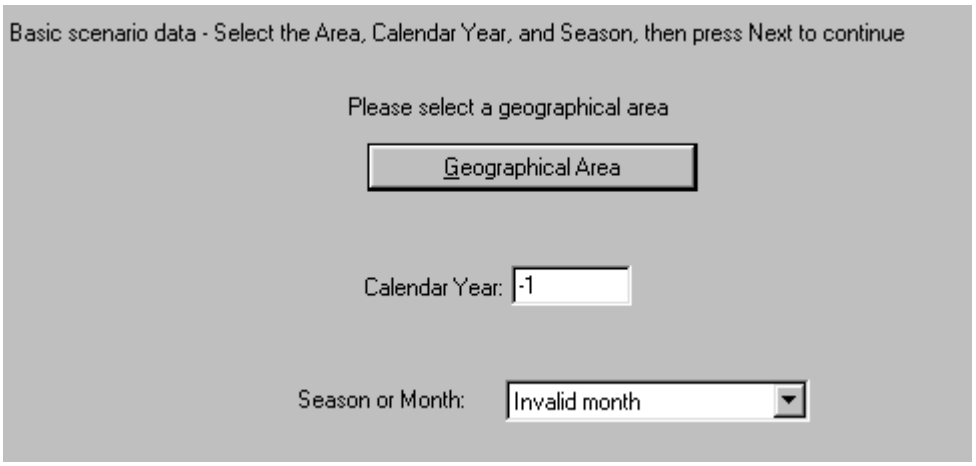
Figure 3 Second Dialog Titled Editing Data

Adding or editing scenarios

When “New” is selected, the only actions enabled on the form are “Finish”, “Cancel”, and “Add New Scenario”. The scenario list on the left is empty. In this case, “Add New Scenario” brings up the Scenario 1 tab; users see input dialogs

with some data set to program default values and some data flagged as "missing" set to invalid values. Figure 4 shows the next window that opens after "Add New Scenario" is depressed.

Figure 4 Scenario 1 Dialog



In this dialog the user is asked to select geographic area, calendar year and season or month. When the geographic area button is selected another window will open with various area options. Figure 5 shows these geographic area options.

Figure 5 Geographic Area Options

Figure 6 shows an example where all the data have been selected or entered.

Figure 6 Example Data for Scenario Tab 1

Figure 7 shows the data requirements for Scenario tab 2 after the “Next” button has been depressed.

Figure 7 Scenario Tab 2

Figure 7 also shows the default scenario name generated from data selected in scenario tab 1. Users can change this default title to something more relevant to their analysis. This window also displays all the model years that will be used in estimating an inventory for calendar year 2020. Users can change this range if they are interested in estimating emissions contribution from specific model years.

The button labeled I/M options displays the default I/M options for the geographic area selected. This option gives users the ability to change default I/M options. These will be discussed in more detail at a later time. However, new users should not change the default IM options.

The next section describes the “modes and output” selections available to the user. This dialog appears after the “Next” button is depressed.

7.0 INTRODUCTION TO THE THREE MODELING MODES

The Emfac2001 model supports calculation of emissions for the Burden, Emfac and Calimfac modes. These mode selections are made in the "Mode and Output" form shown below. Figure 8 shows the mode and output selections when the next button is depressed.

Figure 8 Mode and Output Selections

Key distinctions between model modes:
Burden: Total emissions in tons/day.
Emfac: Emission factors in grams/activity, for input to DTIM and URBEMIS.
Calimfac: Basic emission rates.

Each mode selection triggers a corresponding list of output options. In the example above the user has selected Burden mode to output emissions in tons per day. In this mode the user choose to output emission inventories in up to four file formats.

The next three sub-sections describe the Burden, Emfac and Calimfac mode selections and provide example outputs from each of the mode/output selections.

Burden mode

The Burden mode is used for calculating regional (area-specific) emission inventories. In this mode, the model reports total emissions as tons per weekday for each pollutant, by vehicle class and the total vehicle fleet. The burden mode uses emission factors that have been corrected for ambient conditions and speeds combined with vehicle activity to calculate emissions in tons per day. Vehicle activity includes the number of vehicles, how many miles are driven per day and the number of daily trips. In the burden mode, the user may select either an hourly or daily total output. The hourly output does not add substantially to calculation time, but it increases total output by a factor of 25.

Burden output

The burden output formats are:

1. Planning Inventory - This generates an output file with a “bur” extension. This file has the same format as the “bur” file generated by the MVEI7G and Emfac2000 models. To support formatting and printing on 8.5 x 11 page this older format combined vehicle categories into groups rather than report emissions for each vehicle class. For example, the heavy-duty vehicle group consists of light-heavy, medium-heavy and heavy-heavy duty vehicles.

2. Heavy-Duty Detail - This also generates an output file with a “bur” extension. This output format was created in MVEI7G to provide users with more detailed inventories for trucks. However, in order to support formatting and printing on a legal size paper this format omitted emissions from passenger cars. Note if the user requests both (1) and (2) then a single “bur” file is created containing both outputs.

3. Text File (CSV) - This is a comma-separated file (with a “csv” extension) which can be read by any spreadsheet program. It contains emission inventories for all 13-vehicle classes by fuel type. It is recommended that new users select this as an output option to get an idea of the entire inventory.

4. MVEI7G (CSV) File - This is also a comma-separated file but it has a “bcd” extension. This file is in the same format as that produced by the MVEI7G model. This file has the same information as (3.) but in columnar format, which makes it suitable for sorting using spreadsheets.

Table 2 provides a summary of the Burden mode output extensions.

Table 2 Burden Report Extensions

Option on Input Form (Report Type)	Filename Extension Used
Planning Inventory	BUR
Heavy-Duty Detail (Planning Inventory Detail)	BUR
Text File (CSV) (Planning Inventory Spreadsheet)	CSV
MVEI7G CSV File (Planning Inventory Database)	BCD

Burden output reports

This section provides some sample outputs from the Burden mode.

BUR extension

If both "Planning Inventory" and "Heavy-Duty Detail" are selected then the "Planning Inventory" report always written first. Both reports duplicate older report formats generated by the MVEI7G and Emfac2000 models. The older reports were also written to a BUR file extension.

Planning Inventory Report Format: This report format includes results for the entire fleet. To support formatting and printing on letter size (8.5 x 11) paper, this format combines vehicle classes into categories rather than report emissions for each class. For example, the medium-duty truck category combines medium-duty trucks (MDV) and two light-heavy-duty truck (LHDT1 and LHDT2) classes.

Heavy Duty Detail Report Format: This report format provides users with more detailed inventories for trucks. However, in order to support formatting and printing on legal size (8.5 x 14) paper this format omits emissions from passenger cars.

Viewing the File: The file can be opened in most text editors and word processors. The file will often be too large for Windows Notepad, but WordPad or Word can be used instead. Using WordPad is a quick way to view the file, but it will be difficult to print or to zoom out to see the entire file at once.

Hint: In Word the select the Courier New font (or another fixed-width font), a Regular font style, and 6-point size. You may need to type size "6" if it is not in the list. Change the page orientation to "Landscape" and adjust the page width until lines don't wrap in the report. Note, use a 5-point size if the file includes any heavy-duty detail reports.

Figure 9 shows a screen grab of the planning inventory format (*.BUR) where the season selection was annual average.

Figure 9 Format of the Annual Average Inventory with *.BUR Extension

```
Title    : Statewide totals Avg 2020 Annual Default Title
Version  : Emfac2001 Draft V2.08 Oct 17 2001 Release
Run Date : 05/15/02 10:08:42
Scen Year: 2020 -- Model Years: 1975 to 2020
Season   : Annual
Area     : Statewide totals
I/M Stat : I and M program in effect
Emissions: Tons Per Day
*******************************************************************************

          - - - Light Duty Passenger Cars - - -   - - - - - Light Duty Trucks - -
          Non-cat       Cat    Diesel     Total   Non-cat       Cat    Diesel
 ******************************************************************************
 Vehicles     4709. 19145400.     9305. 19159400.     4429.  8554590.    22228.  8
 VMT/1000       86.   642095.      193.   642374.       77.   281224.      546.
 Trips       17977.118691000.    43478.118752000.    17008. 52410900.   125783. 52
 ------------------------------------------------------------------------------

 Run Exh       0.28     22.03      0.05     22.36      0.19     14.29      0.06
 Idle Exh      0.00      0.00      0.00      0.00      0.00      0.00      0.00
 Start Ex      0.05     24.01      0.00     24.06      0.04     16.29      0.00
              -------   -------   -------   -------   -------   -------   -------
 Total Ex      0.33     46.04      0.05     46.41      0.23     30.59      0.06

 Diurnal       0.04     11.30      0.00     11.34      0.03      7.25      0.00
 Hot Soak      0.03     11.12      0.00     11.14      0.05      6.67      0.00
 Running       0.19     43.65      0.00     43.84      0.08     48.28      0.00
 Resting       0.02      7.45      0.00      7.48      0.02      4.80      0.00
              -------   -------   -------   -------   -------   -------   -------
 Total         0.61    119.56      0.05    120.21      0.41     97.58      0.06
 ------------------------------------------------------------------------------
```

Each report has an eight-line header followed by the report body. In figure 9, note that the header echoes all of the basic scenario data: geographic area, season, calendar year, model year range, and title. The header also echoes a long program version string, and a timestamp for when the scenario was read in.

Data Rows: The report body contains rows of data in the following order: summary vehicle activity data, followed by pollutant and process emission rates, followed by fuel consumption estimates.

Each type of emission rate is given in subtotals by the emissions process (running exhaust, hot soak, tire wear, etc.) and then totaled. Figure 9 shows the first few data rows that are visible. They include the summary vehicle activity data for vehicle population, VMT, and trips. The remaining rows show the tons per day ROG emissions from each exhaust and evaporative emissions process.

Data Columns: In the report body, the columns of data are organized by vehicle categories. Within most categories, results are listed for the three Burden technology classifications, followed by a subtotal for the category (NCAT, CAT, DSL, and Total). Some vehicle categories only include total.

The columns of data in the standard report show results for six general vehicle categories and a fleet total. The six categories include two “specific” categories

(cars and motorcycles), and four aggregated categories (light, medium, and heavy-duty trucks, and buses).

The columns of data in the heavy-duty detail report show results for the light, medium, and heavy-duty trucks, and buses. The heavy-duty truck classes are not aggregated.

CSV extension

This report is written to a file with a CSV extension. This file is very similar to the Planning Inventory Report in the BUR file, but with much more. It is a text file in comma-separated-value (CSV) format. It may contain multiple reports if the run included sub-areas and/or multiple scenarios. The report includes all of the data in the BUR report, but none of the vehicle classes are aggregated, and all vehicle/technology combinations are included.

Viewing the File: The file should be simple to open in spreadsheet programs such as Excel, and also in database programs such as Access or Sybase.

Figure 10 shows a portion of the Burden text file report as viewed in a spreadsheet.

Figure 10 Format of the Text File with *.CSV Extension

Title : BurdenA Example - Statewide totals Avg 2010 Summer								
Version : Emfac2001 Draft V2.08 Oct 17 2001 Release								
Run Date : 04/02/02 14:14:18								
Scen Year: 2010 -- Model Years: 1965 to 2010								
Season : Summer								
Area : Statewide totals								
I/M Stat : I and M program in effect								
Emissions: Tons Per Day								
**********								
	LDA-NCAT	LDA-CAT	LDA-DSL	LDA-TOT	LDT1-NCA	LDT1-CAT	LDT1-DSL	LDT1-TOT
Vehicles	197515	16573800	41735	16813000	95512	2514310	10191	2620010
VMT/1000	3688	561995	957	566641	1739	83046	235	85020
Trips	797529	1.04E+08	219216	1.05E+08	392009	15432700	54399	15879100
Total Organic Gas Emissions								
Run Exh	24.18	67.17	0.33	91.67	11.09	15.82	0.07	26.98
Idle Exh	0	0	0	0	0	0	0	0
Start Ex	4.12	52.52	0	56.64	1.94	9.87	0	11.8
	-------	-------	-------	-------	-------	-------	-------	-------
Total Ex	28.3	119.68	0.33	148.3	13.02	25.69	0.07	38.78
Diurnal	1.9	21.97	0	23.86	0.91	4.96	0	5.86
Hot Soak	2.35	16.77	0	19.12	1.19	3.33	0	4.52
Running	13.6	61.1	0	74.7	3.53	18.96	0	22.49
Resting	1.37	13.11	0	14.49	0.67	3.16	0	3.83
	-------	-------	-------	-------	-------	-------	-------	-------
Total	47.51	232.63	0.33	280.47	19.32	56.1	0.07	75.49
Carbon Monoxide Emissions								
Run Exh	274.82	1669.5	0.84	1945.16	126.8	460.54	0.2	587.53
Idle Exh	0	0	0	0	0	0	0	0
Start Ex	25.36	520.51	0	545.87	12.55	121.65	0	134.2
	-------	-------	-------	-------	-------	-------	-------	-------
Total Ex	300.18	2190.01	0.84	2491.03	139.35	582.19	0.2	721.74

This report also has an eight-line header followed by the report body. This header is essentially identical to the one in the BUR file. All of the observations about the BUR header also apply to this report's header.

Data Rows: The report body contains rows of data in the following order: summary vehicle activity data, followed by pollutant and process emission rates, followed by fuel consumption estimates.

Each type of emission rate is given in subtotals by the emissions process (running exhaust, hot soak, tire wear, etc.) and then totaled. Figure 10 shows the first few data rows that are visible. They include the summary vehicle activity data for vehicle population, VMT, and trips. The remaining rows show the tons per day ROG emissions from each exhaust and evaporative emissions process. The remaining rows show the CO emissions from exhaust emission processes.

Data Columns: In the report body, the columns of data are grouped by thirteen vehicle classes. Within each class, results are listed for the three Burden technology classifications, followed by a subtotal for the vehicle class (NCAT, CAT, DSL, and Total).

Since not all vehicle classes use every technology (there are no diesel motorcycles), some output columns are only placeholders.

BCD extension

This report is written to a file with a BCD extension. Although it uses a BCD extension, this is a text file in comma-separated-value (CSV) format. It duplicates the BCD reports produced by the MVEI7G model. This file contains the same data as the Planning Inventory spreadsheet "Text File (CSV)" report, but in record format rather than tabular format, which makes it suitable for database selections and spreadsheet sorting.

Viewing the File: The file should be simple to open in database programs such as Access or Sybase, and also in spreadsheet programs such as Excel. Since the file does not have a CSV extension, you may need to specify the format as "delimited" with a comma for the delimiter.

Figure 11 shows a portion of the Burden report, as viewed in a spreadsheet, with a BCD extension.

Figure 11 Format of the MVEI7G CSV file with *.BCD

CALYR	START MY	END MYR	AIR BASIN	COUNTY	STARTS	POPULAT	VMT/1000	VEH TYPE	VEH TECH	POLLUTAI	PROCESS	EMISSION	BASIS
2010	1965	2010	State Aver	State Aver	797529	197515	3688	LDA	NCAT	CO	Run Exh	274.815	Day
2010	1965	2010	State Aver	State Aver	797529	197515	3688	LDA	NCAT	NOx	Run Exh	16.88	Day
2010	1965	2010	State Aver	State Aver	797529	197515	3688	LDA	NCAT	SOx	Run Exh	0.025	Day
2010	1965	2010	State Aver	State Aver	797529	197515	3688	LDA	NCAT	PM	Run Exh	0.131	Day
2010	1965	2010	State Aver	State Aver	797529	197515	3688	LDA	NCAT	Pb	Run Exh	0	Day
2010	1965	2010	State Aver	State Aver	797529	197515	3688	LDA	NCAT	TOG	Run Exh	24.175	Day
2010	1965	2010	State Aver	State Aver	797529	197515	3688	LDA	NCAT	CO2	Run Exh	2075.46	Day
2010	1965	2010	State Aver	State Aver	797529	197515	3688	LDA	NCAT	CO	Idle Exh	0	Day
2010	1965	2010	State Aver	State Aver	797529	197515	3688	LDA	NCAT	NOx	Idle Exh	0	Day
2010	1965	2010	State Aver	State Aver	797529	197515	3688	LDA	NCAT	SOx	Idle Exh	0	Day
2010	1965	2010	State Aver	State Aver	797529	197515	3688	LDA	NCAT	PM	Idle Exh	0	Day
2010	1965	2010	State Aver	State Aver	797529	197515	3688	LDA	NCAT	Pb	Idle Exh	0	Day
2010	1965	2010	State Aver	State Aver	797529	197515	3688	LDA	NCAT	TOG	Idle Exh	0	Day
2010	1965	2010	State Aver	State Aver	797529	197515	3688	LDA	NCAT	CO2	Idle Exh	0	Day
2010	1965	2010	State Aver	State Aver	797529	197515	3688	LDA	NCAT	CO	Start Ex	25.362	Day
2010	1965	2010	State Aver	State Aver	797529	197515	3688	LDA	NCAT	NOx	Start Ex	1.15	Day
2010	1965	2010	State Aver	State Aver	797529	197515	3688	LDA	NCAT	SOx	Start Ex	0.002	Day
2010	1965	2010	State Aver	State Aver	797529	197515	3688	LDA	NCAT	PM	Start Ex	0.011	Day
2010	1965	2010	State Aver	State Aver	797529	197515	3688	LDA	NCAT	Pb	Start Ex	0	Day
2010	1965	2010	State Aver	State Aver	797529	197515	3688	LDA	NCAT	TOG	Start Ex	4.121	Day
2010	1965	2010	State Aver	State Aver	797529	197515	3688	LDA	NCAT	CO2	Start Ex	174.716	Day
2010	1965	2010	State Aver	State Aver	797529	197515	3688	LDA	NCAT	CO	Total Ex	300.178	Day

There is one header row that contains names for the 14 fields.

Data Rows: Each row (record) in the file contains a single emission rate for a combination of one pollutant and one process or process total. The record includes several types of fields:

- Five "header" fields that echo scenario data (calendar year, model year range, and geographic area);
- Three fields that echo activity summary data (starts, population, and VMT);
- Five index fields (vehicle class, technology category, pollutant, process, and time basis); and
- One value field (emissions) with emission rate.

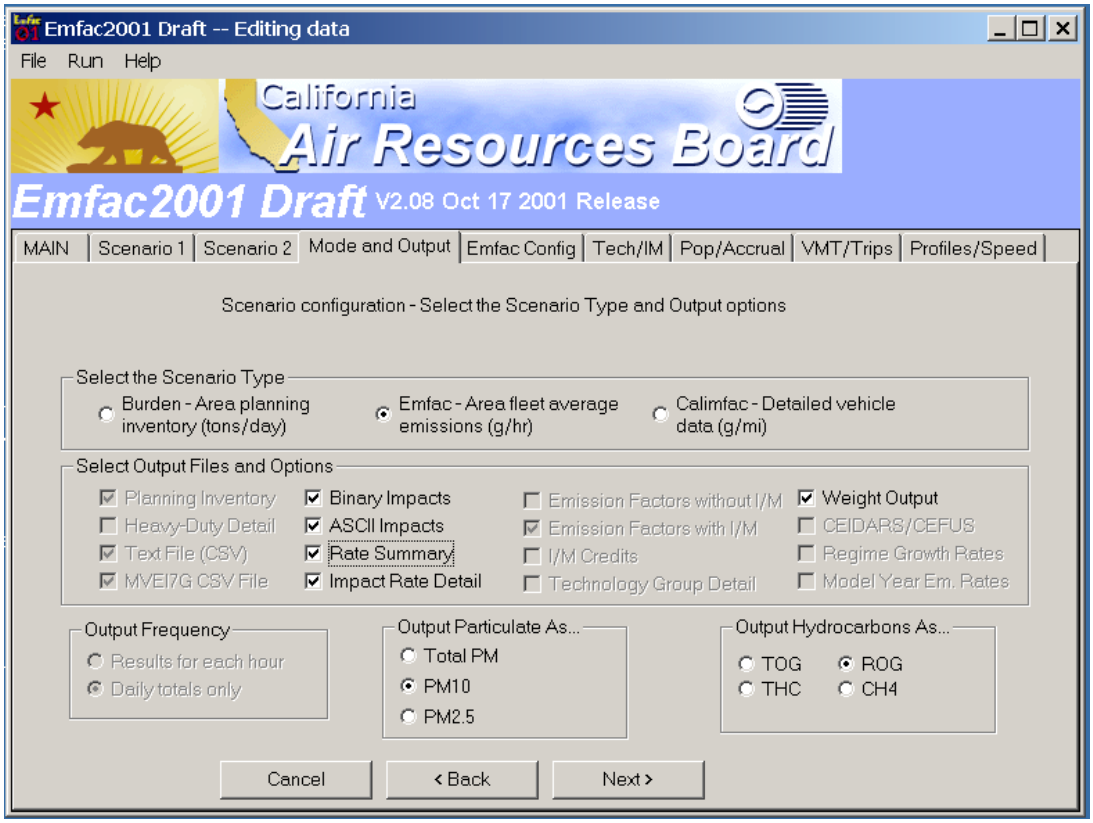
There are a few items to note about the records:

- The combination of the five index fields uniquely identifies each record. (If there is no hourly output, the time basis field is not needed as an index.)
- There is a record for every combination of indexes, including those with no population and those that are never calculated. This yields 4095 data records (13 vehicle classes, 3 technology categories, 7 pollutants, and 15 processes and process totals).
- Unlike the other Burden reports, there are no totals across technology categories, no subtotaled vehicle categories, and no fleet grand totals across all vehicle classes. The user is expected to construct these values with database queries or spreadsheet calculations.
- The header fields are duplicated on every record.
- The activity data is unique by vehicle class and technology category, so it is duplicated for pollutant and process combinations.

Emfac mode

The Emfac mode generates emission factors in terms of grams of pollutant emitted per vehicle activity. Vehicle activity can be in terms of grams per mile or grams per hour, or grams per start, and depends on the emissions process. The emission factors depend on basic scenario data options for geographic area, calendar year and month or season. In the Emfac mode the model calculates a matrix of emission factors at specific values of temperature (-20°F to 120°F), relative humidity (0% to 100%), and vehicle speed (idle and 1 mph to 65 mph) for each vehicle class/technology combination. In the Emfac mode, an additional input form allows users to customize their output and select specific temperature, relative humidities and speed values. One important use for the Emfac mode is to generate files for use with the DTIM model. The output files are also used in other air quality models such as AIRSHED, CALINE and URBEMIS. Figure 12 shows the output options available in the Emfac mode.

Figure 12 EMFAC Mode Output Selections



Emfac output

The Emfac mode output files are:

1. Binary Impacts. This is a binary file with a “bin” extension. This format was created to provide outputs compatible with other computer platforms, and now is almost redundant given the other output format.

2. ASCII Impacts. This is an ascii text file with a “erp” extension. This file is used in gridded inventory models such as DTIM.

3. Rate Summary. This file (also known as “reports format”) has an “rts” extension. This is a summary file in that vehicle classes are grouped for reporting purposes. This output format is similar to that generated by the MVEI7G model.

4. Impact Rate Detail. This file as the name implies generates detailed information for each vehicle class and technology group combination. This file has an “rtl” extension but is in a CSV format. Hence, any spreadsheet program can read this file. It is recommended that new users output this file to get a feel for the type of information generated in Emfac mode.

In Emfac mode, the model calculates a matrix of corrected emission factors. The emission factor units are suitable for input to other models such as DTIM, AIRSHED, CALINE and URBEMIS. The primary Emfac reports are formatted for this purpose.

Table 3 provides a summary of the Emfac mode output extensions.

Table 3 File Output Extensions

Option on Input Form	**Filename Extension Used**
Binary Impacts	BIN
ASCII Impacts	ERP
Rate Summary	RTS
Impact Rate Detail	RTL

The Emfac mode calculates a matrix of emission factors at specific values of temperature, relative humidity, and vehicle speed. For each of these, the user can provide from 1 to 24 values.

The default Emfac scenario data includes 24 temperatures, 11 humidity values, and 13 speeds, for 3432 total Temperature/Relative Humidity/speed

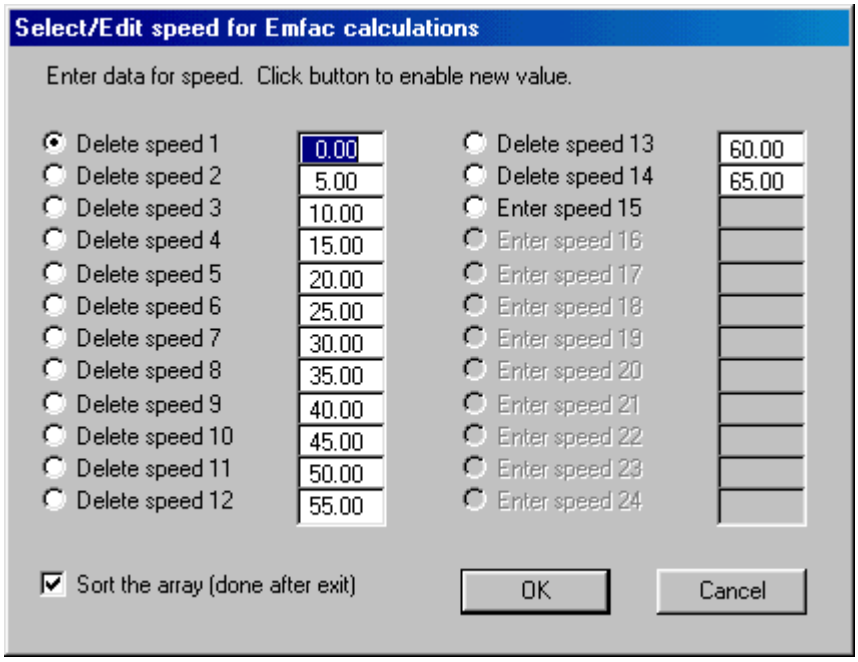
combinations. (Note that Emfac output files are large, and total file size depends on the number of combinations.)

After selecting the output reports and report options in the “Mode and Output” form, pressing “Next” will activate the “Emfac Configuration” form (Figure 13). This form gives access to the three forms used to edit the lists of values for temperature, humidity, and speed.

Figure 13 Emfac Output Configuration Form

The list editing forms for temperature, relative humidity and speed are all the same. Figure 14 shows the list editing form for speed. In this form the user can either select to output emission factors for all speeds or delete some of the speed bins and hence minimize the size of the output file.

Figure 14 List Editing Form for Speed



EMFAC output reports

This section provides some sample outputs from the Emfac mode.

RTS extension

The impact rate summary file generates a file with an *.RTS extension. The impact rate summary report is an ASCII text report that contains column-delimited fixed format reports. It will contain multiple reports if the run included sub-areas and/or multiple scenarios. The report includes data aggregated for all fuels and technologies, in five vehicle categories plus a total. The report does not include results by fuel, technology, or individual vehicle class. The file can be opened in most text editors and word processors.

Figure 15 shows an output from *.RTS file.

Figure 15 Example of Impact Rate Summary Format.

```
Title    : Statewide totals Avg 2020 Annual Default Title
Version  : Emfac2001 Draft V2.08 Oct 17 2001 Release
Run Date : 05/15/02 10:08:42
Scen Year: 2020 -- Model Years: 1975 to 2020
Season   : Annual
Area     : Statewide totals
*******************************************************************************
     Year:2020 -- Model Years 1975 to 2020 Inclusive --  Annual
     Emfac2001 Draft Emission Factors: V2.08 Oct 17 2001 Release

     State Average                    State Average                State Average

                          Table   1:  Running Exhaust Emissions (grams/mile)

     Pollutant Name: Reactive Org Gases       Temperature:  75F  Relative Humidity:  40%

     Speed
      MPH       LDA      LDT      MDT      HDT      UBUS     MCY      ALL

        5      0.166    0.231    0.383    0.697    6.022    4.633    0.258
       10      0.108    0.151    0.257    0.527    4.055    3.486    0.174
       15      0.075    0.105    0.182    0.411    2.846    2.759    0.124
       20      0.054    0.076    0.135    0.329    2.081    2.298    0.093
       25      0.041    0.058    0.106    0.271    1.586    2.015    0.073
       30      0.033    0.047    0.086    0.229    1.258    1.860    0.060
       35      0.028    0.040    0.074    0.199    1.040    1.809    0.052
       40      0.025    0.035    0.066    0.177    0.894    1.853    0.047
       45      0.023    0.033    0.062    0.161    0.800    1.998    0.044
       50      0.023    0.032    0.062    0.150    0.746    2.267    0.044
       55      0.024    0.033    0.064    0.144    0.723    2.704    0.045
       60      0.026    0.036    0.069    0.141    0.729    3.389    0.050
       65      0.030    0.041    0.079    0.141    0.764    4.460    0.057
```

Each report consists of a series of report tables, with each table containing data for a different emissions process. The titles for each table are:

```
Table   1:  Running Exhaust Emissions (grams/mile; grams/hr for idle)
Table   2:  Starting Emissions (grams/trip)
Table   4:  Hot Soak Emissions (grams/trip)
Table  5a:  Partial Day Diurnal Loss Emissions (grams/hour)
Table  5b:  Multi-Day Diurnal Loss Emissions (grams/hour)
Table  6a:  Partial Day Resting Loss Emissions (grams/hour)
Table  6b:  Multi-Day Resting Loss Emissions (grams/hour)
Table   7:  Estimated Travel Fractions
Table   8:  Evaporative Running Loss
```

Table 1 is repeated for each combination of temperature and relative humidity. Tables 2, 4, and 8 are repeated for each temperature. Tables 5a through 7 are only included once. The lines of results in each table vary by the number of speeds and temperatures.

Header and Data Rows: Each table in the report has a 13-line header, followed by the table title, followed by a series of sub-tables. Each sub-table has a one-line identifier followed by columns headings and data.

Data Columns: In each table body, the columns of data are grouped by five aggregated vehicle categories plus a total for all vehicles. This format is similar to that available in MVEI7G model.

RTL extension

The Impact Rate Detail file has an *.RTL extension. This file provides more detailed information than the RTS file. It is a text report in comma-separated-value (CSV) format. It will contain multiple reports if the run included sub-areas and/or multiple scenarios.

The size of each report is variable, depending on the number of combinations of temperature, relative humidity, and speed in the Emfac matrix. The file should be simple to open in spreadsheet programs such as Excel. The report includes all of the data in the Impact Rate Summary report, but results are included for each of the 13 vehicle classes and for the three Burden technology categories (CAT, NCAT, and DSL). The column layout is very similar to the Burden CSV report.

Figure 16 shows an output from the RTL file. This file is typically used as an input file to URBEMIS and CALINE Models.

Figure 16 Example of the Impact Rate Detail Format.

Title : Statewide totals Avg 2020 Annual Default Title
Version : Emfac2001 Draft V2.08 Oct 17 2001 Release
Run Date : 05/15/02 10:08:42
Scen Year: 2020 -- Model Years: 1975 to 2020
Season : Annual
Area : Statewide totals

Year: 2020 -- Model Years 1975 to 2020 Inclusive --
Emfac2001 Draft Emission Factors: V2.08 Oct 17 2001 Release

State Average State Average

Table 1: Running Exhaust Emissions (grams/mile)

Pollutant Name: Reactive Org Gases Temperature: 75F Relative Humidity: 40%

Speed MPH	LDA NCAT	LDA CAT	LDA DSL	LDA ALL	LDT1 NCAT	LDT1 CAT	LDT1 DSL	LDT1 ALL
5	8.452	0.165	0.619	0.166	6.541	0.251	0.661	0.255
10	5.991	0.107	0.486	0.108	4.63	0.169	0.519	0.172
15	4.44	0.074	0.39	0.075	3.426	0.119	0.417	0.122
20	3.442	0.053	0.32	0.054	2.652	0.088	0.342	0.09
25	2.791	0.041	0.268	0.041	2.147	0.068	0.287	0.07
30	2.37	0.033	0.23	0.033	1.821	0.056	0.246	0.057
35	2.108	0.028	0.202	0.028	1.618	0.047	0.215	0.049
40	1.965	0.024	0.181	0.025	1.507	0.042	0.193	0.043
45	1.921	0.023	0.165	0.023	1.473	0.04	0.177	0.041
50	1.97	0.022	0.155	0.023	1.51	0.039	0.165	0.04
55	2.117	0.023	0.148	0.024	1.624	0.04	0.158	0.041

This report includes exactly the same series of tables and sub-tables as the Impact Rate Summary report. In each table body, there are 56 columns of data, for 13 vehicle classes plus a fleet total, and 3 technology categories pus a total.

ERP extension

The ASCII Impacts report file has an *.ERP file extension. This report format is used as an input to the (Direct Travel Impact Model) DTIM. This is an inventory model that requires emission estimates (primarily) in grams per hour. These estimates are then multiplied by time spent on each freeway link to generate emission estimates in each grid.

Figure 17 shows a sample output from the impact rate file. The ASCII Impacts ERP file is an ASCII column-delimited fixed format report, with records using a format specific to the **DTIM** model. For most purposes, this report can only be used by programs written for the DTIM record format.

Figure 17 Example of the ASCII Impact Rate File

```
11Statewide totals Avg 2020 Annual Default Ti
12Emfac2001 DraftV2.08 Oct 17 2001 Release
2 2020                  13 1 1        05/15/02
31  5 10 15 20 25 30 35 40 45 50 55 60 65
41 75
51 40
6A 11LDA NCAT 0.0001 0.0002 0.0003   6633.
7A 11LDA NCAT 0.000000 0.000000 0.000000
6B 12LDA CAT  0.9995 0.9994 0.9992  12255.
7B 12LDA CAT  0.000000 0.000000 0.000000
6C 13LDA DSL  0.0003 0.0004 0.0005   7574.
7C 13LDA DSL  0.000000 0.000000 0.000000
8 ROG CO  NOX CO2 EX10TW10BW30FUELEVAP
9B 11YA  0  0  0     0.000     0.000     0.000     0.000     0.000     0.000
9L 11YA  0 75  0     0.087     0.000     0.000     0.000     0.000     0.000
9K 11YA  0 75  0     0.000     0.000     0.000     0.000     0.000     0.000
9G 11YA  0 75  0     0.038     0.000     0.000     0.000     0.000     0.000
9S 11YA  0 75  0     1.368    14.741     0.874   111.902     0.011     0.000
9S 11YA  0 75  0     1.356    13.053     0.950   121.432     0.010     0.000
9S 11YA  0 75  0     1.369    10.076     1.089   139.927     0.008     0.000
9S 11YA  0 75  0     1.431     7.630     1.208   157.671     0.006     0.000
9S 11YA  0 75  0     1.541     5.715     1.310   174.663     0.004     0.000
9S 11YA  0 75  0     1.699     4.330     1.393   190.904     0.003     0.000
9S 11YA  0 75  0     1.767     3.476     1.457   206.393     0.003     0.000
9S 11YA  0 75  0     1.938     9.371     1.460   279.289     0.007     0.000
9S 11YA  0 75  0     2.110    14.808     1.425   279.509     0.011     0.000
9S 11YA  0 75  0     2.282    19.668     1.379   279.728     0.015     0.000
9S 11YA  0 75  0     2.453    23.952     1.322   279.948     0.018     0.000
9S 11YA  0 75  0     2.625    27.659     1.253   280.167     0.021     0.000
9S 11YA  0 75  0     2.797    30.791     1.173   280.387     0.023     0.000
9S 11YA  0 75  0     2.968    33.346     1.081   280.606     0.025     0.000
9S 11YA  0 75  0     3.140    35.326     0.979   280.826     0.027     0.000
9S 11YA  0 75  0     3.312    36.729     0.865   281.045     0.028     0.000
```

BIN extension

The Binary Impacts file has the same information as the ASCII impacts file except that it is in binary file. The file has a *.BIN extension. This file cannot be viewed/read as ASCII text. It was originally used for supporting earlier versions of DTIM. It's use is now limited.

Calimfac mode

The Calimfac mode is used to calculate very detailed emission rates (basic emission rates or BER) for each vehicle class and model years from 1965 to the scenario calendar year. As a vehicle ages its emissions increase with vehicle mileage. In the Calimfac mode a linear fit is made to the emissions increase with vehicle mileage. This linear fit results in a zero mile rate (emissions when the vehicle is new) and deterioration rate (emissions increase every 10,000 miles) with a flex point where the deterioration rate changes for higher odometer values. These BER are based on standardized driving tests (FTP and UC) and the user can select outputs based on either bag 1, bag 2, bag 3 of the FTP or bag 1, bag 2 of the UC driving cycle. In addition, the user can elect to have the emission factors calculated with or without correction factors, which account for factors not encountered during standardized tests. The types of data that the Calimfac mode can report include:

- Emission rates
- I/M credit factors (difference in emission factors with and without I/M)
- I/M program description
- Constants for calculating emission rates; and
- Regime fractions (fraction of fleet vehicles in each emission regime).

These types of data are available for a number of combinations of options, such as:

- With and without I/M programs
- Using basic emission rates based on FTP composite data or based on either (1) bag 1, bag 2, or bag 3 of the FTP or (2) bag 1 or bag 2 of the UC driving cycle
- With and without correction factors. With correction factors implies that the basic emission rates are corrected for ambient and driving conditions not encountered during standardized testing.

The data can be reported at different levels of aggregation:

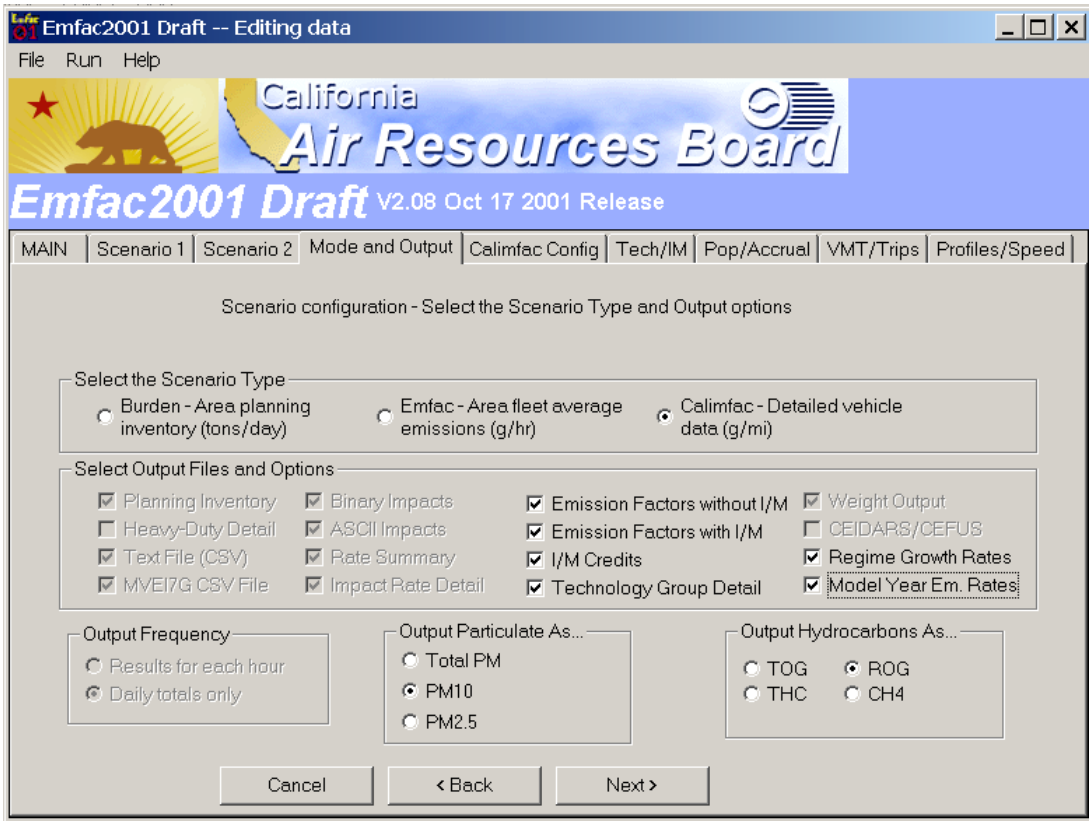
- By calendar year with model year and technology group aggregated
- By calendar year and model year with technology group and fuel aggregated

Regime fractions are reported in disaggregated form only, by calendar year, model year, and technology group.

In the Calimfac mode, emission factors are calculated using the same data and methodology as in Burden or Emfac mode. When “constants for calculating emission factors” (zero-mile and deterioration constants) are reported these are based on linear regressions on the modeled results.

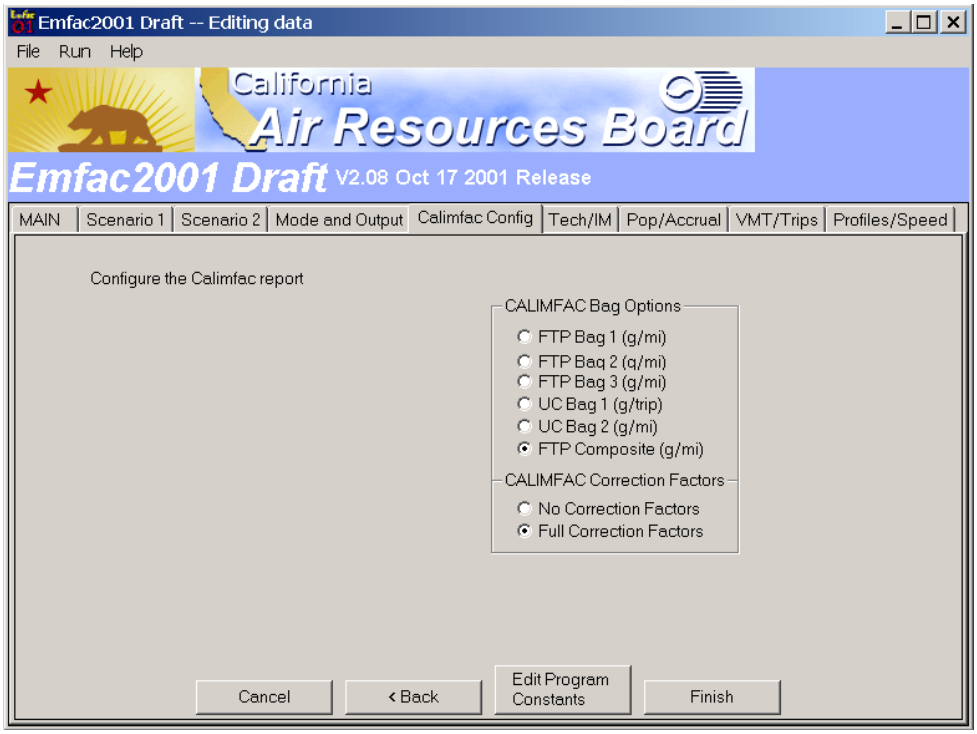
Figure 18 shows the Calimfac mode and output options.

Figure 18 Calimfac Mode and Output Options



After depressing the “Next” button the user can select to output emission rates by bag or select FTP composite rates. Further, the user can select corrected or uncorrected rates. Corrected implies that the emission rates have been adjusted with respect to temperature, relative humidity, air conditioning, speed and other factors not encountered during standardized FTP testing. Figure 19 shows the Calimfac bag and correction factor options.

Figure 19 Calimfac Bag and Correction Factor Options



Calimfac output

The Calimfac mode output files are:

- Emission Factors – without IM & with IM & IM credits & Technology group detail. When any of these options, an output file with “out” extension is created. Depending on the options selected the output file can contain emission factors for vehicles that do not undergo the biennial inspection and maintenance program, emission factors of vehicles that undergo a biennial IM program, calendar year specific benefits for the IM program, and detailed emission factors for each technology group. The emission factors are in a form of a zero mile emission rate and a deterioration rate, which shows the decay in emissions every 10,000 miles.

- Emission Factors – This selection will also generate an output file with a “cyw” extension. This file contains calendar year specific emission rates for each emissions process and vehicle class. These rates are given for both with and without IM cases.

- Model Year Em Rate – This selection can generate two files with the extensions “my1” and “my2.” The “my1” file contains emissions rates assuming no IM program, whereas the “my2” file contains emissions rates

assuming that vehicles have undergone an IM program. Both files have the same format. These files have vehicle class and model year specific emission rates for beginning with when the vehicles are first sold up to their age for the scenario year. For example, if the scenario year is 1970 then the model will output 1965 model year emissions for ages 1 through 7.

- Regime Growth Rates – This selection generates six files with extensions "rg1 rg2 rg3 rg4 rg5 rg6." These are regime growth rate files. Table 4 shows what these files mean.

Table 4 Regime Growth Rate files

Regime Growth Rates	
RG1	HC regime growth rates with no IM
RG2	CO regime growth rates with no IM
RG3	NOx regime growth rates with no IM
RG4	HC regime growth rates with IM
RG5	CO regime growth rates with IM
RG6	NOx regime growth rates with IM

These files contain the size of normal, moderate, high, very high and super emittings vehicles as a function of vehicle class, model year, technology group, and vehicle age.

Table 5 shows the Calimfac mode output file extensions.

Table 5 Calimfac File Output Extensions

Option on Input Form	**Filename Extension Used**
Emission Factors without I/M Emission Factors with I/M I/M Credits Technology Group Detail	OUT & CYW
Regime Growth Rates	RG1, RG2, RG3, RG4, RG5, RG6
Model Year Em. Rates	MY1 & MY2

Calimfac output reports

This section provides some sample outputs from the Calimfac mode.

OUT extension

When any one of the following output options is selected, an output file with extension “OUT” is created:

- Emission Factors without IM;
- Emission Factors with IM; or
- Technology Group Detail.

The *.OUT file contains reports with emission factors, by vehicle class and pollutant/process. The reports include data for:

- ZML, DET1, FLEX PT, DET2 – Constants for evaluating emission factors with deterioration based on odometer mileage.
- 0K, 50K, 100K – Emission factors evaluated at odometer mileage of 0, 50,000, and 100,000 miles.

The first two options (Emission Factors without I/M and Emission Factors with I/M) generate reports with emission factors by vehicle class, pollutant/process, and model year for the scenario calendar year.

The Technology Group Detail option generates a report of emission factors without I/M effects, by vehicle class, pollutant/process, model year, and technology group for the scenario calendar year.

The Emission Factors with I/M option also generates a report that lists the I/M programs defined. Note, this is the only report that lists I/M program details.

The file will contain multiple reports. There are four reports types possible in the OUT file, using three different formats. These reports are all column-delimited fixed format ASCII reports:

- The two model-year reports (without tech groups) are tables with eight columns.
- The tech group detail reports are tables with nine columns.
- The I/M program listings are tables with two columns.

Figure 20 shows a sample output from the *.OUT file. This file contains zero mile emissions and a deterioration rate with odometer.

Figure 20 Model Year Specific Emission Rates from the *.OUT file

```
**
** CALIMFAC v V2.08 Oct 17 2001 Release
**
** California Motor Vehicle Emissions Factor Model
**
** Statewide totals Avg 2020 Annual Default Title
**
** Output file: C:\RADIAN\EMFAC2001_ver2.08\Output_presentation\State_2020_
**
** Date of this run: 05/15/02 10:08:42
**
** Basic Emission Factor Equations      Light-Duty Autos (PC)   Without I/M
**
**                          FTP COMP  Hydrocarbons              Corrected
**
   Model
   Year      ZML      DET1    FLEX PT   DET2       0K       50K      100K
   ----- -------- --------  ------- -------  -------- -------- --------
   1975    0.4330   0.1609  11.0239  0.0130     0.433    1.238    2.042
   1976    0.4449   0.1606  11.0239  0.0125     0.445    1.248    2.050
   1977    0.1910   0.1322   9.8368  0.1052     0.191    0.852    1.508
   1978    0.2099   0.1345   9.8368  0.1025     0.210    0.882    1.550
   1979    0.2419   0.1246   9.8368  0.0877     0.242    0.865    1.482
   1980    0.1517   0.0993   8.6102  0.0405     0.152    0.648    1.063
   1981    0.0804   0.0968   8.6102  0.1025     0.080    0.564    1.056
   1982    0.0535   0.0986   9.8368  0.1037     0.053    0.546    1.040
   1983    0.0445   0.0969   9.8368  0.1005     0.044    0.529    1.014
   1984    0.0400   0.0986   9.8368  0.1021     0.040    0.533    1.026
   1985    0.0739   0.0552  13.2939  0.0205     0.074    0.350    0.626
   1986    0.0534   0.0452  17.4879  0.0085     0.053    0.279    0.505
   1987    0.0512   0.0431  17.4879  0.0111     0.051    0.267    0.482
   1988    0.0461   0.0418  17.4879  0.0134     0.046    0.255    0.464
```

CYW extension

Figure 21 shows an example of calendar year specific output contained in the *.CYW file. This file contains calendar year specific emission rates. These rates when multiplied by the appropriate activity should get the tons per day estimates by calendar year.

Each report consists of a series of report tables. The tables for factors without I/M, with I/M, and I/M credit all have the same format. The tables are ordered by vehicle class. To keep track of which report you are dealing with, note the report type in the table title, and the vehicle class in the first column of data. In the example above, the table title is "CALENDAR YEAR EMISSION FACTORS W/O I/M," and the vehicle class is 1 (LDA or personal cars).

All of the tables for a vehicle class are written together. Within a vehicle class, the tables are written in this order: factors without I/M, factors with I/M, then I/M credit factors.

Figure 21 Example of the CYW Output File

```
Title    : Statewide totals Avg 2020 Annual Default Title
Version  : Emfac2001 Draft V2.08 Oct 17 2001 Release
Run Date : 05/15/02 10:08:42
Scen Year: 2020 -- Model Years: 1975 to 2020
Season   : Annual
Area     : Statewide totals
*************************************************************

 CALENDAR YEAR EMISSION FACTORS W/O I/M
 VEH  CYR   -ROG -  --CO-- --NOx- -HtSk- -RunL- -Rest- -Drnl- -PM10-
    1 1980   0.42   9.19   0.71   0.57   2.40   0.01   0.03   0.01
    1 1981   0.48  10.82   0.76   0.62   2.60   0.01   0.03   0.02
    1 1982   0.54  12.34   0.82   0.69   2.84   0.01   0.04   0.02
    1 1983   0.60  13.80   0.87   0.74   3.04   0.02   0.04   0.02
    1 1984   0.66  15.26   0.91   0.77   3.23   0.02   0.05   0.02
    1 1985   0.70  16.49   0.94   0.82   3.44   0.02   0.05   0.02
    1 1986   0.74  17.51   0.95   0.84   3.60   0.02   0.06   0.02
    1 1987   0.77  18.37   0.96   0.81   3.71   0.02   0.06   0.02
    1 1988   0.80  19.05   0.96   0.83   3.84   0.02   0.06   0.02
    1 1989   0.83  19.61   0.96   0.82   3.88   0.03   0.07   0.02
    1 1990   0.84  20.03   0.95   0.78   3.87   0.03   0.07   0.02
    1 1991   0.85  20.25   0.93   0.77   3.86   0.03   0.07   0.02
    1 1992   0.83  19.13   0.91   0.68   3.67   0.03   0.08   0.02
    1 1993   0.83  18.81   0.88   0.65   3.54   0.03   0.08   0.01
    1 1994   0.82  18.19   0.86   0.61   3.39   0.03   0.08   0.01
    1 1995   0.80  17.33   0.83   0.55   3.18   0.03   0.08   0.01
    1 1996   0.68  15.43   0.72   0.50   2.95   0.03   0.08   0.01
    1 1997   0.65  14.52   0.70   0.47   2.77   0.03   0.08   0.01
    1 1998   0.62  13.54   0.67   0.45   2.56   0.03   0.08   0.01
    1 1999   0.57  12.50   0.64   0.42   2.34   0.03   0.07   0.01
    1 2000   0.53  11.50   0.61   0.39   2.14   0.03   0.07   0.01
    1 2001   0.49  10.53   0.58   0.37   1.95   0.03   0.07   0.01
    1 2002   0.45   9.68   0.55   0.35   1.77   0.03   0.07   0.01
```

RG1 to RG6 extensions

Selecting the “Regime Growth Rates” option generates six file outputs with the file extensions RG1, RG2, RG3, RG4, RG5, and RG6. These files contain the size of normal, moderate, high, very high and super emitting regimes as a function of vehicle class, model year, technology group, and vehicle age. Figure 22 shows an example of the regime growth rate file.

This figure shows how fraction of normal emitting vehicles decrease and the fraction of super emitting vehicles increase with vehicle age.

Figure 22 Example of Regime Growth Rate File (RG1)

```
Title    : Statewide totals Avg 2020 Annual Default Title
Version  : Emfac2001 Draft V2.08 Oct 17 2001 Release
Run Date : 05/15/02 10:08:42
Scen Year: 2020 -- Model Years: 1975 to 2020
Season   : Annual
Area     : Statewide totals
I/M Stat : No I and M program in effect
************************************************************
Regime Fractions for Hydrocarbons
IMVehMYr  TGAgePol Normal  ModerateHigh    VeryHi  SuperHi
 0  1 11   3  1  1 0.43196 0.40754 0.15560 0.00000 0.00489
 0  1 11   3  2  1 0.35748 0.35041 0.27476 0.01109 0.00626
 0  1 11   3  3  1 0.28342 0.30472 0.38326 0.02036 0.00825
 0  1 11   3  4  1 0.21299 0.26637 0.48228 0.02761 0.01075
 0  1 11   3  5  1 0.14680 0.23330 0.57274 0.03349 0.01366
 0  1 11   3  6  1 0.08489 0.20431 0.65552 0.03838 0.01690
 0  1 11   3  7  1 0.02711 0.17861 0.73138 0.04249 0.02041
 0  1 11   3  8  1 0.00000 0.15159 0.78013 0.04479 0.02349
 0  1 11   3  9  1 0.00000 0.12534 0.80319 0.04548 0.02599
 0  1 11   3 10  1 0.00000 0.10351 0.82215 0.04588 0.02846
 0  1 11   3 11  1 0.00000 0.08512 0.83791 0.04608 0.03089
 0  1 11   3 12  1 0.00000 0.06947 0.85113 0.04612 0.03328
 0  1 11   3 13  1 0.00000 0.05602 0.86229 0.04607 0.03562
 0  1 11   3 14  1 0.00000 0.04437 0.87178 0.04593 0.03791
 0  1 11   3 15  1 0.00000 0.03421 0.87989 0.04574 0.04016
 0  1 11   3 16  1 0.00000 0.02528 0.88685 0.04550 0.04236
 0  1 11   3 17  1 0.00000 0.01739 0.89285 0.04524 0.04452
 0  1 11   3 18  1 0.00000 0.01039 0.89803 0.04496 0.04663
 0  1 11   3 19  1 0.00000 0.00414 0.90252 0.04466 0.04869
 0  1 11   3 20  1 0.00000 0.00000 0.90508 0.04429 0.05064
 0  1 11   3 21  1 0.00000 0.00000 0.90390 0.04375 0.05235
 0  1 11   3 22  1 0.00000 0.00000 0.90273 0.04324 0.05403
 0  1 11   3 23  1 0.00000 0.00000 0.90156 0.04276 0.05568
```

MY1 and MY2 extension

- The “Model Year Em. Rate” option selection generates two files, with the extensions “MY1” and “MY2.” Each file contains a single report with emission factors by vehicle class, model year, and age. The MY1 file contains data for the without-I/M case, and the MY2 file contains data for the with-I/M case.

The “MY1” file contains emission rates for vehicles that have not undergone an I/M program, whereas the “MY2” file contains emissions rates assuming vehicles have undergone an I/M program. Both files have the same format. These files contain emission rates, by vehicle class and model year, beginning with when the vehicles were first sold up to their age in the scenario year. For example, if the scenario year is 1970, the model will output 1965 model year emissions for ages 1 through 7. Figure 23 shows a sample output from the *MY1 file.

Figure 23 Emission Rates by Model Year from the *MY1 file

```
Title    : Statewide totals Avg 2020 Annual Default Title
Version  : Emfac2001 Draft V2.08 Oct 17 2001 Release
Run Date : 05/15/02 10:08:42
Scen Year: 2020 -- Model Years: 1975 to 2020
Season   : Annual
Area     : Statewide totals
I/M Stat : No I and M program in effect
*******************************************************************************
```

VEH	MYR	AGE	ODOM	TFRAC	ROG	CO	NOX	PM10	HTSK
1	1975	1	16578.	0.08976	0.6050	15.1412	1.8744	0.0260	1.8234
1	1975	2	31928.	0.08178	0.9627	21.5074	2.0149	0.0271	1.8990
1	1975	3	46405.	0.07382	1.2466	26.5142	2.1232	0.0281	1.9519
1	1975	4	60190.	0.06804	1.4764	30.6823	2.2113	0.0290	2.1587
1	1975	5	73396.	0.06354	1.6684	34.2477	2.2862	0.0300	2.1153
1	1975	6	86102.	0.06025	1.8337	37.3490	2.3516	0.0309	2.2170
1	1975	7	98368.	0.05642	1.9800	40.0788	2.4099	0.0318	2.2884
1	1975	8	110239.	0.05275	2.1097	42.3745	2.4625	0.0327	2.4881
1	1975	9	121753.	0.04924	2.2136	44.3544	2.5104	0.0336	2.5894
1	1975	10	132939.	0.04590	2.3067	46.1735	2.5549	0.0345	2.6685
1	1975	11	143824.	0.04275	2.3784	47.8414	2.5961	0.0353	2.8594
1	1975	12	154430.	0.03912	2.4034	48.2363	2.6345	0.0362	2.9596
1	1975	13	164777.	0.03562	2.4264	48.5893	2.6705	0.0371	2.9426
1	1975	14	174879.	0.03226	2.4476	48.9172	2.7044	0.0380	3.0648
1	1975	15	184753.	0.02889	2.4675	49.2234	2.7365	0.0390	3.1628
1	1975	16	194412.	0.02611	2.4861	49.5104	2.7662	0.0399	3.1445
1	1975	17	203867.	0.02227	2.5036	49.7806	2.7913	0.0407	3.2612
1	1975	18	213129.	0.01835	2.4554	47.3482	2.8071	0.0413	3.0966
1	1975	19	222207.	0.01493	2.4708	47.5770	2.8299	0.0419	3.1254
1	1975	20	231111.	0.01210	2.4849	47.7945	2.8496	0.0411	3.1597
1	1975	21	239848.	0.00998	2.4963	48.0016	2.8700	0.0417	3.0929
1	1975	22	248425.	0.00894	2.1982	45.3359	2.5839	0.0423	3.0496
1	1975	23	256851.	0.00778	2.2074	45.5137	2.5862	0.0428	3.0710

8.0 EDITING FUNDAMENTAL DATA

This section contains screen prints of dialogs where the user can edit fundamental data. These screen prints complement to the real-time presentation given at the workshops.

In Emfac2001 users have the ability to determine the impact on emissions by changing fundamental data (e.g., population, trips, VMT etc.). This is done by pressing the "edit fundamental data" button and changing default data. If the default data are changed in the first scenario then the number of edits allowed in subsequent scenario is limited. This is to preserve the input data created in the first scenario. When it comes to editing fundamental data, the Emfac2001 model as currently designed is a single scenario model.

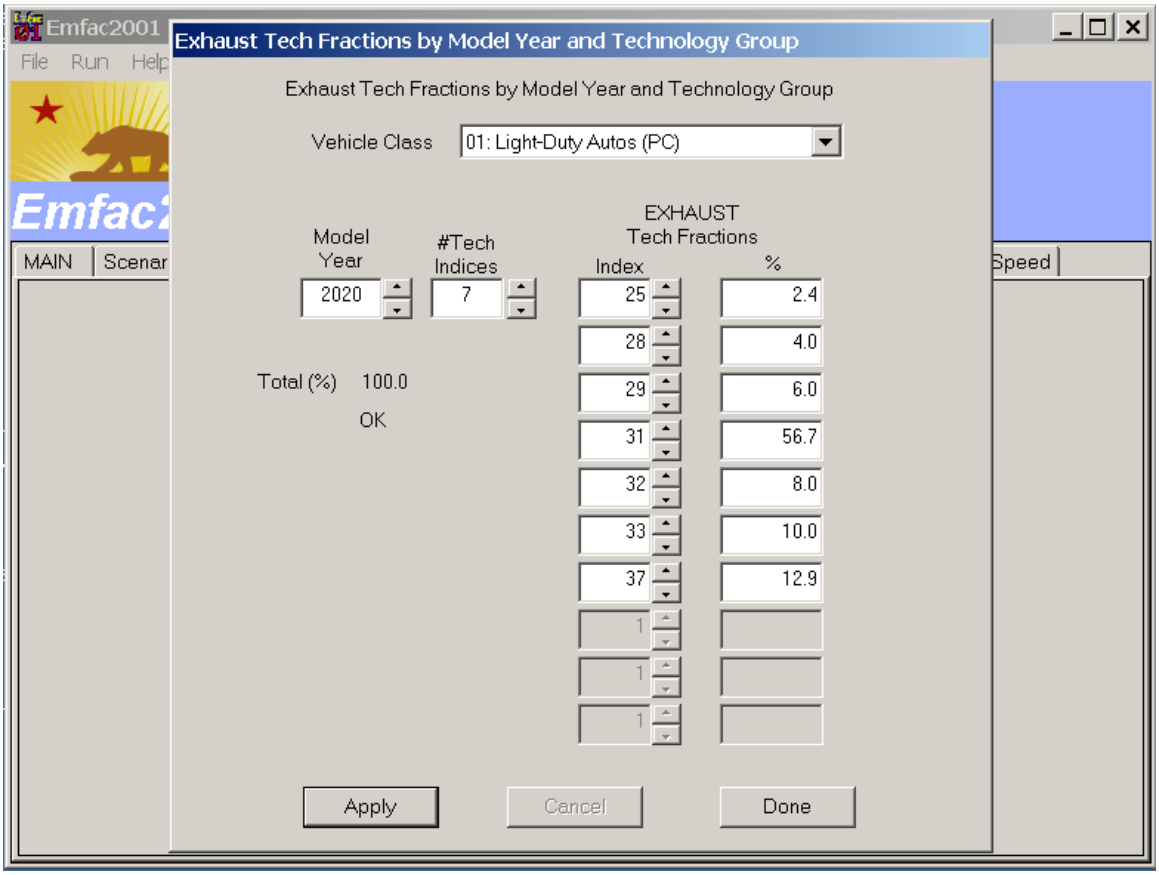
Editing technology fractions and I/M options

Figure 24 shows the dialog for editing the default exhaust and evaporative technology fractions and default I/M options.

Figure 24 Dialog For Editing Technology Fractions and I/M Options

This dialog allows the user to change default sales fractions. These sales fractions reflect the type of vehicles sold in each model year. The sales fractions or technology fractions are specific to each vehicle class. This dialog has been used extensively by groups interested in estimating the effect on inventory from changing the percentage of either zero emitting vehicles or low emission vehicles. Figure 25 shows the next dialog when the "Exh tech Fraction" button is depressed.

Figure 25 Dialog for Editing Exhaust Technology Fraction



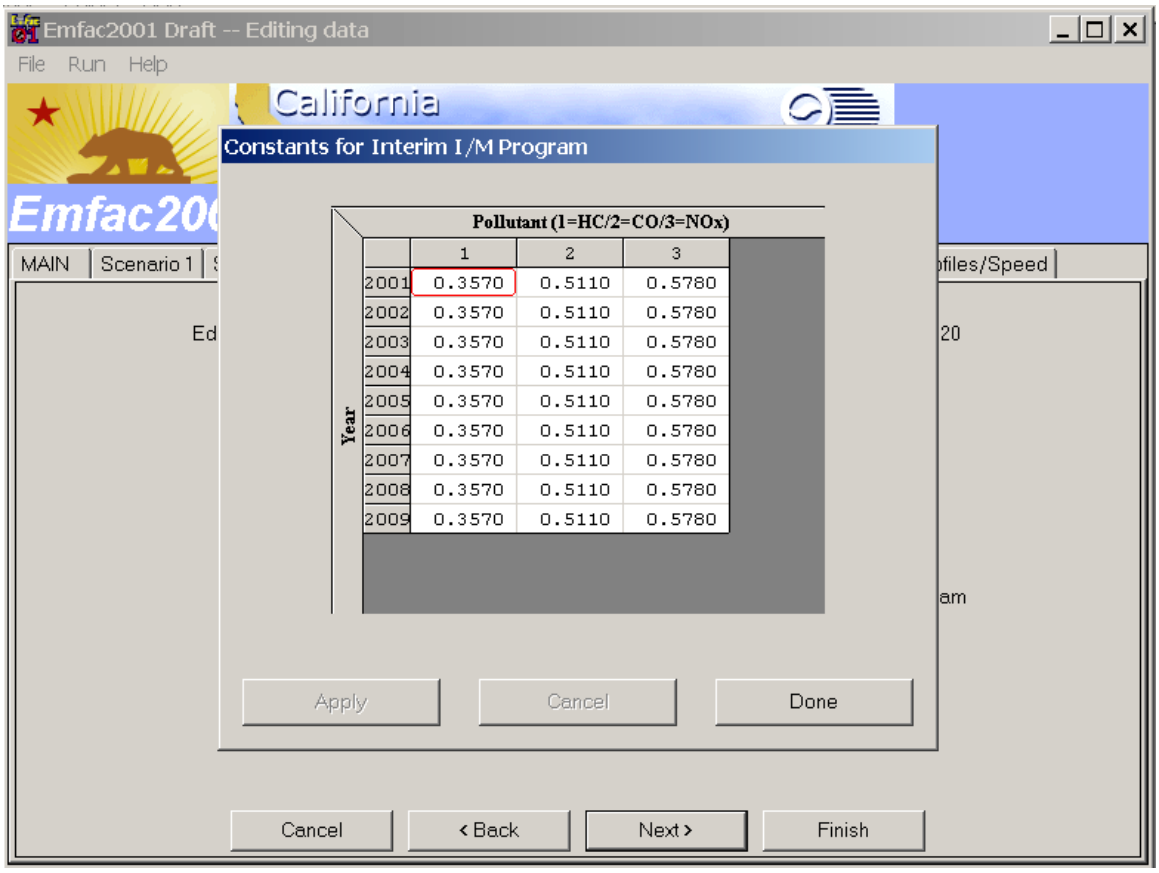
The user can edit sales fractions by vehicle class. Further, for each vehicle class the user can edit sales fractions from the first model year to the last model year (same as the scenario year). The index refers to technology groups as detailed in Appendix A-1. The percentage refers to the default sales fractions.

Interim I/M

This button is a special feature that allows staff to vary the effectiveness of the current ASM I/M program. In Emfac2000 it was assumed that the Bureau of Automotive Repair would implement ASM cut-points that would achieve their SIP reductions. However, BAR has elected to gradually increase the stringency of

the ASM cut-points. When these cut-points are revised, staff can edit these constants and determine the increased benefits from the new cut-points. Figure 26 shows the default interim constants for the current ASM I/M program.

Figure 26 Default Interim Constants for the Current ASM I/M Program



As with all I/M options new users should not change the default I/M options or the interim I/M constants without a through understanding how these options work.

Changing activity data

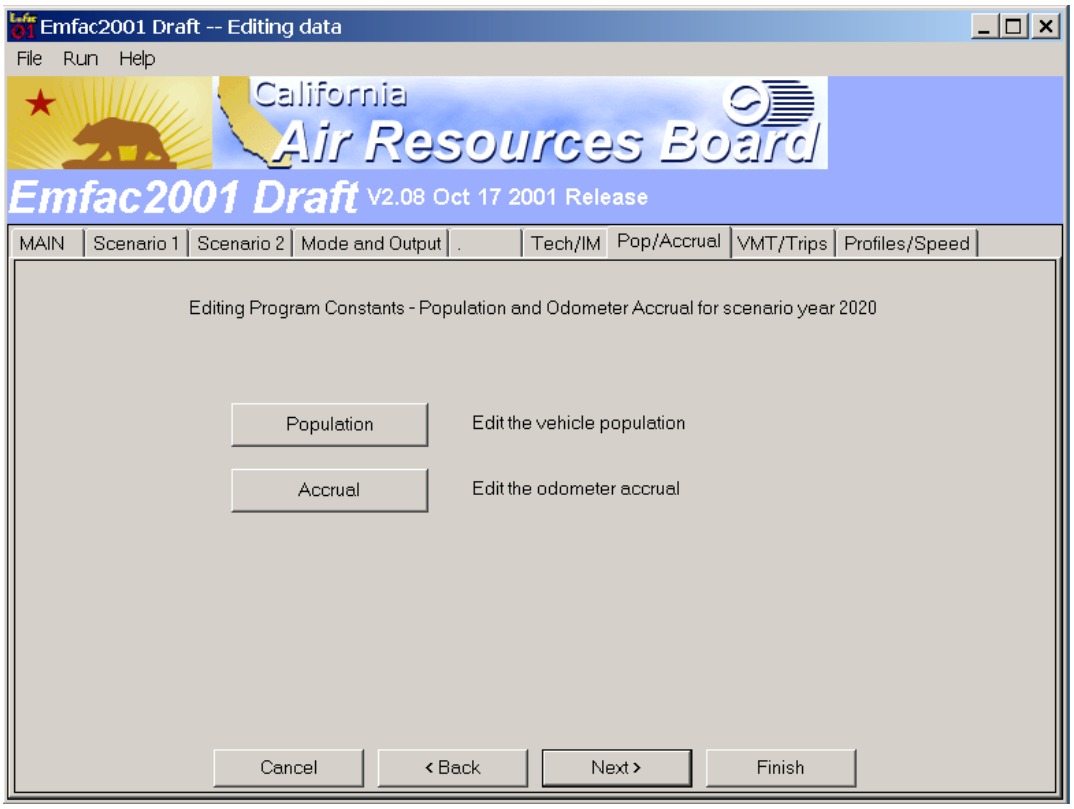
The following dialogs show how the user can edit fundamental activity data such as population, accrual rates, trips and vehicle miles traveled. This ability is of great use to regional planners who may be interested in estimating the impact on emissions by changing the default VMT and trip estimates. For example, when a regional transportation plan (RTP) is revised planners usually have new estimates of VMT for forecast years. The planners are then asked to estimate the impact on emissions as a result of the new RTP.

The following activity dialogs give users the ability to change the default population, VMT and trip estimates for a given scenario year. Users should be aware that all the dialogs are sequenced noting the inter-dependencies between

the data. For example, editing population will affect the default VMT and trip estimates. Hence this dialog precedes the VMT dialog.

Figure 27 shows the main dialog for editing population estimates and changing vehicle accrual rates.

Figure 27 Population and Accrual Edits



Figures 28 and 29 show how the user can change the total population estimate or change population estimates by vehicle class and fuel type. Similarly, Figures 30 and 31 show how the user can edit the default VMT and trip estimates.

Figure 28 Editing Total Population

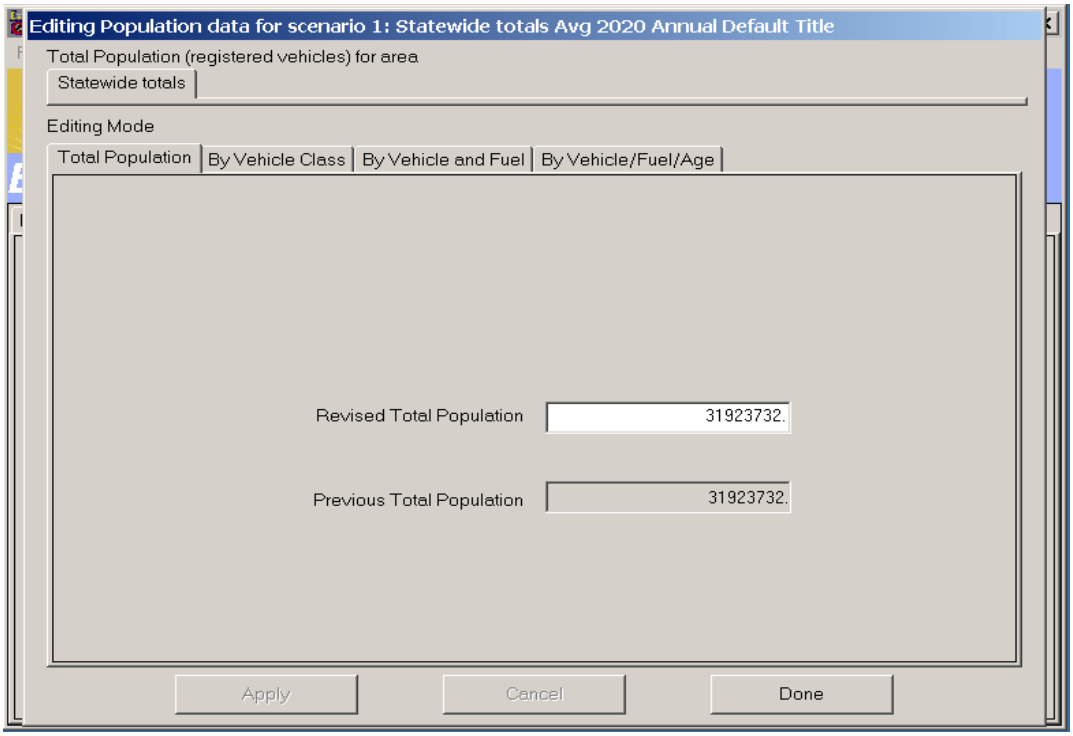


Figure 29 Editing Population By Vehicle Class and Fuel Type

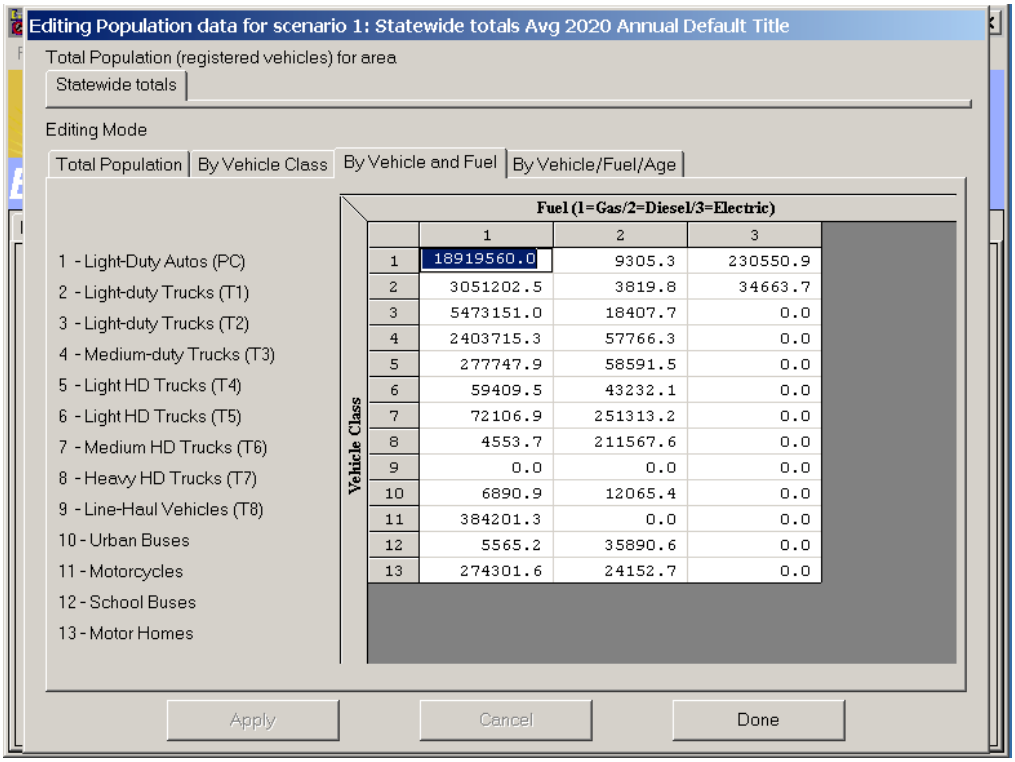


Figure 30 Dialog for Editing Trip and VMT Profiles

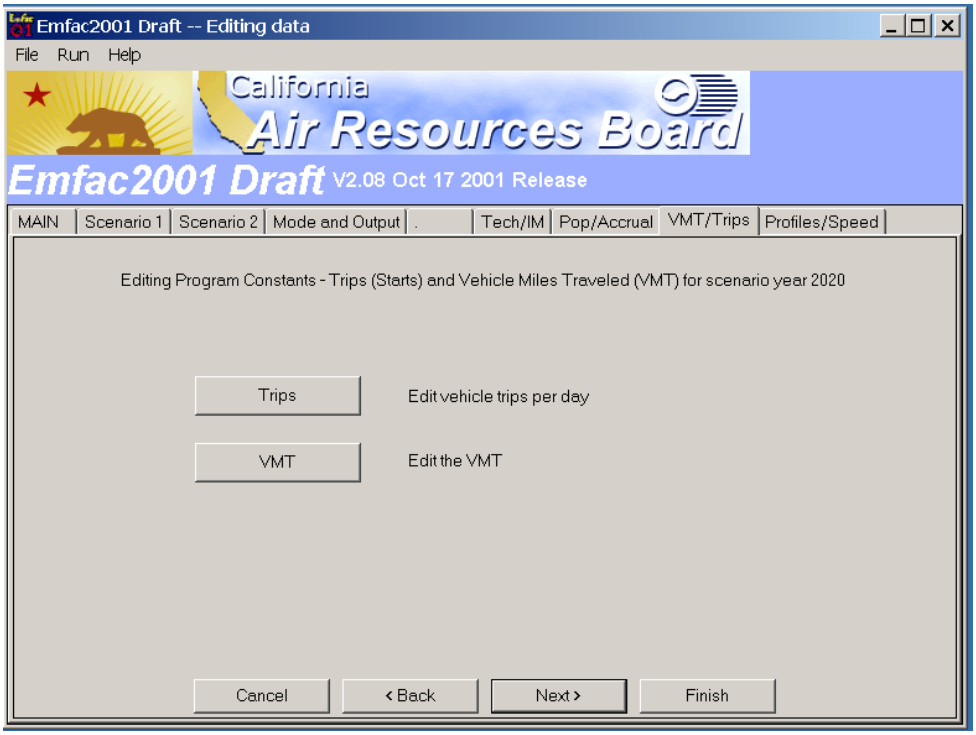
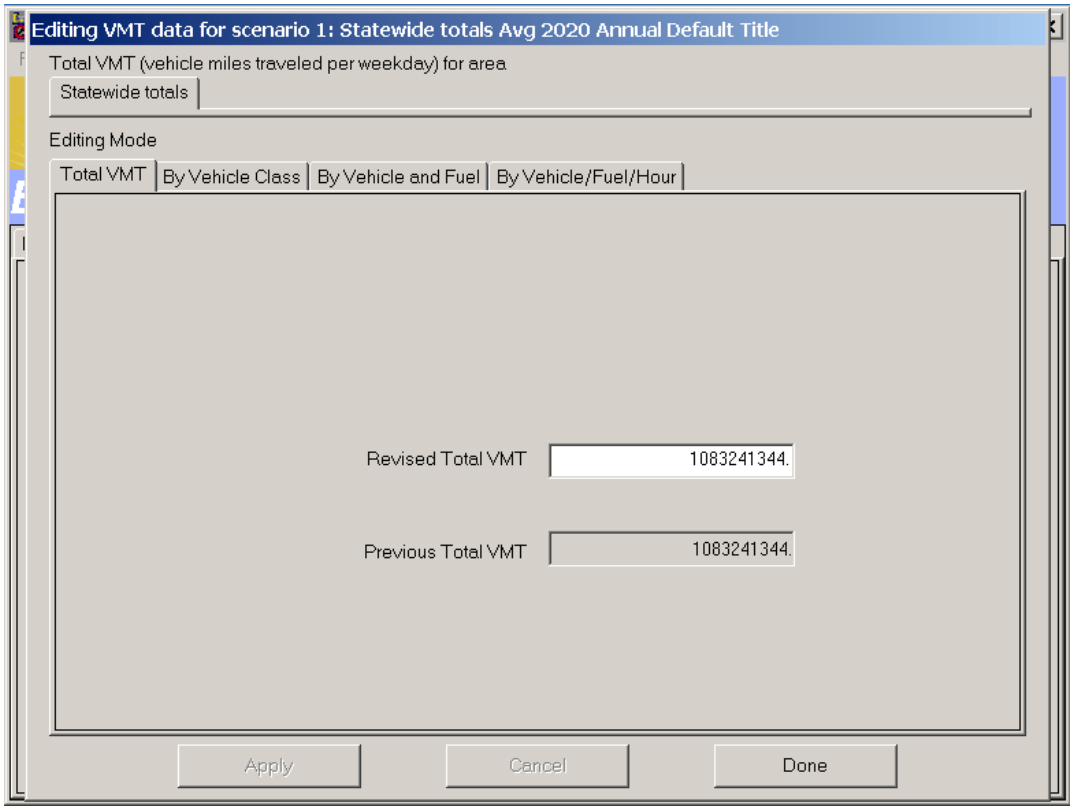


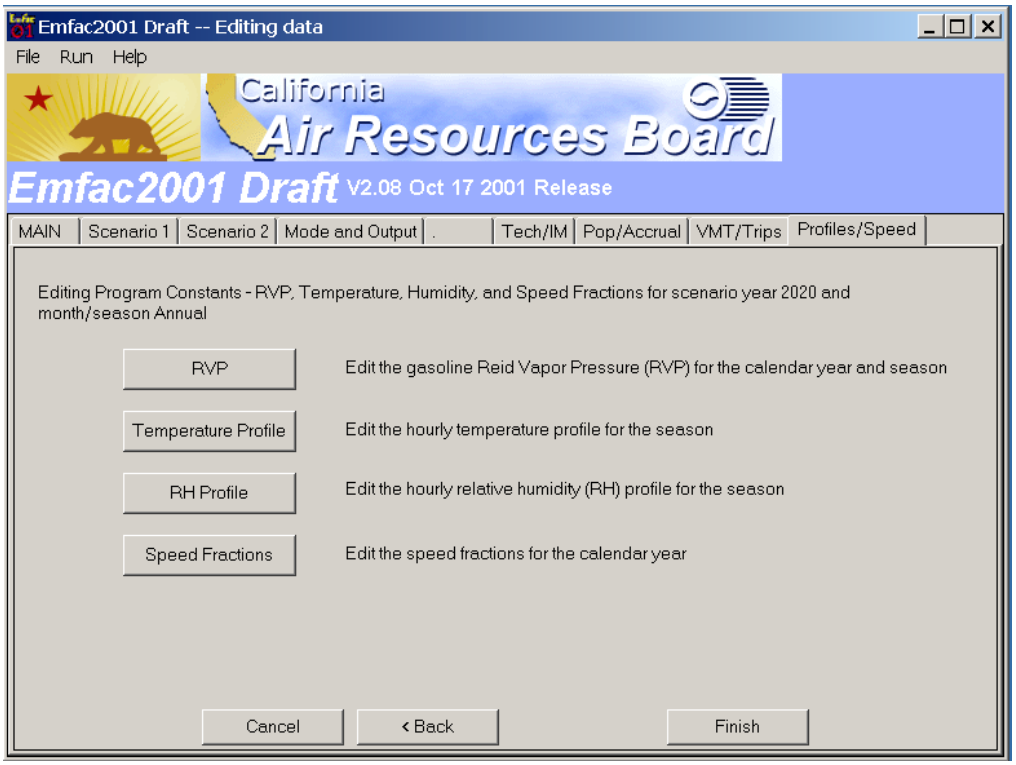
Figure 31 Editing Total VMT



Editing profiles/speed

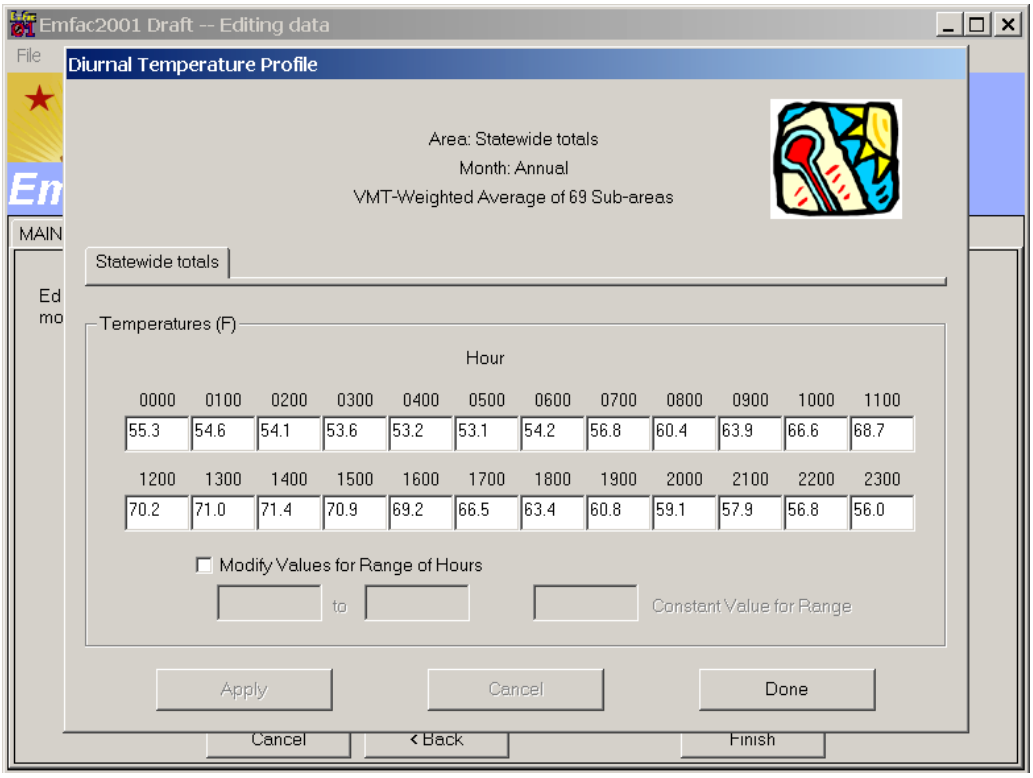
The following dialog allows user to change the diurnal temperature and relative humidity profiles. This ability has allowed staff to estimate emissions specific to ozone episodes for any area of the state. Further, users can also determine the impact of fuel RVP on evaporative emissions. In this dialog, users can also change the default speed distributions by vehicle class and hour. The transportation agencies provide information on the number of miles traveled at various speeds. This information is referred to as a speed distribution. Users can then determine the impact on emissions by changing these default speed distributions. Figure 32 shows the dialog for editing profiles/speed.

Figure 32 Dialog for Editing Profiles/Speed



The dialogs for editing temperature and relative humidity are similar. They both allow the user to change either the temperature or relative humidity for any hour of the day. The user can also edit the values for a range of hours and apply a constant temperature or relative humidity. Figure 33 shows the dialog for editing fundamental temperatures.

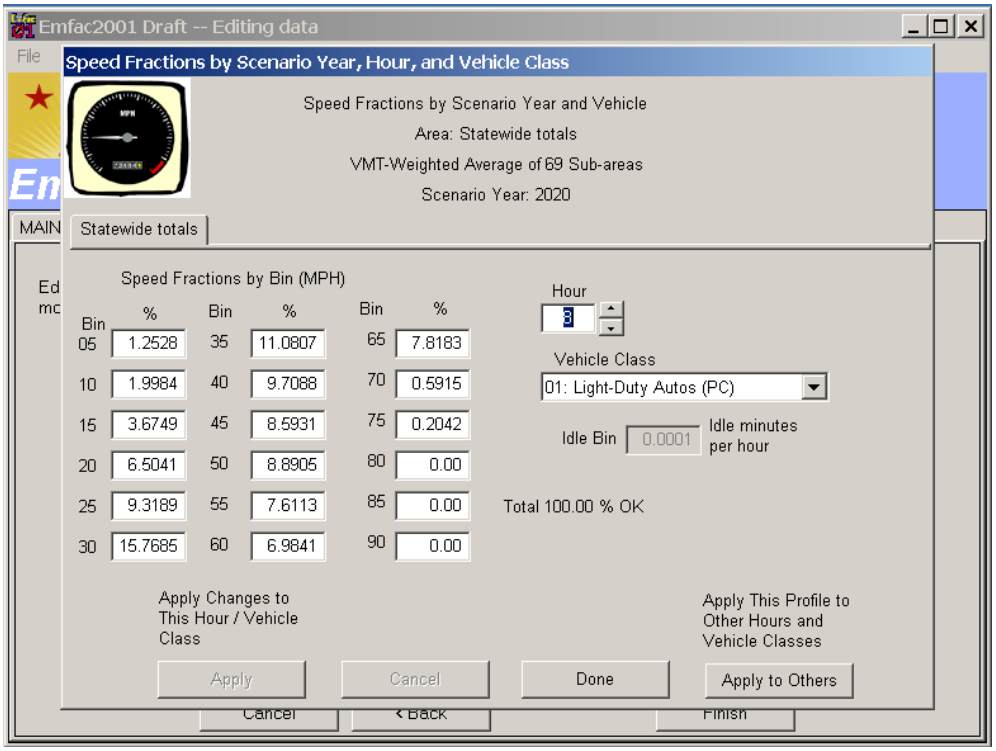
Figure 33 Dialog for Editing Temperature



In the course of developing an RTP, planners are given new VMT estimates and information on how much travel occurs at various speeds. This information is output from transportation models. For example, if an RTP includes new lanes being added. Then this will increase the flow of vehicles, reduce congestion and increase how much travel occurs at higher speeds. The following dialog labeled "speed fractions" gives users the ability to change the default speed distributions. A speed distribution describes the percent of travel that occurs at speed.

In Emfac2001, the speed distributions can vary by 13 vehicle classes, and by hour of the day. The user can select the vehicle class and hour they are interested in editing, edit the values and then apply the changes to the same hour and vehicle class. They can also apply these same edits to other hours and vehicle classes. Figure 34 shows the dialog for editing speeds.

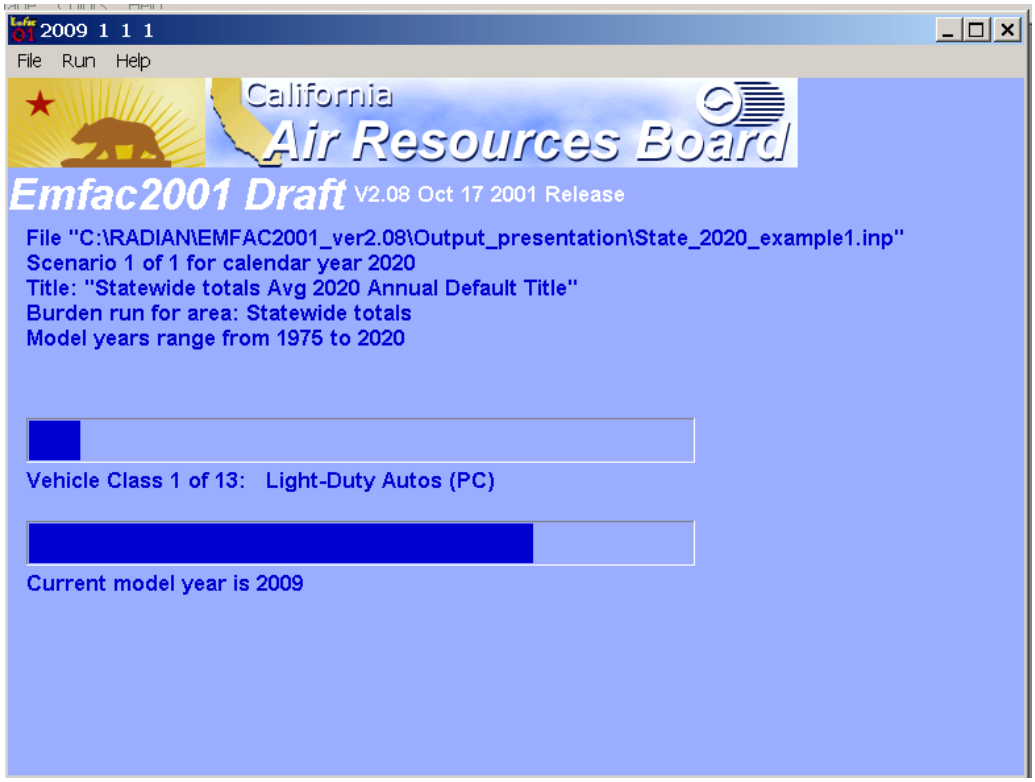
Figure 34 Dialog for Editing Speeds



Having edited fundamental data the user should press “Finish” and then select the “Save As” button to name the output file. Note, in naming the file the user should not attach an extension to the filename. The model will create an input file with “ *.INP” extension. This input file will contain all data necessary for duplicating the results at a later time.

Finally, Figure 35 shows the progress screen when “RUN” has been initiated. This progress screen shows the location of the input/output files. It also shows the scenario number currently being processed.

Figure 35 Final Run or Progress Screen



APPENDICES

Appendix 1 – Exhaust Technology Groups

Tech Group Designations for Exhaust, PM, CO2, old Evap			
TECH GROUP	DESCRIPTION	TECH GROUP	DESCRIPTION
	Note: LDV includes LDV/MDV	150	Pre-75 HHDV/LHV CA dsl
1	<75 LDV no AIR	151	1975-76 HHDV/LHV CA dsl
2	<75 LDV with AIR	152	1977-79 HHDV/LHV CA dsl
3	75+ LDV non-catalyst	153	1980-83 HHDV/LHV CA dsl
4	75-76 LDV OxCat with AIR	154	1984-86 HHDV/LHV CA dsl
5	75-79 LDV OxCat no AIR	155	1987-90 HHDV/LHV CA dsl
6	80+ LDV OxCat no AIR	156	1991-93 HHDV/LHV CA dsl
7	77+ LDV OxCat with AIR	157	1994-97 HHDV/LHV CA dsl
8	77-79 LDV TWC TBI/CARB	158	1998 HHDV/LHV CA dsl
9	81-84 LDV TWC TBI/CARB 0.7 NOx	159	1999-02 HHDV/LHV CA dsl
10	85+ LDV TWC TBI/CARB 0.7 NOx	160	2003-06 HHDV/LHV CA dsl 2g NOx Std
11	77-80 LDV TWC MPFI	161	EPA 2007+ HHDV/LHV
12	81-85 LDV TWC MPFI 0.7 NOx	162	
13	86+ LDV TWC MPFI 0.7 NOx	163	
14	81+ LDV TWC TBI/CARB 0.4 NOx	164	
15	81+ LDV TWC MPFI 0.4 NOx	165	
16	1980 LDV TWC TBI/CARB	166	
17	93+ LDV TWC TBI/CARB .25 HC	167	
18	93+ LDV TWC MPFI .25 HC	168	
19	96+ LDV TWC TBI/CRB .25 OBD2	169	
20	96+ LDV TWC MPFI .25HC OBD2	170	Pre 75 LDA-MDT dsl
21	94-95 LDV TLEV MPFI .25HC	171	1975-79 LDA-MDT dsl
22	96+ LDV TLEV OBD2 GCL	172	1980 LDA-MDT dsl
23	96+ LDV LEV OBD2 GCL CBC AFC	173	1981 LDA-MDT dsl
24	96+ LDV ULEV OBD2 GCL CBC AFC	174	1982 LDA-MDT dsl
25	ALL ZEV	175	1983 LDA-MDT dsl
26	96+ LDT TWC MPFI OBD2 .7NOx	176	1984-92 LDA_MDT dsl
27	96+ LDV TWC TBI/CARB OBD2	177	1993+ LDA_MDT dsl

28	04+ LDV LEV II	178	65-78 LDT dsl Not used
29	04+ LDV ULEV II	179	79-80 LDT dsl Not used
30	04+ LDV SULEV II	180	81-83 LDT dsl Not used
31	04+ LDV PZEV	181	84-85 LDT dsl Not used
32	Tier2-3 120K //0.055/2.1/0.03	182	86 LDT dsl Not used
33	Tier2-4 120K //0.07/2.1/0.04	183	87-93 LDT dsl Not used
34	Tier2-8 120K //0.156/4.2/0.2	184	94-96 LDT dsl Not used
35	Tier2-9 120K //0.09/4.2/0.3	185	97+ LDT dsl Not used
36	Tier2-10 120K //0.23/6.4/0.6	186	65-78 MDT dsl <8500LBS Nu
37	AT PZEV	187	79-80 MDT dsl Not used
38		188	81-82 MDT dsl Not used
39		189	83-84 MDT dsl Not used
40	Mex LDV NoCat/NoAir	190	85-86 MDT dsl Not used
41	Mex LDV OxCat with AIR	191	87-90 MDT dsl Not used
42	Mex LDV TWC TBI/CARB 0.7 NOx	192	91-93 MDT dsl Not used
43	Mex LDV TWC MPFI 0.7 NOx	193	94-96 MDT dsl Not used
44		194	97+ MDT dsl Not used
45		195	
46	Pre-77 LHD1 gas	196	
47	1977-83 LHD1 gas	197	
48	1984-87 LHD1 gas	198	
49	1988-90 LHD1 gas	199	
50	1991-94 LHD1 gas	200	Pre-74 HHDV/LHV Fed dsl
51	MDV LHD1 gas	201	1974-78 HHDV/LHV Fed dsl
52	LEV I LHD1 gas	202	1979-83 HHDV/LHV Fed dsl
53	ULEV I LHD1 gas	203	1984-87 HHDV/LHV Fed dsl
54	EPA2008 LHD1 gas	204	1988-90 HHDV/LHV Fed dsl
55	LEV II LHD1 gas-placeholder	205	1991-93 HHDV/LHV Fed dsl
56	ULEV II LHD1 gas-placeholder	206	1994-97 HHDV/LHV Fed dsl
57	ULEV II LHD1 gas-placeholder	207	1998 HHDV/LHV Fed dsl
58		208	1999-02 HHDV/LHV Fed dsl
59		209	2003-06 HHDV/LHV Fed dsl
60	Pre-75 LHD1 dsl	210	EPA 2007+ HHDV/LHV
61	1975-76 LHD1 dsl	211	2010+ HHDV/LHV Fed-placeholder
62	1977-79 LHD1 dsl	212	
63	1980-83 LHD1 dsl	213	
64	1984-86 LHD1 dsl	214	
65	1987-90 LHD1 dsl	215	
66	1991-93 LHD1 dsl	216	Pre-87 UB dsl
67	1994 LHD1 dsl	217	1987-90 UB dsl
68	MDV LHD1 dsl	218	1991-93 UB dsl
69	LEV I LHD1 dsl	219	1994-95 UB dsl
70	ULEV I LHD1 dsl	220	1996-98 UB dsl
71	EPA 2007+ LHD1 dsl	221	1999-02 UB dsl

72		222	2003 UB dsl
73		223	2004-06 UB dsl
74		224	2007 UB dsl
75		225	2008+ UB dsl ZEV or ZEBS
76	Pre-77 LHD2 gas	226	
77	1977-83 LHD2 gas	227	
78	1984-87 LHD2 gas	228	Pre-77 SBUS gas
79	1988-90 LHD2 gas	229	1977-83 SBUS gas
80	1991-94 LHD2 gas	230	1984-87 SBUS gas
81	MDV LHD2 gas	231	1988-90 SBUS gas
82	LEV I LHD2 gas	232	1991-97 SBUS gas
83	ULEV I LHD2 gas	233	1998-03 SBUS gas
84	EPA2008 LHD2 gas	234	2004 SBUS gas
85	LEV II LHD2 gas-placeholder	235	2005 1gHC+NOx SBUS gas
86	ULEV II LHD2 gas-placeholder	236	EPA2008 SBUS gas
87	ULEV II LHD2 gas-placeholder	237	2010+ SBUS gas-placeholder
88		238	
89		239	
90	Pre-75 LHD2 dsl	240	Pre-75 SBUS dsl
91	1975-76 LHD2 dsl	241	1975-76 SBUS dsl
92	1977-79 LHD2 dsl	242	1977-79 SBUS dsl
93	1980-83 LHD2 dsl	243	1980-83 SBUS dsl
94	1984-86 LHD2 dsl	244	1984-86 SBUS dsl
95	1987-90 LHD2 dsl	245	1987-90 SBUS dsl
96	1991-93 LHD2 dsl	246	1991-93 SBUS dsl
97	1994 LHD2 dsl	247	1994-97 SBUS dsl
98	MDV LHD2 dsl	248	1998 SBUS dsl
99	LEV I LHD2 dsl	249	1999-02 SBUS dsl
100	ULEV I LHD2 dsl	250	2003-06 SBUS dsl 2g NOx Std
101	EPA 2007+ LHD2 dsl	251	EPA 2007+ SBUS dsl
102		252	
103		253	
104		254	
105		255	
106	Pre-77 MHDV gas	256	
107	1977-83 MHDV gas	257	
108	1984-87 MHDV gas	258	
109	1988-90 MHDV gas	259	
110	1991-97 MHDV gas	260	ALL MCY 2 stroke/6g evap
111	1998-03 MHDV gas	261	<78 MCY 6g evap
112	2004 MHDV gas	262	78-79 MCY Carb/6g evap
113	2005 1gHC+NOx MHDV gas	263	80-81 MCY Carb/6g evap
114	EPA2008 MHDV gas-placeholder	264	82-84 MCY Carb/6g evap
115		265	85-87 MCY Carb/2g evap
116		266	88-03 MCY Carb/2g evap

117		267	88-03 MCY FI/2g evap
118		268	88-03 MCY Carb/cat/2g evap
119		269	88-03 MCY FI/cat/2g evap
120	Pre-75 MHDV dsl	270	03-08 MCY Carb/2g evap
121	1975-76 MHDV dsl	271	03-08 MCY FI/2g evap
122	1977-79 MHDV dsl	272	03-08 MCY Carb/cat/2 evap
123	1980-83 MHDV dsl	273	03-08 MCY FI/cat/2g evap
124	1984-86 MHDV dsl	274	08+ MCY Carb/2 evap
125	1987-90 MHDV dsl	275	08+ MCY FI/2 evap
126	1991-93 MHDV dsl	276	08+ MCY Carb/Cat/2g evap
127	1994-97 MHDV dsl	277	08+ MCY FI/Cat/2 g evap
128	1998 MHDV dsl	278	
129	1999-02 MHDV dsl	279	
130	2003-06 MHDV dsl-2g NOx std.	280	
131	EPA 2007+ MHDV dsl		
132			
133			
134			
135			
136	Pre-77 HHDV/LHV gas		
137	1977-84 HHDV/LHV gas		
138	1985 HHDV/LHV gas		
139	1986 HHDV/LHV gas		
140	1987-93 HHDV/LHV gas		
141	1994-97 HHDV/LHV gas		
142	1998-03 HHDV/LHV gas		
143	2004-06 HHDV/LHV gas		
144	2007+ HHDV/LHV-placeholder		
145			
146			
147			
148			
149			

	TBI/CARB = throttle body injection and carbureted fuel systems		
	MPFI = multi-point fuel injection systems		
	TWC = three way catalyst		
	GCL = greater catalyst loading		
	CBC = close-body catalyst		
	AFC = adaptive fuel controls		
	EHC = electrically heated catalysts		

Appendix 2 – Evaporative Technology Groups

Technology Group Designations for Evaporative Emissions			
TECH GROUP	DESCRIPTION	TECH GROUP	DESCRIPTION
		90	
1	<70 PC uncontrolled	91	
2	70-76 PC CARB NCAT	92	
3	75-76 PC CARB CAT	93	
4	77+ PC CARB NCAT	94	
5	77+ PC CARB CAT	95	
6	70-78 PC TBI	96	
7	70-78 PC FI	97	
8	79-85 PC TBI	98	
9	79-85 PC FI	99	
10	86-94 PC TBI	100	
11	86-94 PC FI	101	
12	95+ PC TBI	102	
13	95+ PC FI	103	
14	All PC enhanced evap /OBD	104	
15	All PC near zero evap /OBD	105	
16	All PC ZEV	106	
17	ALL PC PZEV	107	
18		108	
19		109	
20		110	
21	<70 LDT/MDV>HDV uncontrolled	111	
22	70-79 LDT/MDV/HDV CARB NCAT	112	
23	75-79 LDT/MDV/HDV CARB CAT	113	
24	80+ LDT/MDV/HDV CARB NCAT	114	
25	80+ LDT/MDV/HDV CARB CAT	115	
26	70-79 LDT/MDV/HDV TBI	116	
27	70-79 LDT/MDV/HDV FI	117	
28	80-85 LDT/MDV/HDV TBI	118	
29	80-85 LDT/MDV/HDV FI	119	
30	86-94 LDT/MDV/HDV TBI	120	
31	86-94 LDT/MDV/HDV FI	121	
32	95+ LDT/MDV/HDV TBI	122	
33	95+ LDT/MDV/HDV FI	123	
34	All LDT/MDV/HDV	124	

	enhanced/OBD		
35	All LDT/MDV/HDV nearzero/OBD	125	
36	All LDT/MDV/HDV ZEV	126	
37	ALL LDT/MDV/HDV PZEV	127	
38		128	