EMFAC2014 Volume I - User's Guide

v1.0.7

April 30, 2014

California Environmental Protection Agency
Air Resources Board

Mobile Source Analysis Branch

Air Quality Planning & Science Division

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1 INTRODUCTION

1.1 THE MOTOR VEHICLE EMISSIONS INVENTORY

An emissions inventory is a critical element in the control of air pollution and the attainment of national and state ambient air quality standards. It is also an essential tool in developing regulations and control strategies to fulfill the Air Resources Board's (ARB) mission to promote and protect public health, welfare, and ecological resources through the effective and efficient reduction of air pollutants while recognizing and considering the effects on the economy of the state.

An emissions inventory (for any source category) can be calculated, at the most basic level as the product of an emission rate, expressed in grams of a pollutant emitted per some unit of source activity, and a measure of that source's activity. The following expression illustrates this basic relationship between the emissions rate and source activity used to calculate emissions:

Emission Factor X Source Activity = Emissions

For on-road motor vehicles, emissions rates are typically expressed as mass of pollutant emitted per mile driven, per vehicle per day, or per trip made, depending on the emissions process being analyzed. An emissions process for a motor vehicle is the physical mechanism that results in the emissions of a pollutant (e.g., the combustion of fuel, the evaporation of fuel, tire or brake wear, or the start of an engine).

The Air Resources Board (ARB) developed an EMission FACtors (EMFAC) model to calculate statewide or regional emissions inventories by multiplying emissions rates with vehicle activity data from all motor vehicles, including passenger cars to heavy-duty trucks, operating on highways, freeways, and local roads in California.

1.2 EMFAC2014

Over the years, tougher emissions standards have been met with technological solutions of increasing complexity. As a result, the emissions estimation models have also grown in size and complexity.

EMFAC2014 is the latest emissions inventory model that calculates emissions inventories for motor vehicles operating on roads in California. EMFAC2014 represents the next step forward in the ongoing improvement process for EMFAC, and reflects the ARB's current understanding of how vehicles travel and how much they pollute. The EMFAC2014 model is needed to support the Air Resources Board's regulatory and air quality planning efforts and to meet the Federal Highway Administration's transportation planning requirements.

The EMFAC2014 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 evaluate prospective control programs and determine the most effective, science-based proposals for protecting the environment. EMFAC2014 includes the latest data on California's car and truck fleets and travel activity. New forecasting methods have been incorporated for developing vehicle age distributions and estimating vehicle miles traveled. The model also reflects the emissions benefits of ARB's recent rulemakings, including on-road diesel fleet rules, Advanced Clean Car Standards, and the Smartway/Phase I Heavy Duty Vehicle Greenhouse Gas Regulation. The model also includes updates to truck emission factors based on the latest test data. More details about the updates in emissions calculation methodologies and data are available in the EMFAC2014 Technical Support Document.

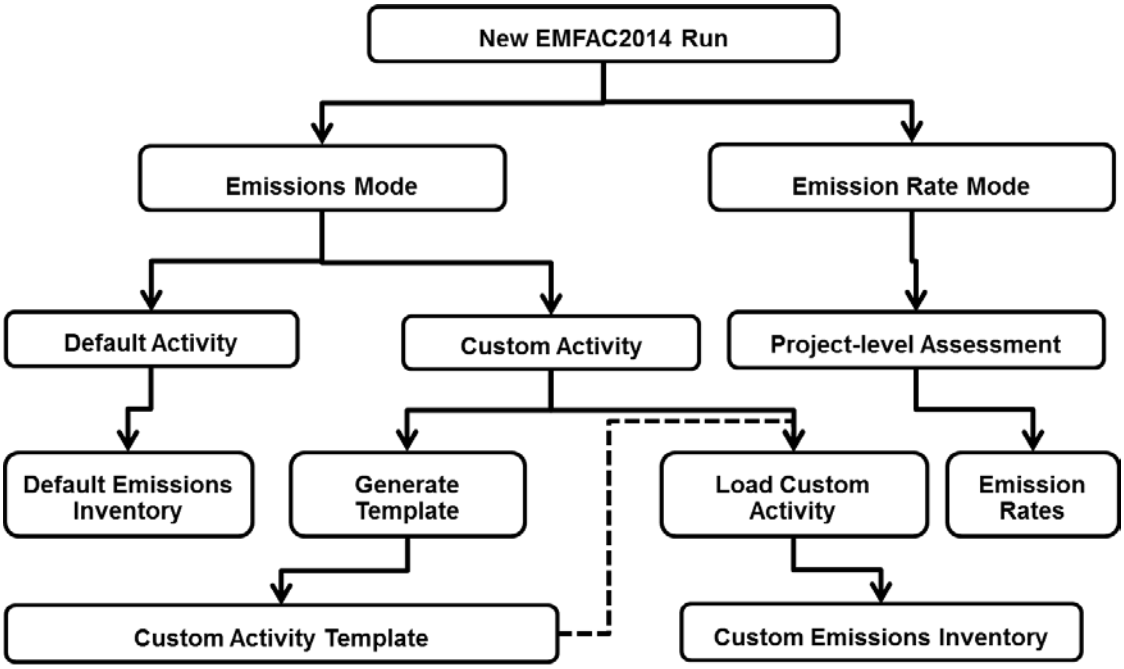
ARB staff has departed from using Fortran (the legacy programming tool that was used for EMFAC2011-LDV and previous versions of EMFAC) and

has rebuilt the model using Python and MySQL software. This was done for several reasons:

- To make the model more user friendly;
- To make it easier to update the model code and associated data & methodologies into the future;
- To provide greater flexibility for incorporating and assessing future new rules;
- To provide the capability for developing more detailed emissions inventories;
- To make it easier to transfer EMFAC output to other tools.

In EMFAC2014, all the functionalities of the three modules in EMFAC2011 (LDV, HD, & SG), as well as the project-level assessment tools, have been integrated into one single package. Figure 1.1 displays a flow chart indicating the GUI selections necessary to generate the various outputs of EMFAC2014. The Emissions Mode can be used to estimate tons of emissions per day and the Emission Rate Mode can be used to estimate grams of emission per unit of activity for the time, region(s), vehicles, pollutant(s) specified through the model's Graphical User Interface.

Figure 1-1. EMFAC2014 Overall Flow



***IMPORTANT*! –** "Custom Activity" Mode

The EMFAC2014 Custom Activity Mode (discussed in detail in Chapter 5.2) can be used to produce emissions inventories for two specific types of assessments: conformity assessments and SB375 assessments.

For conformity assessments, emissions are estimated with all current controls active, except Low Carbon Fuel Standards (LCFS). The reason for excluding LCFS is that most of the emissions benefits due to the LCFS come from the production cycle (upstream emissions) of the fuel rather than the combustion cycle (tailpipe). As a result, LCFS is assumed to not have a significant impact on CO2 emissions from EMFAC's tailpipe emission estimates.

For SB375 assessments, the Advanced Clean Cars (ACC)/Pavley and LCFS rules are deactivated. Because the ACC regulation has certain assumptions about vehicle usage built into it, default data in custom activity templates produced for conformity assessments will not match the default data in templates for SB375 assessments. For the same reason, estimates of CO2 will also differ.

***IMPORTANT!* –** "GHG Emissions"

EMFAC2014 does not produce official GHG emissions.

1.3 ABOUT THIS DOCUMENT

The purpose of this EMFAC2014 User's Guide is to familiarize users with the features and controls in the EMFAC2014 model. For more information regarding the methodologies used in EMFAC2014 to estimate emissions and emission rates, please refer to the EMFAC2014 Technical Documentation.

2 POLLUTANTS AND PROCESSES MODELED

This section describes the pollutants and emissions processes currently modeled in EMFAC2014.

2.1 POLLUTANTS

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

- Carbon monoxide (CO)
- Nitrogen oxides (NOx)
- 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 dioxide (CO2)
- Particulate matter (PM): PM estimates are provided for total suspended particulates for 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.
- Sulfur oxides (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.

2.2 EMISSIONS PROCESSES

Emissions (especially HC) emanate from a vehicle during all hours of the day. The magnitude of these emissions varies with what is happening with the vehicle, such as running on the road, idling at a loading zone, sitting outside in the sun, or just starting. Emissions processes account for all emissions of a vehicle across all hours of the day, regardless of whether the vehicle is in motion or whether or not it has been started. The types of emissions processes in the model are:

- Running Exhaust Emissions (RUNEX) that come out of the vehicle tailpipe while traveling on the road.
- Idle Exhaust Emissions (IDLEX) 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 calculated only for heavy-duty trucks.
- Start Exhaust Tailpipe Emissions (STREX) that occur when starting a vehicle. These emissions are independent of running exhaust emissions and can be thought of as emissions associated with starting a vehicle. The magnitude of these emissions is dependent on how long the vehicle has been sitting prior to starting. Please note that STREX is defined differently for heavy duty diesel trucks than for other vehicles. More details can be found in the EMFAC2014 Technical Support Document.
- Diurnal Evaporative HC Emissions (DIURN) 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, as a result of the breakthrough of vapors from the carbon canister. If a vehicle is sitting for a period of time, emissions from the first 35 minutes are considered as hot soak and emissions from the remaining period are considered as diurnal emissions, provided that the ambient temperature is increasing during the remaining period of time.

- Resting Evaporative Losses (RESTLOSS) that occur while the vehicle is sitting 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 has been stationary, while the ambient temperature is either constant or decreasing.
- Hot Soak Evaporative HC Emissions (HOTSOAK) that occur immediately after a trip are due to fuel heating as an engine remains hot for up to 35 minutes 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 Loss Evaporative HC Emissions (RUNLOSS) that occur are a result of hot fuel vapors escape from the fuel system or overwhelm the carbon canister while the vehicle is operating.
- Tire Wear Particulate Matter Emissions (PMTW) that originate from tires as a result of wear.
- Brake Wear Particulate Matter Emissions (PMBW) that originate from brake usage.

3 INSTALLATION AND CONFIGURATION OF EMFAC2014

3.1 SYSTEM REQUIREMENTS

- Operating System: Microsoft Windows
- At least 2 GB of free space is required to install EMFAC2014.
- The space needed to run EMFAC2014 depends on the level of detail in the output, the number of sub-areas and calendar years selected, and the number of runs. At least 50 GB free space is recommended.
- The model was tested on the following system
  - Processor: Intel® Core™ 2 Duo CPU E8400 @3.00GHZ
  - Installed memory (RAM): 4.00 GB (3.90 GB Usable)
  - System type: 64-bit Operating System
  - Windows Edition: Windows 7 Enterprise
  - The model will run faster with a faster CPU and more RAM.
- We do not recommend installing EMFAC2014 on a system that already has the USEPA's MOVES model installed on it. Having both models installed on one system could potentially lead to issues in the configuration of MySQL causing problems when importing the default database. We recommend EMFAC2014 to be installed on a "clean" machine to avoid these problems.

3.2 PRE-INSTALLATION NOTES

- MySQL Community Server 5.x must be installed on your local computer prior to installing EMFAC2014. The software can be downloaded from http://www.mysql.com/downloads/mysql/ and can be installed following the installation instructions at http://dev.mysql.com/doc/refman/5.6/en/mysql-installer-gui.html
- Only the MySQL server is required for EMFAC2014 to run. If the users do not need any other functions, they can simply choose the "Server only" setup type when installing MySQL. Users should NEVER choose "Client only" setup type for a fresh new installation.

- If the users need other functions, they can choose from "Developer Default", "Full" or "Custom", and make sure the "MySQL Server" component is in the list if they choose "Custom".
- Make sure to write down the password for the "root" account.
- The model has been tested on MySQL 5.5 and 5.6. Older versions of MySQL should also work but have not been tested.
  - If MySQL is already installed, the existing MySQL may work, as long as it was installed through the full installation. You will still need to remember and input the password for the root account.
  - If MySQL needs to be reinstalled, the existing version should be uninstalled first.
- EMFAC2014 was developed using Python version 2.7 and MySQL Community Server (5.6). Python was used to develop the program, and MySQL was used to manage the data. Python is not required on the user's computer to run the model.
- Please note that this User's Guide assumes the default directory for the model is "C:\emfac2014\". The model should also work in a directory other than this default.

Note!

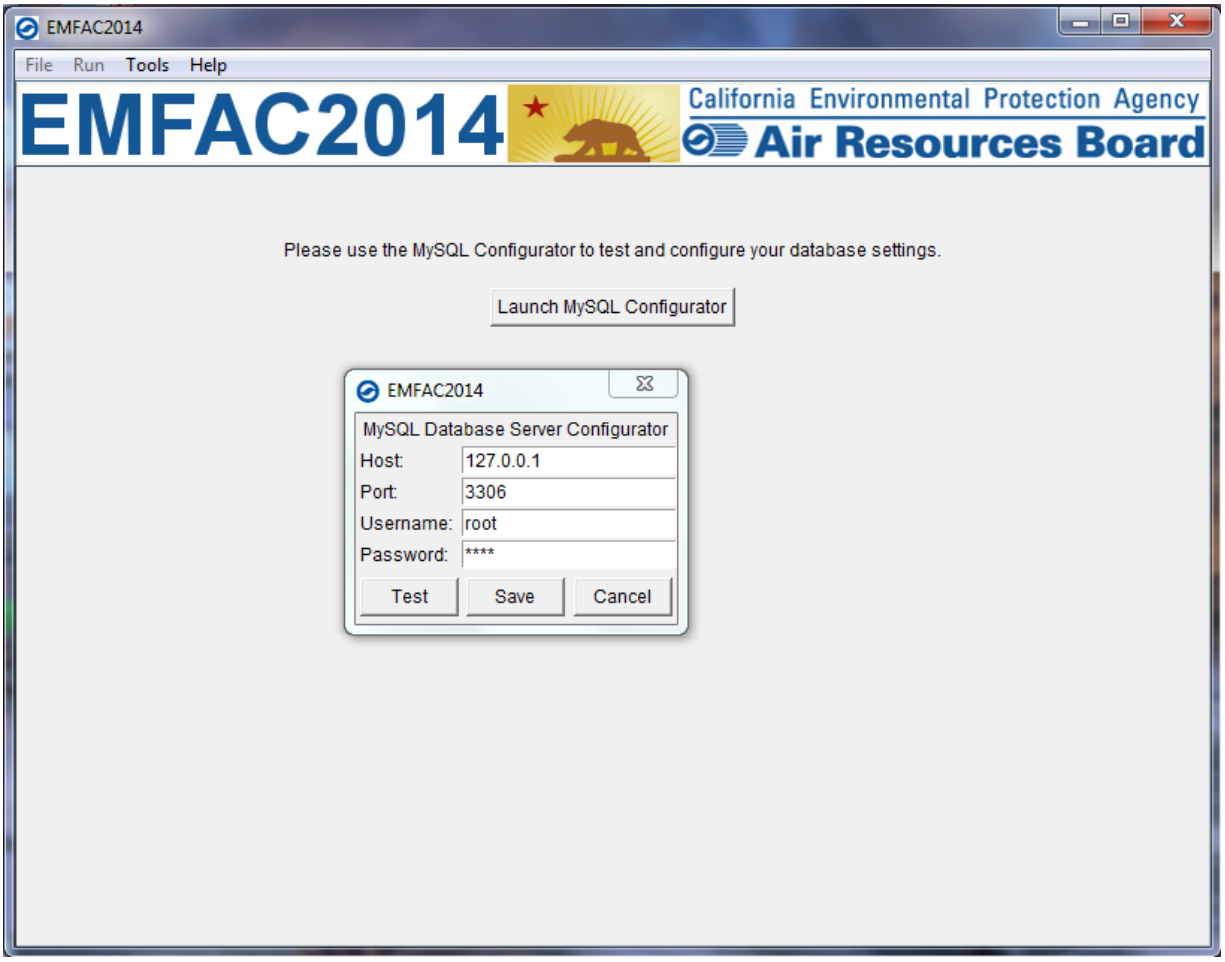
Please do not make any changes to the EMFAC default database on the MySQL server. The model may fail or generate erroneous results if changes are made to the database.

3.3 MODEL INSTALLATION

1. Extract the EMFAC2014 package to a folder of your choice on your local drive. This user's guide assumes the package is extracted or copied to the C: root directory.
2. Right click on "emfac.exe", in the installation directory ("C:\emfac2014\emfac.exe") to create a shortcut or pin it to the taskbar or the start menu.

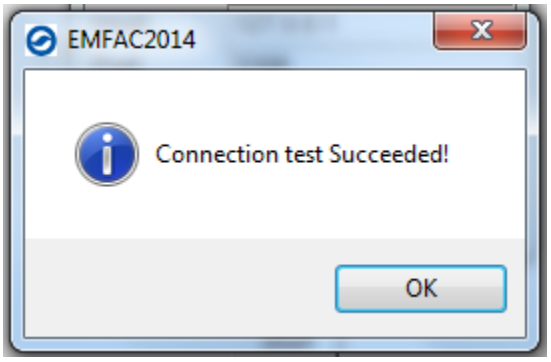
3.4 MODEL CONFIGURATION

1. Double click "emfac.exe" within the installation directory, or click the icon on the taskbar or start menu, to start EMFAC2014. The program will display a page that asks users to configure MySQL settings first using the MySQL Configurator. Ignore the Microsoft Windows security warning window if it shows up.
2. Click the "Launch MySQL Configurator" button to bring up the pop-up window shown below. This configuration is needed for installation of an updated model or when the configuration of MySQL is changed.

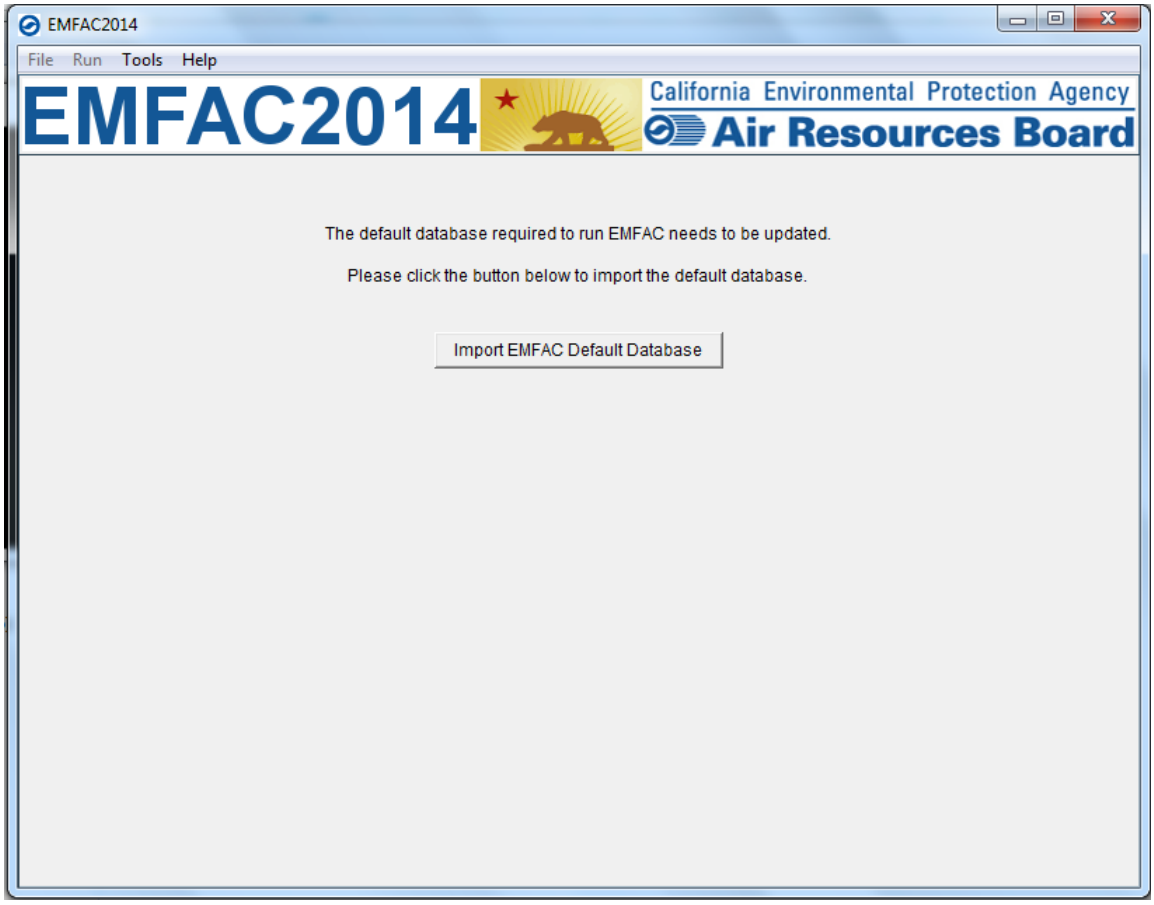


3. Keep "Host," "Port," and "Username" unchanged, and the "Password" will be the one you supplied upon installation of MySQL for the root account.
4. Click "Test" to test the configuration.

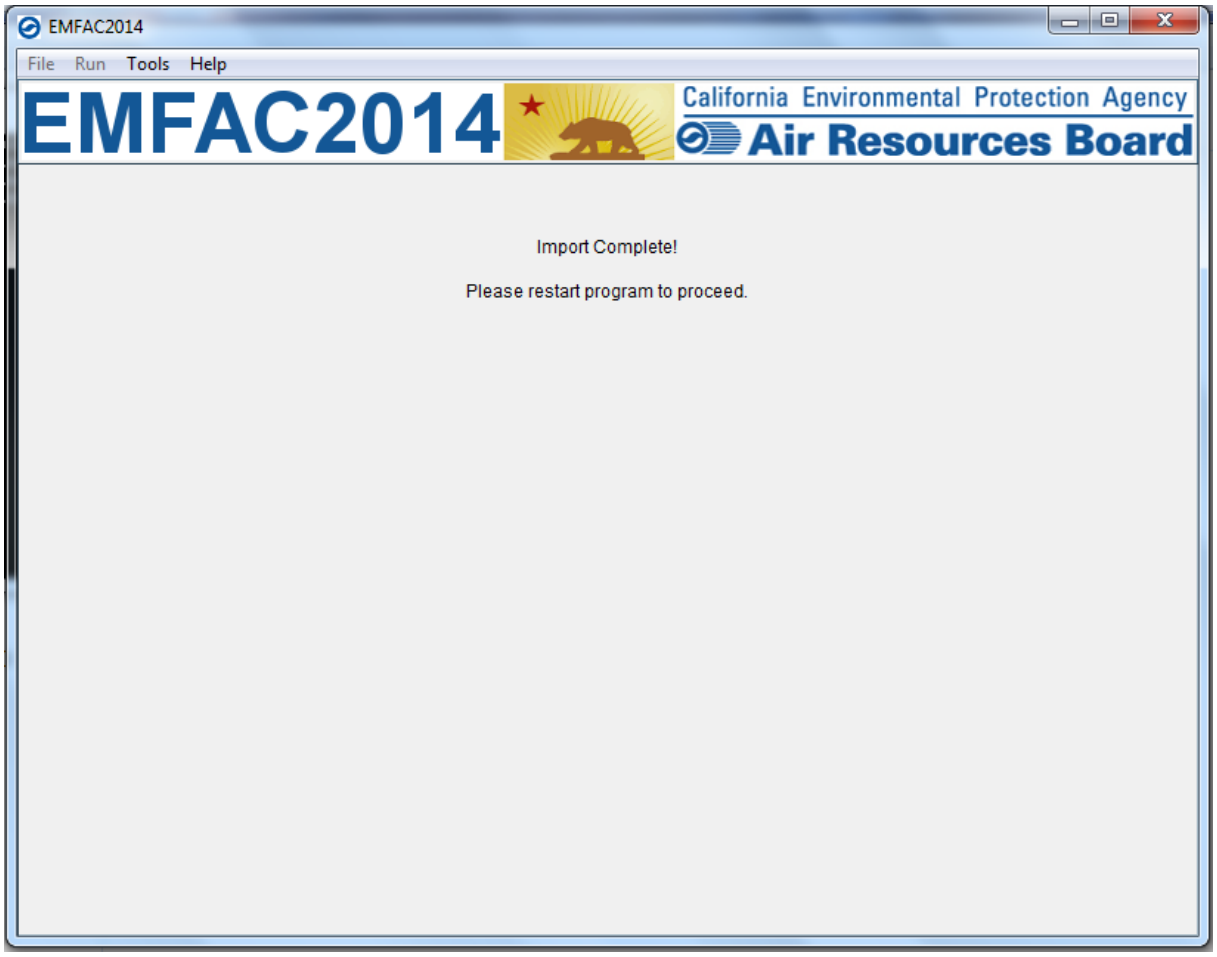
5. Click "Save" only when both the connection and directory are set correctly. Repeat the configuration steps if any mistake is made.



6. EMFAC2014 will close and will need to be restarted.
7. Restart the model and on the following screen click "Import EMFAC Default Database".



8. After the import is completed, close the program and reopen it.



- Please note that a user can reconfigure a previously configured EMFAC2014/MySQL connection by launching the MySQL Configurator from the Tools menu. This functionality could be used, for instance, to connect the model to a different MySQL server.

4 GETTING STARTED WITH EMFAC2014

4.1 GENERAL TIPS

- The EMFAC2014 console shows the status of the model and error messages, if any.
- Consecutive items can be selected by shift-clicking and non-consecutive items can be selected by control-clicking in the list boxes.
- The unit for fuel in the EMFAC2014 output is 1000 gallons/day and the unit for all other pollutants in the emissions inventory is tons/day.
- Units for emission rates: gram per mile for running exhaust, gram per hour for running loss and diurnal/resting loss, gram per idle-hour for idling exhaust, gram per trip for hot soak and start.
- In order to manage the size of the output files, emissions and emission rates equal to zero are not indicated in the output files. Therefore, in instances when data are missing in the output file, the user can assume zero emissions or an emission rate of zero. The program is best viewed with "Smaller" text size on Windows. The "Smaller" text size is used by most people, and can be set within the Control Panel\Appearance and Personalization\Display
- When canceling a run the program will try to terminate all the active queries, some may not stop immediately. But pressing the cancel will not remove the main GUI and the console. It only removes the running dialogue.
- Use the method described in Appendix 1 to estimate the disk space needed before starting a run to make sure there is enough free disk space to finish the run.

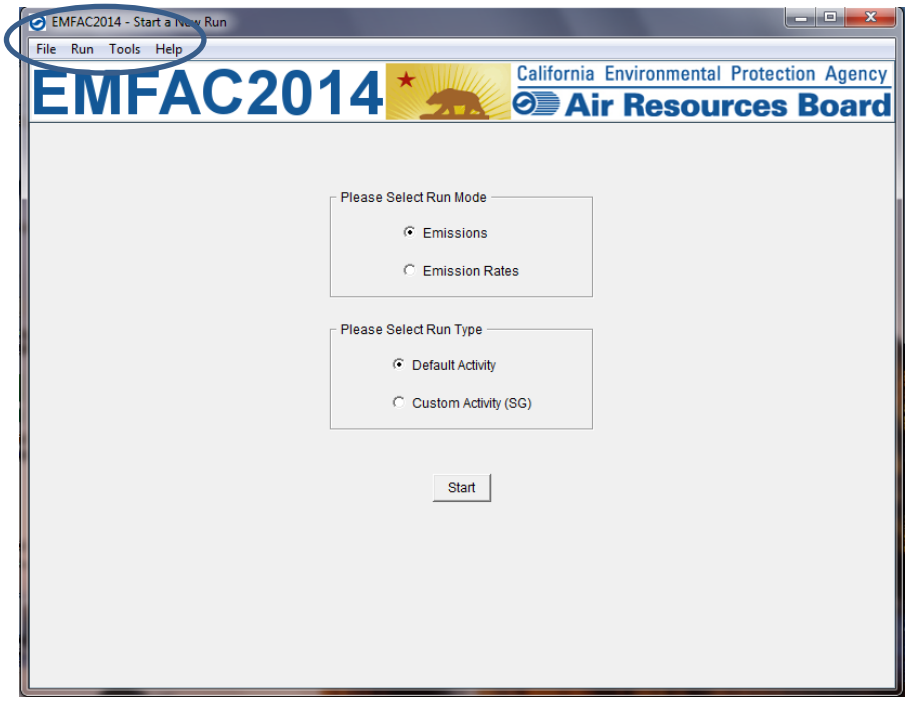
Note!

1. **Do not close the console while the model is running.**
2. **Limit the number of areas and calendar years and level of details selected for one run to manage the run-time of the current run and the size of the output.**
3. **Splitting big runs into small runs is strongly recommended.**

4.2 GRAPHICAL USER INTERFACE

4.2.1 MENUS

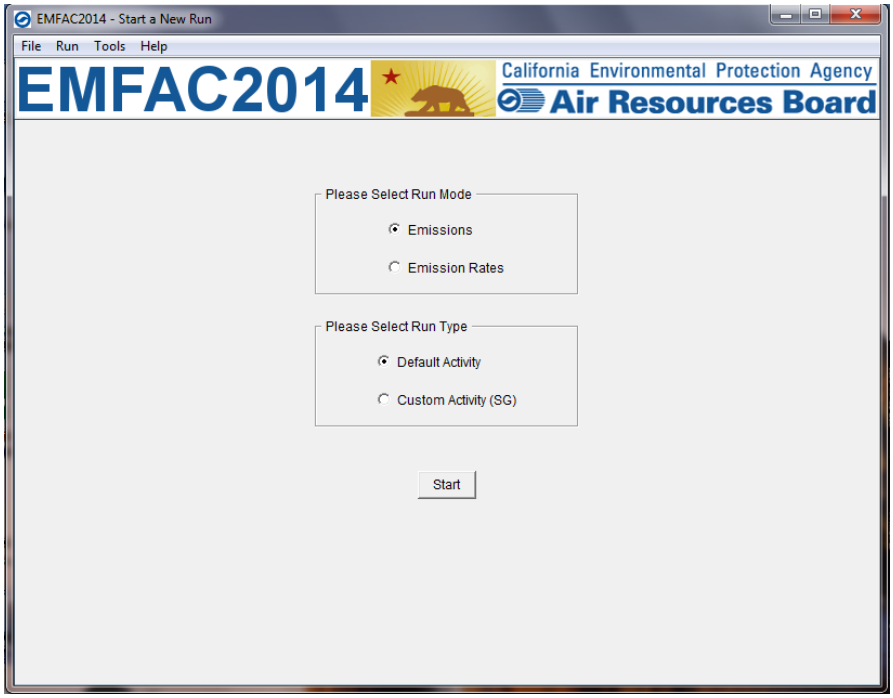
There are four menus in the parent, Home Screen window of EMFAC2014: "File", "Run", "Tools" and "Help".



- The File Menu has four actions: "New" (new run), "Open" (open a saved run specification), "Save" (save a run specification), and "Exit." Upon starting the program, the program automatically assumes the user is creating a new run and thus the parent window displays the Home Screen. One may choose to open a previous run by selecting "Open" in the File Menu and then selecting the appropriate file.
- The Exit action of the File Menu will only work in EMFAC2014 if a calculation is not being made. If calculations are occurring, cancel the run first, and then exit.
- The Run Menu has one action: "Run EMFAC."
- The Tools Menu has one action: "MySQL Configurator."
- The Help Menu has an "About…" action that will tell the user which version of the model is running.

4.2.2 HOME SCREEN, RUN MODES AND TYPES

- The Home Screen (below) is automatically displayed after the model starts or when "New" is selected from the File Menu.



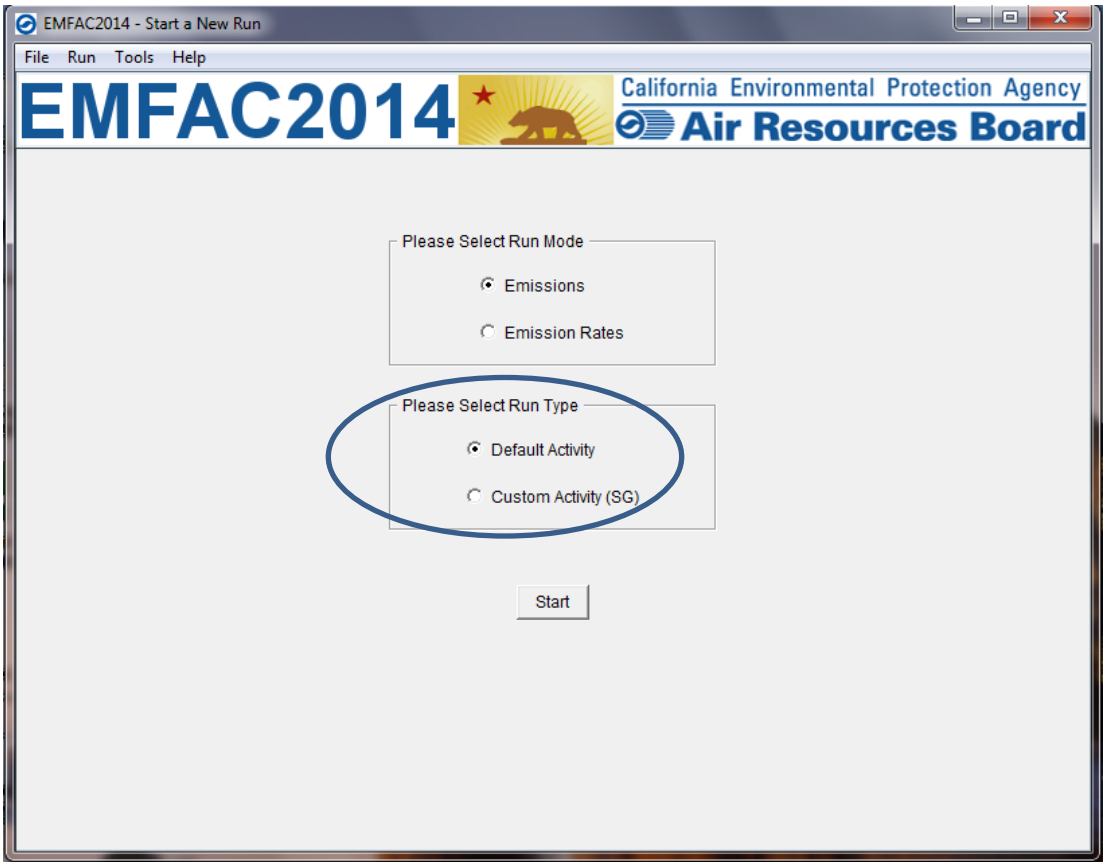
- "Run Mode" and "Run Type" are the selection options in this "New" tab. There are two different Run Modes: "Emissions" and "Emission Rates."
- Under the "Emissions" run mode, two Run Types are available. "Default Activity" runs use default EMFAC activity data, while the "Custom Activity" run type allows the users to use their own activity data to run the model. The "Custom Activity" run type was formerly known as "SG" or "Scenario Generator". It can be used to generate an input activity data file template or to load custom activity data to produce an emissions inventory for transportation planning, a SB375 report, etc..
- Under the "Emission Rates" run mode, only one Run Type is available. The ''PL" run type can be used to calculate emissions rates for project-level assessments.

5 GENERATING EMISSIONS INVENTORIES

For regional analyses (as opposed to project-level analyses), there are two different modes in EMFAC2014 dictated by the travel activity data that are used.

Default Activity Mode. EMFAC 2014 uses historical fuel sales to estimate vehicle miles traveled (VMT) as its default activity to facilitate fuel-based inventory analyses.

Custom Activity Mode. It is necessary to use the latest regional motor vehicle travel activity data developed by local planning agencies to generate the regional on-road emissions for State Implementation Plans (SIPs). Thus, for SIP criteria pollutant (planning inventory) analyses, EMFAC2014 has the ability to allow the user to replace the fuel-based default data with user-supplied data from metropolitan and regional planning agencies.

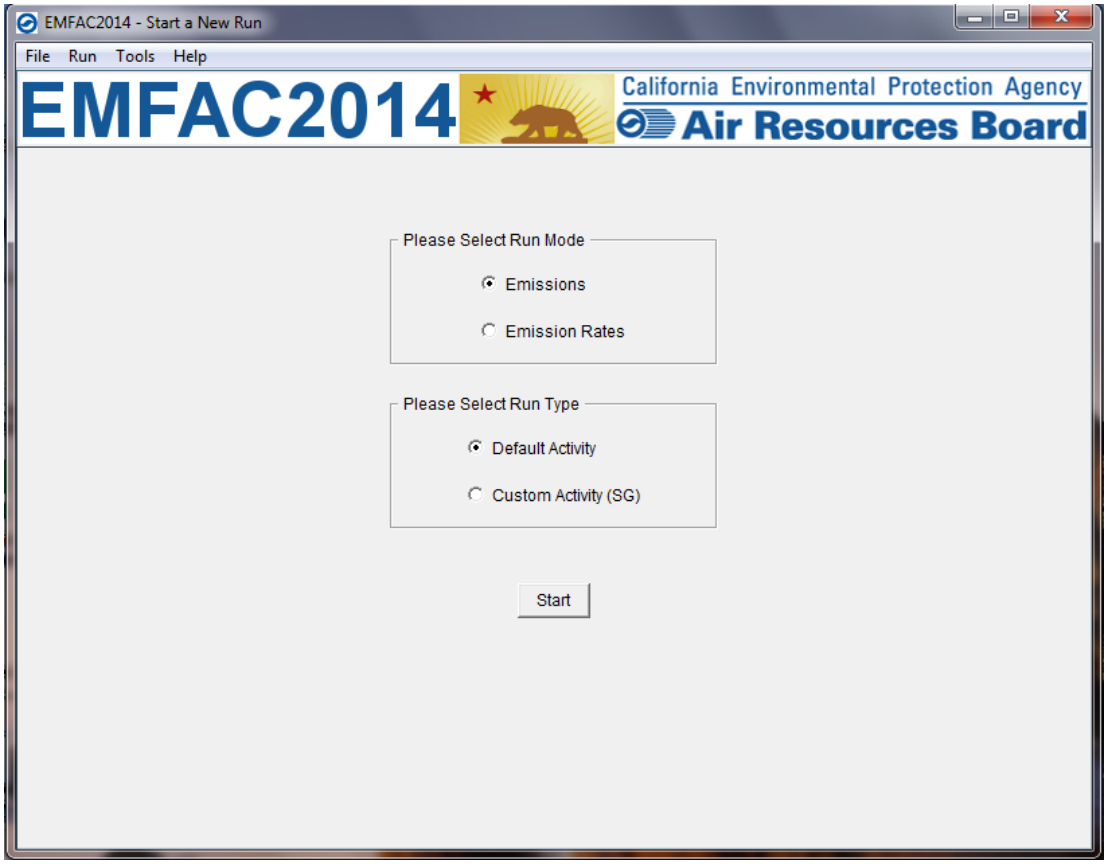


5.1 USING DEFAULT ACTIVITY MODE

In this section we explain how to accomplish a Default Activity Emissions run, which is typically performed for fuel-based emissions inventory analyses, either from the Home Screen or by loading an EMFAC2014 ".ers" file, saved from a previous run. The run parameters for a default emissions run are summarized in Appendix 2.

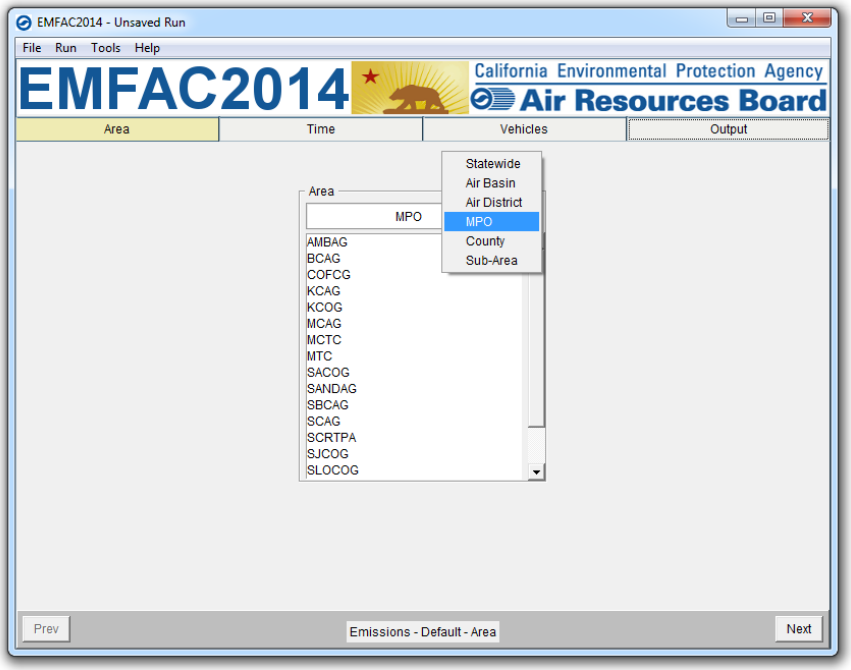
5.1.1 STARTING A DEFAULT ACTIVITY RUN

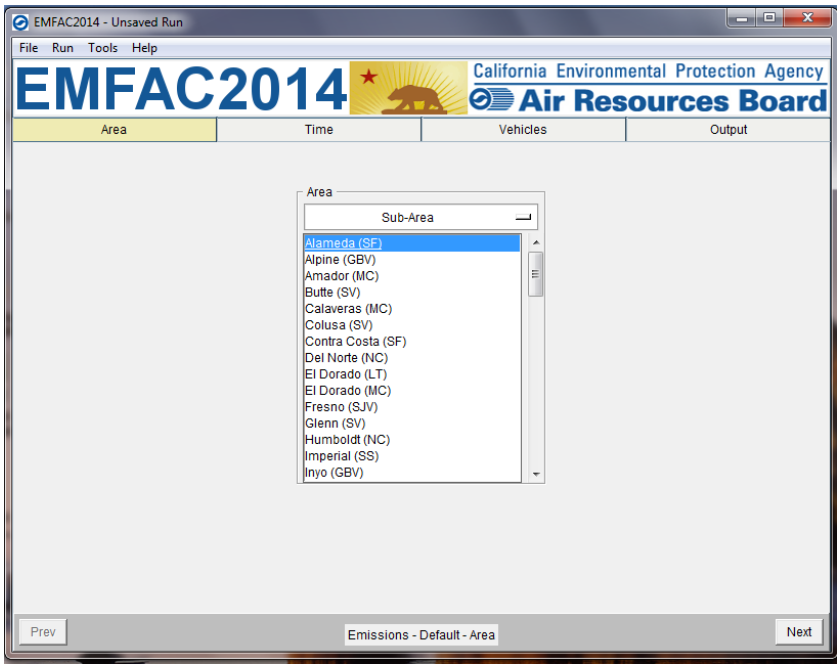
1. Go to the Home Screen by either restarting the model or clicking "New" in the File Menu.
2. Pick "Emissions" and "Default Activity" and click "Start".
   a. This takes the user to a window with four tabs (next page); the Area Tab, the Time Tab, the Vehicles Tab, and the Output Tab.
   b. Each tab presents options for the user to customize for the model run (full descriptions of the options within each of these tabs follows).



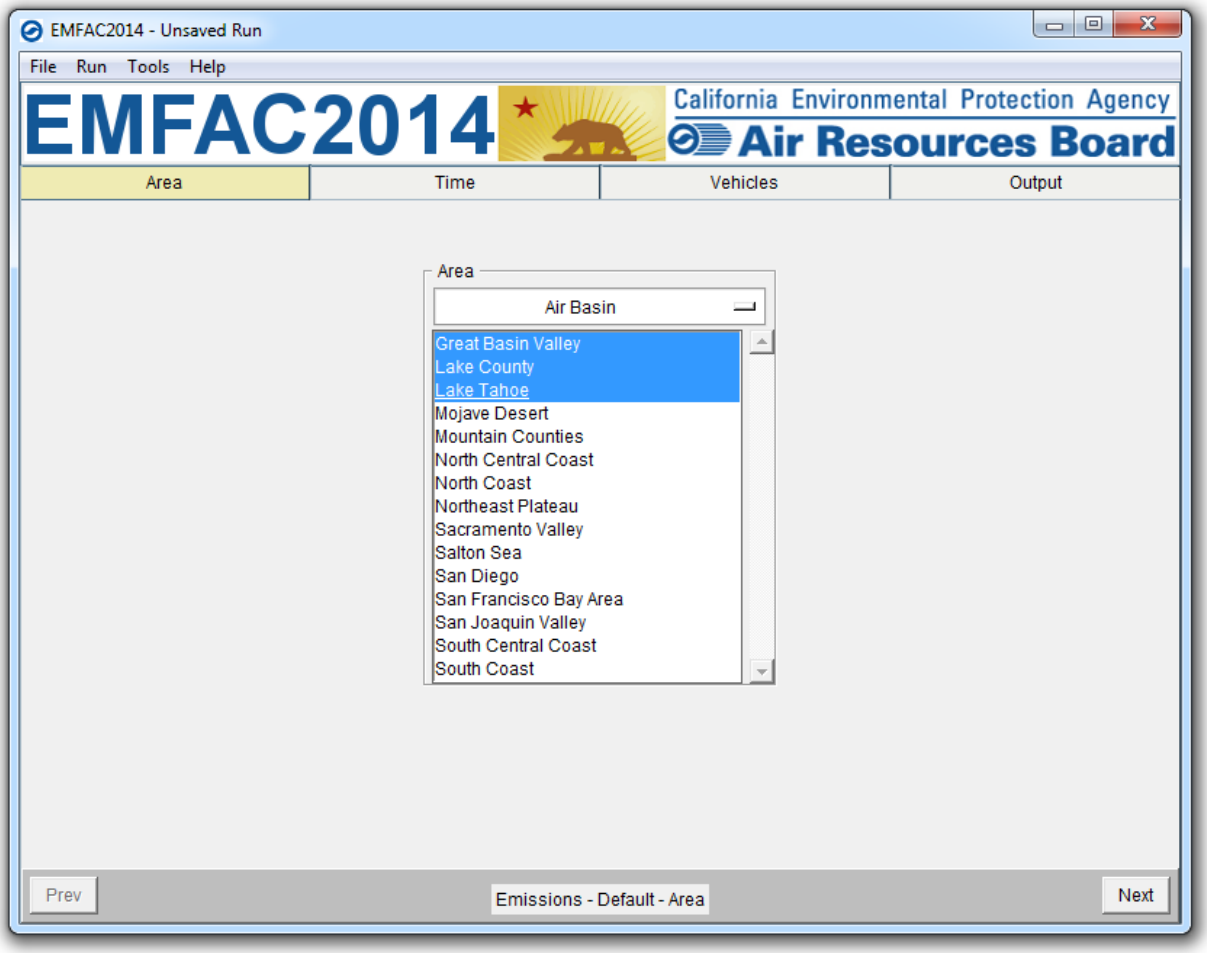
5.1.2 AREA TAB

- The Area Tab's list boxes allow the user to choose different area types and areas for analysis (note the "Area" tab is highlighted below). The user may pick from one of six area types: Statewide, Air Basin, Air District, MPO, County, or Sub-Area. Please refer to Appendix 3 for area definitions.



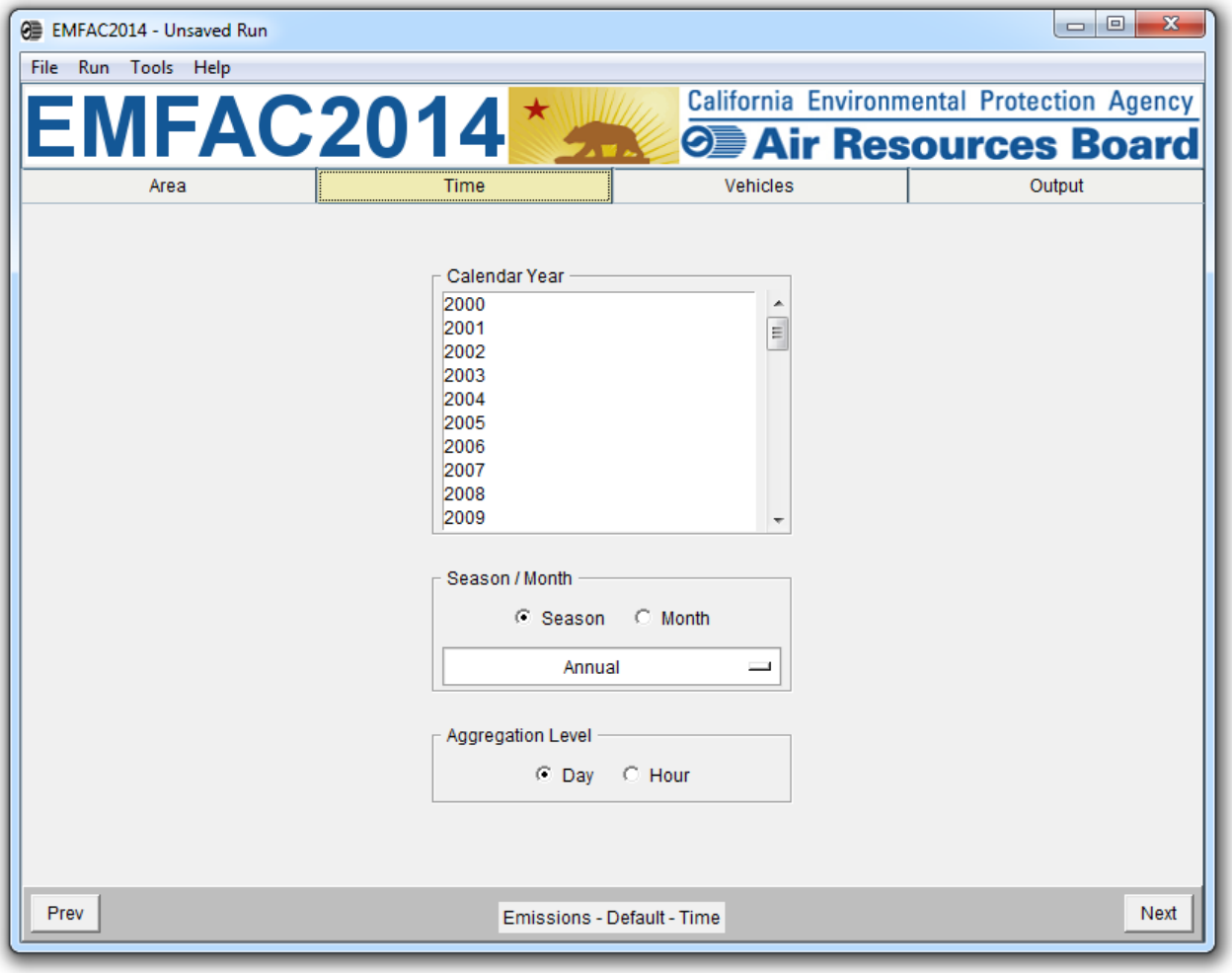


- The user may pick only one Area Type, but has the option of selecting multiple Areas within the chosen Area Type by holding the Ctrl key while clicking on an area.
- "Air Basin" has been selected in the following window, so multiple selections can be made (see figure).

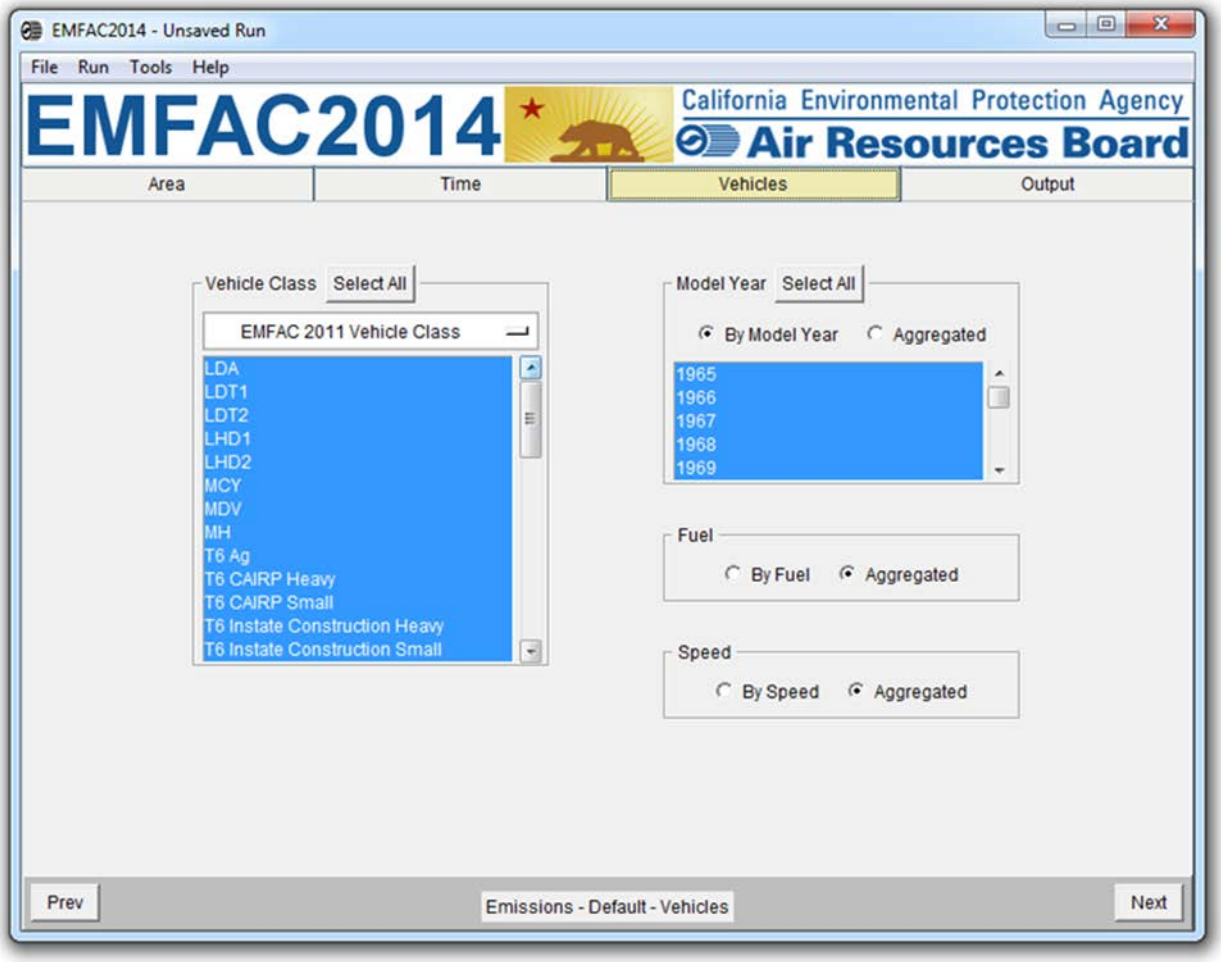


5.1.3 TIME TAB

- In the "Time" tab, a single Calendar Year or multiple years may be selected; however, only one Season or Month may be selected for each run.

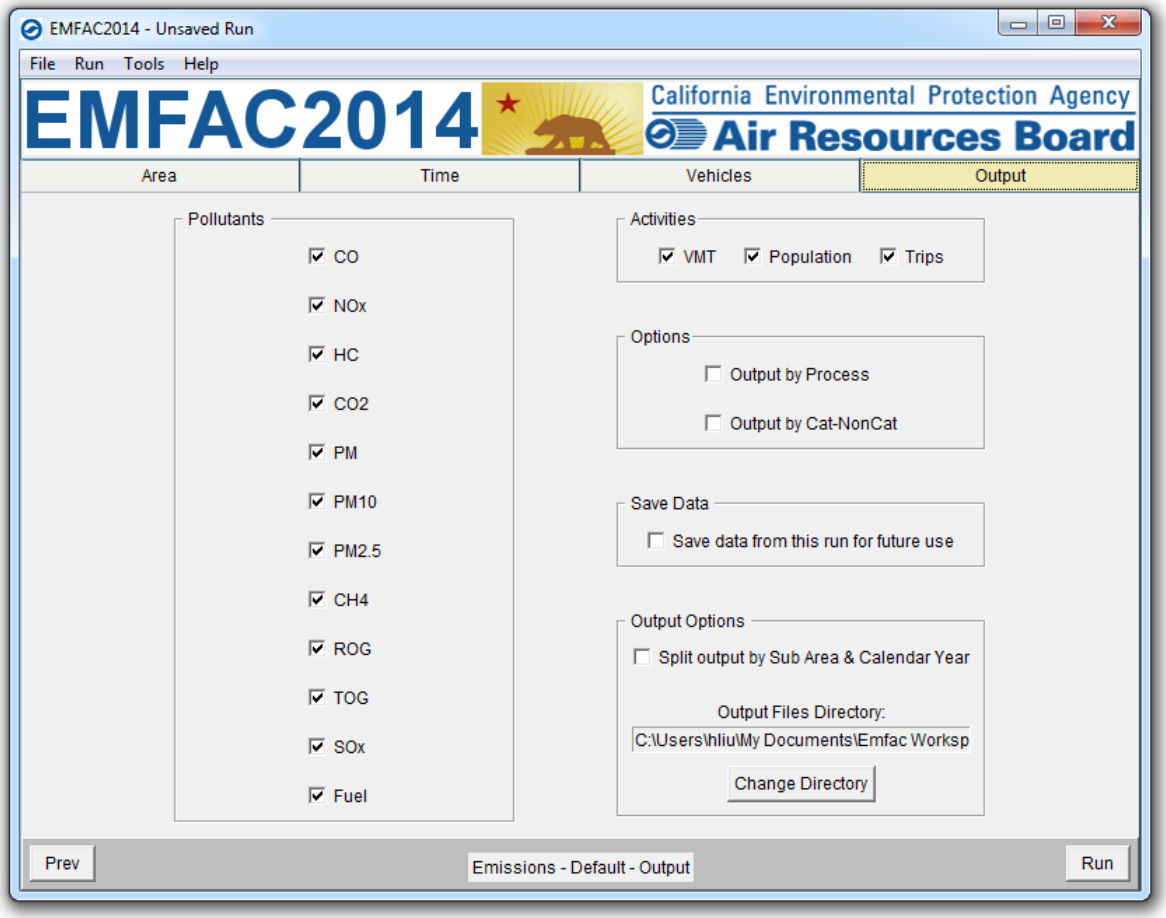


5.1.4 VEHICLES TAB



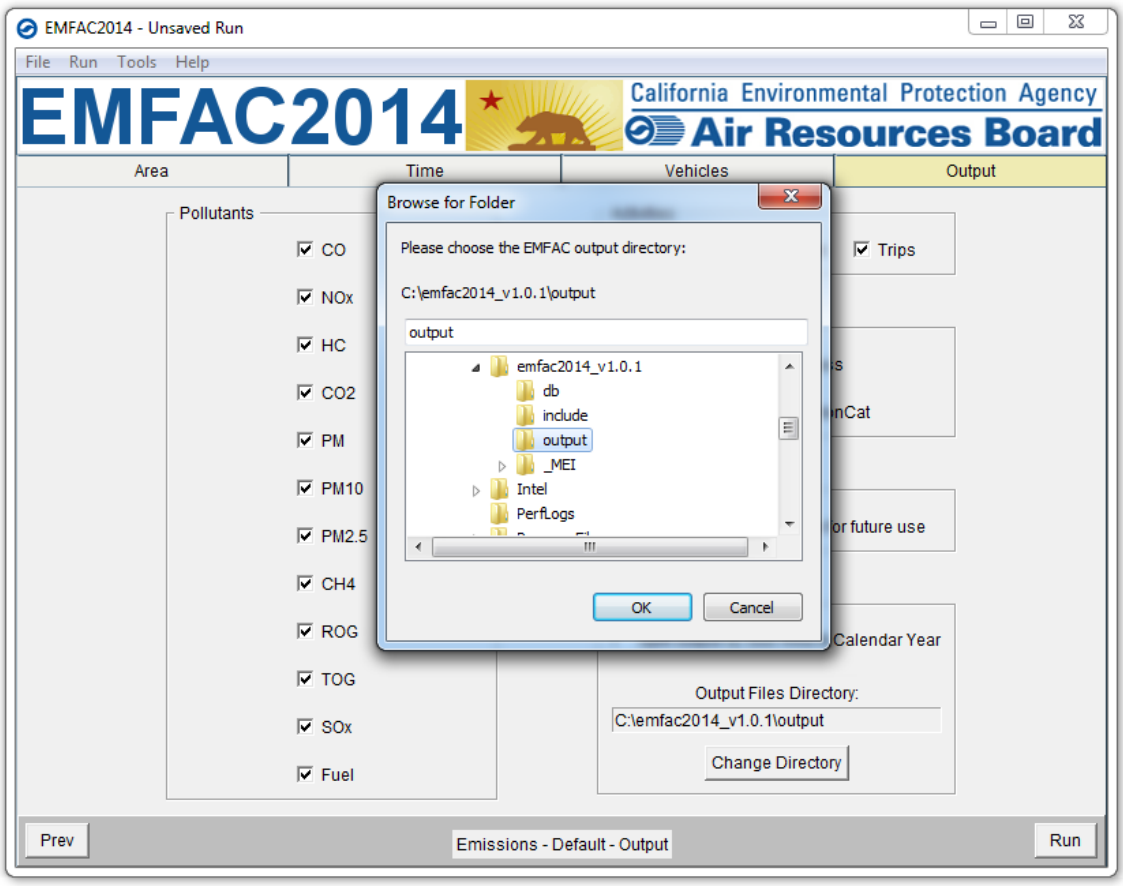
- In the Vehicle Class list box, the user can select the vehicle classes of interest. All vehicles can be selected by clicking "Select All". Both the EMFAC2007 and the EMFAC2011 Vehicle Classes are available. Please refer to Appendix 4 for definitions of vehicle categories.
- The data can be output in either "By Model Year" or "Aggregated" form.
  - Choosing By Model Year and selecting a large number of Model Years will increase the size of the output considerably.
- The user can choose to output the data "By Fuel" (for output by each fuel type) or "Aggregated" (for combined output only).
- The user can also choose to output the data "By Speed" (for output at each speed) or "Aggregated" (for combined output only).
  - Choosing "By Speed" will increase the size of the Output Table considerably.

5.1.5 OUTPUT TAB



- The "Pollutants" group box allows the user to choose the Pollutants for which data are to be included in the output.
- The "Activities" group box indicates which Activity data can be selected to be included in the output.
- The "Options" group box allows the user to choose "Output by Process" to output data per emissions process (e.g., Running Exhaust Emissions, or Start Exhaust Tailpipe emissions) or to choose "Output by Cat-NonCat" for output per Catalyst-Equipped and Non-Catalyst Equipped groupings.
- The "Save Data" group box selection will indicate whether the output data from the current run will be saved by the model INTERNALLY for reuse by eligible future runs. This does not affect model outputs.

- The "Output Options" group box allows users to: 1) split the model output into separate files based upon Sub-Area and Calendar Year to keep the size of the output files manageable; 2) specify a different directory to hold the output files other than the default directory at "C:\emfac2014\Output" by clicking the "Change Directory" button.
- The standard output format for a Default run is "CSV" (comma-separated text files). The format is different than the CSV report output in previous versions of EMFAC. The output files will have a numerical timestamp in the name of the files.

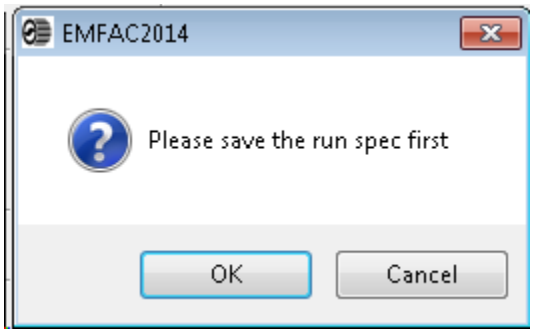


5.1.6 STARTING THE MODEL RUN

1. Limiting the number of calendar years, areas, and the level of detail selected will reduce the free space required for a run. This requirement decreases considerably if you deselect some of the options such as "By Hour", "By Model Year", etc.
2. Click "Run EMFAC", in the Run Menu, or the "Run" button at the lower right corner of the Output tab to start the model run.

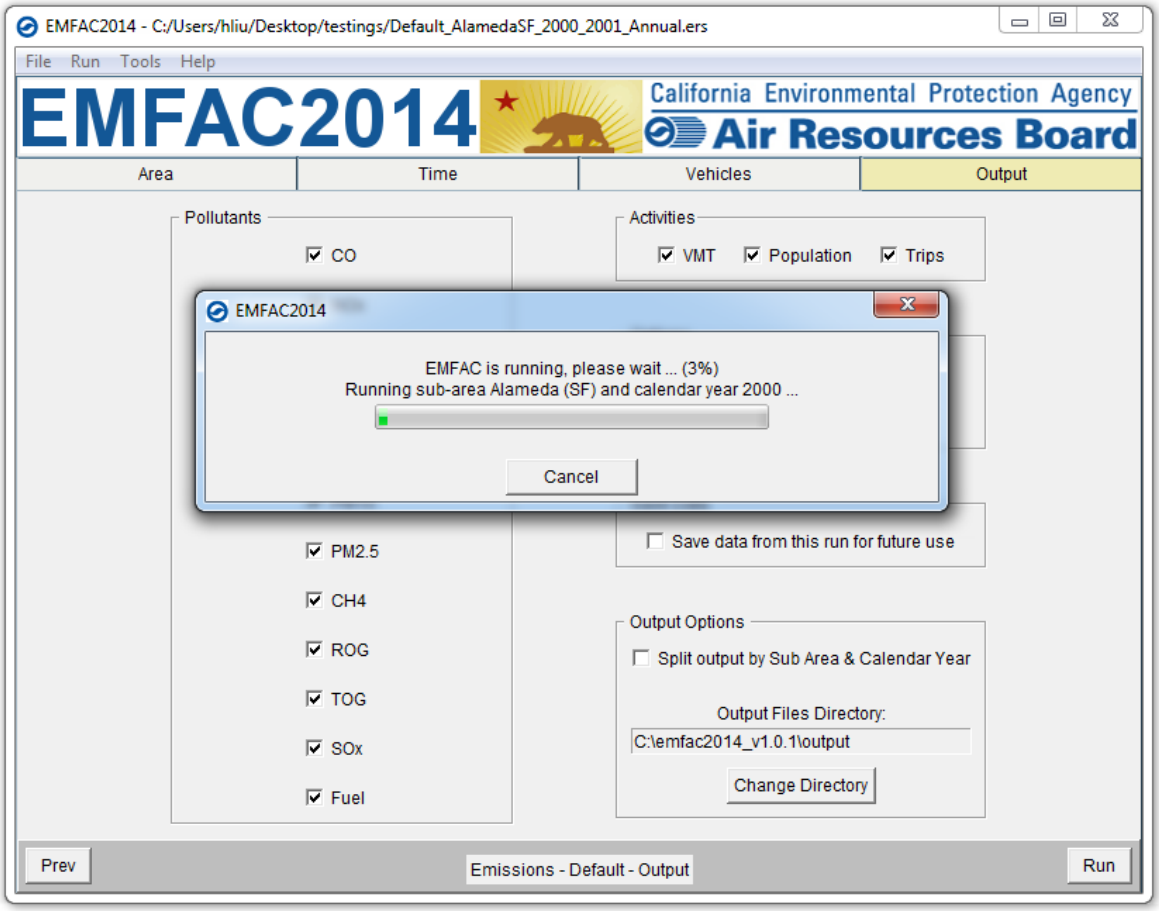
5.1.7 SAVING THE RUN SPECIFICATION

- Save the "Run Specification" (as ".ers" files) for future use after all the run parameters have been determined. Click "Save" in the file menu or click "OK" in the pop-up window after the run button is clicked to save the .ers file.



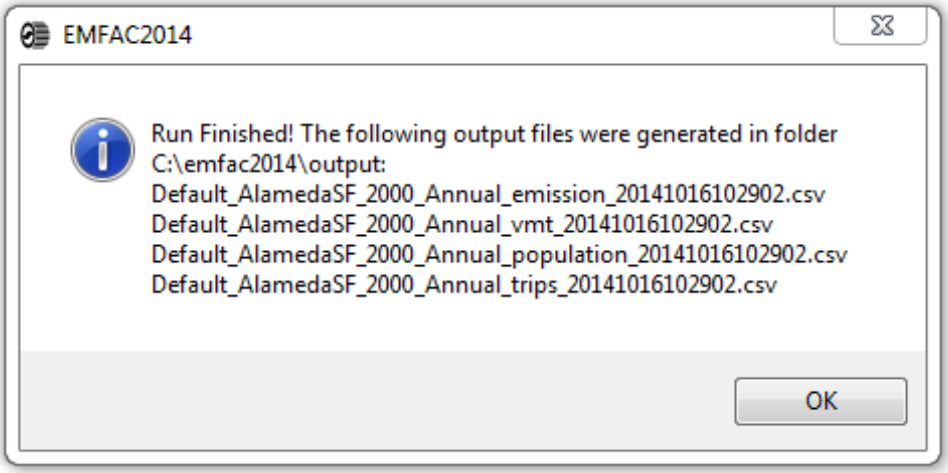
5.1.8 ONCE THE RUN HAS STARTED

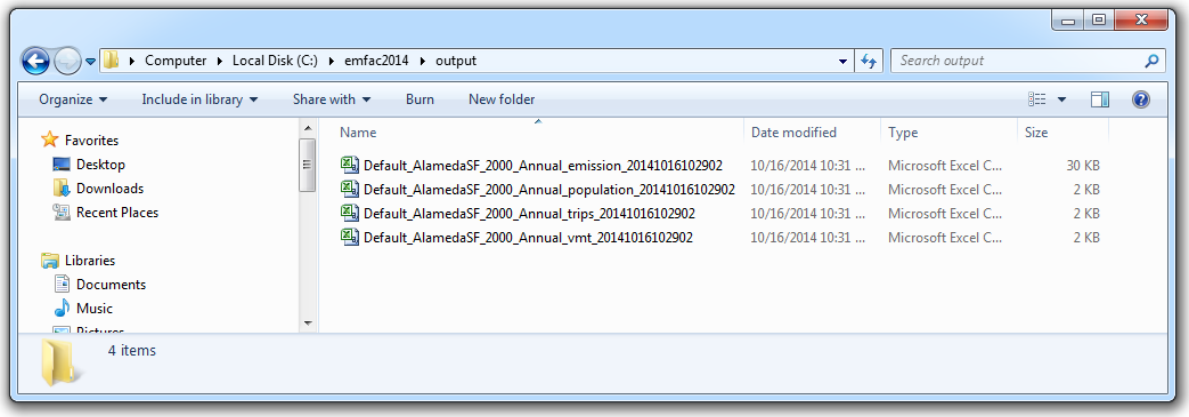
- The time it takes to finish a run depends on how many sub-areas and calendar years were selected, the aggregation level specified for the output files, and the performance of the computer.
- The model run can be stopped by clicking "Cancel" in the EMFAC2014 Window.
- The status window can be minimized by minimizing the main window.



- The following window provides the names and locations of the output files generated after the run has finished.
- A default emissions run file name will consist of the sub-area, the analysis year, the season, data type (emission, vmt, population, trips), and the time when the output file was generated. The user has the option to modify the first half of the filenames to their own naming

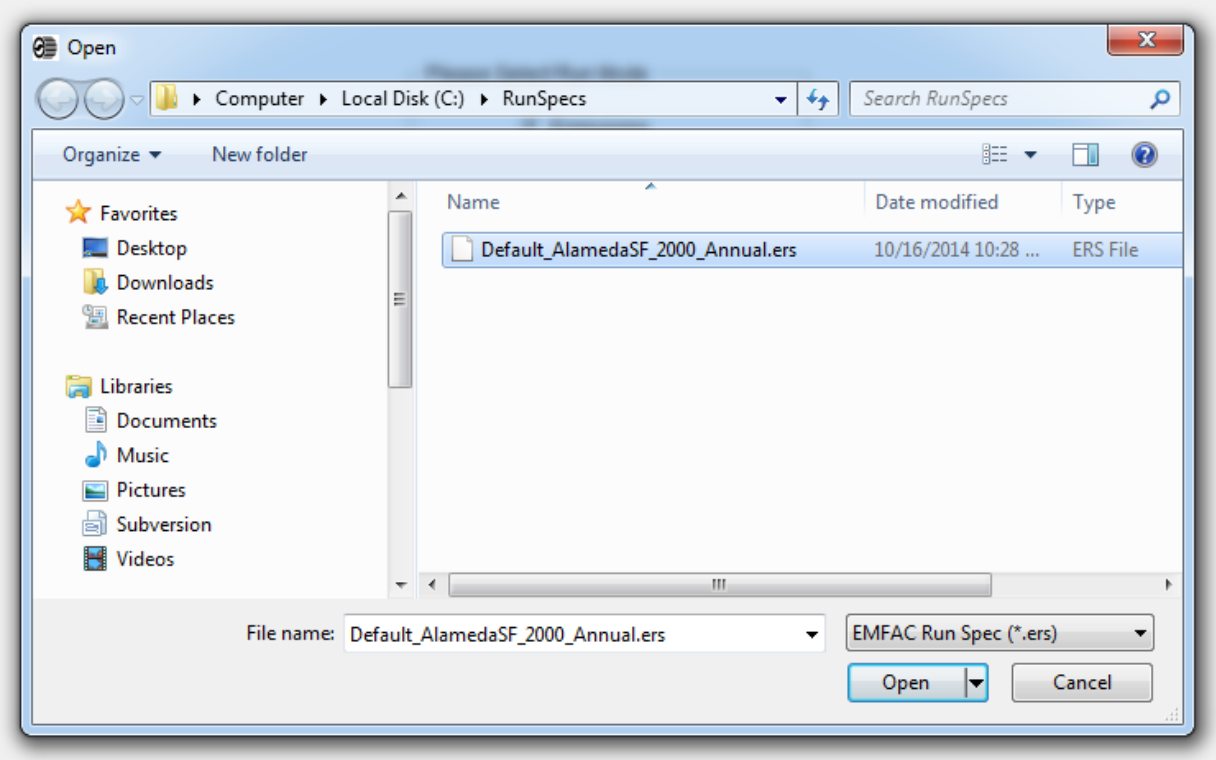
standards when saving the run specification. However, the data type and output file generation time will still be indicated at the end of filename.





5.1.9 START DEFAULT RUN USING A SAVED .ERS FILE

1. Click "Open" in the File Menu to load the file.



2. The run parameters will be loaded to the model and can be modified and saved as a new .ers file by clicking "Save" in the File Menu.

5.1.10 SAVE OUTPUT DATA FROM A RUN FOR FUTURE USE

As a way to reduce computational time, the model allows the output data from the current run to be saved for future use if "save data from this run for future use" is selected in the output tab. This works for both Default Activity Runs as well as Custom Activity (SG) runs.

Data saved from previous runs can be used if one or more of the three criteria are met:

1. The current run has exactly the same run parameters as one of the previous runs that have output saved.
2. The run parameters (Calendar Years, Areas) of the current run are a subset of parameters of one of the previous runs that have output saved.

3. The current run has fewer details or is more aggregated than the previous runs with saved output.

User waiting time is significantly reduced when saved output from previous runs is used for the current run. Extracting data from the saved Output files is much faster than recalculating all of the data.

5.2 USING CUSTOM ACTIVITY MODE (SG)

5.2.1 BACKGROUND

The Custom Activity Mode of EMFAC2014 is designed to perform emissions assessments for determining conformity with the state implementation plan and for compliance with SB375 targets. Both types of assessments are most often done by various planning agencies and air districts throughout California. These assessments require the user to create custom activity data files containing vehicle miles travelled (VMT) and/or speed profile data. This customized activity data will then be used for scaling the default vehicle emissions produced by EMFAC2014. Previously, this function was performed by EMFAC2011-SG ("Scenario Generator") or the What If Scenarios (WIS) generator in EMAC2007 and older versions.

EMFAC2014 allows the user to generate activity templates that contain daily VMT (either as totals or broken out by vehicle-tech) and/or hourly speed profiles. Allowing users to input hourly speed profiles is one of the major changes from EMFAC2011-SG for which only daily speed profiles are allowed. In addition, EMFAC2014 is able to import activity templates generated with EMFAC2011-SG.

5.2.2 TYPES OF CUSTOM ACTIVITY DATA

There are two custom activity input formats supported by EMFAC2014:

- EMFAC2014 format; and
- EMFAC2011-SG format (for backward compatibility purposes).

Both formats are provided as Excel workbooks (For the discussion below, note that, in Excel, the entire spreadsheet file is known as a "workbook"; an individual tab within the workbook is known as a "worksheet".) For both formats, the names of the worksheets MUST be exactly as produced from either EMFAC2011-SG or EMFAC2014. The following table shows a list of the worksheet names and the types of data each contain. EMFAC2014 uses these worksheet names to identify what type of data is present; so,

worksheets with any other names will be ignored. The user must provide either daily total VMT or daily total VMT by vehicle-tech. Speed fraction profiles are optional

Worksheets in EMFAC2011-SG and EMFAC2014 Custom Activity Templates

Template File Format Type	Worksheet Name	Description of Worksheet Data Fields
EMFAC2011-SG (*.xls)	regional_scenarios	Contains run parameters: area type, area, calendar year, and season
	scenario_base_inputs	Whether default or user input will be used and total daily VMT
	scenario_vmt_by_vehcat*	VMT by vehicle type and fuel
	scenario_speed_profiles*	Daily speed profile
EMFAC2014 (*.xlsx)	settings	Season/month and whether it is a SB375 template
	daily_total_vmt**	Daily total VMT
	daily_vmt_by_veh_tech**	Daily VMT by vehicle type and fuel
	hourly_fraction_veh_tech_speed*	Hourly speed profile calculated using default VMT by hour by speed

*Optional – may or may not be created based on user input; **One, not both, will exist.

EMFAC2014 can import multiple sets of activity data at one time; however, they must be the same type: they all must be either the EMFAC2011-SG type or the EMFAC2014 type. Also, EMFAC2014 can only process data for multiple scenarios with the same type of area. That is, one cannot run a scenario with the SCAG MPO and the Lake Tahoe Air Basin, since the first is an MPO and the second is an Air Basin.

<u>EMFAC2011-SG Format:</u>

Since new users may be interested in using existing EMFAC2011-SG activity inputs in EMFAC2014, EMFAC2011 backward compatibility is covered first.

The EMFAC2011-SG format is saved in Excel 2003 format (suffix is "*.xls"). If you have an existing 2011 SG formatted data set that you have edited and saved in the Excel 2007 format (suffix is *.xlsx) , you will need to re-save it in the Excel 2003 format (suffix is *.xls) in order for EMFAC2014 to read it. The top four rows in the table above provides the worksheet

names contained in the EMFAC2011-SG formatted Excel file.

In the EMFAC2011-SG format, the "scenario_base_inputs" worksheet determines which data will be read in as custom data; columns H, I, and J (named "VMT Profile", "VMT by Vehicle Category", "Speed Profile", respectively) indicate to EMFAC2014 whether the data contained in the scenario_base_input, scenario_vmt_by_vehcat, and scenario_speed_profiles worksheets contain "default" data or "user" data (i.e., custom data).

IMPORTANT! The table below summarizes the possible combinations of options in the EMFAC2011-SG formatted scenario_base_inputs worksheet. For scaling to take place, one or more of the two columns, "VMT Profile" or "VMT by Vehicle Category", should contain the "user" designation; otherwise, EMFAC2014 will treat it as a default activity run and neither VMT nor speeds will be scaled. If the combination of options corresponds to a "No Scaling" determination in the VMT column, then EMFAC2014 will post a message to this effect. This means that the user is, essentially, selecting a combination of options that can be generated using a default EMFAC run. Note also that, if both the "VMT Profile" and the "VMT by Vehicle Category" are marked as "user", priority is given to the "VMT by Vehicle Category" scalars contained in the scenario_vmt_by_vehcat worksheet.

Scenario_Base_Inputs Worksheet: Options for VMT and Speed Scaling

VMT Profile	VMT by Vehicle Category	Speed Profile	Scaling Base on VMT	Scaling Base on Speed Profile
Default	Default	Default	No Scaling	No
User	Default	Default	Scaling by VMT Total	No
Default	User	Default	Scaling by VMT-Veh Tech	No
User	User	Default	Priority Scaling by VMT-VehTech	No
Default	Default	User	No Scaling	No
User	Default	User	Scaling by VMT Total	Yes
Default	User	User	Scaling by VMT-Veh Tech	Yes
User	User	User	Priority Scaling by VMT-VehTech	Yes

EMFAC2014 Format:

This section will cover how to generate a custom activity file in EMFAC2014 in more detail. Generally speaking, EMFAC2014 will produce a template with the default VMT and the optional hourly speed fraction profile data. The EMFAC2014 custom activity data format is always saved in the Excel 2007 format (suffix is "*.xlsx"). The EMFAC2014 custom activity data format is similar to that of EMFAC2011-SG, except the scenario number and title columns are removed. The table below summarizes the worksheets contained in the EMFAC2014-formatted Excel activity template file (repeated from the table provided earlier in this section).

Worksheets in EMFAC2014 Format Activity Templates

Template File Format Type	Worksheet Name	Description of Worksheet Data Fields
EMFAC2014 (*.xlsx)	settings	Season/month and whether it is a SB375 template
	daily_total_vmt**	Daily total VMT
	daily_vmt_by_veh_tech**	Daily VMT by vehicle type and fuel
	hourly_fraction_veh_tech_speed*	Hourly speed profile calculated using default VMT by hour by speed

*Optional – may or may not be created based on user input; **One, not both, will exist.

The settings worksheet is used for two purposes: to specify the season/month value for the desired emissions run, and to indicate whether or not the template is for SB375 or conformity purposes.

The table below summarizes the effect of selected GUI options in EMFAC2014 on which worksheets are generated (see ** in previous table) and how custom activity scaling is performed.

EMFAC2014 Templates: Effect of GUI Options on Worksheets and Scaling

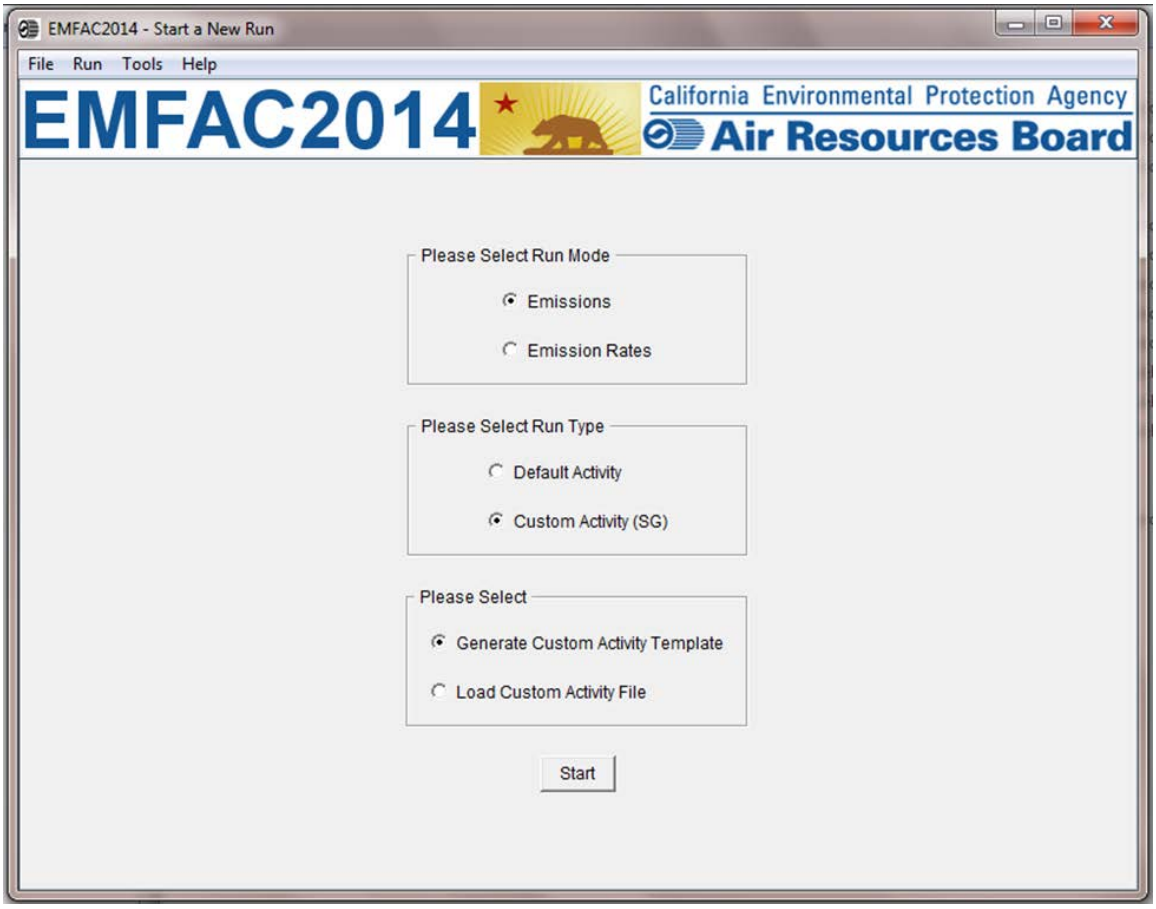
User-Select GUI Options		***Scaling Approach (Cannot be Modified)***	
VMT Data Type	Custom Hourly Speed Fractions	VMT Scaling Result	Speed Scaling?
Total Daily VMT	unchecked	Scaling by VMT Total	No
VMT by Vehicle and Fuel Type	unchecked	Scaling by VMT-Veh Tech	No
Total Daily VMT	Checked	Scaling by VMT Total	Yes
VMT by Vehicle and Fuel Type	Checked	Scaling by VMT-Veh Tech	Yes

IMPORTANT! SB375 vs non-SB375. If the user opts to generate an SB375 template (again, more details are provided in the next section), the Excel template will be 'hard coded' as an SB375 template. This is because SB375 runs require the Advanced Clean Cars and the Low Carbon Fuel Standards to be turned off in the calculations made for the emissions inventory that will be generated. The Advanced Clean Cars program assumes a different fleet mix and vehicle miles travelled, so output produced for SB375 purposes will not match output that was not produced for SB375 purposes.

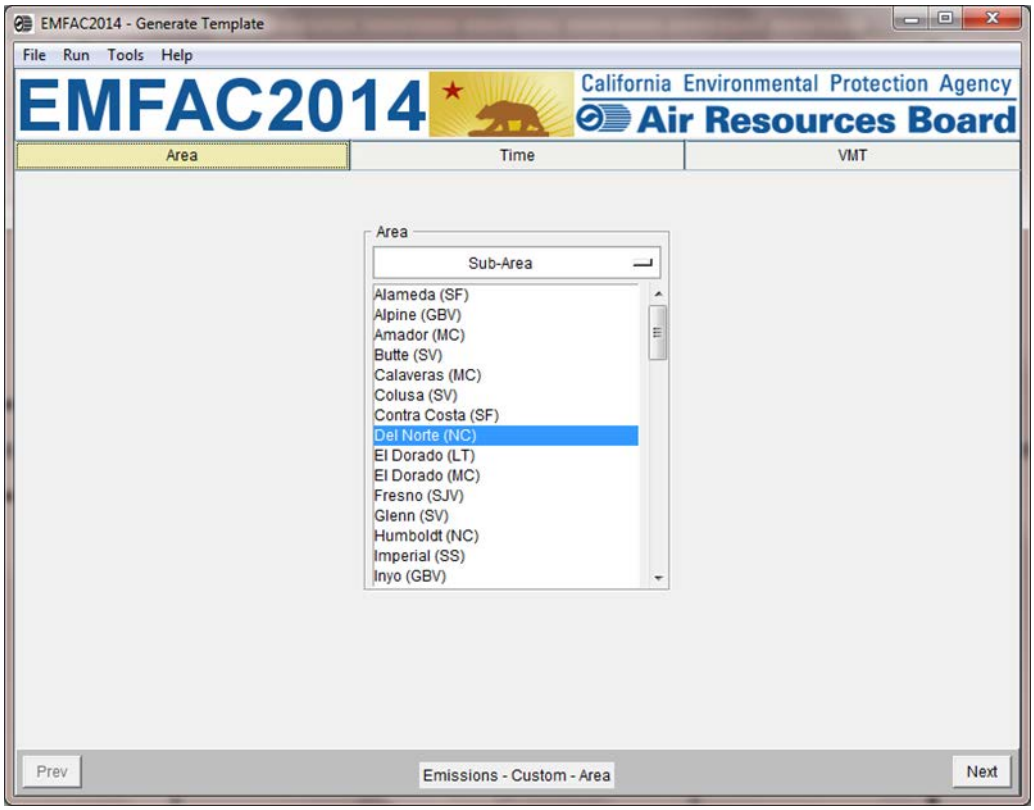
5.2.3 GENERATING A CUSTOM ACTIVITY TEMPLATE

The run parameters for generating a custom activity template are summarized in Appendix 5.

1. Select the "Custom Activity (SG)" Run Type, and then "Generate Custom Activity Template" in the pop-up dialog box that appears.

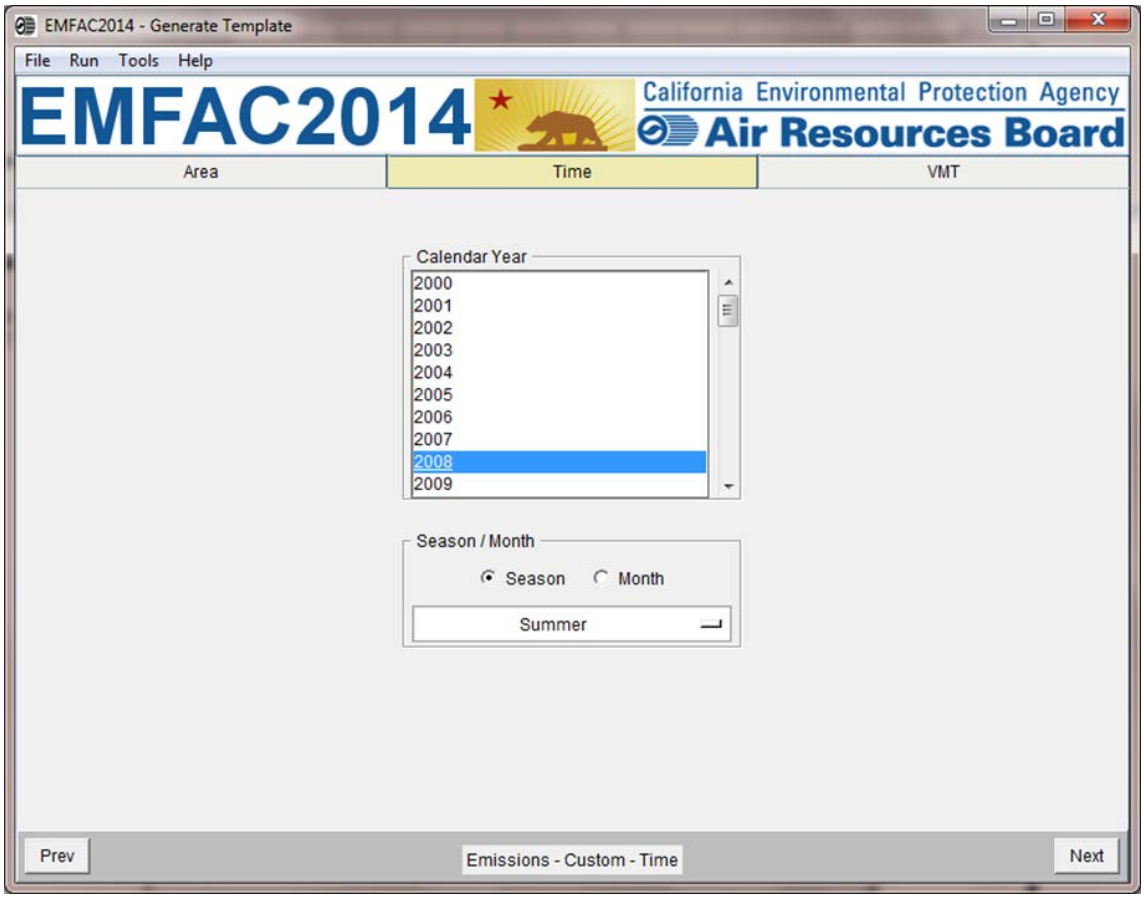


2. Click "Start". The following window will appear:



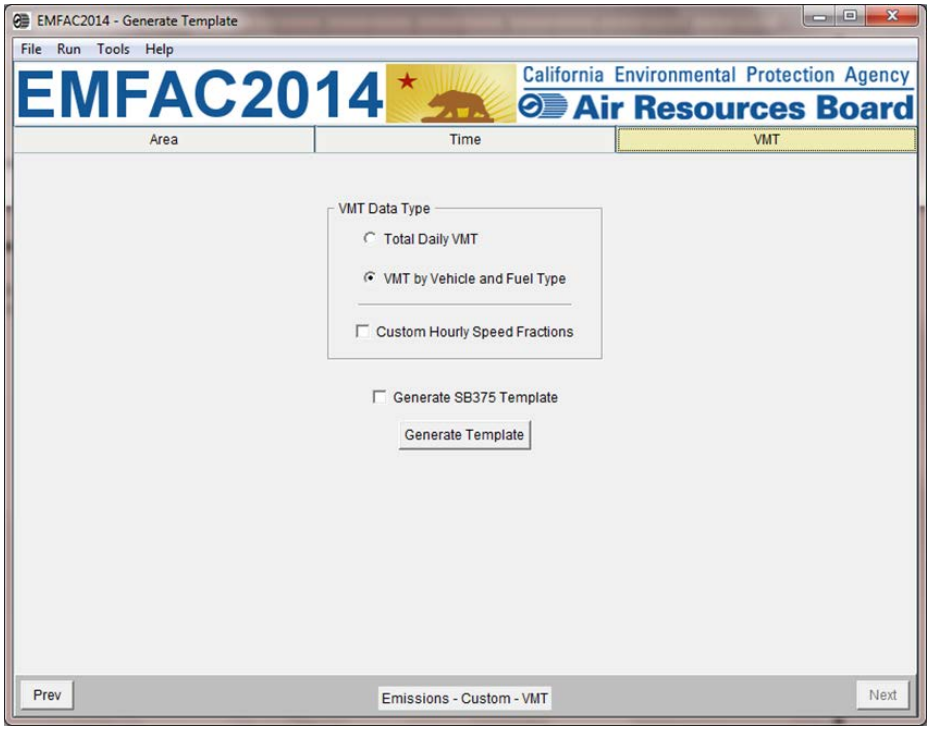
3. In the Area tab, you can change the area type by clicking where "Sub-Area" appears above.
4. Select one or more Areas, however, the more areas selected, the longer the runtime will be. If you hold down either the shift or the control key while clicking, you can select multiple areas.
5. Click "Next" or the Time tab.

6. On the Time tab, select one or more calendar years, however, the more years you select, the longer runtime will be.
7. Select "Season" or "Month" and then specify which Season or Month you would like to use.



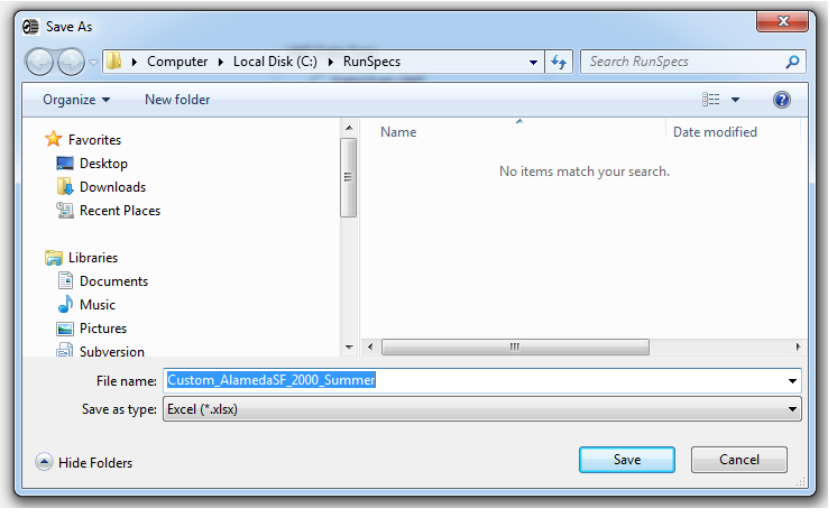
8. Click "Next" or the VMT tab.

9. On the VMT tab, select the VMT data type you would like for inputting the data into the template you will generate.
10. Select "Custom Hourly Speed Fractions" if your own speed profile will be used.
11. Choose whether or not the template will be for SB375.
12. Click the "Generate Template" button.

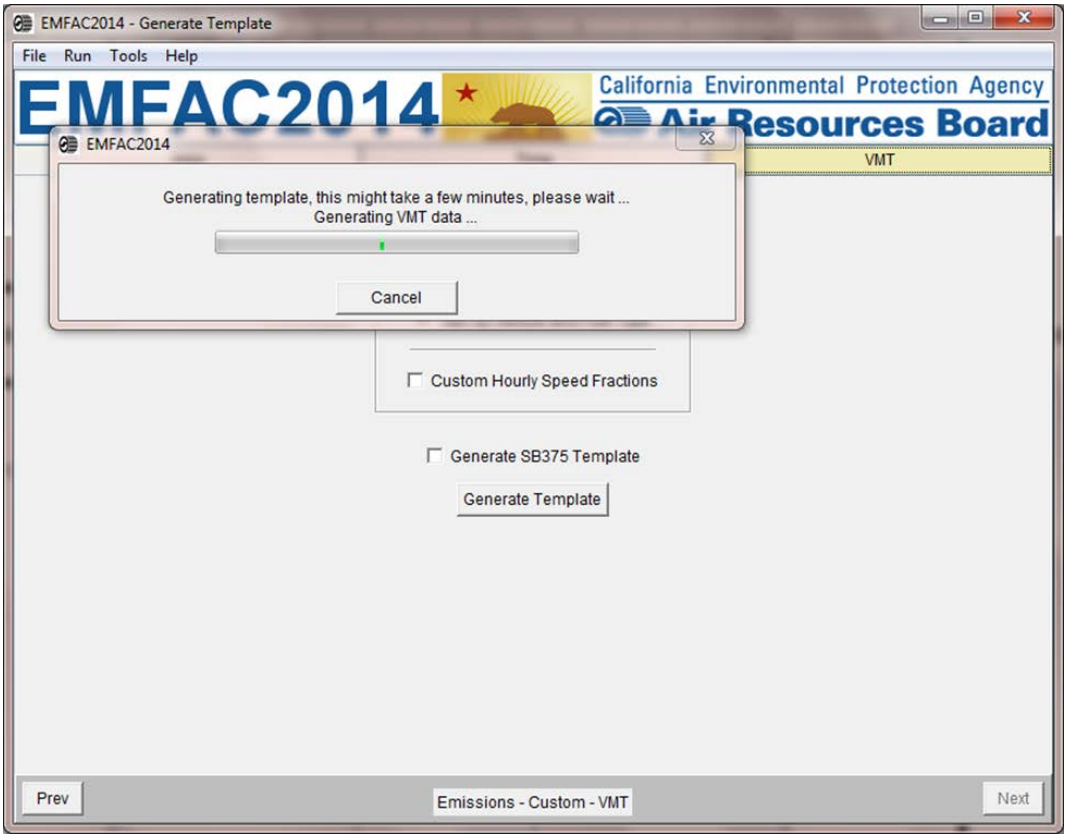


IMPORTANT! SB375 vs non-SB375. If the user opts to generate an SB375 template (by checking the "Generate SB375 Template"), the resulting Excel template will be 'hard coded' as an SB375 template (i.e. a user will not be able to manually modify the SB375 status in the output Excel file). This is because SB375 runs require the Advanced Clean Cars and the Low Carbon Fuel Standards to be turned off in the calculations made for the emissions inventory that will be generated. The Advanced Clean Cars program assumes a different fleet mix and vehicle miles travelled, so output produced for SB375 purposes will not match output that was not produced for SB375 purposes.

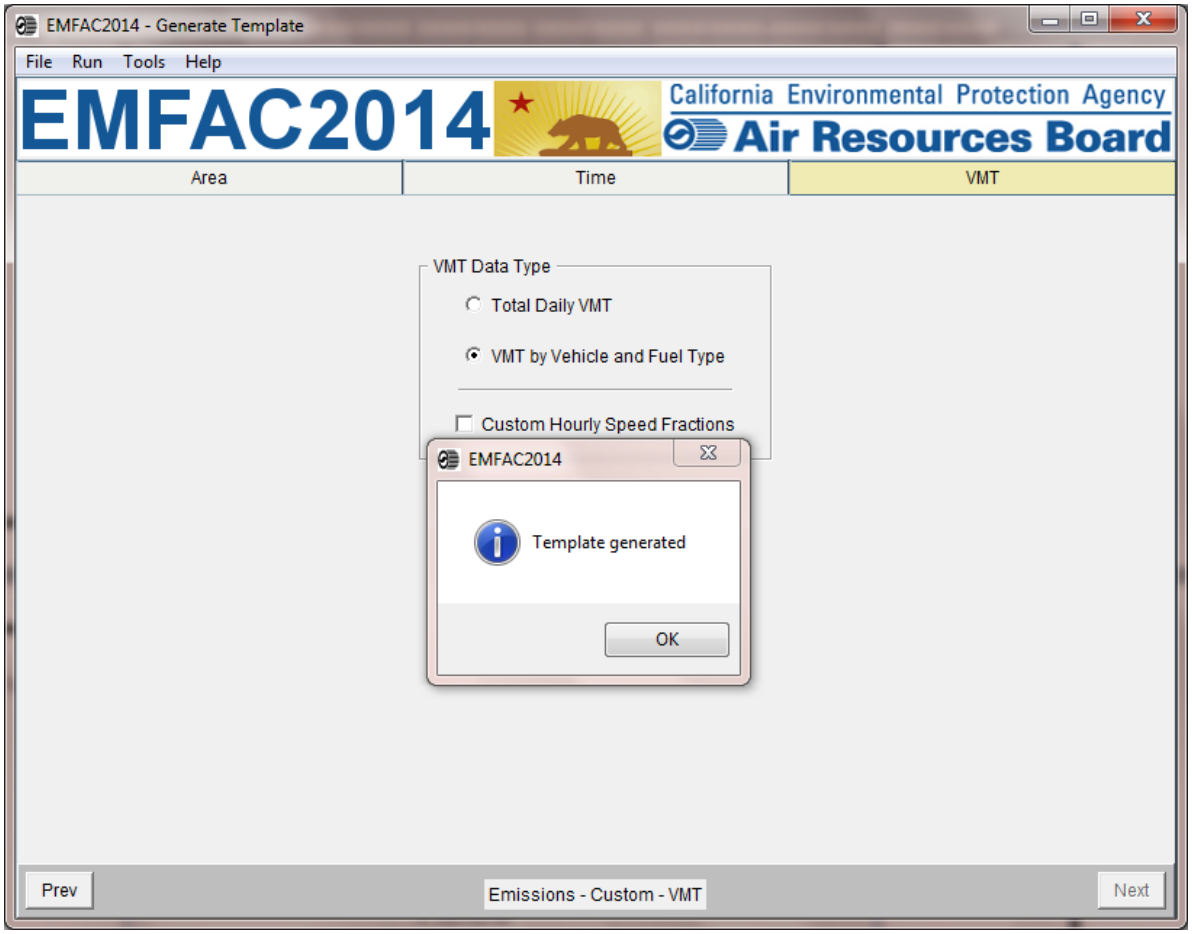
13. Select where the template will be saved, then click "Save" and the model will start generating the template.



14. Click "Save" and the model will start generating the template.



15. The following window will be shown after the template is generated.



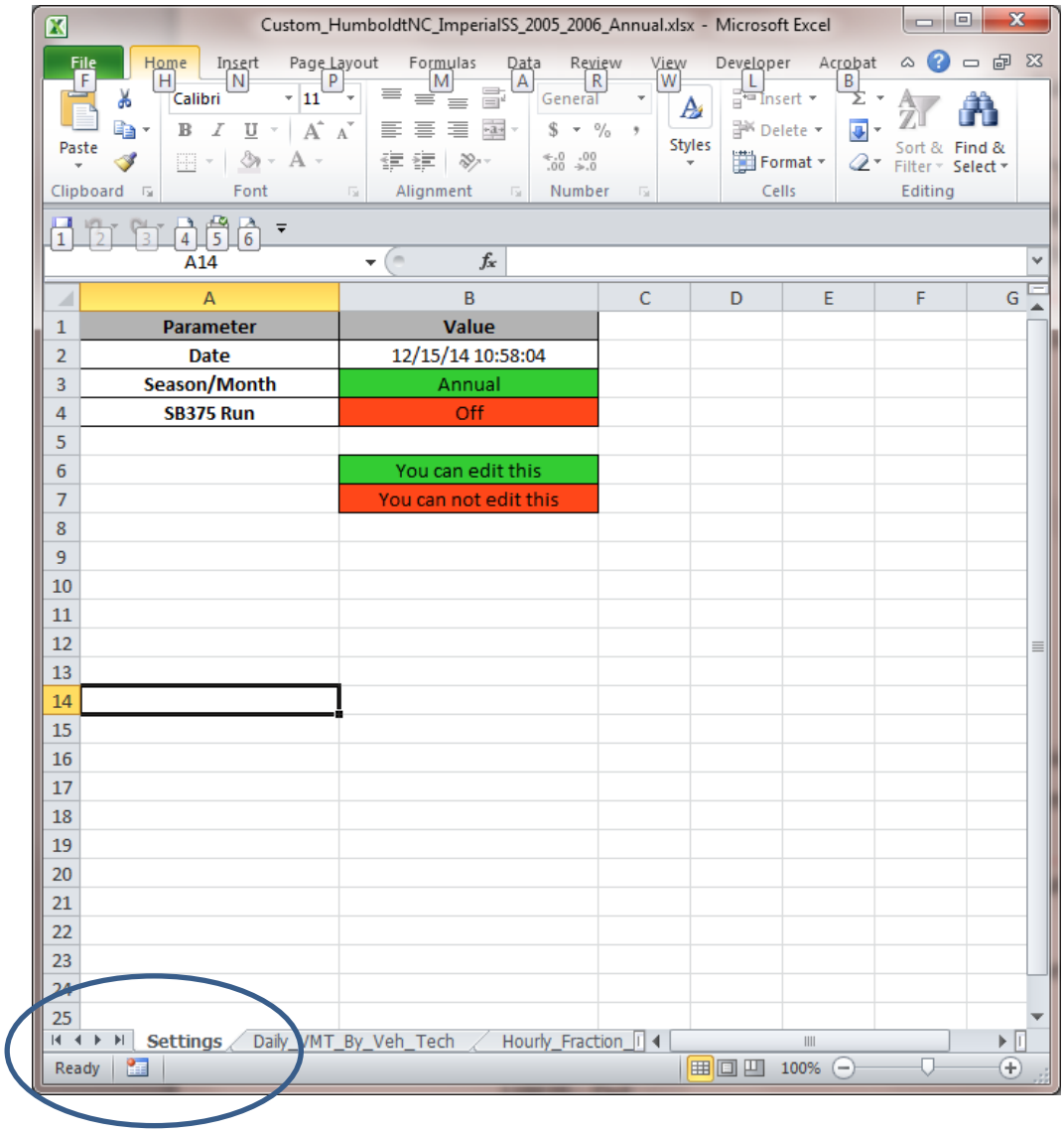
5.2.4 MODIFYING CUSTOM ACTIVITY TEMPLATES

Custom activity templates are generated in a Microsoft Excel format. Users can use Excel to edit the data to meet their needs. Before using the activity templates, there are several things to know:

- EMFAC2014 Templates are always in Excel 2007 format, and have the suffix "xlsx"; while EMFAC2011-SG Templates are always in Excel 2003 format, and have the suffix "xls".
- The worksheet names for either of these types of custom activity template must not be changed. These names are used to identify what type of data is present. Worksheets with any other names will be ignored.

- The order and names of columns should not be changed on worksheets and data rows should not be deleted.

- EMFAC2014 Templates have a worksheet named "Settings" (below). This is primarily used to define the season or month being analyzed and whether the custom activity template contains activity for a conformity assessment or a SB375 assessment. The field indicating the season/month can be changed; the field with the SB375 setting cannot be changed.

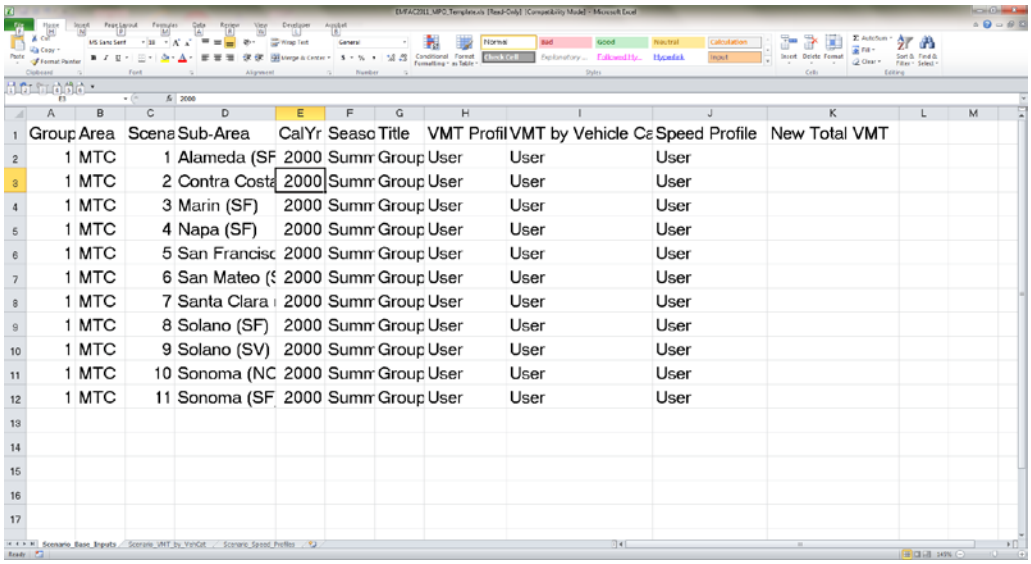


- For worksheets broken out by vehicle-tech, all vehicle-tech types must be present. If you generate an EMFAC2014 custom activity template, all necessary vehicle-techs are provided while this is not required for EMFAC2011-SG.
- Speed fractions should add up to one for each hour in the "Hourly_Fraction_Veh_Tech_Speed" tab.
- The EMFAC default speed profile will always be used for the following vehicle types for all regions:

  UBUS - Gas
  UBUS - Dsl
  PTO – Dsl
  T7 SWCV – Dsl
- The EMFAC default speed profile will always be used for drayage trucks for Alameda (SF), Los Angeles (MD), Los Angeles (SC), San Bernardino (MD), and San Bernardino (SC):

  T7 Other Port - Dsl
  T7 POAK - Dsl
  T7 POLA - Dsl
- "Default" in the "Scenario_Base_Inputs" tab of EMFAC2011 custom activity files means that the model will use EMFAC2014 default data, not EMFAC2011 default data; EMFAC2014 custom activity files contain EMFAC2014 default data, not EMFAC2011 default data.

- One or more of the "VMT Profile", the "VMT by Vehicle Category", and the "Speed Profile" columns in the "Scenario_Base_Input" tab in the EMFAC2011 files needs to be designated as "User" for the EMFAC2014 model to process the input data (see screenshot below). EMFAC2011 files, in which all of the three columns are "Default," will be rejected; a default inventory can be produced using the EMFAC2014 Default Activity run type.

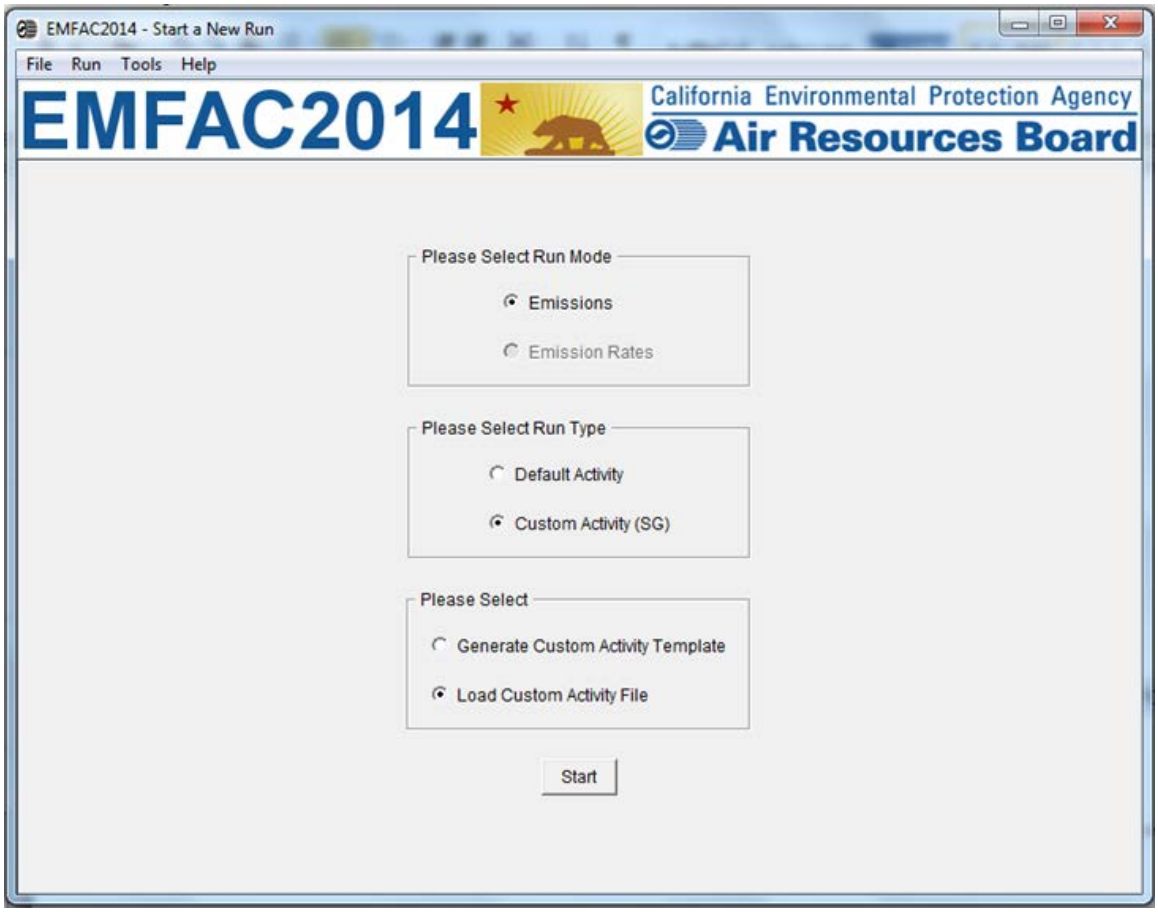


Group	Area	Scena	Sub-Area	CalYr	Seaso	Title	VMT Profil	VMT by Vehicle Ca	Speed Profile	New Total VMT
1	MTC	1	Alameda (SF	2000	Sumn	Group	User	User	User	
1	MTC	2	Contra Costa	2000	Sumn	Group	User	User	User	
1	MTC	3	Marin (SF)	2000	Sumn	Group	User	User	User	
1	MTC	4	Napa (SF)	2000	Sumn	Group	User	User	User	
1	MTC	5	San Francisc	2000	Sumn	Group	User	User	User	
1	MTC	6	San Mateo (S	2000	Sumn	Group	User	User	User	
1	MTC	7	Santa Clara	2000	Sumn	Group	User	User	User	
1	MTC	8	Solano (SF)	2000	Sumn	Group	User	User	User	
1	MTC	9	Solano (SV)	2000	Sumn	Group	User	User	User	
1	MTC	10	Sonoma (NC	2000	Sumn	Group	User	User	User	
1	MTC	11	Sonoma (SF	2000	Sumn	Group	User	User	User	

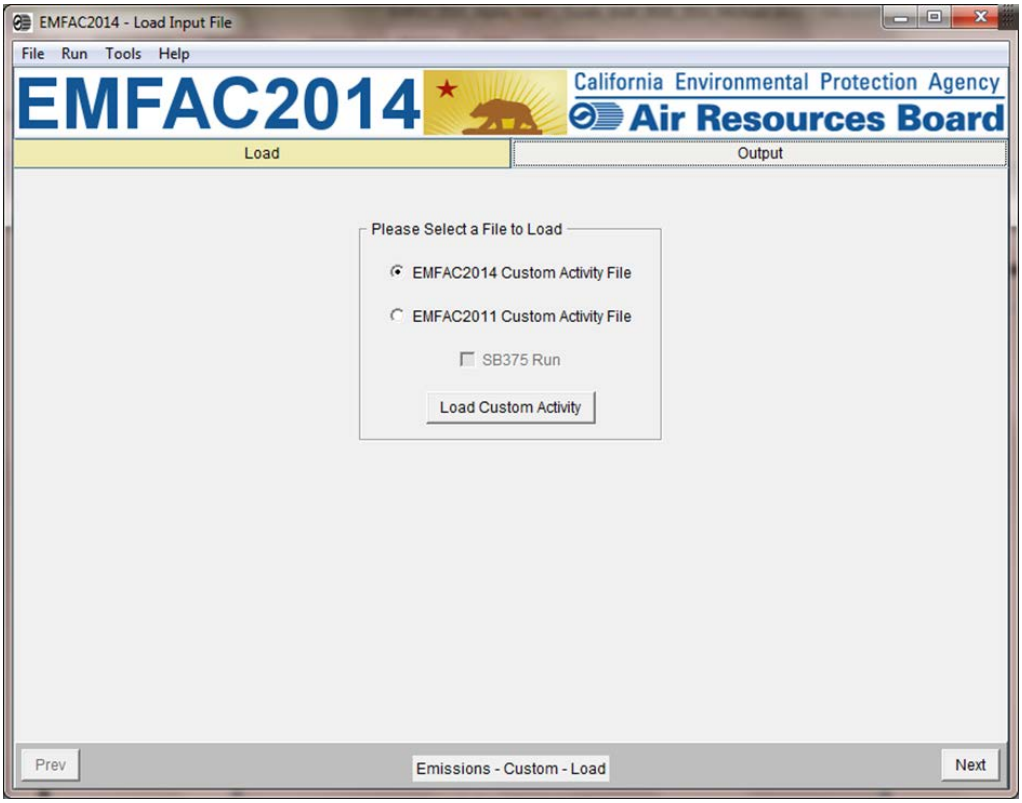
5.2.5 RUNNING EMFAC WITH A CUSTOM ACTIVITY TEMPLATE

NOTE: The run parameters for generating a customized activity inventory are summarized in Appendix 6.

1. Return to the Home Screen by selecting "File", "New" from the menu and select "Custom Activity (SG)".
2. Select "Load Custom Activity File" and click the "Start" button.



3. Select the type of Custom Activity Template, either EMFAC2011 or EMFAC2014.
4. Select SB375 run if an EMFAC2011 file is to be imported for a SB375 run. SB375 will be automatically selected, if it is already specified as a SB375 run, in the EMFAC2014 custom activity template.

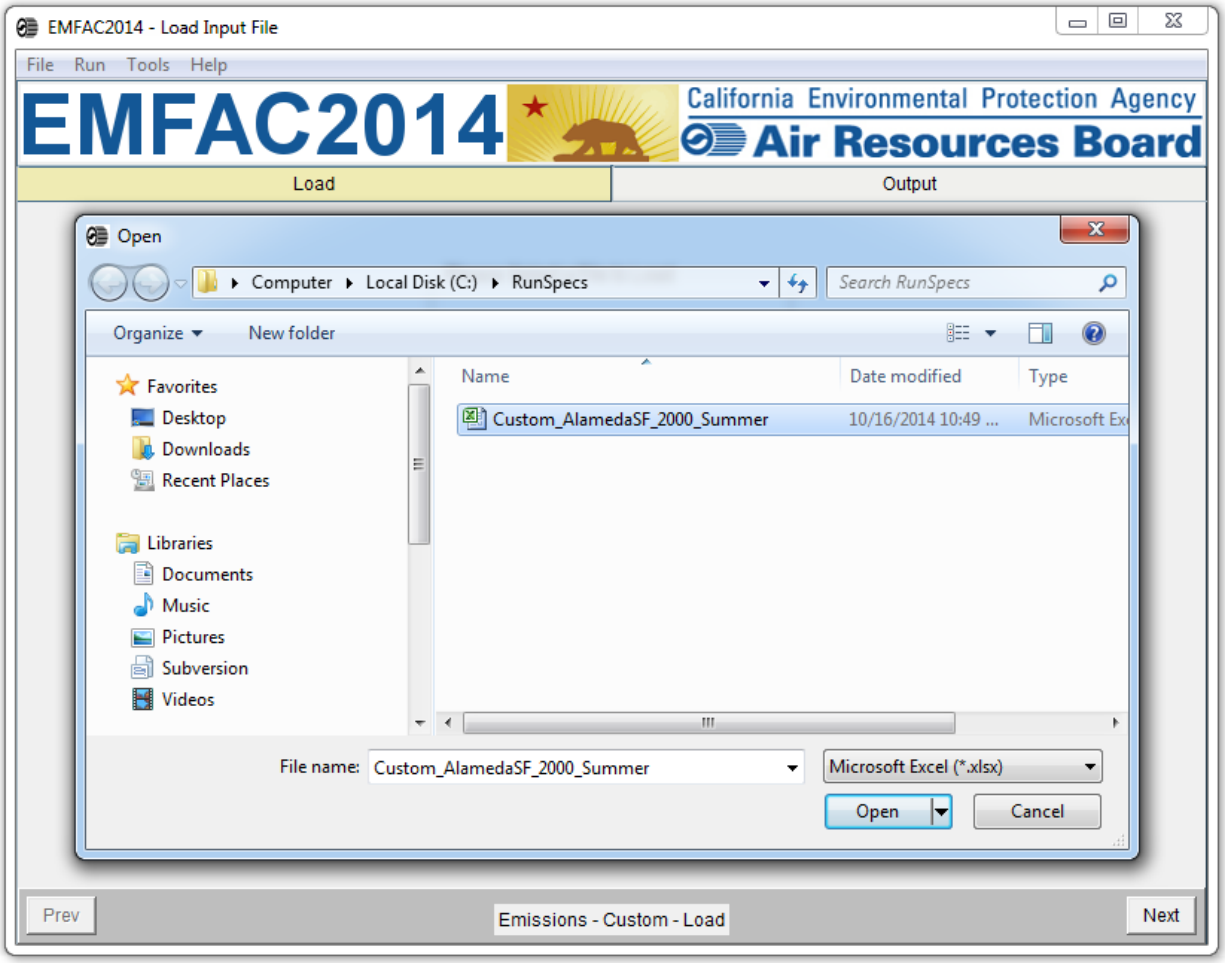


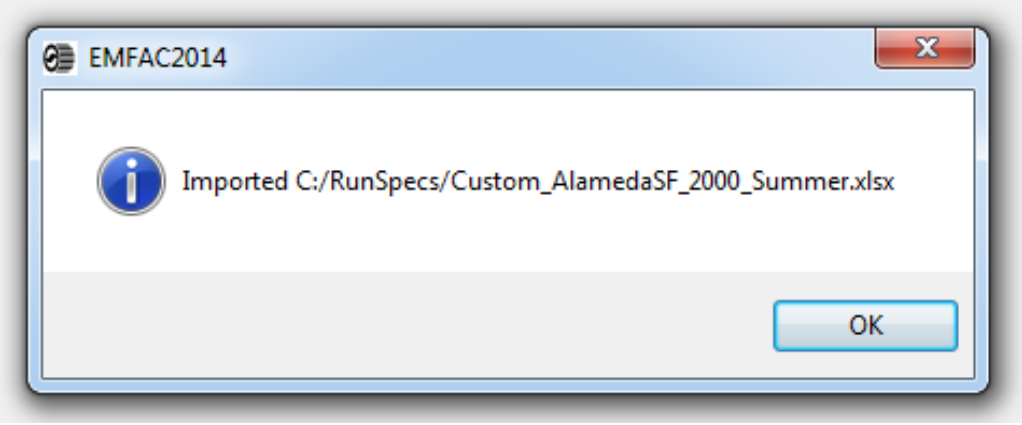
5. Click the "Load Custom Activity" button and find the file. You can hold down either the shift or control keys during selection to load more than one file at a time.

Note!

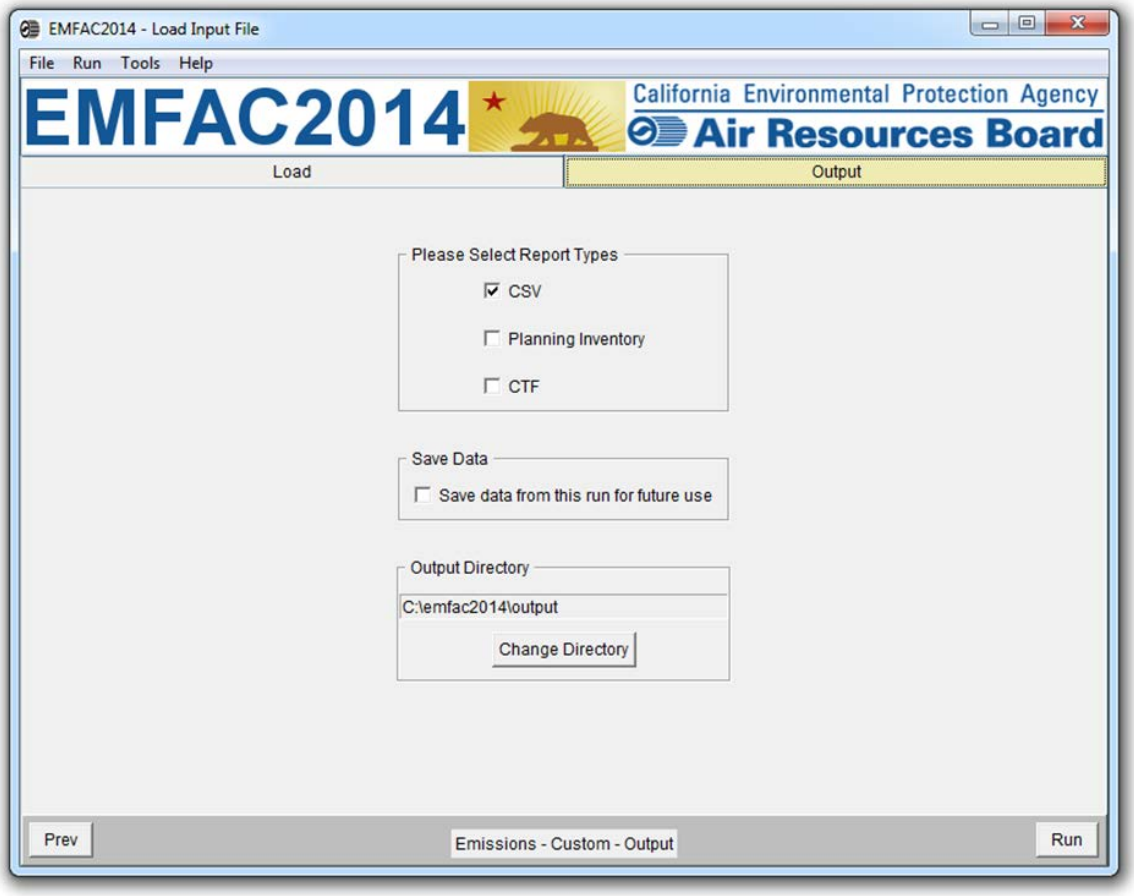
Files with different area types or seasons or SB375 settings cannot be loaded together.

6. Select on the desired file and then click "Open". Click "Ok".

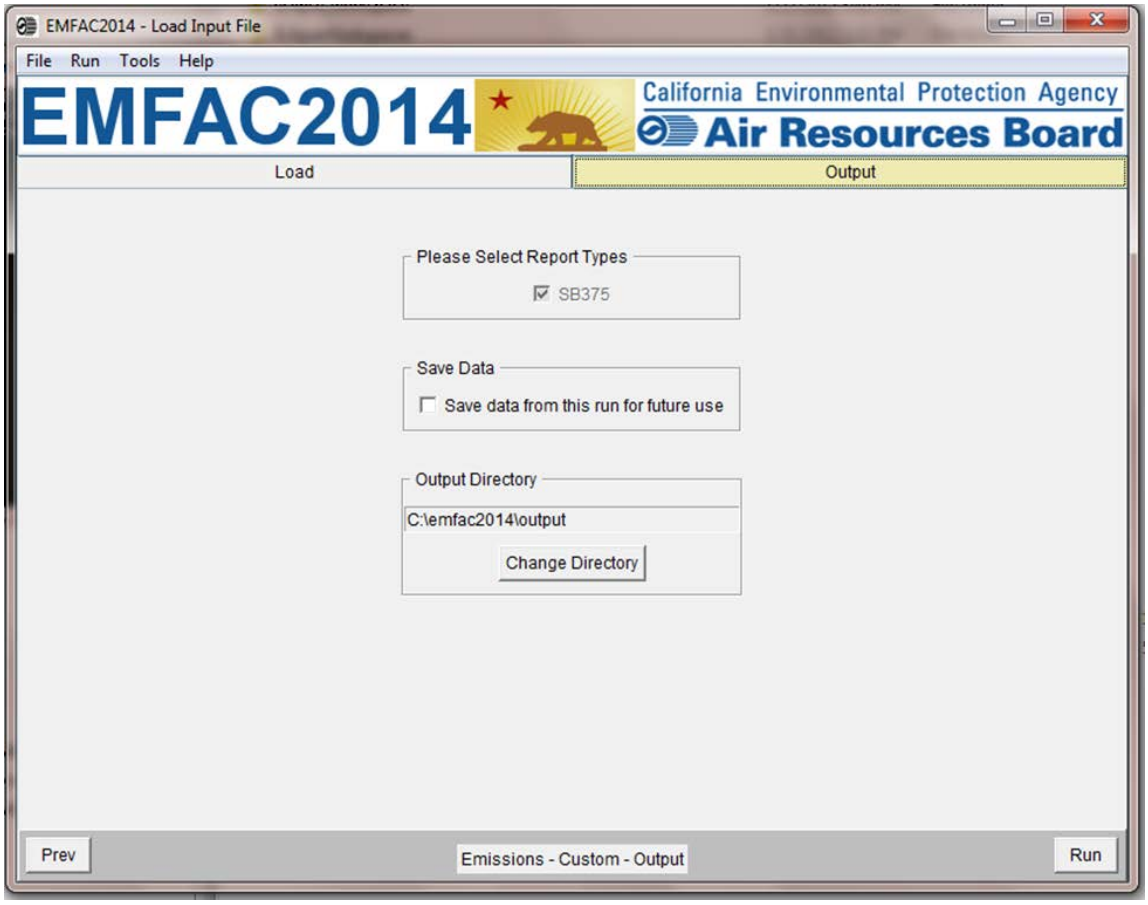




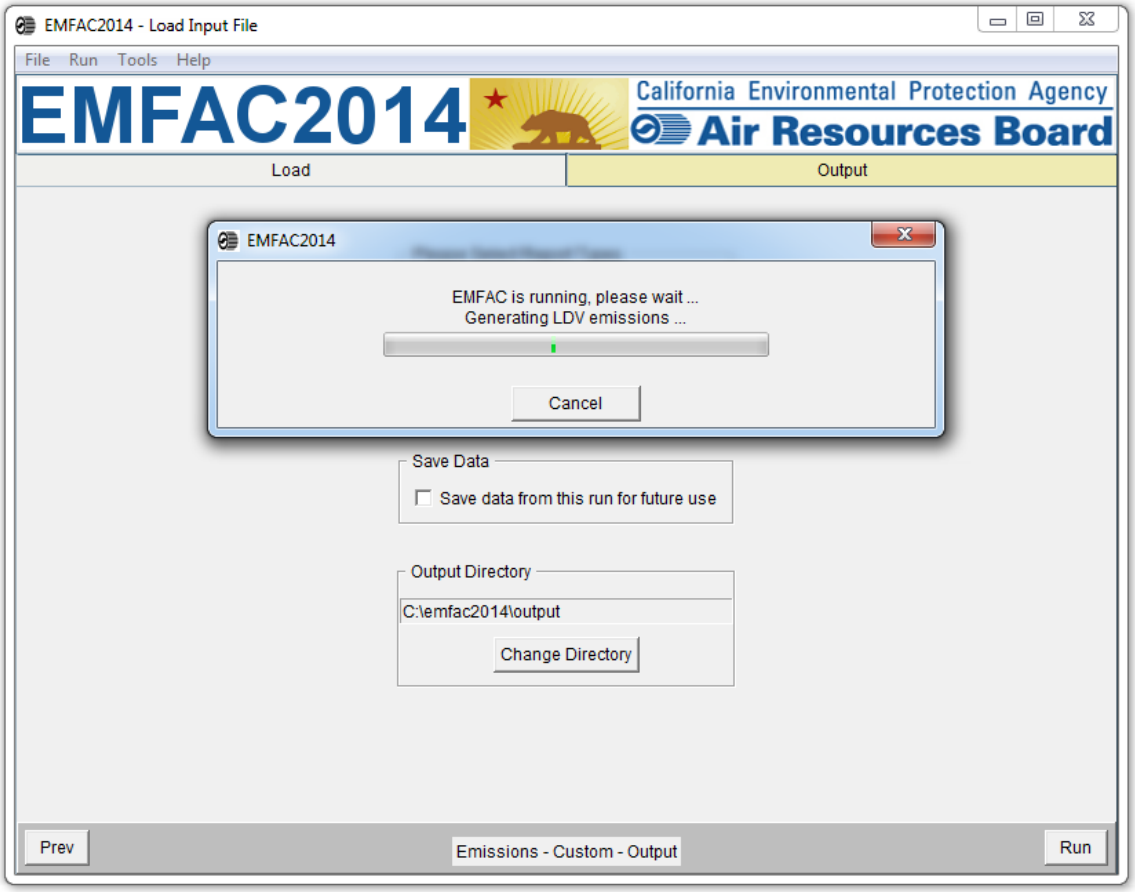
7. Information about the loaded file is displayed on the window. Make sure the correct file has been selected.
8. In the output tab, pick the Report Type, choose whether or not to save the output data for future use, and change the output location if desired. (See Chapter 7 for a description of the Output Files generated by EMFAC2014).



9. An SB375 report will only be generated if it is specified to be a SB375 run.



10. Click "Run" to start the calculation.



11. After the run completes, a window will show the Output File location and file name.

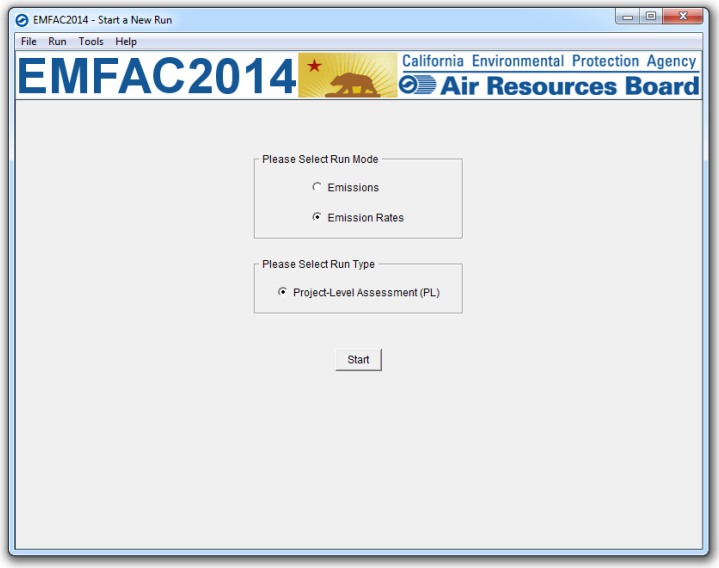
6 GENERATING EMISSIONS RATES

This section will describe the actions needed to generate emissions rates for a Project-Level Assessment or for projects using project specific data. Please note that all emissions rates for project-level assessments can now be obtained from a single source, the EMFAC2014 model. This is in contrast to EMFAC2011, for which different data sources and tools were needed to obtain emissions rates for project-level analysis.

6.1 SETTING UP A PROJECT-LEVEL ASSESSMENT EMISSIONS RATES RUN

NOTE: The run parameters for generating emissions rates are summarized in Appendix 7 .

1. Go to the Home Screen by either restarting the model or clicking "New" in the File Menu.
2. Pick Emission Rates and Project-Level Assessment (PL) as the Run Type and click "Start".
   a. This takes the user to a window with four tabs; the Area Tab, the Time Tab, the Vehicles Tab, the Meteorology Tab, and the Output Tab.
   b. Each tab presents options for the user to customize the PL run.

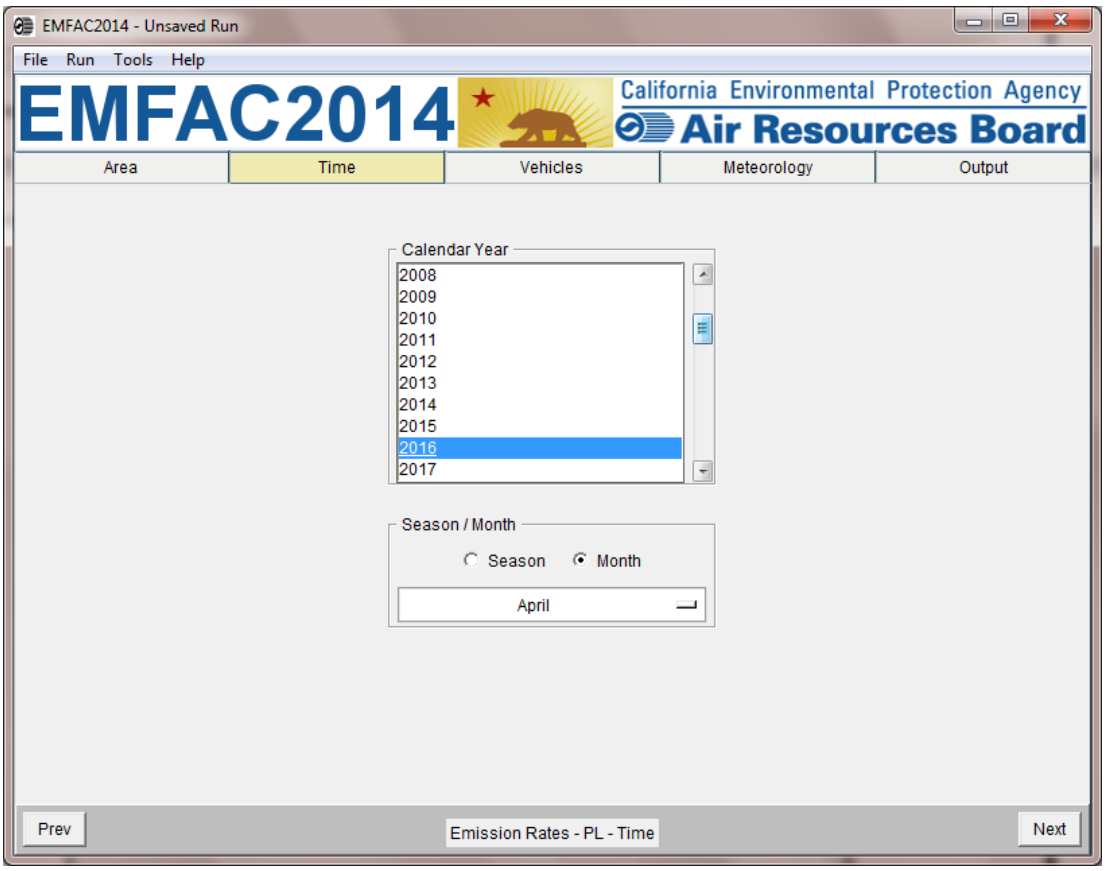


6.1.1 AREA TAB

- The user may pick only one Area Type, but has the option of selecting multiple Areas from within the chosen Area Type.

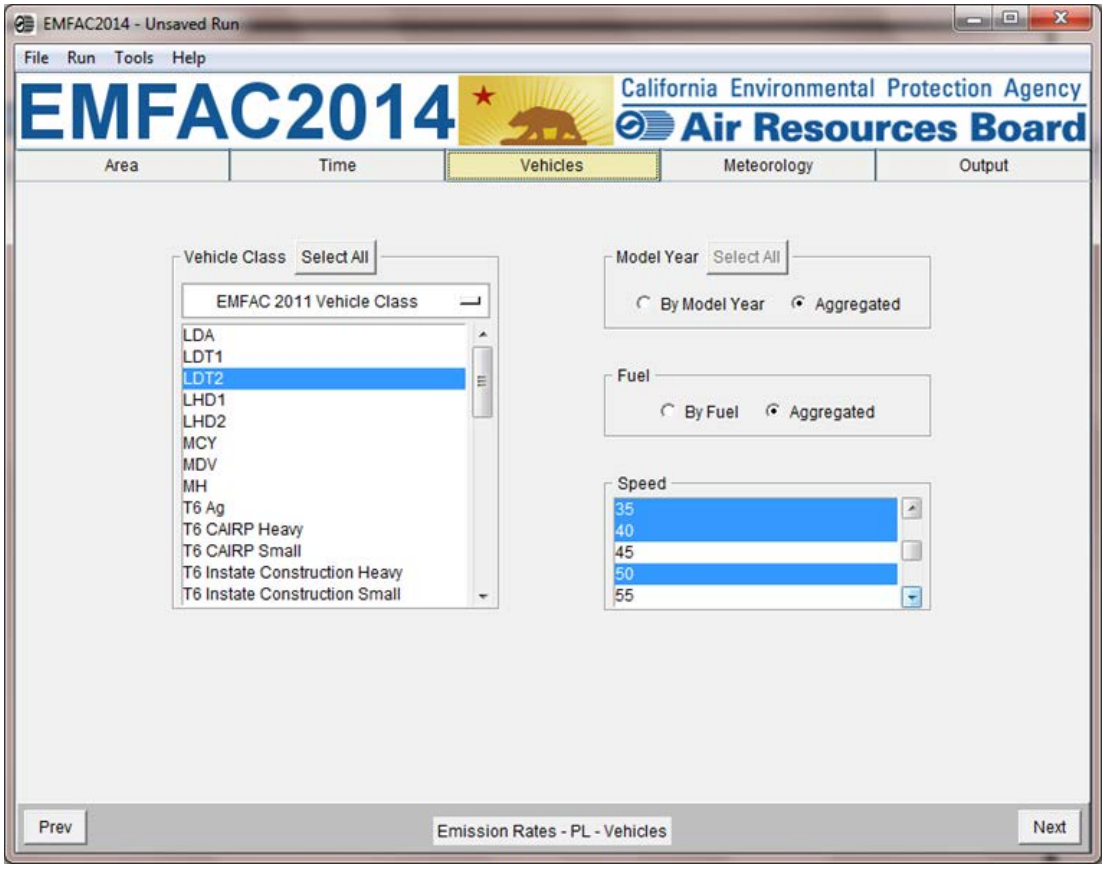
6.1.2 TIME TAB

- In the "Time" tab, a single Calendar Year or multiple years may be selected; however, only one Season or Month may be selected for each run.
- Emissions rates vary by season or month as a result of variation in the Fuel Reid Vapor Pressures by month or season due to fuel composition differences.



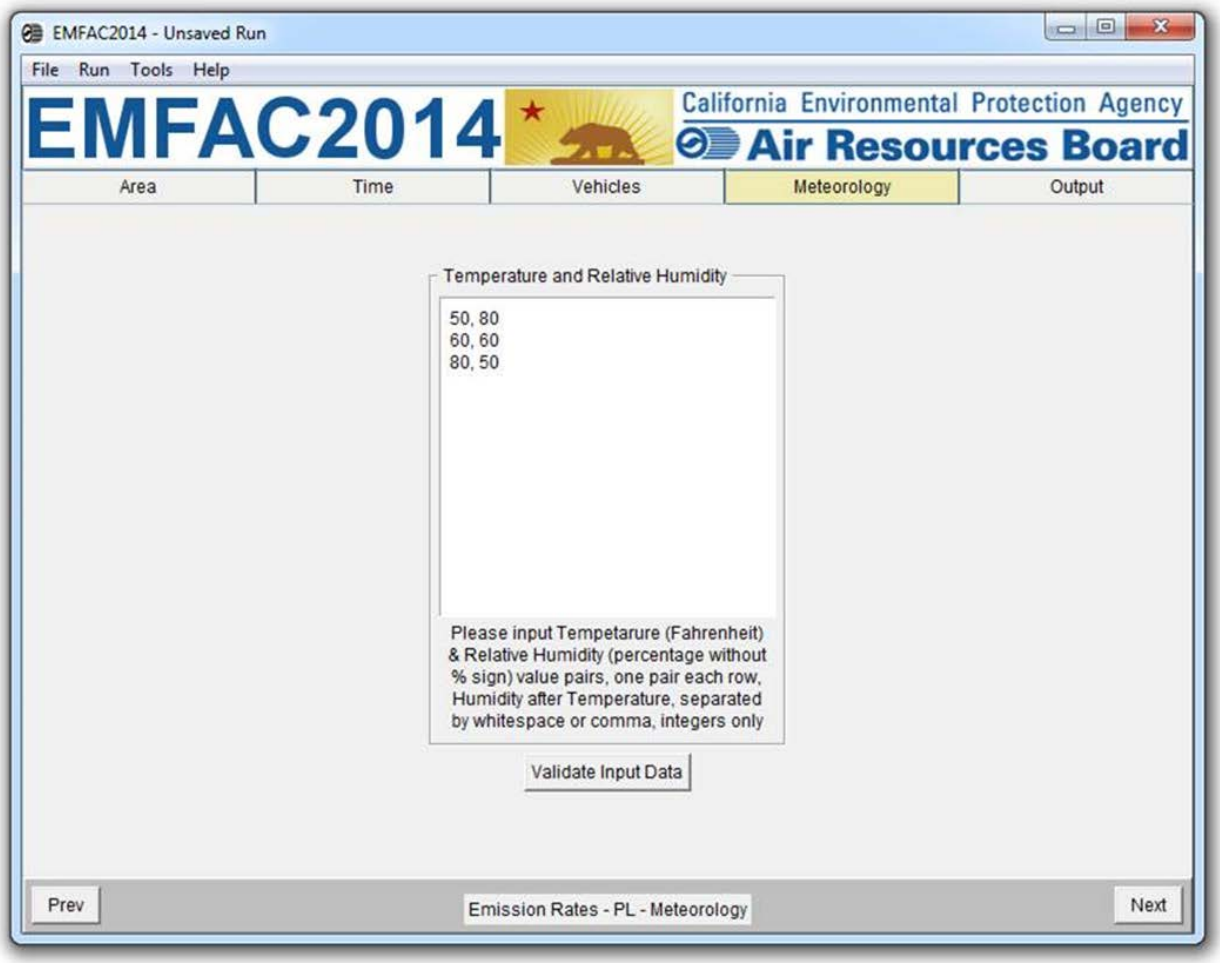
6.1.3 VEHICLES TAB

- The user can select the vehicle classes of interest. All vehicles can be selected by clicking "select all". Emissions rates can also be provided at various sub-levels using the EMFAC2011 or EMFAC2007 vehicle groupings and selections such as truck/non-truck, or truck1/truck2/non-truck levels. Please refer to the definitions of vehicle categories in Appendix 4.
- The data can be output in either the "By Model Year" or the "Aggregated" format.
  - The By Model Year option is for projects in which the activity data by model year are used.
  - The Aggregated option is for projects in which only the combined total activity, and not the activity by model year, is used.
- The user can choose to output the data "By Fuel" (for output by each fuel type) or "Aggregated" (for combined output only).
- In a PL Run, Speed bins must be selected.



6.1.4 METEOROLOGY TAB

- PL Runs require the input user-defined meteorology data
- The data must be input in temperature (Fahrenheit) and relative humidity (percentage without % sign) pairs with one pair in each row. See the example in the following screen shot.
  - The number of pairs of temperature and relative humidity will be limited to 24 for each PL run; that is one pair for each hour of the day
  - The user may either type the temperatures and relative humidity pairs into the meteorology box or copy the data from an Excel File.
- The allowed input temperature range is from -20°F to 120°F and the allowed input relative humidity range is from 0% to 100%.
  - These input ranges are broader than the corresponding default ranges, used in EMFAC2014. The default ranges are 16.7°F to 106.9°F and 13%-100%; these are based upon real meteorology data



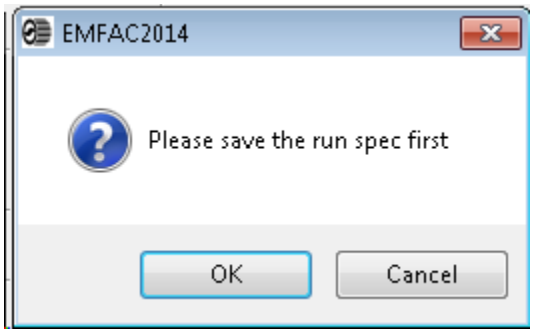
6.1.5 OUTPUT TAB

- The Pollutants group box allows the user to choose the Pollutants for which data are to be included in the output.
- The Output Directory group box allows users to specify a different directory to hold the output files by clicking the "Change Directory" button.

6.2 STARTING THE PROJECT-LEVEL MODEL RUN

1. Click "Run EMFAC", in the Run Menu, or the "Run" button at the lower right corner of the Output tab to start the model run.

- Save the "Run Specification" (as .ers file) for future use after all run parameters have been determined. Click "Save" in the File Menu or click "OK" in the pop-up window after the run button is clicked to save the .ers file.



- The model run can be stopped by clicking "Cancel" in the EMFAC2014 Window.

  The pop-up window provides the names and locations of the output files generated after the run has finished.

7 DESCRIPTION OF OUTPUT

By default, the output files are saved in the "output" folder under the EMFAC installation directory. Users can specify another folder to hold these files. Output file names, which are generated automatically, start with the name of .ers files or the names of the custom activity input files, followed by output type and a timestamp suffix.

For example, the default names for the output files for the default activity emissions run specification file "Default_AlamedaSF_2012_Annual.ers" will be:

- "Default_AlamedaSF_2012_Annual_emission_20141230114553.csv" for the emissions inventory file;
- "Default_AlamedaSF_2012_Annual_population_20141230114553.csv" for the vehicle population file;
- "Default_AlamedaSF_2012_Annual_trips_20141230114553.csv" for the trips file;
- "Default_AlamedaSF_2012_Annual_vmt_20141230114553.csv" for the vehicle miles traveled file.

The default names for the output files for the custom activity emissions input file "Custom_KernSJV_2020_Annual.xlsx" will be:

- "Custom_KernSJV_2020_Annual_emission_20141222143741.csv" for the emissions inventory file;
- "Custom_KernSJV_2020_Annual_population_20141222143741.csv" for the vehicle population file;
- "Custom_KernSJV_2020_Annual_trips_20141222143741.csv" for the tips file;
- "Custom_KernSJV_2020_Annual_vmt_20141222143741.csv" for the vehicle miles traveled file;
- "Custom_KernSJV_2020_Annual_planning_20141222143742.xlsx" for the planning inventory file;

- "Custom_KernSJV_2020_Annual_ctf_20141222143742.csv" for the CEIDARS Transaction Format (CTF) file.

The default names for the output files for the run specification file for the emission rates input file "PL_AlamedaSF_2012_Annual.ers" will be:

- "PL_AlamedaSF_2012_Annual_20141230115638.csv" for the emissions rate file;

7.1 CSV (COMMA-SEPARATED VALUES)

The standard output format from EMFAC2014 is CSV (comma-separated values), which is not to be confused with the CSV report from the previous versions of EMFAC. CSV is a common, relatively simple file format that is widely supported by consumer, business, and scientific applications.

For emissions runs, both EMFAC default and custom activity type, the model may output up to four CSV files per Sub-Area and Calendar Year. Typically emissions data, VMT, trips, and vehicle population data are reported in separate output files.

Please note that the speed_time column in the emissions rates report from a PL run contains different values for different processes. It indicates speed bin for running exhaust and it indicates the time, in minutes, that the vehicle has been sitting prior to starting for start emissions.

Table 7-1 provides descriptions of the columns in the emissions, activity, and emission rates CSV output files. Table 7-2 lists the emissions processes in the emissions rates output files.

Table 7-1. Summary of Columns in CSV output Files

Column Name	Description
calendar_year	Calendar Year between 2000 -2050
season_month	Annual, summer, winter or one of the twelve months
sub_area (GAI)	Sub Area as defined in Appendix 3
vehicle_class	Vehicle class as defined in Appendix 4
fuel	Gasoline, diesel, or other fuel types
model_year	Model year
hour	One of the 24 hour
speed	Speed bin from 5 to 90 with 5 incremental
process	Emission process
cat_ncat	With or without catalytic converter
pollutant	Pollutants
emission	Amount of emissions
vmt	Vehicle-miles traveled
trips	Number of trips
population	Vehicle population
temperature	Temperature in Fahrenheit
relative_humidity	Relative humidity in percentage
speed_time	For running exhaust (RUNEX), the "speed_time" column provides the speed bin ranging from 5 mph to 90 mph. For the start process, this field provides the soak time prior to vehicle starting in minutes, ranging from 5 minutes to 720 minutes. For other processes, where emissions rates do not depend on speed bin or soak time, this field is blank.
emission_rate	Emissions per unit of activity

Table 7-2. Emissions Processes in Emissions Rates Files

Emission Process	Description
RUNEX	Running Exhaust
IDLEX	Idle Exhaust
STREX	Start Exhaust
RUNLOSS	Running Loss
PRESTLOSS	Partial Day Resting Loss
MDRESTLOSS	Multi-Day Resting Loss
RESTLOSS	Resting Loss
PDIURN	Partial Day Diurnal Loss
MDDIURN	Multi-Day Diurnal Loss
DIURN	Diurnal Loss
PMTW	PM Tirewear
PMBW	PM Brakewear

As stated in Section 4.1, in order to manage the size of the output files, emissions and emission rates equal to zero are not indicated in the output files. Therefore, in instances when data are missing in the output file, the user can assume zero emissions or an emission rate of zero.

7.2 PLANNING INVENTORY REPORT

The Planning Inventory Report generated from the Custom Activity type is an Excel 2007 formatted workbook that contains emissions and activities which are summed by area, calendar year, and vehicle-tech type. It provides a column for every pollutant and process, with sub-total columns at the appropriate places. It provides a summary worksheet for a given area and another worksheet entitled "By Sub-Area" in which the data are broken out by the sub-areas within the area specified by the user(if selected). If a run is only for a single sub-area, or if an area only has one sub-area (such as the Lake County Air Basin), only one data worksheet will be produced. This report includes a "Read_me" tab and a "Glossary tab" which provides information on the report type, the date and time the report was generated, and an explanation of the columns.

IMPORTANT! EMFAC2014 does not produce official GHG emissions.

7.3 SB375 REPORT

The SB375 report generated from the Custom Activity type is an Excel 2007 workbook that is a sub-set of the Planning Inventory Report described above. It is limited to four vehicle types, CO2 emissions, and the related activity. The only vehicle-tech types included in this SB375 report are:

- LDA - DSL
- LDA - GAS
- LDT1 - DSL
- LDT1 - GAS
- LDT2 - DSL
- LDT2 - GAS
- MDV - DSL
- MDV – GAS

IMPORTANT! – Note again that, for SB375 analyses, the Advanced Clean Cars (ACC)/Pavley and LCFS rules are deactivated. Also, because the ACC regulation has certain assumptions about vehicle usage built into it, default data in custom activity templates produced for conformity assessments will not match the default data in templates for SB375 assessments (differences will result and affect any comparisons between the two). As a result, CO2 emissions in an SB375 report will not equal CO2 emissions from a standard planning inventory report.

Additionally, please note that EMFAC2014 does not produce official GHG emissions.

7.4 CTF REPORT

The CEIDARS Transaction Format (CTF) generated from the Custom Activity type is a report used internally by the ARB to import emissions inventory data into an internal emissions inventory database and forecasting system. The area and sub-area fields, produced by EMFAC, are replaced with the County-Air Basin-District coding system, and the Emissions Inventory Code (EIC) system replaces the vehicle-tech type and the processes. Appendix 8 provides a description of the fields in a CTF file.

IMPORTANT! EMFAC2014 does not produce official GHG emissions.

APPENDIX 1 DISK SPACE REQUIREMENTS FOR RUNNING EMFAC2014

The disk space needed to perform EMFAC2014 runs consists of two parts: the disk space needed to run the model, i.e. to perform database operations (on system drive); and the disk space needed on the user specified drive for saving output files. Both vary significantly based on the specifications of the run. If the output drive is the same as the system drive, the two parts will need to be added up. This appendix provides estimates for some typical runs that can be used to help estimate the space needed for a particular run.

- Default Runs
  1. The disk space needed for database operations for default runs can be up to about 3 GB if "By Speed" is selected;
  2. If speed is not selected it usually should not take more than 1 GB;
  3. The disk space estimates for the output files for ONE sub-area, ONE calendar year, ALL vehicle classes, ALL pollutants, ALL activities (size may vary slightly by sub-area and calendar year):

Vehicle Class Type	By Hour	By Speed	By Model Year	By Fuel	By Process	Output Size
2011	No	No	No	No	No	0.05 MB
2011	No	No	No	Yes	Yes	0.2 MB
2011	Yes	No	No	Yes	Yes	4 MB
2011	Yes	Yes	No	Yes	Yes	25 MB
2011	Yes	Yes	Yes (All)	Yes	Yes	1 G
2007	Yes	Yes	Yes (All)	Yes	Yes	500 MB

- PL Runs
  1. The disk space needed for database operations for PL runs vary from 100 MB to about 5 GB depending on the number of temperature-humidity pairs entered in the model's Meteorology tab;
  2. The disk space estimates for the output files for ONE sub-area, ONE calendar year, ONE speed, ONE temperature-humidity pair, ALL vehicle classes and ALL pollutants, (size may vary slightly by sub-area and calendar year):

Veh Class Type	By Model Year	By Fuel	Output Size
EMFAC2011	No	No	0.3 MB
EMFAC 2011	Yes (All)	No	12 MB
EMFAC 2011	Yes (All)	Yes	14 MB
EMFAC 2007	Yes (All)	Yes	11 MB
Truck1-Truck2-NonTruck	Yes (All)	Yes	3 MB
Truck-NonTruck	Yes (All)	Yes	2 MB

- SG Runs:
  1. The disk space needed for database operations for SG runs can be up to about 3GB if "Hourly_Fraction_Veh_Tech_Speed" is included in the template;
  2. If "Hourly_Fraction_Veh_Tech_Speed" is not included, it should not take more than 1GB;
  3. The disk space estimates for ONE sub-area and ONE calendar year for EMFAC2014 input templates:

Input Template Type	Custom Speed Fraction	CSV Output Size	Planning Inventory Output Size	CTF Output Size	SB375 Output Size
2014	No	0.15 M	0.04 M	0.3 M	0.01M
2014	Yes	22 M			

APPENDIX 2 SUMMARY OF RUN PARAMETERS FOR GENERATING DEFAULT EMISSIONS INVENTORY

Tab	Run Parameters	Description
Area	Area Type	One of the area types can be picked.
	Area	One or more areas can be selected for one run.
Time	Calendar Year	Between 2000 and 2050. One or more calendar years can be selected for one run.
	Season/Month	One of the three seasons (annual, summer, winter) or one of the 12 months can be selected for one run.
	Day or Hour Aggregation	Output emissions by day or by hour.
Vehicles	Vehicle Class type	Output by EMFAC2011 vehicle class or EMFAC2007 vehicle class.
	Vehicle Class	One or more vehicle classes can be picked for one run.
	Model Year	Aggregated or by model year in output. One or more model years can be selected if by model year is picked.
	Fuel	Aggregated or by fuel in output.
	Speed	Aggregated or by speed in output.
Output	Pollutants	Pollutants in output.
	Activities	Pick one or more of the activities (VMT, vehicle population, or trips) to be included in output files.
	Output by process	Whether output by process.
	Output by Cat/NonCat	Whether output by Cat/NonCat.
	Save data for future use	Users can get results faster in the future if data from previous runs are saved and used.
	Output Directory	Where to save output files.

APPENDIX 3 DEFINITION OF AREAS

Sub-Area	County Name	Air Basin Name	Air District Name	MPO	MPO Name
Alameda (SF)	ALAMEDA	SAN FRANCISCO BAY AREA	BAY AREA AQMD	MTC	Metropolitan Transportation Commission
Alpine (GBV)	ALPINE	GREAT BASIN VALLEYS	GREAT BASIN UNIFIED APCD		
Amador (MC)	AMADOR	MOUNTAIN COUNTIES	AMADOR COUNTY APCD		
Butte (SV)	BUTTE	SACRAMENTO VALLEY	BUTTE COUNTY AQMD	BCAG	Butte County Association of Governments
Calaveras (MC)	CALAVERAS	MOUNTAIN COUNTIES	CALAVERAS COUNTY APCD		
Colusa (SV)	COLUSA	SACRAMENTO VALLEY	COLUSA COUNTY APCD		
Contra Costa (SF)	CONTRA COSTA	SAN FRANCISCO BAY AREA	BAY AREA AQMD	MTC	Metropolitan Transportation Commission
Del Norte (NC)	DEL NORTE	NORTH COAST	NORTH COAST UNIFIED AQMD		
El Dorado (LT)	EL DORADO	LAKE TAHOE	EL DORADO COUNTY APCD	TMPO	Tahoe Metropolitan Planning Organization
El Dorado (MC)	EL DORADO	MOUNTAIN COUNTIES	EL DORADO COUNTY APCD	SACOG	Sacramento Area Council of Governments
Fresno (SJV)	FRESNO	SAN JOAQUIN VALLEY	SAN JOAQUIN VALLEY UNIFIED APCD	COFCG	Fresno Council of Governments
Glenn (SV)	GLENN	SACRAMENTO VALLEY	GLENN COUNTY APCD		
Humboldt (NC)	HUMBOLDT	NORTH COAST	NORTH COAST UNIFIED AQMD		
Imperial (SS)	IMPERIAL	SALTON SEA	IMPERIAL COUNTY APCD	SCAG	Southern California Association of Governments
Inyo (GBV)	INYO	GREAT BASIN VALLEYS	GREAT BASIN UNIFIED APCD		
Kern (MD)	KERN	MOJAVE DESERT	KERN COUNTY APCD	KCOG	Kern Council of Governments
Kern (SJV)	KERN	SAN JOAQUIN VALLEY	SAN JOAQUIN VALLEY UNIFIED APCD	KCOG	Kern Council of Governments
Kings (SJV)	KINGS	SAN JOAQUIN VALLEY	SAN JOAQUIN VALLEY UNIFIED APCD	KCAG	Kings County Association of Governments
Lake (LC)	LAKE	LAKE COUNTY	LAKE COUNTY AQMD		
Lassen (NEP)	LASSEN	NORTHEAST PLATEAU	LASSEN COUNTY APCD		
Los Angeles (MD)	LOS ANGELES	MOJAVE DESERT	ANTELOPE VALLEY AQMD	SCAG	Southern California Association of Governments
Los Angeles (SC)	LOS ANGELES	SOUTH COAST	SOUTH COAST AQMD	SCAG	Southern California Association of Governments
Madera (SJV)	MADERA	SAN JOAQUIN VALLEY	SAN JOAQUIN VALLEY UNIFIED APCD	MCTC	Madera County Transportation Commission
Marin (SF)	MARIN	SAN FRANCISCO BAY AREA	BAY AREA AQMD	MTC	Metropolitan Transportation Commission
Mariposa (MC)	MARIPOSA	MOUNTAIN COUNTIES	MARIPOSA COUNTY APCD		
Mendocino (NC)	MENDOCINO	NORTH COAST	MENDOCINO COUNTY AQMD		
Merced (SJV)	MERCED	SAN JOAQUIN VALLEY	SAN JOAQUIN VALLEY UNIFIED APCD	MCAG	Merced County Association of Governments

Modoc (NEP)	MODOC	NORTHEAST PLATEAU	MODOC COUNTY APCD		
Mono (GBV)	MONO	GREAT BASIN VALLEYS	GREAT BASIN UNIFIED APCD		
Monterey (NCC)	MONTEREY	NORTH CENTRAL COAST	MONTEREY BAY UNIFIED APCD	AMBAG	Association of Monterey Bay Governments
Napa (SF)	NAPA	SAN FRANCISCO BAY AREA	BAY AREA AQMD	MTC	Metropolitan Transportation Commission
Nevada (MC)	NEVADA	MOUNTAIN COUNTIES	NORTHERN SIERRA AQMD		
Orange (SC)	ORANGE	SOUTH COAST	SOUTH COAST AQMD	SCAG	Southern California Association of Governments
Placer (LT)	PLACER	LAKE TAHOE	PLACER COUNTY APCD	TMPO	Tahoe Metropolitan Planning Organization
Placer (MC)	PLACER	MOUNTAIN COUNTIES	PLACER COUNTY APCD	SACOG	Sacramento Area Council of Governments
Placer (SV)	PLACER	SACRAMENTO VALLEY	PLACER COUNTY APCD	SACOG	Sacramento Area Council of Governments
Plumas (MC)	PLUMAS	MOUNTAIN COUNTIES	NORTHERN SIERRA AQMD		
Riverside (MD/MDAQMD)	RIVERSIDE	MOJAVE DESERT	MOJAVE DESERT AQMD	SCAG	Southern California Association of Governments
Riverside (MD/SCAQMD)	RIVERSIDE	MOJAVE DESERT	SOUTH COAST AQMD	SCAG	Southern California Association of Governments
Riverside (SC)	RIVERSIDE	SOUTH COAST	SOUTH COAST AQMD	SCAG	Southern California Association of Governments
Riverside (SS)	RIVERSIDE	SALTON SEA	SOUTH COAST AQMD	SCAG	Southern California Association of Governments
Sacramento (SV)	SACRAMENTO	SACRAMENTO VALLEY	SACRAMENTO METROPOLITAN AQMD	SACOG	Sacramento Area Council of Governments
San Benito (NCC)	SAN BENITO	NORTH CENTRAL COAST	MONTEREY BAY UNIFIED APCD	AMBAG	Association of Monterey Bay Governments
San Bernardino (MD)	SAN BERNARDINO	MOJAVE DESERT	MOJAVE DESERT AQMD	SCAG	Southern California Association of Governments
San Bernardino (SC)	SAN BERNARDINO	SOUTH COAST	SOUTH COAST AQMD	SCAG	Southern California Association of Governments
San Diego (SD)	SAN DIEGO	SAN DIEGO	SAN DIEGO COUNTY APCD	SANDAG	San Diego Association of Governments
San Francisco (SF)	SAN FRANCISCO	SAN FRANCISCO BAY AREA	BAY AREA AQMD	MTC	Metropolitan Transportation Commission
San Joaquin (SJV)	SAN JOAQUIN	SAN JOAQUIN VALLEY	SAN JOAQUIN VALLEY UNIFIED APCD	SJCOG	San Joaquin Council of Governments
San Luis Obispo (SCC)	SAN LUIS OBISPO	SOUTH CENTRAL COAST	SAN LUIS OBISPO COUNTY APCD	SLOCOG	San Luis Obispo Council of Governments
San Mateo (SF)	SAN MATEO	SAN FRANCISCO BAY AREA	BAY AREA AQMD	MTC	Metropolitan Transportation Commission
Santa Barbara (SCC)	SANTA BARBARA	SOUTH CENTRAL COAST	SANTA BARBARA COUNTY APCD	SBCAG	Santa Barbara County Association of Governments
Santa Clara (SF)	SANTA CLARA	SAN FRANCISCO BAY AREA	BAY AREA AQMD	MTC	Metropolitan Transportation Commission
Santa Cruz (NCC)	SANTA CRUZ	NORTH CENTRAL COAST	MONTEREY BAY UNIFIED APCD	AMBAG	Association of Monterey Bay Governments
Shasta (SV)	SHASTA	SACRAMENTO VALLEY	SHASTA COUNTY AQMD	SCRTPA	Shasta Regional Transportation Agency
Sierra (MC)	SIERRA	MOUNTAIN COUNTIES	NORTHERN SIERRA AQMD		
Siskiyou (NEP)	SISKIYOU	NORTHEAST PLATEAU	SISKIYOU COUNTY APCD		
Solano (SF)	SOLANO	SAN FRANCISCO BAY AREA	BAY AREA AQMD	MTC	Metropolitan Transportation Commission

Solano (SV)	SOLANO	SACRAMENTO VALLEY	YOLO/SOLANO AQMD	MTC	Metropolitan Transportation Commission
Sonoma (NC)	SONOMA	NORTH COAST	NORTHERN SONOMA COUNTY APCD	MTC	Metropolitan Transportation Commission
Sonoma (SF)	SONOMA	SAN FRANCISCO BAY AREA	BAY AREA AQMD	MTC	Metropolitan Transportation Commission
Stanislaus (SJV)	STANISLAUS	SAN JOAQUIN VALLEY	SAN JOAQUIN VALLEY UNIFIED APCD	StanCOG	Stanislaus Council of Governments
Sutter (SV)	SUTTER	SACRAMENTO VALLEY	FEATHER RIVER AQMD	SACOG	Sacramento Area Council of Governments
Tehama (SV)	TEHAMA	SACRAMENTO VALLEY	TEHAMA COUNTY APCD		
Trinity (NC)	TRINITY	NORTH COAST	NORTH COAST UNIFIED AQMD		
Tulare (SJV)	TULARE	SAN JOAQUIN VALLEY	SAN JOAQUIN VALLEY UNIFIED APCD	TCAG	Tulare County Association of Governments
Tuolumne (MC)	TUOLUMNE	MOUNTAIN COUNTIES	TUOLUMNE COUNTY APCD		
Ventura (SCC)	VENTURA	SOUTH CENTRAL COAST	VENTURA COUNTY APCD	SCAG	Southern California Association of Governments
Yolo (SV)	YOLO	SACRAMENTO VALLEY	YOLO/SOLANO AQMD	SACOG	Sacramento Area Council of Governments
Yuba (SV)	YUBA	SACRAMENTO VALLEY	FEATHER RIVER AQMD	SACOG	Sacramento Area Council of Governments

APPENDIX 4 : VEHICLE CATEGORIES

EMFAC2011 Veh & Tech	EMFAC2011 Vehicle	Description	EMFAC2007 Vehicle	EMFAC2007 Vehicle Code	Truck / Non-Truck Category	Truck 1 / Truck 2 / Non-Truck Category
LDA - DSL	LDA	Passenger Cars	LDA	PC	Non-Trucks	Non-Trucks
LDA - GAS					Non-Trucks	Non-Trucks
LDT1 - DSL	LDT1	Light-Duty Trucks (GVWR < 6000 lbs and ETW <= 3750 lbs)	LDT1	T1	Non-Trucks	Non-Trucks
LDT1 - GAS					Non-Trucks	Non-Trucks
LDT2 - DSL	LDT2	Light-Duty Trucks (GVWR < 6000 lbs and ETW 3751-5750 lbs)	LDT2	T2	Non-Trucks	Non-Trucks
LDT2 - GAS					Non-Trucks	Non-Trucks
LHD1 - DSL	LHD1	Light-Heavy-Duty Trucks (GVWR 8501-10000 lbs)	LHDT1	T4	Trucks	Truck 1
LHD1 - GAS					Trucks	Truck 1
LHD2 - DSL	LHD2	Light-Heavy-Duty Trucks (GVWR 10001-14000 lbs)	LHDT2	T5	Trucks	Truck 1
LHD2 - GAS					Trucks	Truck 1
MCY - GAS	MCY	Motorcycles	MCY	MC	Non-Trucks	Non-Trucks
MDV - DSL	MDV	Medium-Duty Trucks (GVWR 6000 and 8500 lbs)	MDV	T3	Non-Trucks	Non-Trucks
MDV - GAS					Non-Trucks	Non-Trucks
MH - DSL	MH	Motor Homes	MH	MH	Non-Trucks	Non-Trucks
MH - GAS					Non-Trucks	Non-Trucks
T6 Ag - DSL	T6 Ag	Medium-Heavy Duty Diesel Agriculture Truck	MHDT	T6	Trucks	Truck 2
T6 CAIRP heavy - DSL	T6 CAIRP heavy	Medium-Heavy Duty Diesel CA International Registration Plan Truck with GVWR>26000 lbs			Trucks	Truck 2
T6 CAIRP small - DSL	T6 CAIRP small	Medium-Heavy Duty Diesel CA International Registration Plan Truck with GVWR<=26000 lbs			Trucks	Truck 2
T6 instate construction heavy - DSL	T6 instate construction heavy	Medium-Heavy Duty Diesel instate construction Truck with GVWR>26000 lbs			Trucks	Truck 2
T6 instate construction small - DSL	T6 instate construction small	Medium-Heavy Duty Diesel instate construction Truck with GVWR<=26000 lbs			Trucks	Truck 2
T6 instate heavy - DSL	T6 instate heavy	Medium-Heavy Duty Diesel instate Truck with GVWR>26000 lbs			Trucks	Truck 2
T6 instate small - DSL	T6 instate small	Medium-Heavy Duty Diesel instate Truck with GVWR<=26000 lbs			Trucks	Truck 2
T6 OOS heavy - DSL	T6 OOS heavy	Medium-Heavy Duty Diesel Out-of-state Truck with GVWR>26000 lbs			Trucks	Truck 2
T6 OOS small - DSL	T6 OOS small	Medium-Heavy Duty Diesel Out-of-state Truck with GVWR<=26000 lbs			Trucks	Truck 2
T6 Public - DSL	T6 Public	Medium-Heavy Duty Diesel Public Fleet Truck			Trucks	Truck 2
T6 utility - DSL	T6 utility	Medium-Heavy Duty Diesel Utility Fleet Truck			Trucks	Truck 2

T6TS - GAS	T6TS	Medium-Heavy Duty Gasoline Truck			Trucks	Truck 2
T7 Ag - DSL	T7 Ag	Heavy-Heavy Duty Diesel Agriculture Truck	HHDT	T7	Trucks	Truck 2
T7 CAIRP - DSL	T7 CAIRP	Heavy-Heavy Duty Diesel CA International Registration Plan Truck			Trucks	Truck 2
T7 CAIRP construction - DSL	T7 CAIRP construction	Heavy-Heavy Duty Diesel CA International Registration Plan Construction Truck			Trucks	Truck 2
T7 NNOOS - DSL	T7 NNOOS	Heavy-Heavy Duty Diesel Non-Neighboring Out-of-state Truck			Trucks	Truck 2
T7 NOOS - DSL	T7 NOOS	Heavy-Heavy Duty Diesel Neighboring Out-of-state Truck			Trucks	Truck 2
T7 other port - DSL	T7 other port	Heavy-Heavy Duty Diesel Drayage Truck at Other Facilities			Trucks	Truck 2
T7 POAK - DSL	T7 POAK	Heavy-Heavy Duty Diesel Drayage Truck in Bay Area			Trucks	Truck 2
T7 POLA - DSL	T7 POLA	Heavy-Heavy Duty Diesel Drayage Truck near South Coast			Trucks	Truck 2
T7 Public - DSL	T7 Public	Heavy-Heavy Duty Diesel Public Fleet Truck			Trucks	Truck 2
T7 Single - DSL	T7 Single	Heavy-Heavy Duty Diesel Single Unit Truck			Trucks	Truck 2
T7 single construction - DSL	T7 single construction	Heavy-Heavy Duty Diesel Single Unit Construction Truck			Trucks	Truck 2
T7 SWCV - DSL	T7 SWCV	Heavy-Heavy Duty Diesel Solid Waste Collection Truck			Trucks	Truck 2
T7 tractor - DSL	T7 tractor	Heavy-Heavy Duty Diesel Tractor Truck			Trucks	Truck 2
T7 tractor construction - DSL	T7 tractor construction	Heavy-Heavy Duty Diesel Tractor Construction Truck			Trucks	Truck 2
T7 utility - DSL	T7 utility	Heavy-Heavy Duty Diesel Utility Fleet Truck			Trucks	Truck 2
T7IS - GAS	T7IS	Heavy-Heavy Duty Gasoline Truck			Trucks	Truck 2
PTO - DSL	PTO	Power Take Off			Trucks	Truck 2
SBUS - DSL	SBUS	School Buses	SBUS	SB	Non-Trucks	Non-Trucks
SBUS - GAS					Non-Trucks	Non-Trucks
UBUS - DSL	UBUS	Urban Buses	UBUS	UB	Non-Trucks	Non-Trucks
UBUS - GAS					Non-Trucks	Non-Trucks
Motor Coach - DSL	Motor Coach	Motor Coach	OBUS	OB	Non-Trucks	Non-Trucks
OBUS - GAS	OBUS	Other Buses			Non-Trucks	Non-Trucks
All Other Buses - DSL	All Other Buses	All Other Buses			Non-Trucks	Non-Trucks

* GVWR: gross vehicle weight rating
* ETW: equivalent test weight

APPENDIX 5 SUMMARY OF RUN PARAMETERS FOR GENERATING CUSTOM ACTIVITY TEMPLATE

Tab	Run Parameters	Description
Area	Area Type	One of the area types can be picked.
	Area	One or more areas can be selected for one run.
Time	Calendar Year	Between 2000 and 2050. One or more calendar years can be selected for one run.
	Season/Month	One of the three seasons (annual, summer, winter) or one of the 12 months can be selected for one run.
VMT	VMT Type	Whether input VMT is by daily total or by vehicle and fuel type.
	Hourly Speed Fractions	Whether to include custom hourly speed fractions.
	SB375	Whether it is a SB375 template.

APPENDIX 6 SUMMARY OF RUN PARAMETERS FOR GENERATING CUSTOM ACTIVITY EMISSIONS INVENTORY

Tab	Run Parameters	Description
Load	Template File Type	Whether it is EMFAC2014 format or EMFAC2011 Format.
	SB375	Whether it is a SB375 run if EMFAC2011 Format is chosen.
	Custom Activity File	The custom activity file in EMFAC2014 or EMFAC2011 format.
Output	Report Type	One or more of the reports (csv, planning inventory, or CTF) can be generated for a non-SB375 run.
	Report Type (SB375)	Only SB375 report will be generated.
	Save data for future use	Users can get results faster in the future if data from previous runs are saved and used.
	Output Directory	Where to save output files.

APPENDIX 7 SUMMARY OF RUN PARAMETERS FOR GENERATING EMISSION RATES

Tab	Run Parameters	Description
Area	Area Type	One of the area types can be picked.
	Area	One or more areas can be selected for one run.
Time	Calendar Year	Between 2000 and 2050. One or more calendar years can be selected for one run.
	Season/Month	One of the three seasons (annual, summer, winter) or one of the 12 months can be selected for one run.
Vehicles	Vehicle Class type	Output by EMFAC2011 vehicle class or EMFAC2007 vehicle class or Truck/non-Truck or Truck1/Truck2/non-Truck.
	Vehicle Class	One or more vehicle classes can be picked for one run.
	Model Year	Aggregated or by model year in output. One or more model years can be selected if by model year is picked.
	Fuel	Aggregated or by fuel in output.
	Speed	One or more speeds can be selected.
Meteorology	Temperature	Temperature in Fahrenheit.
	Relative Humidity	Relative humidity.
Output	Pollutants	Pollutants in output.
	Output Directory	Where to save output files.

APPENDIX 8 FIELDS IN CTF FILE

FIELD NAME	FIELD TYPE	LENGTH	FIELD DESCRIPTION
YEAR	NUMERIC	4	CAL YEAR OF THE RUN DATA
DIS	CHAR	3	DISTRICT ID
AB	CHAR	3	AIR BASIN ID
CO	NUMERIC	2	COUNTY ID
EIC	NUMERIC	14	EIC CODE
PR	NUMERIC (11,2)	11	ANNUAL PROCESS RATE
HPDY	NUMERIC	2	HOURS PER DAY
DPWK	NUMERIC	2	DAY PER WEEK
JANT	NUMERIC(4,1)	5	PERCENT ACTIVITY FOR JANUARY - RANGE 0-100
FEBT	NUMERIC(4,1)	5	PERCENT ACTIVITY FOR FEBRUARY - RANGE 0-100
MART	NUMERIC(4,1)	5	PERCENT ACTIVITY FOR MARCH - RANGE 0-100
APRT	NUMERIC(4,1)	5	PERCENT ACTIVITY FOR APRIL - RANGE 0-100
MAYT	NUMERIC(4,1)	5	PERCENT ACTIVITY FOR MAY - RANGE 0-100
JUNT	NUMERIC(4,1)	5	PERCENT ACTIVITY FOR JUNE - RANGE 0-100
JULT	NUMERIC(4,1)	5	PERCENT ACTIVITY FOR JULY - RANGE 0-100
AUGT	NUMERIC(4,1)	5	PERCENT ACTIVITY FOR AUGUST - RANGE 0-100
SEPT	NUMERIC(4,1)	5	PERCENT ACTIVITY FOR SEPTEMBER - RANGE 0-100
OCTT	NUMERIC(4,1)	5	PERCENT ACTIVITY FOR OCTOBER - RANGE 0-100
NOVT	NUMERIC(4,1)	5	PERCENT ACTIVITY FOR NOVEMBER - RANGE 0-100
DECT	NUMERIC(4,1)	5	PERCENT ACTIVITY FOR DECEMBER - RANGE 0-100
POL	NUMERIC	9	POLLUTANT CODE
EMFACT	NUMBER (10,4)	11	EMISSION FACTOR (LBS PER EIC UNIT)
SEASON	CHAR	14	SEASON
EMS	NUMERIC(10,4)	11	EMISSIONS (TONS/DAY)
VERSION	CHAR	15	EMFAC VERSION
OPERATOR	CHAR	3	OPERATOR INITIALS
TDATE	DATE	8	TRANSACTION DATE