EMFAC2025 Volume I: User's Guide



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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 California Air ResourcesBoard's (CARB) mission to promote and protect public health, welfare, and ecological resources through the effective and efficient reduction of air pollutants while recognizingand considering the effects on the economy of the state.

An emissions inventory (for any source category) can be calculated, at the most basiclevel as the product of an emission rate, expressed in grams of a pollutant emitted persome 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 × **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 thephysical 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).

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

1.2 EMFAC2025

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.

EMFAC2025 is the latest emissions inventory model that calculates emissions inventories for motor vehicles operating on roads in California. EMFAC2025 represents the next step forward in the ongoing improvement process for EMFAC and reflects the CARB's current understanding of how vehicles travel and how much they pollute. The EMFAC2025 model is needed to support CARB's planning and policy development efforts and to meet the Federal Highway Administration's transportation conformity requirements.

The EMFAC2025 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 CARB evaluate prospective control programs and determine the most effective, science-based proposals for protecting the environment.

EMFAC2025 includes the latest data on California's car and truck population, activity, and emission testing. New model features are added to reflect additional fuel and technologies, including modules to show emissions from fuel cell electric vehicles (FCEV) as outputs for hydrogen consumption. EMFAC2025 also incorporates all the most recently adopted on-road mobile source regulations. More details about the updates in emissions calculation methodologies and data are available in the EMFAC2025 Technical Documentation.

Figure 1.2-1 displays a flow chart indicating the GUI selections necessary to generate the various outputs of EMFAC2025. 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. The Custom Activity (SG) mode can be used to estimate tons of emission per day with customized activity from the end-users.





1.3 About this Document

The purpose of this EMFAC2025 User's Guide is to familiarize users with the features and controls in the EMFAC2025 model. More information regarding the methodologies and data used in EMFAC2025 to estimate emissions and emission rates will be made available in the EMFAC2025 Technical Documentation.

2 Pollutants, Activities, and Processes Modeled

This section describes the pollutants and emissions processes currently modeled in EMFAC2025.

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 the same as EPA's Volatile Organic Compounds (VOC) definition and does not contain compounds exempt from regulations.
- Particulate matter (PM): Particulate matter estimates are provided for total suspended particulates (PM), with diameter 10 microns or less (PM₁₀), and with diameter 2.5 microns or less (PM_{2.5}).
- 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.
- Fuel: Although fuel is not a pollutant, fuel consumption is calculated based on the tailpipe emissions of CO, CO₂ and THC using the carbon balance equation.
- Greenhouse Gases (GHG): GHG emissions consist of complete combustion CO₂, Nitrous Oxide (N₂O) and Methane (CH₄). These are the greenhouse gases that are included starting from EMFAC2017.
- Ammonia (NH₃): Emission rates of NH₃ vary by vehicle class and model year.

2.2 Activities

The model estimates and projects vehicle activities and outputs them for the following activities:

• Vehicle Miles Traveled (VMT): daily VMT is generated in three types, including total VMT, cVMT, and eVMT. cVMT represents combustion VMT which is powered by conventional fuel, e.g. gasoline, diesel, or natural gas. eVMT represents electric VMT, which is powered by electric battery or hydrogen fuel cells. Total VMT is the sum of cVMT and eVMT. Only Plug-in Hybrid Electric Vehicle (PHEV) has both cVMT and

eVMT, and the rest of fuel types have either cVMT (gasoline, diesel, and natural gas) or eVMT (battery electric and fuel cell electric).

- **Trip:** EMFAC defines a trip as an engine-on event. The total number of trips is estimated by the number of starts per vehicle and vehicle population. Unlike internal combustion engine (ICE) vehicles, PHEVs can use energy from a battery, an ICE or a combination of the two to attain propulsion power, and they could invoke the engine at any moment within a given trip. The PHEV trip output only includes trips with engine-on events.
- Population
- **Energy Consumption:** Energy or electricity consumption is generated in a separate .csv file, similar to other activity outputs (e.g. VMT, trip, and population). It is estimated based on electricity consumption in kilowatt-hour (kWh) per mile.

2.3 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 represent the emissions
 occurring during the initial time period when a vehicle's emissions after treatment
 system is warming up. 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, as they are considered
 as consisting of two parts: 1) running emissions that would otherwise be emitted
 when the SCR system is at a working temperature, and 2) start emissions that only
 exist when the SCR system is below its working temperatures. As a result, start
 emissions for heavy-duty diesel trucks are calculated by subtracting the running
 phase emissions from the starting-phase emissions and multiplying the result by the
 duration of the starting phase. More details can be found in the EMFAC2014
 Technical Documentation.
- 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. Additionally, HC can permeate through hoses and connectors.

- Hot Soak Evaporative HC Emissions (HOTSOAK) that begin immediately fromheated fuels after a car stops its engine operation and continue until the fuel tank reaches ambient temperature.
- Running Loss Evaporative HC Emissions (RUNLOSS) that occur as a result of hot fuel vapors escaping from the fuel system or overwhelming 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 EMFAC2025

3.1 System Requirements

- Operating System: Microsoft Windows 10 and Windows 11
- Disk Storage:
 - EMFAC2025 application itself requires 1 GB disk space.
 - The default MySQL database used by EMFAC2025 will require 5 GB diskspace.
 - At least 50 GB of free disk space is recommended for running EMFAC2025.
 The amount of space required varies depending on the level of detail in the output, the number of sub-areas and calendar years, and the number of runs.
 - The performance of EMFAC2025 depends on the performance of MySQL server. For fast EMFAC runs, we recommend running MySQL server on a computer with multiple CPU cores and a high-performance storage (e.g. Solid State Drives).

3.2 Pre-Installation Notes

- EMFAC2025 requires MySQL Community Server 8.0 or higher. Older versions are not officially supported. You can find more information about getting and installing MySQL software at the official MySQL website: <u>https://www.mysql.com</u>
- 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

Extract the EMFAC2025 package to a folder of your choice on your local drive (for example, C:\EMFAC2025).

3.4 Model Configuration

- Double click "EMFAC.exe" within the installation directory or click the icon on the taskbar or start menu, to start EMFAC2025. The program will display a page that asks users to configure MySQL settings first using the MySQL Configurator. You may safely ignore any Microsoft Windows security or antivirus warning related to the EMFAC2025 software package.
 - a. If presented with this message:



b. Right click the application, open up properties, and check "Unblock":

EF EMFAC Pro	perties	×
Security General	Details Compatibility	Previous Versions Digital Signatures
EF	EMFAC	
Type of file:	Application (.exe)	
Lesstien:	EMPAC	
Size:	19.5 MB (20,478,800 bytes)	
Size on disk:	19.5 MB (20,480,000 bytes)	
Created:	Tuesday, May 6, 2025, 6:28:50	PM
Modified:	Tuesday, May 6, 2025, 9:45:24	PM
Accessed:	Today, May 6, 2025, 2 minutes	
Attributes:	Read-only Hidden	Advanced
Security:	This file came from another computer and might be blocked help protect this computer.	Unblock
	ОК	Cancel Apply

- 2. Click the "Configure MySQL" button to bring up the pop-up window shown below. This configuration is needed for the installation of an updated model or when the configuration of MySQL is changed.
- 3. Enter the "MySQL Username" and "MySQL Password"
- 4. Enter the "MySQL DB Prefix" with a prefix that will be added to all the databases created by EMFAC.
- 5. A suggested value of "# of parallel MySQLs" is provided based on the number of CPU cores available on the PC where you ran EMFAC. Change this value properly based on the available number of CPU cores and the performance of your MySQL server.

EF EMFAC2025			7	- 0 X
File Run Tools Help				
EMFAC			ALIFC	RNIA Les board
Please set up yo	ur MySQL environ	ment properly.		
EF EMFAC2025		×		
MySQL C	Configuration for E	MFAC		
MySQL Host:	127.0.0.1			
MySQL Port:	3307			
MySQL Usernan	ne: root	*****		
MySQL Passwor	c emfac2025	0509		
# of parallel MyS	QLs: 2			
Status:	Valid			
Test	Save	Cancel		

- 6. Click "Test" to test.
- 7. Click "Save" when the configuration is set correctly.
- 8. Click "Import EMFAC Default Database" to import the databases to your MySQL server.

EF EMFAC2025		-		×
File Run Too	ls Help			
EN	FAC	CALIFOR	R N I воа	A R D
		The default database required to run EMFAC needs to be updated.		
		Please click the button below to import the default database.		
		Import EMFAC Default Database		
EF EMFAC2025		-		×
File Run Iool		\sim		
ΕN	FAC		BOA	A RD
		The default database required to run EMEAC needs to be undated		
		Place click the button below to import the default database		
	EF EMEAC2025			
	Li Linniceoro			
		Importing EMFAC default database (45%) hd_activity_total_acf		
		Cancel		

- 9. Please note that a user can reconfigure a previously configured EMFAC2025/MySQL connection by launching the MySQL Configurator from the Tools menu. This functionality could be used, for instance, to connect EMFAC to a different MySQL server.
- 10. Once the import is finished, click "Click to Get Started" to enter the main menu of EMFAC2025.



3.5 EMFAC Command-Line Interface

- EMFAC2025 includes a command-line interface to facilitate batch mode operation. Open a Command Prompt or PowerShell in Windows and navigate to the folder containing "EMFAC.exe" executable. Here, we assume the folder is C:\EMFAC2025 as an example.
- Running ".\EMFAC.exe" without any options will launch the GUI application:

C:\EMFAC2025>.\EMFAC.exe

• Executing the command below will show all the available options for the application:

C:\EMFAC2025>.\EMFAC.exe -h

usage: emfac [-h] [-c] [-m MYSQL_CONFIG_TOML] [-i INPUT_FOLDER] [-o OUTPUT_FOLDER] [-1 LOGFILE] [-s] [-r] [-X]

Command Line Interface for EMFAC2025 v2.0.0

options:

-h,help	show this help message and exit
- C	Run EMFAC in the command line mode
-C	Drop all existing working schemas
-m MYSQL_CONFIG_TOML	MySQL DB configuration (default: emfac_mysql.cfg.toml)
-i INPUT_FOLDER	Input folder (default: input)
-o OUTPUT_FOLDER	Output folder (default: output)
-1 LOGFILE	Log file (default: EMFAC.log)
- S	Keep final output tables in MySQL
-r	reset or import all default tables
-X	drop all EMFAC databases

• EMFAC command-line interface requires a MySQL configuration file. In order to use a single MySQL server, please create a "emfac_mysql.cfg.toml" text file with the following content:

```
[MySQL]
host = "mysql_server_hostname"
port = 3306
username = "dbuser"
password = "dbpassword"
dbprefix = "emfac"
ncore = 2
compression = false
```

 In order to run EMFAC using multiple MySQL servers, create a "emfac_mysql.cfg.toml" text file with the following format:

```
[[MySQL]]
host = "mysql_server1_hostname"
port = 3306
username = "dbuser"
password = "dbpassword"
dbprefix = "emfac"
ncore = 2
compression = false
[[MySQL]]
host = "mysql_server2_hostname"
port = 3306
username = "dbuser"
password = "dbpassword"
dbprefix = "emfac"
ncore = 2
compression = false
```

• To run EMFAC in command line mode, please add one or more "_ers.toml" files in "input" folder, then run emfac using "-c" option and output files will be generated in "output" folder:

C:\EMFAC2025>.\EMFAC.exe -c

• As hinted in "emfac.exe -h" output, "input" or "output" folder location can be changed using "-i" or "-o" option. EMFAC MySQL configuration file can be specified using "-m" option. The MySQL configuration file uses the Tom's Obvious, Minimal Language (TOML) format.

4 Getting Started with EMFAC2025

4.1 General Tips

- The 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 output is 1000 gallons/day. The fuel unit for natural gas vehicles is in diesel equivalent gallon (DEG).
- The units for the output of the GHG module are detailed as follows. Column "emission": in tons/day and in thousand gallons/day where the "pollutant" is fuel. Column "emission_annualized": in tons/year and in thousand gallons/year where the "pollutant" is Fuel. Column "CO2e": in tons/day. Basically, it is to be consistent with the EMFAC model's historical convention: all emissions are in short tons and fuel consumption is in thousand gallons. There is one column that is additionally added in GHG outputs: column "CO2e_annualized" in metric tons per year. This is to facilitate comparison with existing literature which reports CO₂e using metric tons or even million metric tons such as those in Scoping Plan. Note that 1 ton = 0.907185 metric tons.
- In order to manage the size of the output files, some emissions and emission rates that are equal to zero are not included 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.
- 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 themain GUI and the console. It only removes the running dialogue.

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 EMFAC2025:"File", "Run", "Tools" and "Help".

EMFAC	K	CALIFORNIA AIR RESOURCES BOARD
	Please Select Run Mode C Emissions C Emission Rates	
	Please Select Run Type C Default Activity C Custom Activity (SG)	
	Start	

- 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 EMFAC2025 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 what EMFAC version is running

4.2.2 Home Screen, Run Modes and Types

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

EMFAC	A	CALIFORNIA
	Please Select Run Mode	
	Emissions	
	C Emission Rates	
	Please Select Run Type	
	 Default Activity 	
	C Custom Activity (SG)	
	Start	
	Juit	

- "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 (SG)" run type allows users to use their own activity data to run the model. The "Custom Activity (SG)" 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 "Project-Level Assessment (PL)" run type can be used to calculate emissionsrates with inputs of meteorological conditions for project-level assessments.

5 Generating Emissions Inventories

For regional analyses (as opposed to project-level analyses), there are two differentmodes in EMFAC2025 dictated by the travel activity data that are used.

Default Activity Mode. EMFAC uses historical data and future forecast to estimate EMFAC's default VMT to represent CARB's best estimates of California's on-road mobile source emissions inventory.

Custom Activity (SG) Mode. EMFAC allows users to generate emissions inventories using custom VMT information. Metropolitan and regional planning agencies can use this feature to generate emissions inventories that can be used for State Implementation Plans (SIP), transportation conformity analysis, and others.

EMFA	C CAL	IFORNIA OURCES BOARD
	Please Select Run Mode	
	Please Select Run Type	
	C Custom Activity (SG)	

5.1 Using Default Activity Mode

In this section, we explain how to accomplish an Emissions run with Default Activity either from the home screen or by loading an EMFAC2025 "_ers.toml" file that is saved from a previous run. The run parameters for default emissions run are summarized in Appendix 8.1.

5.1.1 Starting a Default Activity Run

- 1. Go to the Home screen by either restarting the model or clicking "New" in theFile Menu.
- 2. Pick "Emissions" and "Default Activity" and click "Start".
 - 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.

5.1.2 Area Tab

File Run Tools Help			
EMFAC		CA AIR	ALIFORNIA RESOURCES BOARD
Area	Time	Vehicles	Output
	Area MPO AMBAG BCAG COFCG KCAG KCAG MCAG MCTC MTC SACOG SANDAG SBCAG SCAG SCAG SCAG SCAG SCAG SCAG SCAG S	Statewide Air Basin Air District MPO County Sub-Area	
Prev	Emissions - D	efault - Area	Next

 The Area tab's list boxes allow users to choose different area types and areas for analysis. The user may pick from one of six area types: Statewide, Air Basin, Air District, MPO, County, or Sub-Area. Please refer to Appendix 8.2 for area definitions.

EMFAC		C A	LIFORNIA RESOURCES BOARD
Area	Time	Vehicles	Output
	Area Sub-Are Alpine (GBV) Amador (MC) Butte (SV) Calaveras (MC) Colusa (SV) Colusa (SV) Contra Costa (SF) Del Norte (NC) El Dorado (LT) El Dorado (LT) El Dorado (MC) Fresno (SJV) Glenn (SV) Humboldt (NC) Imperial (SS) Inyo (GBV)	ea	
Prev	Emissions - I	Default - Area	Next

- 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.
- For example, "Air Basin" has been selected in the following window, so multiple selections canbe made (see figure).

File Run Tools Help			
EMFAC		C AIR	ALIFORNIA RESOURCES BOARD
Area	Time	Vehicles	Output
	Area Air Bas Great Basin Valleys Lake County Lake County Lake Tahoe Mojave Desert Mountain Counties North Central Coast North Coast North Coast Northeast Plateau Sacramento Valley Salton Sea San Diego San Francisco Bay A San Joaquin Valley South Central Coast South Coast	in	
	Emissions -	Detault - Area	Next

5.1.3 Time Tab

• In the "Time" tab, a single Calendar Year or multiple can be selected: however, only one Season or Month can be selected for each run.

Area	Time	Vehicles	Outpu
	Calendar Year		
	2000 2001 2002 2003 2004 2005 2006 2007 2008		
	2009	~	
	€ Season C	Month	
	Annual	_	
	Aggregation Level	Hour	
	Note: GHG output only ava	ilable at Day level	

Calendar y

5.1.4 Vehicles Tab

Vehicle Class Select All
EMFAC202Y Vehicle Class

- In the Vehicle Class list box, the user can select the vehicle classes of interest. All vehicles can be selected by clicking "Select All". EMFAC202Y, EMFAC202X, EMFAC2011, and EMFAC2007 Vehicle Classes are available. Note that "EMFAC202Y Vehicle Class" is newly added in this version of EMFAC. Please refer to Appendix 8.3 for definitions of vehicle categories.
- The data can be output in either "By Model Year" or "Aggregated" form.
- The user can choose to output the data "By Speed" (for output at each speed) or "Aggregated" (for combined output only).

5.1.5 Output Tab

Area	Time	Vehicles
Pollutants	Activ	ties MT 🔽 Population 🔽 Trips 🔽 Energy Consu
I NOx I HC I PM I PM10 I PM2.5 I ROG		Options Cutput by Process Output by Cat-NonCat Save Data Save data from this run for future use
☞ TOG ☞ SOx ☞ GHG and Fuel	8	Output Options Split output by Sub Area & Calendar Year Output Files Directory:
VH3		C:/emfac2025/Output

- The "Pollutants" group box allows users to choose pollutants to beincluded in the output.
- The "Activities" group box indicates the types of activity data to beincluded in the output.
- The "Options" group box allows users 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 indicates whether the output data from the current run is saved in the MySQL server for reuse by the same future runs or their subsets. 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 (e.g. "C:\EMFAC2025\output") by clicking the "Change Directory" button.

• The standard output format for a Default run is "CSV" (comma-separated value text files). The output files will have a numerical timestamp in the name of the files.

5.1.6 Starting the Model Run

• 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.toml" 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.toml file.

EF EMFAC2025	\times
Please save the run spec first	
OK Cancel	

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 EMFAC2025 window.

Area	Time	Vehicles	Output
Pollutants	Activiti	es	
CO V	VM	T 🔽 Population 🔽 Trips	Energy Consumption
I ✓ NOx			
I HC		Options	
E PU		Output by Proce	ess
I♥ PM		Cutput by Cat-N	IonCat
PM1 EF EMFAC202	25		×
PM2	EMEAC	unning place wait 5%	
	Sub-Area Alameda (SF)	Cal Year 2000: Generated vehicle	activity
Г тос			
E ee		Cancel	
I♥ 50X	-		
GHG and Fuel		Output Files Dire	ctory:
ET ANUS		C:/emfac2025/Output	

• Once the model run is done, 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 EMFAC2025 label, sub-area, the analysis year, the season, data type (emission, GHG, VMT, energy consumption, vehicle population, and 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 outputfile generation time will still be indicated at the end of filename.

Cutput	× +			
> This PC > Windows (C	::) > emfac2025 > Output			Searc
A) & 11 s	Sort ~ 🗮 View ~ 🚥			
Name	^	Date modified	Туре	Size
EMFAC2025_v2.0.0_Default_AlamedaSF_2000_Annual_ers_emission_20250509145738		5/9/2025 3:01 PM	Microsoft Excel Comma	2 KB
EMFAC2025_v2.0.0_Default_AlamedaSF_2000_Annual_ers_energy_cons_20250509145738		5/9/2025 3:01 PM	Microsoft Excel Comma	1 KB
EMFAC2025_v2.0.0_Default_AlamedaSF_2000_Annual_ers_ghg_20250509145738 5/9		5/9/2025 3:01 PM	Microsoft Excel Comma	1 KB
BMFAC2025_v2.0.0_Default_AlamedaSF_2000_Annual_ers_population_20250509145738 5/9/2025 3:01 PM Microsoft Excel Comma			1 KB	
EMFAC2025_v2.0.0_Default_AlamedaSF_2000_Annual_ers_trips_20250509145738		5/9/2025 3:01 PM	Microsoft Excel Comma	1 KB
EMFAC2025_v2.0.0_Default_AlamedaSF_2000_Annual_ers_vmt_20250509145738 5/9/2025 3:01 PM Microsoft Excel Comma 1 KB				1 KB

5.1.9 Starting Default Run Using a Saved _ers.toml File

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

RunSpace	×	+				
> This PC >	Windows (C:) >	emfac2025 >	RunSpace			
(A) (a) (b) Sort \sim (b) View \sim (b) \sim						
Name	^		Date modified	Туре	Size	
EMFAC2025_v2.	0.0_Default_AlamedaSF	_2000_Annual_ers	5/9/2025 2:57 PM	Toml Source File	1 KB	

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

5.2 Using Custom Activity Mode (SG)

5.2.1 Background

The Custom Activity (SG) Mode of EMFAC2025 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 EMFAC2025.

5.2.2 Saving 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 CustomActivity (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 previousruns 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 runswith saved output.

Model run time is significantly reduced when the saved output from previous runs option is used for the current run. Extracting data already stored in the model database is much faster than recalculating it.

5.2.3 Types of Custom Activity Data

EMFAC2025 requires SG templates to be generated by EMFAC2025, not by older versions.

For all types of SG templates, the names of the worksheets MUST be exactly the same as produced from EMFAC. EMFAC uses these worksheet names to identify what type of data is present and 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.

EMFAC can import multiple sets of activity data at one time. Also, EMFAC can only process data for multiple scenarios with the same type of area and season. Files with different area types or seasons or SB375 settings cannot be loaded together. 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. Also, files with same area/calendar year combinations will be overwritten. For example, loading two different template files for Alameda/CY2030 with different VMTs at the same time will only generate one emissions output (VMT data from the latter file will be used for emissions calculations).

Table 5.2-1 Worksheets in EMFAC2025 Format Activity Templates

Template File Format Type	Worksheet Name	Description of Worksheet Data Fields
	Settings	Season/month and whether it is a SB375 template
Microsoft Excel (*.xlsx)	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 valuefor the desired emissions run, and to indicate whether the template is for SB375 or conformity purposes.

The table below summarizes the effect of selected GUI options in EMFAC2025 on which worksheets are generated (see ** in the table above) and how custom activity scaling is performed.

Table 5.2-2 EMFAC2025 Tem	plates: Effect of GUI Option	ons on Worksheets and Scaling
---------------------------	------------------------------	-------------------------------

User Select GUI Options		Scaling Approach (Can	not be Modified)
VMT Data Type	Custom Hourly SpeedFractions	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

<u>IMPORTANT!</u> If the user opts to generate an SB375 template (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 Pavley and Advanced Clean Cars 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.

5.2.4 Generating a Custom Activity Template

The run parameters for generating a custom activity template are summarized in Appendix 8.4.

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

File Run Tools Help	
EMFAC	CALIFORNIA AIR RESOURCES BOARD
	Please Select Run Mode
	• Emissions
	C Emission Rates
	Please Select Run Type
	C Default Activity
	 Custom Activity (SG)
	Please Select
	 Generate Custom Activity Template
	C Load Custom Activity File
	Start

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

File Run Tools Help	\sim	
ENFAC	A	AIR RESOURCES BOARD
Area	Time	VMT
	Area Sub-Area Alameda (SF) Alpine (GBV) Amador (MC) Butte (SV) Calaveras (MC) Colusa (SV) Contra Costa (SF) Del Norte (NC) El Dorado (LT) El Dorado (LT) El Dorado (MC) Fresno (SJV) Glenn (SV) Humboldt (NC) Imperial (SS) Inyo (GBV)	
Prev	Emissions - Custom - Area	Next

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

File Run Tools Help		
EMFAC		CALIFORNIA AIR RESOURCES BOARD
Area	Time	VMT
	Calendar Year 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 V Season / Month © Season © Month Annual	
Prev	Emissions - Custom - Time	Next

- 7. Select "Season" or "Month" and then specify which Season or Month youwould 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 datainto 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.

File Run Tools Help		
EMFAC	(A)	CALIFORNIA AIR RESOURCES BOARD
Area	Time	VMT
	VMT Data Type © Total Daily VMT © VMT by Vehicle and Fuel Type © Custom Hourly Speed Fractions Additional Options © SB375 Analysis Generate Template	
Prev	Emissions - Custom - VMT	Next

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



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

EF EMFAC2025 (v2.0.0) - Generate Template		- 🗆 X
File Run Tools Help		
EMFAC	A	CALIFORNIA AIR RESOURCES BOARD
Area	Time	VMT
	VMT Data Type	
EF EMFAC2025		×
Generating	template, this might take a few minutes, please Generating activity data Cancel	wait
	Generate Template	
Prov	Entering Outer 1975	Novi

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

EF EMFAC2025	×
Template generated	
ОК	

5.2.5 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 areseveral things to know:

• Standard custom activity templates are in Microsoft Excel worksheet (.xlsx)format.
- The worksheet names for either of these types of custom activity template mustnot 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 anddata rows should not be deleted.
- Standard custom activity 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 an SB375 assessment. The field indicating the season/monthcan be changed; the field with the SB375 setting cannot be changed.

Æ	AutoSave Off 🖫	9~ ♀ ╯ 븝 ╺ Custom_	DelNorteN	℃ ❤	P Sei	arch								
Fil	e Home Insert Pa	ge Layout Formulas Data	Review	View	Automate	Developer	Help	M-Files	Acrobat			🖵 Comment	s 🖻 Sh	are ~
B3	✓ : × ✓ J	$\hat{x} \sim$ Annual												~
	А	В	С	D	E	F	G	н	1	J	к	L	м	
1	Parameter	Value												
2	Created by	EMFAC2025												
3	Season/Month	Annual	•											_
4	SB375 Run	Off												_
5														_
6		You can edit this												_
7		You can not edit this												_
8														
9														- 1
10														- 1
11														- 11
12														- 11
13														- 11
14														
15														- 1
10														- 1
1/														- U
10														
20	\sim													-
<	> Settings	Daily_Total_VMT +					:	•	_	-	-	_	_	Þ
Read	ly 📧 💱 Accessibility: Go	od to go								⊞ ≣	<u> </u>		+	100%

- For worksheets broken out by vehicle-tech, all vehicle-tech types must be present. If you generate a standard custom activity template, all necessarycombinations of vehicle-tech's should be provided.
- If "Custom Hourly Speed Fractions" is selected, the speed fractions should addup 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 vehicletypes with all fuel types for all regions:
 - o PTO
 - o UBUS
 - o SWCV
- The EMFAC default speed profile will always be used for drayage trucks with allfuel types for Alameda (SF), Los Angeles (MD), Los Angeles (SC), San Bernardino (MD), and San Bernardino (SC):

- o T7 Other Port
- o T7 POAK
- o T7 POLA

5.2.6 Running EMFAC With a Custom Activity Template

The run parameters for generating a customized activity inventory are summarized in Appendix 8.4.

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

File Run Tools Help		
EMFAC	A	AIR RESOURCES BOARD
	Please Select Run Mode	
	Emissions	
	C Emission Rates	
	Please Select Run Type	
	C Default Activity	
	 Custom Activity (SG) 	
	Please Select	
	C Generate Custom Activity Template	
	Coad Custom Activity File	
	Start	

3. 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 atime.

File Run Tools Help		
EMFAC	CALIFORNIA AIR RESOURCES BOARD	
Load	Output	
	Please Select a File to Load Load Custom Activity	
Prev	Emissions - Custom - Load]

* IMPORTANT *

Files with different area types or seasons or SB375 settings cannot be loaded together. Also, files with same area/calendar year combinations will be over-written. For example, loading two different template files for Alameda/CY2030 with different VMTs <u>at the same time</u> will only generate one emissions output (VMT data from the latter file will be used for emissions calculations) 4. Select the desired file and then click "Open". Click "Ok".



5. Information about the loaded file is displayed on the window. Make sure thecorrect file has been selected.



6. 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 EMFAC2025).

File Run Tools Help	
EMFAC	CALIFORNIA AIR RESOURCES BOARD
Load	Output
	Please Select Report Types Image: CSV Image: Planning Inventory Image: CTF Save Data Image: Save data from this run for future use Output Directory C:/emfac21/output Change Directory
Prev	Emissions - Custom - Output Run

7. If the SB375 file was loaded, the output tab will be like the following screenshot.

File Run Tools Help	
EMFAC	CALIFORNIA AIR RESOURCES BOARD
Load	Output
	Please Select Report Types SB375 Save Data Save data from this run for future use Output Directory C:/emfac21/output Change Directory
Prev	Emissions - Custom - Output Run

8. Click "Run" to start the calculation

Load			DARD
	Please Select Report Types		
EF EMFAC20	25 EMFAC is running, please wait 0% Sub-Area Alameda (SF) Cal Year 2000: Start Cancel	ing	

9. After the run is completed, a window will show the Output File location and filename.

Lo	bad		Output
	Please Select	Report Types	
	Save Data		
EF EMFAC20	025		×
	EMFAC is runn Sub-Area Alameda (S	iing, please wait 0% SF) Cal Year 2000: Starting]
		Cancel	

6 Generating Emission Rates

This section describes how to run EMFAC for a Project-Level (PL) Assessment to generate emission rates using project-specific data. This mode generates emissionrates based on meteorological input (temperature and relative humidity) that users provide.

EMFAC Project-Level Assessment (EMFAC-PL) is a tool designed to support project-level assessments. EMFAC-PL is triggered when EMFAC is run under the Emission Rate mode. Using EMFAC-PL, emission rates are estimated based on user- specified, project-specific conditions: ambient temperature and relative humidity, vehicle speeds, vehicle classes, geographic location, and analysis period (month, season, or annual average). EMFAC-PL can provide emission rates by vehicle model year or aggregated ones over model years for a vehicle class. It also can provide emission rates by fuel type or emission rates aggregated over fuel types.

This section describes how to run EMFAC in conducting project- level analyses such as a PM-hot spot analysis required in transportation conformity determinations. This section describes the general steps for using the EMFAC software to generate emission rates for project-level analyses and uses five sample scenarios to illustrate the general approach.

EMFAC-PL outputs are in comma-separated values (CSV) format that can be easily opened and edited in MS Excel.

It is worth noting that unlike the "emission" mode, EMFAC-PL does not produce official GHG emissions and only provide estimates of tailpipe CO₂ emission rates. Moreover, EMFAC "emission" mode has added ammonia emissions, EMFAC-PL does not output ammonia emission rate, which can be easily back calculated based total emissions and VMT from the "emission" mode.

6.1 Project-Level Analysis

6.1.1 Approach

The figure below shows the general steps for using EMFAC-PL and points to thesubsequent sections of this document that provide additional details.

In general, to use EMFAC-PL for a project-level analysis, users need to:

- Determine the number of unique run scenarios based on the scope and resolution of the traffic activity data (a detailed discussion is provided in Section 6.1.2),
- Gather project-specific input (Section 6.3),
- Select desired aggregation scale, and
- Execute the PL run and look up emission rate output for contents of interest (Section 6.5)

EMFAC-PL



6.1.2 Determine the Number of EMFAC Runs

To use the EMFAC-PL efficiently, users need to first determine the number of runs needed that can sufficiently describe activity variation in a project. A single EMFAC-PL run allows users to select multiple areas or sub-areas, calendar years, vehicles, speed bins, and meteorology conditions. However, when a project involves multiple areas or sub-areas or includes multiple calendar years, it is likely that other inputs of interests, such as link speed ormeteorology conditions may be different in each area or sub-area and may also vary by calendar year. Under these circumstances, users are recommended to run multiple scenarios, with each scenario characterizing a unique combination of fleet, speed bin, and meteorology conditions for one area and calendar year. Compared to a single run with multiple areas and calendar years, the multi-run approach can eliminate unnecessary model runs, and reduces users' burden of having to filter out the desired results from massive outputs.

EMFAC-PL allows users to model one season (summer, winter, or annual average) orone month in one run. Users who are interested in multiple seasons or month-to-month variations need to obtain results from multiple runs.

EMFAC emission rates are not specified by the hour of day, or day of a month. However, the main factors causing the temporal variation of emission rates for a particular vehicle type are meteorological conditions, that is, temperature and relative humidity. These meteorology conditions are used directly to define emission rates and *can be* specified by the hour of day or the day of month. EMFAC2025-PL accepts up to 24 sets of user-specified temperature and relative humidity combinations as input in one run. Therefore, users who are interested in temporal variation can prepare a list of unique temperature and humidity combinations under study. For example, in a typical project-level analysis where activities are specified by four time periods (morning peak, midday, evening peak, and overnight), users should collect the temperature and relative humidity in each period and input the four pairs of values in one model run. If there are more than 24 sets of meteorology conditions of interest, multiple runs are needed.

6.2 Setting Up a Project-Level Assessment of Emissions Rates Run

The run parameters for generating emissions rates are summarized in Appendix 8.5.

- 1. Start the model or clicking "New" in the File menu.
- 2. Select Emission Rates as the Run Mode, and Project-Level Assessment (PL)as the Run Type and click "Start".

• 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. Each tab presents options for the user to customize the PL run.

ENFAC	CALIFORN	IA
	M/ IN AIR RESOURCES BO	ARL
	Please Select Run Mode	
	C Emissions	
	Emission Rates	
	Please Select Run Type	
	Project-Level Assessment (PL)	
	Start	

6.3 Develop Scenario Inputs

6.3.1 Geographic Area Tab

Upon starting a PL run, users first need to select the geographic area where the project is located. There are six region types: Statewide, Air Basin, Air District, MPO, County, and Sub-Area (GAI). Under each of these types, users can select one or multiple regions (hold down shift key and click for multiple selections).

Regardless of which of the six region types is chosen, EMFAC2025-PL always generates emission rates at the GAI level and does not provide area-wide average emission rates for any geographic scale higher than GAI. When a project-level analysis involves more than one GAI, users are required to provide project-specific activities for each GAI, separately.

For instance, Los Angeles County consists of two GAIs: the part located in the Mojave Desert Air Basin and the part located in the South Coast Air Basin. If a project is located in the port of Los Angeles, users only need to choose "Sub-Area" and pick "Los Angeles (SC)" to generate the emission rates. If a project is located in both GAIs of the Los Angeles County, users should choose "County" and pick "Los Angeles". Emission rates will be generated separately for the two parts of the county and users should prepare the project activities in each GAI separately to match the relevant emission rates.

The GAI selection matters in that, 1) different regions have different I/M (smog check) programs, which affect exhaust emission rates; 2) different regions designate the same month to either summer or winter season differently, and HDT idle emission rates vary by season; 3) different regions have different Reid Vapor Pressure (RVP) schedules and RVP affects evaporative emission rates; 4) exhaust emission rates are corrected for altitude in El Dorado (LT) and Placer (LT); and 5) evaporative emission rates are corrected for altitude in all GAIs.

File Run Tools Help	С		CALIFORNI AIR RESOURCES BOAR	A RD
Area	Time	Vehicles	Statewide orology Output	
Area	Area Alam Alainin Amac Butte Calav Colus Contr Del N El Do El Do El Do Fresr Glenr Huml Impe	Sub-Area Sub-Area eda (SF) a (GBV) for (MC) (SV) veras (MC) sa (SV) a Costa (SF) lorte (NC) rado (LT) rado (MC) to (SJV) n (SV) boldt (NC) rial (SS) GBV)	Air Basin Air District MPO County Sub-Area	
Prev		Emission Rates - PL -	- Area	Next

6.3.2 Time Tab

- Calendar Year
 - EMFAC2025 is designed to analyze calendar years from 2000 to 2050. It allows users to select multiple calendar years in a single run. However, if other inputs,

such as project travel speed, temperature, or humidity, changes from one year to another, users should consider separate annual runs.

- Season or Month
 - EMFAC2025 can only model one season (summer planning episode, winter planning episode, or annual) or one month in a single run. Season or month selection affects emission rates because seasonal fuel composition differences lead to a difference in fuel Reid Vapor Pressure (RVP), and RVP affects evaporative emissions. In addition, idle emissions rates also vary by season.

File Run Tools Help				
EMFA	C	ł		FORNIA DURCES BOARD
Area	Time	Vehicles	Meteorology	Output
	Caler 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 Seas	on / Month ⓒ Season ⓒ Month Annual		
Prev		Emission Rates - PL - Time		Next

6.3.3 Vehicles Tab

- EMFAC2025-PL provides output in one of six vehicle categorization schemes: EMFAC202Y, EMFAC202X, EMFAC2011, EMFAC2007, Truck1 - Truck2 - NonTruck, or Truck - NonTruck. Vehicle classifications based on these four categorization schemes are presented in Appendix 8.3.
- The vehicle classes are listed by the vehicle categorization schemes. Under each scheme, users may choose one or more vehicle classes, and emission rates will be generated only for the selected vehicle classes. For example, if users select the

EMFAC2007 scheme, then they may select from the 13 vehicle classes defined in EMFAC2007: LDA, LDT1, LDT2, MDV, MCY, LHD1, LHD2, MHDT, HHDT, MH, OBUS, SBUS, and UBUS.

- Emission rates will be aggregated to the scale of the chosen categorization scheme. For example, if users choose "Truck - NonTruck", and select both "Truck" and "NonTruck" entries, the output will include aggregated emission rates for "Truck" and "Non-Truck".
- We suggest that users choose vehicle categorization closest to the characteristics of their project-level activity data. For instance, if for a project the activities are specified for MHDT and HHDT, which are EMFAC2007 classes, then users should choose the EMFAC2007 categorization scheme and select these two vehicle classes. 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 bymodel year are used.
 - The "Aggregated" option is for projects in which only the aggregated total activity, but 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 aggregated output only).
- Special attention should be given to modeling bus fleets. Starting with EMFAC2011, additional bus categories were added to the vehicle class definitions
 - "Motor Coach" are heavy diesel interstate tour buses regulated under the Truck and Bus regulation.
 - "OBUS" now refers to gasoline, diesel and natural gas buses that are not school buses, urban buses, or motor coaches. Rental shuttles and church buses fall in this category. Previously diesel and natural "OBUS" categories were referred to as "All Other Buses."
 - "UBUS" refers to urban transit buses with all fuel types operating by transit agencies.
- Speed Bin
 - In EMFAC2025-PL, speeds are characterized in the form of speed bins at 5 mph intervals. Therefore, users are required to provide project-specific VMT according to these speed bins. At least one speed bin needs to be selected. For projects assessed at a single speed, users can pick an appropriate speed bin as suggested below. For projects with a range of speeds, users need to distribute the VMT into each speed bin to match the corresponding emission rates.
 - The speed bin is defined by the upper range of each bin. For example, the "5 mph" speed bin refers to 0 5 mph, the "10 mph" speed bin refers to 5 10 mph, and so on. The speed correction factors for a speed bin are computed using the midpoint value of the speed range.

Speed Bin [*]	Speed Value to compute SCF	Definition
5	2.5*	Speed <= 5
10	7.5	5 < Speed <= 10
15	12.5	10 < Speed <= 15
20	17.5	15 < Speed <= 20
25	22.5	20 < Speed <= 25
30	27.5	25 < Speed <= 30
35	32.5	30 < Speed <= 35
40	37.5	35 < Speed <= 40
45	42.5	40 < Speed <= 45
50	47.5	45 < Speed <= 50
55	52.5	50 < Speed <= 55
60	57.5	55 < Speed <= 60
65	62.5	60 < Speed <= 65
70	67.5	65 < Speed <= 70
75	72.5	70 < Speed <= 75
80	77.5	75 < Speed <= 80
85	82.5	80 < Speed <= 85
90	87.5	Speed > 85

Table 6.3-1 Speed Bin Definition

*For HD vehicles, speed correction factors for speed bin 5 are computed at the speed of 5 mph.

Therefore, if a project accesses link speed at 50 miles per hour, users are suggested to use the 50 mph speed bin for a rough estimate, or to compute the weighted average of emission rates at 50 mph bin and 55 mph bin for a more accurate estimate.

That is,

$$EEEE_{user} = EEEE_{lower bin} \times \left(\frac{Speed_{upper bin} - Speed_{user}}{5}\right) + EEEE_{upper bin} \times \left(\frac{Speed_{user} - Speed_{lower bin}}{5}\right)$$

Where the Speed_{upper bin} refers to the midpoint speed for the upper speed bin used in the calculation, and the Speed_{lower bin} refers to the midpoint speed for the lower speed bin used in the calculation. In the above example, the upper bin is 55 mph, and the lower bin is 50 mph, therefore the Speed_{upper bin} is 52.5 mph and the Speed_{lower bin} is 47.5 mph, that is,

$$EEEE_{50} = EEEE_{50 mph bin} \times \left(\frac{52.5 - 50}{5}\right) + EEEE_{55 mph bin} \times \left(\frac{50 - 47.5}{5}\right) = 0.5 \times EEEE_{50 mph bin} + 0.5 \times EEEE_{55 mph bin}$$



6.3.4 Meteorology Tab

- PL Runs require users to meteorological conditions
- Each pair of temperature (in Fahrenheit) and relative humidity (in percentage without % sign) must be provided in each row. See the example in the followingscreen 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 EMFAC2025.



6.3.5 Output Tab

• The Pollutants group box allows the user to choose the Pollutants for which dataare to be included in the output.

IMPORTANT - CO₂ emission rates from PL tool are tailpipe CO₂ and are **not** the same as the "complete combustion CO₂" under the "emission" mode.

• The Output Options group box allows users choose whether to split the output by GAI and Calendar Year and to specify a different directory to hold the output files by clicking the "Change Directory" button.

Area	Time	Vehicles	Meteorology	0	utput
Pollutar	ITS CO V NOX V HC V CO2 V PM V PM10 V PM2.5 V CH4 V ROG V TOG V SOX	C./emf	Options it output by Sub Area & Cale Output Files Directory: iac2025/Output Change Directory	ndar Year	

Table 6.3-2 Input Data User Options and Default Assumptions

Input Data	User's Option or Default
Geographic Area	-
-Geographic Scope	Multiple scales, multiple selections
-Aggregation Scale	Default: by sub-area
Calendar Year	Multiple selections
Vehicles	-
-Vehicle class aggregation	Multiple scales, multiple selections
-Fuel type aggregation	Optional
-Model year aggregation	Optional
Pollutants	Multiple selections
Temperature	Any integer, up to 24 entries
Relative humidity	Any integer, up to 24 entries
RVP	Default only
Speed	Multiple selections of speed bins
Pop by vehicle/fuel/age	Default data used for aggregated emission rates
VMT by vehicle/fuel/age	Default data used for aggregated emission rates
Trips by vehicle/fuel/hour	Default data used for aggregated emission rates
VMT bourly distribution	Not used in PL. Users prepare this data to conduct
vivit houry distribution	hourly analysis.
Speed Fractions by hour	Not used in PL. Users prepare this data to conduct
Speed Fractions by hour	hourly analysis.

¹In EMFAC2025 default California meteorology data, the temperature range is (16.7F, 106.9F) and the relativehumidity range is (13.4%, 100%)

6.4 Starting the Project-Level Model Run

- 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.toml 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.toml file.

EF EMFAC2025	×
Please save the run spec first	
OK Cancel	

- The model run can be stopped by clicking "Cancel" in the EMFAC2025 Window.
- The pop-up window provides the names and locations of the output filesgenerated after the run has finished.

6.5 Use Emission Rate Outputs

Upon completion of a model run, emission rate outputs are generated in one or more CSV files. The name of the CSV files consists of a scenario name and a time stamp. As shown in Table 6.5-1, the CSV file contains emission rates by calendar year, season or month, sub- area, selected vehicle classification, temperature, relative humidity, process, speed bin or soak time, and pollutants.

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 8.2
vahiala alaaa	Vehicle class selected based on user-selected
venicie_class	categorization. Refer to Appendix 8.3
fuel*	Gasoline, diesel, or other fuel types
model_year*	Model years
temperature	Temperature in Fahrenheit
relative_humidity	Relative humidity in percentage
process	Emission process
speed_time	For running exhaust (RUNEX), the "speed_time" column provides thespeed 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 6.5-1 Summary of Columns in CSV output Files

*These fields depend on user's choice

In EMFAC2025-PL, emission rates are always specified by process. A project-level analysis should combine these emission rates with the appropriate activities. Table 6.5-2 shows the emission rate units and associated activity for each process

Table 6.5-2 EMFAC2025-PL Emission Rate and Activity Units by Process

Process Name	Process type	Unit	Associated Activity
RUNEX	Running Exhaust	gram/veh-mile	VMT by speed bin
IDLEX	Idle Exhaust	gram/veh-idle hour	Number of Idle Hours
STREX	Start Exhaust	gram/veh-start	Number of starts
HOTSOAK	Hot Soak Evaporative	gram/veh-start	Number of starts
RUNLOSS	Running Loss Evaporative	gram/veh-hour	Running hours
DIURNAL	Diurnal Evaporative	gram/veh-hour	Cold soak hours
PMBW	Brake Wear	gram/veh-mile	VMT by speed bin
PMTW	Tire Wear	gram/veh-mile	VMT over all speed bin

6.5.1 RUNEX: Running Exhaust Emission Rates

Running Exhaust (RUNEX) emissions refer to the emissions that come out of the vehicle tailpipe while the vehicle is traveling on the road, including at speed and idling that occurs aspart of normal driving, such as at intersections. RUNEX emission rates in a PL output are specified by temperature, relative humidity, and speed bin.

6.5.2 IDLEX: Idle Exhaust Emission Rates

Idle Exhaust (IDLEX) emissions refer to the emissions during extended idling events (i.e., a continuous segment of vehicle activity that meets three criteria: all instantaneous vehicle speeds being lower than 5 mph, the total distance of less than 1 mile, and the total duration of more than 5 minutes) by heavy duty trucks. Extended idle may occur during loading or unloading goods, or to power accessories. Idle exhaust is calculated only for heavy-duty trucks. For light duty vehicles, the idle events during normal vehicle operation are already accounted for, i.e. RUNEX emission rates are based on driving cycles that include normal idling events. IDLEX emission rates do not vary by temperature and humidity and are not related to speed bins.

In EMFAC2025-PL, idle emission rates represent emissions *from the main engine only*; emissions from auxiliary power systems (APS) are excluded. The reason for this is that an APS is operated independently from the truck's main engine and behaves very differently. For users interested in project-level APS emissions, APS emission rates are provided in Appendix 8.8. Note that, in EMFAC2025 (not PL), the emission inventory estimation procedure for APS emissions is to include them as part of total HHDT idle emissions rather than as an independent process.

Idle emission rates are in units of grams per vehicle idle hour. To estimate idle emissions from an HD fleet, idle emission rates should be coupled with the total number of hours that the HD fleets engage in idling in the analysis time frame.

6.5.3 STREX: Start Exhaust Emission Rates

Start Exhaust (STREX) emissions are the excess emissions that occur when a vehicle is starting because the emissions-control equipment has not yet reached its optimal operating temperature. Start exhaust emissions are independent of running exhaust emissions. The magnitude of start emissions is dependent on the soak time, that is, the duration between the last engine-off event and the current engine-on event. In general, the longer the soak time is, the higher the STREX emissions. EMFAC2025-PL estimates start emission rates using 18 different soak time bins, ranging from 5 minutes to 720 minutes. Starts after the vehicle engine has been shut-off for more than 720 minutes (12 hours) are considered cold starts andare assumed to have the same STREX emission rates with soak time of 720 minutes.

To estimate start emissions for a project, users need to prepare the number of starts by soak time bin. This includes the cases where a project has a known typical soak time (or a known soak time distribution).

6.5.4 Evaporative Emission Rates

In EMFAC2025-PL, evaporative emissions are produced in three modes of vehicle operations:hot soak, running loss, and diurnal. Evaporative emissions are generated as gasoline fuels evaporate and escape from the vehicle's fuel system.

Hot soak emissions are the hydrocarbon (HC) emissions that are emitted from a vehicle whilethe engine is still hot after the vehicle stopped operating until the fuel tank temperature cools down to a non-operation level. Hot soak emission rates are in the unit of gram per vehicle start and should be combined with the number of starts to estimate total emissions.

Running loss emissions are the HC emissions that are emitted while the vehicle engine is on. Running loss emission rates in EMFAC2025-PL are in the unit of gram per running hour, which is evaporative emission per hour that the vehicle is operating. To estimate total running loss emissions, the emission rates should be coupled with the total number of vehicleoperating hours within the analysis period.

Diurnal emissions are the HC emissions from a sitting vehicle while the ambient temperature changes. The emissions occur when the amount of fuel vapors generated in the fuel tank exceeds the capacity of the carbon canister and they are vented out to the atmosphere.

Diurnal emission rates are in the unit of gram per cold soak hours.

Evaporative emission rates for MHDT, HHDT, SBUS, and OBUS categories only represent the gasoline sub-fleets. Users are advised to conduct the analysis by fuel type if they are interested in evaporative emissions

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.toml" 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.toml" will be:

- "Default_AlamedaSF_2012_Annual_emission_20241208193758.csv" for the emissions inventory file;
- "Default_AlamedaSF_2012_Annual_ghg_20241208193758.csv" for the ghg emissions inventory file;
- "Default_AlamedaSF_2012_Annual_population_20241208193758.csv" for the vehicle population file;
- "Default_AlamedaSF_2012_Annual_trips_20241208193758.csv" for the trips file;
- "Default_AlamedaSF_2012_Annual_vmt_20241208193758.csv" for the vehicle miles traveled file.
- "Default_AlamedaSF_2012_Annual_energycons_20241208193758.csv" for the energy consumption 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_20241208231949.csv" for the emissions inventory file;
- "Custom_KernSJV_2020_Annual_ population_20241208231949.csv" for the vehicle population file;
- "Custom_KernSJV_2020_Annual_trips_20241208231949.csv" for the trips file;
- "Custom_KernSJV_2020_Annual_vmt_20241208231949.csv" for the vehicle miles traveled file;
- "Custom_KernSJV_2020_Annual_planning_20241208231949.xlsx" for the planning inventory file;
- "Custom_KernSJV_2020_Annual_ctf_20241208231949.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.toml" will be:

• "PL_AlamedaSF_2012_Annual_2024120812621.csv" for the emissions rate file

7.1 CSV (Comma Separated Values)

The standard output format from EMFAC2025 is CSV, thesame as previous versions of EMFAC. CSV is a common, relatively simple file format that is widely used by consumers, businesses, 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, energy consumption, 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 tostarting for start emissions.

Table 7.1-1 provides descriptions of the columns in the emissions, activity, and emission rates CSV output files. Table 7.1-2 lists the emissions processes in the emissions rates output files.

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

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 8.2
vehicle_class	Vehicle class as defined in Appendix 8.3
fuel	Gasoline, PHEV, diesel, natural gas, and electric
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 notdepend on speed bin or soak time, this field is blank.
emission_rate	Emissions per unit of activity

Table 7.1-1 Summary of Columns in CSV Output Files

Table 7.1-2 Emissions Processes in Emissions Rates Files

Emission Process	Description
RUNEX	Running Exhaust
IDLEX	Idle Exhaust
STREX	Start Exhaust
RUNLOSS	Running Loss Evaporative
HOTSOAK	Hot Soak Evaporative
DIURN	Diurnal Evaporative
PMTW	PM Tire wear
PMBW	PM Brake wear

7.2 Planning Inventory Report

The Planning Inventory Report generated from the Custom Activity type is a Microsoft Excel 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 includesa "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! The Planning Inventory Report generated by the Custom Activity type does not correspond to official GHG emissions. However, the EMFAC2025 default runsemploy a methodology consistent with CARB's official GHG inventory estimation.

7.3 SB375 Report

The SB375 report generated from the Custom Activity type is a Microsoft Excel Workbook that is a sub-set of the Planning Inventory Report described above. It is limited to four lightduty vehicle types (LDA, LDT1, LDT2, and MDV), CO₂ emissions, and related activity. The only vehicle-tech types included in this SB375 report are:

Custom Activity SB375 Vehicle Types					
	DSL		DSL		
	BEV		BEV		
LDA	GAS	LD12	GAS		
	PHE		PHE		
	DSL		DSL		
	BEV		BEV		
LDTT	GAS		GAS		
	PHE		PHE		

<u>IMPORTANT!</u> - Note again that, for SB375 analyses, ACC/Pavley 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 anSB375 report will not equal CO₂ emissions from a standard planning inventory report.

7.4 CTF Report

The CEIDARS Transaction Format (CTF) generated from the Custom Activity type is areport used internally by CARB 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 theprocesses. Appendix 8.6 describes the fields in a CTF file.

8 Appendices

8.1 Summary of Run Parameters for Generating Default Emissions Inventory

Tab	Run Parameters	Description
A	Area Туре	One of the area types can be picked.
Area	Area	One or more areas can be selected for one run.
	Calendar Year	Between 2000 and 2050. One or more calendar years can be selected for one run.
Time	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 EMFAC2025, EMFAC2021, EMFAC2011, 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 ispicked.
	Speed	Aggregated or by speed in output.
	Pollutants	Pollutants in output.
	Activities	Pick one or more of the activities (VMT, vehicle population, trips, or energy consumption) to be included inoutput files.
	Output by process	Whether to output by process.
Output	Output by Cat/NonCat	Whether to output by Cat/NonCat.
_	Save data for futureuse	Users can get results faster in the future if data from previous runs are saved and used.
	Outrast Octions	Whether to split output by Sub Area & Calendar Year
	Output Options	Where to save output files

8.2 Definition of Areas

Sub-Area	County	Air Basin	Air District Name	МРО	MPO Name
	Name	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 AQMD	TMPO	Tahoe Metropolitan Planning Organization
El Dorado (MC)	El Dorado	Mountain Counties	El Dorado County AQMD	SACOG	Sacramento Area Council of Governments
Fresno (SJV)	Fresno	San Joaquin Valley	San Joaquin Valley APCD	COFCG	Fresno Council of Governements
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	Eastern Kern APCD	KCOG	Kern Council of Governments
Kern (SJV)	Kern	San Joaquin Valley	San Joaquin Valley APCD	KCOG	Kern Council of Governments
Kings (SJV)	Kings	San Joaquin Valley	San Joaquin Valley APCD	KCAG	Kern Council 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 APCD	MCTC	Madera County Transportation Commission

Sub-Area	County Name	Air Basin Name	Air District Name	МРО	MPO Name
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 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 Air Resources District	AMBAG	Association of Montery 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 Air Resources District	AMBAG	Association of Montery 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

Sub-Area	County Name	Air Basin Name	Air District Name	МРО	MPO Name
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 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	Metropolitant Transportation Commission
Santa Cruz (NCC)	Santa Cruz	North Central Coast	Monterey Bay Air Resources District	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 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 APCD	TCAG	Tulare County Association of Governments
Tuolumne (MC)	Tuolumne	Mountain Counties	Tuolumne County APCD		

Sub-Area	County Name	Air Basin Name	Air District Name	MPO	MPO Name
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

8.3 Vehicle Categories

EMFAC202Y	Description	EMFAC202X	EMFAC2011	EMFAC2007
LDA	Passenger Cars	LDA	LDA	LDA
LDT1	Light-Duty Trucks (GVWR <6000 lbs and ETW ≤3750 lbs)	LDT1	LDT1	LDT1
LDT2	Light-Duty Trucks (GVWR <6000 lbs and ETW 3751- 5750 lbs)	LDT2	LDT2	LDT2
MDV	Medium-Duty Trucks (GVWR 6001-8500 lbs)	MDV	MDV	MDV
MH	Motor Homes	MH	MH	MH
MCY	Motorcycles	MCY	MCY	MCY
LHD1 Public	Light-Heavy-Duty Public Trucks (8501-10,000 lbs) Light-Heavy-Duty Other Trucks	LHD1	LHDT1	LHDT1
LHD1 Other	(8501-10,000 lbs)			
LHD2 Public	Light-Heavy-Duty Public Trucks (10,001-14,000 lbs)		LHDT2	LHDT2
LHD2 Other	Light-Heavy-Duty Other Trucks (10,001-14,000 lbs)			
T6 Public Class 4	Medium-Heavy Duty Public Fleet Truck (14,001-16,000 Ibs)	T6 Public Class 4	T6 Public	MHDT
T6 Public Class 5	Medium-Heavy Duty Public Fleet Truck (16,001-19,500 Ibs)	T6 Public Class 5		
T6 Public Class 6	Medium-Heavy Duty Public Fleet Truck (19,501-26,000 Ibs)	T6 Public Class 6		
T6 Public Class 7	Medium-Heavy Duty Public Fleet Truck (26,001-33,000 Ibs)	T6 Public Class 7		
T6 Utility Class 5	Medium-Heavy Duty Utility Fleet Truck (16,001-19,500 Ibs)	T6 Utility Class 5	T6 Utility	
T6 Utility Class 6	Medium-Heavy Duty Utility Fleet Truck (19,501-26,000 Ibs)	T6 Utility Class 6		
T6 Utility Class 7	Medium-Heavy Duty Utility Fleet Truck (26,001-33,000 Ibs)	T6 Utility Class 7		
T6 Instate Tractor Class 6	Medium-Heavy Duty Tractor Truck (19,501-26,000 lbs)	T6 Instate Tractor Class 6	T6 instate small	

EMFAC202Y	Description	EMFAC202X	EMFAC2011	EMFAC2007
T6 Instate Delivery	Medium-Heavy Duty Delivery	T6 Instate	_	
Class 4	Truck (14,001-16,000 lbs)	Delivery Class 4		
T6 Instate Delivery	Medium-Heavy Duty Delivery	T6 Instate		
Class 5	Truck (16,001-19,500 lbs)	Delivery Class 5	-	
T6 Instate Delivery	Medium-Heavy Duty Delivery	T6 Instate		
Class 6	Truck (19,501-26,000 lbs)	Delivery Class 6	I 6 instate	
T6 Instate Other	Medium-Heavy Duty Other	T6 Instate Other	small	
Class 4	Truck (14,001-16,000 lbs)	Class 4	-	
T6 Instate Other	Medium-Heavy Duty Other	T6 Instate Other		
Class 5	Truck (16,001-19,500 lbs)	Class 5	-	
T6 Instate Other	Medium-Heavy Duty Other	T6 Instate Other		
Class 6	Truck (19,501-26,000 lbs)	Class 6		
T6 Instate Tractor	Medium-Heavy Duty Tractor	T6 Instate Tractor		
Class 7	Truck (26,001-33,000 lbs)	Class 7		
T6 Instate Delivery	Medium-Heavy Duty Delivery	T6 Instate	T6 instate	MHDT
Class 7	Truck (26,001-33,000 lbs)	Delivery Class 7	heavy	
T6 Instate Other	Medium-Heavy Duty Other	T6 Instate Other		
Class 7	Truck (26,001-33,000 lbs)	Class 7		
	Medium-Heavy Duty CA			
T6 CAIRP Class 4	International Registration Plan	T6 CAIRP Class 4		
	Truck (14.001-16.000 lbs)			
T6 CAIRP Class 5	Medium-Heavy Duty CA		T6 CAIRP small	
	International Registration Plan	T6 CAIRP Class 5		
	Truck (16 001-19 500 lbs)			
	Medium-Heavy Duty CA		-	
TA CAIRP Class 6	International Registration Plan	TA CAIRP Class A		
	Truck (19 501-26 000 lbs)			-
	Medium-Heavy Duty CA			
TA CAIRP Class 7	International Registration Plan	TA CAIRP Class 7	T6 CAIRP	
TO CAINE Class 7	Truck $(26.001.33.000 \text{ lbs})$	TO CAINE Class 7	heavy	
	Madium Hanky Duty Diasal			-
	Out of state Truck (14 001			
10 003 Class 4	16 000 lbc)	10 003 Class 4		
	Madium Hazur Duty Diasal			
	Out of state Truck (1(001			
		To UUS Class 5	To OOS small	
	Madium Haavy Duty Dissal		-	
	Niedium-Heavy Duty Diesei			
16 OOS Class 6		16 OOS Class 6	T6 OOS heavy	
T6 OOS Class 7				
	Medium-Heavy Duty Diesei	T6 OOS Class 7		
	Out-of-state Truck (26,001-			
	33,000 lbs)			4
T6TS	Medium-Heavy Duty Gasoline	Т6ТЅ	T6TS	
	Truck			
T7 Public Class 8	Heavy-Heavy Duty Diesel	T7 Public Class 8	T7 Public	ннот
	Public Fleet Truck			
EMFAC202Y	Description	EMFAC202X	EMFAC2011	EMFAC2007
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T7 CAIRP Class 8	Heavy-Heavy Duty CA International Registration Plan Truck	T7 CAIRP Class 8	T7 CAIRP	
T7 Utility Class 8	Heavy-Heavy Duty Utility Fleet Truck	T7 Utility Class 8	T7 Utility	
T7 NNOOS Class 8	Heavy-Heavy Duty Non- Neighboring Out-of-state Truck	T7 NNOOS Class 8	T7 NNOOS	
T7 NOOS Class 8	Heavy-Heavy Duty Neighboring Out-of-state Truck	T7 NOOS Class 8	T7 NOOS	
T7 Other Port Class 8	Heavy-Heavy Duty Drayage Truck at Other Facilities	T7 Other Port Class 8	T7 Other Port	
T7 POAK Class 8	Heavy-Heavy Duty Drayage Truck in Bay Area	T7 POAK Class 8	Τ7 ΡΟΑΚ	
T7 POLA Class 8	Heavy-Heavy Duty Drayage Truck near South Coast	T7 POLA Class 8	T7 POLA	HHDT
T7 Single Concrete/Transit Mix Class 8	Heavy-Heavy Duty Single Unit Concrete/Transit Mix Truck	T7 Single Concrete/Transit Mix Class 8		
T7 Single Dump Class 8	Heavy-Heavy Duty Single Unit Dump Truck	T7 Single Dump Class 8	T7 Single	
T7 Single Other Class 8	Heavy-Heavy Duty Single Unit Other Truck	T7 Single Other Class 8		
T7 Tractor Class 8	Heavy-Heavy Duty Diesel Tractor Truck	T7 Tractor Class 8	T7 Tractor	
T7 SWCV Class 8	Heavy-Heavy Duty Solid Waste Collection Truck	T7 SWCV Class 8	T7 SWCV	
T7IS	Heavy-Heavy Duty Gasoline Truck	T7IS	T7IS	
РТО	Power Take Off	РТО	PTO	
SBUS	School Buses	SBUS	SBUS	SBUS
UBUS	Urban Buses	UBUS	UBUS	UBUS
Motor Coach	Motor Coach	Motor Coach	Motor Coach	
OBUS	Other Buses	OBUS	OBUS	OBUS
All Other Buses	All Other Buses	All Other Buses	All Other Buses	

8.4 Summary of Run Parameters for Generating Custom Activity Template

Tab	Run Parameters	Description	
Area	Area Туре	One of the area types can be picked.	
	Area	One or more areas can be selected for one run.	
Time	Colondar Voar	Between 2000 and 2050. One or more calendar	
		years can be selected for one run.	
		One of the three seasons (annual, summer, winter)	
	Season/Month	or one of the 12 months can beselected for one	
		run.	
VMT		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.	

8.5 Summary of Run Parameters for Generating Emission Rates

Таb	Run Parameters	Description	
Area	Area Туре	One of the area types can be picked.	
Aled	Area	One or more areas can be selected for one run.	
	Calendar Year	Between 2000 and 2050. One or more calendar years can be selected for one run.	
Time	Season/Month	One of the three seasons (annual, summer, winter) or one of the 12 months can be selected for one run.	
Vehicles	Vehicle Category Type	Output by EMFAC202Y vehicle category, EMFAC202X vehicle category, EMFAC2011 vehicle category, EMFAC2007 vehicle category, Truck/Non-Truck, or Truck1/Truck2/Non-Truck	
	Vehicle Category	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.	
Mataaralaay	Temperature	Temperature in Fahrenheit	
weteorology	Relative Humidity	Relative Humidity	
Output	Pollutants	Pollutants in output	
	Output Directory	Where to save output files	

8.6 Fields in CTF File

Field Name	Field Type	Field Description
YEAR	NUMERIC	Cal Year Of The Run Data
DIS	CHAR	District Id
AB	CHAR	Air Basin Id
СО	NUMERIC	County Id
EIC	NUMERIC	Eic Code
PR	NUMERIC (11,2)	Annual Process Rate
HPDY	NUMERIC	Hours Per Day
DPWK	NUMERIC	Day Per Week
JANT	NUMERIC(4,1)	Percent Activity For January - Range 0-100
FEBT	NUMERIC(4,1)	Percent Activity For February - Range 0-100
MART	NUMERIC(4,1)	Percent Activity For March - Range 0-100
APRT	NUMERIC(4,1)	Percent Activity For April - Range 0-100
MAYT	NUMERIC(4,1)	Percent Activity For May - Range 0-100
JUNT	NUMERIC(4,1)	Percent Activity For June - Range 0-100
JULT	NUMERIC(4,1)	Percent Activity For July - Range 0-100
AUGT	NUMERIC(4,1)	Percent Activity For August - Range 0-100
SEPT	NUMERIC(4,1)	Percent Activity For September - Range 0-100
OCTT	NUMERIC(4,1)	Percent Activity For October - Range 0-100
NOVT	NUMERIC(4,1)	Percent Activity For November - Range 0-100
DECT	NUMERIC(4,1)	Percent Activity For December - Range 0-100
POL	NUMERIC	Pollutant Code
EMFACT	NUMBER (10,4)	Emission Factor (Lbs Per Eic Unit)
SEASON	CHAR	Season
EMS	NUMERIC(10,4)	Emissions (Tons/Day)
VERSION	CHAR	Emfac Version
OPERATOR	CHAR	Operator Initials
TDATE	DATE	Transaction Date
VMT	NUMERIC	Vehicle-Miles Traveled
VEH_POPULATION	NUMERIC	Vehicle Population
FUEL_CONSUMPTION	NUMERIC	Fuel Consumption (Thousand Gallons)
FUEL_TYPE	CHAR	Fuel Type
OP_DAYS	NUMERIC	Operation Days Per Year

8.7 EMFAC2025-PL Emission Rate Aggregation (Units and Activity)

Process type	Unit	Vehicle Specific Activity	
Running Exhaust	grams/vehicle-mile	Daily VMT by speed	
Start Exhaust	grams/vehicle-start	Number of starts per day	
	grams/vehicle-idle	Number of idle hours per	
Idle Exhaust	hours	day	
Hot Soak Evaporative	grams/vehicle-start	Number of starts per day	
Pupping Loss Evaporativo	grams/vehicle-	Operation hours per day	
	operation hour		
Diurpal Loss Evaporativo	grams/vehicle-cold	Cold soak hours per day	
	soak hour		
Brake Wear	grams/vehicle-mile	Daily VMT by speed	
Tire Wear	grams/vehicle-mile	Daily VMT (over all speeds)	

8.8 Project Level APS Emission Rates

Model Year Range	pre 2007	2007+
HC (g/hr-veh)	3.2	3.2
CO (g/hr-veh)	6.2	6.2
NOx (g/hr-veh)	12.1	12.1
PM (g/hr-veh)	0.87	0.13
CO2 (g/hr-veh)	2228	2228
TOG (g/hr-veh)	4.61	4.61
ROG (g/hr-veh)	4.05	4.05
SOx (g/hr-veh)	0.02	0.02