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1. Introduction

The California Air Resources Board (CARB) maintains the EMission FACtors (EMFAC) model, which is approved by USEPA for developing on-road motor vehicle emission inventories and conformity analyses in California.\(^1\) EMFAC models on-road mobile source emissions under multiple temporal and spatial scales; it produces composite emission factors for an average day of a month (January to December), a season (summer and winter), or an annual average, for specific California geographic areas by air basin, district, and county as well as the statewide level. EMFAC can produce PM\(_{2.5}\) and PM\(_{10}\) emission rates for three exhaust emission processes (running, starting, and idle), tire wear, and brake wear.

In 2011, ARB released an updated version of the EMFAC model called EMFAC2011, which consists of three modules: EMFAC-LDV which estimates passenger vehicles emissions; EMFAC-HD which estimates emissions from diesel trucks and buses over 14,000 lbs.; and a third module called EMFAC-SG which integrates the output of EMFAC-LDV and EMFAC-HD and provides users with the ability to conduct scenario assessments for air quality and transportation planning. In addition, ARB also enhanced data availability by providing a new database through the ARB mobile source emissions inventory web site (EMFAC Web Database) that provides regional population, activity, emissions, and emission rates at varying levels of detail.

ARB has developed this handbook as a guide to use EMFAC2011 to conduct project-level analyses. This section of the handbook describes the steps to generate emission rates to estimate a project’s exhaust, brake wear, and tire wear emissions for project-level analyses in California.

Please note that for PM10 or PM2.5 transportation conformity hot-spot analyses, users should also refer to Section 5 of EPA’s Quantitative PM Hot-spot Guidance. EPA is currently developing EMFAC2011 guidance in coordination with ARB, and when finalized, it will be posted at EPA’s conformity website at: [www.epa.gov/otaq/stateresources/transconf/policy.htm#project](http://www.epa.gov/otaq/stateresources/transconf/policy.htm#project).

1.1. What’s New for Project-level Analysis?

Since EMFAC2011 uses a modular emissions modeling approach that departs from the single model approach used by EMFAC 2007, it may now be necessary to use more than one method – or go to more than one place to obtain the emission rates needed for conducting project-level analyses. In order to aid the user to obtain emission rates for project level assessments, ARB has released a new tool called EMFAC2011-PL. Projects using the default information can utilize the EMFAC2011-PL tool to obtain standard emission rates at the desired vehicle category scheme (which includes EMFAC2011, EMFAC2007, Truck/Non-Truck, and ALL Vehicles Combined level)\(^2\). Where changes are made to the

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\(^1\) The current version of the EMFAC model, future model versions, and supporting documentation can be downloaded from the CARB website at: [www.arb.ca.gov/msei/onroad/latest_version.htm](http://www.arb.ca.gov/msei/onroad/latest_version.htm).

\(^2\) More information on Vehicle Categories is available at [http://www.arb.ca.gov/msei/vehicle-categories.xlsx](http://www.arb.ca.gov/msei/vehicle-categories.xlsx).
default assumptions, projects will need to use a combination of EMFAC2011-LDV, the online emission rates database (http://www.arb.ca.gov/emfac), or the online idling rates database (http://www.arb.ca.gov/msei/emfac2011_idling_emission_rates.xlsx).
2. Approach for Project Level Analysis

To complete an EMFAC-based project-level analysis, users need to determine the scope and resolution of traffic activity data, identify basic scenario data inputs, and gather project-specific traffic data and fleet data. Based on the availability of information, users can follow the General Decision Matrix explained in Figure 1 and select either (a) the Simplified Approach, or (b) the Detailed Approach. The simplified approach is appropriate when projects utilize EMFAC default parameters for the region for the following variables: (a) ambient temperature and relative humidity profiles, (b) vehicle age distributions, and (c) vehicle rest/soak time. If there is more appropriate project-specific information for any of the three variables, then the user is encouraged to use the detailed approach. The approach selection criteria and the two approaches are explained in further detail in the following sections.

Figure 1: General Decision Matrix for Project-level Assessment

3 Variation in ambient Temperature and Relative Humidity do not affect PM emissions. Therefore, for PM assessments, Step 1 can be ignored.
These approaches report process emission rates consistent with EMFAC2011. These emission factor output data should be paired with project-specific activity data to estimate project-level emissions. For example, to calculate project-level running exhaust PM emissions, users need to combine the average running exhaust PM emission factors (in g/mile) provided by EMFAC2011-PL with project-level activity data such as vehicle miles travelled (VMT) by speed bin.
3. Simplified Approach

ARB has released a Project-level assessment tool (EMFAC2011-PL) to assist in the development of emission rates for the purposes of project-level assessments. The EMFAC2011-PL is a new simplified tool that generates emission rates for use in project-level assessments. EMFAC-PL uses emissions and activity data from EMFAC2011-SG module inventory files (default inventories of EMFAC-LDV and EMFAC-HD modules) and calculates emission factors consistent with the default fleet distributions in the region. The tool is available on ARB’s Mobile Source Emission Inventory website (http://www.arb.ca.gov/msei/modeling.htm).

Figure 2: Graphical User Interface (GUI) of the EMFAC2011-PL Tool
The general methodology for using the Simplified Approach is explained in the figure below.

**Figure 3: Simplified Approach for Project-level Assessment**
The emission rates are available through the EMFAC2011-PL tool. Users are required to select the following options:

- **Vehicle Category Scheme**: EMFAC2011, EMFAC2007, Trucks/Non-Trucks, ALL Vehicles
- **Region Type**: Statewide Average, Air Basin, Air District, MPO, County, Sub-Area (GAI)
- **Region**
- **Calendar Year**
- **Season**

Based on the Vehicle Category Scheme selection, users may also select specific vehicle type, or get emission factors for all corresponding vehicle categories. For example, if the user selects EMFAC2007 scheme, then they may select from the 13 vehicle categories specific to EMFAC2007 above (LDA, LDT1, LDT2, MDV, MCY, LHD1, LHD2, MHDT, HHDT, MH, OBUS, SBUS, and UBUS).

Users may also select options for fuel type (GAS, DSL, TOT, or ALL) and speed bin (14 speed bins between 5 -70 MPH at 5 MPH increments) to get emission rates corresponding to project-specific data.

The EMFAC2011-PL tool downloads the emission rates for the selected vehicles for all processes as described below:

- Running Exhaust Emissions Rates [RUNEX] in g/mile/veh
- Idling Exhaust Emissions Rates [IDLEX] in g/hr/veh
- Starting Exhaust Emissions Rates [STREX] in g/trip/veh
- PM Brake Wear [PMBW] and PM Tire Wear [PMTW] in g/mile/veh
- Evaporative Emission Rates in g/veh/day
  - Diurnal Emissions [DIURN]
  - Hot Soak Emissions [HTSK]
  - Running Loss Emissions [RUNLS]
  - Resting Loss Emissions [RESTL]

More information and detailed step-by-step instructions for a few illustrative example projects using the Simplified Approach are available in Appendix A (Pages 6 through 38).
4. Detailed Approach

The detailed approach is to be followed when either (a) regional temperature and/or relative humidity profiles differ from EMFAC default, (b) the vehicle age distributions different from EMFAC defaults, or (c) vehicle rest/soak time data are available for the project.

The detailed approach consists of two parts:

- EMFAC-LDV Procedure
- EMFAC-HD Procedure

Depending on the fleet mix for the project, users may need to use either the EMFAC-LDV procedure, or the EMFAC-HD Procedure, or both the procedures together.

**Figure 4: Detailed Approach for Project-level Assessment**

Note: When modeling bus fleets, users must select the appropriate type from the several kinds of buses available in EMFAC2011:

- Urban buses in California are primarily natural gas buses certified to diesel standards (there are still some diesels around that are certified to diesel standards). So if the project is looking at publicly owned urban transit buses, then the Urban Bus category would be appropriate. [EMFAC-LDV]
- If the terminal is private and the focus is on something like Greyhound buses, then the appropriate category is Motor Coach. Motor Coaches are heavy buses with a specific body type used for interregional transit. They are regulated through the Truck and Bus rule. [EMFAC-HD]
- Rental car shuttles are covered under the Other Bus (Diesel) category. [EMFAC-HD]
- EMFAC also models Other Bus (Gasoline) category vehicles. Other buses are regulated under the Truck and Bus Rule. [EMFAC-LDV]
4.1. Detailed Approach – EMFAC-LDV Procedure

The Detailed Approach – EMFAC-LDV Procedure should be used when generating emission rates for any of the LDV vehicle categories listed in Table 1.

<table>
<thead>
<tr>
<th>EMFAC2011 Vehicle &amp; Technology</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>LDA – DSL</td>
<td>Passenger Cars</td>
</tr>
<tr>
<td>LDA – GAS</td>
<td>Passenger Cars</td>
</tr>
<tr>
<td>LDT1 – DSL</td>
<td>Light-Duty Trucks (0-3750 lbs)</td>
</tr>
<tr>
<td>LDT1 – GAS</td>
<td>Light-Duty Trucks (0-3750 lbs)</td>
</tr>
<tr>
<td>LDT2 – DSL</td>
<td>Light-Duty Trucks (3751-5750 lbs)</td>
</tr>
<tr>
<td>LDT2 – GAS</td>
<td>Light-Duty Trucks (3751-5750 lbs)</td>
</tr>
<tr>
<td>LHD1 – DSL</td>
<td>Light-Heavy-Duty Trucks (8501-10000 lbs)</td>
</tr>
<tr>
<td>LHD1 – GAS</td>
<td>Light-Heavy-Duty Trucks (8501-10000 lbs)</td>
</tr>
<tr>
<td>LHD2 – DSL</td>
<td>Light-Heavy-Duty Trucks (10001-14000 lbs)</td>
</tr>
<tr>
<td>LHD2 – GAS</td>
<td>Light-Heavy-Duty Trucks (10001-14000 lbs)</td>
</tr>
<tr>
<td>MCY – GAS</td>
<td>Motorcycles</td>
</tr>
<tr>
<td>MDV – DSL</td>
<td>Medium-Duty Trucks (5751-8500 lbs)</td>
</tr>
<tr>
<td>MDV – GAS</td>
<td>Medium-Duty Trucks (5751-8500 lbs)</td>
</tr>
<tr>
<td>MH – DSL</td>
<td>Motor Homes</td>
</tr>
<tr>
<td>MH – GAS</td>
<td>Motor Homes</td>
</tr>
<tr>
<td>T6TS – GAS</td>
<td>Medium-Heavy Duty Gasoline Truck</td>
</tr>
<tr>
<td>T7IS – GAS</td>
<td>Heavy-Heavy Duty Gasoline Truck</td>
</tr>
<tr>
<td>SBUS – GAS</td>
<td>School Buses</td>
</tr>
<tr>
<td>UBUS – DSL</td>
<td>Urban Buses</td>
</tr>
<tr>
<td>UBUS – GAS</td>
<td>Urban Buses</td>
</tr>
<tr>
<td>OBUS – GAS</td>
<td>Other Buses</td>
</tr>
</tbody>
</table>

The current version of the EMFAC model, future model versions, and supporting documentation can be downloaded from the CARB website at: [www.arb.ca.gov/msei/onroad/latest_version.htm](http://www.arb.ca.gov/msei/onroad/latest_version.htm). The steps to using EMFAC2011-LDV are illustrated in the figure on the following page. Additional details will be available in the EPA’s guidance, when finalized ([www.epa.gov/otaq/stateresources/transconf/policy.htm](http://www.epa.gov/otaq/stateresources/transconf/policy.htm#project)).
Figure 5: Process for Generating Emission Rates for EMFAC-LDV Vehicles (Detailed Approach)

More information and detailed step-by-step instructions for a few illustrative example projects using the Detailed Approach for EMFAC-LDV vehicles are available in Appendix A (Page 38 and Page 64).
4.2. Detailed Approach – EMFAC-HD Procedure

The Detailed Approach – EMFAC-HD Procedure should be used when generating emission rates for any of the EMFAC2011-HD vehicle categories listed in Table 2.

Table 2: EMFAC2011-HD Vehicle Categories

<table>
<thead>
<tr>
<th>EMFAC2011 Vehicle &amp; Technology</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>T6 Ag - DSL</td>
<td>Medium-Heavy Duty Diesel Agriculture Truck</td>
</tr>
<tr>
<td>T6 CAIRP heavy - DSL</td>
<td>Medium-Heavy Duty Diesel CA International Registration Plan Truck with GVWR&gt;26000 lbs</td>
</tr>
<tr>
<td>T6 CAIRP small - DSL</td>
<td>Medium-Heavy Duty Diesel CA International Registration Plan Truck with GVWR&lt;=26000 lbs</td>
</tr>
<tr>
<td>T6 instate construction heavy - DSL</td>
<td>Medium-Heavy Duty Diesel instate construction Truck with GVWR&gt;26000 lbs</td>
</tr>
<tr>
<td>T6 instate construction small - DSL</td>
<td>Medium-Heavy Duty Diesel instate construction Truck with GVWR&lt;=26000 lbs</td>
</tr>
<tr>
<td>T6 instate heavy - DSL</td>
<td>Medium-Heavy Duty Diesel instate Truck with GVWR&gt;26000 lbs</td>
</tr>
<tr>
<td>T6 instate small - DSL</td>
<td>Medium-Heavy Duty Diesel instate Truck with GVWR&lt;=26000 lbs</td>
</tr>
<tr>
<td>T6 OOS heavy - DSL</td>
<td>Medium-Heavy Duty Diesel Out-of-state Truck with GVWR&gt;26000 lbs</td>
</tr>
<tr>
<td>T6 OOS small - DSL</td>
<td>Medium-Heavy Duty Diesel Out-of-state Truck with GVWR&lt;=26000 lbs</td>
</tr>
<tr>
<td>T6 Public - DSL</td>
<td>Medium-Heavy Duty Diesel Public Fleet Truck</td>
</tr>
<tr>
<td>T6 utility - DSL</td>
<td>Medium-Heavy Duty Diesel Utility Fleet Truck</td>
</tr>
<tr>
<td>T7 Ag - DSL</td>
<td>Heavy-Heavy Duty Diesel Agriculture Truck</td>
</tr>
<tr>
<td>T7 CAIRP - DSL</td>
<td>Heavy-Heavy Duty Diesel CA International Registration Plan Truck</td>
</tr>
<tr>
<td>T7 CAIRP construction - DSL</td>
<td>Heavy-Heavy Duty Diesel CA International Registration Plan Construction Truck</td>
</tr>
<tr>
<td>T7 NNOOS - DSL</td>
<td>Heavy-Heavy Duty Diesel Non-Neighboring Out-of-state Truck</td>
</tr>
<tr>
<td>T7 NOOS - DSL</td>
<td>Heavy-Heavy Duty Diesel Neighboring Out-of-state Truck</td>
</tr>
<tr>
<td>T7 other port - DSL</td>
<td>Heavy-Heavy Duty Diesel Drayage Truck at Other Facilities</td>
</tr>
<tr>
<td>T7 POAK - DSL</td>
<td>Heavy-Heavy Duty Diesel Drayage Truck in Bay Area</td>
</tr>
<tr>
<td>T7 POLA - DSL</td>
<td>Heavy-Heavy Duty Diesel Drayage Truck near South Coast</td>
</tr>
<tr>
<td>T7 Public - DSL</td>
<td>Heavy-Heavy Duty Diesel Public Fleet Truck</td>
</tr>
<tr>
<td>T7 Single - DSL</td>
<td>Heavy-Heavy Duty Diesel Single Unit Truck</td>
</tr>
<tr>
<td>T7 single construction - DSL</td>
<td>Heavy-Heavy Duty Diesel Single Unit Construction Truck</td>
</tr>
<tr>
<td>T7 SWCV - DSL</td>
<td>Heavy-Heavy Duty Diesel Solid Waste Collection Truck</td>
</tr>
<tr>
<td>T7 tractor - DSL</td>
<td>Heavy-Heavy Duty Diesel Tractor Truck</td>
</tr>
<tr>
<td>T7 tractor construction - DSL</td>
<td>Heavy-Heavy Duty Diesel Tractor Construction Truck</td>
</tr>
<tr>
<td>T7 utility - DSL</td>
<td>Heavy-Heavy Duty Diesel Utility Fleet Truck</td>
</tr>
<tr>
<td>PTO - DSL</td>
<td>Power Take Off</td>
</tr>
<tr>
<td>SBUS - DSL</td>
<td>School Buses</td>
</tr>
<tr>
<td>Motor Coach - DSL</td>
<td>Motor Coach</td>
</tr>
<tr>
<td>All Other Buses - DSL</td>
<td>All Other Buses</td>
</tr>
</tbody>
</table>
In order to capture all the emission processes for EMFAC-HD vehicle categories, users will need to access multiple data sources (described in Table 3 below). This is because the data formats and input requirements are quite different for different processes:

- Running Exhaust Emission Rates (g/mile) change by speed, and therefore, requires speed as an input.
- PM Brake Wear and Tire Wear Emissions Rates (g/mile) are assumed to be same at all speeds (EMFAC outputs it at the “ALL Combined Speed” level).
- Idling Exhaust Emission Rates (g/hour) are based on idling time.

All the required emission rates are available on the ARB website. The specific tools used to generate emission rates for the HD vehicle categories will vary depending on the particular type of emissions selected. Table 3 provides a quick reference for data sources for each of the emission processes. Users need to follow all the procedures detailed in following sections (4.2.1-4.2.3) to estimate emission from EMFAC-HD vehicles.

Table 3: Data Sources for EMFAC-HD Vehicle Emission Rates (Detailed Approach)

<table>
<thead>
<tr>
<th>Emission Process</th>
<th>Where to Find</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Running Exhaust Emission Rates (RUNEX)</td>
<td><a href="http://www.arb.ca.gov/emfac">http://www.arb.ca.gov/emfac</a>  Download “by speed” for RUNEX</td>
<td>g/mile</td>
</tr>
<tr>
<td>Other Emission Rates[^4] [PM Brake Wear and Tire Wear (PMBW/TW)]</td>
<td><a href="http://www.arb.ca.gov/emfac">http://www.arb.ca.gov/emfac</a>  Download “Combined” Speeds for Other</td>
<td>g/mile</td>
</tr>
<tr>
<td>Idling Exhaust Emission Rates (IDLEX)</td>
<td><a href="http://www.arb.ca.gov/msei/emfac2011_idling_emission_rates.xlsx">http://www.arb.ca.gov/msei/emfac2011_idling_emission_rates.xlsx</a></td>
<td>g/hr</td>
</tr>
</tbody>
</table>

More information and detailed step-by-step instructions for a few illustrative example projects using the Detailed Approach for EMFAC-HD vehicles are available in Appendix A (Page 57 and Page 77).

4.2.1. EMFAC-HD Vehicles: Running Exhaust Emission Rates (RUNEX)

The general methodology for generating Running Exhaust Emission Rates for EMFAC-HD Vehicles using the Detailed Approach is explained in Figure 6.

Figure 6: Process for Generating RUNEX Emission Rates for EMFAC-HD Vehicles (Detailed Approach)
The emission rates are available through the EMFAC2011 web database (http://www.arb.ca.gov/emfac). Users are required to select the following options:

- Vehicle Category Scheme: EMFAC2011, EMFAC2007
- Region Type: Statewide Average, Air Basin, Air District, MPO, County, Sub-Area (GAI)
- Region
- Calendar Year
- Season
- Vehicle Type (based on vehicle category scheme selection)
- Fuel Type
- Model Year
- Speed

A screenshot of the EMFAC Web Database for Emission Rates is shown in Figure 7.

Figure 7: Graphical User Interface (GUI) of the EMFAC Web Database (Emission Rates)
4.2.2. **EMFAC-HD Vehicles: Other Emission Rates (PMBW, PMTW)**

The general methodology for generating Other Emission Rates (PM Brake Wear and PM Tire Wear) for EMFAC-HD Vehicles using the Detailed Approach is explained in Figure 8.

*Figure 8: Process for Generating Other Emission Rates for EMFAC-HD Vehicles (Detailed Approach)*
The emission rates are available through the EMFAC2011 web database (http://www.arb.ca.gov/emfac). Users are required to select the following options:

- Vehicle Category Scheme: EMFAC2011, EMFAC2007
- Region Type: Statewide Average, Air Basin, Air District, MPO, County, Sub-Area (GAI)
- Region
- Calendar Year
- Season
- Vehicle Type (based on vehicle category scheme selection)
- Fuel Type
- Model Year
- Speed (select “Combined” Speeds option)
4.2.3. EMFAC-HD Vehicles: Idling Exhaust Emission Rates (IDLEX)

The general methodology for generating Idling Exhaust Emission Rates for EMFAC-HD Vehicles using the Detailed Approach is explained in Figure 9.

Figure 9: Process for Generating IDLEX Emission Rates for EMFAC-HD Vehicles (Detailed Approach)

The emission rates are available in an Excel spreadsheet that can be downloaded from the web at http://www.arb.ca.gov/msei/emfac2011_idling_emission_rates.xlsx.

- The spreadsheet provides idling emission rates for EMFAC2011-HD vehicle categories (Diesel Vehicles classes for T6/MHDT, T7/HHDT, OBUS, and SBUS).
- Emission rates are in grams/hour
- Annual idling emission rates are a composite of winter and summer high idle.
- Emission rates are corrected for cleaner fuel, but not for retrofit requirements of the idling rule.
- HD Idling emission rates are available for two geographic areas: (1) the South Coast Air Basin and the South Central Coast (Ventura County) Air Basin; and (2) all other areas.

Specific idling emission rates can be selected by selecting select the “Filter” function from the “Data” menu and then selecting the following from the drop-down menus:

- By Calendar Year
- By Season
- By Vehicle Class
- By Fuel Type
- By Model Year
Appendix A

Project-level Analyses

Sample Scenarios
Decision Matrix

Temperature/Relative Humidity
Are project specific ambient temperature and relative humidity profiles available, and different from EMFAC defaults?

Vehicle Age Distributions
Are population and/or activity data available at the vehicle model year level?

Rest/Soak Time
Are vehicle rest/soak time data available for the project?

Use Simplified Approach (EMFAC2011 PL)

Use Detailed Approach

Simplified Approach

Open EMFAC2011 Project level Tool

Select Database type
EMFAC2011, EMFAC2007, CYEMFAC, or Total

Select Region type

Select Region

Select Calendar Year

Select Season

Uncheck the Vehicle Category checkbox (defaults to the "ALL" option)

Yes

Does the project contain multiple vehicle categories?

No

Check the Vehicle Category checkbox, and select the desired vehicle

Uncheck the Fuel Category checkbox (defaults to the "ALL" option)

Yes

Does the project activity data vary by fuel type?

No

Check the Fuel checkbox, and select the desired fuel ["TDT" for GAS+DSL]

Uncheck the Speed checkbox (defaults to the "ALL" option)

Yes

Are the activity data distributed over multiple speed bins?

No

Check the Speed checkbox and select the desired speed bin

Output Emission Factor Lookup Table
Detailed Approach

EMFAC-LDV Categories
Divide Project data by Vehicle categories
EMFAC-HD Categories

Follow EMFAC LDV Procedure
Follow EMFAC HD Procedure

Detailed Approach - LDV

Divide the project into site

- Determine the number of EMFAC runs

Specify Basic Scenario Input

- Select geographic area
- Select category

- Modify vehicle classes

- Use annual average

Build EMFAC scenario for each condition

- Don’t float activity
- Don’t project

- Don’t make idle

- Create output factors

- Process output factors

Appendix A, Page 2
Detailed Approach – HD
[Processes: RUNEX]

1. Go to EMFAC2011 Web Database
2. Select Database type (EMFAC2011 or EMFAC2007)
3. Select Region type
4. Select Region
5. Select Calendar Year
6. Select Season

- Uncheck the ‘Vehicle Category’ checkbox (defaults to “ALL” option)
  - Yes: Does the project contain multiple vehicle categories?
  - No: Check the ‘Vehicle Category’ checkbox, and select the desired vehicle

- Check the ‘Model Year’ checkbox and select the desired Model Year (or select “ALL” option for multiple Model Years)
  - Yes: Is activity data available at the Model Year level?
  - No: Uncheck the ‘Model Year’ checkbox (defaults to “Combined” option)

- Check the ‘Speed’ checkbox and select the “ALL” option (for multiple speed outputs)
  - Yes: Are the activity data distributed over multiple speed bins?
  - No: Check the ‘Speed’ checkbox and select the desired speed bin

Click ‘Download’ button and save the Emission Rate file
Output Emission Factor Lookup Table

Detailed Approach – HD
[Processes: PMBW, PMTW]

1. Go to EMFAC2011 Web Database
2. Select Database type (EMFAC2011 or EMFAC2007)
3. Select Region type
4. Select Region
5. Select Calendar Year
6. Select Season

- Uncheck the ‘Vehicle Category’ checkbox (defaults to “ALL” option)
  - Yes: Does the project contain multiple vehicle categories?
  - No: Check the ‘Vehicle Category’ checkbox, and select the desired vehicle

- Check the ‘Model Year’ checkbox and select the desired Model Year (or select “ALL” option for multiple Model Years)
  - Yes: Is activity data available at the Model Year level?
  - No: Uncheck the ‘Model Year’ checkbox (defaults to “Combined” option)

- Uncheck the ‘Speed’ checkbox (defaults to “Combined” option)

Click ‘Download’ button and save the Emission Rate file
Output Emission Factor Lookup Table
Detailed Approach – HD
[Processes: IDLEX]

Open ARB's Mobile Source Emissions Inventory webpage
(http://www.arb.ca.gov/msei/modeling.htm)

Right click on the "EMFAC2011 Idling Emission Rates" file and select the
'Save As' option

Output Emission Factor Lookup Table

Browse to the appropriate region

Filter the Excel data table, and
select the appropriate Calendar
year and Vehicle

SAMPLE SCENARIOS
Project Details

• The project is a lane expansion of the existing highway and the addition of an interchange (on/off ramps) to access two park-and-ride lots and bus terminals
• Location: Sacramento, CA*
• The project is expected to be completed in 2019
  – Year of expected peak emissions (analysis year): 2020
• Area is in nonattainment of the annual PM2.5 NAAQS and the 2006 24-hour PM2.5 NAAQS
• Default EMFAC age distribution used
• Default EMFAC Sacramento county fleet mix used for arterials
  – Project-specific fleet mix available for highway LD vs. HD split
• Detailed bus roster (bus type and age distribution) provided by transit agency

*An additional sample scenario for LA County is also shown

Scenarios

• Seven sample scenarios to cover a variety of project combinations are shown (based on variations in fleet mix):
  – One scenario for an arterial link - default fleet mix
  – One scenario for a freeway link - non-truck vehicles
  – One scenario for transit bus-only running links
  – One scenario for highway link with project-specific fleet mix
  – One scenario for bus-only transit terminal - Idle
  – One scenario for starts (light duty passenger cars and trucks only – default EMFAC mix)
  – One sample scenario where the fleet consists of light duty passenger cars (from EMFAC-LDV) and heavy duty trucks (from EMFAC-HD)
SCENARIO #1: Arterial link Default Fleet

- One scenario for an arterial link with default fleet mix (vehicle and fuel/technology distributions are default)

- Provide the emission rates for the project’s arterials.
- Vehicles: All vehicle categories combined
- Fuel: All fuels with default technology distribution
- Speed: 30 MPH

Protocol

- Temperature/Relative Humidity: Are project specific ambient temperature and relative humidity profiles available, and different from EMFAC defaults?
  - Yes: Use Detailed Approach
  - No: Vehicle Age Distributions: Are population and/or activity data available at the vehicle model year level?
    - Yes: Temperature/Relative Humidity
    - No: Rest/Soak Time: Are vehicle rest/soak time data available for the project?
      - Yes: Use Detailed Approach
      - No: Use Simplified Approach (EMFAC2011 PL)
Select Season

Select Vehicle Category

Appendix A, Page 9
EMFAC2011-PL (Ver 1.1)
Project-level Emission Rates Database

Vehicle Category Scheme:
- EMFAC2011 Vehicle Categories
- EMFAC2007 Vehicle Categories
- Trucks / Non-Trucks Categories
- Trucks 1 / Trucks 2 / Non-Trucks Categories
- Total (Fleet average)

Region type:
- State
- Air Basin
- Air District
- MPO
- County
- GA

Region: Sacramento
CalYr: 2020
Season: Annual

Select Fuel Type

Select Speed Bin
Process Completion Message
Output

ER: Running Exhaust (RUNEX)
ER: Starting Exhaust (STREX)

ER: Idling Exhaust (IDLEX)
ER: Evaporative Emissions (EVAP)

ER: PM Brake + Tire Wear (PMBWTW)
SCENARIO #2 – Highway link with Non-truck Fleet

- One scenario for a highway link with non-truck vehicles only (default fleet mix)

- Provide the emission rates for the project fleet
- Vehicles: Non-truck vehicle categories only
- Fuel: All fuels with default technology distribution
- Speed: 65 MPH
Protocol

Temperature/Relative Humidity
Are project specific ambient temperature and relative humidity profiles available, and different from EMFAC defaults?

No

Vehicle Age Distributions
Are population and/or activity data available at the vehicle model year level?

No

Rest/Soak Time
Are vehicle rest/soak time data available for the project?

Yes

Use Detailed Approach

No

Use Simplified Approach (EMFAC2011 PL)

Select Vehicle Category Scheme

Vehicle Category Scheme:

EMFAC2011-PL (Ver 1.1)
Project-level Emission Rates Database

EMFAC2011 Vehicle Categories  EMFAC2007 Vehicle Categories

Trucks / Non-Trucks Categories  Trucks 1 / Trucks 2 / Non-Trucks Categories

Total (Fleet average)

State  Air Basin  Air District  MPO  County  GAI

Region

Season

Vehicle Category  Fuel Type  Speed
Select Calendar year

Select Season
EMFAC2011-PL (Ver 1.1)
Project-level Emission Rates Database

Vehicle Category Scheme:
- EMFAC2011 Vehicle Categories
- EMFAC2007 Vehicle Categories
- Trucks / Non-Trucks Categories
- Trucks 1 / Trucks 2 / Non-Trucks Categories
- Total (Fleet average)

Region type:
- State
- Air Basin
- Air District
- MPO
- County
- GAI

Region: Sacramento
CalYr: 2020
Season: Annual

Vehicle Category: Non-Trucks
Fuel Type: TOT
Speed: 65 MPH

Select Speed Bin
Click “Download”
Process Completion Message

Microsoft Access

Emission Rate outputs have been saved to the <C:\EMFAC2011-PI (Ver 1.1)> folder

OK

ER: Running Exhaust (RUNEX)

Appendix A, Page 21
ER: Starting Exhaust (STREX)

ER: Idling Exhaust (IDLEX)
ER: Evaporative Emissions (EVAP)

ER: PM Brake + Tire Wear (PMBWTW)
SCENARIO #3 – Transit Bus-only Running Links

• One scenario for transit bus-only running links (default fleet mix)

• Provide the emission rates for the project’s arterials.
• Vehicles: UBUS-DSL only
• Speed: 65 MPH

Protocol

Temperature/Relative Humidity
Are project specific ambient temperature and relative humidity profiles available, and different from EMFAC defaults?
Yes
No

Vehicle Age Distributions
Are population and/or activity data available at the vehicle model year level?
Yes
No

Rest/Soak Time
Are vehicle rest/soak time data available for the project?
Yes
No

Use Simplified Approach (EMFAC2011 PL)

No

Use Detailed Approach

Appendix A, Page 24
Select Vehicle Category Scheme

Select Region Type
Select Region, Calendar year, and Season

Select Vehicle Category
EMFAC2011-PL (Ver 1.1)
Project-level Emission Rates Database

Vehicle Category Scheme:
- EMFAC2011 Vehicle Categories
- EMFAC2007 Vehicle Categories
- Trucks / Non-Trucks Categories
- Trucks 1 / Trucks 2 / Non-Trucks Categories
- Total (Fleet average)

Region type:
- State
- Air Basin
- Air District
- MPO
- County
- GAI

Region: Sacramento
CalYr: 2020
Season: Annual

Vehicle Category: UBUS
Fuel Type: OSL
Speed: ALL

Select Fuel Type

Select Speed Bin
Click ‘Download’

Process Completion Message
ER: Running Exhaust (RUNEX)

DSL vehicles do not generate separate starting emissions. Therefore, STREX emission rates for UBUS-DSL vehicles are zero.

ER: Starting Exhaust (STREX)
ER: Idling Exhaust (IDLEX)

<table>
<thead>
<tr>
<th>Engine Type</th>
<th>Regime</th>
<th>Mode</th>
<th>Idle</th>
<th>Revs</th>
<th>Idle Revs</th>
<th>Emissions</th>
</tr>
</thead>
<tbody>
<tr>
<td>DSL</td>
<td>ID</td>
<td>1000</td>
<td>1500</td>
<td>2000</td>
<td>2500</td>
<td>0</td>
</tr>
</tbody>
</table>

DSL vehicles do not generate evaporative emissions. Therefore, EVAP emission rates for UBUS-DSL vehicles are zero.
SCENARIO #4: Highway link with Project-specific Fleet Mix

- One scenario for a highway link with project-specific fleet mix

- Generate emissions rates for a highway link based on the expected vehicle mix from the traffic data.
  - Speed = 65 MPH
  - Fuel: All fuels with default technology distribution
  - Calculate Emission Factors so that population and VMT are 80% light duty and 20% heavy duty.
Protocol

Temperature/Relative Humidity
Are project specific ambient temperature and relative humidity profiles available, and different from EMFAC defaults?

Vehicle Age Distributions
Are population and/or activity data available at the vehicle model year level?

Rest/Soak Time
Are vehicle rest/soak time data available for the project?

Use Simplified Approach (EMFAC2011 PL)

Use Detailed Approach

Select Vehicle Category Scheme

EMFAC2011-PL (Ver 1.1)
Project-level Emission Rates Database

- EMFAC2011 Vehicle Categories
- EMFAC2007 Vehicle Categories
- Trucks / Non-Trucks Categories
- Trucks 1 / Trucks 2 / Non-Trucks Categories
- Total (Fleet average)

Vehicle Category Scheme:

Appendix A, Page 32
Select Region Type

Select Region, Calendar year, and Season
<table>
<thead>
<tr>
<th>Region Sacramen to</th>
<th>CalYr 2020</th>
<th>Season Annual</th>
<th>Vehicle Category</th>
<th>Fuel Type</th>
<th>Speed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Download</td>
<td>Exit</td>
<td>Select Vehicle Category</td>
<td>Select Fuel Type</td>
<td>Appendix A, Page 34</td>
<td></td>
</tr>
</tbody>
</table>
Select Speed Bin

Click ‘Download’
**Process Completion Message**

Emission Rate outputs have been saved to the `<C:\EMFAC2011 -PL r,l lerl l )>` folder.

**ER: RUNEX - Default Output**

| Region, Type | Region | PMT | GEF | RC | SF | PMT | SF | SF2 | SF4 | SF6 | SF8 | SF10 | SF12 | SF14 | SF16 | SF18 | SF20 | SF22 | SF24 | SF26 | SF28 | SF30 | SF32 | SF34 | SF36 | SF38 | SF40 | SF42 | SF44 | SF46 | SF48 | SF50 | SF52 | SF54 | SF56 | SF58 | SF60 | SF62 | SF64 | SF66 | SF68 | SF70 | SF72 | SF74 | SF76 | SF78 | SF80 | SF82 | SF84 | SF86 | SF88 | SF90 | SF92 | SF94 | SF96 | SF98 | SF100 | SF102 | SF104 | SF106 | SF108 | SF110 | SF112 | SF114 | SF116 | SF118 | SF120 | SF122 | SF124 | SF126 | SF128 | SF130 | SF132 | SF134 | SF136 | SF138 | SF140 | SF142 | SF144 | SF146 | SF148 | SF150 | SF152 | SF154 | SF156 | SF158 | SF160 | SF162 | SF164 | SF166 | SF168 | SF170 | SF172 | SF174 | SF176 | SF178 | SF180 | SF182 | SF184 | SF186 | SF188 | SF190 | SF192 | SF194 | SF196 | SF198 | SF200 | SF202 | SF204 | SF206 | SF208 | SF210 | SF212 | SF214 | SF216 | SF218 | SF220 | SF222 | SF224 | SF226 | SF228 | SF230 | SF232 | SF234 | SF236 | SF238 | SF240 | SF242 | SF244 | SF246 | SF248 | SF250 | SF252 | SF254 | SF256 | SF258 | SF260 | SF262 | SF264 | SF266 | SF268 | SF270 | SF272 | SF274 | SF276 | SF278 | SF280 | SF282 | SF284 | SF286 | SF288 | SF290 | SF292 | SF294 | SF296 | SF298 | SF300 | SF302 | SF304 | SF306 | SF308 | SF310 | SF312 | SF314 | SF316 | SF318 | SF320 | SF322 | SF324 | SF326 | SF328 | SF330 | SF332 | SF334 | SF336 | SF338 | SF340 | SF342 | SF344 | SF346 | SF348 | SF350 | SF352 | SF354 | SF356 | SF358 | SF360 | SF362 | SF364 | SF366 | SF368 | SF370 | SF372 | SF374 | SF376 | SF378 | SF380 | SF382 | SF384 | SF386 | SF388 | SF390 | SF392 | SF394 | SF396 | SF398 | SF400 | SF402 | SF404 | SF406 | SF408 | SF410 | SF412 | SF414 | SF416 | SF418 | SF420 | SF422 | SF424 | SF426 | SF428 | SF430 | SF432 | SF434 | SF436 | SF438 | SF440 | SF442 | SF444 | SF446 | SF448 | SF450 | SF452 | SF454 | SF456 | SF458 | SF460 | SF462 | SF464 | SF466 | SF468 | SF470 | SF472 | SF474 | SF476 | SF478 | SF480 | SF482 | SF484 | SF486 | SF488 | SF490 | SF492 | SF494 | SF496 | SF498 | SF500 | SF502 | SF504 | SF506 | SF508 | SF510 | SF512 | SF514 | SF516 | SF518 | SF520 | SF522 | SF524 | SF526 | SF528 | SF530 | SF532 | SF534 | SF536 | SF538 | SF540 | SF542 | SF544 | SF546 | SF548 | SF550 | SF552 | SF554 | SF556 | SF558 | SF560 | SF562 | SF564 | SF566 | SF568 | SF570 | SF572 | SF574 | SF576 | SF578 | SF580 | SF582 | SF584 | SF586 | SF588 | SF590 | SF592 | SF594 | SF596 | SF598 | SF600 | SF602 | SF604 | SF606 | SF608 | SF610 | SF612 | SF614 | SF616 | SF618 | SF620 | SF622 | SF624 | SF626 | SF628 | SF630 | SF632 | SF634 | SF636 | SF638 | SF640 | SF642 | SF644 | SF646 | SF648 | SF650 | SF652 | SF654 | SF656 | SF658 | SF660 | SF662 | SF664 | SF666 | SF668 | SF670 | SF672 | SF674 | SF676 | SF678 | SF680 | SF682 | SF684 | SF686 | SF688 | SF690 | SF692 | SF694 | SF696 | SF698 | SF700 | SF702 | SF704 | SF706 | SF708 | SF710 | SF712 | SF714 | SF716 | SF718 | SF720 | SF722 | SF724 | SF726 | SF728 | SF730 | SF732 | SF734 | SF736 | SF738 | SF740 | SF742 | SF744 | SF746 | SF748 | SF750 | SF752 | SF754 | SF756 | SF758 | SF760 | SF762 | SF764 | SF766 | SF768 | SF770 | SF772 | SF774 | SF776 | SF778 | SF780 | SF782 | SF784 | SF786 | SF788 | SF790 | SF792 | SF794 | SF796 | SF798 | SF800 | SF802 | SF804 | SF806 | SF808 | SF810 | SF812 | SF814 | SF816 | SF818 | SF820 | SF822 | SF824 | SF826 | SF828 | SF830 | SF832 | SF834 | SF836 | SF838 | SF840 | SF842 | SF844 | SF846 | SF848 | SF850 | SF852 | SF854 | SF856 | SF858 | SF860 | SF862 | SF864 | SF866 | SF868 | SF870 | SF872 | SF874 | SF876 | SF878 | SF880 | SF882 | SF884 | SF886 | SF888 | SF890 | SF892 | SF894 | SF896 | SF898 | SF900 | SF902 | SF904 | SF906 | SF908 | SF910 | SF912 | SF914 | SF916 | SF918 | SF920 | SF922 | SF924 | SF926 | SF928 | SF930 | SF932 | SF934 | SF936 | SF938 | SF940 | SF942 | SF944 | SF946 | SF948 | SF950 | SF952 | SF954 | SF956 | SF958 | SF960 | SF962 | SF964 | SF966 | SF968 | SF970 | SF972 | SF974 | SF976 | SF978 | SF980 | SF982 | SF984 | SF986 | SF988 | SF990 | SF992 | SF994 | SF996 | SF998 | SF1000 |
Identify Desired Fractions for Trucks/Non-Trucks

Calculate ER Components using Desired Fraction

For example: \( \text{PM10_RUNEX ER Component}_{\text{Truck}} = 20\% \times 0.040 = 0.0080 \)
Calculate Resulting Emission Rate
*(Repeat procedure for STREX, IDLEX, EVAP, & PMBWTW)*

\[ ER_{Total} = ER_{Non-Truck} + ER_{Truck} \]

For example: \( PM10_{RUNEX} \ E_{Total} = 0.0017 + 0.0080 = 0.0097 \)

---

**Scenario #5A Urban Bus Idle**

- One scenario for bus-only transit terminal
  - Urban Buses

- To produce idles rates for the Urban Buses at the transit terminal.
- UBUS Idle Emission rates are generated by EMFAC-LDV
- Edit the population so that all population is “Urban Bus (UBUS)”
- Fuel is diesel and age changed to reflect the actual ages of the bus fleet
Protocol

Temperature/Relative Humidity
Are project specific ambient temperature and relative humidity profiles available, and different from EMFAC defaults?

No

Vehicle Age Distributions
Are population and/or activity data available at the vehicle model year level?

No

Rest/Soak Time
Are vehicle rest/soak time data available for the project?

Yes

Use Simplified Approach (EMFAC2011 PL)

No

Yes

Use Detailed Approach

Detailed Approach

EMFAC-LDV Categories
Divide Project data by Vehicle categories

EMFAC-HD Categories

Follow EMFAC LDV Procedure

Follow EMFAC HD Procedure
Open EMFAC2011-LDV

Add New Scenario
Inputs

- Step 1 - Select “County”, “Sacramento”
- Step 2 - Select “2020”
- Step 3 - Select “Annual”
- Click “Next”
Input 2 Tab

- Step 4 – Select a Scenario Title name
- Then Click “Next”
- Select “Emfac – Area fleet average emissions”
- Click on “Summary Rates (RTS)” and Output Particulate as “PM2.5”; “Detailed Impact Rates (RTL)” will already be selected
Edit Program Constants

- Select “Temperature”
- Delete all temperatures except 70
- Select “Relative Humidities”
- Delete all except 70
- Click “Finish”
Scenario Type: EMFAC - Area-specific fleet average emissions (g/hr) for selected temperatures, relative humidities, speeds

Configure EMFAC Output:
- Temperatures
- Relative Humidities
- Speeds

Cancel

Edit Program
Constants

California Scenario, speeds, configuration

Delete temperature 1
Delete temperature 2
Delete temperature 3
Delete temperature 4
Delete temperature 5
Delete temperature 6
Delete temperature 7
Delete temperature 8
Delete temperature 9
Delete temperature 10
Delete temperature 11
Delete temperature 12

Enter data for temperature
Click button to enable new value.

PM2.5
Appendix A, Page 45
Select/Edit temperature for Emfac calculation.

Enter data for temperature. Click button to enable new value.

Configure Temperatures, Relative Humidities, Speeds.

Emfac Rate Files:
- Binary Impacts (BIN)
- ASCII Impacts (ERP)
- Summary Rates (RTS)
- Detailed Impact Rates (RTL)

Emfac - Detailed Vehicle data
Scenario Type: EMFAC -- Area-specific fleet average emissions (g/hr) for selected temperatures, relative humidities, speeds.
Click Edit Program Constants.

Click Next.
Select the VMT/Trips tab, then click VMT.

Select By Vehicle and Fuel tab, highlight data, then click Copy with Headings.
Paste the copied default VMT data in an Excel spreadsheet, then calculate the Adjusted Fleet Mix by entering the project-specific VMT.

Highlight data, click Paste Data Only, click Apply, then click Done.
Select Pop/Accrual tab, then click Population.

Change Urban bus population so all buses are diesel.
Enter 735 under diesel and 1 under gas (EMFAC does not allowing editing to 0). Click apply then the By Vehicle Fuel/Age tab.

Click Diesel, highlight all cells, then select Copy with Headings.
Revised age distribution for Urban Buses using bus roster data in the Excel worksheet.

Copy adjusted data from Excel worksheet to EMFAC.
Paste adjusted data, click Apply, then click Done.

Click Finish.
Save file and click Run.
Open rts file in Notepad.

Since UBUS emission rates for Speed 0 MPH [idling] are 0, the 5 MPH Running Emission Rate (g/mile) is converted to Idling Emission Rate (g/hr)

Select the UBUS running emissions for PM2.5 at 5 MPH
- Multiply the 5 MPH Emission rate (g/mile) by 5 (mile/hr) to calculate the Idling Emission rate (g/hr)
Scenario #5B Other Bus - DSL Idle

- One scenario for bus-only transit terminal
  – Other Buses - DSL

- To produce idles rates for the Other Buses at the transit terminal.
- OBUS - DSL Idle Emission rates are generated by EMFAC-HD
- Fuel is diesel and age changed to reflect the actual ages of the bus fleet

Protocol

Temperature/Relative Humidity
Are project specific ambient temperature and relative humidity profiles available, and different from EMFAC defaults?

Vehicle Age Distributions
Are population and/or activity data available at the vehicle model year level?

Rest/Soak Time
Are vehicle rest/soak time data available for the project?

Use Simplified Approach (EMFAC2011 PL)

Yes

Use Detailed Approach

Appendix A, Page 57
Detailed Approach

Follow EMFAC-HO Procedure

Extract Emission Rate data for EMFAC-HO categories from EMFAC2011 Web Database

Procedure

- From the ARB website, select the “Air Quality” tab,
- Then select “Emissions Inventories”
- Then select “Mobile”
- Then select “On-Road Motor Vehicles”
- Then select “EMFAC 2011 Idling Emission Rates”
California Environmental Protection Agency
Air Resources Board

Overview
Portal web pages for Air Quality & Emissions

Air Quality Monitoring Network
Monitoring activities and sites, Quality Assurance activities, etc.

Emissions Inventories
Criteria pollutants, greenhouse gas emissions, and toxics

Modeling Software
Collection of modeling software and associated documentation

Carpool Stickers

Carpooling activities and sites, Quality Assurance activities, etc.

http://www.arb.ca.gov/html/ds.htm

ARB's Emission Inventory
This page was reviewed September 16, 2011.

An Emission Inventory is an estimation of air pollution that helps us answer the following questions:
Where can I find a table of emissions data?
How are emissions estimated?
What pollutants are emitted?
What is the pollution in my neighborhood?
What resources are available?
What about toxics?
What about climate change (Greenhouse Gas Emissions)?

Appendix A, Page 59
Background

The mobile source emissions inventory is ARB’s tool for assessing the population, activity, and emissions from mobile sources. These inventories are constantly being revised and updated to support the latest air quality plans and regulations. Periodically these inventories are compiled and released to the public for use in transportation and air quality assessments both internal and external to the agency. Mobile source inventories are developed by the Mobile Source Analysis Branch in the Planning and Technical Support Division. In these web pages you will find different ways of accessing current information. Data can be accessed for specific regulatory items by mobile source category or through the methods and in some cases models that are used to estimate emissions.

Mobile Source Categories

Individual category-specific emissions estimates and documentation are developed for specific agency regulatory activities. Categories include on-road motor vehicles, heavy-duty trucks, and off-road mobile equipment. These estimates are used to support the various regulatory programs, and the categories include estimates for ocean-going vessels, pleasure craft, and many other types of vehicles.

Select EMFAC 2011 Idling Emission Rates
Using the Idling Emission Rates

• Click on the “Idle_ER.Other_Area” Tab
• From the “Data” menu, select the “Filter” function
• Select the following from the drop-down menus:
  – Select “2020” for Calendar Year
  – Identify the Vehicle Class that corresponds to OBUS from the ‘HD_Vehicle_Category’ table (T6)
  – Select “T6” for Vehicle Class
  – Select “D” Diesel for Fuel Type
  – Select all years from 1995-2015 for Model Year
  – Select “a” (Annual) for Season
To improve the module running speed and to save space, the EMFAC2011-HD module calculates idling emission rates but does not store them. This file provides idling emission rates for vehicle categories included in the EMFAC2011-HD module (for both the combined model year and by model year), and the emission rates for auxiliary power system installed on trucks.

This file also provides the methodology to calculate idling emissions rates for vehicle categories included in the EMFAC2011-LDV.

### Idling Emission Rates for EMFAC2011-HD Vehicle Categories

Emission rates are in grams per hour for vehicle categories in EMFAC2011-HD. The annual idling emission rates are composite of winter and summer high idle; and the emission rates have been corrected for cleaner fuel and retrofit requirements, but not for the idling rule.

### Idling Emission Rates by Model Year for EMFAC2011-HD Vehicle Categories

*HD idling emission rates by model year for South Coast Air Basin and Ventura County*

*Idling emission rates by model year for all other areas*
<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
<th>F</th>
<th>G</th>
<th>H</th>
<th>I</th>
<th>J</th>
<th>K</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Vehicle_Type</td>
<td>Year</td>
<td>Model</td>
<td>Year Range</td>
<td>HC (g/hr-vkm)</td>
<td>CO (g/hr-vkm)</td>
<td>NOx (g/hr-vkm)</td>
<td>PM10 (g/hr-vkm)</td>
<td>PM2.5 (g/hr-vkm)</td>
<td>PM10 (g/hr-vkm)</td>
</tr>
</tbody>
</table>
### Scenario #6: Parking Lot Fleet Mix

- One scenario for starts (light duty passenger cars and trucks only – default EMFAC mix)

- This is to produce the aggregate start rates for light duty vehicles in the park-n-ride lot.

- Population edited to be only light duty vehicles.

- Generates emission rates for soak at 5, 360 and 720 minutes
Protocol

- Temperature/Relative Humidity
  - Are project-specific ambient temperature and relative humidity profiles available, and different from EMFAC defaults?
    - Yes
    - No
  - Vehicle Age Distributions
    - Are population and/or activity data available at the vehicle model year level?
      - Yes
      - No
    - Rest/Soak Time
      - Are vehicle rest/soak time data available for the project?
        - Yes
        - No

- Use Simplified Approach (EMFAC2011 PL)

Detailed Approach

- Divide Project data by Vehicle categories
- EMPAC-LDV Categories
- EMPAC-HD Categories
- Follow EMPAC-LDV Procedure
- Follow EMPAC-HD Procedure
  - Extract Emission Rate data for EMPAC-HD categories from EMPAC2011 Web Database
Open EMFAC2011-LDV

Add New Scenario
Inputs

- Step 1 - Select “County”, “Sacramento”
- Step 2 - Select “2020”
- Step 3 - Select “Annual”
- Click “Next”
Input 2 Tab

- Step 4 – Select a Scenario Title name
- Then Click “Next”
- Select “Emfac – Area fleet average emissions”
- Click on “Summary Rates (RTS)” and Output Particulate as “PM2.5”; “Detailed Impact Rates (RTL)” will already be selected
Basic scenario data
- Select or Enter Scenario Title

Step 4 - Scenario Title for Reports
Parking Lot Fleet Mix

Step 5 - Model Years
All model years selected

Step 6 - Vehicle Classes
All vehicle classes selected

Step 7 - L/M Program Schedule
Standard L/M schedule

Scenario Type: EMFAC - Area-specific fleet average emissions (g/hr) for selected temperatures, relative humidities, speeds

Configure EMFAC Outputs
- Temperature
- Relative Humidity
- Speed

Enter - Area fleet average emissions

Selected Rate Files:
- Binary Impact (BIN)
- ASCII Impact (ERP)
- Summary Rates (RTS)
- Detailed Impact Rates (RTL)

Appendix A, Page 69
Edit Program Constants

- Select “Temperature”
- Delete all temperatures except 70
- Select “Relative Humidities”
- Delete all except 70
- Click “Finish”
Scenario Type: EMFAC - Area-specific fleet average emissions (g/hr) for selected temperatures, relative humidities, speeds

Configure EMFAC Output:
- Temperatures
- Relative Humidities
- Speeds

Options:
- Cancel
- Edit Program
- Constants
- California
- Scenario:
  - Temperature
  - Relative Humidity
  - Speed
- Delete temperature
- Enter temperature

Appendix A, Page 71
Select/Edit temperature for Emfac calculations.
Enter data for temperature. Click button to enable new value.

Temperature 1
Temperature 2
Temperature 3
Temperature 4
Temperature 5
Temperature 6
Temperature 7
Temperature 8
Temperature 9
Temperature 10
Temperature 11
Temperature 12
Temperature 13
Temperature 14
Temperature 15
Temperature 16
Temperature 17
Temperature 18
Temperature 19
Temperature 20
Temperature 21
Temperature 22
Temperature 23
Temperature 24

Scenario Type: EMFAC -- Area-specific fleet average emissions (g/hr) for selected temperatures, relative humidities, speeds.

Configure EMFAC Outputs
- Temperatures
- Relative Humidities
- Speeds

Emfac Rate Files:
- Binary Impacts (BIN)
- ASCII Impacts (ERP)
- Summary Rates (RTS)
- Detailed Impact Rates (RTL)

Appendix A, Page 72
Save Scenario Inputs

- Click “Save As”
- Give the file a name
- Click “Run”
- After the run is completed, open the ‘.rts’ file in Microsoft Notepad
- Select the values for “All” for “5”, “360”, and “720” minutes
**Model Outputs**

**Scenario #7: LDV + HD Vehicles**

- Pollutant of interest: PM2.5
- Region: Los Angeles County
- Calendar Year: 2020
- Season: Annual
- Vehicle Class: LDA + HHDT (DSL) only
- Model Year: 2020 only
- Speed: 60 MPH
- Soak time: 360 minutes
- Idle time: 60 minutes
Protocol

- **Temperature/Relative Humidity**
  - Are project-specific ambient temperature and relative humidity profiles available, and different from EMFAC defaults?
  - **Yes**
    - **Use Detailed Approach**
  - **No**
    - **Vehicle Age Distributions**
      - Are population and/or activity data available at the vehicle model year level?
      - **Yes**
        - **Use Detailed Approach**
      - **No**
        - **Rest/Soak Time**
          - Are vehicle rest/soak time data available for the project?
          - **Yes**
            - **Use Detailed Approach**
          - **No**
            - **Use Simplified Approach (EMFAC2011 PL)**

Approach Summary

- **Step 1:** Run EMFAC LDV for LDA Only
- **Step 2:** Use EMFAC Web Database for T7-DSL
  - Download “by Speed” output for RUNEX
  - Download “Combined Speed” output for Other
  - Download “Idle Emission Rate Inventory” for IDLEX
**Step 1: LDV Procedure**

![Flowchart](chart.png)

**Select Region type and Region**

![Region Selection](region_selection.png)
Select Calendar Year and Season

Select Model Years
Select Vehicle Type

Select Temperature & Relative Humidity
Since LDA emission rates for Speed 0 MPH [idling] are 0, the 5 MPH Running Emission Rate (g/mile) is converted to Idling Emission Rate (g/hr).

Multiply the 5 MPH Emission rate (g/mile) by speed (5 miles/hr) to calculate Idling ER (g/hr).

Idling Emission Rate = 0.010 (g/mile) X 5 (mile/hr) = 0.050 g/hr
**LDA Output:**

**PM Brake Wear + Tire Wear**

![LDA Output: PM Brake Wear + Tire Wear](image)

**LDA Output:**

**STREX (Starting Emission Rate)**

![LDA Output: STREX (Starting Emission Rate)](image)
Step 2: HD Procedure

EMFAC-LDV Categories

Divide Project data by Vehicle categories

EMFAC-HD Categories

Follow EMFAC LDV Procedure

Follow EMFAC HD Procedure

Step 2A: Download RUNEX Emission Rate (by Speed)
### EMFAC Emissions Database

**Data Type:** Emissions, Emission Rates

**Region:**
- 2020

**Calendar Year:**
- Los Angeles (SC)

**Season:** Annual

**Vehicle Category:** EMFAC2007 Categories

**Model Year:**
- 2007

**Speed:** All Speeds

**Fuel:** DSL

**Download Data**
ER Output: Other Processes (PMBW and PMTW)

Step 2C: Download IDLEX ER
ER Output: IDLEX ER

End