

APPENDIX 8
Spatial Emission Estimator
(SEE)



Documentation for the Spatial Emissions Estimator (SEE) Model

Prepared for:

Houston-Galveston Area Council

Prepared by:

Eastern Research Group, Inc.

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SEE Documentation

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1.0 Overview

In 2014, Eastern Research Group, Inc. (ERG) and Cambridge Systematics, Inc. developed a modeling framework called the Spatial Emissions Estimator (SEE) for estimating regional on-road emission inventories of criteria, toxic and GHG emissions for each hour of a day with highly detailed spatial resolution, including emission “hot-spots” not on the traditional travel network, such as truck stops and port terminals. This framework employed MOVES2010b at both the project and county scale to cover all needed emission processes in accordance with EPA modeling guidance¹. Among the novel features of SEE were a) the application of MOVES project scale to develop a regional emissions inventory, which introduced the possibility of including road grade impacts at an area-wide level; and b) allocation of off-network emissions to Transportation Analysis Zones (TAZs) based on travel demand model origin/destination matrices and spatial analysis of truck extended idle locations. For future implementation, this framework could also be extended to include heavy-duty emission “hot spots” not already accounted for in the travel model network, such as port terminals and distribution centers. SEE also incorporated an updated version of a link processing script (TRANSVMT) developed by the Texas Transportation Institute (TTI). The updated TRANSVMT includes the option of a new speed post-processing model which provides a broader range of average network speeds, to allow a more accurate assessment of speed distribution and related emissions across the Houston-Galveston-Brazoria area. Under follow-on contract with the Houston-Galveston Area Council (H-GAC), ERG upgraded SEE to include a new graphical user interface (GUI) and fully integrate with MOVES2014a.

In 2017, SEE was substantially restructured in an effort to decrease runtime and disk space requirements, as well as to make SEE's results consistent with an established emissions inventory for the Houston-Galveston-Brazoria area. Major changes implemented in this updated version of SEE include:

- on-net emissions calculated using a County Scale Rate Mode MOVES run instead of a Project Scale Inventory Mode run
- off-net emissions calculated using the same County Scale Rate Mode MOVES run as used for on-net emissions instead of a separate County Scale Inventory Mode run

¹ U.S. EPA, Using MOVES to Prepare Emission Inventories in State Implementation Plans and Transportation Conformity: Technical Guidance for MOVES2010, 2010a and 2010b, Report No. EPA-420-B-012-028, 2012.

- use activity data – vehicle miles traveled (VMT) and source hours parked (SHP) – from a County Scale Inventory Mode MOVES run to convert off-network evaporative emission rate per vehicle outputs from MOVES into rate per activity, i.e., rate per SHP
- direct calculation of emissions for all links instead of using representative (distinct) links
- use of link average speeds with a precision of three decimal places instead of rounding to the nearest 1 or 5 mph
- use of an hourly fleet mix instead of a daily fleet mix

In the current project (November 2021), SEE underwent minor modifications to simplify the input file requirements and output three new condensed emission factor reports. As of 2021, trip matrices are no longer a required input for SEE, and only one set of AVFT files (fuel type fractions) should be provided for SEE.

This report serves as the detailed technical documentation of the updated SEE’s scripts and GUI. Section 2.0 provides an overview of the installation process. Section 3.0 discusses the execution time and hard drive space requirements for a typical scenario. Section 4.0 is a tour of the GUI’s inputs and capabilities. Following the GUI discussion, Section 5.0 contains detailed documentation of the data flow in SEE, including each SEE script’s calculations and outputs. After the calculation and outputs discussion, Section 6.0 documents the naming convention and format of each input file. Section 7.0 briefly describes SEE’s summary output files. Section 8.0 describes the emission inventory that was used to validate the outputs of SEE.

The authors would like to acknowledge the assistance of several individuals in developing SEE and preparing this documentation:

- The Houston-Galveston Area Council project team: Graciela Lubertino, Chi-Ping Lam, Michael Onuogu, and Chris Van Slyke
- Cambridge Systematics, Inc.: David Kall and Tara Rima
- The Texas Transportation Institute: L.D. White and Dennis Perkinson
- ERG Mobile Sources Modeling Team: John Koupal, Scott Fincher¹, Doug Jackson², and SandeepKishan

¹ Now employed at KNIME.

² Now employed at QEDA Consulting, LLC.

2.0 Installation

In the current version of SEE, all the Perl scripts and configuration files are bundled with the GUI installer. When SEE is launched, it automatically copies all of the scripts and other files it needs into the user's local AppData folder, which is a folder used by applications to store temporary data on Windows machines. Specifically, SEE uses a folder located at C:\Users*username*\AppData\Local\ERG, where *username* is the name of the current user. This folder and the files contained within it do not need to be accessed by users during normal use of SEE – in fact, accessing files in this directory is discouraged, as it could interfere with the proper functioning of the tool.

Before installing SEE, it is essential to uninstall any previous versions. This is done using the *unins000.exe* executable that resides within the SEE installation folder, typically at C:\Program Files\SEE\unins000.exe. After the uninstallation is complete, install the new version of SEE using the installer executable. Next, copy the folder containing your input files to the C: drive, typically to C:\SEE.

2.1 Prerequisites

Both a Perl installation with all the required modules and a properly configured MySQL server are required to run the tool.

Perl: Installation of Perl will be detailed below.

MySQL: It is assumed that a functioning version of the MySQL server has been installed as part of a MOVES 2014a/b installation, so installation of MySQL is not covered in this document. However, there may be some steps necessary to configure the server properly to run SEE; these are described below.

64-bit PC: No additional software needs to be installed to run the GUI itself, as the installer for the GUI contains all the software it requires in a self-contained package. However, the GUI does require a 64-bit computer to run (most newer machines should fulfill this requirement).

2.2 Installing and configuring the prerequisites

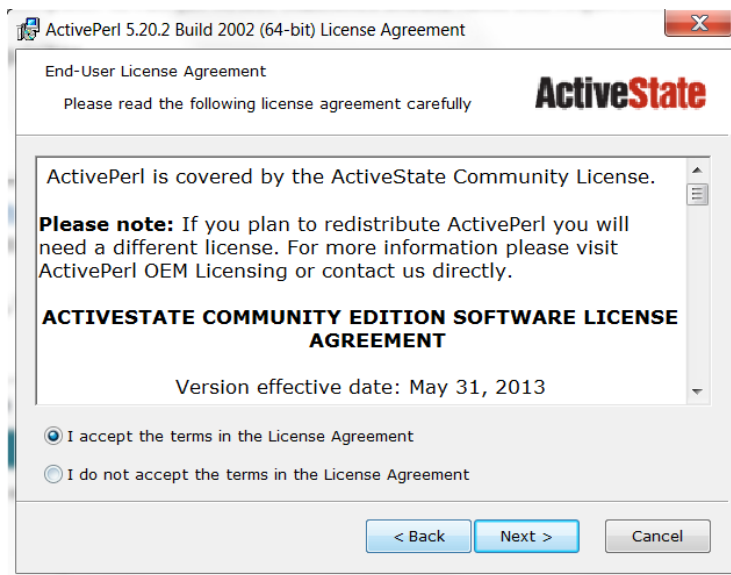
2.2.1 Perl

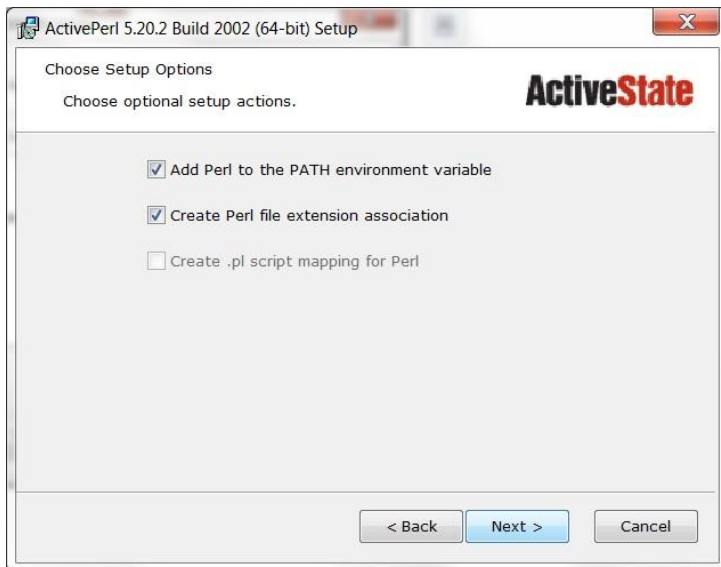
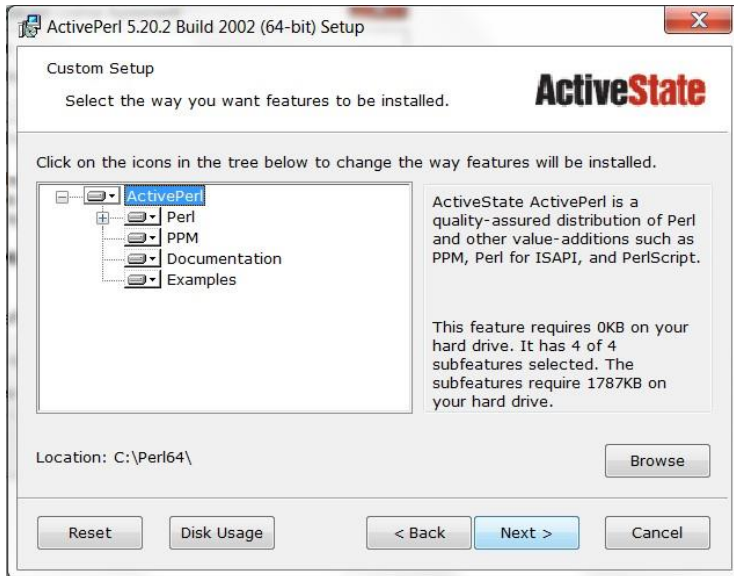
SEE has been tested using the freely-available Community Edition of ActivePerl, available here: <http://www.activestate.com/activeperl>. This version of Perl contains all of the modules necessary to run the tool and is the recommended version.

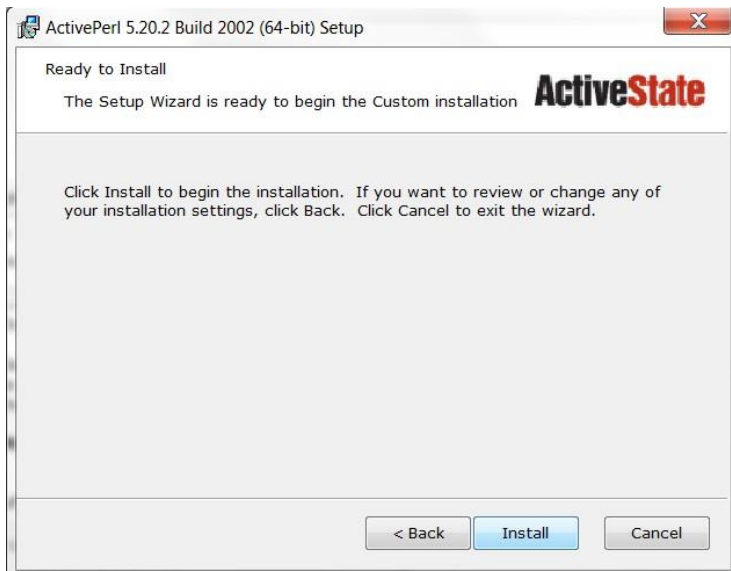
At the time of writing, the download link was near the bottom of the page, and appeared as follows:



The Download link will take you to another page, where you can choose between version for x86 (32-bit) or 64-bit (x64): choose the 64-bit version. After you download the installer (a *.msi file), double click to launch it. Accept the license agreement and choose the default installation options, as shown below.







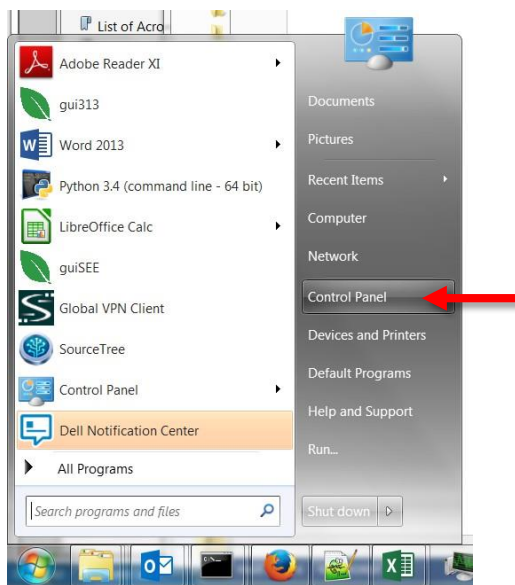
2.2.2 MySQL

SEE runs MySQL from the command line, which requires that the Path environment variable be set properly to point to the MySQL server executable (the file that actually launches MySQL). The Path variable is a basic feature of Windows that many programs require to run correctly, so care must be taken to only add to the existing Path variable, i.e., to not delete anything from it.

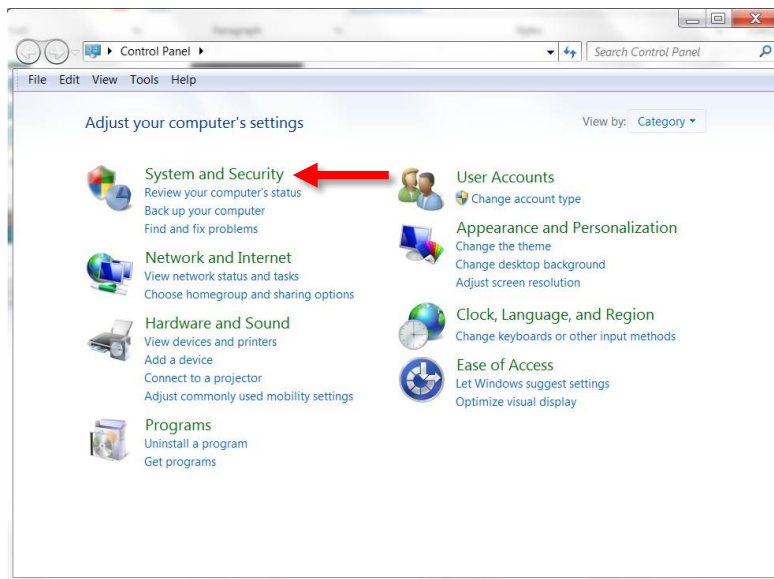
MOVES 2014 installs MySQL Server 5.6 or 5.7, and is probably the version your Path variable should point to. The executable will likely be located in C:\Program Files\MySQL\MySQL Server 5.6\bin, but it should be verified that this path exists on your machine, i.e., that your MySQL Server is this version and is saved in this location.

Setting the Path variable is accomplished via the Control Panel in Windows 7, as illustrated below. The procedure for Windows 10 is similar except the method of accessing the Advanced System Settings has changed and the method for editing system variables (like the Path variable) has been improved; otherwise, the basic procedure is the same.

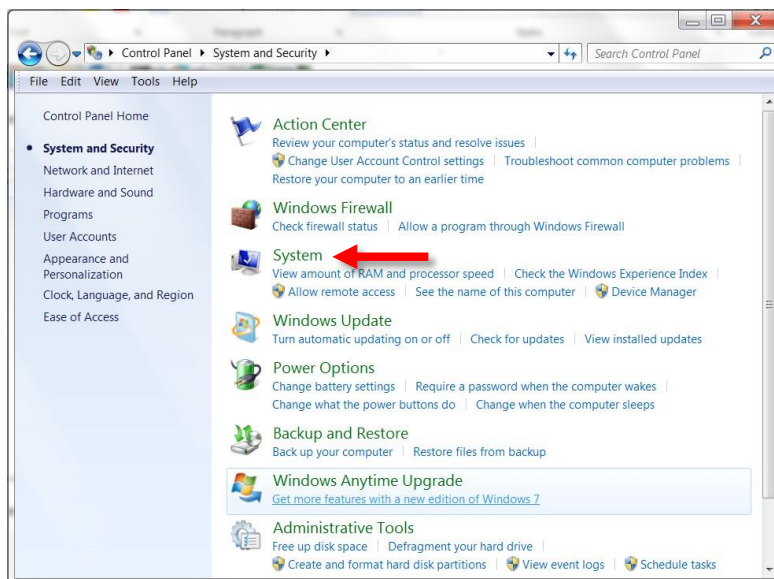
First, choose Control Panel from the Start Menu:



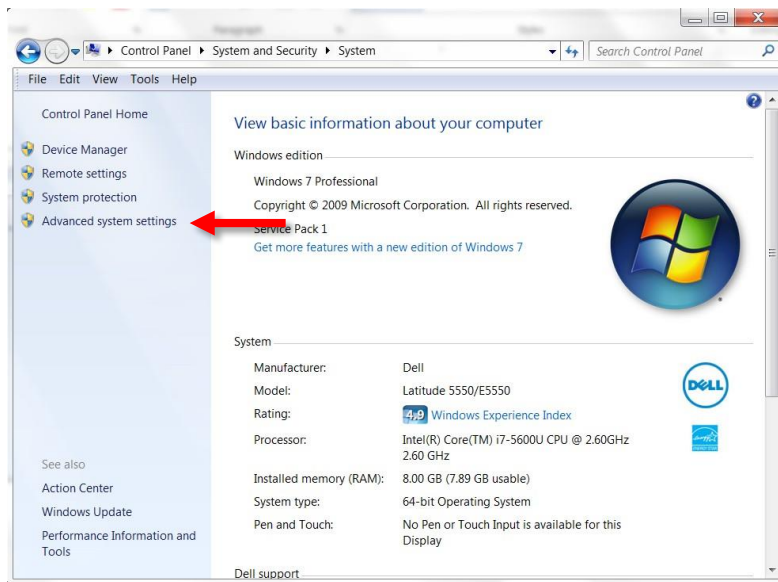
Select System and Security from within the Control Panel:



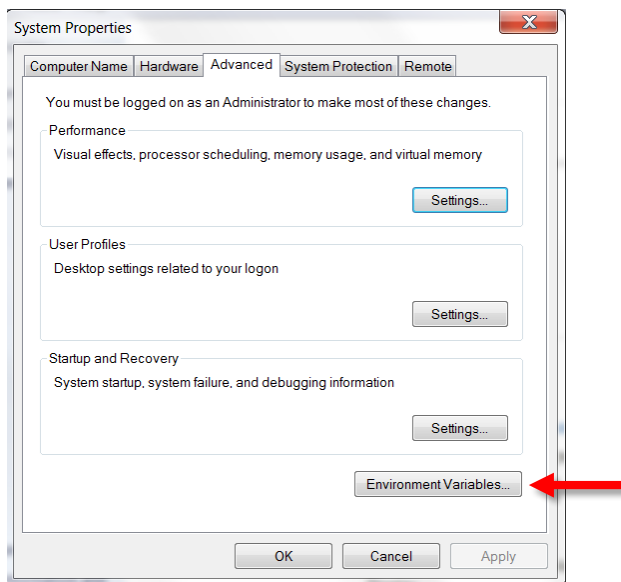
Select System from within System and Security:



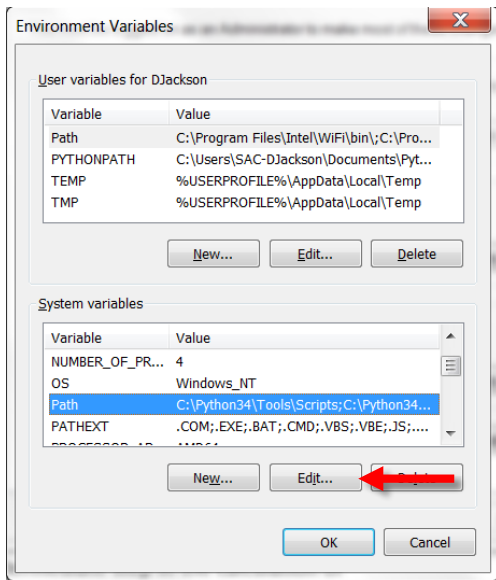
Select Advanced System Settings from within System:



Select Environment Variables from within Advanced System Settings:

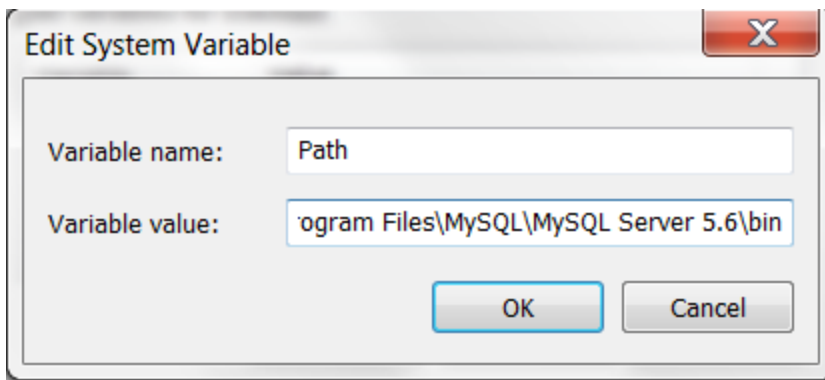


Under System Variables (the bottom of the two sections), scroll down until you see the Path variable. This variable should already exist. In the rare event that it doesn't, you can create it by selecting New. Otherwise, click on the Path variable to highlight it, and then select Edit:



At the very end of the existing path (it is very important that you go to the very end and that you NOT delete any part of the existing path), type a semicolon (if necessary) and then enter the path to your MySQL installation directory, e.g., C:\Program Files\MySQL\MySQL Server 5.6\bin. For example (but only as an example!), your complete Path variable might look like the following after you add the MySQL Server path:

C:\Perl64\site\bin;C:\Perl64\bin;C:\Program Files\MySQL\MySQL Server 5.6\bin



Once you have entered the path, click OK in the Edit System Variable window, then click OK in the Environment Variables, and then click OK in the System Properties window.

3.0 Execution Time and Hard Drive Space Requirements

The total execution time and hard drive space required to run SEE are strongly dependent on the number of counties being modeled and the number of links in each county. Also, enabling the compilation of link-level emissions totals (see Section 4.1.12), which is required for exporting link-level emissions, will increase both runtime and hard drive space requirements. Execution time is also a function of the number MySQL threads (see Table 4-1) and the number of active MOVES workers (see MOVES documentation for details regarding MOVES workers).

As an example of the total execution time and hard drive space required for a typical scenario, a complete run of SEE (all scripts) for the 8 counties in the Houston-Galveston-Brazoria area (Brazoria, Chambers, Fort Bend, Galveston, Harris, Liberty, Montgomery, and Waller counties) for VOC, CO, and NO_x, with the "Compile link-level emissions" option selected, required approximately 14 hours to run on a computer with a 3.4 GHz Intel i7-3770 processor (4 cores, up to 8 threads) with 24 GB RAM, using 7 MOVES workers and 7 MySQL threads. The total hard drive space requirement was approximately 135 GB. The majority of this space was for the summary database (32 GB) and the working databases (ranging from 2 GB for Chambers County to 61 GB for Harris County). With the "Compile link-level emissions" option disabled, total execution time was approximately 11.25 hours and the hard drive space requirement was approximately 73 GB.

4.0 Graphical User Interface

This section describes the full capabilities of SEE's graphical user interface (GUI). A home screen provides areas for user input and buttons that instruct SEE to perform various functions, and a pollutant screen allows the user to select which pollutants to include.

4.1 Home Screen – Inputs

Figure 4-1 shows several input areas: editable text boxes and drop-down menus. Many of these elements have brief reminders that will appear after a short delay when the cursor is hovered over them. For example, hovering your mouse over the text box adjacent to **Calendar Year** will produce the reminder, "Four-digit year. Only one year permitted at a time."

Figure 4-1. GUI Home Screen

The screenshot displays the SEE GUI Home Screen with the following configuration details:

- Run setup (top left and center):**
 - Scenario name: HGAC_2020
 - Calendar Year: 2020
 - Month: 7
 - Day Type: 5
 - Use Trip Matrix files: No
 - Counties to Model: 48039,48071,48157,48167,48201,48291,48339,48473
 - Counties with I/M programs: 48039,48157,48167,48201,48339
 - TRANSVMT data path: C:/SEE/TRANSVMT
 - Path for TCEQ lookups: C:/SEE/TCEQ_MOVES_INPUTS
 - Input Path for lookups: C:/SEE/LOOKUPS
- Export (top right):**
 - Compile link-level emissions:
 - Link-level export zones: 3454
 - Export Link-Level Results: [Green Button]
- Run individual scripts (center right):**
 - Pre-process VMT
 - Pre-process Trips
 - Create Input Database
 - Create Activity Runspec
 - Execute Activity Run
 - Create Rate Mode Runspec
 - Execute Rate Mode Run
 - Calculate Off-Net
 - Post-process Off-Net
 - Post-process and Summarize
- Installation setup (bottom):**
 - Local output path: C:/SEE/LocalGen
 - Path for Script-generated CSV for MOVES: C:/SEE/CSVInputs
 - Default MOVES database: movesdb20181022
 - Database username: root
 - Database password: [Empty]
 - Path for MOVES input and runspec XML: C:/SEE/MOVESXML
 - MOVES install path: C:/Users/Public/EPA/MOVES/MOVES2014b
 - MOVES Java heap size (MB): 1200
 - Number of MySQL threads: 7

At the bottom of the Run setup pane, there are four buttons: QA (green), Pre-process and Run MOVES (blue), Post-process (purple), and Run ALL Scripts (red).

This **Home Screen** view of the GUI contains four panes: the *Run setup* (top left and center), *Installation setup* (bottom), *Export* (top right), and *Run individual scripts* (center right). The *Run setup* pane has 10 required input fields, and will need to be edited the most frequently. Each inputfield is discussed next, one at a time.

4.1.1 Scenario Name

In this text box, you should provide SEE with a meaningful scenario name that will help distinguish your modeling scenarios from one another. SEE uses this input to name the working databases as well as the emission factor reports and the Excel summary results file exported by the **Post-process and Summarize** script. For example, an entry here of “hgb_2018” would result in the following MySQL databases (assuming all 8 counties were also included under **Counties to Model**). The first 8 items are SEE’s working databases, followed by the SEE off-network database, and number 10 is the SEE summary database.

1. hgb_2018_48039
2. hgb_2018_48071
3. hgb_2018_48157
4. hgb_2018_48167
5. hgb_2018_48201
6. hgb_2018_48291
7. hgb_2018_48339
8. hgb_2018_48473
9. hgb_2018_offnet
10. hgb_2018_summary

In addition, SEE would name the summary results spreadsheet *hgb_2018_results.xlsx* and the summary emission factor files *hgb_2018_ratePer*.txt*, located in the local output path, after the **Post-process and Summarize** script completes.

4.1.2 Calendar Year

This input is an editable text box, where you should enter one four-digit year corresponding to your modeling scenario year. Only one year may be entered here, and the acceptable values are those allowed by MOVES (i.e. 1990, 1999-2050). SEE uses this input to set the year for MOVES runs, and it also sets the year that later determines the pass/fail status for some of the quality assurance (QA) checks. QA checks are discussed in detail in Section 4.3.1.

4.1.3 Month

This input is a drop-down menu where you may select a single month, 1 through 12. This choice determines the month of the MOVES run, and the default setting (provided with the installation) is 7, for July.

4.1.4 Day Type

Another drop-down menu, you may select “5” for weekday or “2” for weekend. This selection determines the day type of the MOVES runs, which influences the magnitude of the off-network emission rates. The default setting is 5.

4.1.5 Use Trip Matrix Files

You may choose “Yes” to process trip files, or “No” to bypass the trip files. Choosing “No” will save runtime and produce the same answers as when “Yes” is selected; however, emissions will not be allocated to TAZs with the “No” selection.

4.1.6 Counties to Model

In this text box, you must enter at least one county code, as a 4- or 5-digit integer county FIPS code. If you enter multiple counties, they should be separated by commas (e.g., 48039,48071,48157).

4.1.7 Counties with I/M Programs

This text box has identical format requirements to the **Counties to Model** input box discussed above. However, this input is completely optional. The box may be left blank if you do not desire SEE to perform any QA checks on your *I/M Coverage* input files for MOVES (or if the counties in your modeling scenario do not have any I/M programs). If you do enter one or more counties, SEE’s QA checks require valid records within the *I/M Coverage* files for the county(ies). Section 4.3.1 explains the I/M program file QA check.

4.1.8 TRANSVMT Data Path

This text box shows the path to the location of the 24 hourly VMT files processed through TRANSVMT and the trip origin destination matrices by period. To simplify correct specification of an existing path name, the path is chosen using the "Browse" button to the right of the text box; this field is not directly editable. The default setting for this path is C:/SEE/TRANSVMT.

Note: A suggested naming convention of including a year in the pathname would allow multiple conformity datasets to reside on the same computer (e.g. C:/SEE/TRANSVMT_2018 and C:/SEE/TRANSVMT_2040).

4.1.9 Path for TCEQ Lookups

This text box shows the path to the location of your MOVES inputs such as age distribution, I/M programs, and fuels. To simplify correct specification of an existing path name, the path is chosen using the "Browse" button to the right of the text box; this field is not directly editable. The default location is C:/SEE/TCEQ_MOVES_INPUTS.

4.1.10 Input Path for Lookups

This text box shows the path to the location of other SEE lookups such as the files *CountyLookup.tab*, *RoadtypeLookup.tab*, *TimePeriodLookup.tab*, and many others. To simplify correct specification of an existing path name, the path is chosen using the "Browse" button to the right of the text box; this field is not directly editable. The default setting is C:/SEE/LOOKUPS.

The next section discusses the installation setup pane, located at the bottom of the GUI **Home Screen**.

4.1.11 Installation Setup

In this pane is a group of inputs that are mostly SEE intermediate file paths and system parameters that will not change with scenario. These will likely only have to be set once (if ever) because each time you launch SEE, the GUI will load the previously-saved settings from the configurations previously stored the last time the tool was run. Table 4-1 shows the installation setup pane's input fields, their default settings, and additional details about their purpose and how/where SEE uses them.

Table 4-1. Installation Setup Paths and Settings

| Input Field | Default Setting | Details |
|---|-------------------|--|
| Local output path | C:/SEE/LocalGen/ | This is a SEE intermediate file repository that houses the SEE and MOVES log files and user's pollutant selections. The Post-process and Summarize script also writes intermediate summaries here that end up in the Excel results file. |
| Path for Script-generated CSV for MOVES | C:/SEE/CSVInputs/ | This is another intermediate file repository where primarily the GUI and the Pre-process VMT script create intermediate files that are used in later scripts. |
| Default MOVES database | movesdb20181022 | SEE uses some tables from the default MOVES database, so the name of this database must be specified here. |

| Input Field | Default Setting | Details |
|--------------------------------------|--|---|
| Database username | root | Your MySQL user name |
| Database password | moves | Your MySQL password (if any) |
| Path for MOVES input and runspec XML | C:/SEE/MOVESXML | SEE writes all of the MOVES Runspec files, Data Importer XML files, and Batch executables to this location. |
| MOVES install path | C:/Users/Public/EPA/MOVES/ MOVES2014a | SEE needs to know where MOVES is installed because it launches MOVES from the command line. |
| MOVES Java heap size (MB) | 1200 | Determines the amount of virtual memory to be allocated to the MOVES Master during runs. |
| Number of MySQLthreads | 1 | Determines how many simultaneous MySQLqueries to run using multithreading. This number should be less than the total number of threads available on your machine. If you do not know how many threads your computer is capable of handling, look up the technical specifications of your machine's processor (CPU). |

4.1.12 Export

The top, right portion of the GUI **Home Screen** provides an extra (and optional) export of link-level emissions for a subset of links that reside in a set of one or more TAZs.

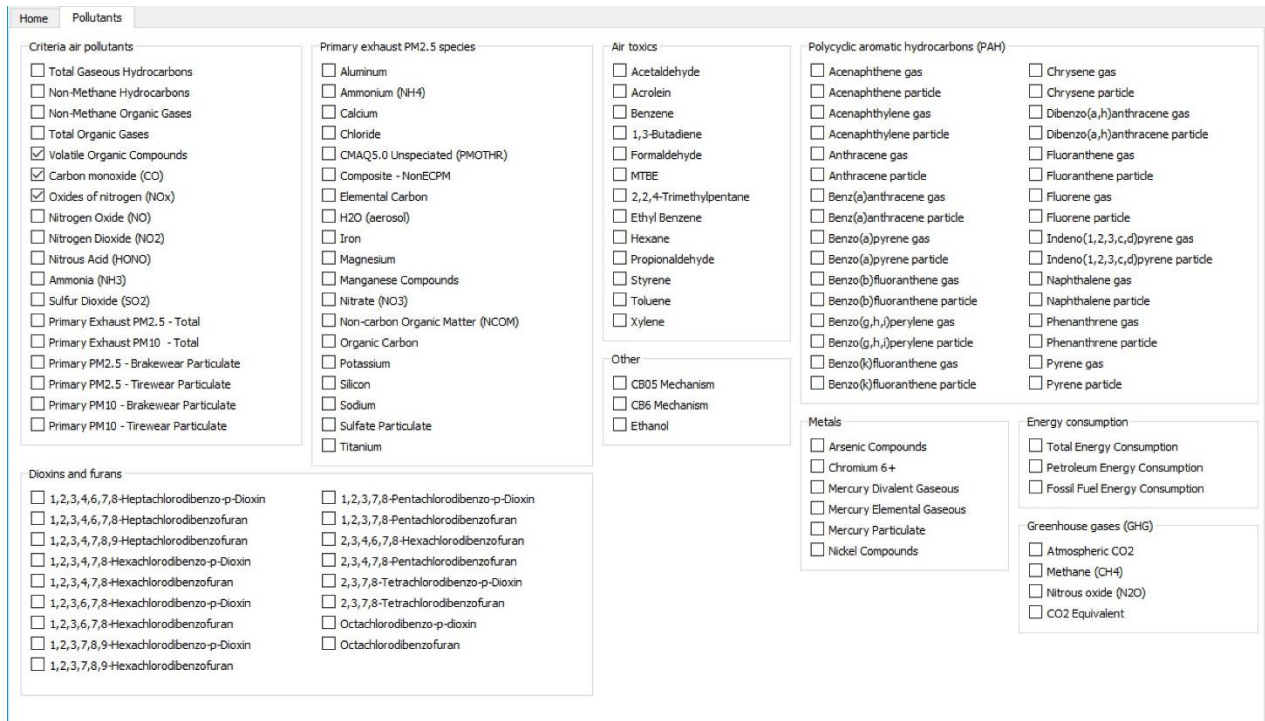
As a reminder, several output summaries are automatically generated in the **Post-process and Summarize** script, which will appear in the file named *GUI-Scenario-Name*_results.xlsx in your local output path. If you wish to export link-level results, you must select the "Compile link-level emissions" prior to running SEE. Then, enter the list of zones, separated by commas if there are more than one. After SEE is done executing, click the **Export link-level results** button, and the Excel results file from the **Post-process and Summarize** script will be replaced with a new one that has an additional worksheet containing the link-level emissions.

Note: This optional button launches the **Export Link-Level Results** script (fully described in Section 5.11), and the results are not instant, though the wait is typically only a few minutes after the main run (of the other scripts) has completed. The precise wait time will depend on the number of zones you request, but likely the additional results will take less than five minutes. SEE will notify you with a pop-up window when the new Excel results file is available.

4.2 Pollutant Screen

To access the **Pollutant Screen**, click the **Pollutants** tab (adjacent to the **Home** tab) at the top of the GUI. Figure 4-2 shows the available list of pollutants, which is the same as those in MOVES2014a. Located to the left of each pollutant name is a clickable checkbox.

Figure 4-2. GUI Pollutant Screen



When you click a pollutant, a check should appear in the checkbox. SEE automatically saves your pollutant selections plus any MOVES-imposed prerequisite pollutants, to be included downstream in the run instructions for MOVES. The next page shows representative examples of the XML “blurbs” that SEE saves for later MOVES runs, using an example user selection of the pollutants VOC and NO_x. These blurbs are updated whenever the user switches between the **Pollutants** and **Home** tabs. SEE includes all emission processes for the pollutants selected. There are two emission processes that SEE intentionally excludes: refueling spillage and vapor losses that occur at fuel dispensing stations.

Additional information on MOVES pollutant prerequisites: In MOVES, a user selection of VOC requires also selecting Non-Methane Hydrocarbons, which in turn requires selecting Total Gaseous Hydrocarbons. The MOVES GUI handles this by including a button to add the prerequisites; SEE mimics the approach of MOVES but adds the prerequisites automatically rather than requiring another button click. The prerequisites are automatically added to the XML blurbs but are not automatically shown in the SEE GUI as being selected.

VOC blurb for MOVES rate mode runs (ratesPollutants.xml):

```
<pollutantprocessassociation pollutantkey="87" pollutantname="Volatile Organic Compounds" processkey="1" processname="Running Exhaust"/>
<pollutantprocessassociation pollutantkey="87" pollutantname="Volatile Organic Compounds" processkey="2" processname="Start Exhaust"/>
<pollutantprocessassociation pollutantkey="87" pollutantname="Volatile Organic Compounds" processkey="11" processname="Evap Permeation"/>
<pollutantprocessassociation pollutantkey="87" pollutantname="Volatile Organic Compounds" processkey="12" processname="Evap Fuel Vapor Venting"/>
<pollutantprocessassociation pollutantkey="87" pollutantname="Volatile Organic Compounds" processkey="13" processname="Evap Fuel Leaks"/>
<pollutantprocessassociation pollutantkey="87" pollutantname="Volatile Organic Compounds" processkey="15" processname="Crankcase Running Exhaust"/>
<pollutantprocessassociation pollutantkey="87" pollutantname="Volatile Organic Compounds" processkey="16" processname="Crankcase Start Exhaust"/>
<pollutantprocessassociation pollutantkey="87" pollutantname="Volatile Organic Compounds" processkey="17" processname="Crankcase Extended Idle Exhaust"/>
<pollutantprocessassociation pollutantkey="87" pollutantname="Volatile Organic Compounds" processkey="90" processname="Extended Idle Exhaust"/>
<pollutantprocessassociation pollutantkey="87" pollutantname="Volatile Organic Compounds" processkey="91" processname="Auxiliary Power Exhaust"/>
<pollutantprocessassociation pollutantkey="1" pollutantname="Total Gaseous Hydrocarbons" processkey="1" processname="Running Exhaust"/>
<pollutantprocessassociation pollutantkey="1" pollutantname="Total Gaseous Hydrocarbons" processkey="2" processname="Start Exhaust"/>
<pollutantprocessassociation pollutantkey="1" pollutantname="Total Gaseous Hydrocarbons" processkey="11" processname="Evap Permeation"/>
<pollutantprocessassociation pollutantkey="1" pollutantname="Total Gaseous Hydrocarbons" processkey="12" processname="Evap Fuel Vapor Venting"/>
<pollutantprocessassociation pollutantkey="1" pollutantname="Total Gaseous Hydrocarbons" processkey="13" processname="Evap Fuel Leaks"/>
<pollutantprocessassociation pollutantkey="1" pollutantname="Total Gaseous Hydrocarbons" processkey="15" processname="Crankcase Running Exhaust"/>
<pollutantprocessassociation pollutantkey="1" pollutantname="Total Gaseous Hydrocarbons" processkey="16" processname="Crankcase Start Exhaust"/>
<pollutantprocessassociation pollutantkey="1" pollutantname="Total Gaseous Hydrocarbons" processkey="17" processname="Crankcase Extended Idle Exhaust"/>
<pollutantprocessassociation pollutantkey="1" pollutantname="Total Gaseous Hydrocarbons" processkey="90" processname="Extended Idle Exhaust"/>
<pollutantprocessassociation pollutantkey="1" pollutantname="Total Gaseous Hydrocarbons" processkey="91" processname="Auxiliary Power Exhaust"/>
<pollutantprocessassociation pollutantkey="79" pollutantname="Non-Methane Hydrocarbons" processkey="1" processname="Running Exhaust"/>
<pollutantprocessassociation pollutantkey="79" pollutantname="Non-Methane Hydrocarbons" processkey="2" processname="Start Exhaust"/>
<pollutantprocessassociation pollutantkey="79" pollutantname="Non-Methane Hydrocarbons" processkey="11" processname="Evap Permeation"/>
<pollutantprocessassociation pollutantkey="79" pollutantname="Non-Methane Hydrocarbons" processkey="12" processname="Evap Fuel Vapor Venting"/>
<pollutantprocessassociation pollutantkey="79" pollutantname="Non-Methane Hydrocarbons" processkey="13" processname="Evap Fuel Leaks"/>
<pollutantprocessassociation pollutantkey="79" pollutantname="Non-Methane Hydrocarbons" processkey="90" processname="Extended Idle Exhaust"/>
```

```
<pollutantprocessassociation pollutantkey="79" pollutantname="Non-Methane Hydrocarbons" processkey="91" processname="Auxiliary Power Exhaust"/>
```

NO_x blurb for MOVES rate mode runs (ratesPollutants.xml):

```
<pollutantprocessassociation pollutantkey="3" pollutantname="Oxides of Nitrogen (NOx)" processkey="1" processname="Running Exhaust"/>
```

```
<pollutantprocessassociation pollutantkey="3" pollutantname="Oxides of Nitrogen (NOx)" processkey="2" processname="Start Exhaust"/>
```

```
<pollutantprocessassociation pollutantkey="3" pollutantname="Oxides of Nitrogen (NOx)" processkey="15" processname="Crankcase Running Exhaust"/>
```

```
<pollutantprocessassociation pollutantkey="3" pollutantname="Oxides of Nitrogen (NOx)" processkey="16" processname="Crankcase Start Exhaust"/>
```

```
<pollutantprocessassociation pollutantkey="3" pollutantname="Oxides of Nitrogen (NOx)" processkey="17" processname="Crankcase Extended Idle Exhaust"/>
```

```
<pollutantprocessassociation pollutantkey="3" pollutantname="Oxides of Nitrogen (NOx)" processkey="90" processname="Extended Idle Exhaust"/>
```

```
<pollutantprocessassociation pollutantkey="3" pollutantname="Oxides of Nitrogen (NOx)" processkey="91" processname="Auxiliary Power Exhaust"/>
```

4.3 Home Screen – Launch Buttons

The **Home Screen** inputs were described in Section 4.1. This section explains each launch button that initiates a script.

4.3.1 QA Inputs

The QA button checks a variety of user-supplied MOVES input files and SEE inputs. These QA checks will not prevent all errors but were designed to prevent simple typos made in the naming of a directory or the most common types of omissions that might occur if using the TTI Utilities to prepare MOVES inputs. The QA button GUI feature checks for the presence of files, and, in some cases, their data contents.

Upon clicking the QA button, SEE will:

- Create a “renamed” subfolder in the MOVES input data folder (e.g., TCEQ_MOVES_INPUTS_*) and in the lookups folder (e.g., LOOKUPS_*).
- Look for files matching the following naming conventions, and move them to the TCEQ_MOVES_INPUTS_*/renamed folder, where “*YR*,” “*CTY*,” etc. are placeholders for the scenario year, county, etc., and * is a wildcard. When the files are moved, the file names are simplified by removing any characters matched by the wildcard. The QA fails if there is more than one match for any file.
 - *YR_CTY_sutage**.csv
 - *YR_CTY_imcoverage**.csv
 - *YR_CTY_fuelsupply**.csv
 - fuelFormulation_*YR**.csv
 - rateModeAVFT_*YR_CTY**.csv
 - actualPopAVFT_*YR_CTY**.csv
 - fuelUsageFraction*.csv
 - hotellingActivityDistribution*.csv
 - hotellingHours_*YR_DT**.csv
 - starts_*YR_CTY**.csv
 - zoneMonthHour*.csv
 - county_*CTY**.csv
 - dummy/*YR_CTY_sourceTypeYear**.csv
 - dummy/monthVMTFraction_month_*MNTH**.csv
 - dummy/dayVMTFraction_daytype_*DAYNUM**.csv
- Look for files matching the following naming conventions and move them to the LOOKUPS_*/renamed folder, as described above for the TCEQ_MOVES_INPUTS_* files.
 - ExtendedIdle_Capacity*.tab
 - RoadTypeLookup*.tab

- SourceTypeAgeLookup*.tab
- TimePeriodLookup*.tab
- **CTY_YR_VMT_Mix_STFTRT***.tab
- TxLEDadjustments*.tab
- CountyLookup*.tab
- DummySpeed*.tab
- defaultRoadType
- **YR_CTY_SHP***.tab
- Check that the years in the **YR_CTY_sutage***.csv file match the year of the scenario being modeled.
- For all of the I/M counties, check that there is at least one entry in the **YR_CTY_imcoverage***.csv file with useIMyn equal to “Y,” and verify that at least one entry (row) with useIMyn equal to “Y” has the same year as the scenario’s year.
- Check that there are TRANSVMT files in the TRANSVMT data path (e.g., TRANSVMT_*) that match the ***THR** naming convention (e.g., HGAC_2018_transvmt.T01, ..., HGAC_2018_transvmt.T24) and report the number of files found.
- If the Home Screen has “Use Trip Matrix Files” set to “Yes,” then check that there are trip matrix files in the TRANSVMT data path that match the *.asc naming convention and report the number of files found. If “Use Trip Matrix Files” is set to “No,” then this QA check is skipped.
- Verify that the trip matrix file names contain a valid time period (e.g., AM) in the correct position. This check relies on the TimePeriodLookup*.tab file listed above to identify valid time periods.
- Verify the MOVES installation path by checking for the setenv.bat file in the specified path.
- Verify that the default MOVES database specified in the GUI exists.

Any failure of a check listed above (e.g., **YR_CTY_sutage***.csv contains the wrong year) will result in a descriptive message of the error in a pop-up window. Otherwise, the pop-up message will read “Passed QA.”

4.4 Running SEE

The simplest way to execute a SEE run is to click the red button, **Run ALL Scripts**, to run everything with a single click. However, if desired, it is also possible to run only the pre-processing and MOVES runs portion of SEE by clicking the blue **Pre-process and Run MOVES** button. If the pre-processing scripts and MOVES runs have already completed, you may then optionally run the post-processing portion of SEE by clicking the purple **Post-process** button. Alternatively, SEE may be run one script at a time using the buttons in the *Run individual scripts* pane. For example, to run all scripts sequentially, click the **Pre-process VMT** button,

followed by the **Pre-process Trips** button, and so on, through **Post-process and Summarize**. If run in this manner, the scripts must be run in order from top to bottom. The inputs and outputs from each script, as well as calculations, are described next in Section 5.1 through Section 5.10. Section 5.11 describes a final script which generates the optional output of detailed link-level results for a group of links.

5.0 SEE Data Flow: Inputs, Calculations, and Outputs

In this version of SEE, calculations proceed linearly through 10 major steps, with each step performed by a particular Perl script. These steps and their associated scripts, in order of execution, are:

- pre-process link characteristics, such as VMT and average speed (**Pre-process VMT** script)
- pre-process trip data to determine how off-network emissions should be allocated (**Pre-process Trips** script)
- create an input database for the MOVES runs (**Create Input Database** script)
- create a MOVES runspec for a County Scale Inventory Mode run to generate activity data (VMT and SHP) (**Create Activity Runspec** script)
- execute the County Scale Inventory Mode run (**Execute Activity Run** script)
- create a MOVES runspec for a County Scale Rate Mode run to generate off-network and on-network emission rates (**Create Rate Mode Runspec** script)
- execute the County Scale Rate Mode run (**Execute Rate Mode Run** script)
- combine the activity outputs (VMT and SHP) with the rate outputs to calculate off-network rates per SHP; combine rate per activity with activity inputs to calculate total off-network emissions (**Calculate Off-net** script)
- allocate off-network emissions using the factors calculated by the **Pre-process Trips** script (**Post-process Off-net** script)
- calculate on-network emissions by combining emission rates with links using link average speeds and interpolated emission rates; perform various post-processing and summarization steps (**Post-process and Summarize** script)

5.1 Pre-process VMT Script

The primary task performed by the **Pre-process VMT** script is aggregating link characteristics, such as average speed and VMT.

Table 5-1 lists the final tables prepared by the **Pre-process VMT** script, which are later used by the **Post-process and Summarize** script.

Table 5-1. Pre-process VMT Script's Final MySQL Tables and their Fate

| Database Table Name, where <i>ONDB_CTY</i> = the SEE on-network database for a specific county and <i>HR</i> = hour from 01 to 24 | Next Used By | How Table is Used |
|--|--|---|
| <i>ONDB_CTY</i> .link_definitions | Post-process and Summarize script | Post-process and Summarize: join linkIDs to linkTotals table; Export Link-Level Results: extract linkIDs for specific TAZs for link-level emissions export |
| <i>ONDB_CTY.HR</i> _Links_All | Post-process and Summarize script | Post-process and Summarize: join emissions rates with links to calculate link-specific emissions |

5.2 Pre-process Trips Script (Optional)

As of November 2021, processing trips data from the travel model is optional. To enable pre-processing of trips, ensure that the Home Screen of the SEE GUI shows a “Yes” setting adjacent to “Use Trip Matrix Files.”

The **Pre-process Trips** script imports trip data and allocates starts, parking, and extended idling to TAZs. The calculations involved in this script are simple sums and fractions of totals.

The first step in the **Pre-process Trips** script is the allocation of extended idling to TAZ as a fraction of the total extended idling that occurs in a given county. The fraction of extended idling in a TAZ is inferred based on the number of truck stops. The number of truck stops per TAZ is loaded from the *ExtendedIdle_Capacity.tab* input file. The fraction of extended idling occurring in a particular TAZ is simply the number of truck stops in the TAZ divided by the total number of truck stops in the county. This fraction is the allocation factor used to allocate County Scale extended idling emissions back to the TAZ level.

The second operation in the **Pre-process Trips** script is the calculation of the number of trips originating in a TAZ and the number of trips ending in a TAZ. These are calculated from the trip files (the **Matrix.asc* input files), which provide the number of trips that begin in a specific TAZ and end in another TAZ in a specific time period. From these data, the total number of trips

originating in a TAZ can be calculated as a simple sum, as can the number of trips that end in a specific TAZ. To allocate County Scale emissions from starts and parking (trip ends), the fractions of these activities that occur in a given TAZ are then calculated to derive allocation factors. The start allocation factors are simply the fractions of starts that occur in a given TAZ at a time period divided by the total number of starts in the county during that time period. The trip end allocation factors are calculated in a similar manner. Table 5-2 lists the final database tables prepared by the **Pre-process Trips** script which are all later used by the **Post-process Off-Net** script to post-process the MOVES run results.

Table 5-2. Pre-process Trips Script's Final MySQL Tables and their Fate

| Database Table Name, where <i>OFFDB</i> = SEE off-network database | Next Used By | How Table is Used |
|---|------------------------------------|--|
| <i>OFFDB.timePeriodLookup</i> | Post-process Off-Net script | Allocate emissions to TAZ based on time period |
| <i>OFFDB.alloc_tripstarts</i> | Post-process Off-Net script | Allocate trip starts to TAZ |
| <i>OFFDB.alloc_tripends</i> | Post-process Off-Net script | Allocate trip ends to TAZ |
| <i>OFFDB.alloc_idlespots</i> | Post-process Off-Net script | Allocate idling to TAZ |

5.3 Create Input Database Script

The **Create Input Database** script generates two types of files: an XML file that provides instructions to the MOVES importer, and a single Windows batch script that launches the MOVES importer using the XML import specification file. The primary purpose of the XML import specification file is to instruct MOVES to load the input files, described in more detail in Section 6.0, into the input database. All of the files generated by the **Create Input Database** script – the *CountyScale_County_CTY_Year_YR_Month_MNTH_Input.xml* files and *CountyScale_XMLImporter.bat* file – are saved to the C:\SEE\MOVESXML directory. The importer batch script is executed by the **Execute Activity Run** script.

5.4 Create Activity Runspec Script

The **Create Activity Runspec** script is the counterpart to the **Create Input Database** script, and creates a MOVES runspec XML for each Inventory Mode run and an associated batch script to launch all of the Inventory Mode MOVES runs. This batch script is also called by the **Execute Activity Run** script. All of the files created by the **Create Activity Runspec** script – the *pop_SHP_CTY_Year_YR_Month_MNTH.mrs* files and the *pop_SHP_ExecuteMOVES.bat* file – are saved in the C:\SEE\MOVESXML directory. The runspec XML files specify the run options, such as the geographic bounds, the time span, etc.

5.5 Execute Activity Run Script

The main purpose of the **Execute Activity Run** script is to call the batch script that launches the MOVES importer for each county (C:\SEE\MOVESXML\CountyScale_XMLImporter.bat) and the script that launches the MOVES runs (C:\SEE\MOVESXML\pop_SHP_ExecuteMOVES.bat). In addition, it also removes any previous versions of the Inventory Mode input and output databases which may have been created by an earlier run. These MySQL databases use the naming conventions *countyScale_county_CTY_year_YR_month_MNTH_input* and *pop_SHP_county_CTY_year_YR_month_MNTH_output*, respectively.

5.6 Create Rate Mode Runspec Script

The **Create Rate Mode Runspec** script is the rate mode analog of the **Create Activity Runspec** script. It creates a County Scale Rate Mode MOVES runspec XML for each county and hour, and an associated batch script to launch all of the Rate Mode MOVES runs. This batch script is also called by the **Execute Rate Mode Run** script. All of the files created by the **Create Rate Mode Runspec** script – the *rates_CTY_Year_YR_Month_MNTH.mrs* files and the *rates_ExecuteMOVES.bat* file – are saved in the C:\SEE\MOVESXML directory.

The runspec XML files specify the run options, such as the geographic bounds, the time span, etc. They also specify the pollutants, which are defined in the GUI by the SEE user. The pollutants selected by the user, and any prerequisites, are saved in the file *ratesPollutants.xml*, which the **Create Rate Mode Runspec** script incorporates into the MOVES runspec XML files.

5.7 Execute Rate Mode Run Script

Like the **Execute Activity Run** script, the **Execute Rate Mode Run** script serves primarily to launch the MOVES runs using the batch files generated in the preceding two scripts. The **Execute Rate Mode Run** script also clears any existing Rate Mode output databases, which are named using the following convention: *rates_county_CTY_year_YR_month_MNTH_output*.

5.8 Calculate Off-Net Script

Off-network emissions are calculated by multiplying rate per activity emission factors by the scenario-specific activity. For example, the rate per start outputs in the MOVES *ratePerStart* table are multiplied by the number of starts per hour, source type, and fuel type to estimate total emissions by hour, source type, fuel type, process, and pollutant. Similarly, rates per hour can be combined with outputs in the *ratePerHour* table to estimate extended idling emissions.

Calculation of off-network evaporative emissions is complicated slightly by the fact that MOVES does not generate rate per activity outputs for evaporative emissions: Instead, it reports rates per vehicle in the *ratePerVehicle* (fuel leaks and permeation) and *ratePerProfile* (fuel vapor venting) tables. Therefore, an intermediate step is required to convert these rate per vehicle data into rate per activity. For evaporative emissions, activity is in terms of source hours parked (SHP).

Rate per SHP can be derived from rate per vehicle as follows:

$$ratePerSHP = ratePerVehicle \times \frac{vehicles}{SHP}$$

where *vehicles* is the vehicle population for a given hour, source type, and fuel type, and *SHP* is the corresponding source hours parked for these vehicles. These activity data come from the County Scale Inventory Mode MOVES runs, and the emission rates come from the County Scale Rate Mode runs.

Prior to aggregating the emissions, NO_x, NO, NO₂, and HONO, i.e., *pollutantIDs* 3, 32, 33, and 34, in counties with Texas Low Emission Diesel (TxLED) diesel fuel formulations are adjusted downwards by multiplying by a TxLED NO_x adjustment factor.

5.9 Post-process Off-Net Script

In the **Post-process Off-Net** script, the emissions calculated by the **Calculate Off-Net** script run are allocated to individual links and to TAZs using the allocation factors calculated in the **Pre-process VMT** and **Pre-process Trips** scripts.

Allocation to TAZ is performed separately for start emissions, off-network evaporative emissions (trip end emissions), and extended idling emissions. These emissions are then combined into a single table, *movesoutput_zone*, for later inclusion in the emissions summaries generated in the **Post-process and Summarize** script. Start emissions by TAZ are obtained by multiplying the emissions for *processIDs* 2 and 16 by the start allocation factors from the **Pre-**

process Trips script. Likewise, the off-network evaporative emissions are obtained by multiplying the emissions for *processIDs* 11, 12, and 13 by the trip end allocation factors. Extended idle emissions by TAZ are the emissions for *processIDs* 17, 90, and 91 multiplied by the extended idle allocation factors from the **Pre-process Trips** script. The **Post-process Off-Net** script does not produce any intermediate text files, but it does prepare a MySQL table, *movesoutput_zone*, in the off-network database that is used later by the **Post-process and Summarize** script.

5.10 Post-process and Summarize script

The **Post-process and Summarize** script is the most time-intensive part of SEE because it performs queries on large tables that are responsible for joining the on-network emission rates to the individual links to calculate emissions by link. Rates for all hours, road types, source types, fuel types, processes, and pollutants are joined to links using link average speeds. The **Post-process and Summarize** script also summarizes SEE results from on-network and off-network components and reports them together in the Excel file located at C:\SEE*GUI-Scenario-Name*_results.xlsx. At the conclusion of the SEE run, all of the messages that were reported to the command window console are copied into a text file located at C:\SEE\LocalGen\SEE_Perl.log. Each run of SEE overwrites this log file, so it should be renamed between runs if you want to keep a record of a previous run.

As occurs in the **Calculate Off-Net** script, the first step in processing the emissions data is to multiply the NOx emissions (*pollutantIDs* 3, 32, 33, and 34) in the TxLED counties by the NOx adjustment factor.

The next step performed by the **Post-process and Summarize** script is interpolation of the emission rates. MOVES Rate Mode generates emission rates by average speed bin, which are generally 5 mph bins. To estimate emissions at the same level of precision as TCEQ's inventories, these rates are interpolated to three decimal places to generate rates for intermediate speeds, as follows:

$$rate_{interp} = rate_{low} + interpFac \times (rate_{high} - rate_{low})$$

where $rate_{interp}$ is the interpolated emission rate; $rate_{low}$ is the emission rate for the average speed bin below the link speed; and $rate_{high}$ is the emission rate for the average speed bin above the link speed. Interpolation of rates requires the use of harmonic averaging, as follows:

$$interpFac = \left(\frac{1}{speed_{link}} - \frac{1}{speed_{low}} \right) / \left(\frac{1}{speed_{high}} - \frac{1}{speed_{low}} \right)$$

where $speed_{link}$ is the link average speed; $speed_{low}$ is the speed corresponding to the average speed bin below the link speed; and $speed_{high}$ is the speed corresponding to the average speed bin above the link speed. On-network emission rates are in terms of rate per mile, so to calculate total emissions requires VMT by hour, road type, source type, and fuel type. This is calculated using a combination of the per-link VMT and hourly fleet mix from the TRANSVMT input files. The **Post-process and Summarize** script also uses these VMT allocations for the final SEE summary tables.

The **Post-process and Summarize** script also exports emission rate tables so they are available for future use and/or analysis external to SEE. These exports include the on-network emission rates in the *ratePerDistance* table and the off-network rates in the *ratePerStart*, *ratePerHour*, *ratePerVehicle*, *ratePerProfile*, and *ratePerSHP* tables. Note that *ratePerStart*, *ratePerHour*, and *ratePerSHP* emission factors are duplicates of emission processes already covered in the *ratePerVehicle* report. As of November 2021, there are three new reports *ratePerDistance_aggregated*, *ratePerVehicle_aggregated*, and *ratePerProfile_aggregated*. The aggregated reports contain the emission factors summed over emission process ID and summed over hour ID into travel model time periods (e.g., AM, MD, PM, OV). All the exported rates are final rates that reflect the TxLED adjustments.

Table 5-3 lists the final output text files created by the **Post-process and Summarize** script, and

Table 5-4 shows the one final table used in a later script (**Export Link-Level Results**) for optional link output reporting.

Table 5-3. Post-process and Summarize Script’s Output Files and their Fate

| Final Output File from the Post-process and Summarize script | Purpose |
|---|--|
| Location: C:\SEE\LocalGen\ CTEmissHourlySummary.txt | The HourlyEmiss tab of the Excel export file |
| CTEmissDailySummary.txt | The DailyEmiss tab of the Excel export file |
| CTVMTHourlySummary.txt | The HourlyVMT tab of the Excel export file |
| CTVMTDailySummary.txt | The DailyVMT tab of the exported Excel file |
| SummaryTotals.txt | The Summary tab of the exported Excel file |
| offnetEmissions.txt | Generated for external QA of SEE output |
| linkEmissions.txt | Generated for external QA of SEE output |
| ratePerDistance.txt | On-network emission rates |
| ratePerDistance_aggregated.txt | On-network emission rates aggregated over |

| Final Output File from the Post-process and Summarize script | Purpose |
|---|---|
| Location: C:\SEE\LocalGen\ emission processes and hours | |
| ratePerStart.txt | Off-network start emission rates |
| ratePerHour.txt | Off-network extended idling emission rates |
| ratePerVehicle.txt | Off-network evaporative permeation and fuel leaks emission rates |
| ratePerVehicle_aggregated.txt | Off-network evaporative permeation and fuel leaks emission rates aggregated over emission process and hours |
| ratePerProfile.txt | Off-network evaporative fuel vapor venting emission rates |
| ratePerProfile_aggregated.txt | Off-network evaporative fuel vapor venting emission rates aggregated over emission process and hours |
| ratePerSHP.txt | Off-network evaporative emission rates per source hour parked |

Table 5-4. Post-process and Summarize Script's Final MySQL Tables and their Fate

| SEE Table Name | Next Used By | How Table is Used |
|---|---|---|
| where <i>SUMDB</i> = the summary database | | |
| <i>SUMDB</i> .linkSummaryTotals | Export Link-Level Results script | Export Link-Level Results: export link-level emissions |

5.11 Export Link-Level Results Script

The **Export Link-Level Results** script is an optional summarization script that is launched by the **Export Link-Level Results** button in the SEE GUI. The summary reports detailed emissions (by link, pollutant, process, source type, fuel type, and hour of the day) for a subset of links within a zone or group of zones. If you wish to export link-level results, you must select the "Compile link-level emissions" prior to running SEE. Then, enter one or more zones into the field under **Link-level export zones** within the **Output options** panel of the **GUI Home Screen**, then click the **Export link-level results** button. After up to approximately five minutes, the Excel file originally created in the **Post-process and Summarize** script will have a new

worksheet tab called `linkSummaryTotals` containing the additional detailed results.

The **Export Link-Level Results** script does not perform any new calculations; it simply queries a large SEE summary database table named *linkSummaryTotals* to extract results for a subset of link IDs. The **Export Link-Level Results** script does this in two steps, and the GUI then imports the output into the Excel results file. First, the **Export Link-Level Results** script determines which link IDs are requested by the user by using the input field from the GUI and cross referencing the user input zones with SEE's on-network database table *link_definitions*; the links that exist in the user's zones are stored in a new SEE summary database table named *linkIDsOfInterest*. Next, the **Export Link-Level Results** script exports results from *linkSummaryTotals* where the link ID matches the link ID contained in *linkIDsOfInterest*. The **Export Link-Level Results** script writes these results to the following file: C:\SEE\LocalGen\linkSummaryTotals.txt. Finally, the GUI imports this file as new spreadsheet tab in the file C:\SEE\LocalGen*GUI-Scenario-Name*_results.xlsx.

Table 5-5. Export Link-Level Results Script's Output Files and their Fate

| Final Output File from the Export Link-Level Results Script | |
|--|--|
| Location: C:\LocalGen\ linkSummaryTotals.txt | Purpose |
| | The link level output for the Excel results file |

6.0 Input Files

This section presents details on the input files that the user must provide, both for MOVES and SEE. Any files that SEE provides for MOVES are not mentioned here (after Table 6-1) because the user does not need to know how to format SEE intermediate files. The two tables below show which input files for MOVES the user must provide. Note that the *hotellingHours* and *starts* tables come from the TTI Utilities, and the user must multiply their values by 5 if modeling a weekday in SEE (or 2 for weekend). MOVES thinks all input *hotellingHours* and *starts* have already been scaled up by 5 or 2, and the model will reduce the vehicle activity by this amount (factor of 5 or 2) in the emissions inventory and activity outputs. If the user forgets this step, the outputs will be up to 5 times too low for all pollutant emissions from hoteling and starts.

One other data file, Source Hours Parked (SHP), also comes from the TTI Utilities. Unlike hoteling and starts, SHP is not an input for MOVES. SHP is discussed in Section 6.3 (Input File Formats for SEE).

Table 6-1. User vs. SEE Responsibilities for County Scale MOVES Inputs

| Database table name | Calculated by SEE | Provided by User | MOVES default | Default Location |
|----------------------------------|-------------------|------------------|---------------|--------------------------|
| <i>AVFT</i> | | X | | C:\SEE\TCEQ_MOVES_INPUTS |
| <i>avgSpeedDistribution</i> | | | X | C:\SEE\CSVInputs |
| <i>dayVMTfraction</i> | | | X | |
| <i>fuelUsageFraction</i> | | X | | C:\SEE\TCEQ_MOVES_INPUTS |
| <i>fuelFormulation</i> | | X | | C:\SEE\TCEQ_MOVES_INPUTS |
| <i>fuelSupply</i> | | X | | C:\SEE\TCEQ_MOVES_INPUTS |
| <i>hourVMTfraction</i> | | | X | C:\SEE\CSVInputs |
| <i>HPMSVtypeYear</i> | | | X | C:\SEE\CSVInputs |
| <i>IMcoverage</i> | | X | | C:\SEE\TCEQ_MOVES_INPUTS |
| <i>monthVMTfraction</i> | | | X | |
| <i>roadType</i> | X | | | C:\SEE\CSVInputs |
| <i>roadTypeDistribution</i> | | | X | C:\SEE\CSVInputs |
| <i>sourceTypeAgeDistribution</i> | | X | | C:\SEE\TCEQ_MOVES_INPUTS |

| Database table name | Calculated by SEE | Provided by User | MOVES default | Default Location |
|--------------------------------------|--------------------------|-------------------------|----------------------|--------------------------|
| <i>sourceTypeYear</i> | | | X | C:\SEE\TCEQ_MOVES_INPUTS |
| <i>zoneMonthHour</i> | | X | | C:\SEE\TCEQ_MOVES_INPUTS |
| <i>hotellingActivityDistribution</i> | | X | | C:\SEE\TCEQ_MOVES_INPUTS |
| <i>hotellingHours</i> | | X | | C:\SEE\TCEQ_MOVES_INPUTS |
| <i>starts</i> | | X | | C:\SEE\TCEQ_MOVES_INPUTS |

6.1 Input (Flexible) File Name Conventions

Most of SEE and MOVES's input files have new filenames which replace the longer, cumbersome names originally used during previous work on SEE during 2014. The goal of the new naming convention is to shorten file names while still including key identifiers such as the county code and year, where appropriate. In addition, the files may end with a wildcard, or any combination of letters, numbers, or symbols; SEE will still recognize them. Table 6-2 shows the filename conventions for MOVES input files and Table 6-3 show the names for SEE inputs. The asterisk symbol (*) indicates a wildcard.

Table 6-2. Flexible Filenames for MOVES

| MOVES Table Name | Filename, where <i>YR</i> = 4-digit year, <i>CTY</i> = County FIPS Code, and * = wildcard |
|--------------------------------------|--|
| <i>AVFT</i> | actualPopAVFT_ <i>YR</i> _ <i>CTY</i> *.csv |
| <i>fuelUsageFraction</i> | fuelUsageFraction*.csv |
| <i>fuelFormulation</i> | fuelFormulation_ <i>YR</i> *.csv |
| <i>fuelSupply</i> | <i>YR</i> _ <i>CTY</i> _fuelsupply*.csv |
| <i>IMcoverage</i> | <i>YR</i> _ <i>CTY</i> _imcoverage*.csv |
| <i>sourceTypeAgeDistribution</i> | <i>YR</i> _ <i>CTY</i> _sutage*.csv |
| <i>sourceTypeYear</i> | <i>YR</i> _ <i>CTY</i> _sourceTypeYear*.csv |
| <i>zoneMonthHour</i> | ZoneMonthHour*.csv |
| <i>county</i> | county_ <i>CTY</i> *.csv |
| <i>hotellingActivityDistribution</i> | hotellingActivityDistribution*.csv |
| <i>hotellingHours</i> | hotellingHours_ <i>YR</i> _ <i>DT</i> *.csv, where <i>DT</i> = Day type (WK for Weekday, or FR, SA, SU, etc.), must match the <i>DT</i> in filename C:\SEE\LOOKUPS\subDayType_ <i>DT</i> .txt |
| <i>starts</i> | starts_ <i>YR</i> _ <i>CTY</i> *.csv |

Table 6-3. Flexible Filenames for SEE

| SEE Table Name, where <i>ONDB</i> = the on-network database and <i>OFFDB</i> = the off-network database | Filename, where <i>YR</i> = 4-digit year, <i>CTY</i> = County FIPS Code, and * = wildcard |
|--|--|
| <i>OFFDB</i> .ExtIdle_Raw | ExtendedIdle_Capacity*.tab |
| <i>ONDB</i> _ <i>CTY</i> .RoadTypeLookup | RoadTypeLookup*.csv |
| <i>ONDB</i> _ <i>CTY</i> .SourceTypeAgeLookup | SourceTypeAgeLookup*.csv |
| <i>OFFDB</i> .TimePeriodLookup | TimePeriodLookup*.csv |
| <i>ONDB</i> _ <i>CTY</i> .SUTmix_ <i>CTY</i> _Lookup | <i>CTY</i> _ <i>YR</i> _VMT_Mix_STFTRT*.tab |
| <i>ONDB</i> _ <i>CTY</i> .CountyLookup | CountyLookup*.tab |
| <i>ONDB</i> _ <i>CTY</i> .SourceTypeAgeDistLookup_ <i>CTY</i> | <i>YR</i> _ <i>CTY</i> _sutage*.csv |
| <i>ONDB</i> _ <i>CTY</i> .HPMSVTypeYearLookup_ <i>CTY</i> | <i>CTY</i> _hpmsvtypeyear.csv |
| <i>OFFDB</i> .TxLEDLookup | TxLEDadjustments*.tab |
| <i>ONDB</i> .roadType | defaultRoadType.tab (no flexibility needed) |
| <i>ONDB</i> _ <i>CTY</i> .SHP | <i>YR</i> _ <i>CTY</i> _SHP*.tab |

6.2 Input File Formats for MOVES

This section describes the format requirements of each input file the user needs to provide for MOVES runs inside of SEE. The formats may not match those in the MOVES database, but they are the formats expected by MOVES data importers so that the model can read them correctly. The user also needs to provide input files for SEE (rather than MOVES) and these formats are discussed separately in Section 6.3.

Table 6-4. Format of AVFT Input

| Columns of the AVFT table | | |
|--|------------------|---|
| For more information, see Section 4.9 of the MOVES2014 Technical Guidance http://www3.epa.gov/otaq/models/moves/documents/420b15007.pdf | | |
| Field Name | Data Type | Comment |
| sourceTypeID | smallint(6) | Numeric value defining a MOVES source type (e.g., 11 for motorcycle) |
| modelYearID | smallint(6) | Numeric value identifying a model year. |
| fuelTypeID | smallint(6) | Identifies a basic kind of fuel used by SourceTypes: 1 = Gasoline 2 = Diesel Fuel 3 = Compressed Natural Gas (CNG) |
| engTechID | smallint(6) | Identifies an engine technology. |
| fuelEngFraction | double | Fraction that must sum to 1 for each combination of sourceTypeID and modelYearID |

6.2.1 AVFT Input File Versions

In the past SEE required two different versions of the AVFT table, but this is no longer the case. Only one set of AVFT tables should be supplied to SEE; otherwise, the QA checks will give an error message about duplicate files.

The AVFT files (naming convention `actualPopAVFT_YR_CTY*.csv`), should specify a vehicle mix that accurately reflects the actual population. These AVFT inputs can be derived from the age distribution (e.g., from a MOVES *sourceTypeAgeDistribution* table that reflects the actual population) combined with the total populations of gasoline and diesel vehicles by source type.

Table 6-5. Format of Fuel Formulation Input

| Columns of the Fuel Formulation Table | | |
|--|------------------|--|
| For more information, see Section 4.9 of the MOVES2014 Technical Guidance http://www3.epa.gov/otaq/models/moves/documents/420b15007.pdf | | |
| Field Name | Data Type | Comment |
| fuelFormulationID | smallint(6) | Numeric value to uniquely identify a fuel type. |
| fuelSubtypeID | smallint(6) | Identifies a particular kind of fuel within a FuelType. e.g. Gasoline may be conventional, or RFG, diesel may be conventional, biodiesel, Fischer-Troppe, etc. |
| RVP | float | Vapor pressure, expressed in psi. |
| sulfurLevel | float | sulfur content, expressed in ppm |
| ETOHVolume | float | Ethanol content, expressed in volume percentage |
| MTBEVolume | float | MTBE content, expressed in volume percentage |
| ETBEVolume | float | ETBE content, expressed in volume percentage |
| TAMEVolume | float | TAME content, expressed in volume percentage |
| aromaticContent | float | aromatic content, expressed as a volume percentage |
| olefinContent | float | olefin content, expressed as a volume percentage |
| benzeneContent | float | benzene content, expressed as a volume percentage |
| e200 | float | percentage vapor at 200 degrees F |
| e300 | float | percentage vapor at 300 degrees F |
| BioDieselEsterVolume | float | percent volume of biodiesel in diesel fuel |
| CetaneIndex | float | Not Used in MOVES2014 |

| Columns of the Fuel Formulation Table | | |
|--|------------------|--|
| For more information, see Section 4.9 of the MOVES2014 Technical Guidance http://www3.epa.gov/otaq/models/moves/documents/420b15007.pdf | | |
| Field Name | Data Type | Comment |
| PAHContent | float | Not Used in MOVES2014 |
| T50 | float | temperature in degrees F at which 50% of a sample of gasoline evaporates |
| T90 | float | temperature in degrees F at which 90% of a sample of gasoline evaporates |

Table 6-6. Format of Fuel Supply Input

| Columns of the Fuel Supply Table | | |
|--|------------------|--|
| For more information, see Section 4.9 of the MOVES2014 Technical Guidance http://www3.epa.gov/otaq/models/moves/documents/420b15007.pdf | | |
| Field Name | Data Type | Comment |
| fuelRegionID | int(11) | Identifies the fuel region code of the county being modeled. |
| fuelYearID | smallint(6) | Identifies a year for which fuel supply data has been entered in the FuelSupply table. (May be used by multiple calendar years.) |
| monthGroupID | smallint(6) | Numeric value of 1-12 and the value <i>must match the SEE GUI Month ID</i> |
| fuelFormulationID | smallint(6) | Numeric value to identify a fuel type and it must have a corresponding entry for the fuelFormulationID in the Fuel Formulation table. |
| marketShare | float | Decimal Fraction of the supply of this fuel type which this fuel formulation constitutes. Market shares must sum to 1 over fuel subtype. |
| marketShareCV | float | Not Used in MOVES2014 |

Table 6-7. Format of Fuel Usage Fraction Input

| Columns of the Fuel Usage Fraction Table For more information, see Section 4.9 of the MOVES2014 Technical Guidance http://www3.epa.gov/otaq/models/moves/documents/420b15007.pdf | | |
|---|------------------|---|
| Field Name | Data Type | Comment |
| countyID | int(11) | 1000* FIPS state code + FIPS county identification code. |
| fuelYearID | int(11) | Identifies a year for which fuel supply data has been entered in the FuelSupply table. (May be used by multiple calendar years.) |
| modelYearGroupID | int(11) | Identifies a model year group. Use zero for a placeholder to indicate all model years. |
| sourceBinFuelTypeID | smallint(6) | Identifies the type of fuel the engine is capable of using: 1 = Gasoline 2 = Diesel Fuel 3 = Compressed Natural Gas (CNG) 5 = Flex Fuel (E85 or Gasoline) |
| fuelSupplyFuelTypeID | smallint(6) | Identifies the type of fuel: 1 = Gasoline 2 = Diesel Fuel 3 = Compressed Natural Gas (CNG) 5 = Ethanol (E85) |
| usageFraction | double | A fraction with value between 0 and 1. The usage fractions must sum to 1 over each combination of countyID, fuelYearID, modelYearGroupID, and sourceBinFuelTypeID. |

Table 6-8. Format of I/M Coverage Input

| Columns of the I/M Coverage Table For more information, see Section 4.10 of the MOVES2014 Technical Guidance http://www3.epa.gov/otaq/models/moves/documents/420b15007.pdf | | |
|---|-------------|--|
| Field Name | Data Type | Comment |
| polProcessID | smallint(6) | 100*pollutantID + processID Set of valid combinations is determined by rows in this table. |
| stateID | smallint(6) | FIPS state identification code. |
| countyID | int(11) | 1000* FIPS state code + FIPS county identification code. |
| yearID | smallint(6) | An actual calendar year. <i>This must match the SEE GUI calendar year</i> |
| sourceTypeID | smallint(6) | Numeric value defining a MOVES source type (e.g., 11 for motorcycle) |
| fuelTypeID | smallint(6) | Identifies the type of fuel: 1 = Gasoline 2 = Diesel Fuel 3 = Compressed Natural Gas (CNG) 5 = Ethanol (E85) |
| IMProgramID | smallint(6) | Numeric value to uniquely identify the application of an IM program to a set of model years. |
| inspectFreq | smallint(6) | "1" means annual "2" means biennial "3" means continuous |
| testStandardsID | smallint(6) | Numeric value corresponding to one of 13 exhaust emissions tests or 7 evaporative tests available in MOVES2014. |
| begModelYearID | smallint(6) | Numeric value identifying a model year. |
| endModelYearID | smallint(6) | Numeric value identifying a model year. |
| useIMyn | char(1) | "Y" means I/M program is in effect "N" means I/M program is turned off |

| Columns of the I/M Coverage Table | | |
|---|------------------|--|
| For more information, see Section 4.10 of the MOVES2014 Technical Guidance http://www3.epa.gov/otaq/models/moves/documents/420b15007.pdf | | |
| Field Name | Data Type | Comment |
| complianceFactor | float | Decimal fraction to indicate the I/M compliance rates, waiver rates and the regulatory class adjustment. |

Table 6-9. Format of Age Distribution Input

| Columns of the Source Type Age Distribution Table | | |
|--|------------------|---|
| For more information, see Section 4.4 of the MOVES2014 Technical Guidance http://www3.epa.gov/otaq/models/moves/documents/420b15007.pdf | | |
| Field Name | Data Type | Comment |
| sourceTypeID | smallint(6) | Numeric value defining a MOVES source type (e.g., 11 for motorcycle) |
| yearID | smallint(6) | An actual calendar year. <i>This must match the SEE GUI calendar year</i> |
| ageID | smallint(6) | Identifies a SourceUseType age category. Values from 0 to 30. 0 = new 1 = one year old 2 = two years old ... 30 = thirty or more years old |
| ageFraction | float | Fraction of total domain SourceUseType population which, in a given calendar year, are a given age. (A set of these elements is sometimes often referred to informally as a "registration distribution".) |

Table 6-10. Format of Vehicle Population Input

| Columns of the Population (Source Type Year) Table For more information, see Section 4.3 of the MOVES2014 Technical Guidance http://www3.epa.gov/otaq/models/moves/documents/420b15007.pdf | | |
|---|-------------|---|
| Field Name | Data Type | Comment |
| yearID | smallint(6) | An actual calendar year. <i>This must match the SEE GUI calendar year</i> |
| sourceTypeID | smallint(6) | Numeric value defining a MOVES source type (e.g., 11 for motorcycle) |
| sourceTypePopulation | float | The total population in the county of a SourceUseType in the calendar year. |

Table 6-11. Format of Meteorology Input

| Columns of the Meteorology (Zone Month Hour) Table For more information, see Section 4.2 of the MOVES2014 Technical Guidance http://www3.epa.gov/otaq/models/moves/documents/420b15007.pdf | | |
|---|-------------|---|
| Field Name | Data Type | Comment |
| monthID | smallint(6) | Numeric value of 1-12 and <i>the value must match the SEE GUI Month ID</i> |
| zoneID | int(11) | Identifies a zone. Use the county ID * 10. |
| hourID | smallint(6) | Numeric value of 1-24. |
| temperature | float | Units of degrees Fahrenheit. |
| relHumidity | float | The ratio of the amount of water vapor in the air at a specific temperature to the maximum amount that the air could hold at that temperature, expressed as a percentage. |

Table 6-12. Format of County Input

| Columns of the County Table This is not a typically required input for a MOVES Run. | | |
|---|------------------|--|
| Field Name | Data Type | Comment |
| countyID | int(11) | 1000* FIPS state code + FIPS county identification code. |
| stateID | smallint(6) | Two digit FIPS state code. |
| countyName | char(50) | Text string up to 50 characters long. |
| altitude | char(1) | Valid entries are “H” for high altitude or “L” for low altitude. |
| GPAFract | float | The geographic phase-in area (GPA) is an area around the Rocky Mountains where the Federal Tier 2 sulfur control program was implemented on a delayed schedule. Enter a value of 0 for Texas counties. |
| barometricPressure | float | Barometric pressure in units of inches mercury |
| barometricPressureCV | float | Not used in MOVES2014. |

Table 6-13. Format of Hotelling Activity Distribution Input

| Columns of the Hotelling Activity Distribution Table For more information, see Section 4.13 of the MOVES2014 Technical Guidance http://www3.epa.gov/otaq/models/moves/documents/420b15007.pdf Additional helpful information is available on PDF page 40 of the MOVES2014a User Interface Manual: http://www3.epa.gov/otaq/models/moves/documents/420b15094.pdf | | |
|---|------------------|--|
| Field Name | Data Type | Comment |
| beginModelYearID | smallint(6) | Numeric value identifying a model year. |
| endModelYearID | smallint(6) | Numeric value identifying a model year. |
| opModeID | smallint(6) | Code that identifies the operating mode. The relevant ones for this input are: 200=Extended Idling (i.e., using the Main Engine) 201=Hotelling Diesel Aux 203=Hotelling Battery AC 204=Hotelling APU Off |
| opModeFraction | float | Fraction between 0 and 1 that should sum to 1 over operating mode IDs for a given set of beginModelYearID and endModelYearID. |

Note that Hotelling Hours must be scaled up by a factor of 5 (if modeling a weekday) or factor of 2 (if modeling a weekend) prior to input into MOVES. MOVES will reduce the hoteling activity by these factors during the run.

Table 6-14. Format of Hotelling Hours Input

| Columns of the Hotelling Hours Table | | |
|---|------------------|---|
| For more information, see Section 4.13 of the MOVES2014 Technical Guidance http://www3.epa.gov/otaq/models/moves/documents/420b15007.pdf | | |
| Additional helpful information is available on PDF page 40 of the MOVES2014a User Interface Manual: http://www3.epa.gov/otaq/models/moves/documents/420b15094.pdf | | |
| Field Name | Data Type | Comment |
| hourDayID | smallint(6) | Combination of an hour (of any day) and a day (of any week). Ids are of the form hhd where hh is the hourID and d is the dayID |
| monthID | smallint(6) | Numeric value of 1-12 and <i>the value must match the SEE GUI Month ID</i> |
| yearID | smallint(6) | An actual calendar year. <i>This must match the SEE GUI calendar year</i> |
| ageID | smallint(6) | Identifies a SourceUseType age category. Values from 0 to 30. 0 = new 1 = one year old 2 = two years old ... 30 = thirty or more years old |
| zoneID | smallint(6) | Identifies a zone. Use the county ID * 10. |
| sourceTypeID | smallint(6) | Numeric value defining a MOVES source type (e.g., 11 for motorcycle) |
| hotellingHours | double | The number of hotelling hours for the entire week for the hourDay type, month, year, ageID, and zone. If weekday the hotelling hours should represent hours*5 (5 weekdays in a week) or hours*2 (for 2 weekend days in a week). |

Note that Starts must be scaled up by a factor of 5 (if modeling a weekday) or factor of 2 (if modeling a weekend) prior to input into MOVES. MOVES will reduce the hoteling activity by these factors during the run.

Table 6-15. Format of Starts Input

| Columns of the Starts Table For more information, see Section 4.12 of the MOVES2014 Technical Guidance http://www3.epa.gov/otaq/models/moves/documents/420b15007.pdf Additional helpful information is available on PDF page 41 of the MOVES2014a User Interface Manual: http://www3.epa.gov/otaq/models/moves/documents/420b15094.pdf | | |
|--|-------------|--|
| Field Name | Data Type | Comment |
| hourDayID | smallint(6) | Combination of an hour (of any day) and a day (of any week). Ids are of the form hhd where hh is the hourID and d is the dayID |
| monthID | smallint(6) | Numeric value of 1-12 and <i>the value must match the SEE GUI Month ID</i> |
| yearID | smallint(6) | An actual calendar year. <i>This must match the SEE GUI calendar year</i> |
| ageID | smallint(6) | Identifies a SourceUseType age category. Values from 0 to 30. 0 = new 1 = one year old 2 = two years old ... 30 = thirty or more years old |
| zoneID | int(11) | Identifies a zone. Use the county ID * 10. |
| sourceTypeID | smallint(6) | Numeric value defining a MOVES source type (e.g., 11 for motorcycle) |
| starts | float | The number of starts that occur for a sourcetype-age combination within all hour/day of a week in the month in the year in the zone. The “Starts” field is the number of starts within a weekly hour/day slot, not the starts within a normal 24hour day’s hour. Similar to hotellngHours field in the HotellingHours table, if you are modeling a weekday the starts should represent starts*5 (5 weekdays in a week) or starts*2 (for 2 weekend days in a week). |
| startsCV | float | Not used by MOVES2014. |

6.3 Input File Formats for SEE

This section describes the format requirements of each input file the user needs to provide to SEE, excluding direct MOVES model inputs which were described above (Section 6.2).

Table 6-16. Format of SEE's Input County Lookup

| Columns of the CountyLookup*.tab file | | |
|---------------------------------------|-----------|--|
| where * = wildcard | | |
| (in C:\SEE\LOOKUPS) | | |
| Field Name | Data Type | Comment |
| County Code | Integer | County code in the TRANSVMT files; values currently used are 1-8. |
| County FIPS | Integer | 5-digit FIPS (e.g., 48201) that corresponds to each County Code in TRANSVMT. |
| County Name | Text | County name (e.g., Harris). This field is not used by SEE. |

Table 6-17. Format of SEE's Input Dummy Speed

| Columns of the DummySpeed*.tab file | | |
|-------------------------------------|-----------|--|
| where * = wildcard | | |
| (in C:\SEE\LOOKUPS) | | |
| Field Name | Data Type | Comment |
| sourceTypeID | Integer | Numeric value defining a MOVES source type (e.g., 11 for motorcycle) |
| roadTypeID | Integer | Road types are 2-5. |
| hourDayID | Integer | hourID*10+dayID |
| avgSpeedBinID | Integer | Speed bin IDs are 1-16. |

| Columns of the DummySpeed*.tab file | | |
|---|------------------|--|
| <p>where * = wildcard</p> <p>(in C:\SEE\LOOKUPS)</p> | | |
| Field Name | Data Type | Comment |
| avgSpeedFraction | 0 | Value is always 0. This is a dummy file. |

Table 6-18. Format of SEE's Extended Idle Allocation

| Columns of the ExtendedIdle_Capacity*.tab file | | |
|---|------------------|---|
| <p>where * = wildcard</p> <p>(in C:\SEE\LOOKUPS)</p> | | |
| Field Name | Data Type | Comment |
| County FIPS | Integer | 5-digit code (e.g., 48201) |
| TAZ | Integer | Transportation Analysis Zone |
| Parking capacity | Integer | Number of Overnight Truck Parking Spaces in the TAZ |

Table 6-19. Format of SEE's Input Road Type Lookup

| Columns of the RoadtypeLookup*.tab file | | |
|---|-----------|--|
| where * = wildcard | | |
| (in C:\SEE\LOOKUPS) | | |
| Field Name | Data Type | Comment |
| Road Type Code | Integer | Road type code of each link from the TRANSVMT files. Past values have included: 1, 2, 3, 4, 5, 6, 7, 8, 10, 11, 12, 13, 14, 15, 40 |
| Area Type Code | Integer | Area type code of each link from the TRANSVMT files. Past values have included: 1, 2, 3, 4, 5, 40 |
| MOVES roadTypeID | Integer | Corresponding MOVES2010b road type ID. Values can only be 2, 3, 4, or 5. |

Table 6-20. Format of SEE's Input Time Period Lookup

| Columns of the TimePeriodLookup*.tab file | | |
|---|-------------|--|
| where * = wildcard | | |
| (in C:\SEE\LOOKUPS) | | |
| Field Name | Data Type | Comment |
| Hour ID | Integer | Hour of Day, 1-24. |
| Description of Time Period | Varchar(20) | Text description up to 20 characters. This field is not used by SEE. |
| Time Period ID | Char(2) | Must be a two-character description of the time period (e.g., AM, MD, PM, OV—or suggested O1, O2 if there are two overnight periods) |

Table 6-21. Format of SEE's Input VMT Mix

| Columns of the CTY_YR_VMT_Mix_STFTRT*.tab file | | |
|--|------------------|--|
| <p>where CTY = County FIPS Code, YR = 4-digit year and and * = wildcard (in C:\SEE\LOOKUPS)</p> | | |
| Field Name | Data Type | Comment |
| roadTypeID | Integer | Numeric value defining a MOVES road type. Values can be 2, 3, 4, or 5. |
| dayType | Char(2) | WK for weekday; FR for Friday; SA for Saturday; or SU for Sunday |
| dayTypeID | Integer | 5 for weekday; 2 for weekend |
| hourID | Integer | Hour of Day, 1-24. |
| dayPeriod | Char(2) | OV for overnight; AM for morning; MD for mid-day; or PM for evening |
| sourceTypeID | Integer | Numeric value defining a MOVES source type (e.g., 11 for motorcycle) |
| fuelTypeID | Integer | Numeric value identifying a type of fuel used by SourceTypes: 1 = Gasoline 2 = Diesel Fuel 3 = Compressed Natural Gas (CNG) |
| SUTMix | Double Precision | Decimal fraction for each combination of source and fuel type, must sum to 1 over each road type. |

Table 6-22. Format of SEE's Input TxLED Adjustments

| Columns of the TxLEDadjustments*.tab file | | |
|---|------------------|---|
| where * = wildcard | | |
| (in C:\SEE\LOOKUPS) | | |
| Field Name | Data Type | Comment |
| yearID | Integer | An actual calendar year. <i>This must include the SEE GUI calendar year</i> |
| sourceTypeID | Integer | Numeric value defining a MOVES source type (e.g., 11 for motorcycle) |
| Adjustment Factor | Double Precision | Numeric value between 0 and 1. SEE multiplies this factor with diesel-fueled NOx emissions. A value of "0" will result in a 100% NOx reduction; a value of "1" will result in 0% NOx reduction (no change). |

Table 6-23. Format of SEE's Default Road Type

| Columns of the defaultRoadType.tab file | | |
|---|-----------|---|
| (in C:\SEE\LOOKUPS) | | |
| Field Name | Data Type | Comment |
| roadTypeID | Integer | Value must be 2 and 4 on separate rows. |
| Fraction | Float | Initial default value of 0.08. SEE will update this value based on the actual fraction of ramp VMT. |

Table 6-24. Format of SEE’s Input Source Type Age Lookup

| Columns of the SourceTypeAgeLookup*.tab file | | |
|--|-----------|---|
| where * = wildcard | | |
| (in C:\SEE\LOOKUPS) | | |
| Field Name | Data Type | Comment |
| ageID | Integer | Identifies a SourceUseType age category. Values from 0 to 30. 0 = new 1 = one year old 2 = two years old ... 30 = thirty or more years old |
| sourceTypeID | Integer | Numeric value defining a MOVES source type (e.g., 11 for motorcycle) |
| survivalRate | Double | SEE doesn’t use this field. |
| relativeMAR | Double | Relative Mileage Accumulation Rate should be a fraction between 0 and 1. The annual per vehicle mileage accumulation for a given SourceUseType and Age, relative to the highest annual mileage accumulation rate within the HPMSVtype. |
| functioningACFraction | Double | SEE doesn’t use this field. |
| functioningACFractionCV | Double | SEE doesn’t use this field. |

Table 6-25. Format of SEE's SHP Lookup

| Columns of the CTY_YR_SHP* .csv file | | |
|---|-----------|--|
| <p>where CTY = County FIPS Code, YR = 4-digit year and and * = wildcard (in C:\SEE\LOOKUPS)</p> | | |
| Field Name | Data Type | Comment |
| sourceTypeID | Integer | Numeric value defining a MOVES source type (e.g., 11 for motorcycle) |
| fuelTypeID | Integer | Numeric value identifying a type of fuel used by SourceTypes: 1 = Gasoline 2 = Diesel Fuel 3 = Compressed Natural Gas (CNG) |
| hourID | Integer | Hour of Day, 1-24. |
| SHP | double | Total source hours parked by source type, fuel type, and hour |

7.0 Output Files

This section briefly describes the output files from the model.

7.1 Excel output file

SEE automatically produces an Excel spreadsheet at the end of each run, with the naming convention C:\SEE\LocalGen*GUI-Scenario-Name*_results.xlsx. The scenario name embedded in the results spreadsheet is the same that the user provides in the GUI. The spreadsheet has five tabs by default, or six if you select the optional link-level results after the run completes. The five core summaries in the results spreadsheet are the following:

1. HourlyEmiss
2. DailyEmiss
3. HourlyVMT

4. DailyVMT

5. Summary

If you decide to extract link-level results from the SEE simulation, a sixth tab will become available in the results spreadsheet. For instructions on how to use the link-level outputs feature, refer to Section 4.1.12. After SEE completes the link output extraction, it adds the following newtab to the results file:

6. linkSummaryTotals

The 'HourlyEmiss' and 'DailyEmiss' emissions summaries contain fields of: year ID, month ID, day ID (5 = Weekday), hour ID (for 'HourlyEmiss' tab only), county ID, fuel type ID, pollutant ID, road Type ID, and 13 columns corresponding to the 13 MOVES source types. The emissions in the source type columns are in units of kilograms.

The VMT summary table fields are: county ID, fuel type ID, road type ID, hour ID (for 'HourlyVMT' only), and 13 source type columns where the VMT is in units of miles.

The 'Summary' sheet contains total on-road emissions by county in units of kilograms.

The 'linkSummaryTotals' sheet has the fields county ID, SEE link ID, Anode, Bnode, hour ID, source type ID, fuel type ID, road type ID, pollutant ID, process ID, and emissionsKG. The emissions units are kilograms.

7.2 Emission factors

SEE exports the emission rates tables from MOVES to text files so they can be used for additional off-model analysis or future reference. These rates are after the TxLED adjustments are applied. The tables are exported to C:\SEE\LocalGen\ *GUI-Scenario-Name_tableName.txt*.

The tables exported are:

1. ratePerDistance
2. ratePerDistance_aggregated
3. ratePerStart
4. ratePerHour (hotelng)
5. ratePerProfile (fuel vapor venting, per vehicle)
6. ratePerProfile_aggregated
7. ratePerVehicle (fuel leaks and permeation, per vehicle)

8. ratePerVehicle_aggregated
9. ratePerSHP (fuel vapor venting, leaks, and permeation, per source hour parked)

As discussed in section 5.8, the MOVES output tables *ratePerDistance*, *ratePerStart*, and *ratePerHour* are already in terms of rate per activity, which is the form that SEE requires for emissions calculations. The *ratePerSHP* table is a table derived by SEE from the *ratePerProfile* and *ratePerVehicle* tables, which are not in terms of rate per activity.

8.0 Quality Assurance of SEE

To verify and validate the output of SEE, we used the emissions budget prepared for the *Houston-Galveston Brazoria Attainment Demonstration State Implementation Plan Revision for the 2008 Eight-Hour Ozone Standard Nonattainment Area* (<https://www.tceq.texas.gov/airquality/sip/hgb/hgb-latest-ozone>). Specifically, we compared the emissions totals generated by SEE to the emissions inventory described in Appendix B of this report. The quality assurance (QA) goal was exact agreement with the values reported for VMT, CO, NO_x, and VOC in Table 3-4 of this report, i.e., agreement out to two decimal places on a tons per day basis. The target values, which SEE reproduces exactly, are shown in Table 8-1.

Table 8-1. VMT and Emissions by County for 2017 HGB Inventory

| County | VMT | CO (tpd) | NOx (tpd) | VOC (tpd) |
|------------|-------------|----------|-----------|-----------|
| Brazoria | 8,047,857 | 37.61 | 4.99 | 3.27 |
| Chambers | 3,217,165 | 12.35 | 4.51 | 0.76 |
| Fort Bend | 13,198,265 | 58.05 | 7.62 | 5.32 |
| Galveston | 6,157,335 | 28.95 | 3.31 | 2.40 |
| Harris | 117,215,490 | 487.25 | 61.50 | 35.93 |
| Liberty | 2,632,844 | 13.02 | 2.62 | 1.11 |
| Montgomery | 15,475,728 | 62.37 | 9.11 | 4.96 |
| Waller | 1,895,008 | 8.92 | 1.88 | 0.65 |
| Total | 167,839,692 | 708.52 | 95.56 | 54.40 |