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| State of Maine |
| MOVES2014a Nonroad Emissions Inventory Development Methodology |
| Tons per Summer Day Emissions Results Using Default Data |

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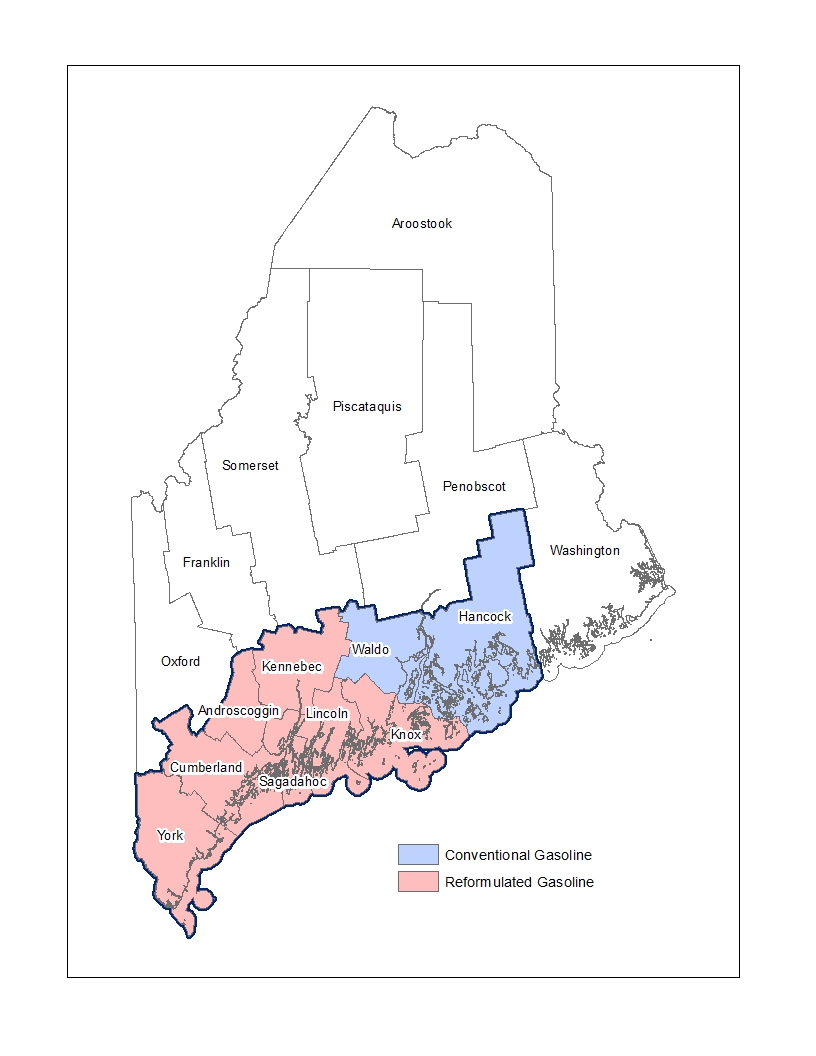
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**1 INTRODUCTION**

**The** Bureau of Air Quality (BAQ) within the Maine Department of Environmental Protection (DEP) is responsible for maintaining and operating the Environmental Protection Agency’s Motor Vehicle Emissions Simulator1 (MOVES) model. The model was used to develop a nitrogen oxide (NOx) and volatile organic compound (VOC) emissions inventory for a typical July ozone season day for nonroad mobile sources to support Maine’s request to discontinue the use of reformulated gasoline statewide by June 1, 2019.

This emissions inventory analysis was performed on counties where RFG is sold (Androscoggin, Cumberland, Kennebec, Knox, Lincoln, Sagadahoc, and York) and two adjourning coastal counties (Hancock, Waldo) where conventional gasoline (CG) is allowed (Figure 1) to document how emissions change over time when RFG is no longer used as a control measure for air quality purposes.

Figure 1.



This demonstration compares NOx and VOC emissions inventories for several years where RFG is used as a control measure and future years where Maine is requesting to use CG statewide (Table 1).

Table 1. Emissions Inventory Analysis Years by Fuel Type

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **County** | **County ID** | **2015** | **2017** | | **2019** | **2019** | | **2023** | |
| Androscoggin | 23001 | RFG | RFG | | RFG | *CG* | | *CG* | |
| Cumberland | 23005 | RFG | RFG | | RFG | *CG* | | *CG* | |
| *Hancock* | *23009* | *CG* | *CG* | | *CG* | *CG* | | *CG* | |
| Kennebec | 23011 | RFG | RFG | | RFG | *CG* | | *CG* | |
| Knox | 23013 | RFG | RFG | | RFG | *CG* | | *CG* | |
| Lincoln | 23015 | RFG | RFG | | RFG | *CG* | | *CG* | |
| Sagadahoc | 23023 | RFG | RFG | | RFG | *CG* | | *CG* | |
| *Waldo* | *23027* | *CG* | *CG* | | *CG* | *CG* | | *CG* | |
| York | 23031 | RFG | RFG | | RFG | *CG* | | *CG* | |
| RFG = Reformulated Gasoline | | | | CG = Conventional Gasoline | | |  | |  | |

This methodology supplements other MOVES documentation, guidance, and tools provided by EPA, including2:

* The MOVES User Guide for MOVES2014;
* MOVES2014 and MOVES2014a Technical Guidance; Using MOVES to prepare Emissions Inventories for State Implementation Plans and Transportation Conformity
* Data processing tools and converters developed by EPA available on their web site.

**2 METHODOLOGY**

The MOVES2014a version of the model was used to generate the nonroad emission results. Emissions inventory inputs for County Databases (CDB) are not required to run the model. Each MOVES2014a run was operated in the national inventory mode to generate NOx and VOC emissions results for all years and counties. All fuels and nonroad sector combinations were selected for each modeling event for July weekdays. The emission output detail defaults were selected to provide emissions in grams per mile for a 24-hour day by county. More details about the run selection are addressed later in the MOVES2014a Run Spec Information section.

The MOVES default database (movesdb20161117) contained much of the emissions inventory inputs required to run the model. For the RFG OPT-OUT analysis, the Nonroad Data Importer (NDI) was used to import local fuel data representing the proposed changes and meteorological conditions to generate the emissions results.

Local inputs were compiled using data from recent National Emissions Inventory compilations (NEI), the MOVES2014a default database (movesdb20161117), and fuel reports provide by Maine’s terminals.

For the inventory compilations identified in Table 2, the fuel supply, and fuel formulations tables were changed for the proposed modeling demonstration. The meteorology inputs were used for all modeling years. The meteorological table is not adjusted to reflect future conditions, it remains constant for all years in the RFG OPT-OUT analysis. It should also be noted that the same gasoline formulations and meteorology conditions were applied to the onroad emissions modeling. The default fuel formulations were taken directly from the MOVES2014a default database (movesdb20161117) for the remaining nonroad fuel types (diesel, propane etc.).

Table 2.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **NONROAD RFG OPT-OUT INVENTORY COMPILATIONS** | | | | | | | |
| **Nonroad Data Importer Tab** Input table | **Build for each year** | **EPA 2011 MET** | **Requires adjustments for each inventory year** | | | | |
| **2015 7.0 RFG** | **2017 7.0 RFG** | **2019 7.0 RFG** | **2019 8.8 CG** | **2023 8.8 CG** |
| **Fuel** |  |  |  |  |  |  |  |
| FuelSupply | x |  | Y | Y | Y | Y | Y |
| FuelFormulation | x |  | Y | Y | Y | Y | Y |
| **Meteorology Data** |  |  |  |  |  |  |  |
| zoneMonthHour |  | x | N | N | N | N | N |

The fuel formulations for the gasoline compilations that best represented local conditions were selected from MOVES2014a default database (movesdb20161117). Maine currently uses reformulated or conventional gasoline blended with 10% ethanol also known as Gasohol (E-10). Limits applied to the fuel volatility properties Reid Vapor Pressure (RVP) in the fuel formulations are used as control measures to regulate emissions. Effective June 1, 2015 a retailer who sells gasoline in York, Cumberland, Sagadahoc, Androscoggin, Kennebec, Knox, or Lincoln County may sell only RFG with a RVP less than 7.8 pounds per square inch (psi) in those counties year-round between May 1, and September 15. All other counties must have an RVP less than or equal to 9.0 psi during the same period.

For this modeling demonstration, Maine selected fuel formulations that represent fuels that are currently sold. Terminals are required to report on the amounts of fuel sold with several fuel properties to our agency on a quarterly basis. Weighted averages for each of the fuel properties were compiled and matched to an existing fuel formulation in the MOVES2014a default table. While the regulatory limit for RVP for Hancock and Waldo County is as high as 9.0 psi, the best representative fuel formulation contains an RVP of 8.8 psi. The formulation chosen for the remaining counties is 7.0 psi based upon the reports obtained from the terminals. The RVP for summertime Reformulated Gasohol (E-10) blends are generally much lower than Conventional Gasohol (E-10) blends. The 7.0 psi RVP formulation was approved by EPA before the modeling runs were conducted. The RVP limits for each county for the years required for the modeling demonstration are noted in Table 3. More details about the fuel inputs required for this demonstration are addressed later in the MOVES2014 Input Development section.

The remaining table imported into the NDI is the zoneMonthHour table representing the meteorology for a typical ozone day. The most complete set of Maine specific meteorological data for temperature and relative humidity available came from the EPA 2011 National Emissions Inventory System (NEI). More details about the meteorological inputs required for this demonstration are addressed later in the MOVES2014a Input Development section.

Table 3. Fuel Formulation RVP limits.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **County** | **County ID** | **2015 RFG RVP Sulfur**  **(30 ppm)** | **2017 RFG RVP Sulfur**  **(10 ppm)** | **2019 RFG RVP Sulfur**  **(10 ppm)** | **2019 CG RVP Sulfur**  **(10 ppm)** | **2023 CG RVP Sulfur**  **(10 ppm)** |
| Androscoggin | 23001 | 7 | 7 | 7 | 8.8 | 8.8 |
| Cumberland | 23005 | 7 | 7 | 7 | 8.8 | 8.8 |
| *Hancock* | *23009* | *8.8* | *8.8* | *8.8* | *8.8* | *8.8* |
| Kennebec | 23011 | 7 | 7 | 7 | 8.8 | 8.8 |
| Knox | 23013 | 7 | 7 | 7 | 8.8 | 8.8 |
| Lincoln | 23015 | 7 | 7 | 7 | 8.8 | 8.8 |
| Sagadahoc | 23023 | 7 | 7 | 7 | 8.8 | 8.8 |
| *Waldo* | *23027* | *8.8* | *8.8* | *8.8* | *8.8* | *8.8* |
| York | 23031 | 7 | 7 | 7 | 8.8 | 8.8 |

The FuelSupply, FuelFormulation, and zoneMonthHour tables were compiled for each year and county to create the input databases for each modeling run. Each MOVES run was constructed with the individual county input databases. One output database file was used for all 9 counties, allowing each result to append to the same database, limiting the amounts of files needed for post processing activities. More details about the files are addressed later in the MOVES2014a RUN FILES section.

The outputs were generated in grams per mile for a July summer day. A decoding script was run on the output database to generate a decodedmovesoutput table. The decodedmovesoutput table was exported to an excel worksheet where the emissions processes were summed together for each pollutant. A conversion factor was used to convert grams to tons to complete the post processing activities.

**3 MOVES2014a RUN SPEC INFORMATION**

**Nonroad National Inventory**

**FILE NAME:** YYYY\_STCTY\_nrTPSD\_xpsi\_mmddyy.mrs

**SCALE**- Nonroad/National/Inventory 🡨MOVES2014a defaults to the national scale

**TIME SPAN**– Day/YYYY/ Weekdays/July 🡨MOVES2014a defaults to day aggregation for the time level

**GEOGRAPHIC BOUNDS**- County

**VEHICLES/EQUIPMENT**-All fuels and sectors selected

**FUELS** **SECTORS**

Compressed Natural Gas (CNG) Agriculture Logging

Gasoline Airport Support Oil Field

Liquefied Petroleum Gas (LPG) - Oil Field Commercial Pleasure Craft

Marine Diesel Fuel Construction Railroad

Nonroad Diesel Fuel Industrial Recreational

Lawn/Garden Underground Mining

**ROAD TYPE**- Not applicable

**POLLUTANTS AND PROCESSES**-

VOC- and all prerequisites selected

NOX- and all prerequisites selected

**MANAGE INPUT DATA SETS**

Not applicable

**OUTPUT**

**GENERAL OUTPUT**

**Output database name:** YYYY\_xxG\_nrTPSD\_xpsi\_mmddyy\_ou

**Units-** Grams/Joules/Miles

**\*OUTPUT EMISSIONS DETAIL- Defaults**

**Always-** Time 24-Hour Day **On Road/Off Road** On Road/Off Road

Location County **On and Off Road** None selected

Pollutant **Off Road** None selected

**For All Vehicle/Equipment Categories**

None selected

**\*These are all defaults; no boxes are checked off in the OUTPUT Emissions Detail panel.**

***NOTE: An individual run spec file and input database is created for every county for each year modeled per fuel allocation. All 9 county runs append to one output database (YYYY\_xxG\_nrTPSD\_xpsi\_mmddyy\_ou) file to limit the number of files used for post processing activities.***

**4 MOVES2014a RUN FILES**

One run spec file and input file was created for each county. To limit the number of files to manage and track, a single MOVES2014a output database file was created to append all the results for the fuel type year.

**Nonroad National County Inventory Run –**

YYYY\_STCTY\_nrTPSD\_xpsi\_mmddyy.mrs

YYYY\_STCTY\_nrTPSD\_xpsi\_mmddyy\_in

YYYY\_xxG\_nrTPSD\_xpsi\_mmddyy\_ou

YYYY- Year represented

STCTY- State and County code

nrTPSD- code indicating that the outputs are intended to represent Nonroad Tons per Summer Day

xpsi- code the RVP psi limit for the fuel formulation

xxG- code for the gasoline blend (RFG or CG)

mmddyy- date field for the date that the run occurred

mrs- extension for the MOVES2014a run spec file

in-code for an input database

ou- code for and output database

The following naming convention was used to track the run files, input, and output databases. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**2015 REFORMULATED GASOLINE MODELING RUN FILES**

**MOVES RUN SPEC FILE NAME:** **INPUT DATABASE FILE NAME:**

2015\_23001\_nrTPSD\_7.0psi\_011918.mrs 2015\_23001\_nrTPSD\_7.0psi\_011918\_in

2015\_23005\_nrTPSD\_7.0psi\_011918.mrs 2015\_23005\_nrTPSD\_7.0psi\_011918\_in

2015\_23009\_nrTPSD\_9.0psi\_011918.mrs 2015\_23009\_nrTPSD\_9.0psi\_011918\_in

2015\_23011\_nrTPSD\_7.0psi\_011918.mrs 2015\_23011\_nrTPSD\_7.0psi\_011918\_in

2015\_23013\_nrTPSD\_7.0psi\_011918.mrs 2015\_23013\_nrTPSD\_7.0psi\_011918\_in

2015\_23015\_nrTPSD\_7.0psi\_012218.mrs 2015\_23015\_nrTPSD\_7.0psi\_012218\_in

2015\_23023\_nrTPSD\_7.0psi\_012218.mrs 2015\_23023\_nrTPSD\_7.0psi\_012218\_in

2015\_23027\_nrTPSD\_9.0psi\_012218.mrs 2015\_23027\_nrTPSD\_9.0psi\_012218\_in

2015\_23031\_nrTPSD\_7.0psi\_012218.mrs 2015\_23031\_nrTPSD\_7.0psi\_012218\_in

COUNTIES (001,005,009,011,013) EMISSIONS RESULTS APPENDED TO 2015\_rfg\_nrtpsd\_7psi\_011918\_ou

COUNTIES (015,023,027,031) EMISSIONS RESULTS APPENDED TO 2015\_rfg\_nrtpsd\_7psi\_012218\_ou

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**2017 REFORMULATED GASOLINE MODELING RUN FILES**

**MOVES RUN SPEC FILE NAME:** **INPUT DATABASE FILE NAME:**

2017\_23001\_nrTPSD\_7.0psi\_011818.mrs 2017\_23001\_nrTPSD\_7.0psi\_011818\_in

2017\_23005\_nrTPSD\_7.0psi\_011818.mrs 2017\_23005\_nrTPSD\_7.0psi\_011818\_in

2017\_23009\_nrTPSD\_9.0psi\_011818.mrs 2017\_23009\_nrTPSD\_9.0psi\_011818\_in

2017\_23011\_nrTPSD\_7.0psi\_011818.mrs 2017\_23011\_nrTPSD\_7.0psi\_011818\_in

2017\_23013\_nrTPSD\_7.0psi\_011818.mrs 2017\_23013\_nrTPSD\_7.0psi\_011818\_in

2017\_23015\_nrTPSD\_7.0psi\_011818.mrs 2017\_23015\_nrTPSD\_7.0psi\_011818\_in

2017\_23023\_nrTPSD\_7.0psi\_011818.mrs 2017\_23023\_nrTPSD\_7.0psi\_011818\_in

2017\_23027\_nrTPSD\_9.0psi\_011818.mrs 2017\_23027\_nrTPSD\_9.0psi\_011818\_in

2017\_23031\_nrTPSD\_7.0psi\_011818.mrs 2017\_23031\_nrTPSD\_7.0psi\_011818\_in

ALL COUNTY EMISSIONS RESULTS APPENDED TO 2017\_rfg\_nrtpsd\_7psi\_011918\_ou

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**2019 REFORMULATED GASOLINE MODELING RUN FILES**

**MOVES RUN SPEC FILE NAME:** **INPUT DATABASE FILE NAME:**

2019\_23001\_nrTPSD\_7.0psi\_011818.mrs 2019\_23001\_nrTPSD\_7.0psi\_011818\_in 2019\_23005\_nrTPSD\_7.0psi\_011818.mrs 2019\_23005\_nrTPSD\_7.0psi\_011818\_in

2019\_23009\_nrTPSD\_9.0psi\_011818.mrs 2019\_23009\_nrTPSD\_9.0psi\_011818\_in

2019\_23011\_nrTPSD\_7.0psi\_011818.mrs 2019\_23011\_nrTPSD\_7.0psi\_011818\_in

2019\_23013\_nrTPSD\_7.0psi\_011818.mrs 2019\_23013\_nrTPSD\_7.0psi\_011818\_in

2019\_23015\_nrTPSD\_7.0psi\_011818.mrs 2019\_23015\_nrTPSD\_7.0psi\_011818\_in

2019\_23023\_nrTPSD\_7.0psi\_011818.mrs 2019\_23023\_nrTPSD\_7.0psi\_011818\_in

2019\_23027\_nrTPSD\_9.0psi\_011818.mrs 2019\_23027\_nrTPSD\_9.0psi\_011818\_in

2019\_23031\_nrTPSD\_7.0psi\_011818.mrs 2019\_23031\_nrTPSD\_7.0psi\_011818\_in

ALL COUNTY EMISSIONS RESULTS APPENDED TO 2019\_rfg\_nrtpsd\_7psi\_011818\_ou

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**2019 CONVENTIONAL GASOLINE MODELING RUN FILES**

**MOVES RUN SPEC FILE NAME:** **INPUT DATABASE FILE NAME:**

2019\_23001\_nrTPSD\_9.0psi\_011818.mrs 2019\_23001\_nrTPSD\_9.0psi\_011818\_in

2019\_23005\_nrTPSD\_9.0psi\_011818.mrs 2019\_23005\_nrTPSD\_9.0psi\_011818\_in

2019\_23009\_nrTPSD2\_9.0psi\_011818.mrs 2019\_23009\_nrTPSD\_9.0psi\_011818\_in

2019\_23011\_nrTPSD\_9.0psi\_011818.mrs 2019\_23011\_nrTPSD\_9.0psi\_011818\_in

2019\_23013\_nrTPSD\_9.0psi\_011818.mrs 2019\_23013\_nrTPSD\_9.0psi\_011818\_in

2019\_23015\_nrTPSD\_9.0psi\_011818.mrs 2019\_23015\_nrTPSD\_9.0psi\_011818\_in

2019\_23023\_nrTPSD\_9.0psi\_011818.mrs 2019\_23023\_nrTPSD\_9.0psi\_011818\_in

2019\_23027\_nrTPSD2\_9.0psi\_011818.mrs 2019\_23027\_nrTPSD\_9.0psi\_011818\_in

2019\_23031\_nrTPSD\_9.0psi\_011818.mrs 2019\_23031\_nrTPSD\_9.0psi\_011818\_in

ALL COUNTY EMISSIONS RESULTS APPENDED TO 2019\_cg\_nrtpsd\_9psi\_011818\_ou

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**2023 CONVENTIONAL GASOLINE MODELING RUN FILES**

**MOVES RUN SPEC FILE NAME:** **INPUT DATABASE FILE NAME:**

2023\_23001\_nrTPSD\_9.0psi\_011918.mrs 2023\_23001\_nrTPSD\_9.0psi\_011918\_in

2023\_23005\_nrTPSD\_9.0psi\_011918.mrs 2023\_23005\_nrTPSD\_9.0psi\_011918\_in

2023\_23009\_nrTPSD\_9.0psi\_011918.mrs 2023\_23009\_nrTPSD\_9.0psi\_011918\_in

2023\_23011\_nrTPSD\_9.0psi\_011918.mrs 2023\_23011\_nrTPSD\_9.0psi\_011918\_in

2023\_23013\_nrTPSD\_9.0psi\_011918.mrs 2023\_23013\_nrTPSD\_9.0psi\_011918\_in

2023\_23015\_nrTPSD\_9.0psi\_011918.mrs 2023\_23015\_nrTPSD\_9.0psi\_011918\_in

2023\_23023\_nrTPSD\_9.0psi\_011918.mrs 2023\_23023\_nrTPSD\_9.0psi\_011918\_in

2023\_23027\_nrTPSD\_9.0psi\_011918.mrs 2023\_23027\_nrTPSD\_9.0psi\_011918\_in

2023\_23031\_nrTPSD\_9.0psi\_011918.mrs 2023\_23031\_nrTPSD\_9.0psi\_011918\_in

ALL COUNTY EMISSIONS RESULTS APPENDED TO 2023\_cg\_nrtpsd\_9psi\_011918\_ou

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The YYYY\_STCTY\_nrTPSD\_xpsi\_mmddyy.mrs, YYYY\_STCTY\_nrTPSD\_xpsi\_mmddyy\_in, and YYYY\_xxG\_nrTPSD\_xpsi\_mmddyy\_ou files are contained in the MOVES\_RUNS YYYY\_xxG folders.

**5 MOVES2014a INPUT DEVELOPMENT**

The following documents how the input databases were constructed to build the modeling run files for

* Applying regulatory fuel formulations for RFG (RVP = 7.0 psi) or CG (RVP = 8.8 psi) containing 10% ethanol (E-10) for 30 parts per million (ppm) sulfur limits for 2015, 10 ppm sulfur limits for remaining years.
* Applying 2011 meteorology data compiled by EPA from the 2014 NEI platform.

The following describes the methodologies used for compiling the inventories for the 3 input tables for all counties for each nonroad national scale inventory modeling run. A listing of the input files used for the MOVES2014a modeling runs are provided in Appendix A.

**5.1 FUEL TYPE TABLES**

Fuels are regulated through federal laws, state statutes, and department regulations. All together they govern the use of fuel properties to control pollution in areas with ambient air quality issues. Most fuel properties are regulated federally at the refineries or terminals. The MOVES2014a defaults contain formulations that were derived from sampling data EPA collected from Petroleum Administration Defense Districts (PADD) throughout the United States. Users are expected to export the default tables and modify them based upon local regulatory conditions.

The fuel tables for nonroad include (FuelSupply, FuelFormulation).

* “The FuelSupply table identifies the formulation used in the region and each of the formulations market share;
* The FuelFormulation defines the fuel properties (Reid Vapor Pressure (RVP), sulfur level, ethanol volume, etc.) of each fuel; “3

For the RFG OPT-OUT modeling analysis, both fuel tables were utilized and applied to the national scale inventory runs. Existing regulatory action that factored into how the fuel tables were selected include the following...

* Effective on January 1, 2007, Methyl Tertiary Butyl Ether (MTBE) was banned in Maine. The volume of the oxygenate (MTBE) in Maine fuels was set to zero. After the MTBE ban, ethanol was gradually added to the gasoline formulations. By 2008, all of Maine’s terminals were reporting the volume of ethanol for blending as 10 percent. All ethanol blended gasolines (RFG or CG) are reported as Gasohol (E-10) in the MOVES fuel sub type descriptions. Fuel supplies were selected based upon the blends approved for each modeling event.
* Effective on June 1, 2015 a retailer who sells gasoline in York, Cumberland, Sagadahoc, Androscoggin, Kennebec, Knox, or Lincoln County may sell only RFG with a RVP less than 7.8 psi in those counties year-round between May 1, and September 15. All other counties must have an RVP no greater than 9.0 psi during the same period. There are no RVP limits in any county during the remaining months. Fuel formulations were selected based upon the RVP limits that were allowed for each modeling event.
* On January 1, 2017 EPA’s Tier 3 fuel rule went into effect reducing the sulfur content in Maine’s gasoline from 30 ppm to 10 ppm or less. The national regulatory sulfur level for diesel remained at 15 ppm or less. Fuel formulations were selected based upon the sulfur contents that applied to the years for each modeling event.
* In January 2011, the Mobile Sources Air Toxic Rule went into effect. For the MSAT gasoline fuel program, beginning January 1, 2011, refiners must meet an annual average gasoline benzene content standard of 0.62 volume percent (Vol%) for all gasoline, both reformulated and conventional, nationwide. The fuel formulations were selected based upon the benzene content as it pertains to the MSAT rule.
* On January 21, 2011, EPA approved the use of Gasohol (E-15) in model years 2001 to 2006 cars and light trucks. EPA also announced that no waiver is being granted for its use in any motorcycles, heavy-duty vehicles, or non-road engines because current testing data does not support such a waiver. These partial waivers do not require the use of Gasohol (E-15), they simply allow terminals and retail facilities the freedom to provide this product for sale. There are strict labeling requirements for retail facilities selling Gasohol (E-15) to ensure the consumer does not use this fuel in vehicles not specifically allowed under these waivers. Maine does not have any retailers offering Gasohol (E-15) for sale. The market share for Gasohol (E-15) was set to zero.

To analyze emissions for a future year, EPA’s Technical Guidance suggests changing the Reid Vapor Pressure (RVP) values to reflect the regulatory requirements in the area being modeled. Fuel formulations within the MOVES2014a databases that matched closely to Maine’s existing fuel formulations and proposed changes were selected for the modeling runs. Selections were specific to the use of RFG, CG, RVP, Sulfur content, and the volume of Benzene contained in the formulation based upon information collected from Maine’s terminals. All terminals who sell gasoline in Maine are required to report to the department on a quarterly basis. The reports contain the volumes of sales within each region as well as the fuel properties. The weighted averages for the fuel properties were used to determine local fuel formulations. The RFG fuel property weighted averages for 2015 and 2016 are noted in Table 4. The CG fuel property weighted averages for 2015 and 2016 are noted in Table 5.

Table 4. Reformulated Gasoline Fuel Property Weighted Averages Summer Blends

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Weighted average for the summer fuels (RFG) used in Maine's Southern Counties.  Selection based on an RVP </= 6.90 psi before ethanol is added.** | | | | | | | | | | | |
|  | **2015** | **2016** |  | **2015** | **2016** |  | **2015** | **2016** |  | **2015** | **2016** |
| **Month** | **RVP (psi)** | **RVP (psi)** |  | **BENZ (% Vol)** | **BENZ (% Vol)** |  | **ARO (% Vol)** | **ARO (% Vol)** |  | **SULF (ppm)** | **SULF (ppm)** |
| May | 6.07 | 6.34 |  | 0.5293 | 0.4083 |  | 20.49 | 22.10 |  | 23.16 | 17.16 |
| June | 6.33 | 6.13 |  | 0.5633 | 0.5283 |  | 23.14 | 22.50 |  | 24.34 | 17.65 |
| July | 5.96 | 6.22 |  | 0.4931 | 0.4950 |  | 22.04 | 21.51 |  | 26.55 | 18.88 |
| August | 6.36 | 5.80 |  | 0.5583 | 0.5572 |  | 23.90 | 23.15 |  | 24.83 | 20.01 |
| **\*May-August** | **6.18** | **6.12** |  | **0.54** | **0.50** |  | **22.39** | **22.31** |  | **24.72** | **18.43** |
| \*Note: When ethanol is added to the blend the RVP is expected to increase by approximately 1.0 psi. | | | | | | | | | | | |

Table 5. Conventional Gasoline Fuel Property Weighted Averages Summer Blends

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Weighted average for the summer fuels (CG) used in Maine's Northern Counties.  Selection based on an RVP > 6.90 psi before ethanol is added.** | | | | | | | | | | | |
|  | **2015** | **2016** |  | **2015** | **2016** |  | **2015** | **2016** |  | **2015** | **2016** |
| **Month** | **RVP (psi)** | **RVP (psi)** |  | **BENZ (% Vol)** | **BENZ (% Vol)** |  | **ARO (% Vol)** | **ARO (% Vol)** |  | **SULF (ppm)** | **SULF (ppm)** |
| May | 7.75 | 7.44 |  | 0.4968 | 0.6445 |  | 18.58 | 22.99 |  | 19.47 | 16.04 |
| June | 7.65 | 7.43 |  | 0.4713 | 0.5714 |  | 20.68 | 20.53 |  | 16.34 | 17.22 |
| July | 7.40 | 7.45 |  | 0.5160 | 0.5651 |  | 22.08 | 22.08 |  | 22.39 | 15.60 |
| August | 7.65 | 7.44 |  | 0.6015 | 0.6099 |  | 22.44 | 21.24 |  | 22.44 | 17.48 |
| **\*May-August** | **7.61** | **7.44** |  | **0.52** | **0.60** |  | **20.94** | **21.71** |  | **20.16** | **16.59** |
| \*Note: When ethanol is added to the blend the RVP is expected to increase by approximately 1.0 psi. | | | | | | | | | | | |

The RVP for both gasoline blends represent weighted averages before ethanol is added. Ethanol increases the RVP by approximately 1.0 psi. Maine’s terminals are meeting all RVP regulatory requirements where the Southern Counties are using RFG with RVP </= 7.8 psi and the Northern Counties are using CG with RVP </= 9.0 psi. The benzene and sulfur contents are also meeting all regulatory requirements. The fuel data also documents how the refineries are gradually starting to decrease the sulfur content from 30 ppm to 10 ppm by 2017. For this modeling demonstration, 2017 fuel data was not available and selections were made based upon the intended sulfur contents for future years.

Maine selected MOVES default fuel supply formulations that best represented local conditions. The best available RVP limits for Gasohol (E-10) blends with the proper sulfur and benzene contents was 7 psi for RFG and 8.8 psi for CG. All gasoline blended with 15% ethanol (Gasohol (E-15)) formulations were omitted in the formulation tables. Gasohol (E-10) was set to represent 100% of the market share in the fuel supply tables for all years and all counties. Gasohol (E-15) is not distributed in Maine. Tables 6-9 include the market share fractions used for the modeling runs.

Table 6. Fuel Supply Market Share for 2015 Modeling Runs for Reformulated Blends

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **2015 Fuel Supply Table Sulfur 30ppm Representing RFG Allocations** | | | | |
| fuelRegionID | monthGroupID | fuelFormulationID | marketShare | marketShareCV |
| 100010000 | 7 | 3204 | 1 | 0.5 |
| 100010000 | 7 | 20008 | 1 | 0.5 |
| 100010000 | 7 | 26012 | 1 | 0.5 |
| 100010000 | 7 | 28001 | 1 | 0.5 |
| 100010000 | 7 | 29001 | 1 | 0.5 |
| 178010000 | 7 | 3201 | 1 | 0.5 |
| 178010000 | 7 | 20008 | 1 | 0.5 |
| 178010000 | 7 | 26012 | 1 | 0.5 |
| 178010000 | 7 | 28001 | 1 | 0.5 |
| 178010000 | 7 | 29001 | 1 | 0.5 |

Table 7. Fuel Supply Market Share for 2017 Modeling Runs for Reformulated Blends

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **2017 Fuel Supply Table Sulfur 10ppm Representing RFG Allocations** | | | | |
| fuelRegionID | monthGroupID | fuelFormulationID | marketShare | marketShareCV |
| 100010000 | 7 | 3462 | 1 | 0.5 |
| 100010000 | 7 | 20008 | 1 | 0.5 |
| 100010000 | 7 | 26012 | 1 | 0.5 |
| 100010000 | 7 | 28001 | 1 | 0.5 |
| 100010000 | 7 | 29001 | 1 | 0.5 |
| 178010000 | 7 | 3459 | 1 | 0.5 |
| 178010000 | 7 | 20008 | 1 | 0.5 |
| 178010000 | 7 | 26012 | 1 | 0.5 |
| 178010000 | 7 | 28001 | 1 | 0.5 |
| 178010000 | 7 | 29001 | 1 | 0.5 |

Table 8. Fuel Supply Market Share for 2019 Modeling Runs for Reformulated Blends

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **2019 Fuel Supply Table Sulfur 10ppm Representing RFG Allocations** | | | | |
| fuelRegionID | monthGroupID | fuelFormulationID | marketShare | marketShareCV |
| 100010000 | 7 | 3462 | 1 | 0.5 |
| 100010000 | 7 | 20008 | 1 | 0.5 |
| 100010000 | 7 | 26013 | 1 | 0.5 |
| 100010000 | 7 | 28001 | 1 | 0.5 |
| 100010000 | 7 | 29001 | 1 | 0.5 |
| 178010000 | 7 | 3459 | 1 | 0.5 |
| 178010000 | 7 | 20008 | 1 | 0.5 |
| 178010000 | 7 | 26013 | 1 | 0.5 |
| 178010000 | 7 | 28001 | 1 | 0.5 |
| 178010000 | 7 | 29001 | 1 | 0.5 |

Table 9. Fuel Supply Market Share for 2019 and 2023 Modeling Runs for Conventional Blends

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **2019/2023 Fuel Supply Table Sulfur 10ppm Representing CG Allocations** | | | | |
| fuelRegionID | monthGroupID | fuelFormulationID | marketShare | marketShareCV |
| 100010000 | 7 | 3462 | 1 | 0.5 |
| 100010000 | 7 | 20008 | 1 | 0.5 |
| 100010000 | 7 | 26013 | 1 | 0.5 |
| 100010000 | 7 | 28001 | 1 | 0.5 |
| 100010000 | 7 | 29001 | 1 | 0.5 |
| 178010000 | 7 | 3462 | 1 | 0.5 |
| 178010000 | 7 | 20008 | 1 | 0.5 |
| 178010000 | 7 | 26013 | 1 | 0.5 |
| 178010000 | 7 | 28001 | 1 | 0.5 |
| 178010000 | 7 | 29001 | 1 | 0.5 |

The fuel supply gasoline formulations selected for the modeling that best represent local conditions are presented in Table 10 as fuelSubtypeID = 12. The remaining formulations in the table represent Nonroad Diesel, Marine Diesel, Compressed Natural Gas, and Liquefied Petroleum Gas. These are the MOVES default formulations.

Table 10. MOVES Default Fuel Formulation Selections for the RFG OPT-OUT analysis

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **fuelFormulationID** | **fuelSubtypeID** | **RVP** | **sulfurLevel** | **ETOHVolume** | **MTBEVolume** | **ETBEVolume** | **TAMEVolume** | **aromaticContent** | **olefinContent** | **benzeneContent** | **e200** | **e300** | **BioDieselEsterVolume** | **CetaneIndex** | **PAHContent** | **T50** | **T90** |
| 3201 | 12 | 7 | 30 | 10 | 0 | 0 | 0 | 23.23 | 12.52 | 0.61 | 44.63 | 79.56 | 0 | 0 | 0 | 212.59 | 342.86 |
| 3204 | 12 | 8.8 | 30 | 10 | 0 | 0 | 0 | 23.23 | 12.52 | 0.61 | 46.9 | 80.45 | 0 | 0 | 0 | 207.97 | 338.77 |
| 3459 | 12 | 7 | 10 | 10 | 0 | 0 | 0 | 20.89 | 11.93 | 0.61 | 45.49 | 79.82 | 0 | 0 | 0 | 208.94 | 343.85 |
| 3462 | 12 | 8.8 | 10 | 10 | 0 | 0 | 0 | 20.89 | 11.93 | 0.61 | 47.76 | 80.72 | 0 | 0 | 0 | 204.31 | 339.77 |
| 20008 | 23 | 0 | 11 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 26012 | 24 | 0 | 56 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 26013 | 24 | 0 | 55 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 28001 | 30 | 0 | 7.6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 29001 | 40 | 0 | 7.6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

All input development files and supporting documentation are provided with this analysis. The Methods Fuel folder contains additional files and references used for constructing fuel Supply, and formulation tables. The default runs to export default tables are included in the Build folder. Additional information pertaining to the fuel year are contained in the Local info folder along with the methodology files for building the tables (Fuels Data 2015.xlsx, Fuels Data 2016.xlsx, Maine Fuel Properties.xlsx, MOVES2014 FUEL SUPPLY Tables.doc). The fuel tables and procedure for the build are contained in the NRFUELBuild.xlsx and PROCEDURES TO BUILD NONROAD FUEL SUPPLY AND FORMULATIONS.docx files.

**5.1.1 FuelSupply** – Represents the NDI input table used to identify the fuel formulation used in the county. MOVES default fuel supplies were selected that best represented the regulatory fuel formulations applied to each modeling year. Default fuel supply information included Nonroad Diesel, Marine Diesel, Compressed Natural Gas, and Liquefied Petroleum Gas. Inputs used for the NDI are provided in the CGnrFuelSupply and RFGnrFuelSupply worksheet in the NRFUELbuild.xlsx file located in the INPUTS folder.

**5.1.2 FuelFormulation** – Represents the NDI input table used to define the properties of the fuel. MOVES default fuel formulations were selected that best represented the regulatory fuel formulations applied to each modeling year. Default formulations are included for Nonroad Diesel, Marine Diesel, Compressed Natural Gas, and Liquefied Petroleum Gas. Inputs used for the NDI are provided on the FuelFormulation\_All worksheet in the NRFUELbuild.xlsx file located in the INPUTS folder.

**5.2 METEOROLOGY**

The most complete set of Maine specific meteorological data for temperature and relative humidity data was available in the EPA 2011 National Emissions Inventory System (NEI). The 2011 NEI MOVES2014 formatted county databases (CDB) were downloaded on 01/04/2016 by using logon credentials to log into the Emissions Inventory System (EIS) Gateway. The database was found in the CDB Activity Data/EPA Default/2014 folder. The downloaded (Maine 2015-05-05 12:19PM 24,779 Onroad) file containing the zip file cdb\_state\_dataset was saved to the desktop where the county databases were extracted to the cdb\_state\_dataset folder. The files were then loaded into the MySQL Program data directory where the zoneMonthHour tables for each of the batch edited databases were exported to excel files to represent the meteorological inputs for all RFG OPT-OUT analysis years.

The zoneMonthHour table containing (24) hourly temperature and relative humidity values for a typical summer day for each month were applied to each national inventory scale run. The hourly temperatures are contained in Table 11. The relative humidity is contained in Table 12.

Table 11. County Hourly Temperatures

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Maine Typical Summer Day Hourly Temperatures by County** | | | | | | | | | | |
| **monthID** | **hourID** | **23001** | **23005** | **23009** | **23011** | **23013** | **23015** | **23023** | **23027** | **23031** |
| 7 | 1 | 63.7 | 65 | 62.6 | 63.3 | 63.6 | 63.8 | 63.3 | 62.8 | 64.2 |
| 7 | 2 | 62.6 | 63.9 | 61.5 | 62 | 62.8 | 62.7 | 62.3 | 61.5 | 63.3 |
| 7 | 3 | 61.6 | 62.8 | 60.6 | 61 | 62.2 | 62 | 61.2 | 60.6 | 61.8 |
| 7 | 4 | 60.8 | 62.1 | 59.9 | 60.3 | 61.6 | 61.2 | 60.4 | 59.9 | 61.1 |
| 7 | 5 | 60 | 61.4 | 59 | 59.4 | 60.6 | 60.4 | 59.7 | 59 | 60.5 |
| 7 | 6 | 60.1 | 61.5 | 59.4 | 59.5 | 60.8 | 60.6 | 59.8 | 59.4 | 60.8 |
| 7 | 7 | 63 | 64.7 | 62.7 | 62.7 | 64.1 | 63.7 | 63.2 | 62.6 | 64.9 |
| 7 | 8 | 67 | 68.7 | 66.2 | 66.3 | 67.8 | 67.5 | 67.4 | 66.4 | 69.3 |
| 7 | 9 | 71 | 72.6 | 69.8 | 70 | 71.4 | 71.1 | 71.3 | 70.1 | 73.2 |
| 7 | 10 | 74.3 | 75.8 | 72.9 | 73.6 | 74.1 | 74.1 | 74.5 | 73.5 | 76.5 |
| 7 | 11 | 76.9 | 78.3 | 75.6 | 76.4 | 76.5 | 76.4 | 76.9 | 76.3 | 79.2 |
| 7 | 12 | 78.7 | 80 | 77.7 | 78.6 | 78.2 | 78.1 | 78.6 | 78.3 | 80.7 |
| 7 | 13 | 80.1 | 81.2 | 79.1 | 80.1 | 79.2 | 79.2 | 79.8 | 79.6 | 82.1 |
| 7 | 14 | 80.7 | 81.8 | 79.9 | 80.8 | 79.5 | 79.9 | 80.5 | 80.4 | 82.8 |
| 7 | 15 | 81.4 | 82.3 | 80.5 | 81.4 | 80 | 80.3 | 80.9 | 81 | 83.1 |
| 7 | 16 | 81.5 | 82.1 | 80.5 | 81.7 | 79.9 | 80.1 | 80.7 | 81 | 83 |
| 7 | 17 | 80.4 | 81.2 | 79.6 | 80.8 | 79 | 79.2 | 79.7 | 80.3 | 82.1 |
| 7 | 18 | 79.3 | 80 | 78.4 | 79.6 | 77.7 | 78 | 78.4 | 78.9 | 80.7 |
| 7 | 19 | 76.8 | 77.5 | 76 | 76.6 | 75.6 | 75.7 | 76 | 76.3 | 77.9 |
| 7 | 20 | 73.6 | 74.4 | 72.1 | 73.1 | 72.5 | 72.4 | 72.6 | 72.5 | 74.6 |
| 7 | 21 | 69.9 | 71 | 68.7 | 69.8 | 69.3 | 69.3 | 69.3 | 69.1 | 70.9 |
| 7 | 22 | 67.8 | 69 | 66.7 | 67.5 | 67.7 | 67.3 | 67.2 | 67 | 68.7 |
| 7 | 23 | 66.1 | 67.3 | 65 | 65.8 | 66 | 65.8 | 65.4 | 65.3 | 66.6 |
| 7 | 24 | 65 | 66.2 | 63.7 | 64.5 | 64.8 | 64.8 | 64.5 | 64 | 65.6 |

Table 12. County Hourly Relative Humidity

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Maine Typical Summer Day Hourly relHumidity by County** | | | | | | | | | | |
| **monthID** | **hourID** | **23001** | **23005** | **23009** | **23011** | **23013** | **23015** | **23023** | **23027** | **23031** |
| 7 | 1 | 83.8 | 82.7 | 82.2 | 81.4 | 82.3 | 83.5 | 83.1 | 81.9 | 83.8 |
| 7 | 2 | 85.8 | 84.7 | 83.9 | 83.1 | 83.7 | 85.2 | 84.9 | 83.9 | 84.6 |
| 7 | 3 | 87 | 86.1 | 85.4 | 84.5 | 84.9 | 86.4 | 86.4 | 85.4 | 87 |
| 7 | 4 | 88.2 | 87 | 86.3 | 85.7 | 85.1 | 87.3 | 87.3 | 86 | 87.9 |
| 7 | 5 | 88.8 | 87.9 | 87.2 | 86.3 | 86.3 | 88.2 | 87.9 | 86.9 | 88.9 |
| 7 | 6 | 88.8 | 88 | 87.2 | 86.9 | 85.7 | 88.2 | 88.2 | 86.9 | 88.6 |
| 7 | 7 | 85.5 | 84.1 | 83.4 | 83.1 | 83.5 | 84.7 | 84.3 | 83.4 | 83.5 |
| 7 | 8 | 79.1 | 77.5 | 77.9 | 78.2 | 77.7 | 78.3 | 77.4 | 77.9 | 76.2 |
| 7 | 9 | 71.2 | 69.8 | 71.3 | 71.3 | 71 | 70.7 | 69.7 | 71.1 | 68 |
| 7 | 10 | 63.9 | 62.5 | 65.3 | 64.7 | 65.7 | 64.1 | 62.8 | 64.5 | 61.1 |
| 7 | 11 | 57 | 56.4 | 60.1 | 58.5 | 60.7 | 58.3 | 57 | 58.9 | 55.1 |
| 7 | 12 | 52.9 | 52.7 | 55.9 | 54 | 56.7 | 54 | 52.9 | 54.8 | 51.4 |
| 7 | 13 | 50.2 | 50.5 | 52.8 | 51.1 | 54.5 | 51.3 | 50.2 | 51.9 | 48.9 |
| 7 | 14 | 49.2 | 49.6 | 51.2 | 49.8 | 53.2 | 50.2 | 49 | 50.8 | 47.8 |
| 7 | 15 | 48.1 | 48.9 | 50.1 | 48.6 | 52.2 | 49.5 | 48.7 | 49.6 | 47.5 |
| 7 | 16 | 48.5 | 49.6 | 50.4 | 48.8 | 53.1 | 50.4 | 49.7 | 50 | 48.3 |
| 7 | 17 | 50.4 | 51.1 | 51.4 | 50.3 | 53.9 | 52.1 | 51.6 | 50.9 | 49.9 |
| 7 | 18 | 52.6 | 53.5 | 53.3 | 52.5 | 56.3 | 54 | 53.6 | 52.9 | 52.6 |
| 7 | 19 | 57.4 | 58.1 | 57.7 | 57.5 | 60.1 | 58.4 | 58.3 | 57.5 | 57.7 |
| 7 | 20 | 64.7 | 64.6 | 64.8 | 64 | 66.5 | 66 | 65.3 | 64.4 | 64.9 |
| 7 | 21 | 72.1 | 71.7 | 70.9 | 69.5 | 72 | 72.5 | 72 | 70.2 | 72.4 |
| 7 | 22 | 76.4 | 75.1 | 74.7 | 73.4 | 75.3 | 76.6 | 76 | 74.1 | 75.9 |
| 7 | 23 | 79.8 | 78.8 | 77.8 | 76.7 | 78.4 | 79.8 | 79.5 | 77.5 | 79.9 |
| 7 | 24 | 81.8 | 81 | 80.2 | 78.9 | 80.6 | 81.5 | 81.2 | 79.7 | 81.5 |

Methods for predicting or projecting future meteorological conditions are not available. The most recent and reliable meteorological data is normally applied to future years. This set of meteorological data was applied to all years for the modeling analysis.

All input development files and supporting documentation are provided with this analysis. The Methods MET folder contains additional files and references used for constructing the zoneMonthHour table (M14\_All2011NEI\_County\_zoneMonthHour.xlsx, 2011\_NEI\_v2\_EIS, README.txt).

**5.2.1 zoneMonthHour–** Represents the NDI input table used to import meteorological data for a national scale inventory run. The zoneMonthHour table from the 2011 National Emissions Inventory containing (24) hourly temperature and relative humidity values for a typical summer day for each month were used for all years for county inputs. While each table contains data inputs for all twelve months, the MOVES2014a model uses what is needed for July, ignoring the remaining months. Inputs used for the NDI are provided in the STCTYzoneMonthHour worksheets in the M14\_All2011NEI\_County\_zoneMonthHour.xlsx file located in the INPUTS folder.

**6 MOVES2014 OUTPUT POST PROCESSING ACTIVITIES**

After each MOVES run was completed, the DecodeMOVESOutput.sql script was selected from the MOVES2014a post processing menu to create an output table that contains descriptive fields (decodedmovesoutput). It is more convenient to work with tables containing descriptive fields when performing post processing activities. After the last county run was saved to the output database, each output database file was opened within the MySQL Query Browser to locate the decodedmovesoutput table and export it to a Microsoft Excel (.csv) file.

The following naming convention was used to track the exported tables from the MOVES2014a output databases. Each Decodedmovesoutput table was exported as a (.csv) file using the same naming convention of the output database.

**County Inventory Output database - Decodedmovesoutput table exported file name-**

YYYY\_xxG\_nrTPSD\_xpsi\_mmddyy\_ou YYYY\_xxG\_nrTPSD\_xpsi\_mmddyy.csv

The following contains a list of the output databases and exported tables used for the modeling runs.

**County Inventory Output database - Decodedmovesoutput table exported file name**

2015\_rfg\_nrtpsd\_7psi\_011918\_ou 2015\_rfg\_nrtpsd\_7psi\_011918.csv

2015\_rfg\_nrtpsd\_7psi\_012218\_ou 2015\_rfg\_nrtpsd\_7psi\_012218.csv

2017\_rfg\_nrtpsd\_7psi\_011918\_ou 2017\_rfg\_nrtpsd\_7psi\_011918.csv

2019\_rfg\_nrtpsd\_7psi\_011818\_ou 2019\_rfg\_nrtpsd\_7psi\_011818.csv

2019\_cg\_nrtpsd\_9psi\_011818\_ou 2019\_cg\_nrtpsd\_9psi\_011818.csv

2023\_cg\_nrtpsd\_9psi\_011918\_ou 2023\_cg\_nrtpsd\_9psi\_011918.csv

The output databases and (.csv) files are contained in the MOVES\_RUNS YYYY\_xxG folders.

The (.csv) files were converted into Microsoft Excel files for post processing activities where the emissions processes were summed together by pollutant. All MOVES2014a emissions results representing grams per summer day were multiplied by (1.10E-06 or 0.00000110231) to convert grams to tons. Results from these files were used to build the report tables displayed in the results section of this report. The OUTPUTS folder contains all the YYYY\_xxG\_nrTPSD\_xpsi\_mmddyy.xlsx files used for conducting the post processing activities to generate the results.

**7 RESULTS**

MOVES2014a was used to generate emissions in Maine’s Southern Counties for all RFG OPT-OUT years where RFG is sold. Tables 13 and 14 contain the projected inventory for nonroad mobile sources including agriculture, airport support, commercial, construction, industrial, lawn/garden, logging, oil field, pleasure craft, railroad, and recreational type nonroad sources. NOx emissions are expected to decrease by 29.86% from 2015 through 2023, and VOC emission are expected to decrease by 21.20% for the same period. Comparing the 2019 NOx data, there is no difference in the total value for RVP at 9.0 psi compared to the RVP at 7.0 psi. Similarly, when comparing the 2019 VOC data, the total value for RVP at 9.0 psi is 3.54% higher than RVP at 7.0 psi.

Table 13. Nonroad NOx Emissions for Maine Southern Counties

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **County** | **Current 7.0 psi RVP** | | | **9.0 psi RVP** | |
| **2015** | **2017** | **2019** | **2019** | **2023** |
| --tons per typical summer day-- | | | | |
| **Androscoggin** | 0.94 | 0.81 | 0.71 | 0.71 | 0.60 |
| **Cumberland** | 3.71 | 3.28 | 2.96 | 2.96 | 2.56 |
| **Hancock** | 1.09 | 0.99 | 1.07 | 1.07 | 0.95 |
| **Kennebec** | 1.14 | 1.00 | 0.90 | 0.90 | 0.76 |
| **Knox** | 0.95 | 0.86 | 0.79 | 0.79 | 0.69 |
| **Lincoln** | 0.64 | 0.59 | 0.55 | 0.55 | 0.49 |
| **Sagadahoc** | 0.53 | 0.46 | 0.41 | 0.41 | 0.36 |
| **Waldo** | 0.63 | 0.54 | 0.50 | 0.50 | 0.41 |
| **York** | 1.90 | 1.66 | 1.48 | 1.48 | 1.26 |
| **Total** | 11.52 | 10.19 | 9.37 | 9.37 | 8.08 |

Table 14. Nonroad VOC Emissions for Maine Southern Counties

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **County** | **Current 7.0 psi RVP** | | | **9.0 psi RVP** | |
| **2015** | **2017** | **2019** | **2019** | **2023** |
| --tons per typical summer day-- | | | | |
| **Androscoggin** | 1.05 | 0.94 | 0.87 | 0.90 | 0.85 |
| **Cumberland** | 5.99 | 5.47 | 5.11 | 5.26 | 5.00 |
| **Hancock** | 2.60 | 2.23 | 2.19 | 2.19 | 1.82 |
| **Kennebec** | 2.14 | 1.89 | 1.70 | 1.77 | 1.61 |
| **Knox** | 1.51 | 1.34 | 1.20 | 1.28 | 1.12 |
| **Lincoln** | 1.64 | 1.47 | 1.34 | 1.42 | 1.30 |
| **Sagadahoc** | 0.77 | 0.68 | 0.61 | 0.67 | 0.60 |
| **Waldo** | 0.71 | 0.62 | 0.67 | 0.67 | 0.59 |
| **York** | 3.40 | 3.05 | 2.79 | 2.90 | 2.72 |
| **Total** | 19.81 | 17.69 | 16.49 | 17.07 | 15.61 |

**8 REFERENCES**

1 MOVES (Motor Vehicle Emissions Simulator), United State Environmental Protection Agency; <https://www.epa.gov/moves>

2 MOVES (Motor Vehicle Emissions Simulator), United State Environmental Protection Agency; [https://www.epa.gov/moves/moves2014a-latest-version-motor-vehicle-emission-simulator-moves#manuals](https://www.epa.gov/moves/moves2014a-latest-version-motor-vehicle-emission-simulator-moves%23manuals)

3 “MOVES2014 and MOVES2014a Technical Guidance: Using MOVES to Prepare Emissions Inventories for State Implementation Plans and Transportation Conformity”, US EPA. EPA-420-B-15-093, November 2015; [https://www.epa.gov/moves/moves2014a-latest-version-motor-vehicle-emission-simulator-moves#manuals](https://www.epa.gov/moves/moves2014a-latest-version-motor-vehicle-emission-simulator-moves%23manuals)

**APPENDIX A MOVES2014a INPUT DATABASE FILES**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Nonroad Data Importer Tab** Input table | **2015 RFG 7.0  Sulfur 30ppm Excel File** Worksheet | **2017 RFG 7.0 Sulfur 10ppm Excel File** Worksheet | **2019 RFG 7.0 Sulfur 10ppm Excel File** Worksheet | **2019 CG 8.8 Sulfur 10ppm Excel File** Worksheet | **2023 CG 8.8 Sulfur 10ppm Excel File** Worksheet |
|
| **Fuel** | **nrFuel\_inputs.xlsx** | **nrFuel\_inputs.xlsx** | **nrFuel\_inputs.xlsx** | **nrFuel\_inputs.xlsx** | **nrFuel\_inputs.xlsx** |
| FuelSupply | RFGnrFuelSupply | RFGnrFuelSupply | RFGnrFuelSupply | CGnrFuelSupply | CGnrFuelSupply |
| FuelFormulation | FuelFormulation\_All | FuelFormulation\_All | FuelFormulation\_All | FuelFormulation\_All | FuelFormulation\_All |
| **Meteorology Data** | **M14\_All2011NEI\_County\_zoneMonthHour.xlsx** | **M14\_All2011NEI\_County\_zoneMonthHour.xlsx** | **M14\_All2011NEI\_County\_zoneMonthHour.xlsx** | **M14\_All2011NEI\_County\_zoneMonthHour.xlsx** | **M14\_All2011NEI\_County\_zoneMonthHour.xlsx** |
| zoneMonthHour | STCTYzoneMonthHour | STCTYzoneMonthHour | STCTYzoneMonthHour | STCTYzoneMonthHour | STCTYzoneMonthHour |