Technical Support Document (TSD)

Preparation of Emissions Inventories for the Version 7, 2014 Emissions Modeling Platform for NATA

--DRAFT--

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Acronyms

AE5	CMAQ Aerosol Module, version 5, introduced in CMAQ v4.7
AE6	CMAQ Aerosol Module, version 6, introduced in CMAQ v5.0
AEO	Annual Energy Outlook
AERMOD	American Meteorological Society/Environmental Protection Agency Regulatory Model
NBAFM	Naphthalene, Benzene, Acetaldehyde, Formaldehyde and Methanol
BEIS	Biogenic Emissions Inventory System
BELD	Biogenic Emissions Land use Database
Bgal	Billion gallons
BPS	Bulk Plant Storage
BTP	Bulk Terminal (Plant) to Pump
C1/C2	Category 1 and 2 commercial marine vessels
C3	Category 3 (commercial marine vessels)
CAEP	Committee on Aviation Environmental Protection
CAIR	Clean Air Interstate Rule
CAMD	EPA's Clean Air Markets Division
CAMx	Comprehensive Air Quality Model with Extensions
CAP	Criteria Air Pollutant
CARB	California Air Resources Board
CB05	Carbon Bond 2005 chemical mechanism
CBM	Coal-bed methane
CEC	North American Commission for Environmental Cooperation
CEMS	Continuous Emissions Monitoring System
CEPAM	California Emissions Projection Analysis Model
CISWI	Commercial and Industrial Solid Waste Incinerators
Cl	Chlorine
CMAQ	Community Multiscale Air Quality
CMV	Commercial Marine Vessel
CO	Carbon monoxide
CSAPR	Cross-State Air Pollution Rule
E0, E10, E85	0%, 10% and 85% Ethanol blend gasoline, respectively
EBAFM	Ethanol, Benzene, Acetaldehyde, Formaldehyde and Methanol
ECA	Emissions Control Area
EEZ	Exclusive Economic Zone
EF	Emission Factor
EGU	Electric Generating Units
EIS	Emissions Inventory System
EISA	Energy Independence and Security Act of 2007
EPA	Environmental Protection Agency
EMFAC	Emission Factor (California's onroad mobile model)
FAA	Federal Aviation Administration
FAPRI	Food and Agriculture Policy and Research Institute
FASOM	Forest and Agricultural Section Optimization Model
FCCS	Fuel Characteristic Classification System
FF10	Flat File 2010
FIPS	Federal Information Processing Standards
FHWA	Federal Highway Administration
HAP	Hazardous Air Pollutant

HCl	Hydrochloric acid
HDGHG	Heavy-Duty Vehicle Greenhouse Gas
Hg	Mercury
HMS	Hazard Mapping System
HPMS	Highway Performance Monitoring System
HWC	Hazardous Waste Combustion
HWI	Hazardous Waste Incineration
ICAO	International Civil Aviation Organization
ICI	Industrial/Commercial/Institutional (boilers and process heaters)
ICR	Information Collection Request
IDA	Inventory Data Analyzer
I/M	Inspection and Maintenance
IMO	International Marine Organization
IPAMS	Independent Petroleum Association of Mountain States
IPM	Integrated Planning Model
ITN	Itinerant
LADCO	Lake Michigan Air Directors Consortium
LDGHG	Light-Duty Vehicle Greenhouse Gas
LPG	Liquefied Petroleum Gas
MACT	Maximum Achievable Control Technology
MARAMA	Mid-Atlantic Regional Air Management Association
MATS	Mercury and Air Toxics Standards
MCIP	Meteorology-Chemistry Interface Processor
Mgal	Million gallons
MMS	Minerals Management Service (now known as the Bureau of Energy Management, Regulation and Enforcement (BOEMRE)
MOVES	Motor Vehicle Emissions Simulator
MSA	Metropolitan Statistical Area
MSAT2	Mobile Source Air Toxics Rule
MTBE	Methyl tert-butyl ether
MWRPO	Mid-west Regional Planning Organization
NCD	National County Database
NEEDS	National Electric Energy Database System
NEI	National Emission Inventory
NESCAUM	Northeast States for Coordinated Air Use Management
NESHAP	National Emission Standards for Hazardous Air Pollutants
NH_3	Ammonia
NIF	NEI Input Format
NLCD	National Land Cover Database
NLEV	National Low Emission Vehicle program
nm	nautical mile
NMIM	National Mobile Inventory Model
NOAA	National Oceanic and Atmospheric Administration
NODA	Notice of Data Availability
NONROAD	OTAQ’s model for estimation of nonroad mobile emissions
NO_X	Nitrogen oxides
NSPS	New Source Performance Standards
NSR	New Source Review
OAQPS	EPA’s Office of Air Quality Planning and Standards
OHH	Outdoor Hydronic Heater

OTAQ	EPA's Office of Transportation and Air Quality
ORIS	Office of Regulatory Information System
ORD	EPA's Office of Research and Development
ORL	One Record per Line
OTC	Ozone Transport Commission
PADD	Petroleum Administration for Defense Districts
PF	Projection Factor, can account for growth and/or controls
PFC	Portable Fuel Container
$PM_{2.5}$	Particulate matter less than or equal to 2.5 microns
PM_{10}	Particulate matter less than or equal to 10 microns
ppb, ppm	Parts per billion, parts per million
RBT	Refinery to Bulk Terminal
RFS2	Renewable Fuel Standard
RIA	Regulatory Impact Analysis
RICE	Reciprocating Internal Combustion Engine
RWC	Residential Wood Combustion
RPO	Regional Planning Organization
RVP	Reid Vapor Pressure
SCC	Source Classification Code
SEMAP	Southeastern Modeling, Analysis, and Planning
SESARM	Southeastern States Air Resource Managers
SESQ	Sesquiterpenes
SMARTFIRE	Satellite Mapping Automated Reanalysis Tool for Fire Incident Reconciliation
SMOKE	Sparse Matrix Operator Kernel Emissions
SO_2	Sulfur dioxide
SOA	Secondary Organic Aerosol
SI	Spark-ignition
SIP	State Implementation Plan
SPDPRO	Hourly Speed Profiles for weekday versus weekend
SPPD	Sector Policies and Programs Division
TAF	Terminal Area Forecast
TCEQ	Texas Commission on Environmental Quality
TOG	Total Organic Gas
TSD	Technical support document
ULSD	Ultra Low Sulfur Diesel
USDA	United States Department of Agriculture
VOC	Volatile organic compounds
VMT	Vehicle miles traveled
VPOP	Vehicle Population
WRAP	Western Regional Air Partnership
WRF	Weather Research and Forecasting Model

1 Introduction

The U.S. Environmental Protection Agency (EPA) developed an air quality modeling platform that represents the year 2014 based on the 2014 National Emissions Inventory (NEI), version 1 (2014NEIv1). The air quality modeling platform consists of all the emissions inventories and ancillary data files used for emissions modeling, as well as the meteorological, initial condition, and boundary condition files needed to run the air quality model. This document focuses on the emissions modeling component of the 2014 modeling platform, which includes the emission inventories, the ancillary data files, and the approaches used to transform inventories for use in air quality modeling. Many emissions inventory components of this air quality modeling platform are based on the 2014NEIv1, although there are some differences between the platform inventories and the 2014NEIv1 emissions as a result of addressing known issues and the incorporation of newly available data and improved methods.

This 2014 modeling platform includes all criteria air pollutants and precursors (CAPs) and two groups of hazardous air pollutants (HAPs). The first group are HAPs explicitly used by the chemical mechanism in the Community Multiscale Air Quality (CMAQ) model for ozone/particulate matter (PM): chlorine (Cl), hydrogen chloride (HCl), benzene, acetaldehyde, formaldehyde, methanol, naphthalene. The second group consists of 51 HAPs or HAP groups (such as polycyclic aromatic hydrocarbon groups) added to CMAQ for the purposes of air quality modeling for the 2014 National Air Toxics Assessment (NATA). The latter five HAPs in the first group are also abbreviated as NBAFM in subsequent sections of the document. A list of all HAPs is in Appendix A. This platform is called the "2014 NATA-Based Platform, version 7.0" (2014v7.0) because it is a multipollutant platform used primarily for NATA. Here, "version 7.0" denotes an evolution from the latest version of the 2011-based platform, version 6.3, which was the starting point for a number of the ancillary data files. The 2011v6.3 Technical Support Document (TSD) is available on the EPA's Air Emissions Modeling website for the version 6 platforms, https://www.epa.gov/air-emissions-modeling/2011-version-6-air-emissions-modeling-platforms, under the section entitled "2011v6.3 Platform."

For the rest of this document, the platform that is described is referred to as the "2014 v7.0 platform" or "2014v7.0."

The 2014v7.0 platform was used to support version 1 of the 2014 NATA, the focus of which is multipollutant modeling of HAPs and CAPs using CMAQ version 5.2 multipollutant (Appel, 2016). The modeling domain includes the lower 48 states and parts of Canada and Mexico. The 2014 NATA also utilizes the American Meteorological Society/Environmental Protection Agency Regulatory Model (AERMOD), which is an air dispersion modeling system, for all NEI HAPs (about 130 more than covered by CMAQ) across all 50 states, Puerto Rico and the Virgin Islands. Emissions preparation for AERMOD is discussed elsewhere.

The CMAQ model requires hourly and gridded emissions of chemical species that correspond to CAPs and specific HAPs. The chemical mechanism used by CMAQ for this platform is called Carbon Bond version 6 -CMAQ (CB6-CMAQ) and includes important reactions for simulating ozone formation, nitrogen oxides (NOx) cycling, and formation of secondary aerosol species. It is basically the same as the CB6 used in the 2011v6.3 platform described in (Hildebrant Ruiz and Yarwood, 2013) except that CMAQ-CB6 removes naphthalene from the XYL lumped species group and treats it explicitly. In addition, many additional HAPs are included to support the NATA analysis.

The 2014v7.0 platform consists of one 'complete' emissions case: the 2014 base case (i.e., 2014fa_nata_cb6cmaq_14j). In the case abbreviations, 2014 is the year represented by the emissions; the “f” represents the base year platform iteration (the previous platform, which was a 2011-based platform, was “e”) and the “a” stands for the first set of emissions modeled for a 2014-based modeling platform (the next case will be 2014fb). Table 1-1 summarizes this emissions case. The purpose of this 2014 base case is to provide actual 2014 emissions for air quality modeling of the HAPs in the 2014 NEI within a multipollutant framework that accounts for atmospheric chemistry and transport within a state of the art photochemical grid model.

Table 1-1. List of cases in the 2014 Version 7.0 Emissions Modeling Platform

Case Name	Abbreviation	Description
2014 base case	2014fa_nata_cb6cmaq_14j	2014 case relevant for air quality model evaluation purposes. Uses 2014NEIv1 along with some other inventory data, with hourly 2014 continuous emissions monitoring system (CEMS) data for electrical generating units (EGUs), hourly onroad mobile emissions, and 2014 day-specific wild and prescribed fire data.

The emissions data in the 2014v7.0 platform are primarily based on the 2014NEIv1 for point sources, nonpoint sources, commercial marine vessels (CMV), onroad and nonroad mobile sources, and fires. Some platform categories are based on more disaggregated data than that 2014NEI such as onroad mobile source emissions, which use hourly emissions by vehicle type, fuel type process and road type. For the 2014NEI, which uses the same modeling and inputs, the emissions are provided as vehicle type/fuel type totals at annual temporal resolution. In addition, emissions from Canada and Mexico are used for the platform but are not part of the NEI. Temporal, spatial and other changes in emissions between the 2014NEI and the emissions input into the platform are described in Section 2 of this TSD.

The primary emissions modeling tool used to create the air quality model-ready emissions was the Sparse Matrix Operator Kernel Emissions (SMOKE) modeling system (http://www.smoke-model.org/). Primarily SMOKE version 4.0 was used, though to enable some speciation enhancements discussed in Section 3, a beta version of SMOKE 4.5 was used for some modeling sectors. This emission modeling created emissions files for a 12-km national grid that includes all of the contiguous states “12US2,” shown in Figure 3-1. Electronic copies of the data used as input to SMOKE for the 2014 Platform are available from the EPA Air Emissions Modeling website, https://www.epa.gov/air-emissions-modeling/2014-version-7-air-emissions-modeling-platforms, under the 2014v7.0 section.

The gridded meteorological model used for the emissions modeling was developed using the Weather Research and Forecasting Model (WRF, http://wrf-model.org) version 3.8, Advanced Research WRF core (Skamarock, et al., 2008). The WRF Model is a mesoscale numerical weather prediction system developed for both operational forecasting and atmospheric research applications. The WRF was run for 2014 over a domain covering the continental U.S. at a 12km resolution with 35 vertical layers. The WRF data were collapsed to 25 layers prior to running the emissions and air quality models. The run for this platform included high resolution sea surface temperature data from the Group for High Resolution Sea Surface Temperature (GHRSST) (see https://www.ghrsst.org/) and is given the EPA meteorological case label “14j.” The full case name includes this abbreviation following the emissions portion of the case name to fully specifiy the name of the case as “2014fa_nata_cb6cmaq_14j.”

This document contains five sections and several appendices. Section 2 describes the 2014 inventories input to SMOKE. Section 3 describes the emissions modeling and the ancillary files used with the emission inventories. Data summaries are provided in Section 4. Section 5 provides references. The Appendices provide additional details about specific technical methods.

2 2014 Emission Inventories and Approaches

This section describes the 2014 emissions data that make up the 2014 platform. The starting point for the 2014 stationary source emission inputs is the 2014NEIv1 or more detailed temporal/spatial resolution data used to build the NEI, with adjustments to account for corrections of errors identified by the EPA. Documentation for the 2011NEIv1, including a TSD, is available at https://www.epa.gov/air-emissions-inventories/2014-national-emissions-inventory-nei-documentation.

The NEI data for CAPs are largely compiled from data submitted by state, local and tribal (S/L/T) air agencies. HAP emissions data are also from the S/L/T agencies, but are often augmented by the EPA because they are voluntarily submitted. The EPA uses the Emissions Inventory System (EIS) to compile the NEI. The EIS includes hundreds of automated quality assurance (QA) checks to help improve data quality, and also supports tracking release point (e.g., stack) coordinates separately from facility coordinates. The EPA collaborated extensively with S/L/T agencies to ensure a high quality of data in the 2014NEIv1.

Onroad and nonroad mobile source emissions in the 2014NEIv1 were developed using the Motor Vehicle Emission Simulator (MOVES). MOVES2014a was used with S/L inputs, where provided, or EPA defaults. The 2014 NEI is the first use of MOVES for nonroad emissions. MOVES2014a essentially replaces the National Mobile Inventory Model (NMIM) as the interface for using the NONROAD2008 model, ensuring that the gasoline fuels used for nonroad equipment are consistent with those used for onroad vehicles and using newer data to estimate the HAPs than had been used in NMIM.

The 2014 NEI includes five data categories: point sources, nonpoint (formerly called "stationary area") sources, nonroad mobile sources, onroad mobile sources, and events consisting of fires. The NEI uses 60 sectors to further describe the emissions, with an additional biogenic sector generated from a summation of the gridded, hourly 2014 biogenic data used in the emissions modeling platform. In addition to the NEI data, emissions from the Canadian and Mexican inventories and several other non-NEI data sources are included in the 2014emissions modeling platform. Many sectors for 2014 used improved emission approaches and/or updated emission factors including nonroad, commercial marine vessels, residential wood combustion, oil and gas, agricultural ammonia (including both livestock and fertilizer sources), and fires (including wild, prescribed and agricultural burning).

As explained below, the major differences between the 2014 NEIv1 and the 2014v7.0 platform include: meteorologically-adjusted road dust emissions, CEMS data for EGUs, updates implemented to a few sectors as a result of corrections identified by the EPA, and emissions for areas outside the U.S. In addition, the modeling platform uses more temporally-resolved emissions than the NEI for many sectors.

For the purposes of preparing the air quality model-ready emissions, the 2014NEIv1 was split into finer-grained sectors used for emissions modeling. The significance of an emissions modeling or "platform sector" is that the data are run through all of the SMOKE programs except the final merge (Mrggrid) independently from the other sectors. The final merge program then combines the sector-specific gridded, speciated, hourly emissions together to create CMAQ-ready emission inputs.

Table 2-1 presents the sectors in the 2014 platform and how they generally relate to the 2014NEIv1 as a starting point. As discussed in greater detail in Table 2-2, the emissions in some of these sectors were modified from the 2014NEIv1 emissions for the 2014 modeling platform. The platform sector abbreviations are provided in italics. These abbreviations are used in the SMOKE modeling scripts, inventory file names, and throughout the remainder of this document.

Table 2-1. Platform sectors for the 2014v7.0 emissions modeling platform

Platform Sector: *abbreviation*	NEI Data Category	Description and resolution of the data input to SMOKE
EGU units: ***ptegu***	Point	2014NEIv1 point source EGUs. The 2014NEIv1 emissions are replaced with hourly 2014 CEMS values for NO_X and SO_2 for any units that are matched to the NEI. Other pollutants are scaled from 2014NEIv1 using CEMS heat input. Emissions for all sources not matched to CEMS data come from 2014NEIv1. Annual resolution for sources not matched to CEMS data, hourly for CEMS sources.
Point source oil and gas: ***pt_oilgas***	Point	2014NEIv1 point sources that include oil and gas production emissions processes based on facilities with the following NAICS: 211* (Oil and Gas Extraction), 213111 (Drilling Oil and Gas Wells) 213112 (Support Activities for Oil and Gas Operations), 4861* (Pipeline Transportation of Crude Oil), 4862* (Pipeline Transportation of Natural Gas). Annual resolution.
Remaining non-EGU point: ***ptnonipm***	Point	All 2014NEIv1 point source records not matched to the ptegu or pt_oilgas sectors, except for offshore point sources that are in the othpt sector. Includes all aircraft and airport ground support emissions and some rail yard emissions. Annual resolution.
Agricultural: ***ag***	Nonpoint	Ammonia emissions from 2014NEIv1 nonpoint livestock and fertilizer application, county and daily resolution for livestock; county and annual resolution for fertilizer.
Agricultural fires with point resolution: ***ptagfire***	Nonpoint	2014NEIv1 agricultural fire sources that were developed by EPA as point and day-specific emissions; they were put into the nonpoint NEI data category, but in the platform, they are treated as point sources. This sector was not in the 2011v6.3 platform since day-specific emissions for agricultural burning via the EPA estimation method were not available for the 2011 NEI.
Agricultural fires: ***agfire***	Nonpoint	2014NEIv1 agricultural fire sources reported by S/L agencies. County and annual resolution. Monthly profiles derived from annual S/L data using day-specific information from the EPA-derived data for these states.
Area fugitive dust: ***afdust***	Nonpoint	PM_{10} and $PM_{2.5}$ fugitive dust sources from the 2014NEIv1 nonpoint inventory; including building construction, road construction, agricultural dust, and road dust. The emissions modeling adjustment applies a transport fraction and a meteorology-based (precipitation and snow/ice cover) zero-out. County and annual resolution.
Biogenic: ***Beis***	Nonpoint	Year 2014, hour-specific, grid cell-specific emissions generated from the BEIS3.61 model within SMOKE, including emissions in Canada and Mexico using BELD v4.1 land use data.
Category 1, 2 and 3 CMV: ***cmv***	Nonpoint	Category 1 (C1), category 2 (C2) and category 3 (C3) CMV emissions sources from the 2014NEIv1 nonpoint inventory, except that it does not use C3 from the 2014 NEI in Federal Waters. County and annual resolution; see othpt sector for all non-U.S. C3 emissions.
locomotives: ***rail***	Nonpoint	Rail locomotives emissions from the 2014NEIv1. County and annual resolution.
Remaining nonpoint: ***nonpt***	Nonpoint	2014NEIv1 nonpoint sources not included in other platform sectors with adjustments to remove chromium from fugitive dust categories (paved and unpaved roads, construction and crops and livestock). County and annual resolution.

Platform Sector: *abbreviation*	NEI Data Category	Description and resolution of the data input to SMOKE
Nonpoint source oil and gas: ***np_oilgas***	Nonpoint	2014NEIv1 nonpoint sources from oil and gas-related processes with specific adjustment in four unitah basin counties in Utah to correct EPA augmented benzene, toluene, ethylbenzene and xylenes. County and annual resolution.
Residential Wood Combustion: ***rwc***	Nonpoint	2014NEIv1 nonpoint sources with residential wood combustion (RWC) processes. County and annual resolution.
Nonroad: ***nonroad***	Nonroad	2014NEIv1 nonroad equipment emissions developed with the MOVES2014a using NONROAD2008 version NR08a and new HAP emission factors than had been used in the 2011NEI. MOVES was used for all states except California, which submitted their own emissions for the 2014NEIv1. County and monthly resolution.
Onroad: ***onroad***	Onroad	2014 onroad mobile source gasoline and diesel vehicles from parking lots and moving vehicles. Includes the following modes: exhaust, extended idle, auxiliary power units, evaporative, permeation, refueling, and brake and tire wear. For all states except California, based on monthly MOVES emissions tables produced by MOVES2014a.
Onroad California: ***onroad_ca_adj***	Onroad	2014 California-provided CAP and metal HAP onroad mobile source gasoline and diesel vehicles from parking lots and moving vehicles based on Emission Factor (EMFAC), gridded and temporalized using MOVES2014a. Volatile organic compound (VOC) HAP emissions derived from California-provided VOC emissions and MOVES-based speciation.
Point source fires-smoldering: ***Ptfire_s***	Fires	Point source day-specific wildfires and prescribed fires for 2014 computed using SMARTFIRE2 for smoldering processes (i.e., SCCs 281XXXX001), except for Georgia-submitted emissions. Consistent with 2014NEIv1.
Point source fires-flaming: ***Ptfire_f***	Fires	Point source day-specific wildfires and prescribed fires for 2014 computed using SMARTFIRE2 for flaming processes (i.e., SCCs 281XXXX002), except for Georgia-submitted emissions. Consistent with 2014NEIv1.
Non-US. fires: ***ptfire_mxca***	N/A	Point source day-specific wildfires and prescribed fires for 2014 provided by Environment Canada with data for missing months and for Mexico filled in using fires from the Fire INventory (FINN) from National Center for Atmospheric Research (NCAR) fires (NCAR, 2016 and Wiedinmyer, C., 2011).
Other dust sources not from the 2014 NEI: ***othafdust***	N/A	Fugitive dust sources from Canada's 2010 inventory. The emissions modeling adjustment applies a transport fraction and a meteorology-based (precipitation and snow/ice cover) zero-out. County and annual resolution.
Other point sources not from the 2014 NEI: ***othpt***	N/A	Point sources from Canada's 2010 inventory and Mexico's 2014 inventory, annual resolution. Also includes all non-U.S. C3 CMV and U.S. offshore oil production.
Other non-NEI nonpoint and nonroad: ***othar***	N/A	Monthly year 2010 Canada (province resolution) and year 2014 Mexico (municipio resolution) nonpoint and nonroad mobile inventories. 2010 Canada nonroad mobile inventory projected to 2014.

Platform Sector: *abbreviation*	NEI Data Category	Description and resolution of the data input to SMOKE
Other non-NEI onroad sources: *onroad_can*	N/A	Monthly year 2010 Canada (province resolution) onroad mobile inventory, projected to 2014.
Other non-NEI onroad sources: *onroad_mex*	N/A	Monthly year 2014 Mexico (municipio resolution) onroad mobile inventory.

Table 2-2 provides a brief by-sector overview of the most significant differences between the 2014 emissions platform and the 2011v6.3 platform methodologies. Only those sectors with significant differences between the 2014NEIv1 and the 2011 emissions modeling platform are listed. The specific by-sector updates to the 2011 platform are described in greater detail later in this section under each by-sector subsection. For all sectors with VOC emissions in the U.S., speciation of VOC was done differently from the 2011v6.3. In 2014v7.0 and in all NATA platforms, we use the inventory HAPs that are explicit in the chemical mechanism for speciation (NBAFM) and we remove these compounds from the speciation profiles input to the Speciation Tool so as not to double count the mass.

Table 2-2. Summary of methodological differences between 2014v7.0 platform and 2011v6.3 emissions by sector

Platform Sector	Summary of Significant Methodological Differences of 2014v7.0 Platform vs. 2011v6.3 Platform
EGU units: *ptegu*	-Speciation relies on inventory HAP emissions for NBAFM rather than speciation of VOC
Point source oil and gas: *pt_oilgas*	-Speciation relies on inventory HAP emissions for NBAFM rather than speciation of VOC -Sector excludes natural gas distribution
Remaining non-EGU point: *ptnonipm*	-Speciation relies on inventory HAP emissions for NBAFM rather than speciation of VOC
Agricultural: *ag*	-Created daily emissions for livestock. The EPA estimates were already developed as daily and were used to create daily estimates of state-reported data.
Agriculture Burning: *ptagfire*	-New sector. The 2014 EPA-estimated agricultural fires have specific geographic coordinates and day-specific temporal resolution. -Speciation relies on inventory HAP emissions for NBAFM rather than speciation of VOC
Agriculture Burning: *agfire*	--This sector includes only the county-level data submitted by states for which we do not have specific geographic coordinates or day specific temporal resolution and, therefore, does not represent the total emissions from agricultural burning. -Speciation relies on inventory HAP emissions for NBAFM rather than speciation of VOC
Point source fires-flaming: *ptfire_f*	-Speciation relies on inventory HAP emissions for NBAFM rather than speciation of VOC -We broke out the flaming part of the ptfire sector- previously flaming was not distinguished form smoldering. This was done in order to model the two with different vertical resolution. -New regional profiles for VOC (same profiles used for flaming and smoldering)

Platform Sector	Summary of Significant Methodological Differences of 2014v7.0 Platform vs. 2011v6.3 Platform
Point source fires-smoldering: ***ptfire_s***	-Speciation relies on inventory HAP emissions for NBAFM rather than speciation of VOC -New regional profiles for VOC (same profiles used for flaming and smoldering)
Remaining nonpoint sector: ***nonpt***	-New sector. We broke out the smoldering part of the ptfire sector- previously smolding was not distinguished form smoldering. This was done in order to model the two with different vertical resolution (though likely this will be reverted back to just the one ptfire sector for the next version of the platform). For the smoldering sector, we did not use plume rise for layering of smoldering, rather it was put into layer 1. -Speciation relies on inventory HAP emissions for NBAFM rather than speciation of VOC
Nonpoint oil and gas sector: ***np_oilgas***	-Used HAP integration for speciation - Assign multiple speciation profiles to county/SCC to account for the different speciation of VOC coming from a controlled stream (flare) versus a process (e.g., pneumatic pump).
Nonroad: ***Nonroad***	-Except for California, the MOVES2014a model provides NONHAPTOG along with the speciation profile code instead of speciating using an SCC-to-speciation profile cross reference (GSREF).
Onroad sector: ***Onroad***	-Updated speciation profile for brake and tirewear emissions
Other non-NEI sources: othafdust, othpt, othar, ptfire_mxca, ***onroad_can and onroad_mex***	-Separated Mexico onroad from Canada and used new inventory based on MOVES-Mexico. - Included new ptfire_mxca sector to reflect point fires in Canada and Mexico. -MOVES-Mexico emissions are fully integrated with all HAPs while remaining Mexico and Canada emissions use speciation to generate NBAFM. - Used inventory HAP emissions for NBAFM rather than speciation of VOC for the US-based (NEI emissions) contained in othpt (i.e., CMV in Federal waters).

The emission inventories in SMOKE input formats for the 2014 base case are available from the EPA's Air Emissions Modeling website for the version 7 platform: https://www.epa.gov/air-emissions-modeling/2014-version-7-air-emissions-modeling-platforms, under the section entitled "2014v7.0 Platform." The 2014v7.0 "README" file indicates the particular zipped files associated with each platform sector. A number of reports (i.e., summaries) are available with the data files for the 2014v7.0 platform. The types of reports include state summaries of inventory pollutants and model species by modeling platform sector and county annual totals by modeling platform sector.

The remainder of Section 2 provides details about the data contained in each of the 2014 platform sectors. Different levels of detail are provided for different sectors depending on the availability of reference information for the data, the degree of changes or manipulation of the data needed to prepare it for input to SMOKE, and whether the 2014 platform emissions are significantly different from the 2014NEIv1.

2.1 2014 NEI point sources (ptegu, pt_oilgas and ptnonipm)

Point sources are sources of emissions for which specific geographic coordinates (e.g., latitude/longitude) are specified, as in the case of an individual facility. A facility may have multiple emission release points that may be characterized as units such as boilers, reactors, spray booths, kilns, etc. A unit may have multiple processes (e.g., a boiler that sometimes burns residual oil and sometimes burns natural gas). With a couple of minor exceptions, this section describes only NEI point sources within the contiguous U.S. The offshore oil platform (othpt sector) emissions are processed by SMOKE as point source inventories, as described in Section 2.5.1. A comprehensive description of how EGU emissions were characterized and estimated in the 2014 NEI is located in Section 3.4 in the 2014NEIv1 TSD.

The point source file used for the modeling platform is exported from EIS into the Flat File 2010 (FF10) format that is compatible with SMOKE (see https://www.cmascenter.org/smoke/documentation/4.0/html/ch08s02s08.html).

A new step taken in the 2014v7.0 platform is to incorporate all changes to release parameters that would occur in SMOKE as a result of missing values or values outside SMOKE internally set ranges in the FF10 file prior to SMOKE run. This is done for two reasons: 1) to provide better transparency in the FF10 files with respect to the data used in the model, and 2) to ensure that emission inputs are consistent across CMAQ and AERMOD models since both use the FF10 as the starting point. Because SMOKE uses metric units (i.e., m and K) for defaults, these are converted to the English units (ft and F) as specified by the FF10 file format. For velocity, a maximum of 300 m/s was used to be consistent with what we chose for AERMOD modeling, even though the SMOKE maximum is 500 m/s.

Table 2-3 shows the changes made and why. The "Records changed" column indicates how many records were changed and provide the keywords used in the FF10 that indicate that a release parameter was changed and the situation. Even though SMOKE does not use the fugitive release point parameters, they are included in the table to make it complete.

Table 2-3. Release parameter changes to the FF10 inventory files for point sources

Field	Existing Value	New Value	Conditions/Notes	Number of records defaulted or changed and comment[1]
For point sources with stack releases (ERPtype NOT equal to "1")				
stkhgt	missing	use pstk[2] or global defaults[2]		None
stkdiam	missing	use pstk[2] or global defaults[3]		None
stkvel	missing	calculate from stkflow and stkdiam if not missing; otherwise reference by SCC from pstk[2] or global defaults[3]	vel = 4*stkflow/(pi*stkdiam^2) If the flow and diam are missing such that you cannot compute, then use new value based pstk or global defaults.	1,396,220 No pstk values used *ERPVelCompute*
stktemp	missing	use pstk[2] or global defaults[3]		None
stkhgt	Outside SMOKE tolerance	use minimum value or maximum value in feet	Less than 0.5m (1.64ft) or greater than 5100 m (16732.28 ft)	Below min: 94,306 Above max: None *ERPHtRange*
stkdiam	Outside SMOKE tolerance	use minimum value or maximum value in ft	Less than 0.01m (0.0328 ft) or greater than 100 m (328.08 ft)	Below min: 1,429 Above max: None *ERPDiamRange*

stkvel	Outside SMOKE tolerance[4]	use minimum value or maximum value in ft/s	Less than 0.0001m/s (0.000328 ft/s) or greater than 300 m/s (984.252 ft/s)	Below min: 14,019 Above max: 28,933 *ERPVelRange*
stktemp	Outside SMOKE tolerance	use minimum value or maximum value in F	Less than 260 K (8.3 F) or greater than 2000 K (3140.33 F)	Below min: 11,318 Above max:1181 *ERPTempRange*
For Fugitive Release Points (not used in CMAQ)				
fug_width_ydim	missing	32.808 ft		3,793,801; *ERPFugMissing*
fug_length_xdim	missing	32.808 ft		3,825,359; *ERPFugMissing*
fug_angle	missing	0		3,865,422; *ERPFugMissing*
fug_height	missing	10 ft	fug_width_ydim and fug_length_xdim are missing	3,525,573; *ERPFugMissing*
fug_height	missing	0	WHEN fug_width_ydim and fug_length_xdim are not missing and > 0	11,904 *ERPFugHeight0*
For Coke Ovens: Any release point that emits coke oven emissions (pollutant code 140) -all pollutants at that release point are changed to the below-				
stkhgt	< 126 ft	126 ft	erptype NOT = "1"	88; *ERPCokeoven126*
fug_height	< 126 ft	126 ft	erptype = "1"	85; *ERPCokeoven126*
fug_length_xdim	< 50 ft	50 ft	erptype = "1"	81; *ERPCokeovenFug50*
fug_width_ydim	< 50 ft	50 ft	erptype = "1"	81; *ERPCokeovenFug50*

1. Comments were put into the modeling file to indicate why a record was changed:
   ERPVelCompute – velocity computed from the flowrate provided in the inventory
   ERPHtRange – height in the inventory was out of range
   ERPDiamRange– diameter in the inventory was out of range
   ERPVelRange – velocity in the inventory or velocity calculated from the flowrate in the inventory was out of range
   ERPTempRange– diameter in the inventory was out of range
   ERPFugHeight0 – fugitive height in the inventory was set to 0 because the width and length were not missing
   ERPFugMissing – fugitive height, length and width are missing or fugitive length and/or width are missing.
   ERPCokeoven126 – fugitive or stack height of release point emitting coke oven emissions was less than 126 ft
   ERPCokeovenFug50 – fugitive length or width was less than 50 ft.
2. Pstk provides default stack parameters and is provided with other SMOKE ancillary files (ge_dat directory) on the website. The pstk file is formatted: region_cd, scc, stkhgt (m), stkdiam (m), stktemp (K), and stkvel (m/s)
3. Global defaults (converted to English): stkvel = 13.1234 ft; stktemp=72.05 F, stkdiam=0.6562 ft, stkhgt=9.8425 ft
4. For velocity, the SMOKE upper bound is 500 m/s but we changed to 300 m/s as that is the AERMOD upper bound

After moving offshore oil platforms into the othpt sector, and dropping sources without specific locations (i.e., their FIPS code ends in 777), initial versions of the other four platform point source sectors were created from the remaining 2014NEIv1 point sources. The point sectors are: the EGU sector (ptegu), point source oil and gas extraction-related emissions (pt_oilgas), and the remaining non-EGU sector also called the non-IPM (ptnonipm) sector. The EGU emissions are split out from the other sources to facilitate the use of distinct SMOKE temporal processing and future-year projection techniques. The oil and gas sector emissions (pt_oilgas) were processed separately for summary tracking purposes and distinct future-year projection techniques from the remaining non-EGU emissions (ptnonipm). The 2014v7.0 platform utilizes a smaller universe of facilities than the pt_oilgas sector of the 2011v6.3 platform: facilities with NAICS 2212* (natural gas distribution) are no longer included since this NAICS reflects the distribution of natural gas and is outside of the oil and gas categories covered by oil and gas production operations.

The inventory pollutants processed through SMOKE for all point source sectors were: carbon monoxide (CO), NO_X, VOC, sulfur dioxide (SO_2), ammonia (NH_3), particles less than 10 microns in diameter (PM_{10}), and particles less than 2.5 microns in diameter ($PM_{2.5}$), and all of the air toxics listed in Appendix A. The NBAFM are explicit in the CMAQ-CB6 chemical mechanism and are taken from the HAP emissions as opposed to generated through VOC speciation, as is normally done for non-toxics modeling applications such as the 2011v6.3 platform. To prevent double counting of mass, NBAFM is removed from VOC speciation profiles, thus resulting in speciation profiles that may sum to less than 1. This is called the "no-integrate" VOC speciation case and is discussed in detail in Section 3.2.1.1. The resulting VOC in the modeling system may be higher or lower than the VOC emissions in the NEI; they would only be the same if the HAP inventory and speciation profiles were exactly consistent. For HAPs other than NBAFM, there is no concern for double-counting since CMAQ handles these outside the CB6 mechanism.

The ptnonipm and pt_oilgas sector emissions were provided to SMOKE as annual emissions. For those ptegu sources with CEMS data (that could be matched to the 2014NEIv1), 2014 hourly CEMS NO_X and SO_2 emissions were used rather than NEI emissions. For all other pollutants, annual emissions were used as-is from the NEI, but were allocated to hourly values using heat input CEMS data. For the sources in the ptegu sector not matched to CEMS data, daily emissions were created using an approach described in Section 2.1.1, and IPM region- and pollutant-specific diurnal profiles were applied to create hourly emissions.

In addition to the release parameter changes discussed above, the 2014NEIv1 point inventory was split into the ptnonipm, pt_oilgas and ptegu sectors. The split was done at the unit level for ptegu and facility level for pt_oilgas such that a facility may have units and processes in both ptnonipm and ptegu, but cannot be in both pt_oilgas and any other point sector. These sectors are discussed in more detail in the following sections.

2.1.1 EGU sector (ptegu)

The ptegu sector contains emissions from EGUs in the 2014NEIv1 point inventory that could be matched to units found in the National Electric Energy Data System (NEEDS) v5.16 database. The matching was prioritized according to the amount of the emissions produced by the source. It is customary to put these EGUs into separate sectors in the platform to support future year modeling even though future year modeling is not done for 2014 NATA. In the SMOKE point flat file, emission records for sources that have been matched to the NEEDS database have a value filled into the IPM_YN column based on the matches stored within EIS.

Some units in the ptegu sector are matched to CEMS data via ORIS facility codes and boiler ID. For matched units, SMOKE replaces the 2014 emissions of NO_X and SO_2 with the CEMS emissions, thereby ignoring the annual values specified in the NEI. For other pollutants, the hourly CEMS heat input data are used to allocate the NEI annual emissions to hourly values. All stack parameters, stack locations, and Source Classification Codes (SCC) for these sources come from the NEI (except those changed as discussed in Table 2-3). Because these attributes are obtained from the NEI, the chemical speciation of VOC and $PM_{2.5}$ for the sources is selected based on the SCC or in some cases, based on unit-specific data. If CEMS data exists for a unit, but the unit is not matched to the NEI, the CEMS data for that unit is not used in the modeling platform. However, if the source exists in the NEI and is not matched to a CEMS unit, the emissions from that source are still modeled using the annual emission value in the NEI. The EIS stores many matches from EIS units to the ORIS facility codes and boiler IDs used to reference the CEMS data.

In the SMOKE point flat file, emission records for point sources matched to CEMS data have values prefilled into the ORIS_FACILITY_CODE and ORIS_BOILER_ID columns. The CEMS data in SMOKE-ready format is available at http://ampd.epa.gov/ampd/ near the bottom of the "Prepackaged Data" tab. Many smaller emitters in the CEMS program are not identified with ORIS facility or boiler IDs that can be matched to the NEI due to inconsistencies in the way a unit is defined between the NEI and CEMS datasets, or due to uncertainties in source identification such as inconsistent plant names in the two data systems. Also, the NEEDS database of units modeled by IPM includes many smaller emitting EGUs that are not included in the hourly CEMS programs. Therefore, there will be more units in the NEEDS database than have CEMS data. The temporalization of EGU units matched to CEMS is based on the CEMS data, whereas regional profiles are used for the remaining units. More detail can be found in Section 3.3.2.

For sources not matched to CEMS data, daily emissions were computed from the NEI annual emissions using average CEMS data profiles specific to fuel type, pollutant[2], and IPM region. To allocate emissions to each hour of the day, diurnal profiles were created using average CEMS data for heat input specific to fuel type and IPM region. See Section 3.3.2 for more details on the temporalization approach for ptegu sources.

2.1.2 Point source oil and gas sector (pt_oilgas)

The pt_oilgas sector was separated from the ptnonipm sector by selecting sources with specific NAICS codes shown in Table 2-4. This list was modified from the NAICS used in the 2011 platforms in that the 2014v7.0 platform excludes NAICS related to natural gas distribution which is not part of the oil and gas production category.

The emissions and other source characteristics in the pt_oilgas sector are submitted by states, while the EPA developed a dataset of nonpoint oil and gas emissions for each county in the U.S. with oil and gas activity that was available for states to use. Nonpoint oil and gas emissions can be found in the np_oilgas sector. More information on the development of the 2014 oil and gas emissions can be found in Section 4.16 of the 2014NEIv1 TSD.

Table 2-4. Point source oil and gas sector NAICS Codes

NAICS	NAICS description
2111	Oil and Gas Extraction
4862	Pipeline Transportation of Natural Gas
21111	Oil and Gas Extraction
48611	Pipeline Transportation of Crude Oil
48621	Pipeline Transportation of Natural Gas
211111	Crude Petroleum and Natural Gas Extraction
211112	Natural Gas Liquid Extraction
213111	Drilling Oil and Gas Wells
213112	Support Activities for Oil and Gas Operations

[2] The year to day profiles use NOx and SO_2 CEMS for NOx and SO_2, respectively. For all other pollutants, they use heat input CEMS data.

NAICS	NAICS description
486110	Pipeline Transportation of Crude Oil
486210	Pipeline Transportation of Natural Gas

2.1.3 Non-IPM sector (ptnonipm)

With minor exceptions, the ptnonipm sector contains the 2014NEIv1 point sources that are not in the ptegu or pt_oilgas sectors. For the most part, the ptnonipm sector reflects the non-EGU sources of the NEI point inventory; however, it is likely that some small low-emitting EGUs not matched to the NEEDS database or to CEMS data are present in the ptnonipm sector.

The ptnonipm sector contains a small amount of fugitive dust PM emissions from vehicular traffic on paved or unpaved roads at industrial facilities, coal handling at coal mines, and grain elevators. Sources with state/county FIPS code ending with "777" are in the 2014NEIv1 but are not included in any modeling sectors. These sources typically represent mobile (i.e., temporary) asphalt plants that are only reported for some states, and are generally in a fixed location for only a part of the year, and are thus difficult to allocate to specific places and days as is needed for modeling. Therefore, these sources are dropped from the point-based sectors in the modeling platform.

Table 2-5. Summary of point sources with state/county FIPS ending with "777"

State	VOC (TPY)	NO_X (TPY)	$PM_{2.5}$ (TPY)	SO_2 (TPY)	Total HAP (TPY)
Alaska	60	983	66	197	0.001
Colorado	472	3,043	283	319	49.5
Florida	68	107	9	42	2.1
Kansas	76	137	68	75	0.015
Kentucky	82	85	57	15	4.9
Michigan	34	348	91	43	2.1
Minnesota	186	471	109	217	48.7
Nevada	7	4	2	1	0.1
Ohio	257	162	179	77	1.8
Texas	2	1	0.2	1	0.1

2.2 2014 nonpoint sources (afdust, ag, agfire, ptagfire, np_oilgas, rwc, nonpt)

Several modeling platform sectors were created from the 2014NEIv1 nonpoint inventory. This section describes the *stationary* nonpoint sources. Locomotives, C1 and C2 CMV, and C3 CMV are also included the 2014NEIv1 nonpoint data category, but are mobile sources that are described in Sections 2.4.1 and 2.4.2 as the cmv and rail sectors, respectively. The 2014NEIv1 TSD, available from https://www.epa.gov/sites/production/files/2016-12/documents/nei2014v1_tsd.pdf, includes documentation for the nonpoint sector of the 2014NEIv1.

The nonpoint tribal-submitted emissions are dropped during spatial processing with SMOKE due to the configuration of the spatial surrogates. Part of the reason for this is to prevent possible double-counting with county-level emissions and also because spatial surrogates for tribal data are not currently available. These omissions are not expected to have an impact on the results of the air quality modeling at the 12-km scales used for this platform.

The following subsections describe how the sources in the 2014NEIv1 nonpoint inventory were separated into 2014 modeling platform sectors, along with any data that were updated replaced with non-NEI data.

2.2.1 Area fugitive dust sector (afdust)

The area-source fugitive dust (afdust) sector contains PM_{10} and $PM_{2.5}$ emission estimates for nonpoint SCCs identified by EPA staff as dust sources. Categories included in the afdust sector are paved roads, unpaved roads and airstrips, construction (residential, industrial, road and total), agriculture production, and mining and quarrying. It does not include fugitive dust from grain elevators, coal handling at coal mines, or vehicular traffic on paved or unpaved roads at industrial facilities because these are treated as point sources so they are properly located.

The afdust sector is separated from other nonpoint sectors to allow for the application of a "transport fraction," and meteorological/precipitation reductions. These adjustments are applied with a script that applies land use-based gridded transport fractions followed by another script that zeroes out emissions for days on which at least 0.01 inches of precipitation occurs or there is snow cover on the ground. The land use data used to reduce the NEI emissions determines the amount of emissions that are subject to transport. This methodology is discussed in Pouliot, et al., 2010, and in "Fugitive Dust Modeling for the 2008 Emissions Modeling Platform" (Adelman, 2012). Both the transport fraction and meteorological adjustments are based on the gridded resolution of the platform (e.g., 12km grid cells); therefore, different emissions will result if the process were applied to different grid resolutions. A limitation of the transport fraction approach is the lack of monthly variability that would be expected with seasonal changes in vegetative cover. While wind speed and direction are not accounted for in the emissions processing, the hourly variability due to soil moisture, snow cover and precipitation is accounted for in the subsequent meteorological adjustment.

The sources in the afdust sector are for SCCs and pollutant codes (i.e., PM_{10} and $PM_{2.5}$) that are considered to be "fugitive" dust sources. These SCCs are provided in Table 2-6.

Table 2-6. SCCs in the afdust platform sector for NEI2014v1

SCC	SCC Description
2275085000	Mobile Sources;Aircraft;Unpaved Airstrips;Total
2294000000	Mobile Sources;Paved Roads;All Paved Roads;Total: Fugitives
2294000002	Mobile Sources;Paved Roads;All Paved Roads;Total: Sanding/Salting - Fugitives
2296000000	Mobile Sources;Unpaved Roads;All Unpaved Roads;Total: Fugitives
2311000000	Industrial Processes;Construction: SIC 15 - 17;All Processes;Total
2311010000	Industrial Processes;Construction: SIC 15 - 17;Residential;Total
2311010070	Industrial Processes;Construction: SIC 15 - 17;Residential;Vehicle Traffic
2311020000	Industrial Processes;Construction: SIC 15 - 17;Industrial/Commercial/Institutional;Total
2311030000	Industrial Processes;Construction: SIC 15 - 17;Road Construction;Total
2325000000	Industrial Processes;Mining and Quarrying: SIC 14;All Processes;Total
2325060000	Industrial Processes;Mining and Quarrying: SIC 10;Lead Ore Mining and Milling;Total

SCC	SCC Description
2801000000	Miscellaneous Area Sources;Agriculture Production - Crops;Agriculture - Crops;Total
2801000003	Miscellaneous Area Sources;Agriculture Production - Crops;Agriculture - Crops;Tilling
2801000005	Miscellaneous Area Sources;Agriculture Production - Crops;Agriculture - Crops;Harvesting
2801000007	Miscellaneous Area Sources;Agriculture Production - Crops;Agriculture - Crops;Loading
2801000008	Miscellaneous Area Sources;Agriculture Production - Crops;Agriculture - Crops;Transport
2805001100	Miscellaneous Area Sources;Agriculture Production - Livestock;Beef cattle - finishing operations on feedlots (drylots);Confinement
2805001300	Miscellaneous Area Sources;Agriculture Production - Livestock;Beef cattle - finishing operations on feedlots (drylots);Land application of manure
2805002000	Miscellaneous Area Sources;Agriculture Production - Livestock;Beef cattle production composite;Not Elsewhere Classified
2805003100	Miscellaneous Area Sources;Agriculture Production - Livestock;Beef cattle - finishing operations on pasture/range;Confinement
2805007100	Miscellaneous Area Sources;Agriculture Production - Livestock;Poultry production - layers with dry manure management systems;Confinement
2805009100	Miscellaneous Area Sources;Agriculture Production - Livestock;Poultry production - broilers;Confinement
2805010100	Miscellaneous Area Sources;Agriculture Production - Livestock;Poultry production - turkeys;Confinement
2805018000	Miscellaneous Area Sources;Agriculture Production - Livestock;Dairy cattle composite;Not Elsewhere Classified
2805020002	Miscellaneous Area Sources;Agriculture Production - Livestock;Cattle and Calves Waste Emissions;Beef Cows
2805023100	Miscellaneous Area Sources;Agriculture Production - Livestock;Dairy cattle - drylot/pasture dairy;Confinement
2805030000	Miscellaneous Area Sources;Agriculture Production - Livestock;Poultry Waste Emissions;Not Elsewhere Classified (see also 28-05-007, -008, -009)
2805030007	Miscellaneous Area Sources;Agriculture Production - Livestock;Poultry Waste Emissions;Ducks
2805030008	Miscellaneous Area Sources;Agriculture Production - Livestock;Poultry Waste Emissions;Geese
2805035000	Miscellaneous Area Sources;Agriculture Production - Livestock;Horses and Ponies Waste Emissions;Not Elsewhere Classified
2805039100	Miscellaneous Area Sources;Agriculture Production - Livestock;Swine production - operations with lagoons (unspecified animal age);Confinement
2805040000	Miscellaneous Area Sources;Agriculture Production - Livestock;Sheep and Lambs Waste Emissions;Total
2805045000	Miscellaneous Area Sources;Agriculture Production - Livestock;Goats Waste Emissions;Not Elsewhere Classified
2805047100	Miscellaneous Area Sources;Agriculture Production - Livestock;Swine production - deep-pit house operations (unspecified animal age);Confinement
2805053100	Miscellaneous Area Sources;Agriculture Production - Livestock;Swine production - outdoor operations (unspecified animal age);Confinement

Typically, the NEI will also have applied a meteorological based adjustment (based on a coarser spatial and temporal resolution than the modeling platform adjustment), but this was inadvertently not done for the 2014 NEI v1. It will be corrected for the 2014 NEI v2.

Where states submitted afdust data, it was assumed that the state-submitted data were not met-adjusted and therefore the meteorological adjustments were applied. Thus, if states submitted data that were met-adjusted, these sources would have been adjusted for meteorology twice. Even with that possibility, air quality modeling shows that, in general, dust is frequently overestimated in the air quality modeling results.

The total impacts of the transport fraction and meteorological adjustments for the 2014NEIv1 are shown in Table 2-7. The amount of the reduction ranges from about 94 percent in New Hampshire to about 23 percent in Nevada. The afdust emissions adjustments are similar to previous platforms; in the 2011v6.3 the reduction ranged from 29 percent in Nevada to 93 percent in New Hampshire.

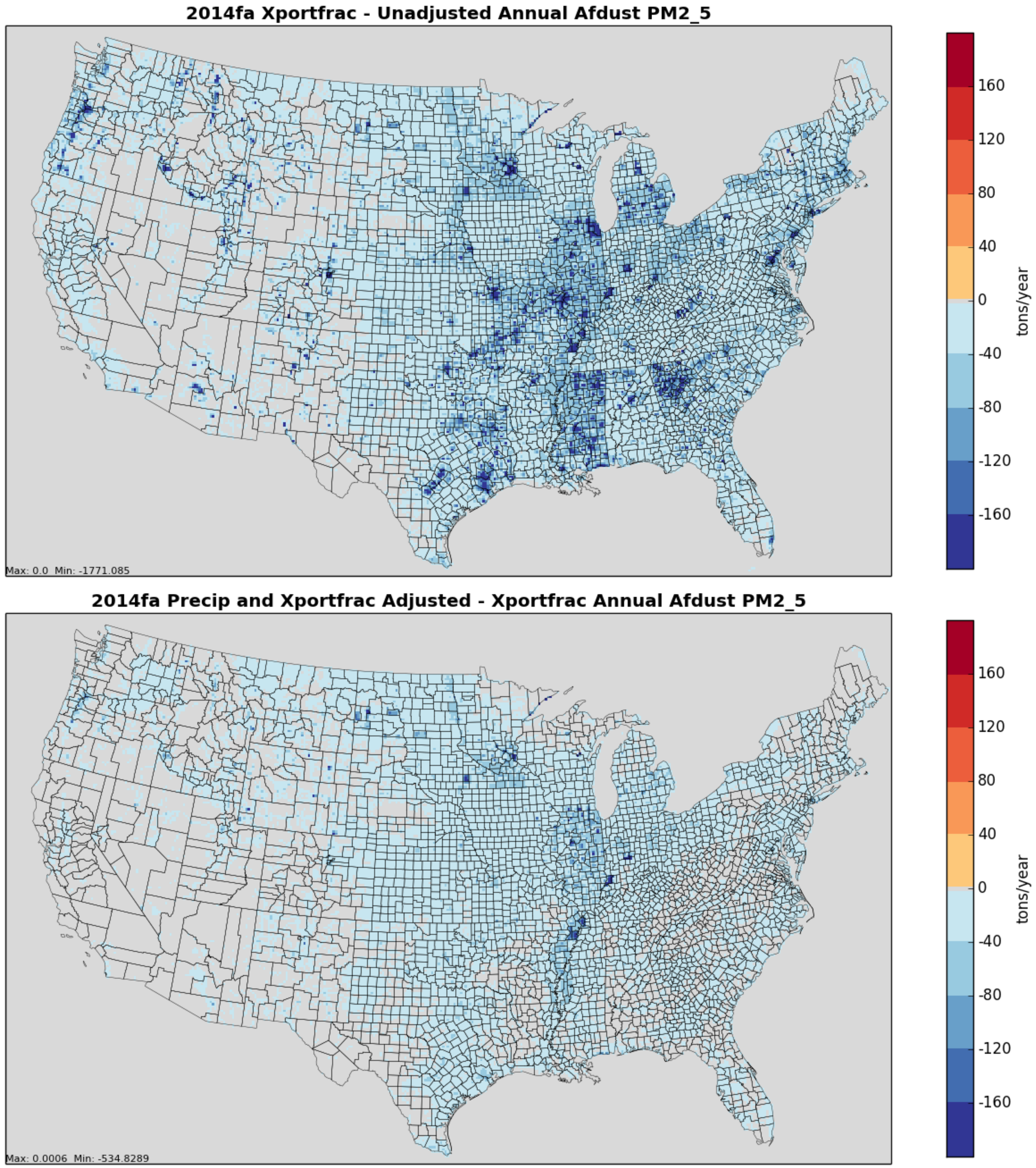
Figure 2-1 shows the impact of each step of the adjustment for 2014. The reductions due to the transport fraction adjustments alone are shown at the top of Figure 2-1. The reductions due to the precipitation adjustments are shown in the middle of Figure 2-1. The cumulative emission reductions after both transport fraction and meteorological adjustments are shown at the bottom of Figure 2-1. The top plot shows how the transport fraction has a larger reduction effect in the east, where forested areas are more effective at reducing PM transport than in many western areas. The middle plot shows how the meteorological impacts of precipitation, along with snow cover in the north, further reduce the dust emissions.

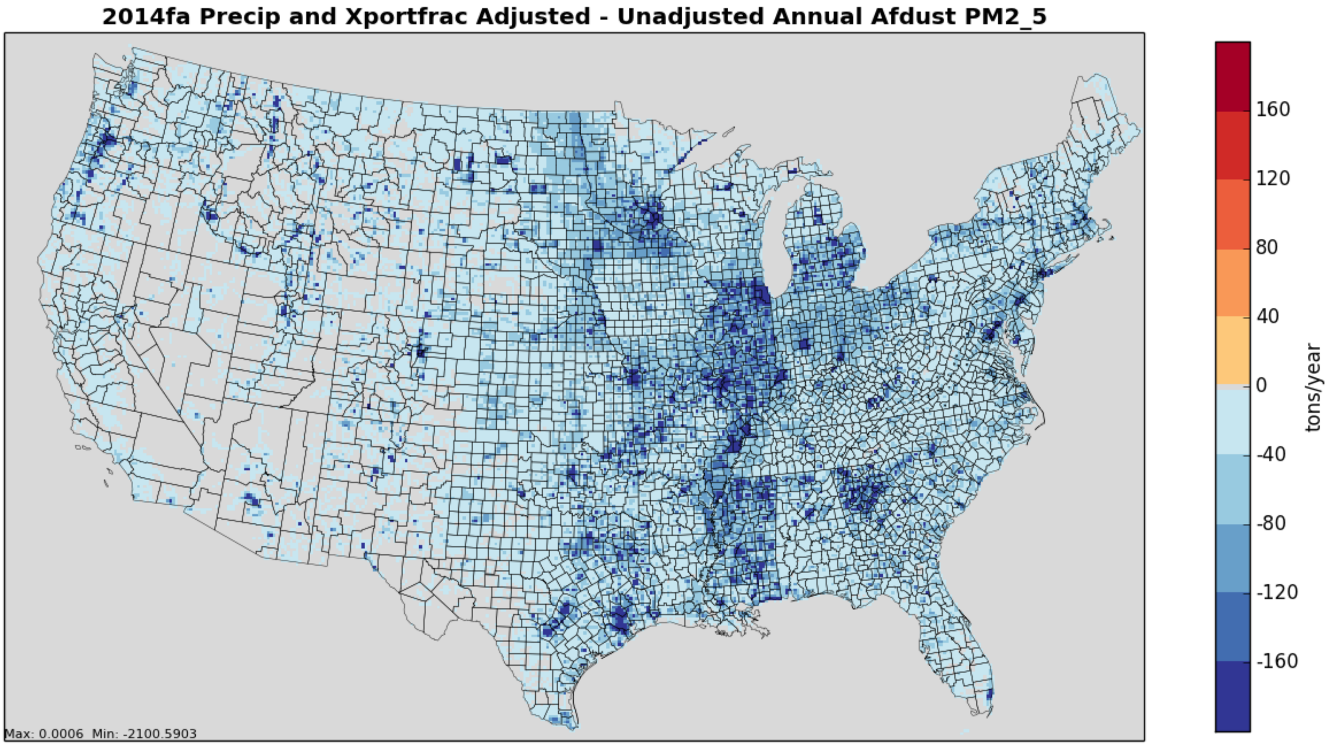
Table 2-7. Total impact of fugitive dust adjustments to unadjusted 2014 inventory

State	Unadjusted PM_{10}	Unadjusted $PM_{2.5}$	Change in PM_{10}	Change in $PM_{2.5}$	PM_{10} Reduction	$PM_{2.5}$ Reduction
Alabama	301,066	39,238	-247,604	-32,323	82%	82%
Arizona	254,017	31,465	-85,038	-10,486	33%	33%
Arkansas	522,929	77,319	-365,957	-52,085	70%	67%
California	242,366	29,019	-107,648	-12,594	44%	43%
Colorado	320,178	46,675	-186,191	-26,305	58%	56%
Connecticut	24,763	3,443	-21,689	-3,025	88%	88%
Delaware	11,792	2,103	-8,617	-1,530	73%	73%
District of Columbia	2,724	385	-2,098	-301	77%	78%
Florida	267,505	35,137	-166,740	-21,719	62%	62%
Georgia	652,978	76,464	-539,820	-62,912	83%	82%
Idaho	394,948	42,204	-264,567	-27,673	67%	66%
Illinois	1,508,681	193,959	-983,512	-125,592	65%	65%
Indiana	334,337	64,063	-238,264	-45,678	71%	71%
Iowa	414,565	59,709	-262,000	-37,486	63%	63%
Kansas	730,033	109,224	-348,062	-50,327	48%	46%
Kentucky	246,960	40,288	-193,555	-31,519	78%	78%

State	Unadjusted PM_{10}	Unadjusted $PM_{2.5}$	Change in PM_{10}	Change in $PM_{2.5}$	PM_{10} Reduction	$PM_{2.5}$ Reduction
Louisiana	253,283	37,433	-177,236	-25,625	70%	68%
Maine	52,659	7,289	-47,311	-6,580	90%	90%
Maryland	89,556	13,287	-69,111	-10,208	77%	77%
Massachusetts	84,833	10,444	-73,006	-8,949	86%	86%
Michigan	599,754	75,364	-475,888	-59,860	79%	79%
Minnesota	994,798	146,884	-738,425	-107,204	74%	73%
Mississippi	969,415	112,262	-787,972	-89,169	81%	79%
Missouri	1,192,487	155,430	-856,307	-109,633	72%	71%
Montana	503,025	73,674	-313,862	-43,850	62%	60%
Nebraska	672,131	100,677	-337,364	-49,948	50%	50%
Nevada	156,786	21,971	-37,635	-5,085	24%	23%
New Hampshire	23,647	3,499	-22,125	-3,274	94%	94%
New Jersey	24,165	5,413	-18,985	-4,257	79%	79%
New Mexico	542,948	58,691	-187,942	-20,307	35%	35%
New York	308,356	43,255	-258,663	-35,975	84%	83%
North Carolina	191,357	31,325	-156,502	-25,536	82%	82%
North Dakota	578,498	102,941	-343,227	-60,734	59%	59%
Ohio	412,523	63,677	-313,565	-48,094	76%	76%
Oklahoma	811,301	102,376	-431,612	-52,677	53%	51%
Oregon	483,334	57,107	-360,980	-40,719	75%	71%
Pennsylvania	186,345	32,785	-159,152	-28,248	85%	86%
Rhode Island	5,456	831.925	-4,258	-652	78%	78%
South Carolina	254,609	31,080	-199,760	-24,398	78%	79%
South Dakota	424,307	76,111	-239,017	-42,552	56%	56%
Tennessee	167,206	28,600	-132,452	-22,598	79%	79%
Texas	2,216,284	271,267	-1,161,139	-137,767	52%	51%
Utah	156,067	21,109	-80,361	-10,762	51%	51%
Vermont	67,204	7,491	-61,705	-6,868	92%	92%
Virginia	167,918	24,601	-140,043	-20,485	83%	83%
Washington	185,634	31,451	-102,422	-16,991	55%	54%
West Virginia	108,001	13,569	-100,214	-12,593	93%	93%
Wisconsin	284,614	50,548	-219,653	-39,216	77%	78%
Wyoming	474,706	51,957	-252,122	-27,579	53%	53%
Domain Total	**19,873,047**	**2,715,097**	**-12,881,384**	**-1,739,951**	**65%**	**64%**

Figure 2-1. Impact of adjustments to fugitive dust emissions due to transport fraction, precipitation, and cumulative





Agricultural ammonia sector (ag)Table 2-9. The “ag” sector includes all of the NH_3 emissions from fertilizer from the NEI. However, the “ag” sector does not include all of the livestock NH_3 emissions, as there is a very small amount of NH_3 emissions from livestock in the ptnonipm inventory (as point sources) in California (883 tons; less than 0.5 percent of state total) and Wisconsin (356 tons; about 1 percent of state total). The total ag sector (livestock plus fertilizer) in the 2014v7.0 platform has 3,140,259 tons NH_3 compared with 3,522,491 tons NH_3 in the 2011v6.3 platform.

Table 2-8. Livestock SCCs extracted from the NEI to create the ag sector

SCC	SCC Description*
2805001100	Beef cattle - finishing operations on feedlots (drylots);Confinement
2805001200	Beef cattle - finishing operations on feedlots (drylots);Manure handling and storage
2805001300	Beef cattle - finishing operations on feedlots (drylots);Land application of manure
2805002000	Beef cattle production composite; Not Elsewhere Classified
2805003100	Beef cattle - finishing operations on pasture/range; Confinement
2805007100	Poultry production - layers with dry manure management systems;Confinement
2805007300	Poultry production - layers with dry manure management systems;Land application of manure
2805008100	Poultry production - layers with wet manure management systems;Confinement
2805008200	Poultry production - layers with wet manure management systems;Manure handling and storage
2805008300	Poultry production - layers with wet manure management systems;Land application of manure
2805009100	Poultry production - broilers;Confinement
2805009200	Poultry production - broilers;Manure handling and storage
2805009300	Poultry production - broilers;Land application of manure
2805010100	Poultry production - turkeys;Confinement
2805010200	Poultry production - turkeys;Manure handling and storage
2805010300	Poultry production - turkeys;Land application of manure
2805018000	Dairy cattle composite;Not Elsewhere Classified
2805019100	Dairy cattle - flush dairy;Confinement
2805019200	Dairy cattle - flush dairy;Manure handling and storage
2805019300	Dairy cattle - flush dairy;Land application of manure

SCC	SCC Description*
2805020002	Cattle and Calves Waste Emissions:Beef Cows
2805021100	Dairy cattle - scrape dairy;Confinement
2805021200	Dairy cattle - scrape dairy;Manure handling and storage
2805021300	Dairy cattle - scrape dairy;Land application of manure
2805022100	Dairy cattle - deep pit dairy;Confinement
2805022200	Dairy cattle - deep pit dairy;Manure handling and storage
2805022300	Dairy cattle - deep pit dairy;Land application of manure
2805023100	Dairy cattle - drylot/pasture dairy;Confinement
2805023200	Dairy cattle - drylot/pasture dairy;Manure handling and storage
2805023300	Dairy cattle - drylot/pasture dairy;Land application of manure
2805025000	Swine production composite;Not Elsewhere Classified (see also 28-05-039, -047, -053)
2805030000	Poultry Waste Emissions;Not Elsewhere Classified (see also 28-05-007, -008, -009)
2805030007	Poultry Waste Emissions;Ducks
2805030008	Poultry Waste Emissions;Geese
2805035000	Horses and Ponies Waste Emissions;Not Elsewhere Classified
2805039100	Swine production - operations with lagoons (unspecified animal age);Confinement
2805039200	Swine production - operations with lagoons (unspecified animal age);Manure handling and storage
2805039300	Swine production - operations with lagoons (unspecified animal age);Land application of manure
2805040000	Sheep and Lambs Waste Emissions;Total
2805045000	Goats Waste Emissions;Not Elsewhere Classified
2805047100	Swine production - deep-pit house operations (unspecified animal age);Confinement
2805047300	Swine production - deep-pit house operations (unspecified animal age);Land application of manure
2805053100	Swine production - outdoor operations (unspecified animal age);Confinement

* All SCC Descriptions begin “Miscellaneous Area Sources;Agriculture Production – Livestock”

Table 2-9. Fertilizer SCCs extracted from the NEI for inclusion in the “ag” sector

SCC	SCC Description*
2801700001	Anhydrous Ammonia
2801700002	Aqueous Ammonia
2801700003	Nitrogen Solutions
2801700004	Urea
2801700005	Ammonium Nitrate
2801700006	Ammonium Sulfate
2801700007	Ammonium Thiosulfate
2801700010	N-P-K (multi-grade nutrient fertilizers)
2801700011	Calcium Ammonium Nitrate
2801700012	Potassium Nitrate
2801700013	Diammonium Phosphate
2801700014	Monoammonium Phosphate
2801700015	Liquid Ammonium Polyphosphate
2801700099	Miscellaneous Fertilizers

* All descriptions include “Miscellaneous Area Sources; Agriculture Production – Crops; Fertilizer Application” as the beginning of the description.

Agricultural NH_3 emissions in the platform are based on the 2014NEIv1, which is a mix of state-submitted data and EPA estimates. The EPA estimates used new methodologies for both livestock and fertilizer emissions. Livestock emissions were estimated based on daily emission factors by animal and county from a model developed by Carnegie Mellon University (CMU) (Pinder, 2004, McQuilling,

2015) and 2012 and 2014 U.S. Department of Agriculture (USDA) agricultural census data. Details are provided in Section 4.5 of the 2014NEIv1 TSD. For the NEI, these were summed to annual totals, but for the platform, they were used at the daily resolution. State data, which were annual, were allocated to daily emissions using the county-specific EPA data for matching animal types. For horses and goats (not estimated by EPA), the EPA's dairy cattle estimates were used. For counties with no EPA dairy cattle estimates, the sum of all animals was used. If there were no EPA county-level livestock data, the daily estimates were created using EPA state-level daily totals.

Annual fertilizer emissions were submitted by three states for all or part of the sector as shown in parentheses: California (68 percent), Illinois (100 percent) and Georgia (58 percent). The remainder, estimated by EPA, employed a methodology that uses the bidirectional (bi-di) version of CMAQ (v5.0.2) and the Fertilizer Emissions Scenario Tool for CMAQ FEST-C (v1.2). This is described in Section 4.4 of the 2014 NEIv1 TSD. These data were used at annual resolution. The temporal allocation is discussed in Section 3.3.4.

2.2.2 Agricultural fires (agfire and ptagfire)

There are two agricultural fire sectors that together contain emissions from agricultural fires for 2014 based on the 2014NEIv1 emissions for SCCs starting with 28015: agfire and ptagfire. These emissions were placed into these sectors based on whether they were state data and had county resolution (agfire) or EPA data and had day-specific point source resolution. The first three levels of descriptions for these SCCs are: 1) Fires - Agricultural Field Burning; Miscellaneous Area Sources; 2) Agriculture Production - Crops - as nonpoint; and 3) Agricultural Field Burning - whole field set on fire. The SCC 2801500000 does not specify the crop type or burn method, while the more specific SCCs specify field or orchard crops and, in some cases, the specific crop being grown. New agricultural field burning SCCs were added to the NEI for 2014 to account for grass/pasture burning (also known as rangeland burning) which is included the agriculture field burning sector of the NEI. The EPA's estimation methods were improved from those used in the 2011 NEI and are documented in Section 4.11 of the 2014NEIv1 TSD. Improvements include use of multiple satellite detection database and crop level land use information.

The ptagfire contains all agricultural fire emissions estimated by the EPA at point source and day-specific resolution. For the NEI, these are summed to the county and national level, but because they are computed at this finer resolution, we chose to use the data at this level for the platform. States covered in the ptagfire sector are: AL, AR, CO, KS, KY, LA, MD, MA, MI, MN, MS, MO, MT, NE, NV, NM, NY, NC, ND, OH, OK, OR, PA, SD, TN, TX, UT, VA, WV, WI, and WY.

The agfire sector contains only emissions that were submitted by state agencies and were not able to be modeled with finer resolution than county/annual. These states are: AZ, CA, FL, GA, HI, ID, IL, IN, IA, NJ, SC and WA.

2.2.3 Nonpoint source oil and gas sector (np_oilgas)

The nonpoint oil and gas (np_oilgas) sector contains onshore and offshore oil and gas emissions. The EPA estimated emissions for all counties with 2014 oil and gas activity data with the Oil and Gas Tool, and many S/L/T agencies also submitted nonpoint oil and gas data. Where S/L/T submitted nonpoint CAPS but no HAPs, the EPA augmented the HAPs using HAP augmentation factors (county and SCC level) created from the Oil and Gas Tool. The types of sources covered include drill rigs, workover rigs, artificial lift, hydraulic fracturing engines, pneumatic pumps and other devices, storage tanks, flares, truck loading, compressor engines, and dehydrators. Nonpoint oil and gas emissions of benzene, ethyl benzene, xylenes and toluene were corrected in the 2014v7.0 platform for four counties in the Uinta due to an error discoved in the Uinta-basin specific speciation profiles for oil and condensate tanks which was used in the oil and gas tool for generating the HAP augmentation factors. The updates affected the following SCCs: 2310010200 (Oil Well Tanks - Flashing & Standing/Working/Breathing); 2310011201 (Tank Truck/Railcar Loading: Crude Oil); 2310021010 (Storage Tanks: Condensate); and 2310021030 (Tank Truck/Railcar Loading: Condensate), and generally reduced these HAPs from the 2 condensate-related SCCs and increased benzene (by a factor of 3) from the two oil tank-related SCCs. Overall, the np_oilgas emissions in Utah in the platform are 31 tons lower for benzene, 29 tons lower for ethylbenzene, 213 tons lower for toluene, and 335 tons lower for xylenes than the 2014NEIv1.

A complete list of SCCs for the np_oilgas modeling platform sector is provided in Appendix B. See the pt_oilgas sector (section 2.1.2) for more information on point source oil and gas sources. Updates were made to the speciation, and spatial allocation of sources from the 2011v6.3 platform based on updated speciation and spatial surrogate data. Sections 3.2, 3.3, and 3.4 provide additional details.

2.2.4 Residential wood combustion sector (rwc)

The residential wood combustion (rwc) sector includes residential wood burning devices such as fireplaces, fireplaces with inserts (inserts), free standing woodstoves, pellet stoves, outdoor hydronic heaters (also known as outdoor wood boilers), indoor furnaces, and outdoor burning in firepots and chimneas. Free standing woodstoves and inserts are further differentiated into three categories: 1) conventional (not EPA certified); 2) EPA certified, catalytic; and 3) EPA certified, noncatalytic. Generally speaking, the conventional units were constructed prior to 1988. Units constructed after 1988 have to meet EPA emission standards and they are either catalytic or non-catalytic. As with the other nonpoint categories, a mix of S/L and EPA estimates were used. The EPA's estimates use updated methodologies for activity data and some changes to emission factors. For more information on the development of the residential wood combustion emissions, see Section 4.14 of the 2014NEIv1 TSD.

Table 2-10. SCCs in the residential wood combustion sector (rwc)*

SCC	SCC Description
2104008100	SSFC;Residential;Wood;Fireplace: general
2104008210	SSFC;Residential;Wood;Woodstove: fireplace inserts; non-EPA certified
2104008220	SSFC;Residential;Wood;Woodstove: fireplace inserts; EPA certified; non-catalytic
2104008230	SSFC;Residential;Wood;Woodstove: fireplace inserts; EPA certified; catalytic
2104008310	SSFC;Residential;Wood;Woodstove: freestanding, non-EPA certified
2104008320	SSFC;Residential;Wood;Woodstove: freestanding, EPA certified, non-catalytic
2104008330	SSFC;Residential;Wood;Woodstove: freestanding, EPA certified, catalytic
2104008400	SSFC;Residential;Wood;Woodstove: pellet-fired, general (freestanding or FP insert)
2104008510	SSFC;Residential;Wood;Furnace: Indoor, cordwood-fired, non-EPA certified
2104008610	SSFC;Residential;Wood;Hydronic heater: outdoor
2104008700	SSFC;Residential;Wood;Outdoor wood burning device, NEC (fire-pits, chimeas, etc)
2104009000	SSFC;Residential;Firelog;Total: All Combustor Types

* SSFC=Stationary Source Fuel Combustion

2.2.5 Other nonpoint sources sector (nonpt)

Stationary nonpoint sources that were not subdivided into the afdust, ag, np_oilgas, or rwc sectors were assigned to the "nonpt" sector. Locomotives and CMV mobile sources from the 2014NEIv1 nonpoint inventory are described in Section 2.4.1. There are too many SCCs in the nonpt sector to list all of them individually, but the types of sources in the nonpt sector include:

- stationary source fuel combustion, including industrial, commercial, and residential and orchard heaters;
- chemical manufacturing;
- industrial processes such as commercial cooking, metal production, mineral processes, petroleum refining, wood products, fabricated metals, and refrigeration;
- solvent utilization for surface coatings such as architectural coatings, auto refinishing, traffic marking, textile production, furniture finishing, and coating of paper, plastic, metal, appliances, and motor vehicles;
- solvent utilization for degreasing of furniture, metals, auto repair, electronics, and manufacturing;
- solvent utilization for dry cleaning, graphic arts, plastics, industrial processes, personal care products, household products, adhesives and sealants;
- solvent utilization for asphalt application and roofing, and pesticide application;
- storage and transport of petroleum for uses such as portable gas cans, bulk terminals, gasoline service stations, aviation, and marine vessels;
- storage and transport of chemicals;
- waste disposal, treatment, and recovery via incineration, open burning, landfills, and composting;
- miscellaneous area sources such as cremation, hospitals, lamp breakage, and automotive repair shops.

2.3 2014 onroad mobile sources (onroad)

Onroad mobile source emissions result from motorized vehicles that are normally operated on public roadways. These include passenger cars, motorcycles, minivans, sport-utility vehicles, light-duty trucks, heavy-duty trucks, and buses. The sources are further divided between diesel, gasoline, E-85, and compressed natural gas (CNG) vehicles. The sector characterizes emissions from parked vehicle processes (e.g., starts, hot soak, and extended idle) as well as from on-network processes (i.e., from vehicles moving along the roads). Except for California, all onroad emissions are generated using the SMOKE-MOVES emissions modeling framework that leverages MOVES generated emission factors (http://www.epa.gov/otaq/models/moves/index.htm), county and SCC-specific activity data, and hourly meteorological data. The onroad SCCs in the modeling platform are more resolved than those in the NEI, because the NEI SCCs distinguish vehicles and fuels, but in the platform, they also distinguish between off-network, extended idle, and the various MOVES road-types. For more details on the approach and for a summary of the inputs submitted by states, see the section 6.4.1 of the 2014NEIv1 TSD.

One difference between the preparation of 2014 onroad emissions inventories as compared to those for previous years is that the 2014 inventories (i.e., both NEI and platform) contain diesel PM for diesel-fueled vehicles. The pollutants DIESEL-PM10 and DIESEL-PM25 were set equal to the PM_{10} and $PM_{2.5}$ emissions for all diesel vehicles.

2.3.1 Onroad (onroad)

For the continental U.S., the EPA used a modeling framework that took into account the temperature sensitivity of the on-road emissions. Specifically, the EPA used MOVES inputs for representative counties, vehicle miles traveled (VMT), vehicle population (VPOP), and hoteling data for all counties, along with tools that integrated the MOVES model with SMOKE. In this way, it was possible to take advantage of the gridded hourly temperature information available from meteorology modeling used for air quality modeling. The "SMOKE-MOVES" integration tool was developed by the EPA in 2010 and is used for regional air quality modeling of onroad mobile sources.

SMOKE-MOVES requires that emission rate "lookup" tables be generated by MOVES, which differentiates emissions by process (i.e., running, start, vapor venting, etc.), vehicle type, road type, temperature, speed, hour of day, etc. To generate the MOVES emission rates that could be applied across the U.S., the EPA used an automated process to run MOVES to produce emission factors for a series of temperatures and speeds for a set of "representative counties," to which every other county is mapped. Representative counties are used because it is impractical to generate a full suite of emission factors for the more than 3,000 counties in the U.S. The representative counties for which emission factors are generated are selected according to their state, elevation, fuels, age distribution, ramp fraction, and inspection and maintenance programs. Each county is then mapped to a representative county based on its similarity to the representative county with respect to those attributes. For the 2014v7.0 platform, there are 297 representative counties, a slight increase from the 285 representative counties in the 2011v6.3 platform. A detailed discussion of the representative counties is in the 2014NEIv1 TSD, Section 6.6.2.

Once representative counties have been identified, emission factors are generated with MOVES for each representative county and for two "fuel months" – January to represent winter months, and July to represent summer months – due to the different types of fuels used. SMOKE selects the appropriate MOVES emissions rates for each county, hourly temperature, SCC, and speed bin and multiplies the emission rate by appropriate activity data: VMT (vehicle miles travelled), VPOP (vehicle population), or HOTELING (hours of extended idle) to produce emissions. These calculations are done for every county and grid cell in the continental U.S. for each hour of the year.

The SMOKE-MOVES process for creating the model-ready emissions consists of the following steps:

1) Determine which counties will be used to represent other counties in the MOVES runs.
2) Determine which months will be used to represent other month's fuel characteristics.
3) Create inputs needed only by MOVES. MOVES requires county-specific information on vehicle populations, age distributions, and inspection-maintenance programs for each of the representative counties.
4) Create inputs needed both by MOVES and by SMOKE, including temperatures and activity data.
5) Run MOVES to create emission factor tables for the temperatures found in each county.
6) Run SMOKE to apply the emission factors to activity data (VMT, VPOP, and HOTELING) to calculate emissions based on the gridded hourly temperatures in the meteorological data.
7) Aggregate the results to the county-SCC level for summaries and QA.

The onroad emissions are processed in four processing streams that are merged together into the onroad sector emissions after each of the four streams have been processed:

- rate-per-distance (RPD) uses VMT as the activity data plus speed and speed profile information to compute on-network emissions from exhaust, evaporative, permeation, refueling, and brake and tire wear processes;
- rate-per-vehicle (RPV) uses VPOP activity data to compute off-network emissions from exhaust, evaporative, permeation, and refueling processes;
- rate-per-profile (RPP) uses VPOP activity data to compute off-network emissions from evaporative fuel vapor venting, including hot soak (immediately after a trip) and diurnal (vehicle parked for a long period) emissions; and
- rate-per-hour (RPH) uses hoteling hours activity data to compute off-network emissions for idling of long-haul trucks from extended idling and auxiliary power unit process.

The onroad emissions inputs for the platform are the same as for the emissions in the onroad data category of the 2014NEIv1, described in more detail in Sections 6.4 and 6.5 of the 2014NEIv1 TSD. These inputs are:

- MOVES County databases (CDBs) including Low Emission Vehicle (LEV) table
- Representative counties
- Fuel months
- Meteorology
- Activity data (VMT, VPOP, speed, HOTELING)

The key differences between the 2014v7.0 platform onroad emission inventories and the 2014NEIv1 inventories are:

- The 2014 platform uses a different post-processor to create emission factors for SMOKE because the pollutants needed for speciation and running CMAQ are different than what is needed for the NEI. For example, the NEI needs a much larger set of HAPs and the modeling platform requires emissions for the components of $PM_{2.5}$.

- The NEI includes emissions for Alaska, Hawaii, Puerto Rico, and the Virgin Islands, whereas the modeling platform does not.

- The treatment of California emissions differs between the two inventories (see below for more details). Due to this treatment, the California HAP VOC emissions are different in the platform than what was submitted to the NEI (See Table 2-13, below).

- Manganese emissions for brake and tirewear are different, except for California, which submitted their own emissions. Other than in California, the platform manganese was computed using speciation profiles for brake and tirewear that were updated from those used for the NEI. For the platform, we used profiles 95462 (Composite - Brake Wear) and 95460 (Composite - Tire Dust), which were added to SPECIATE4.5. For the NEI, we used profiles 91134 (Brake Lining Dust – Composite) and 91150 (Tire Dust – Composite), which are from SPECIATE4.3.

Table 2-11. Brake and tirewear manganese emissions

	2014 Brake and Tirewear Manganese Emissions, tons		
	Sum of 49 states, Puerto Rico, Virgin Islands		California
	Using Platform Speciation	Using NEI Speciation	
Brakewear	19.3	14.9	26.1
Tirewear	0.0070	0.5	0.32
Total	19.3	15.4	26.4

- The list of emission modes and SCCs differ between the two inventories. Both SMOKE-MOVES runs were generated at the same level of detail, but the NEI emissions were aggregated into 2 all-inclusive modes: refueling and all other modes. In addition, the NEI SCCs were aggregated over roads to all parking and all road emissions. The list of modes (or aggregate processes) used in the 2011v6.3 platform and the corresponding MOVES processes mapped to them are listed in Table 2-12.

Table 2-12. Onroad emission aggregate processes

Aggregate process	Description	MOVES process IDs
40	All brake and tire wear	9;10
53	All extended idle exhaust	17;90
62	All refueling	18;19
72	All exhaust and evaporative except refueling and hoteling	1;2;11;12;13;15;16
91	Auxiliary Power Units	91

An additional step was taken for the refueling emissions. Colorado submitted point emissions for refueling for some counties[3]. For these counties, the EPA zeroed out the onroad estimates of refueling (i.e., SCCs =220xxxxx62) so that the states' point emissions would take precedence. The onroad refueling emissions were zeroed out using the adjustment factor file (CFPRO) and Movesmrg.
For more detailed information on the methods used to develop the 2014 onroad mobile source emissions and the input data sets, see the 2014NEIv1 TSD.

California is the only state agency for which submitted onroad emissions were used in the 2014 NEI v1 and 2014v7.0 platform. California uses their own emission model, EMFAC, which uses emission inventory codes (EICs) to characterize the emission processes instead of SCCs. The EPA and California worked together to develop a code mapping to better match EMFAC's EICs to EPA MOVES' detailed set of SCCs that distinguish between off-network and on-network and brake and tire wear emissions. This detail is needed for modeling but not for the NEI. This code mapping is provided in "2014v1_EICtoEPA_SCCmapping.xlsx." California then provided their CAP and HAP emissions by county using EPA SCCs after applying the mapping. There was one change made after the mapping: the vehicle/fuel type combination gas intercity buses (first 6 digits of the SCC = 220141), that is not generated using MOVES, was changed to gasoline single unit short-haul trucks (220152) for consistency with the modeling inventory.

[3] There were 52 counties in Colorado that had point emissions for refueling. Outside Colorado, it was determined that refueling emissions in the 2014 NEIv1 point did not significantly duplicate the refueling emissions in onroad.

California also submitted onroad refueling VOC emissions. For the NEI, the mapped California emissions were summed to the level of fuel type and MOVES source type. For the modeling platform, the emissions were used to adjust the MOVES-based California onroad emissions (including refueling) as described below. MOVES provides chemical-mechanism specific emissions that, for onroad, use the MOVES-based HAPs, and ethanol, and the speciation of the remainder of the VOC based on model-year information. For California, we adjusted the MOVES-based emissions using California VOC, NO_X, PM and metal HAPs. This preserved the MOVES speciation but it did not allow for use of the California-submitted VOC HAPs that are in the 2014NEIv1.

The California onroad mobile source emissions were created through a hybrid approach of combining state-supplied annual emissions with EPA-developed SMOKE-MOVES runs. Through this approach, the platform was able to reflect the unique rules in California, while leveraging the more detailed SCCs and the highly resolved spatial patterns, temporal patterns, and speciation from SMOKE-MOVES. The basic steps involved in temporally allocating onroad emissions from California based on SMOKE-MOVES results were:

1) Run CA using EPA inputs through SMOKE-MOVES to produce hourly 2014 emissions hereafter known as "EPA estimates." These EPA estimates for CA are run in a separate sector called "onroad_ca."
2) Calculate ratios between state-supplied emissions and EPA estimates[4]. These were calculated for each county/SCC/pollutant combination. Unlike in previous platforms, the California data separated off and on-network emissions and extended idling. However, the on-network did not provide specific road types, and California's emissions did not include information for vehicles fueled by E-85, so these differentiations were obtained using MOVES.
3) Create an adjustment factor file (CFPRO) that includes EPA-to-state estimate ratios.
4) Rerun CA through SMOKE-MOVES using EPA inputs and the new adjustment factor file.

Through this process, adjusted model-ready files were created that sum to annual totals from California, but have the temporal and spatial patterns reflecting the highly resolved meteorology and SMOKE-MOVES. After adjusting the emissions, this sector is called "onroad_ca_adj." Note that in emission summaries, the emissions from the "onroad" and "onroad_ca_adj" sectors are summed and designated as the emissions for the onroad sector.

Table 2-13. Differences in California VOC HAP emissions between 2014v7.0 platform and the 2014NEIv1

Pollutant	NEI	Platform
1,3-Butadiene	348	285
2,2,4-Trimethylpentane	2,691	2,833
Acetaldehyde	1,346	1,074
Acrolein	55	97
Benzene	3,075	2,582

[4] These ratios were created for all matching pollutants. These ratios were duplicated for all appropriate modeling species. For example, the EPA used the NO_X ratio for NO, NO_2, HONO and used the $PM_{2.5}$ ratio for PEC, PNO_3, POC, PSO_4, etc. (For more details on NO_X and PM speciation, see Sections 3.2.2, and 3.2.3. For VOC model-species, if there was an exact match (e.g., BENZENE), the EPA used that HAP pollutant ratio. For other VOC-based model-species that didn't exist in the NEI inventory, the EPA used VOC ratios.)

Pollutant	NEI	Platform
Ethylbenzene	1,380	2,004
Formaldehyde	2,809	1,628
Hexane	1,389	2,838
Methanol	3,334	0
Methyl tert-butyl ether	111	0
Naphthalene	182	204
Styrene	137	68
Toluene	8,034	12,714
Xylenes	6,635	7,389

2.4 2014 nonroad mobile sources (cmv, rail, nonroad)

The nonroad mobile source emission modeling sectors consist of nonroad equipment emissions (nonroad), locomotive (rail) and CMV emissions.

2.4.1 Category 1, Category 2, Category 3 Commercial Marine Vessels (cmv)

The cmv sector contains Category 1, 2 and 3 CMV emissions from the 2014 NEIv1, but excludes C3 emissions from the NEI that originate in Federal Waters (FIPs beginning with 85). Instead, we used the more spatially resolved emissions from the Emissions Control Area-International Marine Organization (ECA-IMO)-based C3 CMV. The ECA-IMO emissions are in the othpt sector. All emissions in this sector are annual and at county-SCC resolution; however, in the NEI they are provided at the sub-county level (port or underway shape ids) and by SCC and emission type (e.g., hoteling, maneuvering). This sub-county data in the NEI are used to create spatial surrogates. Table 2-12 provides the SCCs extracted from the NEI for the cmv sector. Category 1 and 2 vessels are the diesel ships; Category 3 vessels are the residual oil ships.

Table 2-14. 2014NEIv1 SCCs extracted for the cmv sector

SCC	Sector	Description: Mobile Sources prefix for all
2280002100	cmv	Marine Vessels; Commercial; Diesel; Port
2280002200	cmv	Marine Vessels; Commercial; Diesel; Underway
2280003100	cmv	Marine Vessels, Commercial; Residual; Port emissions
2280003200	cmv	Marine Vessels, Commercial; Residual; Underway emissions

Emissions estimates are a mix of state-submitted values and EPA-developed emissions in areas where states did not submit. The emissions developed by EPA use a new “bottom up” procedure based on activity details from the U.S. Coast Guard and Army Corps of Engineers databases. See section 4.19 of the 2014NEIv1 TSD for a description of the methodology.

The cmv sector includes C1 and C2 vessels outside of state waters, but that are in Federal waters (FIPS = 85). These areas include parts of the Gulf of Mexico and East and West Coasts of the U.S. Federal waters around Puerto Rico and Alaska are outside the CONUS modeling domain and are not used in the platform. As stated earlier, the cmv sector does not include emissions from C3 sources in Federal waters, even though these emissions are included in the NEI.

For all sources in this sector, DIESEL-PM10 and DIESEL-PM2.5 were set equal to the PM_{10} and $PM_{2.5}$ for each source. These pollutants are included in both the NEI and the FF10 input to SMOKE.

2.4.2 Railroad sources: (rail)

The rail sector includes all locomotives in the NEI nonpoint data category. This sector excludes railway maintenance locomotives and point source yard locomotives. Railway maintenance emissions are included in the nonroad sector. The point source yard locomotives are included in the ptnonipm sector.

The nonpoint rail data are a mix of S/L and EPA data. For 2014NEIv1, the EPA data were carried forward from the 2011 NEI. DIESEL-PM10 and DIESEL-PM2.5 are included in the NEI and are equivalent to the PM_{10} and $PM_{2.5}$ from all sources in this sector. For more information on locomotive sources in the NEI, see Section 4.20 of the 2014NEIv1 TSD.

Table 2-15. 2014NEIv1 SCCs extracted for the starting point in rail development

SCC	Sector	Description: Mobile Sources prefix for all
2285002006	rail	Railroad Equipment;Diesel;Line Haul Locomotives: Class I Operations
2285002007	rail	Railroad Equipment;Diesel;Line Haul Locomotives: Class II / III Operations
2285002008	rail	Railroad Equipment;Diesel;Line Haul Locomotives: Passenger Trains (Amtrak)
2285002009	rail	Railroad Equipment;Diesel;Line Haul Locomotives: Commuter Lines
2285002010	rail	Railroad Equipment;Diesel;Yard Locomotives

2.4.3 Nonroad mobile equipment sources: (nonroad)

The nonroad equipment emissions in the platform and the NEI result primarily from running the MOVES2014a model, which incorporates the NONROAD2008 model. MOVES2014a replaces NMIM, which was used for 2011 and earlier NEIs. MOVES2014a provides a complete set of HAPs and incorporates updated nonroad emission factors for HAPs. MOVES2014a was used for all states other than California, which uses their own model. As with other mobile diesel sources, the EPA added DIESEL-PM10 and DIESEL-PM25 for all diesel fuel SCCs and they were set equal to the PM_{10} and $PM_{2.5}$ emissions from these diesel SCCs. Additional details on the development of the 2014NEIv1 nonroad emissions are available in Section 4.5 the 2014NEIv1 TSD.

The magnitude of the annual emissions in the nonroad platform are equivalent to the emissions in the nonroad data category of the 2014NEIv1. However, the platform has monthly emission totals, which are provided by MOVES2014a and contain additional pollutants used in the emissions modeling. The emissions in the modeling platform include NONHAPTOG and ETHANOL, which are not included in the NEI. NONHAPTOG is the difference between total organic gases (TOG) and explicit species that are estimated separately such as benzene, toluene, styrene, ethanol, and numerous other compounds and are integrated into the chemical speciation process. MOVES2014a provides estimates of NONHAPTOG along with the speciation profile code for the NONHAPTOG emsission source. This is accomplished by using NHTOG#### as the pollutant code in the FF10 inventory file, where #### is a speciation profile code. Since speciation profiles are applied by SCC and pollutant, no changes to SMOKE were needed in order to use the FF10 with this profile information. This approach is not used for California, because their model provides VOC. Therefore, the profiles used in the 2011v6.3 profile were used for all California VOC sources.

The CARB-supplied nonroad annual inventory emissions values were temporalized to monthly values using monthly temporal profiles applied in SMOKE by SCC. Some VOC emissions were added to California to account for situations when VOC HAP emissions were included in the inventory, but VOC emissions were either less than the sum of the VOC HAP emissions, or were missing entirely. These additional VOC emissions were computed by summing benzene, acetaldehyde, formaldehyde, and naphthalene for the specific sources.

2.5 "Other Emissions": Offshore Category 3 commercial marine vessels, drilling platforms and non-U.S. sources

The emissions from Canada, Mexico, and non-U.S. offshore Category 3 CMV (C3 CMV) and drilling platforms are included as part of four emissions modeling sectors: othpt, othar, othafdust, and othon. The "oth" refers to the fact that these emissions are usually "other" than those in the U.S. state-county geographic FIPS, and the remaining characters provide the SMOKE source types: "pt" for point, "ar" for "area and nonroad mobile," "afdust" for area fugitive dust (Canada only), and "on" for onroad mobile.

2.5.1 Point sources from offshore C3 CMV, drilling platforms, Canada and Mexico (othpt)

The othpt sector contains a variety of point sources that are located in Federal Waters, Canada or Mexico. It includes the ECA-IMO-based C3 CMV inventory, which consists of C3 CMV emissions outside of state waters, and non-U.S. emissions farther offshore than U.S. waters. These are the same emissions as were used in the 2011v6.3 platform and are described below. Because these emissions are treated as point sources, shipping lane routes can be preserved and they may be allocated to air quality model layers higher than layer 1.

The EPA-estimated C3 CMV emissions were developed based on a 4-km resolution ASCII raster format dataset that preserves shipping lanes. This dataset has been used since the ECA-IMO project began in 2005, although it was then known as the Sulfur Emissions Control Area (SECA). The ECA-IMO emissions consist of large marine diesel engines (at or above 30 liters/cylinder) that, until recently, were allowed to meet relatively modest emission requirements and, as a result, these ships would often burn residual fuel in that region. The emissions in this sector are comprised of primarily foreign-flagged ocean-going vessels, referred to as C3 CMV ships. The cmv inventory sector includes these ships in several intra-port modes (i.e., cruising, hoteling, reduced speed zone, maneuvering, and idling) and an underway mode, and includes near-port auxiliary engine emissions.

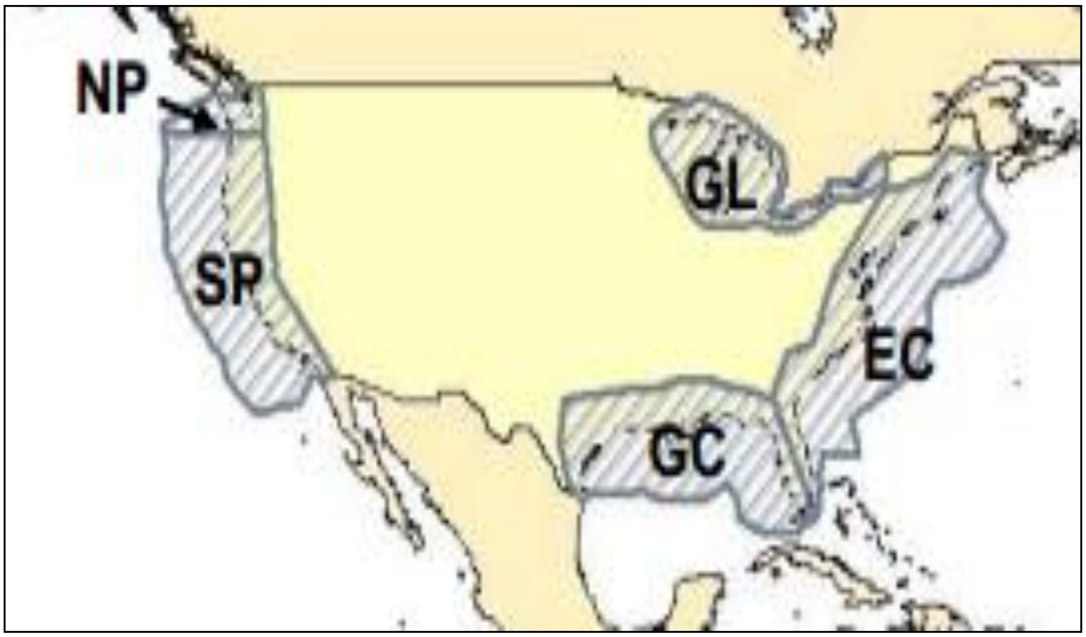
An overview of the C3 ECA Proposal to the International Maritime Organization project (EPA-420-F-10-041, August 2010) and future-year goals for reduction of NO_X, SO_2, and PM C3 emissions can be found at: http://www.epa.gov/oms/regs/nonroad/marine/ci/420r09019.pdf. The resulting ECA-IMO coordinated strategy, including emission standards under the Clean Air Act for new marine diesel engines with per-cylinder displacement at or above 30 liters, and the establishment of ECA is available from http://www.epa.gov/oms/oceanvessels.htm. The base-year ECA inventory is 2002 and consists of these CAPs: PM_{10}, $PM_{2.5}$, CO, CO_2, NH_3, NO_X, SO_X (assumed to be SO_2), and hydrocarbons (assumed to be VOC). The EPA developed regional growth (activity-based) factors that were applied to create the 2011 inventory from the 2002 data. These growth factors are provided in Table 2-16**Error! Reference**

source not found.. The geographic regions listed in the table are shown in Figure 2-2**Error! Reference source not found.**. The East Coast and Gulf Coast regions were divided along a line roughly through Key Largo (longitude 80° 26' West). Technically, the Exclusive Economic Zone (EEZ) FIPS are not really "FIPS" state-county codes, but are treated as such in the inventory and emissions processing.

Table 2-16. Growth factors to project the 2002 ECA-IMO inventory to 2011

Region	**EEZ FIPS**	**NO_X**	**PM_{10}**	**$PM_{2.5}$**	**VOC**	**CO**	**SO_2**
East Coast (EC)	85004	1.301	0.500	0.496	1.501	1.501	0.536
Gulf Coast (GC)	85003	1.114	0.428	0.423	1.288	1.288	0.461
North Pacific (NP)	85001	1.183	0.467	0.458	1.353	1.353	0.524
South Pacific (SP)	85002	1.367	0.525	0.521	1.565	1.562	0.611
Great Lakes (GL)	n/a	1.072	0.394	0.390	1.177	1.176	0.415
Outside ECA	98001	1.341	1.457	1.457	1.457	1.457	1.457

Figure 2-2. Illustration of regional modeling domains in ECA-IMO study



The emissions were converted to SMOKE point source inventory format as described in http://www.epa.gov/ttn/chief/conference/ei17/session6/mason.pdf, allowing for the emissions to be allocated to modeling layers above the surface layer. As described in the paper, the ASCII raster dataset was converted to latitude-longitude, mapped to state/county FIPS codes that extended up to 200 nautical miles (nm) from the coast, assigned stack parameters, and monthly ASCII raster dataset emissions were used to create monthly temporal profiles. All non-US, non-EEZ emissions (i.e., in waters considered outside of the 200 nm EEZ and, hence, out of the U.S. and Canadian ECA-IMO controllable domain) were simply assigned a dummy state/county FIPS code=98001, and were projected to year 2011 using the "Outside ECA" factors**Error! Reference source not found.**.

No data from this inventory were used for State waters which extend approximatedly 3 to 10 miles offshore, since all CMV emissions in state waters are in the cmv sector. Also, the SMOKE-ready data have been cropped from the original ECA-IMO entire northwestern quarter of the globe to cover only the large continental U.S. 36-km "36US1" air quality model domain, the largest Continental U.S. domain used by the EPA in recent years[5].

The original ECA-IMO inventory did not delineate between ports and underway emissions (or other C3 modes such as hoteling, maneuvering, reduced-speed zone, and idling). However, a U.S. ports spatial surrogate dataset was used to assign the ECA-IMO emissions to ports and underway SCCs 2280003100 and 2280003200, respectively. This had no effect on temporal allocation or speciation because all C3 CMV emissions, unclassified/total, port and underway, share the same temporal and speciation profiles. See Section 3.2.1.3 for more details on C3 speciation in the cmv sector and Section 3.3.8 for details on temporal allocation.

For Canadian point sources, 2010 emissions provided by Environment Canada were used. Other than for upstream oil and gas and oil sands, they were provided as CB05 speciated emissions. In order to use CB6 speciation for CMAQ, the individual CB05 model species were summed to total VOC, and then re-speciated to CB6-CMAQ model species. We summed all species, including non-VOC species such as CH4, and called it "VOC". Because these CB05 speciated emissions have a single SCC (39999999, which is Industrial Not elswhere classified), they receive a single profile, "Automotive Painting" profile (2546). The upstream oil and gas and oil sands SCCs were provided as VOC emissions using more detailed SCCs. Temporal profiles were also provided. Point sources in Mexico were compiled based on a year 2014 inventory (ERG, 2016a). The point source emissions in the 2014 inventory were converted to English units and into the FF10 format that could be read by SMOKE, missing stack parameters were gapfilled using SCC-based defaults, and latitude and longitude coordinates were verified and adjusted if they were not consistent with the reported municipality. Note that there are no explicit HAP emissions in this inventory.

The othpt sector also includes point source offshore oil and gas drilling platforms that are in Federal Waters beyond U.S. state-county boundaries in the Gulf of Mexico. For these offshore emissions, data from the 2014NEIv1 were used.

2.5.2 Area and nonroad mobile sources from Canada and Mexico (othar, othafdust)

For Canadian area and sources, month-specific year-2010 emissions provided by Environment Canada were used, including C3 CMV emissions. The Canadian inventory included fugitive dust emissions that do not incorporate either a transportable fraction or meteorological-based adjustments. To properly account for this, a separate sector called othafdust was created and modeled using the same adjustments as are done for U.S. sources (see Section 2.2.1 for more details). Updated Shapefiles used for creating spatial surrogates for Canada were also provided. For Canada nonroad mobile sources, 2014 emissions were estimated by projecting from 2010 using national US (minus California) projection factors by SCC7/pollutant, based on the 2011NEIv2 and 2014NEIv1 nonroad inventories.

For Mexico, emissions projected to the year 2014 based on Mexico's 2008 inventory were used for area, point and nonroad sources (ERG, 2016a). The resulting inventory was written using English units to the nonpoint FF10 format that could be read by SMOKE. Note that unlike the U.S. inventories, there are no

[5] The extent of the "36US1" domain is similar to the full geographic region shown in Figure 3-1. Note that this domain is not specifically used in this 2011 platform, although spatial surrogates that can be used with it are provided.

explicit HAPs in the nonpoint or nonroad inventories for Canada and Mexico and, therefore, all HAPs are created from speciation.

2.5.3 Onroad mobile sources from Canada and Mexico (onroad_can, onroad_mex)

For Mexico, a version of the MOVES model for Mexico was run that provided the same VOC HAPs and speciated VOCs as for the U.S. MOVES model (ERG, 2016a). This includes NBAFM plus several other VOC HAPs such as toluene, xylene, ethylbenzene and others. Except for VOC HAPs that are part of the speciation, no other HAPs are included in the Mexico onroad inventory (but not particulate HAPs nor diesel particulate matter).

For Canada, month-specific year-2010 emissions provided by Environment Canada were used, projected to 2014 based on the trend of U.S. onroad mobile emissions from 2011 to 2014. Ratios of 2011-to-2014 U.S. onroad emissions were calculated by fuel, vehicle type, and pollutant for the entire Continential U.S. except California, and then applied to the 2010 Canada onroad inventory to project to 2014. Note that unlike the U.S. and Mexico inventories, there are no explicit HAPs in the onroad inventories for Canada and, therefore, NBAFM HAPs are created from speciation.

2.5.4 Fires from Canada and Mexico (*ptfire_mxca*)

Annual 2014 wildland emissions for Mexico and Canada in the 2014v7.0 platform were developed from a combination of FINN (Fire Inventory from NCAR) daily fire emissions and fire data provided by Environment Canada when available. Environment Canada emissions were used for Canada wildland fire emissions for June through November and FINN fire emissions were used to fill in the annual gaps from January through May and December. Only CAP emissions are provided in the Canada and Mexico fire inventories.

For FINN fires, listed vegetation type codes of 1 and 9 are defined as agricultural burning, all other fire detections and assumed to be wildfires. All wildland fires that are not defined as agricultural are assumed to be wild fires rather than prescribed. FINN fire detects less than 50 square meters (0.012 acres) are removed from the inventory. The locations of FINN fires are geocoded from latitude and longitude to FIPS code.

2.6 Fires (ptfire_f, ptfire_s)

In the 2014v7.0 platform, both the wildfires and prescribed burning emissions are contained in the sectors ptfire_f and ptfire_s, which contain emissions from flaming and smoldering, respectively. Fire emissions in these sectors are specified at geographic coordinates (point locations) and have daily emissions values. The ptfire sectors exclude agricultural burning and other open burning sources that are included in the agfire and nonpt sectors, respectively. They are consistent with the fires stored in the events data category of the 2014NEIv1. The NEI SCCs for the ptfire sectors are showin in Table 2-17. As can be seen in the table, the 2014 NEI distinguishes between flaming and smoldering; they were put into separate sectors in order to use different vertical layering structure. This was done to force smoldering into layer 1, and vertically distribute flaming based on plume rise. Parameters associated with the emissions such as acres burned and fuel load allow estimation of plume rise. For more information on the development of the 2014NEIv1 fire inventory, see Section 7 of the 2014NEIv1 TSD.

Table 2-17. 2014 Platform SCCs representing emissions in the ptfire modeling sectors

SCC	SCC Description*
2810001001	Other Combustion-as Event; Forest Wildfires; Smoldering
2810001002	Other Combustion-as Event; Forest Wildfires; Flaming
2811015001	Other Combustion-as Event; Prescribed Forest Burning; Smoldering
2811015002	Other Combustion-as Event; Prescribed Forest Burning; Flaming

* The first tier level of the SCC Description is "Miscellaneous Area Sources."

Preparation of the 2014 wildland fire EI begins with raw input fire activity data and ends with daily estimates of emissions from each included fire location. Following on the use of local data sets for the 2011 NEI, input data sets from 22 states and one Indian Nation were used to calculate fire activity. State, local, and tribal agencies that provided input data were also asked to complete the NEI Wildland Fire Inventory Database Questionnaire, which consisted of a self-assessment of data completeness. Based on input from SLT data providers, submitted data sets were supplemented with up to seven data sets from national sources. The data sets were cleaned to eliminate errors and to achieve standardized formatting. Cleaned data sets were reconciled into a single, comprehensive fire location data set using the SmartFire2 (SF2) data processing system (airfire.org/smartfire). The SF2 reconciles multiple data sets to retain the best available information for each aspect of each fire event. The reconciled fire locations, along with fuel moisture and fuel loading data, were used in the BlueSky Framework (Larkin et al., 2009) to estimate smoke emissions. BlueSky Framework is a modeling framework that "links a variety of independent models of fire information, fuel loading, fire consumption, fire emissions, and smoke dispersion." (airfire.org/bluesky. For the 2014 NEI, wildland fire emissions estimates were estimated separately for flaming and smoldering combustion phases of fire to facilitate better understanding emission characteristics and to assist modeling efforts.

SMARTFIRE2 estimates were used directly for all states except Georgia. For Georgia, the satellite-derived emissions were removed from the ptfire inventory and replaced with a separate state-supplied ptfire inventory.

As was done with the 2011 platform, fires over 20,000 acres were split into the respective grid cells that they overlapped. The idea of this was to prevent all emissions from going into a single grid cell when, in reality, the fire was more dispersed than a single point. The large fires were each projected as a circle over the area centered on the specified latitude and longitude, and then apportioned into the grid cells they overlapped. The area of each of the "subfires" was computed in proportion to the overlap with that grid cell. These "subfires" were given new names that were the same as the original, but with "_a", "_b", "_c", and "_d" appended as needed. The FIPS state and county codes and fire IDs for the ten fires apportioned to multiple grid cells are shown in Table 2-18.

Table 2-18. Large fires apportioned to multiple grid cells

County FIPS[a]	Fire ID
02122	nei140018117
02122	nei140018197
06017	nei140125469
12011	nei140014500
16063	nei140105145
27007	nei140082399

County FIPS[a]	Fire ID
41025	nei140105167
41025	nei140105172
49001	nei140097811
53047	nei140105851
[a]We split fires in Alaska even though it was outsited our modeling domain.	

2.7 Biogenic sources (beis)

Biogenic emissions were computed based on the same 14j version of the 2014 meteorology data used for the air quality modeling, and were developed using the Biogenic Emission Inventory System version 3.61 (BEIS3.61) within SMOKE. The BEIS3.61 creates gridded, hourly, model-species emissions from vegetation and soils. It estimates CO, VOC (most notably isoprene, terpene, and sesquiterpene), and NO emissions for the contiguous U.S. and for portions of Mexico and Canada.

The BEIS3.61 was used in conjunction with Version 4.1 of the Biogenic Emissions Landuse Database (BELD4) and incorporates a canopy two-layer canopy model to estimate leaf-level temperatures (Pouliot and Bash, 2015). In the BEIS 3.61 two-layer canopy model, the layer structure varies with light intensity and solar zenith angle. Both layers include estimates of sunlit and shaded leaf area based on solar zenith angle and light intensity, direct and diffuse solar radiation, and leaf temperature (Bash et al., 2015). The new algorithm requires additional meteorological variables over previous versions of BEIS. The variables output from the Meteorology-Chemistry Interface Processor (MCIP) that are used to convert WRF outputs to CMAQ inputs are shown in Table 2-19.

Table 2-19. Meteorological variables required by BEIS 3.61

Variable	Description
LAI	leaf-area index
PRSFC	surface pressure
Q2	mixing ratio at 2 m
RC	convective precipitation per met TSTEP
RGRND	solar rad reaching sfc
RN	nonconvective precipitation per met TSTEP
RSTOMI	inverse of bulk stomatal resistance
SLYTP	soil texture type by USDA category
SOIM1	volumetric soil moisture in top cm
SOIT1	soil temperature in top cm
TEMPG	skin temperature at ground
USTAR	cell averaged friction velocity
RADYNI	inverse of aerodynamic resistance
TEMP2	temperature at 2 m

The BELD version 4.1 is based on an updated version of the USDA-USFS Forest Inventory and Analysis (FIA) vegetation speciation based data from 2001 to 2014 from the FIA version 5.1. Canopy coverage is based on the Landsat satellite National Land Cover Database (NLCD) product from 2011. The FIA includes approximately 250,000 representative plots of species fraction data that are within approximately 75 km of one another in areas identified as forest by the NLCD canopy coverage. The 2011 NLCD provides land cover information with a native data grid spacing of 30 meters. For land areas outside the conterminous United States, 500 meter grid spacing land cover data from the Moderate Resolution Imaging Spectroradiometer (MODIS) is used. BELDv4.1 also incorporates the following:

- 30 meter NASA's Shuttle Radar Topography Mission (SRTM) elevation data (http://www2.jpl.nasa.gov/srtm/) to more accurately define the elevation ranges of the vegetation species than in previous versions; and
- 2011 30 meter USDA Cropland Data Layer (CDL) data (http://www.nass.usda.gov/research/Cropland/Release/).

To provide a sense of the scope and spatial distribution of the emissions, plots of annual BEIS outputs for NO, isoprene, acetaldehyde, and formaldehyde for 2014 are shown in Figure 2-3, Figure 2-4, Figure 2-5, and Figure 2-6, respectively.

Figure 2-3. Annual NO emissions output from BEIS 3.61 for 2014

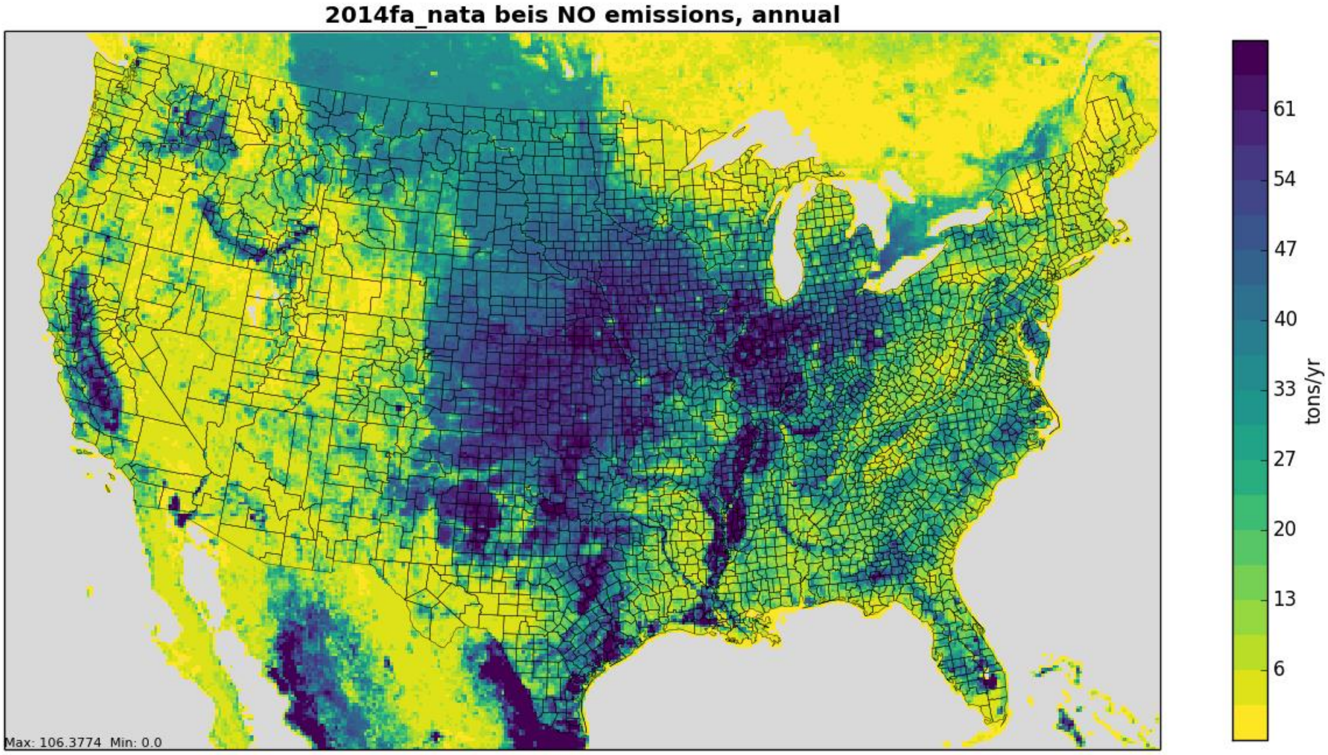


Figure 2-4. Annual isoprene emissions output from BEIS 3.61 for 2014

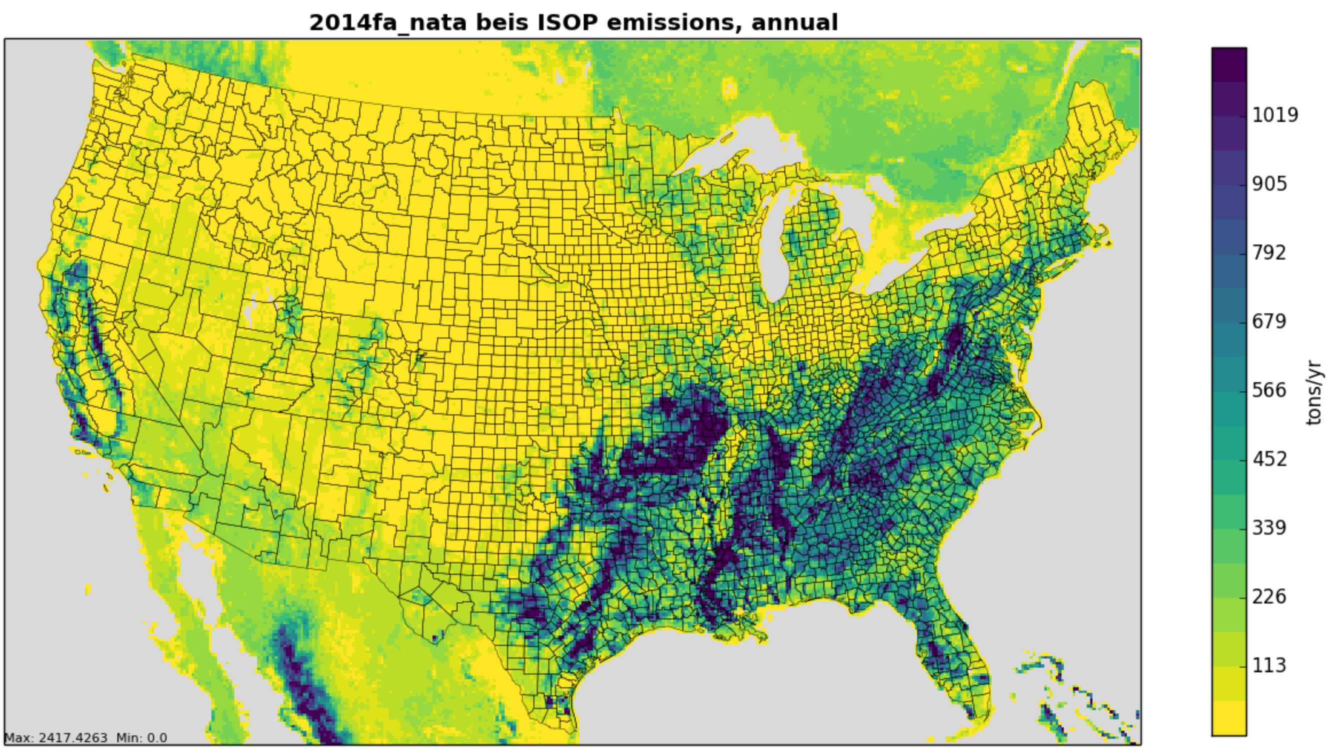


Figure 2-5. Annual acetaldehyde emissions output from BEIS 3.61 for 2014

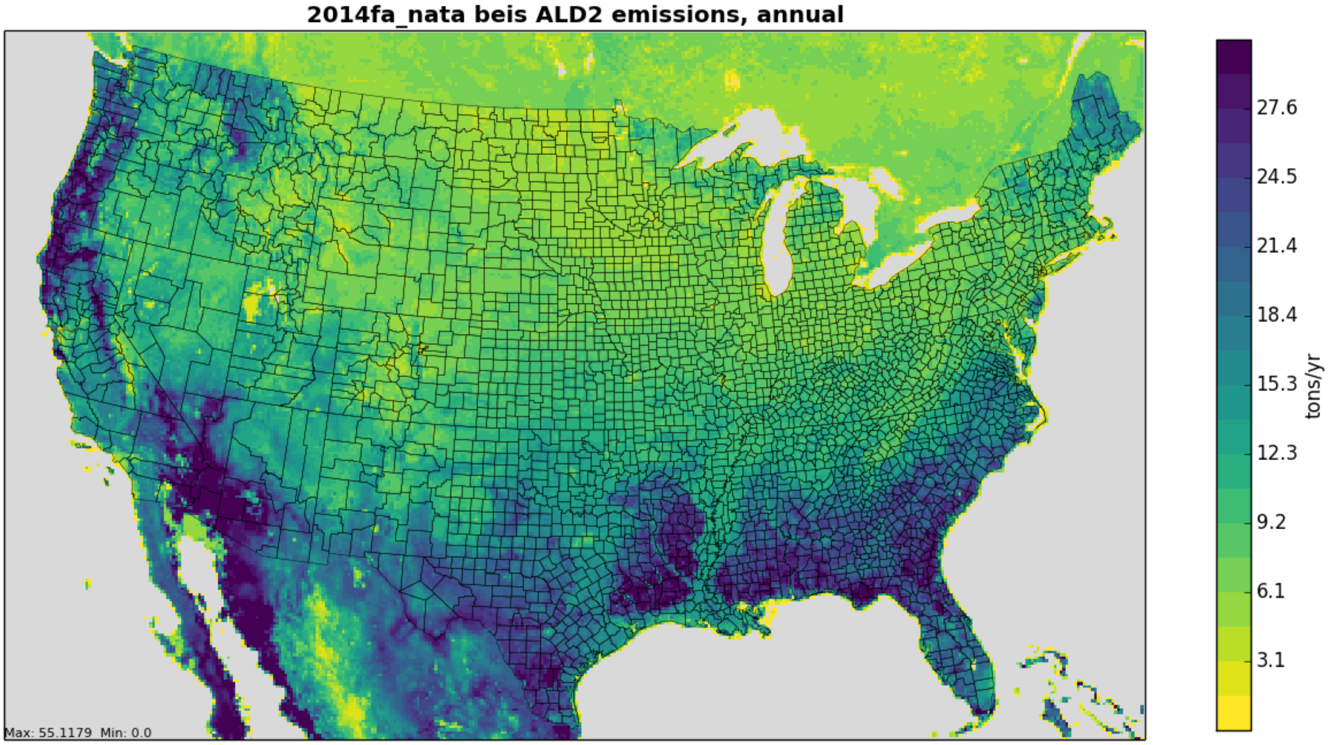
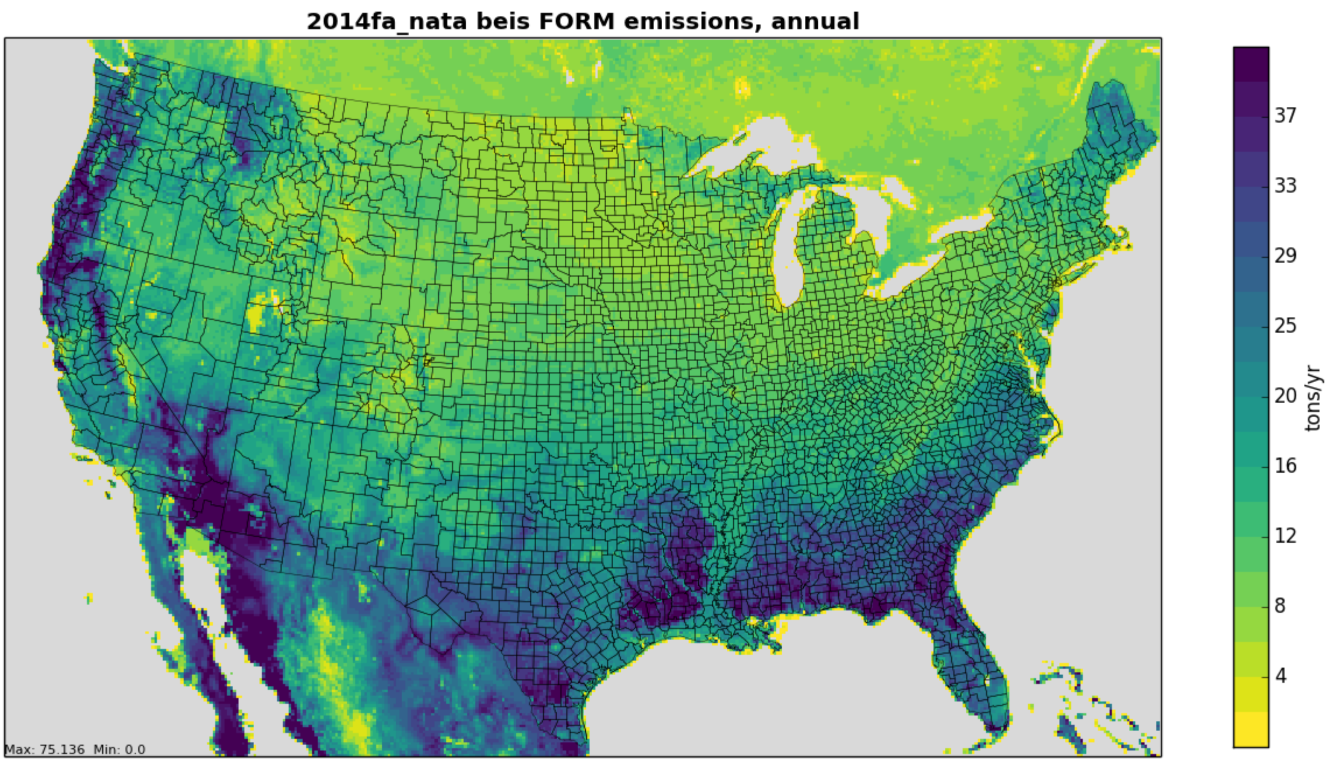


Figure 2-6. Annual formaldehyde emissions output from BEIS 3.61 for 2014



2.8 SMOKE-ready non-anthropogenic inventories for chlorine

The ocean chlorine gas emission estimates are based on the build-up of molecular chlorine (Cl_2) concentrations in oceanic air masses (Bullock and Brehme, 2002). Data at 36 km and 12 km resolution were available and were not modified other than the model-species name “CHLORINE” was changed to “CL2” to support CMAQ modeling.

3 Emissions Modeling Summary

The CMAQ model requires hourly emissions of specific gas and particle species for the horizontal and vertical grid cells contained within the modeled region (i.e., modeling domain). To provide emissions in the form and format required by the model, it is necessary to “pre-process” the “raw” emissions (i.e., emissions input to SMOKE) for the sectors described above in Section 2. In brief, the process of emissions modeling transforms the emissions inventories from their original temporal resolution, pollutant resolution, and spatial resolution into the hourly, speciated, gridded resolution required by the air quality model. Emissions modeling includes temporal allocation, spatial allocation, and pollutant speciation. In some cases, emissions modeling also includes the vertical allocation of point sources, but many air quality models also perform this task because it greatly reduces the size of the input emissions files if the vertical layers of the sources are not included.

As seen in Section 2, the temporal resolutions of the emissions inventories input to SMOKE vary across sectors and may be hourly, daily, monthly, or annual total emissions. The spatial resolution, may be individual point sources, county/province/municipio totals, or gridded emissions and varies by sector. This section provides some basic information about the tools and data files used for emissions modeling as part of the modeling platform. In Section 2, the emissions inventories and how they differ from the the previous platform are described. In Section 3, the descriptions of data are limited to the ancillary data SMOKE uses to perform the emissions modeling steps. Note that all SMOKE inputs for the 2014 platform are available from the CHIEF Emissions Modeling Clearinghouse website (see Section 1).

SMOKE version 4.5 was used to pre-process the raw emissions inventories into emissions inputs for each modeling sector in a format compatible with CMAQ. For sectors that have plume rise, the in-line emissions capability of the air quality models was used, which allows the creation of source-based and two-dimensional gridded emissions files that are much smaller than full three-dimensional gridded emissions files. For QA of the emissions modeling steps, emissions totals by specie for the entire model domain are output as reports that are then compared to reports generated by SMOKE on the input inventories to ensure that mass is not lost or gained during the emissions modeling process.

3.1 Emissions modeling Overview

When preparing emissions for the air quality model, emissions for each sector are processed separately through SMOKE, and then the final merge program (Mrggrid) is run to combine the model-ready, sector-specific emissions across sectors. The SMOKE settings in the run scripts and the data in the SMOKE ancillary files control the approaches used by the individual SMOKE programs for each sector. Table 3-1 summarizes the major processing steps of each platform sector. The “Spatial” column shows the spatial approach used: “point” indicates that SMOKE maps the source from a point location (i.e., latitude and longitude) to a grid cell; “surrogates” indicates that some or all of the sources use spatial surrogates to allocate county emissions to grid cells; and “area-to-point” indicates that some of the sources use the SMOKE area-to-point feature to grid the emissions (further described in Section 3.4.2). The “Speciation” column indicates that all sectors use the SMOKE speciation step, though biogenics speciation is done within the Tmpbeis3 program and not as a separate SMOKE step. The “Inventory resolution” column shows the inventory temporal resolution from which SMOKE needs to calculate hourly emissions. Note that for some sectors (e.g., onroad, beis), there is no input inventory; instead, activity data and emission factors are used in combination with meteorological data to compute hourly emissions.

Finally, the "plume rise" column indicates the sectors for which the "in-line" approach is used. These sectors are the only ones with emissions in aloft layers based on plume rise. The term "in-line" means that the plume rise calculations are done inside of the air quality model instead of being computed by SMOKE. The air quality model computes the plume rise using the stack data and the hourly air quality model inputs found in the SMOKE output files for each model-ready emissions sector. The height of the plume rise determines the model layer into which the emissions are placed. The othpt sector has only "in-line" emissions, meaning that all of the emissions are treated as elevated sources and there are no emissions for those sectors in the two-dimensional, layer-1 files created by SMOKE. Day-specific point fires' flaming emissions are treated separately. After plume rise is applied, there will be emissions in every layer from the ground up to the top of the plume.

Table 3-1. Key emissions modeling steps by sector.

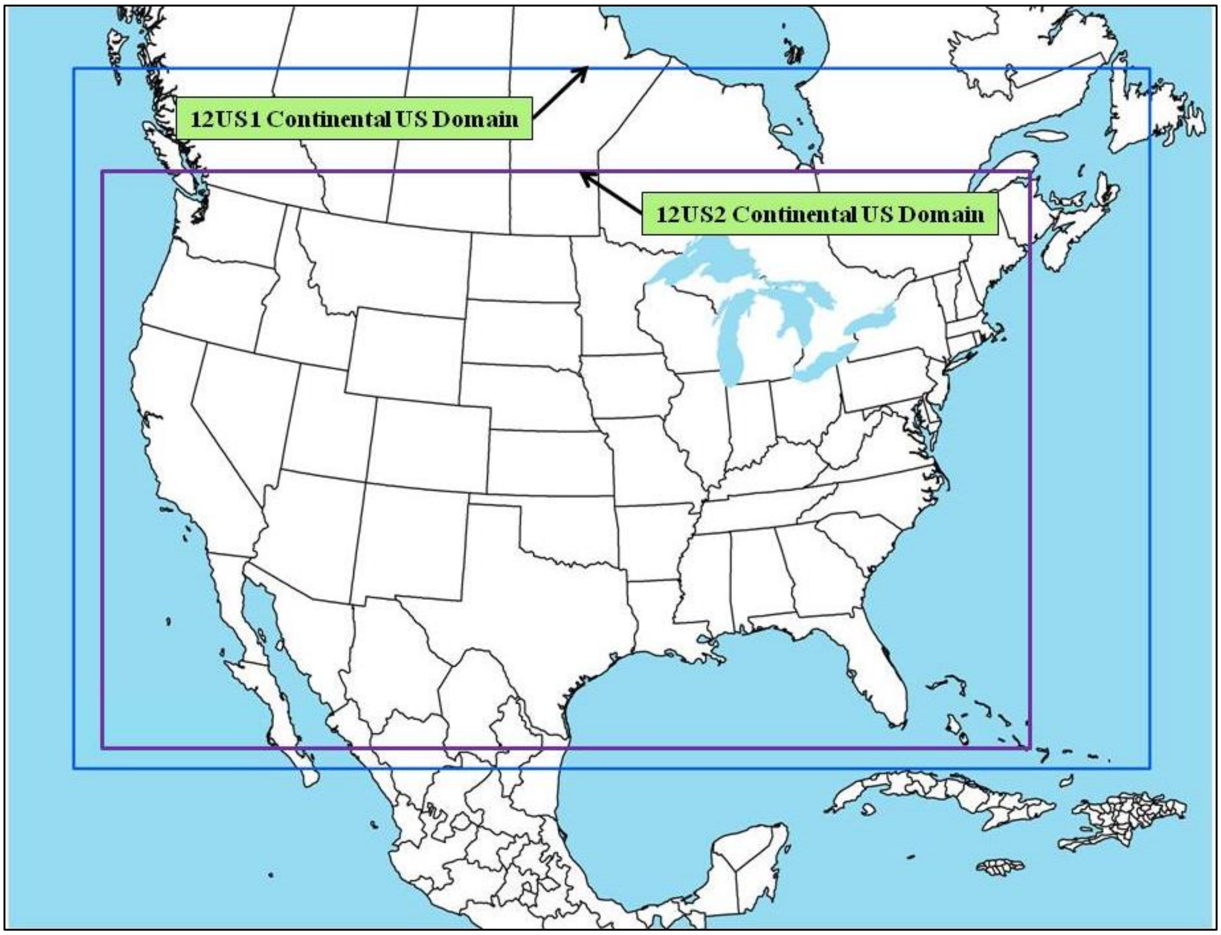
Platform sector	Spatial	Speciation	Inventory resolution	Plume rise
afdust	Surrogates	Yes	annual	
ag	Surrogates	Yes	annual & daily[1]	
agfire	Surrogates	Yes	annual	
beis	Pre-gridded land use	in BEIS3.61	computed hourly	
rail	Surrogates	Yes	annual	
cmv	Surrogates	Yes	annual	
nonpt	Surrogates & area-to-point	Yes	annual	
nonroad	Surrogates & area-to-point	Yes	monthly	
np_oilgas	Surrogates	Yes	annual	
onroad	Surrogates	Yes	monthly activity, computed hourly	
othafdust	Surrogates	Yes	annual	
othar	Surrogates	Yes	annual & monthly	
onroad_can	Surrogates	Yes	monthly	
onroad_mex	Surrogates	Yes	monthly	
othpt	Point	Yes	annual	in-line
ptagfire	Point	Yes	daily	Forced to layer 1
pt_oilgas	Point	Yes	annual	in-line
ptegu	Point	Yes	daily & hourly	in-line
ptfire_f	Point	Yes	daily	in-line
ptfire_s	Point	Yes	daily	Forced to layer 1
ptfire_mxca	Point	Yes	daily	in-line
ptnonipm	Point	Yes	annual	in-line
rwc	Surrogates	Yes	annual	

1. Livestock is daily, fertilizer is annual

SMOKE has the option of grouping sources so that they are treated as a single stack when computing plume rise. For this platform, no grouping was performed because grouping combined with "in-line" processing will not give identical results as "offline" processing (i.e., when SMOKE creates 3-dimensional files). This occurs when stacks with different stack parameters or latitudes/longitudes are grouped, thereby changing the parameters of one or more sources. The most straightforward way to get the same results between in-line and offline is to avoid the use of grouping.

SMOKE was run for the smaller 12-km CONtinental United States "CONUS" modeling domain (12US2) shown in Figure 3-1 and boundary conditions for some model species including formaldehyde and acetaldehyde were obtained from a 2014 run of GEOS-Chem (others such as benzene relied on ambient measurements or were set to 0). Section 3.4 provides the details on the spatial surrogates and area-to-point data used to accomplish spatial allocation with SMOKE.

Figure 3-1. Air quality modeling domains



Both grids use a Lambert-Conformal projection, with Alpha = 33º, Beta = 45º and Gamma = -97º, with a center of X = -97º and Y = 40º. Table 3-2 describes the grids for the two domains.

Table 3-2. Descriptions of the platform grids

Common Name	Grid Cell Size	Description (see Figure 3-1)	Grid name	Parameters listed in SMOKE grid description (GRIDDESC) file: projection name, xorig, yorig, xcell, ycell, ncols, nrows, nthik
Continental 12km grid	12 km	Entire conterminous US plus some of Mexico/Canada	12US1_459X299	'LAM_40N97W', -2556000, -1728000, 12.D3, 12.D3, 459, 299, 1
US 12 km or "smaller" CONUS-12	12 km	Smaller 12km CONUS plus some of Mexico/Canada	12US2	'LAM_40N97W', -2412000 , -1620000, 12.D3, 12.D3, 396, 246, 1

3.2 Chemical Speciation

The emissions modeling step for chemical speciation creates the "model species" needed by the air quality model for a specific chemical mechanism. These model species are either individual chemical compounds (i.e., "explicit species") or groups of species (i.e., "lumped species"). The chemical mechanism used for the 2014 platform is the CB6 mechanism (Yarwood, 2010). We used a particular version of CB6 that we refer to as "CMAQ CB6" that breaks out naphthalene from XYL as an explicit model species, resulting in model species NAPHTHALENE and XYLMN instead of XYL and uses SOAALK. Otherwise it is the same as the CB6 used in the 2011v6.3 platform. This platform generates the $PM_{2.5}$ model species associated with the CMAQ Aerosol Module version 6 (AE6), which were also used for the 2011v6.3 platform. Table 3-3 through Table 3-5 list the model species produced by SMOKE in the 2014 platform. Per Table 3-4, many HAPs added as tracer species (not participating in the CB6 chemistry) are used. These species are not generated through speciation but rather mapped or aggregated from inventory species directly to model species. Eight species were added to CMAQ (these are shown with an asterisk) since the version that was used in the 2011 NATA. The HAP metals, also from the inventory, are speciated within SMOKE into coarse and fine components.

The TOG and $PM_{2.5}$ speciation factors that are the basis of the chemical speciation approach were developed from the SPECIATE 4.5 database (https://www.epa.gov/air-emissions-modeling/speciate-version-45-through-32), which is the EPA's repository of TOG and PM speciation profiles of air pollution sources. The SPECIATE database development and maintenance is a collaboration involving the EPA's Office of Research and Development (ORD), Office of Transportation and Air Quality (OTAQ), and the Office of Air Quality Planning and Standards (OAQPS), in cooperation with Environment Canada (EPA, 2016). The SPECIATE database contains speciation profiles for TOG, speciated into individual chemical compounds, VOC-to-TOG conversion factors associated with the TOG profiles, and speciation profiles for $PM_{2.5}$. Appendix C provides a summary of the new/revised TOG profiles in SPECIATE version 4.5 profiles that were used in this platform[6]; there were just 2 new $PM_{2.5}$ profiles used – brake and tirewear.

Some key features and updates to speciation from previous platforms include the following (the subsections below contain more details on the specific changes):

- VOC speciation profile cross reference assignments for point and nonpoint oil and gas sources were updated to (1) make corrections to the 2011v6.3 cross references, (2) use new and revised

[6] Excluding onroad mobile since speciation is done, other than for brake and tire, within MOVES. Two new-to-SPECIATE4.5 brake and tirewear profiles were used in this platform: 95462 (Composite - Brake Wear) and 95460 (Composite - Tire Dust).

profiles that were added to SPECIATE4.5 and (3) account for the portion of VOC estimated to come from flares, based on data from the Oil and Gas estimation tool used to estimate emissions for the NEI. The new/revised profiles included oil and gas operations in specific regions of the country and a national profile for natural gas flares;

- the Western Regional Air Partnership (WRAP) speciation profiles (**Error! Reference source not found.**) used for the np_oilgas sector were revised;
- VOC speciation for nonroad mobile has been updated to include a different speciation profile assignment method for VOC (profiles are assigned to SCCs within MOVES2014a which outputs the emissions with those assignments) and updated profiles;
- VOC and PM speciation for onroad mobile sources occurs within MOVES2014a;
- Speciation for onroad mobile sources in Mexico is done within MOVES and is more consistent with that used in the United States; and
- As with the 2011 platforms, the 2010 Canadian point source inventories, other than upstream oil & gas and oil sands, in the othpt sector are derived from CB05 pre-speciated emissions as these were provided from Environment Canada.

Speciation profiles and cross-references for the 2014 platform are available in the SMOKE input files for the 2014 platform. Emissions of VOC and $PM_{2.5}$ emissions by county, sector and profile for all sectors other than onroad mobile can be found in the sector summaries for the case. Totals of each model species by state and sector can be found in the state-sector totals workbook for this case.

Table 3-3. Emission model species produced for CMAQ CB6

Inventory Pollutant	Model Species	Model species description
Cl_2	CL2	Atomic gas-phase chlorine
HCl	HCL	Hydrogen Chloride (hydrochloric acid) gas
CO	CO	Carbon monoxide
NO_X	NO	Nitrogen oxide
	NO2	Nitrogen dioxide
	HONO	Nitrous acid
SO_2	SO2	Sulfur dioxide
	SULF	Sulfuric acid vapor
NH_3	NH3	Ammonia
VOC	ACET	Acetone
	ALD2	Acetaldehyde
	ALDX	Propionaldehyde and higher aldehydes
	BENZ	Benzene
	CH4	Methane[7]
	ETH	Ethene
	ETHA	Ethane
	ETHY	Ethyne
	ETOH	Ethanol
	FORM	Formaldehyde

[7] Technically, CH_4 is not a VOC but part of TOG. Although emissions of CH_4 are derived, the AQ models do not use these emissions because the anthropogenic emissions are dwarfed by the CH_4 already in the atmosphere.

Inventory Pollutant	Model Species	Model species description
	KET	Ketone Groups
	IOLE	Internal olefin carbon bond (R-C=C-R)
	ISOP	Isoprene
	MEOH	Methanol
	NAPH	Naphthalene
	OLE	Terminal olefin carbon bond (R-C=C)
	PAR	Paraffin carbon bond
	PRPA	Propane
	TOL	Toluene and other monoalkyl aromatics
	XYLMN	Xylene and other polyalkyl aromatics, minus naphthalene
	SOAALK	Lumped SOA tracer
Naphthalene	NAPH	Naphthalene from inventory
Benzene	BENZ	Benzene from the inventory
Acetaldehyde	ALD2	Acetaldehyde from inventory
Formaldehyde	FORM	Formaldehyde from inventory
Methanol	MEOH	Methanol from inventory
VOC species from the biogenics model that do not map to model species above	SESQ	Sesquiterpenes
	TERP	Terpenes
PM_{10}	PMC	Coarse PM > 2.5 microns and ≤ 10 microns
$PM_{2.5}$	PAL	Aluminum
	PCA	Calcium
	PCL	Chloride
	PEC	Particulate elemental carbon ≤ 2.5 microns
	PFE	Iron
	PK	Potassium
	PH2O	Water
	PMG	Magnesium
	PMN	Manganese
	PMOTHR	$PM_{2.5}$ not in other AE6 species
	PNA	Sodium
	PNCOM	Non-carbon organic matter
	PNO3	Particulate nitrate ≤ 2.5 microns
	PNH4	Ammonium
	POC	Particulate organic carbon (carbon only) ≤ 2.5 microns
	PSI	Silica
	PSO4	Particulate Sulfate ≤ 2.5 microns
	PTI	Titanium
Sea-salt species (non – anthropogenic) [8]	PCL	Particulate chloride
	PNA	Particulate sodium
*Notes: 1. naphthalene, benzene, acetaldehyde, formaldehyde and methanol (NBAFM) is produced via VOC speciation for Canada and Mexico, for other than onroad mobile sources in Mexico, or, in very small quantities due to mixtures in the speciation profiles as is discussed in 3.2.1.1 from profiles listed in Appendix E.		

[8] These emissions are created outside of SMOKE

Inventory Pollutant	Model Species	Model species description
2. Additional HAPs used outside of CMAQ-CB6 for NATA are provided in Table 3-4.		

Table 3-4. Additional HAP Gaseous model species produced for CMAQ multipollutant specifically for NATA (not used within CB6)

Inventory Pollutant	**Model Species**
Acetaldehyde	ALD2_PRIMARY
Formaldehyde	FORM_PRIMARY
Acetonitrile *	ACETONITRILE
Acrolein	ACROLEIN
Acrylic acid *	ACRYLICACID
Acrylonitrile	ACRYLONITRILE
1,3-Butadiene	BUTADIENE13
Carbon tetrachloride	CARBONTET
Carbonyl Sulfide *	CARBSULFIDE
Chloroform	CHCL3
Chloroprene *	CHLOROPRENE
1,4-Dichlorobenzene(p)	DICHLOROBENZENE
1,3-Dichloropropene	DICHLOROPROPENE
Ethylbenzene *	ETHYLBENZ
Ethylene dibromide (Dibromoethane)	BR2_C2_12
Ethylene dichloride (1,2-Dichloroethane)	CL2_C2_12
Ethylene oxide	ETOX
Hexamethylene-1,6-diisocyanate	HEXAMETH_DIIS
Hexane *	HEXANE
Hydrazine	HYDRAZINE
Maleic Anyhydride	MAL_ANYHYDRIDE
Methyl Chloride *	METHCLORIDE
Methylene chloride (Dichloromethane)	CL2_ME
Specific PAHs assigned with URE =0	PAH_000E0
Specific PAHs assigned with URE =1.76E-5	PAH_176E5
Specific PAHs assigned with URE =8.80E-5	PAH_880E5
Specific PAHs assigned with URE =1.76E-4	PAH_176E4
Specific PAHs assigned with URE =1.76E-3	PAH_176E3
Specific PAHs assigned with URE =1.76E-2	PAH_176E2
Specific PAHs assigned with URE =1.01E-2	PAH_101E2
Specific PAHs assigned with URE =1.14E-1	PAH_114E1
Specific PAHs assigned with URE =1.92E-3	PAH_192E3
Propylene dichloride (1,2-Dichloropropane)	PROPDICHLORIDE
Quinoline	QUINOLINE
Styrene *	STYRENE
1,1,2,2-Tetrachloroethane	CL4_ETHANE1122
Tetrachloroethylene (Perchloroethylene)	CL4_ETHE
Toluene	TOLU
2,4-Toluene diisocyanate	TOL_DIIS
Trichloroethylene	CL3_ETHE
Triethylamine	TRIETHYLAMINE
m-xylene, o-xylene, p-xylene, xylenes (mixed isomers) **	XYLENES
Vinyl chloride	CL_ETHE
*new to CMAQ5.2 – version of CMAQ used for 2011 NATA did not include these HAPs. ** In 2011 NATA, these were separated into 3 model species: MXYL, OXYL and PXYL; in 2014 they are combined into XYLENES	

Table 3-5. Additional HAP Particulate* model species produced for CMAQ multipollutant specifically for NATA

Inventory Pollutant	Model Species
Arsenic	ARSENIC_C, ARSENIC_F
Beryllium	BERYLLIUM_C, BERYLLIUM_F
Cadmium	CADMIUM_C, CADMIUM_F
Chromium VI, Chromic Acid (VI), Chromium Trioxide	CHROMHEX_C, CHROMHEX_F
Chromium III	CHROMTRI_C, CHROMTRI_F
Lead	LEAD_C, LEAD_F
Manganese	MANGANESE_C, MANGANESE_F
Mercury	HGIIGAS, HGNRVA, PHGI
Nickel, Nickel Oxide, Nickel Refinery Dust	NICKEL_C, NICKEL_F
Diesel-PM10, Diesel-PM25	DIESEL_PMC , DIESEL_PMFINE, DIESEL_PMEC, DIESEL_PMOC, DIESEL_PMNO3, DIESEL_PMSO4
*mercury is multi-phase	

3.2.1 VOC speciation

The concept of VOC speciation is to use emission source-related speciation profiles to convert VOC to TOG, to speciate TOG into individual chemical compounds, and to use a chemical mechanism mapping file to aggregate the chemical compounds to the chemical mechanism model species. The chemical mechanism mapping file is typically developed by the developer of the chemical mechanism.

SMOKE uses profiles that convert inventory species and TOG directly to the model species. The SMOKE-ready profiles are generated from the Speciation Tool which uses the "raw" (TOG to chemical compounds) SPECIATE profiles and the chemical mechanism mapping file.

For the 2014v7.0 platform, we updated the CB6 chemical mapping file to add assignments for compounds in SPECIATE4.5 that had not been assigned (see Appendix D), and we added molecular weights to some compounds which were missing. In addition, we revised the speciation cross reference and used updated profiles from the SPECIATE4.5 database for oil and gas, livestock waste and nonroad mobile sources. Appendix E provides a list of these profiles. Similar to previous platforms, HAP VOC inventory species were used in the VOC speciation process for some sectors as described below.

3.2.1.1 The combination of HAP NBAFM (naphthalene, benzene, acetaldehyde, formaldehyde and methanol) and VOC for VOC speciation

The VOC speciation includes HAP emissions from the 2014NEIv1 in the speciation process. Instead of speciating VOC to generate all of the species listed in Table 3-3, emissions of five specific HAPs: naphthalene, benzene, acetaldehyde, formaldehyde and methanol (collectively known as "NBAFM") from the NEI were "integrated" with the NEI VOC. The integration combines these HAPs with the VOC in a way that does not double count emissions and uses the HAP inventory directly in the speciation process. The basic process is to subtract the specified HAPs emissions mass from the VOC emissions mass, and to then use a special "integrated" profile to speciate the remainder of VOC to the model species excluding the specific HAPs. The EPA believes that the HAP emissions in the NEI are often more representative of emissions than HAP emissions generated via VOC speciation, although this varies by sector.

The NBAFM HAPs were chosen for integration because they are the only explicit VOC HAPs in the CMAQ version 5.2 multipollutant. Explicit means that they are not lumped chemical groups like PAR, IOLE and several other CB6 model species. These "explicit VOC HAPs" are model species that participate in the modeled chemistry using the CB6 chemical mechanism. The use of inventory HAP emissions along with VOC is called "HAP-CAP integration."

The integration of HAP VOC with VOC is a feature available in SMOKE for all inventory formats other than PTDAY (the format used for the ptfire sector). SMOKE allows the user to specify both the particular HAPs to integrate via the INVTABLE. This is done by setting the "VOC or TOG component" field to "V" for all HAP pollutants chosen for integration. SMOKE allows the user to also choose the particular sources to integrate via the NHAPEXCLUDE file (which actually provides the sources to be *excluded* from integration[9]). For the "integrated" sources, SMOKE subtracts the "integrated" HAPs from the VOC (at the source level) to compute emissions for the new pollutant "NONHAPVOC." The user provides NONHAPVOC-to-NONHAPTOG factors and NONHAPTOG speciation profiles[10]. SMOKE computes NONHAPTOG and then applies the speciation profiles to allocate the NONHAPTOG to the other air quality model VOC species not including the integrated HAPs. After determining if a sector is to be integrated, if all sources have the appropriate HAP emissions, then the sector is considered fully integrated and does not need a NHAPEXCLUDE file. If, on the other hand, certain sources do not have the necessary HAPs, then an NHAPEXCLUDE file must be provided based on the evaluation of each source's pollutant mix. The EPA considered CAP-HAP integration for all sectors determined whether sectors would have full, no or partial integration (see Table 3-6). For sectors with partial integration, all sources are integrated other than those that have either the sum of NBAFM > VOC or the sum of NBAFM = 0. Section 3.2.1.3 provides additional sector-specific details.

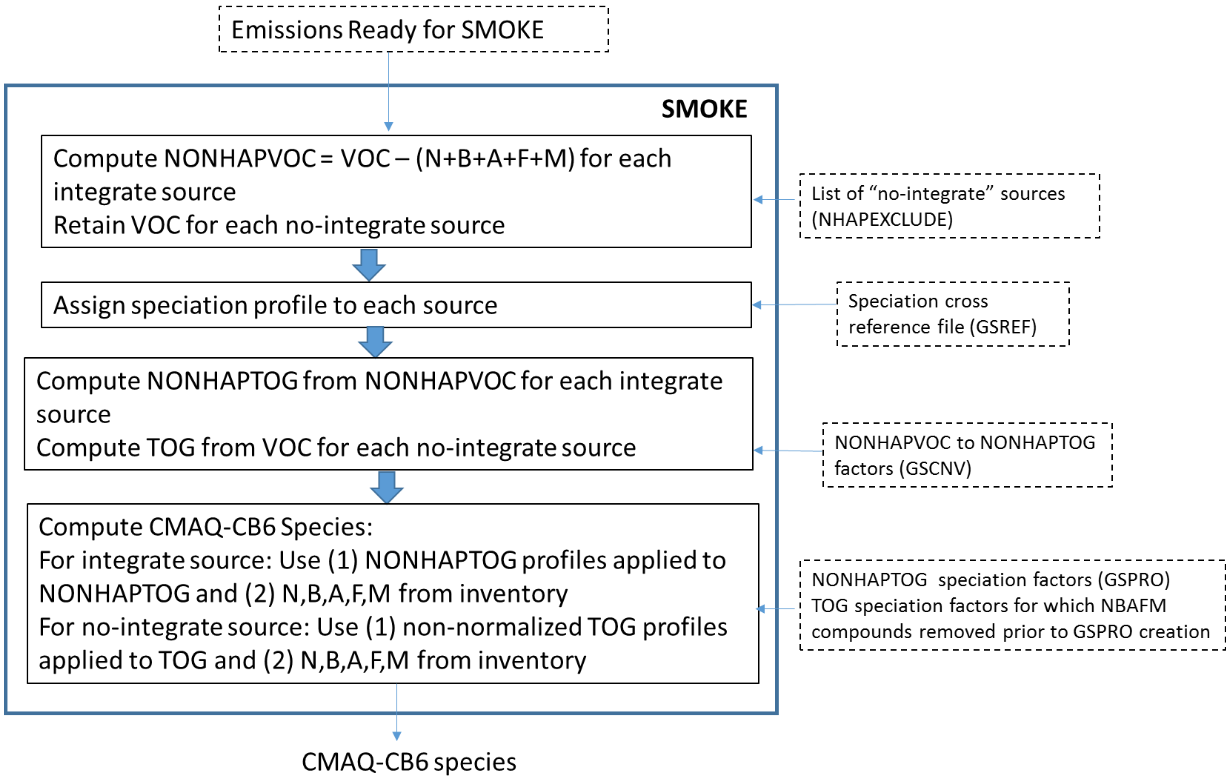
For the 2014v7.0 case, the no-integrate sources are treated differently from the 2011v6.3 platform. In 2014v7.0, we remove the integrate HAPs from the profile, but use the emissions from the NEI. In 2011v6.3, we did not keep any HAPs from the no-integrate sources; instead, we created them from the no-integrate source VOC emissions. For NATA, we are modeling using both CMAQ and AERMOD and we can only get the HAPs from one source (speciation or the inventory). We chose to use the HAPs in the inventory since these are the data that are used to represent HAP emissions in the U.S. Also, HAP emissions in the NEI may be developed using more site-specific data (e.g., source testing, material balance) that would not be reflected by applying a speciation profile to VOC emissions. In addition, we have applied numerous HAP augmentation measures in the NEI. Figure 3-2 illustrates the integrate and no-integrate processes for U.S. Sources. Since Canada and Mexico inventories do not contain HAPs, we use the 2011v6.3 approach of generating the HAPs via speciation, except for Mexico onroad mobile sources where emissions for integrate HAPs were available.

[9] Since SMOKE version 3.7, the options to specify sources for integration are expanded so that a user can specify the particular sources to include or exclude from integration, and there are settings to include or exclude all sources within a sector. In addition, the error checking is significantly stricter for integrated sources. If a source is supposed to be integrated, but it is missing BAFM or VOC, SMOKE will now raise an error.

[10] These ratios and profiles are typically generated from the Speciation Tool when it is run with integration of a specified list of pollutants, for example NBAFM.

It should be noted that even though NBAFM were removed from the SPECIATE profiles used to create the GSPRO for both the NONHAPTOG and no-integrate TOG profiles, there still may be small fractions for "BENZENE", "FORM", "ALD2", "METHANOL" present. This is because these model species may have come from species in SPECIATE that are mixtures. The quantity of these model species is expected to be very small compared to the BAFM in the NEI. These profiles are listed in Appendix E. There are no NONHAPTOG profiles that produce "NAPHTHALENE."

Figure 3-2. Process of integrating NBAFM with VOC for use in VOC Speciation for U.S. Sources



Integration for the mobile sources estimated from MOVES (onroad and nonroad sectors, other than for California) is done differently, and is discussed in more detail in 3.2.1.3. Briefly there are three major differences: 1) for these sources integration is done using more than just NBAFM, 2) all sources from the MOVES model are integrated and 3) integration is done fully or partially within MOVES. For onroad mobile, speciation is done fully within MOVES2014a such that the MOVES model outputs emission factors for individual VOC model species along with the HAPs. This requires MOVES to be run for a specific chemical mechanism. For nonroad mobile, speciation is partially done within MOVES such that it does not need to be run for a specific chemical mechanism. For nonroad, MOVES outputs emissions of HAPs and NONHAPTOG split by speciation profile. Taking into account that integrated species were subtracted out by MOVES already, the appropriate speciation profiles are then applied in SMOKE to get the VOC model species. HAP integration for nonroad uses the same additional HAPs and ethanol as for onroad.

Table 3-6. Integration approach for NBAFM for each platform sector

Platform Sector	Approach for Integrating NEI emissions of Naphthalene (N), Benzene (B), Acetaldehyde (A), Formaldehyde (F), and Methanol (M)
ptegu	No integration, use NBAFM from inventory and not speciation
ptnonipm	No integration, use NBAFM from inventory and not speciation
othafdust	N/A – sector contains no VOC
othar	No integration, no NBAFM in inventory, create NBAFM from speciation
onroad_can	No integration, no NBAFM in inventory, create NBAFM from speciation
onroad_mex	Full integration (internal to MOVES-Mexico)[1]; however, MOVES-MEXICO speciation was CB6-CAMx, not CB6-CMAQ, so post-SMOKE we converted the emissions to CB6-CMAQ
ag	N/A – sector contains no VOC
afdust	N/A – sector contains no VOC
beis	N/A – sector contains no inventory pollutant "VOC"; but rather specific VOC species
agfire	Partial integration (NBAFM)[2], Use NBAFM in inventory for no-integrate sources
ptagfire	No integration, use NBAFM from inventory and not speciation
cmv	Full integration (NBAFM)
rail	Partial integration (NBAFM)[3] ; no-integrate sources have no NBAFM so it is missing
nonpt	Partial integration (NBAFM)[4] Use NBAFM in inventory for no-integrate sources
nonroad	Full integration (NBAFM in California, internal to MOVES elsewhere)[1]
np_oilgas	Partial integration (NBAFM)[5] Use NBAFM in inventory for no-integrate sources
pt_oilgas	No integration Use NBAFM in inventory for no-integrate sources
rwc	Partial integration (NBAFM) Use NBAFM in inventory for no-integrate sources
othpt	Partial integration (NBAFM) – offshore c3 marine (FIPS =85 and FIPS = 98) NBAFM comes from inventory but for Canada point and Mexico (not integrated), create NBAFM from speciation
onroad	Full integration (internal to MOVES)[1]
ptfire_f	No integration, Use NBAFM in inventory for no-integrate sources
ptfire_s	No integration, Use NBAFM in inventory for no-integrate sources
ptfire_mxca	No integration, no NBAFM in inventory, create NBAFM from speciation

[1]For the integration that is internal to MOVES or MOVES-Mexico, an extended list of HAPs are integrated, not just BAFM. See 3.2.1.3

[2] 322 tons VOC from SCC 2801500170 (Miscellaneous Area Sources;Agriculture Production - Crops - as nonpoint;Agricultural Field Burning - whole field set on fire;Field Crop is Grasses: Burning Techniques Not Important) with no NBAFM, reported in a few counties in Florida and New Jersey

[3] 762 tons VOC from SCCs 2285002008,2285002009,2285002010, with no NBAFM, primarily in California and Massachusetts

[4]940,000 tons VOCs without BAFM from a large variety of SCCs, some of which are not expected to have any BAFM

[5] 535,000 tons VOCs without BAFM [6] no VOC without BAFM, some sources where BAFM > VOC; largest source is 7 tons BAFM (exceeds VOC by about 6 tons)

More details on the integration of specific sectors and additional details of the speciation are provided in Section 3.2.1.3.

3.2.1.2 County specific profile combinations

SMOKE can compute speciation profiles from mixtures of other profiles in user-specified proportions via two different methods. The first method, GSPRO_COMBO was used in previous platforms since the 2005, and the second method (GSPRO with fraction) is used for the first time in this 2014v7.0 as it required a SMOKE update. The GSPRO_COMBO method uses profile combinations specified in the GSPRO_COMBO ancillary file by pollutant (which can include emissions mode, e.g., EXH__VOC), state and county (i.e., state/county FIPS code) and time period (i.e., month). Different GSPRO_COMBO files can be used by sector, allowing for different combinations to be used for different sectors but within a sector, different profiles cannot be applied based on SCC. The GSREF file indicates that a specific source uses a combination file with the profile code "COMBO." SMOKE computes the resultant profile using the fraction of each specific profile assigned by county, month and pollutant.

In previous platforms, the GSPRO_COMBO feature was used to speciate nonroad mobile and gasoline-related stationary sources that use fuels with varying ethanol content. In these cases, the speciation profiles require different combinations of gasoline profiles, e.g. E0 and E10 profiles. Since the ethanol content varies spatially (e.g., by state or county), temporally (e.g., by month), and by modeling year (future years have more ethanol), the GSPRO_COMBO feature allows combinations to be specified at various levels for different years. For the 2014v7.0 platform, GSPRO_COMBO is still used for nonroad sources in California and for certain gasoline-related stationary sources nationwide. The feature is also used to combine exhaust and evaporative profiles to use with Canadian mobile sources, which do not include the mode in the SCC or pollutant. GSPRO_COMBO is no longer needed for nonroad sources outside of California because nonroad emissions within MOVES have the speciation profiles built into the results, so there is no need to assign them via the GSREF or GSPRO_COMBO feature.

A new method to combine multiple profiles is available in SMOKE4.5. It allows multiple profiles to be combined by by pollutant, state and county (i.e., state/county FIPS code) and SCC. This was used specifically for the oil and gas sectors (pt_oilgas and np_oilgas) because SCCs include both controlled and uncontrolled oil and gas operations which use different profiles.

3.2.1.3 Additional sector specific considerations for integrating HAP emissions from inventories into speciation

The decision to integrate HAPs into the speciation was made on a sector by sector basis. For some sectors, there is no integration and VOC is speciated directly; for some sectors, there is full integration meaning all sources are integrated; and for other sectors, there is partial integration, meaning some sources are not integrated and other sources are integrated. The integrated HAPs are either NBAFM or, in the case of MOVES (onroad, nonroad and MOVES-Mexico), a larger set of HAPs plus ethanol are integrated. Table 3-6 above summarizes the integration method for each platform sector.

For the rail sector, the EPA integrated NBAFM for most sources. Some SCCs had zero BAFM and, therefore, they were not integrated. These were SCCs provided by states for which EPA did not do HAP augmentation (2285002008, 2285002009 and 2285002010) because EPA does not create emissions for these SCCs. The VOC for these sources sum to 762 tons, and most of the mass is in California.

For the othpt sector, the C3 marine sources (see Section 2.4.2) are integrated. HAPs in this sector are derived identically to the U.S. C3 in the cmv sector. The rest of the sources in othpt are not integrated, thus the sector is partially integrated.

For the onroad sector, there are series of unique speciation issues. First, SMOKE-MOVES (see Section 2.3.1) is used to create emissions for these sectors and both the MEPROC and INVTABLE files are involved in controlling which pollutants are processed. Second, the speciation occurs within MOVES itself, not within SMOKE. The advantage of using MOVES to speciate VOC is that during the internal calculation of MOVES, the model has complete information on the characteristics of the fleet and fuels (e.g., model year, ethanol content, process, etc.), thereby allowing it to more accurately make use of specific speciation profiles. This means that MOVES produces EF tables that include inventory pollutants (e.g., TOG) and model-ready species (e.g., PAR, OLE, etc)[11]. SMOKE essentially calculates the model-ready species by using the appropriate emission factor without further speciation[12]. Third, MOVES' internal speciation uses full integration of an extended list of HAPs beyond NBAFM (called "M-profiles"). The M-profiles integration is very similar to NBAFM integration explained above except that the integration calculation (see Figure 3-2) is performed on emissions factors instead of on emissions, and a much larger set of pollutants are integrated besides NBAFM. The list of integrated pollutants is described in Table 3-7. An additional run of the Speciation Tool was necessary to create the M-profiles that were then loaded into the MOVES default database. Fourth, for California, the EPA applied adjustment factors to SMOKE-MOVES to produce California adjusted model-ready files (see Section 2.3.1 for details). By applying the ratios through SMOKE-MOVES, the CARB inventories are essentially speciated to match EPA estimated speciation. This resulted in changes to the VOC HAPs from what CARB submitted to the EPA.

Table 3-7. MOVES integrated species in M-profiles

MOVES ID	Pollutant Name
5	Methane (CH_4)
20	Benzene
21	Ethanol
22	MTBE
24	1,3-Butadiene
25	Formaldehyde
26	Acetaldehyde
27	Acrolein
40	2,2,4-Trimethylpentane
41	Ethyl Benzene
42	Hexane
43	Propionaldehyde
44	Styrene

[11] Because the EF table has the speciation "baked" into the factors, all counties that are in the county group (i.e., are mapped to that representative county) will have the same speciation.
[12] For more details on the use of model-ready EF, see the SMOKE 3.7 documentation: https://www.cmascenter.org/smoke/documentation/3.7/html/.

45	Toluene
46	Xylene
185	Naphthalene gas

For the nonroad sector, all sources are integrated, using the same list of integrated pollutants as shown in Table 3-7. Outside California, the integration calculations are performed within MOVES. For California, integration calculations are handled by SMOKE. The CARB-based nonroad inventory includes VOC HAP estimates for all sources, so every source in California was integrated as well. Some sources in the original CARB inventory had lower VOC emissions compared to sum of all VOC HAPs. For those sources, VOC was augmented to be equal to the VOC HAP sum, ensuring that every source in California could be integrated. The CARB-based nonroad data includes exhaust and evaporative mode-specific data for VOC, but does not contain refueling.

MOVES-MEXICO for onroad used the same speciation approach as for the U.S. in that the larger list of species shown in Table 3-7 ws used. However, MOVES-MEXICO used CB6-CAMx, not CB6-CMAQ, so post-SMOKE we converted the emissions to CB6-CMAQ as follows:

- XYLMN = XYL[1]-0.966*NAPHTHALENE[1]
- PAR = PAR[1]-0.00001*NAPHTHALENE[1]
- SOAALK = 0.108*PAR[1]

For most sources in the rwc sector, the VOC emissions were greater than or equal to NBAFM, and NBAFM was not zero, so those sources were integrated, although a few specific sources that did not meet these criteria could not be integrated. In all cases, these sources had NBAFM > VOC, but not by a significant amount. In total, the no-integrate rwc sector sources summed to 5 tons VOC and 85 tons of NBAFM. Because for the NATA case the NBAFM are used from the inventory, these no-integrate NBAFM emissions were used in the speciation.

There is a substantial amount of mass in the nonpt sector that is not integrated: 942,000 tons. It is likely that there would be sources in nonpt that are not integrated because the emission source is not expected to have NBAFM. It would be useful to estimate the NBAFM that might be in the profiles (and that would have been dropped from the profiles per the procedure in Figure 3-2) for these no-integrrate sources.

For the biog sector, the speciation profiles used by BEIS are not included in SPECIATE. The 2011 platform uses BEIS3.61, which includes a new species (SESQ) that was mapped to the model species SESQT. The profile code associated with BEIS3.61 for use with CB05 is “B10C5,” while the profile for use with CB6 is “B10C6.” The main difference between the profiles is the explicit treatment of acetone emissions in B10C6.

For the nonpt sector, sources for which VOC emissions were greater than or equal to BAFM and BAFM was not zero were integrated.

3.2.1.4 Oil and gas related speciation profiles

A new national flare profile, FLR99, Natural Gas Flare Profile with DRE >98% was developed from a Flare Test study and used. Most of the new VOC profiles from SPECIATE4.5 listed in Appendix C are for the oil and gas sector. For the oil and gas sources in the np_oilgas and pt_oilgas sectors, several counties were assigned to newly available basin or area-specific profiles in SPECIATE4.5 that account for measured or modeled from measured compositions specific a particular region of the country. In the 2011 platform, the only county-specific profiles were for the WRAP, but in 2014, several new profiles were added for other parts of the country. In addition, some of the WRAP profiles were revised to correct for errors such as mole fractions being used for mass fractions and VOCtoTOG factors or replaced with newer data. All WRAP profiles codes were renamed to include an "_R" to distinguish between the previous set of profiles (even those that did not change). For the Uintah basin and Denver-Julesburg Basin, Colorado, more updated profiles were used instead of the WRAP Phase III profiles. **Error! Reference source not found.** lists the region-specific profiles assigned to particular counties or g roups of counties. Although this platform increases the use of regional profiles, many counties still rely on the national profiles.

In addition to region-specific assignments, multiple profiles were assigned to particular county/SCC combinations using the SMOKE feature discussed in 3.2.1.2. The profile fractions were computed from VOC emissions provided in an intermediate file generated by the 2014 Nonpoint Oil and Gas Emission Estimation Tool used for the 2014NEIv1. The intermediate file provides flare, non-flare (process), and reboiler (for dehydrators) emissions for six source categories that have flare emissions: Associated Gas, Condensate Tanks, Crude Oil Tanks, Dehydrators, Liquids Unloading and Well Completions by county FIPS and SCC code for the U.S. to account for portions of VOC for a particular VOC that were from controlled emissions or reboiler.

Table 3-8. Basin/Region-specific profiles for oil and gas

Profile Code	Description	Region (if not in the profile name)
DJVNT_R	Denver-Julesburg Basin Produced Gas Composition from Non-CBM Gas Wells	
PNC01_R	Piceance Basin Produced Gas Composition from Non-CBM Gas Wells	
PNC02_R	Piceance Basin Produced Gas Composition from Oil Wells	
PNC03_R	Piceance Basin Flash Gas Composition for Condensate Tank	
PNCDH	Piceance Basin, Glycol Dehydrator	
PRBCB_R	Powder River Basin Produced Gas Composition from CBM Wells	
PRBCO_R	Powder River Basin Produced Gas Composition from Non-CBM Wells	
PRM01_R	Permian Basin Produced Gas Composition for Non-CBM Wells	
SSJCB_R	South San Juan Basin Produced Gas Composition from CBM Wells	
SSJCO_R	South San Juan Basin Produced Gas Composition from Non-CBM Gas Wells	
SWFLA_R	SW Wyoming Basin Flash Gas Composition for Condensate Tanks	
SWVNT_R	SW Wyoming Basin Produced Gas Composition from Non-CBM Wells	
UNT01_R	Uinta Basin Produced Gas Composition from CBM Wells	
WRBCO_R	Wind River Basin Produced Gagres Composition from Non-CBM Gas Wells	
95087a	Oil and Gas - Composite - Oil Field - Oil Tank Battery Vent Gas	East Texas
95109a	Oil and Gas - Composite - Oil Field - Condensate Tank Battery Vent Gas	East Texas

95417	Uinta Basin, Untreated Natural Gas	
95418	Uinta Basin, Condensate Tank Natural Gas	
95419	Uinta Basin, Oil Tank Natural Gas	
95420	Uinta Basin, Glycol Dehydrator	
95398	Composite Profile - Oil and Natural Gas Production - Condensate Tanks	Denver-Julesburg Basin
95399	Composite Profile - Oil Field - Wells	State of California
95400	Composite Profile - Oil Field - Tanks	State of California
95403	Composite Profile - Gas Wells	San Joaquin Basin

3.2.1.5 Mobile source related speciation profiles

The VOC speciation approach for mobile source and mobile source-related source categories is customized to account for the impact of fuels and engine type and technologies. The impact of fuels also affects the parts of the nonpt and ptnonipm sectors that are related to mobile sources such as portiable fuel containers and gasoline distribution.

The VOC speciation profiles for the nonroad sector other than for California are listed in Table 3-9. They include new profiles (i.e., those that begin with "953") for 2-stroke and 4-stroke gasoline engines running on E0 and E10 and compression ignition engines with different technologies developed from recent EPA test programs, which also supported the updated toxics emission factor in MOVES2014a (Reichle, 2015 and EPA, 2015b). California nonroad source profiles are presented in Table 3-10.

Table 3-9. TOG MOVES-SMOKE Speciation for nonroad emissions in MOVES2014 used for the 2014v7.0 Platform

Profile	Profile Description	Engine Type	Engine Technology	Engine Size	Horse-power category	Fuel	Fuel Sub-type	Emission Process
95327	SI 2-stroke E0	SI 2-stroke	all	all	all	Gasoline	E0	exhaust
95328	SI 2-stroke E10	SI 2-stroke	all	all	all	Gasoline	E10	exhaust
95329	SI 4-stroke E0	SI 4-stroke	all	all	all	Gasoline	E0	exhaust
95330	SI 4-stroke E10	SI 4-stroke	all	all	all	Gasoline	E10	exhaust
95331	CI Pre-Tier 1	CI	Pre-Tier 1	all	all	Diesel	all	exhaust
95332	CI Tier 1	CI	Tier 1	all	all	Diesel	all	exhaust
95333	CI Tier 2	CI	Tier 2 and 3	all	all	Diesel	all	exhaust
95333	CI Tier 2	CI	Tier 4	<56 kW (75 hp)	S	Diesel	all	exhaust
8775	ACES Phase 1 Diesel Onroad	CI Tier 4	Tier 4	>=56 kW (75 hp)	L	Diesel	all	exhaust
8753	E0 Evap	SI	all	all	all	Gasoline	E0	evaporative
8754	E10 Evap	SI	all	all	all	Gasoline	E10	evaporative
8766	E0 evap permeation	SI	all	all	all	Gasoline	E0	permeation
8769	E10 evap permeation	SI	all	all	all	Gasoline	E10	permeation
8869	E0 Headspace	SI	all	all	all	Gasoline	E0	headspace
8870	E10 Headspace	SI	all	all	all	Gasoline	E10	headspace

1001	CNG Exhaust	All	all	all	all	CNG	all	exhaust
8860	LPG exhaust	All	all	all	all	LPG	all	exhaust

Speciation profiles for VOC in the nonroad sector account for the ethanol content of fuels across years. A description of the actual fuel formulations for 2014 can be found in the 2014NEIv1 TSD. For 2014, the EPA used "COMBO" profiles to model combinations of profiles for E0 and E10 fuel use.

Combination profiles reflecting a combination of E10 and E0 fuel use are also used for sources upstream of mobile sources such as portable fuel containers (PFCs) and other fuel distribution operations associated with the transfer of fuel from bulk terminals to pumps (BTP) which are in the nonpt sector. They are also used for California nonroad soruces. For these sources, ethanol may be mixed into the fuels, in which case speciation would change across years. The speciation changes from fuels in the ptnonipm sector include BTP distribution operations inventoried as point sources. Refinery-to-bulk terminal (RBT) fuel distribution and bulk plant storage (BPS) speciation does not change across the modeling cases because this is considered upstream from the introduction of ethanol into the fuel. The mapping of fuel distribution SCCs to PFC, BTP, BPS, and RBT emissions categories can be found in Appendix F.

Table 3-10 summarizes the different profiles utilized for the fuel-related sources in each of the sectors for 2014. The term "COMBO" indicates that a combination of the profiles listed was used to speciate that subcategory using the GSPRO_COMBO file.

Table 3-10. Select mobile-related VOC profiles 2014

Sector	**Sub-category**	**2014**	
Nonroad- California & non US	gasoline exhaust	COMBO	
		8750a	Pre-Tier 2 E0 exhaust
		8751a	Pre-Tier 2 E10 exhaust
Nonroad-California	gasoline evap-orative	COMBO	
		8753	E0 evap
		8754	E10 evap
Nonroad-California	gasoline refueling	COMBO	
		8869	E0 Headspace
		8870	E10 Headspace
Nonroad-California	diesel exhaust	8774	Pre-2007 MY HDD exhaust
Nonroad-California	diesel evap-orative and diesel refueling	4547	Diesel Headspace
nonpt/ ptnonipm	PFC and BTP	COMBO	
		8869	E0 Headspace
		8870	E10 Headspace
nonpt/ ptnonipm	BPS/RBT	8869	E0 Headspace

The speciation of onroad VOC occurs within MOVES. MOVES takes into account fuel type and properties, emission standards as they affect different vehicle types and model years, and specific emission processes. Table 3-11 describes all of the M-profiles available to MOVES depending on the model year range, MOVES process (processID), fuel sub-type (fuelSubTypeID), and regulatory class (regClassID). Table 3-12 throughTable 3-14 describe the meaning of these MOVES codes. For a specific representative county and future year, there will be a different mix of these profiles. For example, for HD diesel exhaust, the emissions will use a combination of profiles 8774M and 8775M depending on the proportion of HD vehicles that are pre-2007 model years (MY) in that particular county. As that county is projected farther into the future, the proportion of pre-2007 MY vehicles will decrease. A second example, for gasoline exhaust (not including E-85), the emissions will use a combination of profiles 8756M, 8757M, 8758M, 8750aM, and 8751aM. Each representative county has a different mix of these key properties and, therefore, has a unique combination of the specific M-profiles. More detailed information on how MOVES speciates VOC and the profiles used is provided in the technical document, "Speciation of Total Organic Gas and Particulate Matter Emissions from On-road Vehicles in MOVES2014" (EPA, 2015c).

Table 3-11. Onroad M-profiles

Profile	Profile Description	Model Years	ProcessID	FuelSubTypeID	RegClassID
1001M	CNG Exhaust	1940-2050	1,2,15,16	30	48
4547M	Diesel Headspace	1940-2050	11	20,21,22	0
4547M	Diesel Headspace	1940-2050	12,13,18,19	20,21,22	10,20,30,40,41, 42,46,47,48
8753M	E0 Evap	1940-2050	12,13,19	10	10,20,30,40,41,42, 46,47,48
8754M	E10 Evap	1940-2050	12,13,19	12,13,14	10,20,30,40,41, 42,46,47,48
8756M	Tier 2 E0 Exhaust	2001-2050	1,2,15,16	10	20,30
8757M	Tier 2 E10 Exhaust	2001-2050	1,2,15,16	12,13,14	20,30
8758M	Tier 2 E15 Exhaust	1940-2050	1,2,15,16	15,18	10,20,30,40,41, 42,46,47,48
8766M	E0 evap permeation	1940-2050	11	10	0
8769M	E10 evap permeation	1940-2050	11	12,13,14	0
8770M	E15 evap permeation	1940-2050	11	15,18	0
8774M	Pre-2007 MY HDD exhaust	1940-2006	1,2,15,16,17,90	20, 21, 22	40,41,42,46,47, 48
8774M	Pre-2007 MY HDD exhaust	1940-2050	91[13]	20, 21, 22	46,47
8774M	Pre-2007 MY HDD exhaust	1940-2006	1,2,15,16	20, 21, 22	20,30
8775M	2007+ MY HDD exhaust	2007-2050	1,2,15,16	20, 21, 22	20,30
8775M	2007+ MY HDD exhaust	2007-2050	1,2,15,16,17,90	20, 21, 22	40,41,42,46,47,48
8855M	Tier 2 E85 Exhaust	1940-2050	1,2,15,16	50, 51, 52	10,20,30,40,41, 42,46,47,48
8869M	E0 Headspace	1940-2050	18	10	10,20,30,40,41, 42,46,47,48
8870M	E10 Headspace	1940-2050	18	12,13,14	10,20,30,40,41, 42,46,47,48
8871M	E15 Headspace	1940-2050	18	15,18	10,20,30,40,41, 42,46,47,48
8872M	E15 Evap	1940-2050	12,13,19	15,18	10,20,30,40,41, 42,46,47,48

[13] 91 is the processed for APUs which are diesel engines not covered by the 2007 Heavey-Duty Rule, so the older technology applieds to all years.

Profile	Profile Description	Model Years	ProcessID	FuelSubTypeID	RegClassID
8934M	E85 Evap	1940-2050	11	50,51,52	0
8934M	E85 Evap	1940-2050	12,13,18,19	50,51,52	10,20,30,40,41, 42,46,47,48
8750aM	Pre-Tier 2 E0 exhaust	1940-2000	1,2,15,16	10	20,30
8750aM	Pre-Tier 2 E0 exhaust	1940-2050	1,2,15,16	10	10,40,41,42,46,47,48
8751aM	Pre-Tier 2 E10 exhaust	1940-2000	1,2,15,16	11,12,13,14	20,30
8751aM	Pre-Tier 2 E10 exhaust	1940-2050	1,2,15,16	11,12,13,14,15, 18[14]	10,40,41,42,46,47,48

Table 3-12. MOVES process IDs

Process ID	Process Name
1	Running Exhaust
2	Start Exhaust
9	Brakewear
10	Tirewear
11	Evap Permeation
12	Evap Fuel Vapor Venting
13	Evap Fuel Leaks
15	Crankcase Running Exhaust
16	Crankcase Start Exhaust
17	Crankcase Extended Idle Exhaust
18	Refueling Displacement Vapor Loss
19	Refueling Spillage Loss
20	Evap Tank Permeation
21	Evap Hose Permeation
22	Evap RecMar Neck Hose Permeation
23	Evap RecMar Supply/Ret Hose Permeation
24	Evap RecMar Vent Hose Permeation
30	Diurnal Fuel Vapor Venting
31	HotSoak Fuel Vapor Venting
32	RunningLoss Fuel Vapor Venting
40	Nonroad
90	Extended Idle Exhaust
91	Auxiliary Power Exhaust

Table 3-13. MOVES Fuel subtype IDs

Fuel Subtype ID	Fuel Subtype Descriptions
10	Conventional Gasoline
11	Reformulated Gasoline (RFG)
12	Gasohol (E10)
13	Gasohol (E8)

[14] The profile assingments for pre-2001 gasoline vehicles fueled on E15/E20 fuels (subtypes 15 and 18) were corrected for MOVES2014a. This model year range, process, fuelsubtype regclass combinate is already assigned to profile 8758.

14	Gasohol (E5)
15	Gasohol (E15)
18	Ethanol (E20)
20	Conventional Diesel Fuel
21	Biodiesel (BD20)
22	Fischer-Tropsch Diesel (FTD100)
30	Compressed Natural Gas (CNG)
50	Ethanol
51	Ethanol (E85)
52	Ethanol (E70)

Table 3-14. MOVES regclass IDs

Reg. Class ID	Regulatory Class Description
0	Doesn't Matter
10	Motorcycles
20	Light Duty Vehicles
30	Light Duty Trucks
40	Class 2b Trucks with 2 Axles and 4 Tires (8,500 lbs < GVWR <= 10,000 lbs)
41	Class 2b Trucks with 2 Axles and at least 6 Tires or Class 3 Trucks (8,500 lbs < GVWR <= 14,000 lbs)
42	Class 4 and 5 Trucks (14,000 lbs < GVWR <= 19,500 lbs)
46	Class 6 and 7 Trucks (19,500 lbs < GVWR <= 33,000 lbs)
47	Class 8a and 8b Trucks (GVWR > 33,000 lbs)
48	Urban Bus (see CFR Sec 86.091_2)

For portable fuel containers (PFCs) and fuel distribution operations associated with the bulk-plant-to-pump (BTP) distribution, ethanol may be mixed into the fuels; therefore, county- and month-specific COMBO speciation was used (via the GSPRO_COMBO file). Refinery to bulk terminal (RBT) fuel distribution and bulk plant storage (BPS) speciation are considered upstream from the introduction of ethanol into the fuel; therefore, a single profile is sufficient for these sources. No refined information on potential VOC speciation differences between cellulosic diesel and cellulosic ethanol sources was available; therefore, cellulosic diesel and cellulosic ethanol sources used the same SCC (30125010: Industrial Chemical Manufacturing, Ethanol by Fermentation production) for VOC speciation as was used for corn ethanol plants.

3.2.2 PM speciation

In addition to VOC profiles, the SPECIATE database also contains the $PM_{2.5}$ speciated into both individual chemical compounds (e.g., zinc, potassium, manganese, lead), and into the "simplified" $PM_{2.5}$ components used in the air quality model. We speciated $PM_{2.5}$ into the AE6 species associated with CMAQ 5.0.1 and later versions. The majority of the 2014 platform PM profiles come from the 911XX series, which include updated AE6 speciation[15].

[15] The exceptions are 5674 (Marine Vessel – Marine Engine – Heavy Fuel Oil) used for cmv and 92018 (Draft Cigarette Smoke – Simplified) used in nonpt.

For the onroad sector, for all processes except brake and tire wear, PM speciation occurs within MOVES itself, not within SMOKE (similar to the VOC speciation described above). The advantage of using MOVES to speciate PM is that during the internal calculation of MOVES, the model has complete information on the characteristics of the fleet and fuels (e.g., model year, sulfur content, process, etc.) to accurately match to specific profiles. This means that MOVES produces EF tables that include total PM (e.g., PM_{10} and $PM_{2.5}$) and speciated PM (e.g., PEC, PFE, etc). SMOKE essentially calculates the PM components by using the appropriate EF without further speciation[16]. The specific profiles used within MOVES include two compressed natural gas (CNG) profiles, 45219 and 45220, which were added to SPECIATE4.5. A list of profiles is provided in the technical document, "Speciation of Total Organic Gas and Particulate Matter Emissions from On-road Vehicles in MOVES2014" (EPA, 2015c).

For onroad brake and tire wear, the PM is speciated in the *moves2smk* postprocessor that prepares the emission factors for processing in SMOKE. The formulas for this are based on the standard speciation factors from break and tirewear profiles. These profiles were updated based on data from a Health Effects Institute report (Schauer, 2006).

Table 3-15. SPECIATE4.5 brake and tire profiles compared to those used in the 2011v6.3 Platform

Inventory Pollutant	Model Species	Previous brakewear profile: 91134	SPECIATE4.5 brakewear profile: 95462 from Schauer (2006)	Previous tirewear profile: 91150	SPECIATE4.5 tirewear profile: 95460 from Schauer (2006)
PM2_5	PAL	0.00124	0.000793208	6.05E-04	3.32401E-05
PM2_5	PCA	0.01	0.001692177	0.00112	
PM2_5	PCL	0.001475		0.0078	
PM2_5	PEC	0.0261	0.012797085	0.22	0.003585907
PM2_5	PFE	0.115	0.213901692	0.0046	0.00024779
PM2_5	PH2O	0.0080232		0.007506	
PM2_5	PK	1.90E-04	0.000687447	3.80E-04	4.33129E-05
PM2_5	PMG	0.1105	0.002961309	3.75E-04	0.000018131
PM2_5	PMN	0.001065	0.001373836	1.00E-04	1.41E-06
PM2_5	PMOTHR	0.4498	0.691704999	0.0625	0.100663209
PM2_5	PNA	1.60E-04	0.002749787	6.10E-04	7.35312E-05
PM2_5	PNCOM	0.0428	0.020115749	0.1886	0.255808124
PM2_5	PNH4	3.00E-05		1.90E-04	
PM2_5	PNO3	0.0016		0.0015	
PM2_5	POC	0.107	0.050289372	0.4715	0.639520309
PM2_5	PSI	0.088		0.00115	
PM2_5	PSO4	0.0334		0.0311	
PM2_5	PTI	0.0036	0.000933341	3.60E-04	5.04E-06

that would otherwise be used in SMOKE via the profiles 91134 for brake wear and 91150 for tire wear:

```
POC = 0.6395 * PM25TIRE + 0.0503 * PM25BRAKE
PEC = 0.0036 * PM25TIRE + 0.0128 * PM25BRAKE
```

[16] Unlike previous platforms, the PM components (e.g., POC) are now consistently defined between MOVES2014 and CMAQ. For more details on the use of model-ready EF, see the SMOKE 3.7 documentation: https://www.cmascenter.org/smoke/documentation/3.7/html/.

```
PNO3 = 0.000 * PM25TIRE + 0.000 * PM25BRAKE
PSO4 = 0.0 * PM25TIRE + 0.0 * PM25BRAKE
PNH4 = 0.000 * PM25TIRE + 0.0000 * PM25BRAKE
PNCOM = 0.2558 * PM25TIRE + 0.0201 * PM25BRAKE
```

For California onroad emissions, adjustment factors were applied to SMOKE-MOVES to produce California adjusted model-ready files (see Section 2.3.1 for details). California did not supply speciated PM, therefore, the adjustment factors applied to PM2.5 were also applied to the speciated PM components. By applying the ratios through SMOKE-MOVES, the CARB inventories are essentially speciated to match EPA estimated speciation.

3.2.3 NO_X speciation

NOx emission factors and therefore NOx inventories are developed on a NO_2 weight basis. For air quality modeling, NO_X is speciated into NO, NO_2, and/or HONO. For the non-mobile sources, the EPA used a single profile "NHONO" to split NO_X into NO and NO_2.

The importance of HONO chemistry, identification of its presence in ambient air and the measurements of HONO from mobile sources have prompted the inclusion of HONO in NOx speciation for mobile sources. Based on tunnel studies, a HONO to NOx ratio of 0.008 was chosen (Sarwar, 2008). For the mobile sources, except for onroad (including nonroad, cmv, rail, othon sectors), and for specific SCCs in othar and ptnonipm, the profile "HONO" is used. Table 3-16 gives the split factor for these two profiles. The onroad sector does not use the "HONO" profile to speciate NO_X. MOVES2014 produces speciated NO, NO_2, and HONO by source, including emission factors for these species in the emission factor tables used by SMOKE-MOVES. Within MOVES, the HONO fraction is a constant 0.008 of NO_X. The NO fraction varies by heavy duty versus light duty, fuel type, and model year. The NO_2 fraction = 1 – NO – HONO. For more details on the NO_X fractions within MOVES, see https://nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=P100F1A5.pdf .

Table 3-16. NO_X speciation profiles

Profile	pollutant	species	split factor
HONO	NOX	NO2	0.092
HONO	NOX	NO	0.9
HONO	NOX	HONO	0.008
NHONO	NOX	NO2	0.1
NHONO	NOX	NO	0.9

3.3 Temporal Allocation

Temporal allocation (i.e., temporalization) is the process of distributing aggregated emissions to a finer temporal resolution, thereby converting annual emissions to hourly emissions. While the total emissions are important, the timing of the occurrence of emissions is also essential for accurately simulating ozone, PM, and other pollutant concentrations in the atmosphere. Many emissions inventories are annual or monthly in nature. Temporalization takes these aggregated emissions and, if needed, distributes them to the month, and then distributes the monthly emissions to the day and the daily emissions to the hours of each day. This process is typically done by applying temporal profiles to the inventories in this order: monthly, day of the week, and diurnal.

The temporal factors applied to the inventory are selected using some combination of country, state, county, SCC, and pollutant. Table 3-17 summarizes the temporal aspects of emissions modeling by comparing the key approaches used for temporal processing across the sectors. In the table, "Daily temporal approach" refers to the temporal approach for getting daily emissions from the inventory using the SMOKE Temporal program. The values given are the values of the SMOKE L_TYPE setting. The "Merge processing approach" refers to the days used to represent other days in the month for the merge step. If this is not "all," then the SMOKE merge step runs only for representative days, which could include holidays as indicated by the right-most column. The values given are those used for the SMOKE M_TYPE setting (see below for more information).

Table 3-17. Temporal settings used for the platform sectors in SMOKE

Platform sector short name	Inventory resolutions	Monthly profiles used?	Daily temporal approach	Merge processing approach	Process Holidays as separate days
afdust_adj	Annual	Yes	week	all	Yes
ag	Annual and Daily	Yes	all	all	Yes
agfire	Annual	Yes	mwdss	mwdss	Yes
ptagfire	Daily		all	all	Yes
beis	Hourly		n/a	all	Yes
cmv	Annual	Yes	aveday	aveday	
rail	Annual	Yes	aveday	aveday	
nonpt	Annual	Yes	week	week	Yes
nonroad	Monthly		mwdss	mwdss	Yes
np_oilgas	Annual	Yes	week	week	Yes
onroad	Annual & monthly[1]		all	all	Yes
onroad_ca_adj	Annual & monthly[1]		all	all	Yes
othafdust_adj	Annual	Yes	week	all	
othar	Annual & monthly	Yes	week	week	
onroad_can	Monthly		week	week	
onroad_mex	Monthly		week	week	
othpt	Annual	yes	mwdss	mwdss	
pt_oilgas	Annual	yes	mwdss	mwdss	Yes
ptegu	Daily & hourly		all	all	Yes
ptnonipm	Annual	yes	mwdss	mwdss	Yes
ptfire_f	Daily		all	all	Yes
ptfire_s	Daily		all	all	Yes
ptfire_mxca	Daily		all	all	Yes
rwc	Annual	no	met-based	all	Yes

1. Note the annual and monthly "inventory" actually refers to the activity data (VMT and VPOP) for onroad. The actual emissions are computed on an hourly basis.

The following values are used in the table. The value "all" means that hourly emissions are computed for every day of the year and that emissions potentially have day-of-year variation. The value "week" means that hourly emissions computed for all days in one "representative" week, representing all weeks for each month. This means emissions have day-of-week variation, but not week-to-week variation within the month. The value "mwdss" means hourly emissions for one representative Monday, representative weekday (Tuesday through Friday), representative Saturday, and representative Sunday for each month.

This means emissions have variation between Mondays, other weekdays, Saturdays and Sundays within the month, but not week-to-week variation within the month. The value “aveday” means hourly emissions computed for one representative day of each month, meaning emissions for all days within a month are the same. Special situations with respect to temporalization are described in the following subsections.

In addition to the resolution, temporal processing includes a ramp-up period for several days prior to January 1, 2014, which is intended to mitigate the effects of initial condition concentrations. The ramp-up period was 10 days (December 22-31, 2013). For most sectors, emissions from December 2014 were used to fill in surrogate emissions for the end of December 2013. In particular, December 2014 emissions (representative days) were used for December 2013. For biogenic emissions, December 2013 emissions were processed using 2013 meteorology.

3.3.1 Use of FF10 format for finer than annual emissions

The FF10 inventory format for SMOKE provides a consolidated format for monthly, daily, and hourly emissions inventories. With the FF10 format, a single inventory file can contain emissions for all 12 months and the annual emissions in a single record. This helps simplify the management of numerous inventories. Similarly, daily and hourly FF10 inventories contain individual records with data for all days in a month and all hours in a day, respectively.

SMOKE prevents the application of temporal profiles on top of the “native” resolution of the inventory. For example, a monthly inventory should not have annual-to-month temporalization applied to it; rather, it should only have month-to-day and diurnal temporalization. This becomes particularly important when specific sectors have a mix of annual, monthly, daily, and/or hourly inventories. The flags that control temporalization for a mixed set of inventories are discussed in the SMOKE documentation. The modeling platform sectors that make use of monthly values in the FF10 files are nonroad, onroad, onroad_can, onroad_mex, othar and ptegu.

3.3.2 Electric Generating Utility temporalization (ptegu)

3.3.2.1 Base year temporal allocation of EGUs

The 2014NEIv1 annual EGU emissions not matched to CEMS sources use region/fuel specific profiles based on average houly emissions for the region and fuel. Peaking units were removed during the averaging to mimimized the spikes generated by those units. The non-matched units are allocated to hourly emissions using the following 3-step methodology: annual value to month, month to day, and day to hour. First, the CEMS data were processed using a tool that reviewed the data quality flags that indicate the data were not measured. Unmeasured data can cause erroneously high values in the CEMS data. If the data were not measured at specific hours, and those values were found to be more than three times the annual mean for that unit, the data for those hours were replaced with annual mean values (Adelman et al., 2012). These adjusted CEMS data were then used for the remainder of the temporalization process described below (see Figure 3-3 for an example). Winter and summer seasons are included in the development of the diurnal profiles as opposed to using data for the entire year because analysis of the hourly CEMS data revealed that there were different diurnal patterns in winter versus summer in many areas. Typically, a single mid-day peak is visible in the summer, while there are morning and evening peaks in the winter as shown in Figure 3-4.

The temporal allocation procedure is differentiated by whether or not the source could be directly matched to a CEMS unit via ORIS facility code and boiler ID. Note that for units matched to CEMS data, annual totals of their emissions may be different than the annual values in 2014NEIv1 because the CEMS data actually replaces the inventory data for the seasons in which the CEMS are operating. If a CEMS-matched unit is determined to be a partial year reporter, as can happen for sources that run CEMS only in the summer, emissions totaling the difference between the annual emissions and the total CEMS emissions are allocated to the non-summer months.

Figure 3-3. Eliminating unmeasured spikes in CEMS data

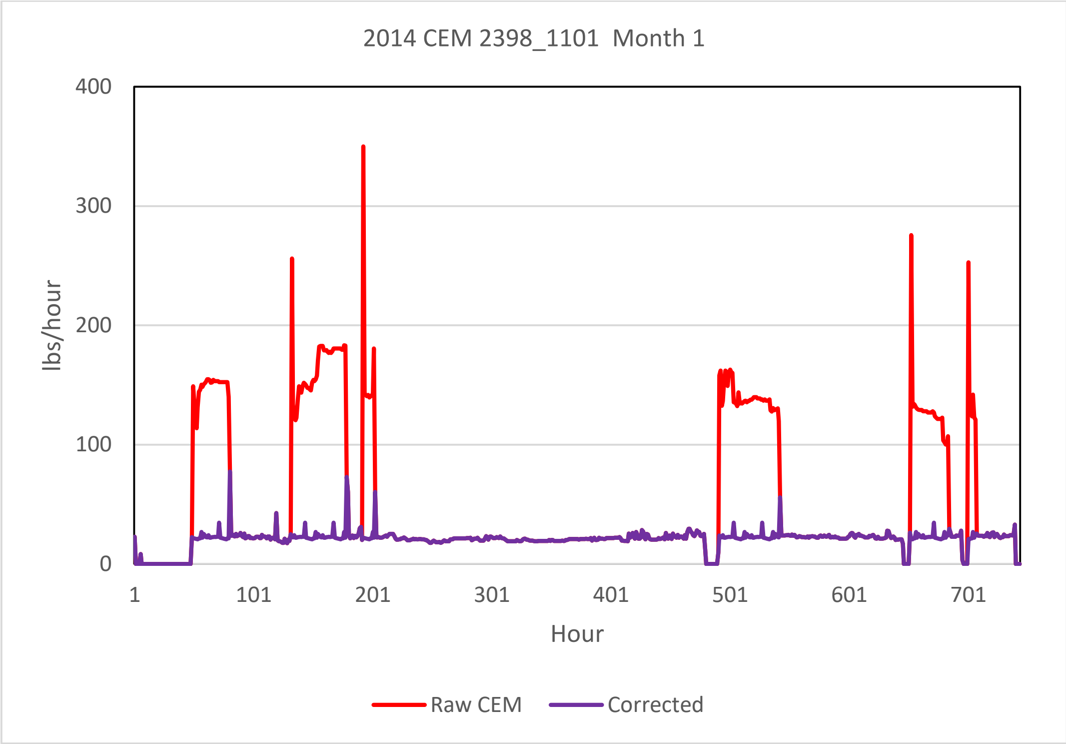
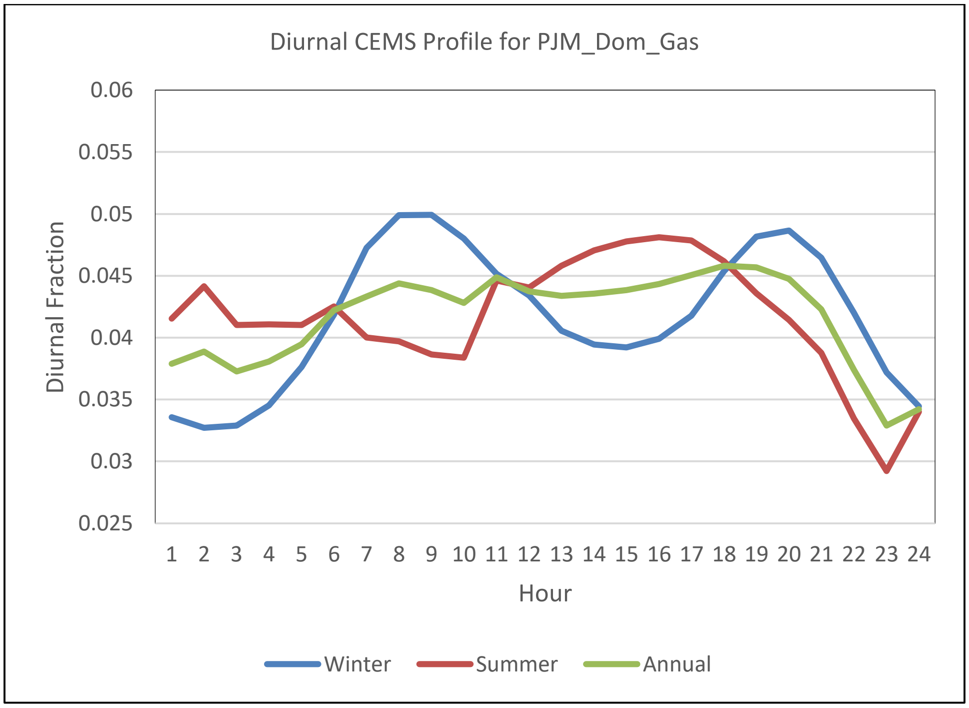
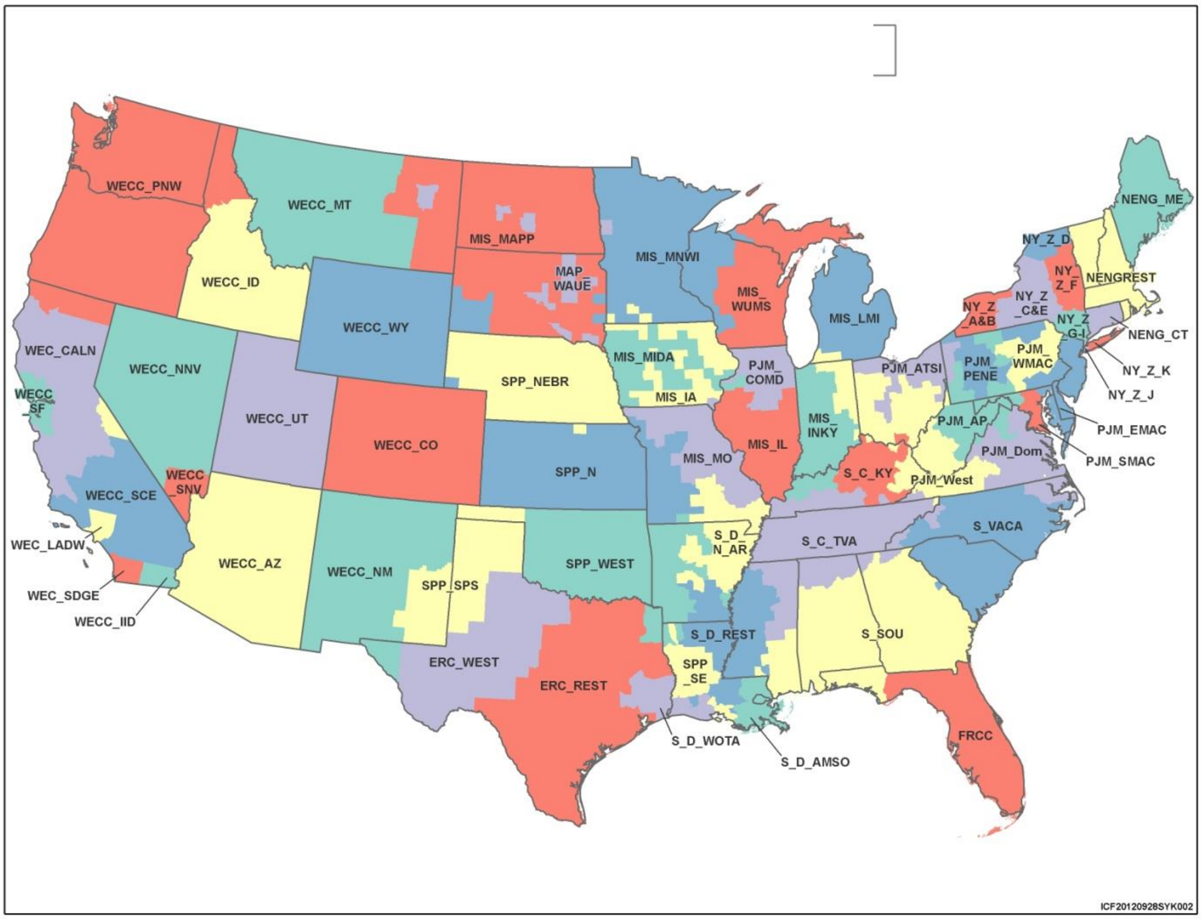


Figure 3-4. Seasonal diurnal profiles for EGU emissions in a Virginia Region



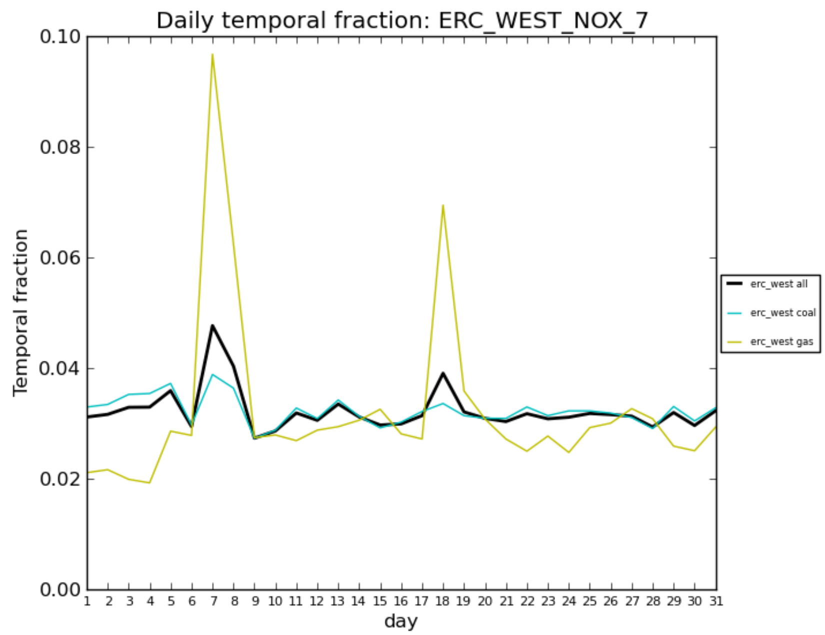
For sources not matched to CEMS units, the allocation of annual emissions to months and then days is done outside of SMOKE and then daily emissions are output to day-specific inventory files. For these units, the allocation of the inventory annual emissions to months is done using average fuel-specific season-to-month factors generated for each of the 64 IPM regions shown in Figure 3-5. These factors are based 2014 CEMS data only. In each region, separate factors were developed for the fuels: coal, natural gas, and "other," where the types of fuels included in "other" vary by region. Separate profiles were computed for NO_X, SO_2, and heat input. An overall composite profile was also computed and used when there were no CEMS units with the specified fuel in the region containing the unit. For both CEMS-matched units and units not matched to CEMS, NO_X and SO_2 CEMS data are used to allocate NO_X and SO_2 emissions to monthly emissions, respectively, while heat input data are used to allocate emissions of all other pollutants and to allocate emissions of all pollutants from monthly to daily emissions.

Figure 3-5. IPM Regions used to Create Temporal Profiles



Daily temporal allocation of units matched to CEMS was performed using a procedure similar to the approach to allocate emissions to months in that the CEMS data replaces the inventory data for each pollutant. For units without CEMS data, emissions were allocated from month to day using IPM-region and fuel-specific average month-to-day factors based on the 2014 CEMS data. Separate month-to-day allocation factors were computed for each month of the year using heat input for the fuels coal, natural gas, and "other" in each region. For both CEMS and non-CEMS matched units, NO_X and SO_2 CEMS data are used to allocate NO_X and SO_2 emissions, while CEMS heat input data are used to allocate all other pollutants. An example of month-to-day profiles for gas, coal, and an overall composite for a region in western Texas is shown in Figure 3-6.

Figure 3-6. Month-to-day profiles for different fuels in a West Texas Region



For units matched to CEMS data, hourly emissions use the hourly CEMS values for NO_X and SO_2, while other pollutants are allocated according to heat input values. For units not matched to CEMS data, temporal profiles from days to hours are computed based on the season-, region- and fuel-specific average day-to-hour factors derived from the CEMS data for those fuels and regions using the appropriate subset of data. For the unmatched units, CEMS heat input data are used to allocate *all* pollutants (including NO_X and SO_2) because the heat input data was generally found to be more complete than the pollutant-specific data. SMOKE then allocates the daily emissions data to hours using the temporal profiles obtained from the CEMS data for the analysis base year (i.e., 2014 in this case).

3.3.3 Airport Temporalization (ptnonipm)

Airport temporal profiles were updated. All airport SCCs (i.e., 2275*, 2265008005, 2267008005, 2268008005 and 2270008005) were given the same hourly, weekly and monthly profile for all airports other than Alaska seaplanes. Hourly airport operations data were obtained from the Aviation System Performance Metrics (ASPM) Airport Analysis website (https://aspm.faa.gov/apm/sys/AnalysisAP.asp). A report of 2014 hourly Departures and Arrivals for Metric Computation was generated. An overview of the ASPM metrics is at http://aspmhelp.faa.gov/index.php/Aviation_Performance_Metrics_%28APM%29. Figure 3-7 shows the diurnal airport profile.

Weekly and monthly temporal profiles are based on 2014 data from the FAA Operations Network Air Traffic Activity System (http://aspm.faa.gov/opsnet/sys/Terminal.asp). A report of all airport operations (takeoffs and landings) by day for 2014 was generated. These data were then summed to month and day-of-week to derive the monthly and weekly temporal profiles shown in Figure 3-7, Figure 3-8, and Figure 3-9. An overview of the Operations Network data system is at http://aspmhelp.faa.gov/index.php/Operations_Network_%28OPSNET%29.

Alaska seaplanes, which are outside the CONUS domain use the same monthly profile as in the 2011 platform shown in Figure 3-10. These were assigned based on the facility ID.

Figure 3-7. Diurnal Profile for all Airport SCCs

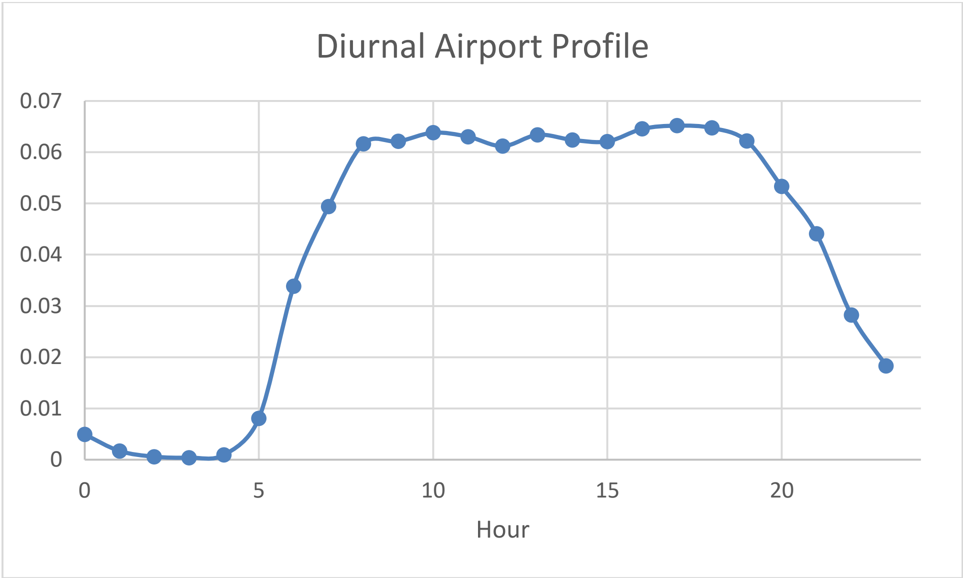


Figure 3-8. Weekly profile for all Airport SCCs

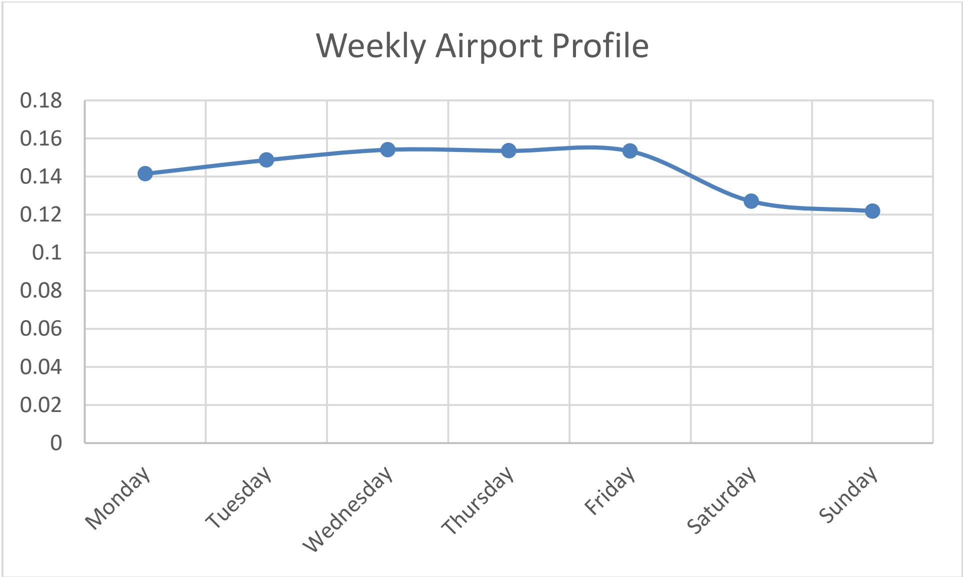


Figure 3-9. Monthly Profile for all Airport SCCs

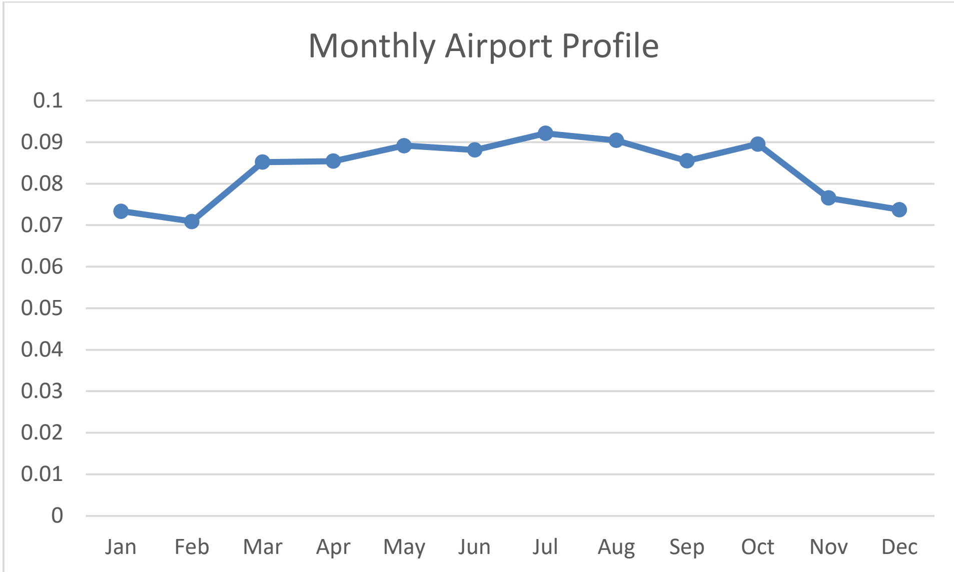
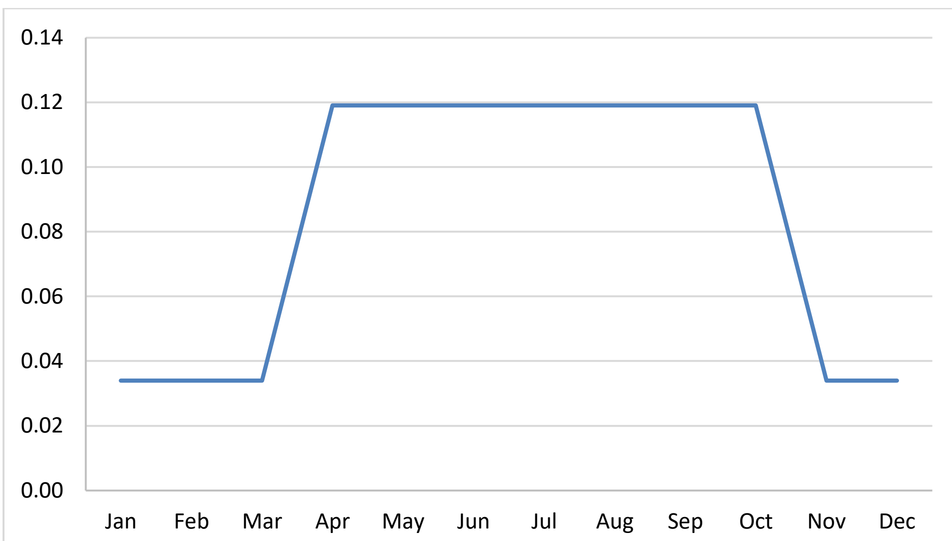


Figure 3-10. Alaska Seaplane Profile



3.3.4 Residential Wood Combustion Temporalization (rwc)

There are many factors that impact the timing of when emissions occur, and for some sectors this includes meteorology. The benefits of utilizing meteorology as method for temporalization are: (1) a meteorological dataset consistent with that used by the AQ model is available (e.g., outputs from WRF); (2) the meteorological model data are highly resolved in terms of spatial resolution; and (3) the meteorological variables vary at hourly resolution and can, therefore, be translated into hour-specific temporalization.

The SMOKE program GenTPRO provides a method for developing meteorology-based temporalization. Currently, the program can utilize three types of temporal algorithms: annual-to-day temporalization for residential wood combustion (RWC); month-to-hour temporalization for agricultural livestock NH_3; and a generic meteorology-based algorithm for other situations. Meteorological-based temporalization was used for portions of the rwc sector and for livestock within the ag sector.

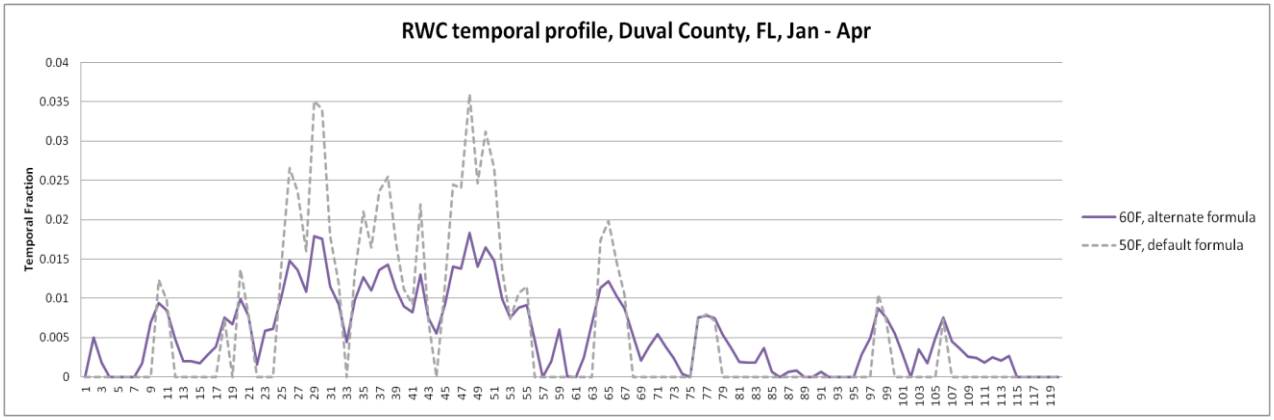
GenTPRO reads in gridded meteorological data (output from MCIP) along with spatial surrogates, and uses the specified algorithm to produce a new temporal profile that can be input into SMOKE. The meteorological variables and the resolution of the generated temporal profile (hourly, daily, etc.) depend on the selected algorithm and the run parameters. For more details on the development of these algorithms and running GenTPRO, see the GenTPRO documentation and the SMOKE documentation at http://www.cmascenter.org/smoke/documentation/3.1/GenTPRO_TechnicalSummary_Aug2012_Final.pdf and https://www.cmascenter.org/smoke/documentation/3.7/html/ch05s03s06.html, respectively.

As of the 2011v6.2 platform and in SMOKE 3.6.5, the temporal profile format was updated. GenTPRO now produces separate files including the monthly temporal profiles (ATPRO_MONTHLY) and day-of-month temporal profiles (ATPRO_DAILY), instead of a single ATPRO_DAILY with day-of-year temporal profiles as it did in SMOKE 3.5. The results are the same either way, so the temporal profiles themselves are effectively the same in 2011v6.2 as they were in 2011v6.0 since the meteorology is the same, but they are formatted differently.

For the RWC algorithm, GenTPRO uses the daily minimum temperature to determine the temporal allocation of emissions to days. GenTPRO was used to create an annual-to-day temporal profile for the RWC sources. These generated profiles distribute annual RWC emissions to the coldest days of the year. On days where the minimum temperature does not drop below a user-defined threshold, RWC emissions for most sources in the sector are zero. Conversely, the program temporally allocates the largest percentage of emissions to the coldest days. Similar to other temporal allocation profiles, the total annual emissions do not change, only the distribution of the emissions within the year is affected. The temperature threshold for rwc emissions was 50 ˚F for most of the country, and 60 ˚F for the following states: Alabama, Arizona, California, Florida, Georgia, Louisiana, Mississippi, South Carolina, and Texas.

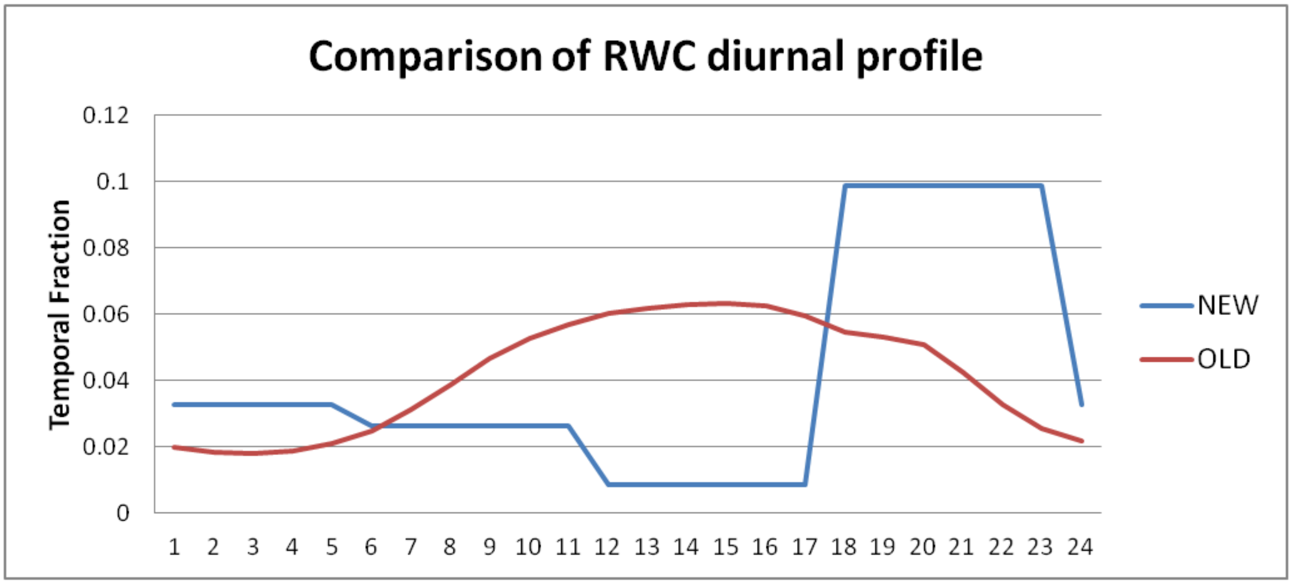
Figure 3-11 illustrates the impact of changing the temperature threshold for a warm climate county. The plot shows the temporal fraction by day for Duval County, Florida, for the first four months of 2007. The default 50 ˚F threshold creates large spikes on a few days, while the 60 ˚F threshold dampens these spikes and distributes a small amount of emissions to the days that have a minimum temperature between 50 and 60 ˚F.

Figure 3-11. Example of RWC temporalization in 2007 using a 50 versus 60 ˚F threshold



The diurnal profile for used for most RWC sources (see Figure 3-12) places more of the RWC emissions in the morning and the evening when people are typically using these sources. This profile is based on a 2004 MANE-VU survey based temporal profiles (see http://www.marama.org/publications_folder/ResWoodCombustion/Final_report.pdf). This profile was created by averaging three indoor and three RWC outdoor temporal profiles from counties in Delaware and aggregating them into a single RWC diurnal profile. This new profile was compared to a concentration based analysis of aethalometer measurements in Rochester, New York (Wang *et al.* 2011) for various seasons and days of the week and was found that the new RWC profile generally tracked the concentration based temporal patterns.

Figure 3-12. RWC diurnal temporal profile



The temporalization for "Outdoor Hydronic Heaters" (i.e., "OHH," SCC=2104008610) and "Outdoor wood burning device, NEC (fire-pits, chimneas, etc.)" (i.e., "recreational RWC," SCC=21040087000) is not based on temperature data, because the meteorological-based temporalization used for the rest of the rwc sector did not agree with observations for how these appliances are used.

For OHH, the annual-to-month, day-of-week and diurnal profiles were modified based on information in the New York State Energy Research and Development Authority's (NYSERDA) "Environmental, Energy Market, and Health Characterization of Wood-Fired Hydronic Heater Technologies, Final Report" (NYSERDA, 2012), as well as a Northeast States for Coordinated Air Use Management (NESCAUM) report "Assessment of Outdoor Wood-fired Boilers" (NESCAUM, 2006). A Minnesota 2008 Residential Fuelwood Assessment Survey of individual household responses (MDNR, 2008) provided additional annual-to-month, day-of-week and diurnal activity information for OHH as well as recreational RWC usage.

The diurnal profile for OHH, shown in Figure 3-13, is based on a conventional single-stage heat load unit burning red oak in Syracuse, New York. As shown in Figure 3-14, the NESCAUM report describes how for individual units, OHH are highly variable day-to-day but that in the aggregate, these emissions have no day-of-week variation. In contrast, the day-of-week profile for recreational RWC follows a typical "recreational" profile with emissions peaked on weekends.

Annual-to-month temporalization for OHH as well as recreational RWC were computed from the MDNR 2008 survey and are illustrated in Figure 3-15. The OHH emissions still exhibit strong seasonal variability, but do not drop to zero because many units operate year round for water and pool heating. In contrast to all other RWC appliances, recreational RWC emissions are used far more frequently during the warm season.

Figure 3-13. Diurnal profile for OHH, based on heat load (BTU/hr)

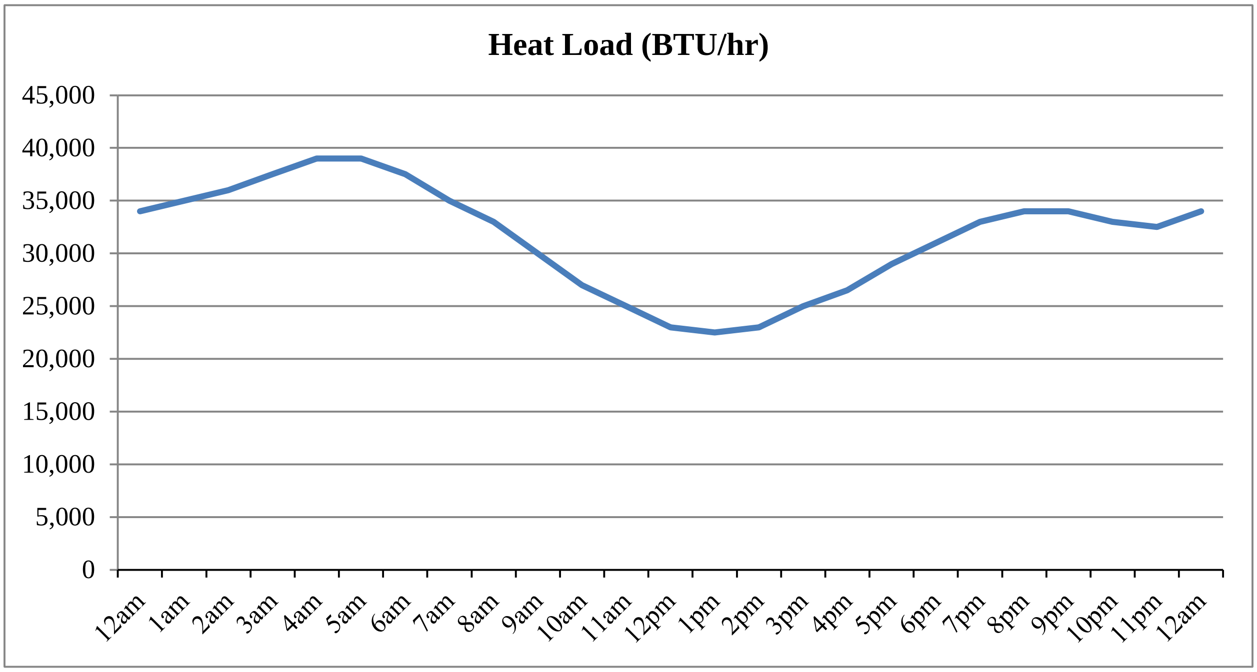


Figure 3-14. Day-of-week temporal profiles for OHH and Recreational RWC

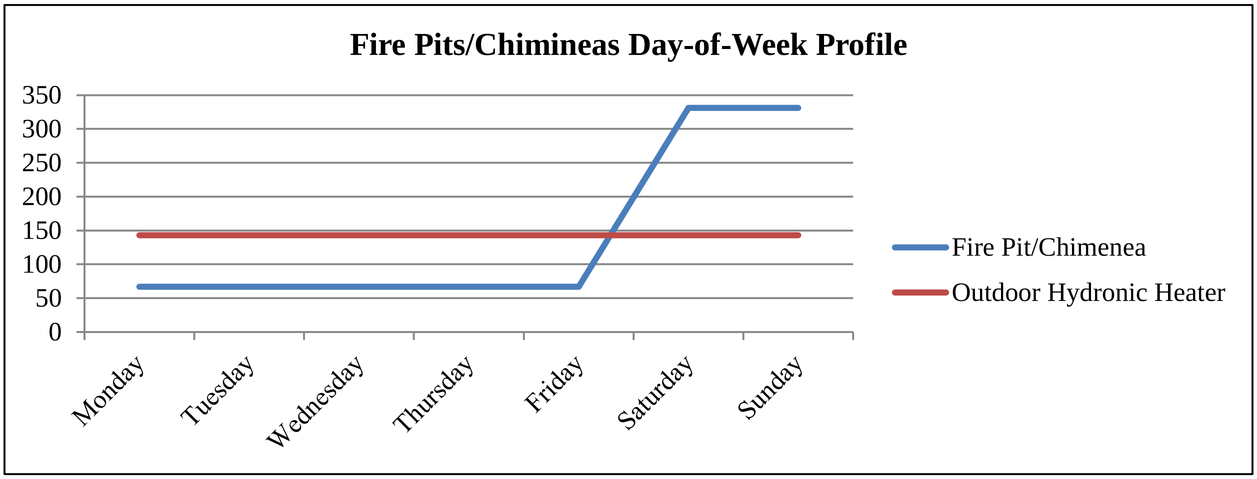
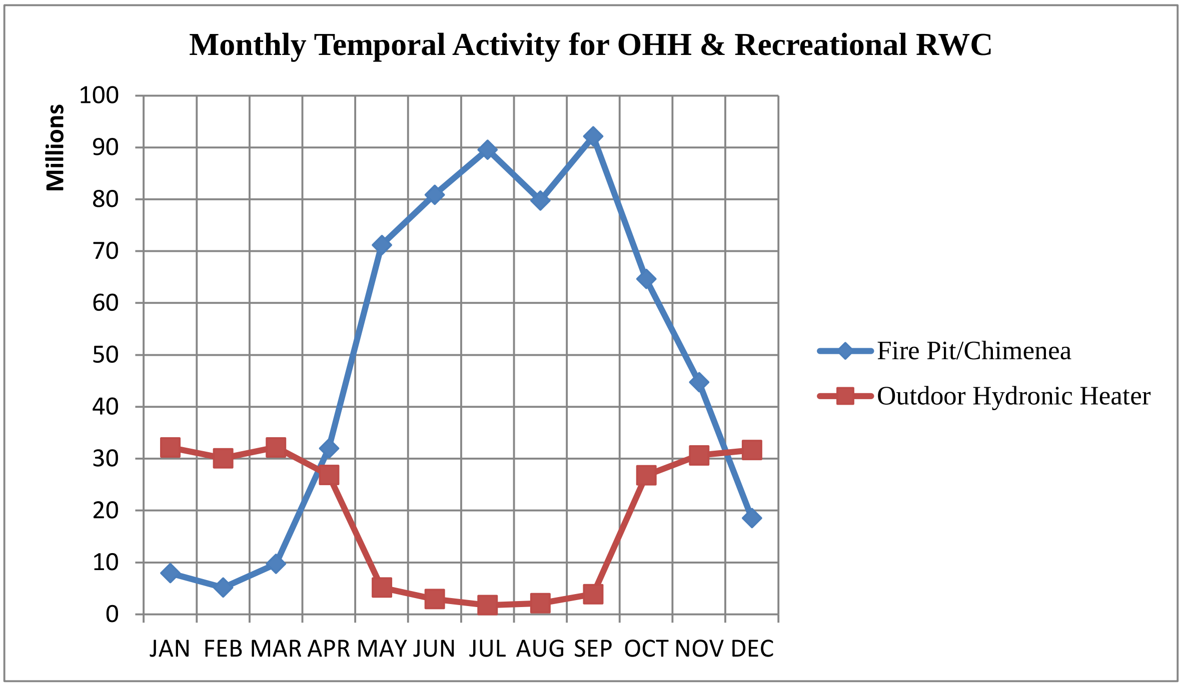


Figure 3-15. Annual-to-month temporal profiles for OHH and recreational RWC



3.3.5 Agricultural Ammonia Temporal Profiles (ag)

For the agricultural livestock NH_3 algorithm, the GenTPRO algorithm is based on an equation derived by Jesse Bash of the EPA's ORD based on the Zhu, Henze, et al. (2013) empirical equation. This equation is based on observations from the TES satellite instrument with the GEOS-Chem model and its adjoint to estimate diurnal NH_3 emission variations from livestock as a function of ambient temperature, aerodynamic resistance, and wind speed. The equations are:

$$E_{i,h} = [161500/T_{i,h} \text{ x } e^{(-1380/T_{i,h})}] \text{ x } AR_{i,h}$$

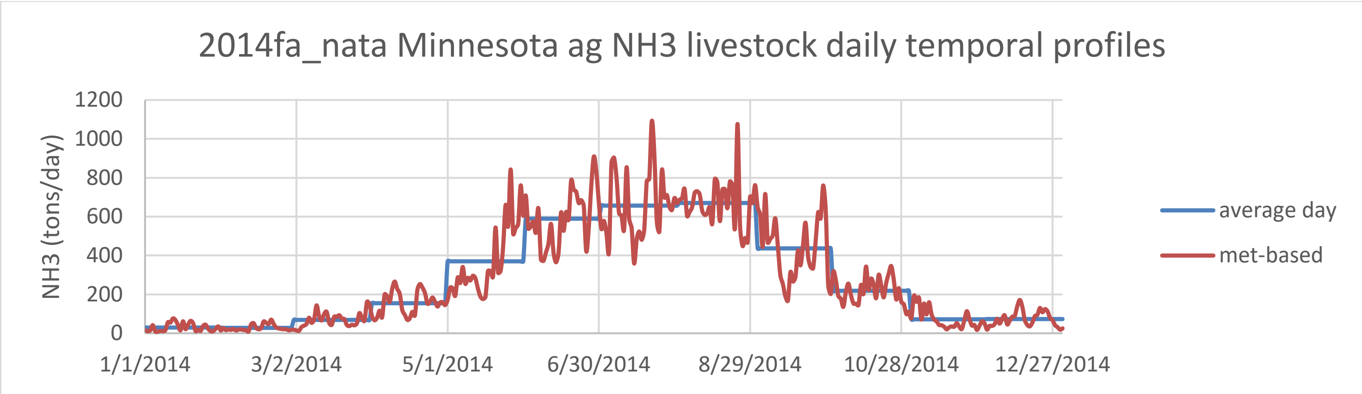
$$PE_{i,h} = E_{i,h} / \text{Sum}(E_{i,h})$$

where

- $PE_{i,h}$ = Percentage of emissions in county *i* on hour *h*
- $E_{i,h}$ = Emission rate in county *i* on hour *h*
- $T_{i,h}$ = Ambient temperature (Kelvin) in county *i* on hour *h*
- $V_{i,h}$ = Wind speed (meter/sec) in county *i* (minimum wind speed is 0.1 meter/sec)
- $AR_{i,h}$ = Aerodynamic resistance in county *i*

GenTPRO was run using the "BASH_NH3" profile method to create month-to-hour temporal profiles for these sources. Because these profiles distribute to the hour based on monthly emissions, the monthly emissions are obtained from a monthly inventory, or from an annual inventory that has been temporalized to the month. Figure 3-16 compares the daily emissions for Minnesota from the "old" approach (uniform monthly profile) with the "new" approach (GenTPRO generated month-to-hour profiles). Although the GenTPRO profiles show daily (and hourly variability), the monthly total emissions are the same between the two approaches.

Figure 3-16. Example of animal NH_3 emissions temporalization approach, summed to daily emissions



3.3.6 Oil and gas temporalization (np_oilgas)

The same county monthly oil and gas temporal profiles developed for the 2011 Platform were used for the 2014 Platform. These were developed at the same time as the 2011 surrogates and were based primarily on activity data extracted from the "DI Desktop Database powered by HPDI." (Drillinginfo, 2015). Data from state Oil and Gas Commission websites and from the RigData website (rigdata.com) were also used.

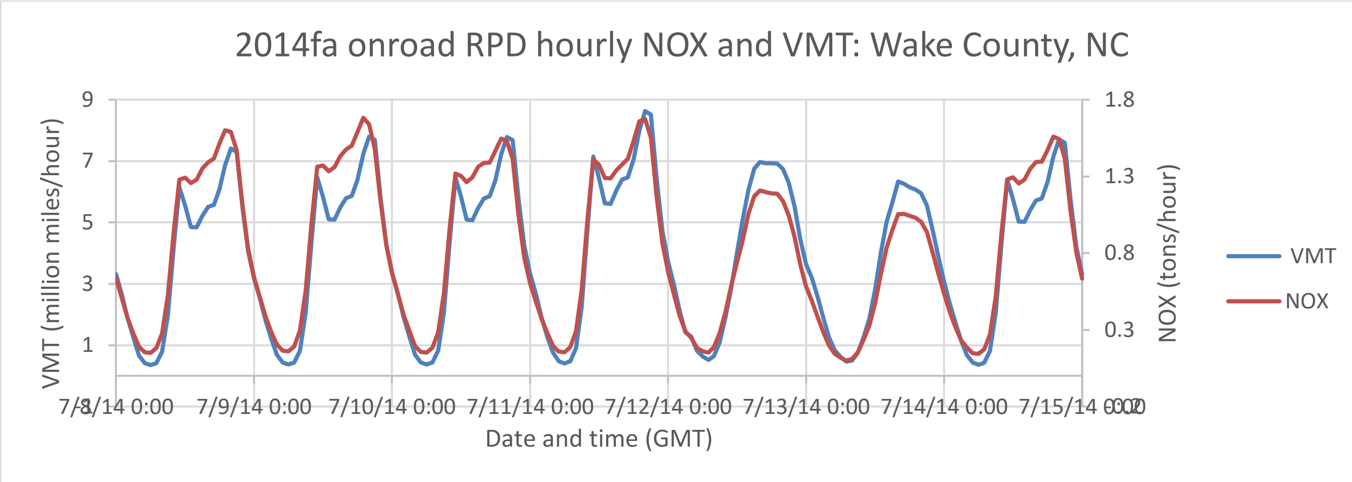
3.3.7 Onroad mobile temporalization (onroad)

For the onroad sector, the temporal distribution of emissions is a combination of more traditional temporal profiles and the influence of meteorology. This section will discuss both the meteorological influences and the diurnal temporal profiles for this platform.

Meteorology is not used in the development of the temporal profiles, but rather it impacts the calculation of the hourly emissions through the program Movesmrg. The result is that the emissions vary at the hourly level by grid cell. More specifically, the on-network (RPD) and the off-network parked vehicle (RPV, RPH, and RPP) processes use the gridded meteorology (MCIP) either directly or indirectly. For RPD, RPV, and RPH, Movesmrg determines the temperature for each hour and grid cell and uses that information to select the appropriate emission factor for the specified SCC/pollutant/mode combination. For RPP, instead of reading gridded hourly meteorology, Movesmrg reads gridded daily minimum and maximum temperatures. The combination of these four processes (RPD, RPV, RPH, and RPP) is the total onroad sector emissions. The onroad sector shows a strong meteorological influence on its temporal patterns.

Figure 3-17 illustrates the temporalization of the onroad sector and the meteorological influence via SMOKE-MOVES. Similar temporalization is done for the VMT in SMOKE-MOVES, but the meteorologically varying emission factors add variation on top of the temporalization.

Figure 3-17. Example of SMOKE-MOVES temporal variability of NOx emissions

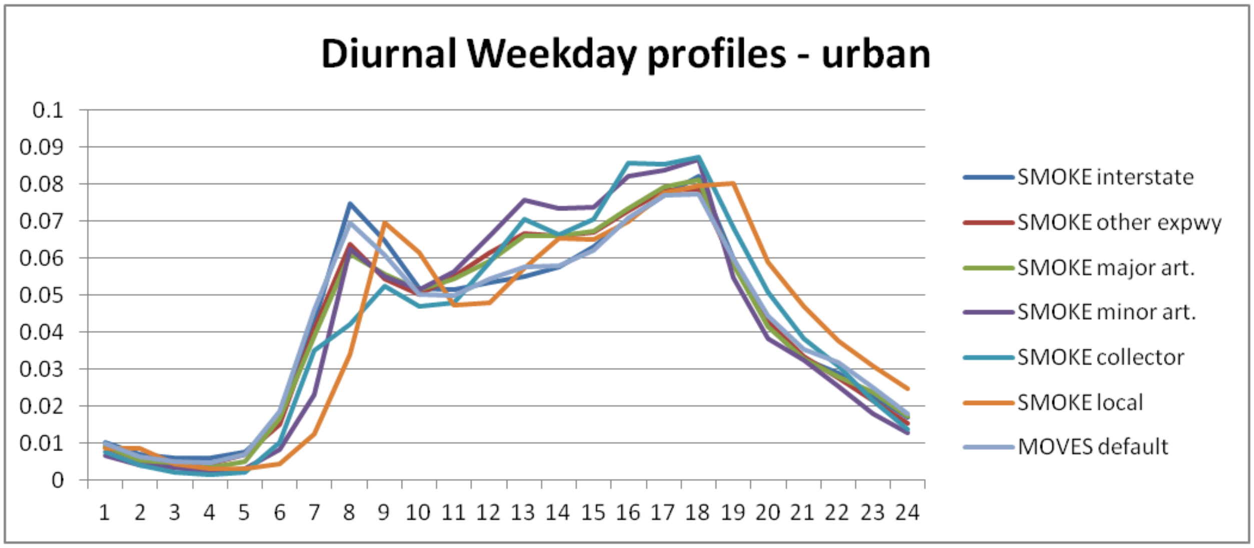


For the onroad sector, the "inventories" referred to in Table 3-17 actually consist of activity data, not emissions. For RPP and RPV processes, the VPOP inventory is annual and does not need temporalization. For RPD, the VMT inventory is annual for some sources and monthly for other sources, depending on the source of the data. Sources without monthly VMT were temporalized from annual to month through temporal profiles. VMT was also temporalized from month to day of the week, and then to hourly through temporal profiles. The RPD processes require a speed profile (SPDPRO) that consists of vehicle speed by hour for a typical weekday and weekend day. Unlike other sectors, the temporal profiles and SPDPRO will impact not only the distribution of emissions through time but also the total emissions. Because SMOKE-MOVES (for RPD) calculates emissions from VMT, speed and meteorology, if one shifted the VMT or speed to different hours, it would align with different temperatures and hence different emission factors. In other words, two SMOKE-MOVES runs with identical annual VMT, meteorology, and MOVES emission factors, will have different total emissions if the temporalization of VMT changes. For RPH, the HOTELING inventory is annual and was temporalized to month, day of the week, and hour of the day through temporal profiles. This is an analogous process to RPD except that speed is not included in the calculation of RPH.

In older platforms, the diurnal profile for VMT[17] varied by road type but not by vehicle type (see Figure 3-18). These profiles were used throughout the nation.

[17] These profiles were used in the 2007 platform and proceeding platforms.

Figure 3-18. Previous onroad diurnal weekday profiles for urban roads



Diurnal profiles that could differentiate by vehicle type as well as by road type and would potentially vary over geography were desired. In the development of the 2011v6.0[18] platform, the EPA updated these profiles to include information submitted by states in their MOVES county databases (CDBs). The 2011NEIv2 process provided an opportunity to update these diurnal profile with new information submitted by states, to supplement the data with additional sources, and to refine the methodology.

States submitted MOVES county databases (CDBs) that included information on the distribution of VMT by hour of day and by day of week[19] (see the 2011NEIv2 TSD for details on the submittal process for onroad). The EPA mined the state submitted MOVES CDBs for non-default diurnal profiles[20]. The list of potential diurnal profiles was then analyzed to see whether the profiles varied by vehicle type, road type, weekday versus weekend, and by county within a state. For the MOVES diurnal profiles, the EPA only considered the state profiles that varied significantly by both vehicle and road types. Only those profiles that passed this criteria were used in that state or used in developing default temporal profiles. The Vehicle Travel Information System (VTRIS) is a repository for reported traffic count data to the Federal Highway Administration (FHWA). The EPA used 2012 VTRIS data to create additional temporal profiles for states that did not submit temporal information in their CDBs or where those profiles did not pass the variance criteria. The VTRIS data were used to create state specific diurnal profiles by HPMS vehicle and road type. The EPA created distinct diurnal profiles for weekdays, Saturday and Sunday along with day of the week profiles[21]. In comparison to the temporal profiles from the 2011 emissions modeling platform, the profiles for the 2014 platform include the same 2012 VTRIS data, but updated data from MOVES CDBs for 2014.

The EPA attempted to maximize the use of state and/or county specific diurnal profiles (either from MOVES or VTRIS). Where there was no MOVES or VTRIS data, then a new default profile would be used (see below for description of new profiles). This analysis was done separately for weekdays and for

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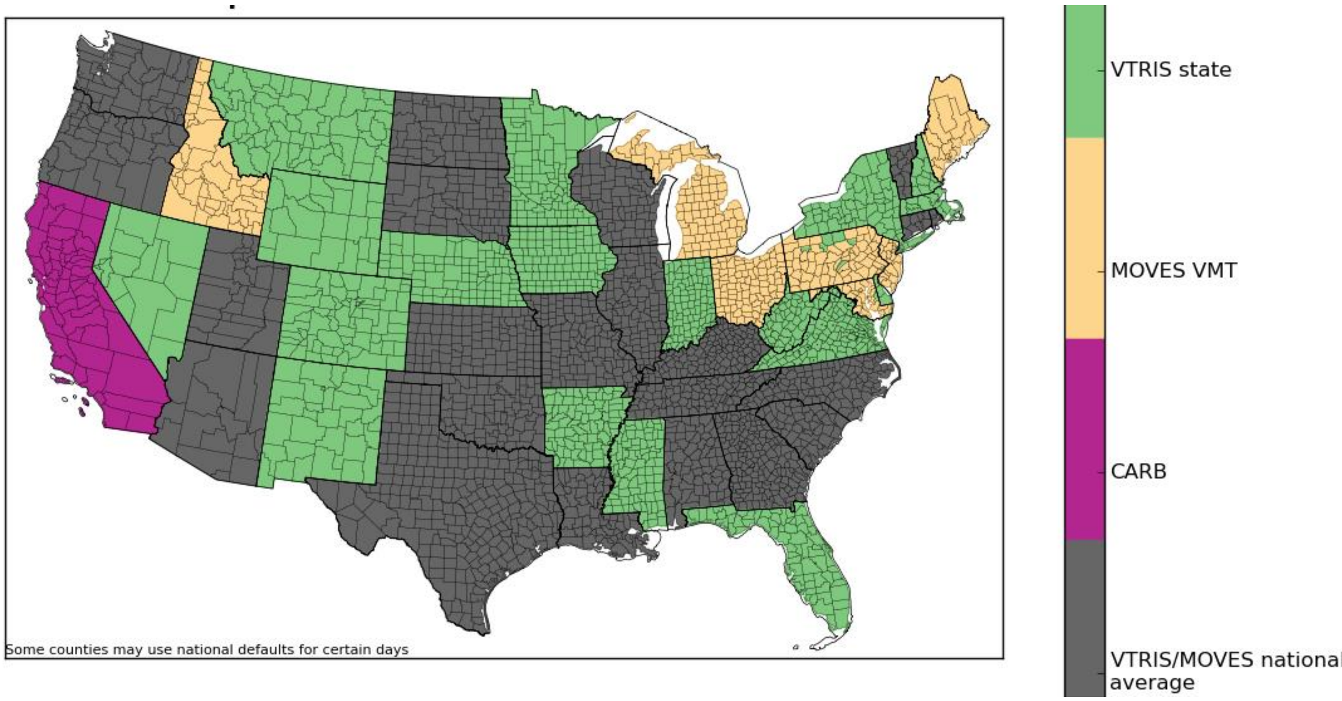
[18] These profiles that were generated from MOVES submittals only, without consideration of VTRIS data, were used for the v6 and v6.1 platforms. See their respective TSDs for more details.
[19] The MOVES tables are the hourvmtfraction and the dayvmtfraction.
[20] Further QA was done to remove duplicates and profiles that were missing two or more hours. If they were missing a single hour, the missing hour could be calculated by subtracting all other hours fractions from 1.
[21] Note, the day of the week profiles (i.e., Monday vs Tuesday vs etc) are only from the VTRIS data. The MOVES CDBs only have weekday versus weekend profiles so they were not included in calculating a new national default day of the week profile.

weekends and, therefore, some areas had submitted profiles for weekdays but defaults for weekends. The result was a set of profiles that varied geographically depending on the source of the profile and the characteristics of the profiles (see Figure 3-19).

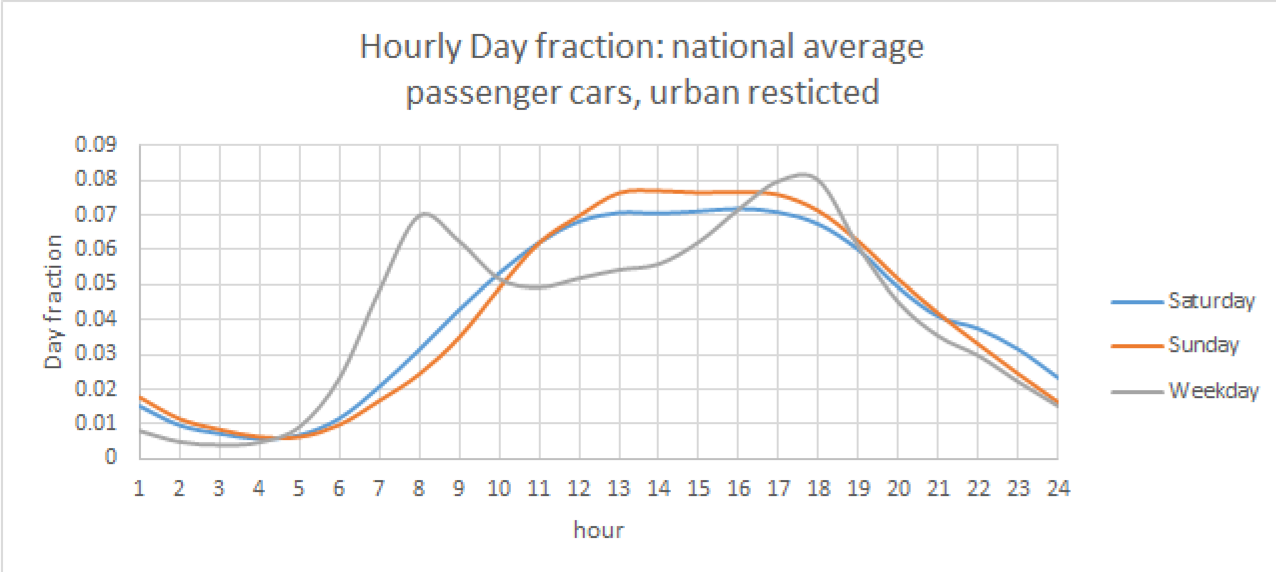
Figure 3-19. Use of submitted versus new national default profiles

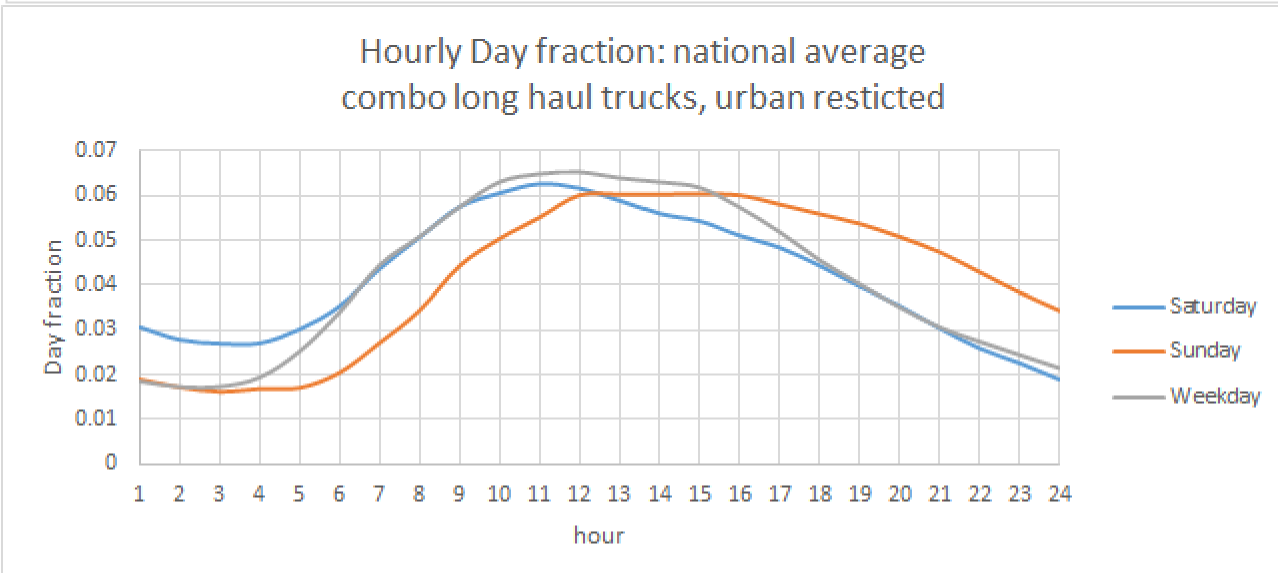


A new set of diurnal profiles was developed for the 2011v6.2 platform from the submitted profiles that varied by both vehicle type and road type. For the purposes of constructing the national default diurnal profiles, the EPA created individual profiles for each state (averaging over the counties within) to create a single profile by state, vehicle type, road type, and the day (i.e., weekday versus Saturday versus Sunday). The source of the underlying profiles was either 2014 MOVES or 2012 VTRIS data (see Figure 3-19). The states' individual profiles were averaged together to create a new default profile[22]. The 2014 platform national default profiles were computed by the same method as the 2011 platform defaults, except that they incorporate 2014 MOVES data instead of 2011 MOVES, resulting in only minor changes to the default profiles compared to the 2011 platform. Figure 3-20 shows two 2014 platform national default profiles for light duty gas vehicles (LDGV, SCC6 220121) and combination long-haul diesel trucks (HHDDV, SCC6 220262) on restricted urban roadways (interstates and freeways).

Figure 3-20. 2014 national default profiles for LDGV vs. HHDDV, urban restricted

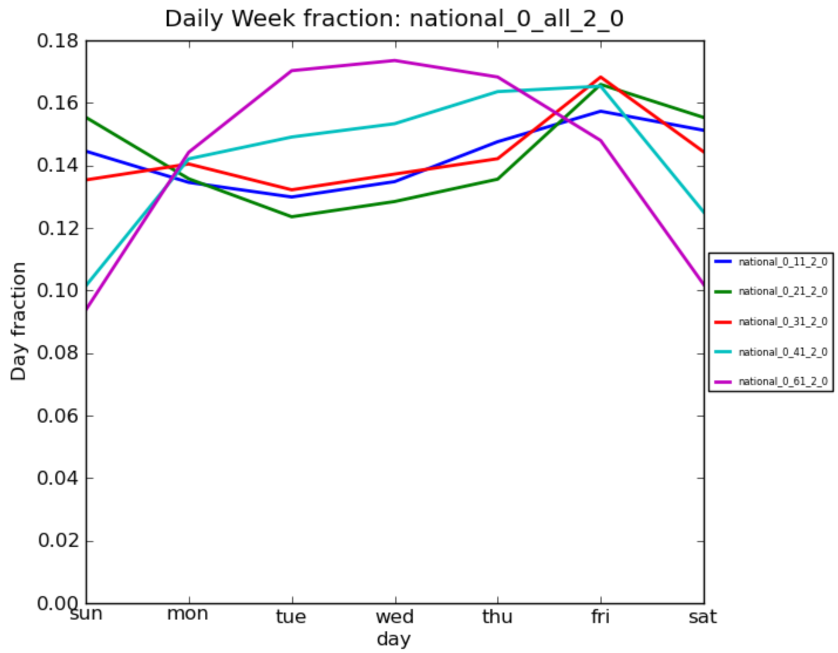
[22] Note that the states were weighted equally in the average independent of the size of the state or the variation in submitted county data.

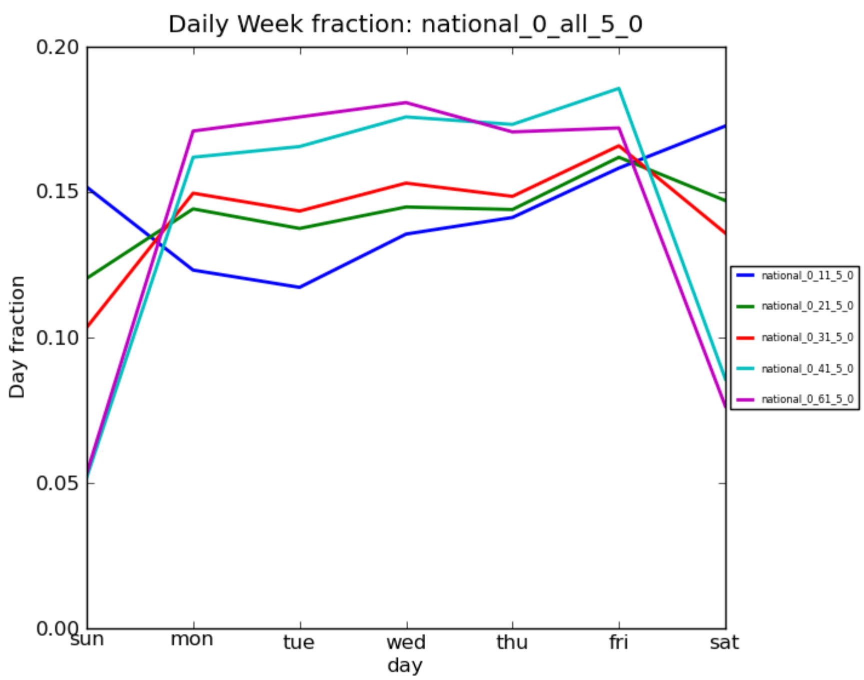




The gray lines of Figure 3-20 indicate the weekday profile, the blue the Saturday profile, and the orange the Sunday profile. In comparison, the new default profiles for weekdays places more LDGV VMT (upper plot) in the rush hours while placing HHDDV VMT (lower plot) predominately in the middle of the day with a longer tail into the evening hours and early morning. In addition to creating diurnal profiles, the EPA developed day of week profiles using the VTRIS data. The creation of the state and national profiles was similar to the diurnal profiles (described above). Figure 3-21 shows a set of national default profiles for rural restricted roads (top plot) and urban unrestricted roads (lower plot). Each vehicle type is a different color on the plots.

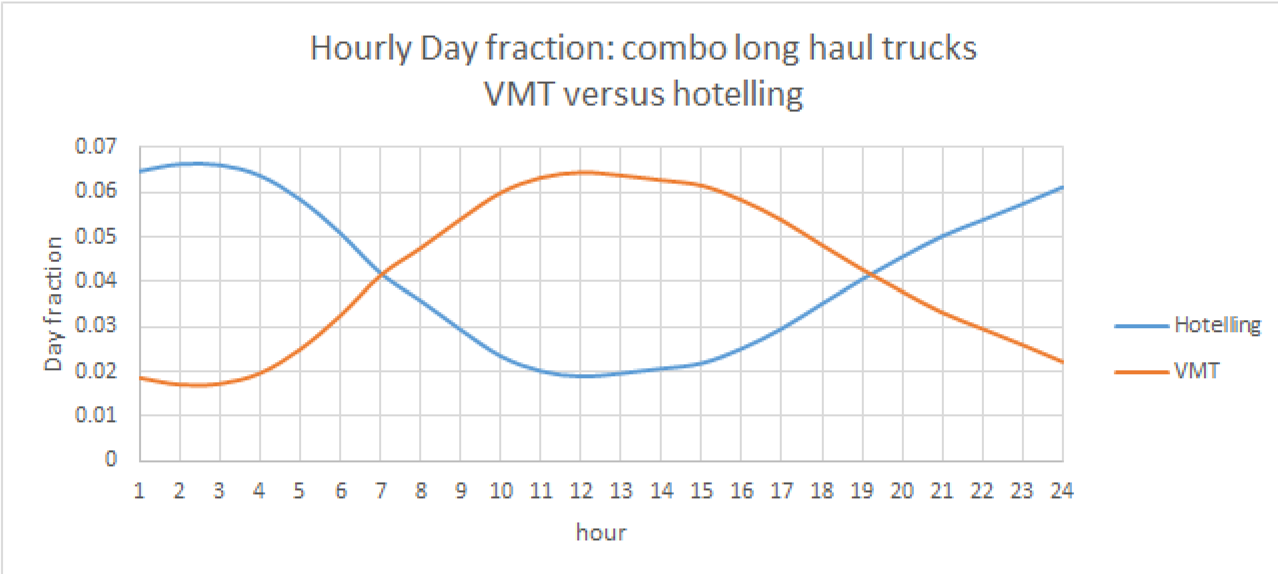
Figure 3-21. Updated national default profiles for day of week





The EPA also developed a national profile for hoteling by averaging all the combination long-haul truck profiles on restricted roads (urban and rural) for weekdays to create a single national restricted profile (orange line in Figure 3-22). This was then inverted to create a profile for hoteling (blue line in Figure 3-22). This single national profile was used for hoteling irrespective of location.

Figure 3-22. Combination long-haul truck restricted and hoteling profile



For California, CARB supplied diurnal profiles that varied by vehicle type, day of the week[23], and air basin. These CARB-specific profiles were used in developing EPA estimates for California. Although the EPA adjusted the total emissions to match California's submittal to the 2014NEIv1, the temporalization of these emissions took into account both the state-specific VMT profiles and the SMOKE-MOVES process of incorporating meteorology. For more details on the adjustments to California's onroad emissions, see Section 2.3.1.

3.3.8 Additional sector specific details (afdust, beis, cmv, rail, nonpt, ptnonipm, ptfire, np_oilgas)

For the afdust sector, meteorology is not used in the development of the temporal profiles, but it is used to reduce the total emissions based on meteorological conditions. These adjustments are applied through sector-specific scripts, beginning with the application of land use-based gridded transport fractions and then subsequent zero-outs for hours during which precipitation occurs or there is snow cover on the ground. The land use data used to reduce the NEI emissions explains the amount of emissions that are subject to transport. This methodology is discussed in (Pouliot et al., 2010, http://www3.epa.gov/ttn/chief/conference/ei19/session9/pouliot_pres.pdf), and in "Fugitive Dust Modeling for the 2008 Emissions Modeling Platform" (Adelman, 2012). The precipitation adjustment is applied to remove all emissions for days where measureable rain occurs. Therefore, the afdust emissions vary day-to-day based on the precipitation and/or snow cover for that grid cell and day. Both the transport fraction and meteorological adjustments are based on the gridded resolution of the platform; therefore, somewhat different emissions will result from different grid resolutions. Application of the transport fraction and meteorological adjustments prevents the overestimation of fugitive dust impacts in the grid modeling as compared to ambient samples.

Biogenic emissions in the beis sector vary by every day of the year because they are developed using meteorological data including temperature, surface pressure, and radiation/cloud data. The emissions are

[23] California's diurnal profiles varied within the week. Monday, Friday, Saturday, and Sunday had unique profiles and Tuesday, Wednesday, Thursday had the same profile.

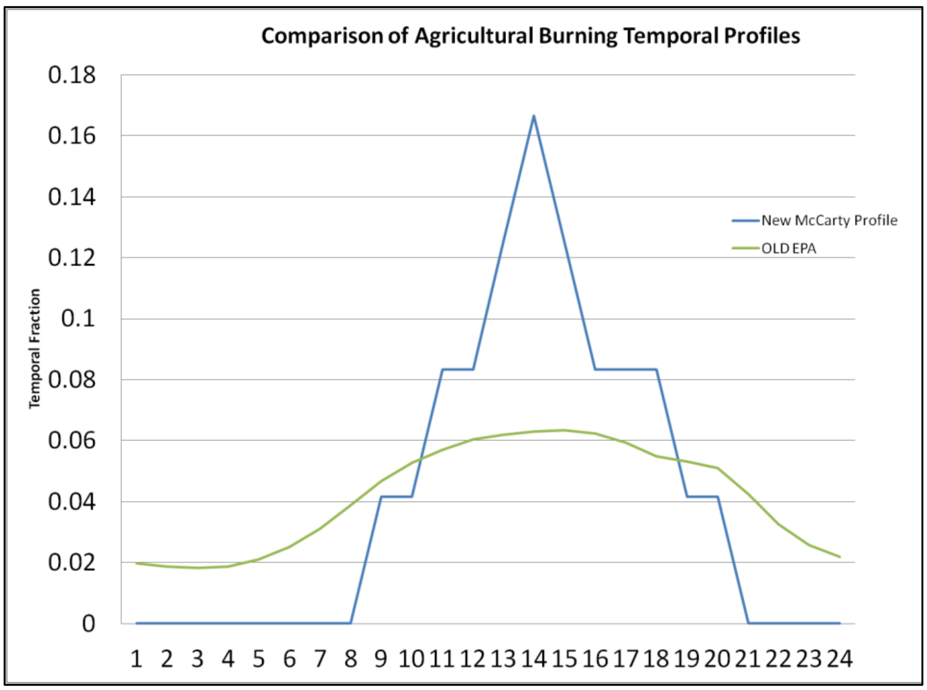
computed using appropriate emission factors according to the vegetation in each model grid cell, while taking the meteorological data into account.

For the cmv sector, emissions are allocated with flat day of week and flat hourly profiles. The C1 and C2 emissions are allocated with a flat monthly profile, while C3 emissions are allocated with a monthly profile developed specifically for C3.

For the rail sector, new monthly profiles were developed for the 2014 platform. Monthly temporalization for rail freight emissions is based on AAR Rail Traffic Data, Total Carloads and Intermodal, for 2014. For passenger trains, monthly temporalization is based on rail passenger miles data for 2014 from the Bureau of Transportation Statistics. Rail emissions are allocated with flat day of week profiles, and most emissions are allocated with flat hourly profiles.

For the agfire sector, we used the EPA-generated day-specific $PM_{2.5}$ emissions to develop state specific monthly profiles. For both agfire and ptagfire, the diurnal temporal profile used reflected the fact that burning occurs during the daylight hours (see Figure 3-23 (McCarty et al., 2009)). This puts most of the emissions during the work day and suppresses the emissions during the middle of the night. A uniform profile for each day of the week was used for all agricultural burning emissions in the agfire sector, except in Iowa, where the EPA used state-specific day of week profiles.

Figure 3-23. Agricultural burning diurnal temporal profile



Updates were made to temporal profiles for the ptnonipm sector in the 2011v6.2 platform based on comments and data review by EPA staff. Temporal profiles for small airports (i.e., non-commercial) were updated to eliminate emissions between 10pm and 6am due to a lack of tower operations. Industrial processes that are not likely to shut down on Sundays, such as those at cement plants, were assigned to other more realistic profiles that included emissions on Sundays. This also affected emissions on holidays because Sunday emissions are also used on holidays.

For the ptfire sectors, the inventories are in the daily point fire format ORL PTDAY. The ptfire sector is used in the model evaluation case (2011ek) and in the future base case (2017ek). The 2007 and earlier platforms had additional regulatory cases that used averaged fires and temporally averaged EGU emissions, but the 2011 platform uses base year-specific (i.e., 2011) data for both cases.

For the nonroad sector, while the NEI only stores the annual totals, the modeling platform uses monthly inventories from output from MOVES. For California, CARB's annual inventory was temporalized to monthly using monthly temporal profiles applied in SMOKE by SCC. This is an improvement over the 2011 platform, which applied monthly temporalization in California at the broader SCC7 level.

Some cross reference updates for temporalization of the np_oilgas sector were made in the 2011v6.2 and 2011v6.3 platform to assign np_oilgas sources to 24 hour per day, 7 days a week based on comments received.

3.4 Spatial Allocation

The methods used to perform spatial allocation are summarized in this section. For the modeling platform, spatial factors are typically applied by county and SCC. As described in Section 3.1, spatial allocation was performed for a national 12-km domain. To accomplish this, SMOKE used national 12-km spatial surrogates and a SMOKE area-to-point data file. For the U.S., the EPA updated surrogates to use circa 2010-2011 data wherever possible. For Mexico, updated spatial surrogates were used as described below. For Canada, surrogates provided by Environment Canada were used and are unchanged from the 2007 platform. The U.S., Mexican, and Canadian 12-km surrogates cover the entire CONUS domain 12US1 shown in Figure 3-1.

With the exception of some updates to the spatial surrogate cross reference, the spatial surrogates for the U.S. and Mexico used in the 2011v6.3 platform are the same as the surrogates used for the 2011v6.2 platform. The details regarding how the 2011v6.2 platform surrogates were created are available from ftp://ftp.epa.gov/EmisInventory/2011v6/v2platform/spatial_surrogates/ in the files *US_SpatialSurrogate_Workbook_v072115.xlsx* and *US_SpatialSurrogate_Documentation_v070115.pdf*, and *SurrogateTools_Scripts_2014.zip* available. The remainder of this subsection provides further detail on the origin of the data used for the spatial surrogates and the area-to-point data.

3.4.1 Spatial Surrogates for U.S. emissions

There are more than 100 spatial surrogates available for spatially allocating U.S. county-level emissions to the 12-km grid cells used by the air quality model. As described in Section 3.4.2, an area-to-point approach overrides the use of surrogates for a limited set of sources. Table 3-18 lists the codes and descriptions of the surrogates. Surrogate names and codes listed in *italics* are not directly assigned to any sources for the 2014v7.0 platform, but they are sometimes used to gapfill other surrogates, or as an input for merging two surrogates to create a new surrogate that is used.

Many surrogates were updated or newly developed for use in the 2014v7.0 platform (Adelman, 2016). They include the use of the 2011 National Land Cover Database (the previous platform used 2006) and development of various development density levels such as open, low, medium high and various combinations of these. These landuse surrogates largely replaced the FEMA category surrogates that were used in the 2011 platform. Additionally, onroad surrogates were developed using average annual daily traffic counts from the highway monitoring performance system (HPMS). Previously, the "activity" for the onroad surrogates was length of road miles. This and other surrogates are described in the reference Adelman, 2016.

Similar to 2011, the Surrogates for ports (801) and shipping lanes (802) were developed based on the shapes in the NEI; however they were updated using 2014NEIv1 shapefiles and activity data. The creation of surrogates and shapefiles for the U.S. was generated via the Surrogate Tool. The tool and documentation for it is available at https://www.cmascenter.org/sa-tools/documentation/4.2/SurrogateToolUserGuide_4_2.pdf.

Table 3-18. U.S. Surrogates available for the 2014 modeling platform

Code	Surrogate Description	Code	Surrogate Description
N/A	Area-to-point approach (see 3.3.1.2)	505	Industrial Land
100	Population	506	Education
110	*Housing*	*507*	*Heavy Light Construction Industrial Land*
131	*urban Housing*	*510*	*Commercial plus Industrial*
132	*Suburban Housing*	*515*	*Commercial plus Institutional Land*
134	*Rural Housing*	*520*	*Commercial plus Industrial plus Institutional*
137	*Housing Change*	*525*	*Golf Courses plus Institutional plus Industrial plus Commercial*
140	*Housing Change and Population*	*526*	*Residential - Non-Institutional*
150	Residential Heating - Natural Gas	*527*	*Single Family Residential*
160	*Residential Heating - Wood*	535	Residential + Commercial + Industrial + Institutional + Government
170	Residential Heating - Distillate Oil	*540*	*Retail Trade (COM1)*
180	Residential Heating - Coal	*545*	*Personal Repair (COM3)*
190	Residential Heating - LP Gas	*555*	*Professional/Technical (COM4) plus General Government (GOV1)*
201	*Urban Restricted Road Miles*	560	Hospital (COM6)
202	Urban Restricted AADT	*575*	*Light and High Tech Industrial (IND2 + IND5)*
205	Extended Idle Locations	*580*	*Food Drug Chemical Industrial (IND3)*
211	*Rural Restricted Road Miles*	*585*	*Metals and Minerals Industrial (IND4)*
212	Rural Restricted AADT	*590*	*Heavy Industrial (IND1)*
221	*Urban Unrestricted Road Miles*	*595*	*Light Industrial (IND2)*
222	Urban Unrestricted AADT	*596*	*Industrial plus Institutional plus Hospitals*
231	*Rural Unrestricted Road Miles*	650	Refineries and Tank Farms
232	Rural Unrestricted AADT	670	Spud Count - CBM Wells
239	Total Road AADT	671	Spud Count - Gas Wells
240	Total Road Miles	672	Gas Production at Oil Wells
241	*Total Restricted Road Miles*	673	Oil Production at CBM Wells
242	All Restricted AADT	674	Unconventional Well Completion Counts
243	*Total Unrestricted Road Miles*	*676*	*Well Count - All Producing*
244	All Unrestricted AADT	*677*	*Well Count - All Exploratory*
258	Intercity Bus Terminals	678	Completions at Gas Wells
259	Transit Bus Terminals	679	Completions at CBM Wells
260	*Total Railroad Miles*	681	Spud Count - Oil Wells
261	NTAD Total Railroad Density	683	Produced Water at All Wells
271	NTAD Class 1 2 3 Railroad Density	685	Completions at Oil Wells
272	*NTAD Amtrak Railroad Density*	*686*	*Completions at All Wells*
273	*NTAD Commuter Railroad Density*	687	Feet Drilled at All Wells
275	*ERTAC Rail Yards*	691	Well Counts - CBM Wells
280	*Class 2 and 3 Railroad Miles*	692	Spud Count - All Wells
300	NLCD Low Intensity Development	693	Well Count - All Wells

Code	Surrogate Description	Code	Surrogate Description
301	*NLCD Med Intensity Development*	694	Oil Production at Oil Wells
302	*NLCD High Intensity Development*	695	Well Count - Oil Wells
303	*NLCD Open Space*	696	Gas Production at Gas Wells
304	NLCD Open + Low	697	Oil Production at Gas Wells
305	NLCD Low + Med	698	Well Count - Gas Wells
306	NLCD Med + High	699	Gas Production at CBM Wells
307	NLCD All Development	*710*	*Airport Points*
308	NLCD Low + Med + High	711	Airport Areas
309	NLCD Open + Low + Med	801	Port Areas
310	NLCD Total Agriculture	*805*	*Offshore Shipping Area*
318	*NLCD Pasture Land*	806	Offshore Shipping NEI2014 Activity
319	NLCD Crop Land	*807*	*Navigable Waterway Miles*
320	NLCD Forest Land	*820*	*Ports NEI2014 Activity*
321	NLCD Recreational Land	850	Golf Courses
340	*NLCD Land*	860	Mines
350	NLCD Water	*890*	*Commercial Timber*
500	*Commercial Land*		

For the onroad sector, the on-network (RPD) emissions were allocated differently from the off-network (RPP and RPV). On-network used average annual daily traffic (AADT) data and off network used land use surrogates as shown in **Table 3-19**. Starting with the 2011v6.2 platform, emissions from the extended (i.e., overnight) idling of trucks were assigned to a new surrogate 205 that is based on locations of overnight truck parking spaces. The underlying data in this surrogate was updated for use in the 2014v7.0 platform to include additional data sources and corrections based on comments received on the 2011 NATA.

Table 3-19. Off-Network Mobile Source Surrogates

Source type	Source Type name	**Surrogate ID**	**Description**
11	Motorcycle	307	NLCD All Development
21	Passenger Car	307	NLCD All Development
31	Passenger Truck	307	NLCD All Development
32	Light Commercial Truck	308	NLCD Low + Med + High
41	Intercity Bus	258	Intercity Bus Terminals
42	Transit Bus	259	Transit Bus Terminals
43	School Bus	506	Education
51	Refuse Truck	306	NLCD Med + High
52	Single Unit Short-haul Truck	306	NLCD Med + High
53	Single Unit Long-haul Truck	306	NLCD Med + High
54	Motor Home	304	NLCD Open + Low
61	Combination Short-haul Truck	306	NLCD Med + High
62	Combination Long-haul Truck	306	NLCD Med + High

For the oil and gas sources in the np_oilgas sector, the spatial surrogates were updated to those shown in Table 3-20 using 2014 data consistent with what was used to develop the 2014NEI nonpoint oil and gas emissions. The primary activity data source used for the development of the oil and gas spatial surrogates was data from Drilling Info (DI) Desktop’s HPDI database (Drilling Info, 2015). This database contains well-level location, production, and exploration statistics at the monthly level. Due to a proprietary agreement with DI Desktop, individual well locations and ancillary production cannot be made publicly available, but aggregated statistics are allowed. These data were supplemented with data from state Oil and Gas Commission (OGC) websites (Illinois, Idaho, Indiana, Kentucky, Missouri, Nevada, Oregon and Pennsylvania, Tennessee). In many cases, the correct surrogate parameter was not available (e.g., feet drilled), but an alternative surrogate parameter was available (e.g., number of spudded wells) and downloaded. Under that methodology, both completion date and date of first production from HPDI were used to identify wells completed during 2011. In total, over 1.43 million unique wells were compiled from the above data sources. The wells cover 34 states and 1,158 counties. (ERG, 2016b).

Table 3-20. Spatial Surrogates for Oil and Gas Sources

Surrogate Code	Surrogate Description
670	Spud Count - CBM Wells
671	Spud Count - Gas Wells
672	Gas Production at Oil Wells
673	Oil Production at CBM Wells
674	Unconventional Well Completion Counts
676	Well Count - All Producing
677	Well Count - All Exploratory
678	Completions at Gas Wells
679	Completions at CBM Wells
681	Spud Count - Oil Wells
683	Produced Water at All Wells
685	Completions at Oil Wells
686	Completions at All Wells
687	Feet Drilled at All Wells
691	Well Counts - CBM Wells
692	Spud Count - All Wells
693	Well Count - All Wells
694	Oil Production at Oil Wells
695	Well Count - Oil Wells
696	Gas Production at Gas Wells
697	Oil Production at Gas Wells
698	Well Count - Gas Wells
699	Gas Production at CBM Wells

Not all of the available surrogates are used to spatially allocate sources in the modeling platform; that is, some surrogates shown in Table 3-18 were not assigned to any SCCs, although many of the "unused" surrogates are actually used to "gap fill" other surrogates that are used. When the source data for a surrogate has no values for a particular county, gap filling is used to provide values for the surrogate in those counties to ensure that no emissions are dropped when the spatial surrogates are applied to the emission inventories. Table 3-22 shows the CAP emissions (i.e., NH_3, NOx, $PM_{2.5}$, SO_2, and VOC) by sector, with rows for each sector listed in order of most emissions to least CAP emissions. To look at the relative importance of the surrogates within the platform sectors for HAPs, we computed the toxicity-weighted emissions for the CMAQ HAPs for the surrogates used in CMAQ (i.e., based on the SCC-to-surrogate assignments for CMAQ); these are shown Table 3-22.

Table 3-21. Selected 2014 CAP emissions by sector for U.S. Surrogates (CONUS domain totals)

Sector	ID	Description	NH3	NOX	PM2_5	SO2	VOC
afdust	240	Total Road Miles			253,093		
afdust	304	NLCD Open + Low			1,116,883		
afdust	306	NLCD Med + High			45,958		
afdust	308	NLCD Low + Med + High			139,554		
afdust	310	NLCD Total Agriculture			1,169,400		
ag	310	NLCD Total Agriculture	3,135,285				
agfire	310	NLCD Total Agriculture	51,422	10,807	28,598	3,627	20,194
agfire	319	NLCD Crop Land	273	224	234	28	229
agfire	320	NLCD Forest Land	7	30	94	12	105
cmv	801	Port Areas	24	48,600	1,745	13,428	1,971
cmv	806	Offshore Shipping NEI2014 Activity	285	553,705	16,145	30,848	12,719
nonpt	100	Population	32,222	0	0	0	1,137,409
nonpt	150	Residential Heating - Natural Gas	47,296	219,671	3,593	1,445	13,311
nonpt	170	Residential Heating - Distillate Oil	1,726	34,923	3,680	64,628	1,153
nonpt	180	Residential Heating - Coal	20	101	53	1,086	111
nonpt	190	Residential Heating - LP Gas	121	34,025	175	675	1,321
nonpt	239	Total Road AADT	0	25	552	0	276,354
nonpt	240	Total Road Miles	0	0	0	0	36,941
nonpt	242	All Restricted AADT	0	0	0	0	5,451
nonpt	244	All Unrestricted AADT	0	0	0	0	95,327
nonpt	271	NTAD Class 1 2 3 Railroad Density	0	0	0	0	2,252
nonpt	300	NLCD Low Intensity Development	5,183	24,399	107,748	2,982	76,167
nonpt	304	NLCD Open + Low	0	0	0	0	0
nonpt	306	NLCD Med + High	22,268	239,863	290,187	181,982	864,662
nonpt	307	NLCD All Development	24	53,320	144,940	16,485	611,569
nonpt	308	NLCD Low + Med + High	1,205	187,485	17,977	31,506	72,126
nonpt	310	NLCD Total Agriculture	0	0	37	0	242,713
nonpt	319	NLCD Crop Land	0	0	95	71	293
nonpt	320	NLCD Forest Land	3,984	13	54	0	61
nonpt	505	Industrial Land	0	0	0	0	174
nonpt	535	Residential + Commercial + Industrial + Institutional + Government	0	2	130	0	39
nonpt	560	Hospital (COM6)	0	0	0	0	0
nonpt	650	Refineries and Tank Farms	0	22	0	0	101,206
nonpt	711	Airport Areas	0	0	0	0	277
nonpt	801	Port Areas	0	0	0	0	7,862
nonroad	261	NTAD Total Railroad Density	3	2,593	273	4	503

Sector	ID	Description	NH3	NOX	PM2_5	SO2	VOC
nonroad	304	NLCD Open + Low	4	2,205	191	6	3,245
nonroad	305	NLCD Low + Med	110	23,017	4,557	146	149,863
nonroad	306	NLCD Med + High	345	243,170	15,750	526	126,354
nonroad	307	NLCD All Development	101	36,090	15,361	132	169,762
nonroad	308	NLCD Low + Med + High	673	458,488	38,060	886	69,386
nonroad	309	NLCD Open + Low + Med	111	22,350	1,257	148	44,500
nonroad	310	NLCD Total Agriculture	479	419,553	31,921	667	48,098
nonroad	320	NLCD Forest Land	19	8,900	1,377	25	8,628
nonroad	321	NLCD Recreational Land	157	20,841	15,119	229	553,747
nonroad	350	NLCD Water	215	144,088	8,855	361	448,425
nonroad	693	Well Count - All Wells	10	5,845	229	12	1,566
nonroad	850	Golf Courses	13	2,176	115	17	5,668
nonroad	860	Mines	2	2,760	298	4	549
np_oilgas	670	Spud Count - CBM Wells	0	0	0	0	267
np_oilgas	671	Spud Count - Gas Wells	0	0	0	0	10,989
np_oilgas	672	Gas Production at Oil Wells	0	2,863	0	21,709	127,494
np_oilgas	673	Oil Production at CBM Wells	0	35	0	0	1,795
np_oilgas	674	Unconventional Well Completion Counts	0	47,606	1,823	47	3,150
np_oilgas	678	Completions at Gas Wells	0	3,735	26	6,328	74,408
np_oilgas	679	Completions at CBM Wells	0	16	0	601	2,155
np_oilgas	681	Spud Count - Oil Wells	0	0	0	0	66,565
np_oilgas	683	Produced Water at All Wells	0	10	0	0	67,101
np_oilgas	685	Completions at Oil Wells	0	3,107	130	2,181	50,785
np_oilgas	687	Feet Drilled at All Wells	0	109,487	4,004	628	8,130
np_oilgas	691	Well Counts - CBM Wells	0	38,117	603	15	34,187
np_oilgas	692	Spud Count - All Wells	0	8,628	258	135	366
np_oilgas	693	Well Count - All Wells	0	0	0	0	166
np_oilgas	694	Oil Production at Oil Wells	0	4,375	0	5,468	1,104,120
np_oilgas	695	Well Count - Oil Wells	0	122,856	3,091	63	455,552
np_oilgas	696	Gas Production at Gas Wells	0	59,634	3,131	251	112,335
np_oilgas	697	Oil Production at Gas Wells	0	1,360	0	26	354,406
np_oilgas	698	Well Count - Gas Wells	15	388,677	6,726	310	623,925
np_oilgas	699	Gas Production at CBM Wells	0	3,094	403	32	6,578
onroad	202	Urban Restricted AADT	24,687	790,075	30,439	5,846	149,645
onroad	205	Extended Idle Locations	748	273,106	4,425	104	56,079
onroad	212	Rural Restricted AADT	10,867	684,006	20,322	2,853	77,075
onroad	222	Urban Unrestricted AADT	42,001	1,223,593	54,345	11,950	376,209
onroad	232	Rural Unrestricted AADT	25,027	987,683	33,882	6,434	201,764
onroad	239	Total Road AADT					6,573
onroad	242	All Restricted AADT					315
onroad	258	Intercity Bus Terminals		165	2	0	38
onroad	259	Transit Bus Terminals		58	5	0	171
onroad	304	NLCD Open + Low		821	22	1	2,683

Sector	ID	Description	NH3	NOX	PM2_5	SO2	VOC
onroad	306	NLCD Med + High		18,500	384	20	22,396
onroad	307	NLCD All Development		560,112	12,560	1,001	1,142,592
onroad	308	NLCD Low + Med + High		83,977	1,583	113	133,883
onroad	506	Education		664	29	1	1,107
rail	261	NTAD Total Railroad Density	2	12,494	297	282	736
rail	271	NTAD Class 1 2 3 Railroad Density	362	767,307	22,868	6,704	39,121
rwc	300	NLCD Low Intensity Development	16,221	32,174	332,700	8,087	351,696

Table 3-22. Total and Toxicity-weighted Emissions of CMAQ HAPs Based on the CMAQ Surrogate Assignments

Surrogate Code	Surrogate Description	Total CMAQ Emissions (HAP and Diesel PM): Fraction of Sector and Total									Cancer-weighted CMAQ Emissions: Fraction of Sector and Total									Respiratory-weighted CMAQ Emissions: Fraction of Sector and Total								
		agfire	cmv	nonpt	nonroad	np_oilgas	onroad	rail	rwc	Total (TPY)	agfire	cmv	nonpt	nonroad	np_oilgas	onroad	rail	rwc	Total (TPY)	agfire	cmv	nonpt	nonroad	np_oilgas	onroad	rail	rwc	Total (TPY)
100	Population			1.00						175,749			1.00						142,136			1.00						10,617
150	Residential Heating - Natural Gas			1.00						813			1.00						2,021			1.00						845
170	Residential Heating - Distillate Oil			1.00						82			1.00						3,838			1.00						185
180	Residential Heating - Coal			1.00						13			1.00						9			1.00						3
190	Residential Heating - LP Gas			1.00						45			1.00						204			1.00						38
202	Urban Restricted AADT						1.00			59,103						1.00			47,686						1.00			55,572
205	Extended Idle Locations						1.00			18,087						1.00			44,128						1.00			80,817
212	Rural Restricted AADT						1.00			36,468						1.00			25,869						1.00			41,375
222	Urban Unrestricted AADT						1.00			132,474						1.00			98,825						1.00			103,245
232	Rural Unrestricted AADT						1.00			78,599						1.00			57,406						1.00			73,498
239	Total Road AADT			0.89			0.11			17,406			0.94			0.06			2,570			1.00			0.00			2,173
240	Total Road Miles			1.00						2,816			1.00						1			1.00						0
242	All Restricted AADT			0.94			0.06			274			0.95			0.05			92			1.00			0.00			0
244	All Unrestricted AADT			1.00						3,910			1.00						783			1.00						0
258	Intercity Bus Terminals						1.00			11						1.00			29						1.00			53
259	Transit Bus Terminals						1.00			47						1.00			89						1.00			132
261	NTAD Total Railroad Density				0.61			0.39		813				1.00			0.00		587				0.89			0.11		2,144
271	NTAD Class 1 2 3 Railroad Density			0.00				1.00		28,020			0.00				1.00		10,818			0.00				1.00		35,854
300	NLCD Low Intensity Development			0.31					0.69	77,479			0.13					0.87	291,399			0.19					0.81	194,627
304	NLCD Open + Low			0.00	0.61		0.39			1,843			0.00	0.74		0.26			1,453			0.00	0.89		0.11			1,945
305	NLCD Low + Med				1.00					43,820				1.00					32,065				1.00					7,499
306	NLCD Med + High			0.59	0.36		0.05			133,824			0.53	0.42		0.05			135,209			0.09	0.83		0.08			95,250
307	NLCD All Development			0.08	0.14		0.78			404,405			0.20	0.11		0.68			360,756			0.23	0.12		0.65			204,290
308	NLCD Low + Med + High			0.05	0.61		0.34			109,665			0.05	0.66		0.29			113,067			0.00	0.90		0.09			211,239
309	NLCD Open + Low + Med				1.00					14,387				1.00					15,410				1.00					4,941
310	NLCD Total Agriculture	0.24		0.03	0.73					72,364	0.49		0.03	0.48					118,012	0.56		0.05	0.39					410,821
319	NLCD Crop Land	0.91		0.09						259	0.41		0.59						2,077	1.00		0.00						1,912
320	NLCD Forest Land	0.02		0.00	0.98					3,623	0.09		0.00	0.91					3,312	0.22		0.00	0.78					3,983
321	NLCD Recreational Land				1.00					182,261				1.00					89,067				1.00					40,247
350	NLCD Water				1.00					139,898				1.00					84,122				1.00					44,840
505	Industrial Land									0									0									0
506	Education						1.00			302						1.00			443						1.00			607

Surrogate Code	Surrogate Description	Total CMAQ Emissions (HAP and Diesel PM): Fraction of Sector and Total									Cancer-weighted CMAQ Emissions: Fraction of Sector and Total									Respiratory-weighted CMAQ Emissions: Fraction of Sector and Total								
		agfire	cmv	nonpt	nonroad	np_oilgas	onroad	rail	rwc	Total (TPY)	agfire	cmv	nonpt	nonroad	np_oilgas	onroad	rail	rwc	Total (TPY)	agfire	cmv	nonpt	nonroad	np_oilgas	onroad	rail	rwc	Total (TPY)
535	Residential + Commercial + Industrial + Institutional + Government									0									0									0
560	Hospital (COM6)									0									0									0
650	Refineries and Tank Farms			1.00						4,337			1.00						1,315			1.00						0
670	Spud Count - CBM Wells					1.00				1					1.00				1									0
671	Spud Count - Gas Wells					1.00				31					1.00				34									0
672	Gas Production at Oil Wells					1.00				321					1.00				1,005					1.00				64
673	Oil Production at CBM Wells					1.00				37					1.00				103					1.00				7
674	Unconventional Well Completion Counts					1.00				642					1.00				1,639					1.00				202
678	Completions at Gas Wells					1.00				458					1.00				1,460					1.00				99
679	Completions at CBM Wells					1.00				18					1.00				52					1.00				3
681	Spud Count - Oil Wells					1.00				182					1.00				270									0
683	Produced Water at All Wells					1.00				192					1.00				291									0
685	Completions at Oil Wells					1.00				532					1.00				1,878					1.00				130
687	Feet Drilled at All Wells					1.00				1,727					1.00				4,691					1.00				2,223
691	Well Counts - CBM Wells					1.00				1,315					1.00				3,949					1.00				13,587
692	Spud Count - All Wells					1.00				9					1.00				21					1.00				1
693	Well Count - All Wells				1.00	0.00				681				1.00	0.00				1,057				1.00	0.00				1,158
694	Oil Production at Oil Wells					1.00				17,393					1.00				29,554					1.00				507
695	Well Count - Oil Wells					1.00				8,548					1.00				24,933					1.00				84,624
696	Gas Production at Gas Wells					1.00				48,651					1.00				43,667					1.00				2,452
697	Oil Production at Gas Wells					1.00				5,897					1.00				12,806					1.00				770
698	Well Count - Gas Wells					1.00				15,815					1.00				36,698					1.00				115,595
699	Gas Production at CBM Wells					1.00				2,441					1.00				1,806					1.00				170
711	Airport Areas			1.00						12			1.00						9			1.00						0
801	Port Areas		1.00	0.00						2,195		1.00	0.00						4,831		1.00	0.00						2,332
806	Offshore Shipping NEI2014 Activity		1.00							18,486		1.00							13,272		1.00							16,553
850	Golf Courses				1.00					1,816				1.00					1,884				1.00					398
860	Mines				1.00					573				1.00					787				1.00					2,610

3.4.2 Allocation method for airport-related sources in the U.S.

There are numerous airport-related emission sources in the NEI, such as aircraft, airport ground support equipment, and jet refueling. The modeling platform includes the aircraft and airport ground support equipment emissions as point sources. For the modeling platform, the EPA used the SMOKE “area-to-point” approach for only jet refueling in the nonpt sector. The following SCCs use this approach: 2501080050 and 2501080100 (petroleum storage at airports), and 2810040000 (aircraft/rocket engine firing and testing). The ARTOPNT approach is described in detail in the 2002 platform documentation: http://www3.epa.gov/scram001/reports/Emissions%20TSD%20Vol1_02-28-08.pdf. The ARTOPNT file that lists the nonpoint sources to locate using point data were unchanged from the 2005-based platform.

3.4.3 Surrogates for Canada and Mexico emission inventories

The surrogates for Canada to spatially allocate the 2010 Canadian emissions have been updated in the 2011v6.2 platform. The spatial surrogate data came from Environment Canada, along with cross references. The surrogates they provided were outputs from the Surrogate Tool (previously referenced). The Canadian surrogates used for this platform are listed in Table 3-23. The leading “9” was added to the surrogate codes to avoid duplicate surrogate numbers with U.S. surrogates. Surrogates for Mexico are circa 1999 and 2000 and were based on data obtained from the Sistema Municpal de Bases de Datos (SIMBAD) de INEGI and the Bases de datos del Censo Economico 1999. Most of the CAPs allocated to the Mexico and Canada surrogates are shown in Table 3-24. The entries in this table are for the othar sector except for the “MEX Total Road Miles” and the “CAN traffic” rows, which are for the othon sector.

Table 3-23. Canadian Spatial Surrogates

Code	Canadian Surrogate Description	Code	Description
9100	Population	92424	BARLEY
9101	total dwelling	92425	BUCWHT
9103	rural dwelling	92426	CANARY
9106	ALL_INDUST	92427	CANOLA
9111	Farms	92428	CHICPEA
9113	Forestry and logging	92429	CORNGR
9211	Oil and Gas Extraction	92425	BUCWHT
9212	Mining except oil and gas	92430	CORNSI
9221	Total Mining	92431	DFPEAS
9222	Utilities	92432	FLAXSD
9233	Total Land Development	92433	FORAGE
9308	Food manufacturing	92434	LENTIL
9321	Wood product manufacturing	92435	MUSTSD
9323	Printing and related support activities	92436	MXDGRN
9324	Petroleum and coal products manufacturing	92437	OATS
9327	Non-metallic mineral product manufacturing	92438	ODFBNS
9331	Primary Metal Manufacturing	92439	OTTAME
9412	Petroleum product wholesaler-distributors	92440	POTATS
9416	Building material and supplies wholesaler-distributors	92441	RYEFAL

Code	Canadian Surrogate Description	Code	Description
9447	Gasoline stations	92442	RYESPG
9448	clothing and clothing accessories stores	92443	SOYBNS
9481	Air transportation	92444	SUGARB
9482	Rail transportation	92445	SUNFLS
9562	Waste management and remediation services	92446	TOBACO
9921	Commercial Fuel Combustion	92447	TRITCL
9924	Primary Industry	92448	WHITBN
9925	Manufacturing and Assembly	92449	WHTDUR
9932	CANRAIL	92450	WHTSPG
9941	PAVED ROADS	92451	WHTWIN
9942	UNPAVED ROADS	92452	BEANS
9945	Commercial Marine Vessels	92453	CARROT
9946	Construction and mining	92454	GRPEAS
9948	Forest	92455	OTHVEG
9950	Combination of Forest and Dwelling	92456	SWCORN
9955	UNPAVED_ROADS_AND_TRAILS	92457	TOMATO
9960	TOTBEEF	92430	CORNSI
9970	TOTPOUL	92431	DFPEAS
9980	TOTSWIN	92432	FLAXSD
9990	TOTFERT	92433	FORAGE
9996	urban_area	92434	LENTIL
9997	CHBOISQC	92435	MUSTSD
91201	traffic_bcw	92436	MXDGRN
92401	BULLS	92437	OATS
92402	BFCOWS	92438	ODFBNS
92403	BFHEIF	92439	OTTAME
92404	CALFU1	92440	POTATS
92405	FDHEIF	92441	RYEFAL
92406	STEERS	92442	RYESPG
92407	MLKCOW	92443	SOYBNS
92408	MLKHEIF	92444	SUGARB
92409	MBULLS	92445	SUNFLS
92410	MCALFU1	92446	TOBACO
92412	BROILER	92447	TRITCL
92413	LAYHEN	92448	WHITBN
92414	TURKEY	92449	WHTDUR
92416	BOARS	92450	WHTSPG
92417	GRWPIG	92451	WHTWIN
92418	NURPIG	92452	BEANS
92419	SOWS	92453	CARROT
92421	IMPAST	92454	GRPEAS
92422	UNIMPAST	92455	OTHVEG
92423	ALFALFA	92456	SWCORN
		92457	TOMATO

Table 3-24. CAPs Allocated to Mexican and Canadian Spatial Surrogates

Code	Mexican or Canadian Surrogate Description	NH_3	NO_X	PM_{2_5}	SO_2	VOC
10	MEX Population	0	190	5	1	382
12	MEX Housing	22,251	100,483	3,592	404	124,046
14	MEX Residential Heating – Wood	0	1,047	13,415	161	92,226
16	MEX Residential Heating - Distillate Oil	0	11	0	3	0
20	MEX Residential Heating - LP Gas	0	5,043	153	0	87
22	MEX Total Road Miles	2,324	314,011	8,477	4,788	65,593
24	MEX Total Railroads Miles	0	18,474	413	162	721
26	MEX Total Agriculture	151,745	106,403	22,474	5,170	8,474
32	MEX Commercial Land	0	65	1,405	0	18,989
34	MEX Industrial Land	4	1,003	1,726	0	103,122
36	MEX Commercial plus Industrial Land	0	1,782	26	4	87,825
38	MEX Commercial plus Institutional Land	3	1,611	77	4	51
40	MEX Residential (RES1-4)+Comercial+Industrial+Institutional+Government	0	4	9	0	66,174
42	MEX Personal Repair (COM3)	0	0	0	0	4,833
44	MEX Airports Area	0	2,489	67	316	793
50	MEX Mobile sources - Border Crossing - Mexico	4	130	1	2	241
9100	CAN Population	583	19	607	11	243
9101	CAN total dwelling	266	26,532	6,819	4,937	17,532
9103	CAN rural dwelling	2	340	71	2	2,004
9106	CAN ALL_INDUST	5	5,895	257	6	1,219
9111	CAN Farms	31	23,269	1,890	29	2,799
9113	CAN Forestry and logging	576	5,242	268	630	15,295
9211	CAN Oil and Gas Extraction	1	1,275	72	1	132
9212	CAN Mining except oil and gas	0	0	2,074	0	0
9221	CAN Total Mining	39	9,808	41,214	1,212	940
9222	CAN Utilities	60	3,831	305	652	164
9233	CAN Total Land Development	16	10,779	1,134	14	1,788
9308	CAN Food manufacturing	0	0	4,324	0	7,548
9321	CAN Wood product manufacturing	0	0	537	0	0
9323	CAN Printing and related support activities	0	0	0	0	33,802
9324	CAN Petroleum and coal products manufacturing	0	784	835	410	2,751
9327	CAN Non-metallic mineral product manufacturing	0	0	4,362	0	0
9331	CAN Primary Metal Manufacturing	0	142	5,279	46	17
9412	CAN Petroleum product wholesaler-distributors	0	0	0	0	44,247
9448	CAN clothing and clothing accessories stores	0	0	0	0	132
9481	CAN Air transportation	5	7,692	130	787	6,112
9482	CAN Rail transportation	3	4,247	94	136	94
9562	CAN Waste management and remediation services	1,111	1,497	1,837	2,183	13,868
9921	CAN Commercial Fuel Combustion	478	123,718	10,306	29,081	70,997
9924	CAN Primary Industry	0	0	0	0	220,319
9925	CAN Manufacturing and Assembly	0	0	0	0	71,914
9932	CAN CANRAIL	67	62,928	2,373	1,431	1,846

Code	Mexican or Canadian Surrogate Description	NH_3	NO_X	PM_{2_5}	SO_2	VOC
9941	CAN PAVED ROADS	2	1,069	158,390	2	2,065
9942	CAN UNPAVED ROADS	23	4,557	1,201	28	51,436
9945	CAN Commercial Marine Vessels	30	40,951	3,337	27,661	4,641
9946	CAN Construction and mining	0	2	9	0	75
9950	CAN Combination of Forest and Dwelling	267	2,899	31,312	424	44,340
9955	CAN UNPAVED_ROADS_AND_TRAILS	0	0	242,537	0	0
9990	CAN TOTFERT	0	0	29,267	0	159,859
9996	CAN urban_area	0	0	618	0	0
9997	CAN CHBOISQC	442	4,912	48,653	702	71,051
91201	CAN traffic_bcw	15,579	285,138	10,197	1,776	144,243
92401	CAN BULLS	4,394	0	0	0	0
92402	CAN BFCOWS	46,101	0	0	0	0
92403	CAN BFHEIF	7,398	0	0	0	0
92404	CAN CALFU1	17,987	0	0	0	0
92406	CAN STEERS	24,551	0	0	0	0
92407	CAN MLKCOW	37,604	0	0	0	0
92408	CAN MLKHEIF	2,617	0	0	0	0
92409	CAN MBULLS	35	0	0	0	0
92410	CAN MCALFU1	11,988	0	0	0	0
92412	CAN BROILER	7,049	0	0	0	0
92413	CAN LAYHEN	8,044	0	0	0	0
92414	CAN TURKEY	3,220	0	0	0	0
92416	CAN BOARS	139	0	0	0	0
92417	CAN GRWPIG	51,078	0	0	0	0
92418	CAN NURPIG	13,047	0	0	0	0
92419	CAN SOWS	5,376	0	0	0	0
92421	CAN IMPAST	1,949	0	0	0	0
92422	CAN UNIMPAST	2,081	0	0	0	0
92423	CAN ALFALFA	1,622	0	0	0	0
92424	CAN BARLEY	7,576	0	0	0	0
92425	CAN BUCWHT	21	0	0	0	0
92426	CAN CANARY	282	0	0	0	0
92427	CAN CANOLA	7,280	0	0	0	0
92428	CAN CHICPEA	449	0	0	0	0
92429	CAN CORNGR	15,655	0	0	0	0
92430	CAN CORNSI	2,328	0	0	0	0
92431	CAN DFPEAS	703	0	0	0	0
92432	CAN FLAXSD	1,667	0	0	0	0
92433	CAN FORAGE	526	0	0	0	0
92434	CAN LENTIL	547	0	0	0	0
92435	CAN MUSTSD	722	0	0	0	0
92436	CAN MXDGRN	658	0	0	0	0
92437	CAN OATS	4,452	0	0	0	0
92438	CAN ODFBNS	254	0	0	0	0
92439	CAN OTTAME	5,985	0	0	0	0

Code	Mexican or Canadian Surrogate Description	NH_3	NO_X	PM_{2_5}	SO_2	VOC
92440	CAN POTATS	1,268	0	0	0	0
92441	CAN RYEFAL	153	0	0	0	0
92442	CAN RYESPG	7	0	0	0	0
92443	CAN SOYBNS	1,775	0	0	0	0
92444	CAN SUGARB	30	0	0	0	0
92445	CAN SUNFLS	383	0	0	0	0
92446	CAN TOBACO	72	0	0	0	0
92447	CAN TRITCL	73	0	0	0	0
92448	CAN WHITBN	288	0	0	0	0
92449	CAN WHTDUR	5,524	0	0	0	0
92450	CAN WHTSPG	13,929	0	0	0	0
92451	CAN WHTWIN	2,785	0	0	0	0
92452	CAN BEANS	109	0	0	0	0
92453	CAN CARROT	73	0	0	0	0
92454	CAN GRPEAS	113	0	0	0	0
92455	CAN OTHVEG	294	0	0	0	0
92456	CAN SWCORN	297	0	0	0	0
92457	CAN TOMATO	98	0	0	0	0

4 Emission Summaries

The following tables summarize emissions for the 2014v7.0 platform. These summaries are provided at the national level by sector for the contiguous U.S. and for the portions of Canada and Mexico inside the smaller 12km domain (12US2) discussed in Section 3.1. The afdust sector emissions represent the summaries *after* application of both the land use (transport fraction) and meteorological adjustments (see Section 2.2.1); therefore, this sector is called "afdust_adj" in these summaries. The onroad sector totals are post-SMOKE-MOVES totals, representing air quality model-ready emission totals, and include CARB emissions for California (except HAPs were adjusted as discussed in 2.3.1). The cmv sector includes U.S. emissions within state waters only; these extend to roughly 3-5 miles offshore and includes CMV emissions at U.S. ports. "Offshore to EEZ" represents CMV emissions that are within the (up to) 200 nautical mile Exclusive Economic Zone (EEZ) boundary but are outside of U.S. state waters along with the offshore oil platform emissions from the NEI. Finally, the "Non-US SECA C3" represents all non-U.S. and non-Canada emissions outside of the (up to) 200nm offshore boundary, including all Mexican CMV emissions. Canadian CMV emissions are included in the othar sector.

National emission totals by air quality model-ready sector are provided for all CAP emissions in Table 4-1. The total of all sectors is listed as "Con U.S. Total." **Error! Reference source not found.**

Error! Reference source not found. provides summaries of select VOC HAPs: NBAFM (including p ost-speciated NBAFM in the U.S., Canada and Mexico) and 1,3 butadiene and acrolein. Table 4-3 provides a summary of diesel PM and selected metal HAPs. County monthly summaries are on the ftp site.

Table 4-1. National by-sector CAP emissions summaries for the 2014v7.0 Platform

Sector	CO	NH_3	NO_X	PM_{10}	$PM_{2.5}$	SO_2	VOC
afdust_adj				6,991,664	975,147		
ag		3,135,284					
agfire	275,781	51,703	11,061	36,751	28,925	3,667	20,527
ptagfire	301,331	37,954	8,923	49,907	35,324	2,570	18,817
cmv	56,107	138	340,287	10,199	9,546	42,108	9,736
nonpt	2,894,351	114,049	794,416	712,611	569,249	300,871	3,571,099
nonroad	12,425,532	2,244	1,392,082	140,863	133,362	3,163	1,630,321
np_oilgas	820,021	15	793,601	20,628	20,196	37,794	3,104,473
onroad	21,548,865	103,333	4,622,761	307,113	157,997	28,324	2,170,529
ptegu	735,537	25,933	1,759,009	236,039	183,024	3,241,505	35,502
ptfire_f	5,809,858	93,817	197,066	703,768	598,115	77,636	1,334,362
ptfire_s	10,978,140	177,445	48,154	1,026,465	870,276	51,403	2,548,830
ptnonipm	2,055,868	64,812	1,193,939	525,317	292,831	880,638	828,209
pt_oilgas	190,104	330	398,376	11,637	11,155	43,571	132,770
rail	119,252	364	779,801	25,094	23,166	6,986	39,857
rwc	2,156,051	16,221	32,174	333,219	332,700	8,087	351,696
Con U.S. Total	**60,366,800**	**3,823,642**	**12,371,652**	**11,131,276**	**4,241,012**	**4,728,322**	**15,796,729**
Canada othafdust				691,390	100,114		
Canada othar	2,850,991	326,903	339,975	156,762	128,890	70,236	844,963
Canada onroad_can	2,529,869	15,577	285,257	15,726	10,201	1,780	144,253
Canada othpt	489,485	13,070	247,732	68,380	28,300	497,500	357,766
Canada ptfire_mxca	717,703	1,619	16,918	81,549	69,397	7,325	174,656
Mexico othar	188,542	174,005	174,602	91,707	42,818	6,091	434,539
Mexico onroad_mex	1,580,773	2,324	378,196	12,579	9,012	4,925	138,957
Mexico othpt	184,332	4,184	449,067	68,984	54,925	525,750	63,694
Mexico ptfire_mxca	172,046	2,729	8,475	31,444	18,729	1,059	54,860
Offshore cmv	52,300	172	261,816	8,611	8,353	2,169	4,959
Offshore othpt	134,813	0	811,501	33,241	30,515	256,078	82,098
Non-US Total	**8,900,854**	**540,582**	**2,973,540**	**1,260,371**	**501,254**	**1,372,913**	**2,300,745**

Table 4-2. National by-sector VOC HAP emissions summaries for the 2014v7.0 Platform

Sector	Acetaldehyde	Benzene	Formaldehyde	Methanol	Naphthalene	Acrolein	1,3-Butadiene
afdust_adj	0	0	0	0	0	0	0
ag	0	0	0	0	0	0	0
agfire	4,510	2,227	5,319	128	0	1,298	1,068
ptagfire	2,726	1,346	6,364	0	0	800	669
cmv	268	73	545	0.5	6.1	10	3
nonpt	6,447	13,641	6,434	130,740	9,606	422	502
nonroad	15,442	37,756	39,008	1,986	3,007	2,762	6,260
np_oilgas	2,198	26,504	18,251	1,235	47	1,235	276
onroad	26,617	53,247	35,546	3,040	4,716	2,426	8,255
ptegu	405	711	2,098	73	73	324	2
ptfire_f	64,350	23,633	131,911	111,161	19,771	23,690	14,826
ptfire_s	46,561	15,151	89,101	81,053	13,812	15,701	8,986
ptnonipm	7,585	3,995	10,663	55,694	1,630	1,890	1,323
pt_oilgas	2,359	1,358	10,750	1,733	24	1,818	146
rail	621	85	1,430	0	62	103	107
rwc	8,255	17,814	17,334	0	2,072	838	2,352
Con U.S. Total	**188,344**	**197,543**	**374,755**	**386,843**	**54,826**	**53,318**	**44,774**
Canada othafdust	0	0	0	0	0	0	0
Canada othar	13,779	22,498	11,291	21,208	1,584	0	0
Canada onroad_can	1,709	6,261	2,425	0	51	0	0
Canada othpt	51	13,294	78	20,389	0	0	0
Canada ptfire_mxca	4,523	4,164	18,749	16,843	0	0	0
Mexico othar	12,721	6,034	8,907	10,547	1,739	0	0
Mexico onroad_mex	624	3,542	1,461	412	219	102	539
Mexico othpt	169	1,454	5,592	411	27	0	0
Mexico ptfire_mxca	1,342	1,312	5,908	5,367	0	0	0
Offshore cmv	230	63	464	0	7	11	0
Offshore othpt	13	187	273	0	0	0	0
Non-US Total	**35,162**	**58,810**	**55,148**	**75,177**	**3,627**	**113**	**539**

Table 4-3. National by-sector Diesel PM and metal emissions summaries for the 2014v7.0 Platform

Sector	Diesel PM_{10}	Diesel $PM_{2.5}$	Chromium Hex	Arsenic	Cadmium	Nickel	Manganese
afdust_adj							
ag							
agfire				0.01	0.08	0.01	0.74
ptagfire							
cmv	10,199	9,546	0.50	1.10	0.12	38.68	0.28
nonpt			3.79	13.51	5.86	25.17	28.43
nonroad	85,340	82,523	0.01	0.83		6.43	1.76
np_oilgas			0.12	0.47	0.25	0.12	0.25
onroad	99,392	91,555	0.09	6.95		16.37	50.25
ptegu			12.54	41.26	7.30	142.02	203.86
ptfire_f							
ptfire_s							
ptnonipm	9,229	2,735	29.78	29.96	15.94	177.31	635.24
pt_oilgas			0.03	0.09	0.27	5.33	1.96
rail	25,094	23,166	0.05	0.01	0.70	0.16	0.05
rwc				0.02	0.15	0.09	1.04
Con U.S. Total[a]	**229,253**	**209,525**	**46.92**	**94.22**	**30.67**	**411.71**	**923.86**

[a]Canada and Mexico do not have any of these pollutants

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Appendix A: Pollutants in the 2014v7.0 Platform

2014 cmaq species name(s)	pollcode	2014 NEI -Event	2014NEI-Nonpoint	2014NEI - Point	2014NEI - Nonroad	2014NEI - Onroad	NEI Pollutant Category Name (if different from description)	Description	SMOKEshortname
PAH_880E5	83329		1	1	1	1	Polycyclic Organic Matter	Acenaphthene	PAH_880E5
PAH_880E5	208968		1	1	1	1	Polycyclic Organic Matter	Acenaphthylene	PAH_880E5
ALD2,ALD2_PRIMARY	75070	1	1	1	1	1		Acetaldehyde	ACETALD
ACETONITRILE	75058	1	1	1				Acetonitrile	ACETONIT
ACROLEIN, ACROLEIN_PRIMARY	107028	1	1	1	1	1		Acrolein	ACROLEI
ACRYLICACID	79107	1	1	1				Acrylic Acid	ACRYLCACID
ACRYLONITRILE	107131		1	1				Acrylonitrile	ACRYLONITRL
PAH_000E0	120127	1	1	1	1	1	Polycyclic Organic Matter	Anthracene	PAH_000E0
AASI, AASJ, and ASSK	7440382		1	1	1	1	Arsenic Compounds	Arsenic	ARSENIC
PAH_176E4	56553	1	1	1	1	1	Polycyclic Organic Matter	Benz[a]Anthracene	PAH_176E4
BENZENE	71432	1	1	1	1	1		Benzene	BENZENE
PAH_176E4	203338	1	1	1			Polycyclic Organic Matter	Benzo(a)Fluoranthene	PAH_176E4
PAH_880E5	195197	1	1				Polycyclic Organic Matter	Benzo(c)phenanthrene	PAH_880E5
PAH_880E5	192972	1	1	1			Polycyclic Organic Matter	Benzo[e]Pyrene	PAH_880E5
PAH_176E4	203123		1	1			Polycyclic Organic Matter	Benzo(g,h,i)Fluoranthene	PAH_176E4
PAH_880E5	191242	1	1	1	1	1	Polycyclic Organic Matter	Benzo[g,h,i,]Perylene	PAH_880E5
PAH_176E3	50328	1	1	1	1	1	Polycyclic Organic Matter	Benzo[a]Pyrene	PAH_176E3
PAH_176E4	205992		1	1	1	1	Polycyclic Organic Matter	Benzo[b]Fluoranthene	PAH_176E4
PAH_176E4	205823			1			Polycyclic Organic Matter	Benzo[j]fluoranthene	PAH_176E4
PAH_176E4	207089	1	1	1	1	1	Polycyclic Organic Matter	Benzo[k]Fluoranthene	PAH_176E4
PAH_176E4	56832736	1	1	1			Polycyclic Organic Matter	Benzofluoranthenes	PAH_176E4
ABEK, ABEI, ABEJ	7440417		1	1			Beryllium Compounds	Beryllium	BERYLLIUM
BUTADIENE13	106990	1	1	1	1	1		1,3-Butadiene	BUTADIE
ACDI,ACDJ,ACDK	7440439		1	1			Cadmium Compounds	Cadmium	CADMIUM
PAH_176E5	86748		1	1			Polycyclic Organic Matter	Carbazole	PAH_176E5
CARBONTET	56235		1	1				Carbon Tetrachloride	CARBONTET
CARBONYLSULFIDE	463581	1	1	1				Carbonyl Sulfide	CARBNYLSUL
CL2	7782505		1	1				Chlorine	CHLORIINE
CHCL3	67663		1	1				Chloroform	CHCL3
PAH_880E5	91587		1	1			Polycyclic Organic Matter	2-Chloronaphthalene	PAH_880E5
CHLOROPRENE	126998		1	1				Chloroprene	CHLOROPRENE
ACR_VIK,ACR_VIJ,ACR_VII	7738945			1			Chromium Compounds	Chromic Acid (VI)	CHROMHEX
ACR_IIIK,ACR_IIII,ACR_IIIJ	16065831		1	1	1	1	Chromium Compounds	Chromium III	CHROMTRI
ACR_VIK,ACR_VIJ,ACR_VII	18540299		1	1	1	1	Chromium Compounds	Chromium (VI)	CHROMHEX

ACR_VIK,ACR_VIJ,ACR_VII	1333820			1			Chromium Compounds	Chromium Trioxide	CHROMHEX
PAH_176E5	218019	1	1	1	1	1	Polycyclic Organic Matter	Chrysene	PAH_176E5
PAH_880E5	8007452			1			Polycyclic Organic Matter	Coal Tar	PAH_880E5
PAH_176E4	226368			1			Polycyclic Organic Matter	Dibenz[a,h]acridine	PAH_176E4
PAH_176E4	224420			1			Polycyclic Organic Matter	Dibenzo[a,j]Acridine	PAH_176E4
PAH_176E3	192654			1			Polycyclic Organic Matter	Dibenzo[a,e]Pyrene	PAH_176E3
PAH_192E3	53703		1	1	1	1	Polycyclic Organic Matter	Dibenzo[a,h]Anthracene	PAH_192E3
PAH_176E2	189640			1			Polycyclic Organic Matter	Dibenzo[a,h]Pyrene	PAH_176E2
PAH_176E2	189559			1			Polycyclic Organic Matter	Dibenzo[a,i]Pyrene	PAH_176E2
PAH_176E2	191300			1			Polycyclic Organic Matter	Dibenzo[a,l]Pyrene	PAH_176E2
PAH_176E3	194592			1			Polycyclic Organic Matter	7H-Dibenzo[c,g]carbazole	PAH_176E3
DICHLOROBENZENE	106467		1	1				1,4-Dichlorobenzene	DICHLRBNZN
DICHLOROPROPENE	542756		1	1				1,3-Dichloropropene	DICLPRO13
PAH_114E1	57976		1	1			Polycyclic Organic Matter	7,12-Dimethylbenz[a]Anthracene	PAH_114E1
ETHYLBENZ	100414		1	1	1	1		Ethyl Benzene	ETHYLBENZ
BR2_C2_12	106934		1	1				Ethylene Dibromide	ETHDIBROM
CL2_C2_12	107062		1	1				Ethylene Dichloride	CL2_C2_12
ETOX	75218		1	1				Ethylene Oxide	ETOX
PAH_880E5	284		1	1			POM as non-15 PAH	Extractable Organic Matter (EOM)	PAH_880E5
PAH_880E5	206440	1	1	1	1	1	Polycyclic Organic Matter	Fluoranthene	PAH_880E5
PAH_880E5	86737		1	1	1	1	Polycyclic Organic Matter	Fluorene	PAH_880E5
FORM, FORM_PRIMARY	50000	1	1	1	1	1		Formaldehyde	FORMALD
HEXAMETHY_DIIS	822060		1	1				Hexamethylene Diisocyanate	HEXAMTHLE
HEXANE	110543	1	1	1	1	1		Hexane	HEXANE
HYDRAZINE	302012			1				Hydrazine	HYDRAZINE
HCL	7647010		1	1				Hydrochloric Acid	HCL
PAH_176E4	193395	1	1	1	1	1	Polycyclic Organic Matter	Indeno[1,2,3-c,d]Pyrene	PAH_176E4
APBK,APBJ,APBI	7439921		1	1			Lead Compounds	Lead	LEAD
MAL_ANHYDRIDE	108316		1	1				Maleic Anhydride	MALANHYD
AMN_HAPSK,AMN_HAPSJ,AMN_HAPSI	7439965		1	1	1	1	Manganese Compounds	Manganese	MANGANESE
HG,HGIIGAS,APHGI,APHGJ (there is no APHGK)	7439976		1	1	1	1	Mercury Compounds	Mercury	HGSUM
MEOH	67561	1	1	1				Methanol	METHANOL
PAH_880E5	779022						Polycyclic Organic Matter	9-Methyl Anthracene	PAH_880E5
METHYLCHLORIDE	74873	1	1	1				Methyl Chloride	MTHYLCHLRD
PAH_880E5	26914181	1	1	1			Polycyclic Organic Matter	Methylanthracene	PAH_880E5
PAH_880E5	2422799						Polycyclic Organic Matter	12-Methylbenz(a)Anthracene	PAH_880E5
PAH_880E5	65357699	1	1				Polycyclic Organic Matter	Methylbenzopyrene	PAH_880E5
PAH_101E2	56495		1	1			Polycyclic Organic Matter	3-Methylcholanthrene	PAH_101E2
PAH_176E3	3697243		1	1			Polycyclic Organic Matter	5-Methylchrysene	PAH_176E3
CL2_ME	75092		1	1				Methylene Chloride	MECL
PAH_880E5	90120			1			Polycyclic Organic Matter	1-Methylnaphthalene	PAH_880E5
PAH_880E5	91576		1	1	1		Polycyclic Organic Matter	2-Methylnaphthalene	PAH_880E5

PAH_880E5	832699						Polycyclic Organic Matter	1-Methylphenanthrene	PAH_880E5
PAH_880E5	2381217	1	1				Polycyclic Organic Matter	1-Methylpyrene	PAH_880E5
NAPHTHALENE	91203	1	1	1	1	1		Naphthalene	NAPHTH
ANIK, ANII, ANIJ	7440020		1	1	1	1	Nickel Compounds	Nickel	NICKEL
ANIK, ANII, ANIJ	1313991			1			Nickel Compounds	Nickel Oxide	NICKEL
ANIK, ANII, ANIJ	604			1			Nickel Compounds	Nickel Refinery Dust	NICKEL
PAH_176E4	5522430						Polycyclic Organic Matter	1-Nitropyrene	PAH_176E4
PAH_880E5	1.3E+08		1	1	1	1	Polycyclic Organic Matter	PAH, total	PAH_880E5
PAH_880E5	198550	1	1	1			Polycyclic Organic Matter	Perylene	PAH_880E5
PAH_000E0	85018	1	1	1	1	1	Polycyclic Organic Matter	Phenanthrene	PAH_000E0
PROPDICHLORIDE	78875		1	1				Propylene Dichloride	PROPDICLR
PAH_000E0	129000	1	1	1	1	1	Polycyclic Organic Matter	Pyrene	PAH_000E0
QUINOLINE	91225			1				Quinoline	QUINOLINE
STYRENE	100425	1	1	1	1	1		Styrene	STYRENE
CL4_ETHANE1122	79345		1	1				1,1,2,2-Tetrachloroethane	TTCLE1122
CL4_ETHE	127184		1	1				Tetrachloroethylene	PERC
TOLU	108883	1	1	1	1	1		Toluene	TOLUENE
TOL_DIIS	584849		1	1				2,4-Toluene Diisocyanate	TOL_DIIS
CL3_ETHE	79016		1	1				Trichloroethylene	CL3_ETHE
TRIETHYLAMINE	121448		1	1				Triethylamine	TRIETHLAMN
CL_ETHE	75014		1	1				Vinyl Chloride	VINYCHLRI
XYLENES	108383		1	1	1	1	Xylenes (Mixed Isomers)	m-Xylene	XYLENES
XYLENES	95476		1	1	1	1	Xylenes (Mixed Isomers)	o-Xylene	XYLENES
XYLENES	106423		1	1	1	1	Xylenes (Mixed Isomers)	p-Xylene	XYLENES
XYLENES	1330207	1	1	1	1	1	Xylenes (Mixed Isomers)	Xylenes (Mixed Isomers)	XYLENES
ADE_ECI,ADE_ECJ,ADE_OCI,ADE_OCJ,ADE_SO4J,ADE_NO3J,ADE_OTHRI,ADE_OTHRK,ADE_K	DIESEL-PM10		1	1	1	1		Diesel PM	DIESEL_PM10
PAH_176E3	41637905	1	1				Polycyclic Organic Matter	Methylchrysene	PAH_176E3
PAH_880E5	250		1	1			Polycyclic Organic Matter	PAH/POM - Unspecified	PAH_880E5
ADE_ECI,ADE_ECJ,ADE_OCI,ADE_OCJ,ADE_SO4J,ADE_NO3J,ADE_OTHRI,ADE_OTHRK,ADE_K	DIESEL-PM25		1	1	1	1	Not in the NEI	Diesel PM	DIESEL_PM25

Appendix B: Nonpoint Oil and Gas (np_oilgas) SCCs

The table below shows the SCCs in the nonpoint oil and gas sector (np_oilgas).

SCC	SCC description
2310000000	Industrial Processes;Oil and Gas Exploration and Production;All Processes;Total: All Processes
2310000220	Industrial Processes;Oil and Gas Exploration and Production;All Processes;Drill Rigs
2310000230	Industrial Processes;Oil and Gas Exploration and Production;All Processes;Workover Rigs
2310000330	Industrial Processes;Oil and Gas Exploration and Production;All Processes;Artificial Lift
2310000550	Industrial Processes;Oil and Gas Exploration and Production;All Processes;Produced Water
2310000660	Industrial Processes;Oil and Gas Exploration and Production;All Processes;Hydraulic Fracturing Engines
2310001000	Industrial Processes;Oil and Gas Exploration and Production;All Processes : On-shore;Total: All Processes
2310002000	Industrial Processes;Oil and Gas Exploration and Production;Off-Shore Oil And Gas Production;Total: All Processes
2310002401	Industrial Processes;Oil and Gas Exploration and Production;Off-Shore Oil And Gas Production;Pneumatic Pumps: Gas And Oil Wells
2310002411	Industrial Processes;Oil and Gas Exploration and Production;Off-Shore Oil And Gas Production;Pressure/Level Controllers
2310002421	Industrial Processes;Oil and Gas Exploration and Production;Off-Shore Oil And Gas Production;Cold Vents
2310010000	Industrial Processes;Oil and Gas Exploration and Production;Crude Petroleum;Total: All Processes
2310010100	Industrial Processes;Oil and Gas Exploration and Production;Crude Petroleum;Oil Well Heaters
2310010200	Industrial Processes;Oil and Gas Exploration and Production;Crude Petroleum;Oil Well Tanks - Flashing & Standing/Working/Breathing
2310010300	Industrial Processes;Oil and Gas Exploration and Production;Crude Petroleum;Oil Well Pneumatic Devices
2310010700	Industrial Processes;Oil and Gas Exploration and Production;Crude Petroleum;Oil Well Fugitives
2310010800	Industrial Processes;Oil and Gas Exploration and Production;Crude Petroleum;Oil Well Truck Loading
2310011000	Industrial Processes;Oil and Gas Exploration and Production;On-Shore Oil Production;Total: All Processes
2310011020	Industrial Processes;Oil and Gas Exploration and Production;On-Shore Oil Production;Storage Tanks: Crude Oil
2310011100	Industrial Processes;Oil and Gas Exploration and Production;On-Shore Oil Production;Heater Treater
2310011201	Industrial Processes;Oil and Gas Exploration and Production;On-Shore Oil Production;Tank Truck/Railcar Loading: Crude Oil
2310011500	Industrial Processes;Oil and Gas Exploration and Production;On-Shore Oil Production;Fugitives: All Processes
2310011501	Industrial Processes;Oil and Gas Exploration and Production;On-Shore Oil Production;Fugitives: Connectors
2310011502	Industrial Processes;Oil and Gas Exploration and Production;On-Shore Oil Production;Fugitives: Flanges
2310011503	Industrial Processes;Oil and Gas Exploration and Production;On-Shore Oil Production;Fugitives: Open Ended Lines
2310011504	Industrial Processes;Oil and Gas Exploration and Production;On-Shore Oil Production;Fugitives: Pumps
2310011505	Industrial Processes;Oil and Gas Exploration and Production;On-Shore Oil Production;Fugitives: Valves
2310011506	Industrial Processes;Oil and Gas Exploration and Production;On-Shore Oil Production;Fugitives: Other
2310012000	Industrial Processes;Oil and Gas Exploration and Production;Off-Shore Oil Production;Total: All Processes
2310012020	Industrial Processes;Oil and Gas Exploration and Production;Off-Shore Oil Production;Storage Tanks: Crude Oil
2310012525	Industrial Processes;Oil and Gas Exploration and Production;Off-Shore Oil Production;Fugitives, Valves: Oil/Water
2310012526	Industrial Processes;Oil and Gas Exploration and Production;Off-Shore Oil Production;Fugitives, Other: Oil/Water
2310020000	Industrial Processes;Oil and Gas Exploration and Production;Natural Gas;Total: All Processes

SCC	SCC description
2310020600	Industrial Processes;Oil and Gas Exploration and Production;Natural Gas;Compressor Engines
2310020700	Industrial Processes;Oil and Gas Exploration and Production;Natural Gas;Gas Well Fugitives
2310020800	Industrial Processes;Oil and Gas Exploration and Production;Natural Gas;Gas Well Truck Loading
2310021010	Industrial Processes;Oil and Gas Exploration and Production;On-Shore Gas Production;Storage Tanks: Condensate
2310021011	Industrial Processes;Oil and Gas Exploration and Production;On-Shore Gas Production;Condensate Tank Flaring
2310021030	Industrial Processes;Oil and Gas Exploration and Production;On-Shore Gas Production;Tank Truck/Railcar Loading: Condensate
2310021100	Industrial Processes;Oil and Gas Exploration and Production;On-Shore Gas Production;Gas Well Heaters
2310021101	Industrial Processes;Oil and Gas Exploration and Production;On-Shore Gas Production;Natural Gas Fired 2Cycle Lean Burn Compressor Engines < 50 HP
2310021102	Industrial Processes;Oil and Gas Exploration and Production;On-Shore Gas Production;Natural Gas Fired 2Cycle Lean Burn Compressor Engines 50 To 499 HP
2310021103	Industrial Processes;Oil and Gas Exploration and Production;On-Shore Gas Production;Natural Gas Fired 2Cycle Lean Burn Compressor Engines 500+ HP
2310021201	Industrial Processes;Oil and Gas Exploration and Production;On-Shore Gas Production;Natural Gas Fired 4Cycle Lean Burn Compressor Engines <50 HP
2310021202	Industrial Processes;Oil and Gas Exploration and Production;On-Shore Gas Production;Natural Gas Fired 4Cycle Lean Burn Compressor Engines 50 To 499 HP
2310021203	Industrial Processes;Oil and Gas Exploration and Production;On-Shore Gas Production;Natural Gas Fired 4Cycle Lean Burn Compressor Engines 500+ HP
2310021251	Industrial Processes;Oil and Gas Exploration and Production;On-Shore Gas Production;Lateral Compressors 4 Cycle Lean Burn
2310021300	Industrial Processes;Oil and Gas Exploration and Production;On-Shore Gas Production;Gas Well Pneumatic Devices
2310021301	Industrial Processes;Oil and Gas Exploration and Production;On-Shore Gas Production;Natural Gas Fired 4Cycle Rich Burn Compressor Engines <50 HP
2310021302	Industrial Processes;Oil and Gas Exploration and Production;On-Shore Gas Production;Natural Gas Fired 4Cycle Rich Burn Compressor Engines 50 To 499 HP
2310021303	Industrial Processes;Oil and Gas Exploration and Production;On-Shore Gas Production;Natural Gas Fired 4Cycle Rich Burn Compressor Engines 500+ HP
2310021310	Industrial Processes;Oil and Gas Exploration and Production;On-Shore Gas Production;Gas Well Pneumatic Pumps
2310021351	Industrial Processes;Oil and Gas Exploration and Production;On-Shore Gas Production;Lateral Compressors 4 Cycle Rich Burn
2310021400	Industrial Processes;Oil and Gas Exploration and Production;On-Shore Gas Production;Gas Well Dehydrators
2310021402	Industrial Processes;Oil and Gas Exploration and Production;On-Shore Gas Production;Nat Gas Fired 4Cycle Rich Burn Compressor Engines 50 To 499 HP w/NSCR
2310021403	Industrial Processes;Oil and Gas Exploration and Production;On-Shore Gas Production;Nat Gas Fired 4Cycle Rich Burn Compressor Engines 500+ HP w/NSCR
2310021411	Industrial Processes;Oil and Gas Exploration and Production;On-Shore Gas Production;Gas Well Dehydrators - Flaring
2310021450	Industrial Processes;Oil and Gas Exploration and Production;On-Shore Gas Production;Wellhead
2310021500	Industrial Processes;Oil and Gas Exploration and Production;On-Shore Gas Production;Gas Well Completion - Flaring
2310021501	Industrial Processes;Oil and Gas Exploration and Production;On-Shore Gas Production;Fugitives: Connectors
2310021502	Industrial Processes;Oil and Gas Exploration and Production;On-Shore Gas Production;Fugitives: Flanges
2310021503	Industrial Processes;Oil and Gas Exploration and Production;On-Shore Gas Production;Fugitives: Open Ended Lines
2310021504	Industrial Processes;Oil and Gas Exploration and Production;On-Shore Gas Production;Fugitives: Pumps
2310021505	Industrial Processes;Oil and Gas Exploration and Production;On-Shore Gas Production;Fugitives: Valves

SCC	SCC description
2310021506	Industrial Processes;Oil and Gas Exploration and Production;On-Shore Gas Production;Fugitives: Other
2310021509	Industrial Processes;Oil and Gas Exploration and Production;On-Shore Gas Production;Fugitives: All Processes
2310021600	Industrial Processes;Oil and Gas Exploration and Production;On-Shore Gas Production;Gas Well Venting
2310021601	Industrial Processes;Oil and Gas Exploration and Production;On-Shore Gas Production;Gas Well Venting - Initial Completions
2310021602	Industrial Processes;Oil and Gas Exploration and Production;On-Shore Gas Production;Gas Well Venting - Recompletions
2310021603	Industrial Processes;Oil and Gas Exploration and Production;On-Shore Gas Production;Gas Well Venting - Blowdowns
2310021604	Industrial Processes;Oil and Gas Exploration and Production;On-Shore Gas Production;Gas Well Venting - Compressor Startups
2310021605	Industrial Processes;Oil and Gas Exploration and Production;On-Shore Gas Production;Gas Well Venting - Compressor Shutdowns
2310021700	Industrial Processes;Oil and Gas Exploration and Production;On-Shore Gas Production;Miscellaneous Engines
2310022000	Industrial Processes;Oil and Gas Exploration and Production;Off-Shore Gas Production;Total: All Processes
2310022010	Industrial Processes;Oil and Gas Exploration and Production;Off-Shore Gas Production;Storage Tanks: Condensate
2310022051	Industrial Processes;Oil and Gas Exploration and Production;Off-Shore Gas Production;Turbines: Natural Gas
2310022090	Industrial Processes;Oil and Gas Exploration and Production;Off-Shore Gas Production;Boilers/Heaters: Natural Gas
2310022105	Industrial Processes;Oil and Gas Exploration and Production;Off-Shore Gas Production;Diesel Engines
2310022410	Industrial Processes;Oil and Gas Exploration and Production;Off-Shore Gas Production;Amine Unit
2310022420	Industrial Processes;Oil and Gas Exploration and Production;Off-Shore Gas Production;Dehydrator
2310022506	Industrial Processes;Oil and Gas Exploration and Production;Off-Shore Gas Production;Fugitives, Other: Gas
2310023010	Industrial Processes;Oil and Gas Exploration and Production;Coal Bed Methane Natural Gas;Storage Tanks: Condensate
2310023030	Industrial Processes;Oil and Gas Exploration and Production;Coal Bed Methane Natural Gas;Tank Truck/Railcar Loading: Condensate
2310023100	Industrial Processes;Oil and Gas Exploration and Production;Coal Bed Methane Natural Gas;CBM Well Heaters
2310023102	Industrial Processes;Oil and Gas Exploration and Production;Coal Bed Methane Natural Gas;CBM Fired 2Cycle Lean Burn Compressor Engines 50 To 499 HP
2310023202	Industrial Processes;Oil and Gas Exploration and Production;Coal Bed Methane Natural Gas;CBM Fired 4Cycle Lean Burn Compressor Engines 50 To 499 HP
2310023251	Industrial Processes;Oil and Gas Exploration and Production;Coal Bed Methane Natural Gas;Lateral Compressors 4 Cycle Lean Burn
2310023300	Industrial Processes;Oil and Gas Exploration and Production;Coal Bed Methane Natural Gas;Pneumatic Devices
2310023302	Industrial Processes;Oil and Gas Exploration and Production;Coal Bed Methane Natural Gas;CBM Fired 4Cycle Rich Burn Compressor Engines 50 To 499 HP
2310023310	Industrial Processes;Oil and Gas Exploration and Production;Coal Bed Methane Natural Gas;Pneumatic Pumps
2310023351	Industrial Processes;Oil and Gas Exploration and Production;Coal Bed Methane Natural Gas;Lateral Compressors 4 Cycle Rich Burn
2310023400	Industrial Processes;Oil and Gas Exploration and Production;Coal Bed Methane Natural Gas;Dehydrators
2310023509	Industrial Processes;Oil and Gas Exploration and Production;Coal Bed Methane Natural Gas;Fugitives
2310023511	Industrial Processes;Oil and Gas Exploration and Production;Coal Bed Methane Natural Gas;Fugitives: Connectors
2310023512	Industrial Processes;Oil and Gas Exploration and Production;Coal Bed Methane Natural Gas;Fugitives: Flanges

SCC	SCC description
2310023513	Industrial Processes;Oil and Gas Exploration and Production;Coal Bed Methane Natural Gas;Fugitives: Open Ended Lines
2310023515	Industrial Processes;Oil and Gas Exploration and Production;Coal Bed Methane Natural Gas;Fugitives: Valves
2310023516	Industrial Processes;Oil and Gas Exploration and Production;Coal Bed Methane Natural Gas;Fugitives: Other
2310023600	Industrial Processes;Oil and Gas Exploration and Production;Coal Bed Methane Natural Gas;CBM Well Completion: All Processes
2310023603	Industrial Processes;Oil and Gas Exploration and Production;Coal Bed Methane Natural Gas;CBM Well Venting - Blowdowns
2310023606	Industrial Processes;Oil and Gas Exploration and Production;Coal Bed Methane Natural Gas;Mud Degassing
2310030401	Industrial Processes;Oil and Gas Exploration and Production;Natural Gas Liquids;Gas Plant Truck Loading
2310111100	Industrial Processes;Oil and Gas Exploration and Production;On-Shore Oil Exploration;Mud Degassing
2310111401	Industrial Processes;Oil and Gas Exploration and Production;On-Shore Oil Exploration;Oil Well Pneumatic Pumps
2310111700	Industrial Processes;Oil and Gas Exploration and Production;On-Shore Oil Exploration;Oil Well Completion: All Processes
2310112401	Industrial Processes;Oil and Gas Exploration and Production;Off-Shore Oil Exploration;Oil Well Pneumatic Pumps
2310121100	Industrial Processes;Oil and Gas Exploration and Production;On-Shore Gas Exploration;Mud Degassing
2310121401	Industrial Processes;Oil and Gas Exploration and Production;On-Shore Gas Exploration;Gas Well Pneumatic Pumps
2310121700	Industrial Processes;Oil and Gas Exploration and Production;On-Shore Gas Exploration;Gas Well Completion: All Processes
2310122100	Industrial Processes;Oil and Gas Exploration and Production;Off-Shore Gas Exploration;Mud Degassing
2310321010	Industrial Processes;Oil and Gas Exploration and Production;On-Shore Gas Production - Conventional;Storage Tanks: Condensate
2310321400	Industrial Processes;Oil and Gas Exploration and Production;On-Shore Gas Production - Conventional;Gas Well Dehydrators
2310321603	Industrial Processes;Oil and Gas Exploration and Production;On-Shore Gas Production - Conventional;Gas Well Venting - Blowdowns
2310400220	Industrial Processes;Oil and Gas Exploration and Production;All Processes - Unconventional;Drill Rigs
2310421010	Industrial Processes;Oil and Gas Exploration and Production;On-Shore Gas Production - Unconventional;Storage Tanks: Condensate
2310421100	Industrial Processes;Oil and Gas Exploration and Production;On-Shore Gas Production - Unconventional;Gas Well Heaters
2310421400	Industrial Processes;Oil and Gas Exploration and Production;On-Shore Gas Production - Unconventional;Gas Well Dehydrators
2310421603	Industrial Processes;Oil and Gas Exploration and Production;On-Shore Gas Production - Unconventional;Gas Well Venting - Blowdowns

Appendix C: Profiles (other than onroad) that are new or revised in SPECIATE4.5 that were used in the 2014 v7.0 Platform

sector	pollutant	profile	profile desc
nonpt	VOC	95223	Poultry Production - Average of Production Cycle
nonpt	VOC	95240	Beef Cattle Farm and Animal Waste
nonpt	VOC	95241	Swine Farm and Animal Waste
nonroad	VOC	95328	Spark-Ignition Exhaust Emissions from 2-stroke off-road engines - E10 ethanol gasoline
nonroad	VOC	95330	Spark-Ignition Exhaust Emissions from 4-stroke off-road engines - E10 ethanol gasoline
nonroad	VOC	95331	Diesel Exhaust Emissions from Pre-Tier 1 Off-road Engines
nonroad	VOC	95332	Diesel Exhaust Emissions from Tier 1 Off-road Engines
nonroad	VOC	95333	Diesel Exhaust Emissions from Tier 2 Off-road Engines
np_oilgas	VOC	95087a	Oil and Gas - Composite - Oil Field - Oil Tank Battery Vent Gas
np_oilgas	VOC	95109a	Oil and Gas - Composite - Oil Field - Condensate Tank Battery Vent Gas
np_oilgas	VOC	95398	Composite Profile - Oil and Natural Gas Production - Condensate Tanks
np_oilgas	VOC	95403	Composite Profile - Gas Wells
np_oilgas	VOC	95417	Oil and Gas Production - Composite Profile - Untreated Natural Gas, Uinta Basin
np_oilgas	VOC	95418	Oil and Gas Production - Composite Profile - Condensate Tank Vent Gas, Uinta Basin
np_oilgas	VOC	95419	Oil and Gas Production - Composite Profile - Oil Tank Vent Gas, Uinta Basin
np_oilgas	VOC	95420	Oil and Gas Production - Composite Profile - Glycol Dehydrator, Uinta Basin
np_oilgas	VOC	DJVNT_R	Oil and Gas -Denver-Julesburg Basin Produced Gas Composition from Non-CBM Gas Wells
np_oilgas	VOC	FLR99	Natural Gas Flare Profile with DRE >98%
np_oilgas	VOC	PNC01_R	Oil and Gas -Piceance Basin Produced Gas Composition from Non-CBM Gas Wells
np_oilgas	VOC	PNC02_R	Oil and Gas -Piceance Basin Produced Gas Composition from Oil Wells
np_oilgas	VOC	PNC03_R	Oil and Gas -Piceance Basin Flash Gas Composition for Condensate Tank
np_oilgas	VOC	PNCDH	Oil and Gas Production - Composite Profile - Glycol Dehydrator, Piceance Basin
np_oilgas	VOC	PRBCB_R	Oil and Gas -Powder River Basin Produced Gas Composition from CBM Wells
np_oilgas	VOC	PRBCO_R	Oil and Gas -Powder River Basin Produced Gas Composition from Non-CBM Wells
np_oilgas	VOC	PRM01_R	Oil and Gas -Permian Basin Produced Gas Composition for Non-CBM Wells
np_oilgas	VOC	SSJCB_R	Oil and Gas -South San Juan Basin Produced Gas Composition from CBM Wells
np_oilgas	VOC	SSJCO_R	Oil and Gas -South San Juan Basin Produced Gas Composition from Non-CBM Gas Wells
np_oilgas	VOC	SWFLA_R	Oil and Gas -SW Wyoming Basin Flash Gas Composition for Condensate Tanks
np_oilgas	VOC	SWVNT_R	Oil and Gas -SW Wyoming Basin Produced Gas Composition from Non-CBM Wells
np_oilgas	VOC	UNT01_R	Oil and Gas -Uinta Basin Produced Gas Composition from CBM Wells
np_oilgas	VOC	WRBCO_R	Oil and Gas -Wind River Basin Produced Gas Composition from Non-CBM Gas Wells
pt_oilgas	VOC	95325	Chemical Manufacturing Industry Wide Composite
pt_oilgas	VOC	95326	Pulp and Paper Industry Wide Composite
pt_oilgas	VOC	95399	Composite Profile - Oil Field - Wells
pt_oilgas	VOC	95403	Composite Profile - Gas Wells
pt_oilgas	VOC	95417	Oil and Gas Production - Composite Profile - Untreated Natural Gas, Uinta Basin
pt_oilgas	VOC	DJVNT_R	Oil and Gas -Denver-Julesburg Basin Produced Gas Composition from Non-CBM Gas Wells
pt_oilgas	VOC	FLR99	Natural Gas Flare Profile with DRE >98%

pt_oilgas	VOC	PNC01_R	Oil and Gas -Piceance Basin Produced Gas Composition from Non-CBM Gas Wells
pt_oilgas	VOC	PNC02_R	Oil and Gas -Piceance Basin Produced Gas Composition from Oil Wells
pt_oilgas	VOC	PNCDH	Oil and Gas Production - Composite Profile - Glycol Dehydrator, Piceance Basin
pt_oilgas	VOC	PRBCO_R	Oil and Gas -Powder River Basin Produced Gas Composition from Non-CBM Wells
pt_oilgas	VOC	PRM01_R	Oil and Gas -Permian Basin Produced Gas Composition for Non-CBM Wells
pt_oilgas	VOC	SSJCO_R	Oil and Gas -South San Juan Basin Produced Gas Composition from Non-CBM Gas Wells
pt_oilgas	VOC	SWVNT_R	Oil and Gas -SW Wyoming Basin Produced Gas Composition from Non-CBM Wells
ptfire_f	VOC	95421	Composite Profile - Prescribed fire southeast conifer forest
ptfire_f	VOC	95422	Composite Profile - Prescribed fire southwest conifer forest
ptfire_f	VOC	95423	Composite Profile - Prescribed fire northwest conifer forest
ptfire_f	VOC	95424	Composite Profile - Wildfire northwest conifer forest
ptfire_f	VOC	95425	Composite Profile - Wildfire boreal forest
ptfire_s	VOC	95421	Composite Profile - Prescribed fire southeast conifer forest
ptfire_s	VOC	95422	Composite Profile - Prescribed fire southwest conifer forest
ptfire_s	VOC	95423	Composite Profile - Prescribed fire northwest conifer forest
ptfire_s	VOC	95424	Composite Profile - Wildfire northwest conifer forest
ptfire_s	VOC	95425	Composite Profile - Wildfire boreal forest
ptnonipm	VOC	95240	Beef Cattle Farm and Animal Waste
ptnonipm	VOC	95325	Chemical Manufacturing Industry Wide Composite
ptnonipm	VOC	95326	Pulp and Paper Industry Wide Composite
ptnonipm	VOC	95399	Composite Profile - Oil Field - Wells
ptnonipm	VOC	FLR99	Natural Gas Flare Profile with DRE >98%
ptnonipm	VOC	PRBCO_R	Oil and Gas -Powder River Basin Produced Gas Composition from Non-CBM Wells
ptnonipm	VOC	PRM01_R	Oil and Gas -Permian Basin Produced Gas Composition for Non-CBM Wells
ptnonipm	VOC	SWVNT_R	Oil and Gas -SW Wyoming Basin Produced Gas Composition from Non-CBM Wells

Appendix D: CB6 Assignment for New Species

RAMBOLL ENVIRON

September 27, 2016

MEMORANDUM

To: Alison Eyth and Madeleine Strum, OAQPS, EPA
From: Ross Beardsley and Greg Yarwood, Ramboll Environ
Subject: Species Mappings for CB6 and CB05 for use with SPECIATE 4.5

Summary

Ramboll Environ (RE) reviewed version 4.5 of the SPECIATE database, and created CB05 and CB6 mechanism species mappings for newly added compounds. In addition, the mapping guidelines for Carbon Bond (CB) mechanisms were expanded to promote consistency in current and future work.

Background

The Environmental Protection Agency's SPECIATE repository contains gas and particulate matter speciation profiles of air pollution sources, which are used in the generation of emissions data for air quality models (AQM) such as CMAQ (http://www.cmascenter.org/cmaq/) and CAMx (http://www.camx.com). However, the condensed chemical mechanisms used within these photochemical models utilize fewer species than SPECIATE to represent gas phase chemistry, and thus the SPECIATE compounds must be assigned to the AQM model species of the condensed mechanisms. A chemical mapping is used to show the representation of organic chemical species by the model compounds of the condensed mechanisms.

This memorandum describes how chemical mappings were developed from SPECIATE 4.5 compounds to model species of the CB mechanism, specifically CB05 (http://www.camx.com/publ/pdfs/CB05_Final_Report_120805.pdf) and CB6 (http://aqrp.ceer.utexas.edu/projectinfoFY12_13/12-012/12-012%20Final%20Report.pdf).

Methods

CB Model Species

Organic gases are mapped to the CB mechanism either as explicitly represented individual compounds (e.g. ALD2 for acetaldehyde), or as a combination of model species that represent common structural groups (e.g. ALDX for other aldehydes, PAR for alkyl groups). Table 1 lists all of the explicit and structural model species in CB05 and CB6 mechanisms, each of which represents a defined number of carbon atoms allowing for carbon to be conserved in all cases. CB6 contains four more explicit model species than CB05 and an additional structural group to represent ketones. The CB05 representation of the five additional CB6 species is provided in the '*Included in CB05*' column of Table 1.

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UNC-EMAQ(4-02)-16

In addition to the explicit and structural species, there are two model species that are used to represent organic gases that are not treated by the CB mechanism:

NVOL – Very low volatility SPECIATE compounds that reside predominantly in the particle phase and should be excluded from the gas phase mechanism. These compounds are mapped by setting NVOL equal to the molecular weight (e.g. decabromodiphenyl oxide is mapped as 959.2 NVOL), which allows for the total mass of all NVOL to be determined.

UNK – Compounds that are unable to be mapped to CB using the available model species. This approach should be avoided unless absolutely necessary, and will lead to a warning message in the speciation tool.

Table 1. Model species in the CB05 and CB6 chemical mechanisms.

Model Species Name	Description	Number of Carbons	Included in CB05 (structural mapping)	Included in CB6
Explicit model species				
ACET	Acetone (propanone)	3	No (3 PAR)	Yes
ALD2	Acetaldehyde (ethanal)	2	Yes	Yes
BENZ	Benzene	6	No (1 PAR, 5 UNR)	Yes
CH4	Methane	1	Yes	Yes
ETH	Ethene (ethylene)	2	Yes	Yes
ETHA	Ethane	2	Yes	Yes
ETHY	Ethyne (acetylene)	2	No (1 PAR, 1 UNR)	Yes
ETOH	Ethanol	2	Yes	Yes
FORM	Formaldehyde (methanal)	1	Yes	Yes
ISOP	Isoprene (2-methyl-1,3-butadiene)	5	Yes	Yes
MEOH	Methanol	1	Yes	Yes
PRPA	Propane	3	No (1.5 PAR, 1.5 UNR)	Yes
Common Structural groups				
ALDX	Higher aldehyde group (-C-CHO)	2	Yes	Yes
IOLE	Internal olefin group (R_1R_2>C=C<R_3R_4)	4	Yes	Yes
KET	Ketone group (R_1R_2 >C=O)	1	No (1 PAR)	Yes
OLE	Terminal olefin group (R_1R_2>C=C)	2	Yes	Yes
PAR	Paraffinic group (R_1-C<R_2R_3)	1	Yes	Yes
TERP	Monoterpenes	10	Yes	Yes
TOL	Toluene and other monoalkyl aromatics	7	Yes	Yes
UNR	Unreactive carbon groups (e.g., halogenated carbons)	1	Yes	Yes
XYL	Xylene and other polyalkyl aromatics	8	Yes	Yes
Not mapped to CB model species				
NVOL	Very low volatility compounds	*	Yes	Yes
UNK	Unknown	*	Yes	Yes

*Each NVOL represents 1 g mol^{-1} and low volatility compounds are assigned to NVOL based on molecular weight. UNK is unmapped and thus does not represent any carbon.

Mapping guidelines for non-explicit organic gases using CB model species

SPECIATE compounds that are not treated explicitly are mapped to CB model species that represent common structural groups. Table 2 lists the carbon number and general mapping guidelines for each of the structure model species.

Table 2. General Guidelines for mapping using CB6 structural model species.

CB6 Species Name	Number of Carbons	Represents
ALDX	2	Aldehyde group. ALDX represents 2 carbons and additional carbons are represented as alkyl groups (mostly PAR), e.g. propionaldehyde is ALDX + PAR
IOLE	4	Internal olefin group. IOLE represents 4 carbons and additional carbons are represented as alkyl groups (mostly PAR), e.g. 2-pentene isomers are IOLE + PAR. *Exceptions:* • IOLE with 2 carbon branches on both sides of the double bond are downgraded to OLE
KET	1	Ketone group. KET represents 1 carbon and additional carbons are represented as alkyl groups (mostly PAR), e.g. butanone is 3 PAR + KET
OLE	2	Terminal olefin group. OLE represents 2 carbons and additional carbons are represented as alkyl groups (mostly PAR), e.g. propene is OLE + PAR. Alkyne group, e.g. butyne isomers are OLE + 2 PAR.
PAR	1	Alkanes and alkyl groups. PAR represents 1 carbon, e.g. butane is 4 PAR. See UNR for exceptions.
TERP	10	All monoterpenes are represented as 1 TERP.
TOL	7	Toluene and other monoalkyl aromatics. TOL represents 7 carbons and any additional carbons are represented as alkyl groups (mostly PAR), e.g. ethylbenzene is TOL + PAR. Cresols are represented as TOL and PAR. Styrenes are represented using TOL, OLE and PAR.
UNR	1	Unreactive carbons are 1 UNR such as quaternary alkyl groups (e.g., neo-pentane is 4 PAR + UNR), carboxylic acid groups (e.g., acetic acid is PAR + UNR), ester groups (e.g., methyl acetate is 2 PAR + UNR), halogenated carbons (e.g., trichloroethane isomers are 2 UNR), carbons of nitrile groups (-C≡N).
XYL	8	Xylene isomers and other polyalkyl aromatics. XYL represents 8 carbons and any additional carbons are represented as alkyl groups (mostly PAR), e.g. trimethylbenzene isomers are XYL + PAR

Some compounds that are multifunctional and/or include hetero-atoms lack obvious CB mappings. We developed guidelines for some of these compound classes to promote consistent representation in this work and future revisions. Approaches for several compound classes are explained in Table 3. We developed guidelines as needed to address newly added species in SPECIATE 4.5 but did not systematically review existing mappings for "difficult to assign" compounds that could benefit from developing a guideline.

Table 3. Mapping guidelines for some difficult to map compound classes and structural groups

Compound Class/Structural group	CB model species representation
Chlorobenzenes and other halogenated benzenes	Guideline: • 3 or less halogens – 1 PAR, 5 UNR • 4 or more halogens – 6 UNR Examples: • 1,3,5-Chlorobenzene – 1 PAR, 5 UNR • Tetrachlorobenzenes – 6 UNR
Cyclodienes	Guideline: • 1 IOLE with additional carbons represented as alkyl groups (generally PAR) Examples: • Methylcyclopentadiene – 1 IOLE, 2 PAR • Methylcyclohexadiene – 1 IOLE, 3 PAR
Furans/Pyrroles	Guideline: • 2 OLE with additional carbons represented as alkyl groups (generally PAR) Examples: • 2-Butylfuran – 2 OLE, 4 PAR • 2-Pentylfuran – 2 OLE, 5 PAR • Pyrrole – 2 OLE • 1-Methylpyrrole – 2 OLE, 1 PAR
Heterocyclic aromatic compounds containing 2 non-carbon atoms	Guideline: • 1 OLE with remaining carbons represented as alkyl groups (generally PAR) Examples: • Ethylpyrazine – 1 OLE, 4 PAR • 1-methylpyrazole – 1 OLE, 2 PAR • 4,5-Dimethyloxazole – 1 OLE, 3 PAR
Triple bond(s)	Guideline: • Triple bonds are treated as PAR unless they are the only reactive functional group. If a compound contains more than one triple bond and no other reactive functional groups, then one of the triple bonds is treated as OLE with additional carbons treated as alkyl groups. Examples: • 1-Penten-3-yne – 1 OLE, 3 PAR • 1,5-Hexadien-3-yne – 2 OLE, 2 PAR • 1,6-Heptadiyne – 1 OLE, 5 PAR

These guidelines were used to map the new species from SPEICATE4.5, and also to revise some previously mapped compounds. Overall, a total of 175 new species from SPECIATEv4.5 were mapped and 7 previously mapped species were revised based on the new guidelines.

Recommendation

1. Complete a systematic review of the mapping of all species to ensure conformity with current mapping guidelines. The assignments of existing compounds that are similar to new species were reviewed and revised to promote consistency in mapping approaches, but the majority of existing species mappings were not reviewed as it was outside the scope of this work.

2. Develop a methodology for classifying and tracking larger organic compounds based on their volatility (semi, intermediate, or low volatility) to improve support for secondary organic aerosol (SOA) modeling using the volatility basis set (VBS) SOA model, which is available in both CMAQ and CAMx. A preliminary investigation of the possibility of doing so has been performed, and is discussed in a separate memorandum.

Appendix E: NONHAPTOG profiles that that produce NBAFM via compound mixtures

Profile code	Inventory Species	Mechanism species	Numerator	Divisor	Mass Fraction	Used in 2014v7.0 platform?
0000	NONHAPTOG	ALD2	5.67E-04	40.1466	5.67E-04	YES
1089	NONHAPTOG	ALD2	0.1651	40.1466	0.1651	YES
4710	NONHAPTOG	ALD2	2.01E-06	40.1466	2.01E-06	
4715	NONHAPTOG	ALD2	5.22E-06	40.1466	5.22E-06	
4716	NONHAPTOG	ALD2	2.81E-06	40.1466	2.81E-06	
8861	NONHAPTOG	ALD2	2.41E-06	40.1466	2.41E-06	
8862	NONHAPTOG	ALD2	4.82E-06	40.1466	4.82E-06	
8500	NONHAPTOG	FORM	2.12E-04	30.026	2.12E-04	
8526	NONHAPTOG	FORM	9.22E-04	30.026	9.22E-04	
8530	NONHAPTOG	FORM	6.13E-03	30.026	6.13E-03	
3001	NONHAPTOG	BENZ	9.02E-04	86.0788	9.02E-04	YES
8500	NONHAPTOG	BENZ	8.00E-04	86.0788	8.00E-04	
8511	NONHAPTOG	BENZ	6.28E-05	86.0788	6.28E-05	
8512	NONHAPTOG	BENZ	7.75E-05	86.0788	7.75E-05	
8514	NONHAPTOG	BENZ	1.46E-05	86.0788	1.46E-05	
8516	NONHAPTOG	BENZ	9.21E-05	86.0788	9.21E-05	
8517	NONHAPTOG	BENZ	3.87E-05	86.0788	3.87E-05	
8519	NONHAPTOG	BENZ	1.64E-04	86.0788	1.64E-04	
8520	NONHAPTOG	BENZ	5.93E-03	86.0788	5.93E-03	YES
8521	NONHAPTOG	BENZ	5.89E-03	86.0788	5.89E-03	
8522	NONHAPTOG	BENZ	5.93E-03	86.0788	5.93E-03	
8523	NONHAPTOG	BENZ	4.82E-05	86.0788	4.82E-05	
8524	NONHAPTOG	BENZ	5.34E-05	86.0788	5.34E-05	
8526	NONHAPTOG	BENZ	9.55E-04	86.0788	9.55E-04	
8527	NONHAPTOG	BENZ	9.61E-04	86.0788	9.61E-04	
8528	NONHAPTOG	BENZ	1.82E-03	86.0788	1.82E-03	
8529	NONHAPTOG	BENZ	1.43E-03	86.0788	1.43E-03	
8530	NONHAPTOG	BENZ	1.46E-05	86.0788	1.46E-05	
8532	NONHAPTOG	BENZ	1.37E-04	86.0788	1.37E-04	
8534	NONHAPTOG	BENZ	3.74E-04	86.0788	3.74E-04	
8535	NONHAPTOG	BENZ	1.23E-04	86.0788	1.23E-04	
8536	NONHAPTOG	BENZ	3.52E-04	86.0788	3.52E-04	
2543	NONHAPTOG	MEOH	1.66E-03	14.3806	1.66E-03	
2544	NONHAPTOG	MEOH	1.66E-03	14.3806	1.66E-03	YES
3018	NONHAPTOG	MEOH	1.84E-05	14.3806	1.84E-05	
3020	NONHAPTOG	MEOH	7.49E-05	14.3806	7.49E-05	
3021	NONHAPTOG	MEOH	1.09E-04	14.3806	1.09E-04	
3022	NONHAPTOG	MEOH	4.31E-05	14.3806	4.31E-05	
3023	NONHAPTOG	MEOH	5.46E-05	14.3806	5.46E-05	
3029	NONHAPTOG	MEOH	3.80E-05	14.3806	3.80E-05	
3030	NONHAPTOG	MEOH	3.66E-04	14.3806	3.66E-04	
3031	NONHAPTOG	MEOH	3.11E-04	14.3806	3.11E-04	
3048	NONHAPTOG	MEOH	8.10E-04	14.3806	8.10E-04	
3049	NONHAPTOG	MEOH	1.45E-03	14.3806	1.45E-03	
3050	NONHAPTOG	MEOH	1.45E-03	14.3806	1.45E-03	
3051	NONHAPTOG	MEOH	4.10E-04	14.3806	4.10E-04	
3052	NONHAPTOG	MEOH	1.07E-04	14.3806	1.07E-04	
3053	NONHAPTOG	MEOH	9.30E-04	14.3806	9.30E-04	
3054	NONHAPTOG	MEOH	9.31E-04	14.3806	9.31E-04	

Profile code	Inventory Species	Mechanism species	Numerator	Divisor	Mass Fraction	Used in 2014v7.0 platform?
3055	NONHAPTOG	MEOH	8.05E-04	14.3806	8.05E-04	
3064	NONHAPTOG	MEOH	4.09E-04	14.3806	4.09E-04	
3066	NONHAPTOG	MEOH	1.50E-04	14.3806	1.50E-04	YES
3067	NONHAPTOG	MEOH	1.46E-04	14.3806	1.46E-04	
3078	NONHAPTOG	MEOH	1.37E-03	14.3806	1.37E-03	
3079	NONHAPTOG	MEOH	1.38E-03	14.3806	1.38E-03	
3081	NONHAPTOG	MEOH	4.72E-04	14.3806	4.72E-04	
3082	NONHAPTOG	MEOH	4.69E-04	14.3806	4.69E-04	
3086	NONHAPTOG	MEOH	4.40E-05	14.3806	4.40E-05	
3087	NONHAPTOG	MEOH	4.50E-05	14.3806	4.50E-05	
3089	NONHAPTOG	MEOH	7.36E-05	14.3806	7.36E-05	
3091	NONHAPTOG	MEOH	3.11E-04	14.3806	3.11E-04	
3092	NONHAPTOG	MEOH	7.09E-04	14.3806	7.09E-04	
3143	NONHAPTOG	MEOH	4.73E-05	14.3806	4.73E-05	
3145	NONHAPTOG	MEOH	5.35E-04	14.3806	5.35E-04	YES
3146	NONHAPTOG	MEOH	9.51E-05	14.3806	9.51E-05	YES
8500	NONHAPTOG	MEOH	5.46E-05	14.3806	5.46E-05	
8501	NONHAPTOG	MEOH	2.57E-05	14.3806	2.57E-05	
8507	NONHAPTOG	MEOH	3.72E-05	14.3806	3.72E-05	
8509	NONHAPTOG	MEOH	4.03E-06	14.3806	4.03E-06	
8510	NONHAPTOG	MEOH	1.89E-04	14.3806	1.89E-04	
8511	NONHAPTOG	MEOH	6.57E-05	14.3806	6.57E-05	
8512	NONHAPTOG	MEOH	1.28E-05	14.3806	1.28E-05	
8513	NONHAPTOG	MEOH	4.26E-05	14.3806	4.26E-05	
8514	NONHAPTOG	MEOH	4.63E-05	14.3806	4.63E-05	
8516	NONHAPTOG	MEOH	6.39E-05	14.3806	6.39E-05	
8517	NONHAPTOG	MEOH	4.31E-07	14.3806	4.31E-07	
8518	NONHAPTOG	MEOH	4.31E-06	14.3806	4.31E-06	
8519	NONHAPTOG	MEOH	2.24E-04	14.3806	2.24E-04	
8520	NONHAPTOG	MEOH	9.17E-05	14.3806	9.17E-05	YES
8521	NONHAPTOG	MEOH	2.02E-04	14.3806	2.02E-04	
8522	NONHAPTOG	MEOH	8.15E-05	14.3806	8.15E-05	
8523	NONHAPTOG	MEOH	7.42E-05	14.3806	7.42E-05	
8524	NONHAPTOG	MEOH	7.89E-05	14.3806	7.89E-05	
8525	NONHAPTOG	MEOH	3.51E-05	14.3806	3.51E-05	
8526	NONHAPTOG	MEOH	8.15E-05	14.3806	8.15E-05	
8527	NONHAPTOG	MEOH	3.00E-04	14.3806	3.00E-04	
8528	NONHAPTOG	MEOH	3.12E-05	14.3806	3.12E-05	
8529	NONHAPTOG	MEOH	5.75E-06	14.3806	5.75E-06	
8531	NONHAPTOG	MEOH	4.31E-05	14.3806	4.31E-05	
8532	NONHAPTOG	MEOH	2.37E-05	14.3806	2.37E-05	
8533	NONHAPTOG	MEOH	7.19E-07	14.3806	7.19E-07	
8534	NONHAPTOG	MEOH	6.43E-05	14.3806	6.43E-05	
8535	NONHAPTOG	MEOH	2.24E-05	14.3806	2.24E-05	
8536	NONHAPTOG	MEOH	6.40E-05	14.3806	6.40E-05	

Appendix F: Mapping of Fuel Distribution SCCs to BTP, BPS and RBT

The table below provides a crosswalk between fuel distribution SCCs and classification type for portable fuel containers (PFC), fuel distribution operations associated with the bulk-plant-to-pump (BTP), refinery to bulk terminal (RBT) and bulk plant storage (BPS).

SCC	Type	Description
40301001	RBT	Petroleum and Solvent Evaporation; Petroleum Product Storage at Refineries; Fixed Roof Tanks (Varying Sizes); Gasoline RVP 13: Breathing Loss (67000 Bbl. Tank Size)
40301002	RBT	Petroleum and Solvent Evaporation; Petroleum Product Storage at Refineries; Fixed Roof Tanks (Varying Sizes); Gasoline RVP 10: Breathing Loss (67000 Bbl. Tank Size)
40301003	RBT	Petroleum and Solvent Evaporation; Petroleum Product Storage at Refineries; Fixed Roof Tanks (Varying Sizes); Gasoline RVP 7: Breathing Loss (67000 Bbl. Tank Size)
40301004	RBT	Petroleum and Solvent Evaporation; Petroleum Product Storage at Refineries; Fixed Roof Tanks (Varying Sizes); Gasoline RVP 13: Breathing Loss (250000 Bbl. Tank Size)
40301006	RBT	Petroleum and Solvent Evaporation; Petroleum Product Storage at Refineries; Fixed Roof Tanks (Varying Sizes); Gasoline RVP 7: Breathing Loss (250000 Bbl. Tank Size)
40301007	RBT	Petroleum and Solvent Evaporation; Petroleum Product Storage at Refineries; Fixed Roof Tanks (Varying Sizes); Gasoline RVP 13: Working Loss (Tank Diameter Independent)
40301101	RBT	Petroleum and Solvent Evaporation; Petroleum Product Storage at Refineries; Floating Roof Tanks (Varying Sizes); Gasoline RVP 13: Standing Loss (67000 Bbl. Tank Size)
40301102	RBT	Petroleum and Solvent Evaporation; Petroleum Product Storage at Refineries; Floating Roof Tanks (Varying Sizes); Gasoline RVP 10: Standing Loss (67000 Bbl. Tank Size)
40301103	RBT	Petroleum and Solvent Evaporation; Petroleum Product Storage at Refineries; Floating Roof Tanks (Varying Sizes); Gasoline RVP 7: Standing Loss (67000 Bbl. Tank Size)
40301105	RBT	Petroleum and Solvent Evaporation; Petroleum Product Storage at Refineries; Floating Roof Tanks (Varying Sizes); Gasoline RVP 10: Standing Loss (250000 Bbl. Tank Size)
40301151	RBT	Petroleum and Solvent Evaporation; Petroleum Product Storage at Refineries; Floating Roof Tanks (Varying Sizes); Gasoline: Standing Loss - Internal
40301202	RBT	Petroleum and Solvent Evaporation; Petroleum Product Storage at Refineries; Variable Vapor Space; Gasoline RVP 10: Filling Loss
40301203	RBT	Petroleum and Solvent Evaporation; Petroleum Product Storage at Refineries; Variable Vapor Space; Gasoline RVP 7: Filling Loss
40400101	RBT	Petroleum and Solvent Evaporation; Petroleum Liquids Storage (non-Refinery); Bulk Terminals; Gasoline RVP 13: Breathing Loss (67000 Bbl Capacity) - Fixed Roof Tank
40400102	RBT	Petroleum and Solvent Evaporation; Petroleum Liquids Storage (non-Refinery); Bulk Terminals; Gasoline RVP 10: Breathing Loss (67000 Bbl Capacity) - Fixed Roof Tank
40400103	RBT	Petroleum and Solvent Evaporation; Petroleum Liquids Storage (non-Refinery); Bulk Terminals; Gasoline RVP 7: Breathing Loss (67000 Bbl. Capacity) - Fixed Roof Tank
40400104	RBT	Petroleum and Solvent Evaporation; Petroleum Liquids Storage (non-Refinery); Bulk Terminals; Gasoline RVP 13: Breathing Loss (250000 Bbl Capacity)-Fixed Roof Tank
40400105	RBT	Petroleum and Solvent Evaporation; Petroleum Liquids Storage (non-Refinery); Bulk Terminals; Gasoline RVP 10: Breathing Loss (250000 Bbl Capacity)-Fixed Roof Tank
40400106	RBT	Petroleum and Solvent Evaporation; Petroleum Liquids Storage (non-Refinery); Bulk Terminals; Gasoline RVP 7: Breathing Loss (250000 Bbl Capacity) - Fixed Roof Tank
40400107	RBT	Petroleum and Solvent Evaporation; Petroleum Liquids Storage (non-Refinery); Bulk Terminals; Gasoline RVP 13: Working Loss (Diam. Independent) - Fixed Roof Tank
40400108	RBT	Petroleum and Solvent Evaporation; Petroleum Liquids Storage (non-Refinery); Bulk Terminals; Gasoline RVP 10: Working Loss (Diameter Independent) - Fixed Roof Tank
40400109	RBT	Petroleum and Solvent Evaporation; Petroleum Liquids Storage (non-Refinery); Bulk Terminals; Gasoline RVP 7: Working Loss (Diameter Independent) - Fixed Roof Tank
40400110	RBT	Petroleum and Solvent Evaporation; Petroleum Liquids Storage (non-Refinery); Bulk Terminals; Gasoline RVP 13: Standing Loss (67000 Bbl Capacity)-Floating Roof Tank

SCC	Type	Description
4040011 1	RBT	Petroleum and Solvent Evaporation; Petroleum Liquids Storage (non-Refinery); Bulk Terminals; Gasoline RVP 10: Standing Loss (67000 Bbl Capacity)-Floating Roof Tank
4040011 2	RBT	Petroleum and Solvent Evaporation; Petroleum Liquids Storage (non-Refinery); Bulk Terminals; Gasoline RVP 7: Standing Loss (67000 Bbl Capacity)- Floating Roof Tank
4040011 3	RBT	Petroleum and Solvent Evaporation; Petroleum Liquids Storage (non-Refinery); Bulk Terminals; Gasoline RVP 13: Standing Loss (250000 Bbl Cap.) - Floating Roof Tank
4040011 4	RBT	Petroleum and Solvent Evaporation; Petroleum Liquids Storage (non-Refinery); Bulk Terminals; Gasoline RVP 10: Standing Loss (250000 Bbl Cap.) - Floating Roof Tank
4040011 5	RBT	Petroleum and Solvent Evaporation; Petroleum Liquids Storage (non-Refinery); Bulk Terminals; Gasoline RVP 7: Standing Loss (250000 Bbl Cap.) - Floating Roof Tank
4040011 6	RBT	Petroleum and Solvent Evaporation; Petroleum Liquids Storage (non-Refinery); Bulk Terminals; Gasoline RVP 13/10/7: Withdrawal Loss (67000 Bbl Cap.) - Float Rf Tnk
4040011 7	RBT	Petroleum and Solvent Evaporation; Petroleum Liquids Storage (non-Refinery); Bulk Terminals; Gasoline RVP 13/10/7: Withdrawal Loss (250000 Bbl Cap.) - Float Rf Tnk
4040011 8	RBT	Petroleum and Solvent Evaporation; Petroleum Liquids Storage (non-Refinery); Bulk Terminals; Gasoline RVP 13: Filling Loss (10500 Bbl Cap.) - Variable Vapor Space
4040011 9	RBT	Petroleum and Solvent Evaporation; Petroleum Liquids Storage (non-Refinery); Bulk Terminals; Gasoline RVP 10: Filling Loss (10500 Bbl Cap.) - Variable Vapor Space
4040012 0	RBT	Petroleum and Solvent Evaporation; Petroleum Liquids Storage (non-Refinery); Bulk Terminals; Gasoline RVP 7: Filling Loss (10500 Bbl Cap.) - Variable Vapor Space
4040013 0	RBT	Petroleum and Solvent Evaporation; Petroleum Liquids Storage (non-Refinery); Bulk Terminals; Specify Liquid: Standing Loss - External Floating Roof w/ Primary Seal
4040013 1	RBT	Petroleum and Solvent Evaporation; Petroleum Liquids Storage (non-Refinery); Bulk Terminals; Gasoline RVP 13: Standing Loss - Ext. Floating Roof w/ Primary Seal
4040013 2	RBT	Petroleum and Solvent Evaporation; Petroleum Liquids Storage (non-Refinery); Bulk Terminals; Gasoline RVP 10: Standing Loss - Ext. Floating Roof w/ Primary Seal
4040013 3	RBT	Petroleum and Solvent Evaporation; Petroleum Liquids Storage (non-Refinery); Bulk Terminals; Gasoline RVP 7: Standing Loss - External Floating Roof w/ Primary Seal
4040014 0	RBT	Petroleum and Solvent Evaporation; Petroleum Liquids Storage (non-Refinery); Bulk Terminals; Specify Liquid: Standing Loss - Ext. Float Roof Tank w/ Secondy Seal
4040014 1	RBT	Petroleum and Solvent Evaporation; Petroleum Liquids Storage (non-Refinery); Bulk Terminals; Gasoline RVP 13: Standing Loss - Ext. Floating Roof w/ Secondary Seal
4040014 2	RBT	Petroleum and Solvent Evaporation; Petroleum Liquids Storage (non-Refinery); Bulk Terminals; Gasoline RVP 10: Standing Loss - Ext. Floating Roof w/ Secondary Seal
4040014 3	RBT	Petroleum and Solvent Evaporation; Petroleum Liquids Storage (non-Refinery); Bulk Terminals; Gasoline RVP 7: Standing Loss - Ext. Floating Roof w/ Secondary Seal
4040014 8	RBT	Petroleum and Solvent Evaporation; Petroleum Liquids Storage (non-Refinery); Bulk Terminals; Gasoline RVP 13/10/7: Withdrawal Loss - Ext. Float Roof (Pri/Sec Seal)
4040014 9	RBT	Petroleum and Solvent Evaporation; Petroleum Liquids Storage (non-Refinery); Bulk Terminals; Specify Liquid: External Floating Roof (Primary/Secondary Seal)
4040015 0	RBT	Petroleum and Solvent Evaporation; Petroleum Liquids Storage (non-Refinery); Bulk Terminals; Miscellaneous Losses/Leaks: Loading Racks
4040015 1	RBT	Petroleum and Solvent Evaporation; Petroleum Liquids Storage (non-Refinery); Bulk Terminals; Valves, Flanges, and Pumps
4040015 2	RBT	Petroleum and Solvent Evaporation; Petroleum Liquids Storage (non-Refinery); Bulk Terminals; Vapor Collection Losses
4040015 3	RBT	Petroleum and Solvent Evaporation; Petroleum Liquids Storage (non-Refinery); Bulk Terminals; Vapor Control Unit Losses
4040016 0	RBT	Petroleum and Solvent Evaporation; Petroleum Liquids Storage (non-Refinery); Bulk Terminals; Specify Liquid: Standing Loss - Internal Floating Roof w/ Primary Seal
4040016 1	RBT	Petroleum and Solvent Evaporation; Petroleum Liquids Storage (non-Refinery); Bulk Terminals; Gasoline RVP 13: Standing Loss - Int. Floating Roof w/ Primary Seal
4040016 2	RBT	Petroleum and Solvent Evaporation; Petroleum Liquids Storage (non-Refinery); Bulk Terminals; Gasoline RVP 10: Standing Loss - Int. Floating Roof w/ Primary Seal
4040016 3	RBT	Petroleum and Solvent Evaporation; Petroleum Liquids Storage (non-Refinery); Bulk Terminals; Gasoline RVP 7: Standing Loss - Internal Floating Roof w/ Primary Seal

SCC	Type	Description
40400170	RBT	Petroleum and Solvent Evaporation; Petroleum Liquids Storage (non-Refinery); Bulk Terminals; Specify Liquid: Standing Loss - Int. Floating Roof w/ Secondary Seal
40400171	RBT	Petroleum and Solvent Evaporation; Petroleum Liquids Storage (non-Refinery); Bulk Terminals; Gasoline RVP 13: Standing Loss - Int. Floating Roof w/ Secondary Seal
40400172	RBT	Petroleum and Solvent Evaporation; Petroleum Liquids Storage (non-Refinery); Bulk Terminals; Gasoline RVP 10: Standing Loss - Int. Floating Roof w/ Secondary Seal
40400173	RBT	Petroleum and Solvent Evaporation; Petroleum Liquids Storage (non-Refinery); Bulk Terminals; Gasoline RVP 7: Standing Loss - Int. Floating Roof w/ Secondary Seal
40400178	RBT	Petroleum and Solvent Evaporation; Petroleum Liquids Storage (non-Refinery); Bulk Terminals; Gasoline RVP 13/10/7: Withdrawal Loss - Int. Float Roof (Pri/Sec Seal)
40400179	RBT	Petroleum and Solvent Evaporation; Petroleum Liquids Storage (non-Refinery); Bulk Terminals; Specify Liquid: Internal Floating Roof (Primary/Secondary Seal)
40400199	RBT	Petroleum and Solvent Evaporation; Petroleum Liquids Storage (non-Refinery); Bulk Terminals; See Comment **
40400201	BTP/BPS	Petroleum and Solvent Evaporation; Petroleum Liquids Storage (non-Refinery); Bulk Plants; Gasoline RVP 13: Breathing Loss (67000 Bbl Capacity) - Fixed Roof Tank
40400202	BTP/BPS	Petroleum and Solvent Evaporation; Petroleum Liquids Storage (non-Refinery); Bulk Plants; Gasoline RVP 10: Breathing Loss (67000 Bbl Capacity) - Fixed Roof Tank
40400203	BTP/BPS	Petroleum and Solvent Evaporation; Petroleum Liquids Storage (non-Refinery); Bulk Plants; Gasoline RVP 7: Breathing Loss (67000 Bbl. Capacity) - Fixed Roof Tank
40400204	BTP/BPS	Petroleum and Solvent Evaporation; Petroleum Liquids Storage (non-Refinery); Bulk Plants; Gasoline RVP 13: Working Loss (67000 Bbl. Capacity) - Fixed Roof Tank
40400205	BTP/BPS	Petroleum and Solvent Evaporation; Petroleum Liquids Storage (non-Refinery); Bulk Plants; Gasoline RVP 10: Working Loss (67000 Bbl. Capacity) - Fixed Roof Tank
40400206	BTP/BPS	Petroleum and Solvent Evaporation; Petroleum Liquids Storage (non-Refinery); Bulk Plants; Gasoline RVP 7: Working Loss (67000 Bbl. Capacity) - Fixed Roof Tank
40400207	BTP/BPS	Petroleum and Solvent Evaporation; Petroleum Liquids Storage (non-Refinery); Bulk Plants; Gasoline RVP 13: Standing Loss (67000 Bbl Cap.) - Floating Roof Tank
40400208	BTP/BPS	Petroleum and Solvent Evaporation; Petroleum Liquids Storage (non-Refinery); Bulk Plants; Gasoline RVP 10: Standing Loss (67000 Bbl Cap.) - Floating Roof Tank
40400210	BTP/BPS	Petroleum and Solvent Evaporation; Petroleum Liquids Storage (non-Refinery); Bulk Plants; Gasoline RVP 13/10/7: Withdrawal Loss (67000 Bbl Cap.) - Float Rf Tnk
40400211	BTP/BPS	Petroleum and Solvent Evaporation; Petroleum Liquids Storage (non-Refinery); Bulk Plants; Gasoline RVP 13: Filling Loss (10500 Bbl Cap.) - Variable Vapor Space
40400212	BTP/BPS	Petroleum and Solvent Evaporation; Petroleum Liquids Storage (non-Refinery); Bulk Plants; Gasoline RVP 10: Filling Loss (10500 Bbl Cap.) - Variable Vapor Space
40400213	BTP/BPS	Petroleum and Solvent Evaporation; Petroleum Liquids Storage (non-Refinery); Bulk Plants; Gasoline RVP 7: Filling Loss (10500 Bbl Cap.) - Variable Vapor Space
40400230	BTP/BPS	Petroleum and Solvent Evaporation; Petroleum Liquids Storage (non-Refinery); Bulk Plants; Specify Liquid: Standing Loss - External Floating Roof w/ Primary Seal
40400231	BTP/BPS	Petroleum and Solvent Evaporation; Petroleum Liquids Storage (non-Refinery); Bulk Plants; Gasoline RVP 13: Standing Loss - Ext. Floating Roof w/ Primary Seal

SCC	Type	Description
4040023 2	BTP/B PS	Petroleum and Solvent Evaporation; Petroleum Liquids Storage (non-Refinery); Bulk Plants; Gasoline RVP 10: Standing Loss - Ext. Floating Roof w/ Primary Seal
4040023 3	BTP/B PS	Petroleum and Solvent Evaporation; Petroleum Liquids Storage (non-Refinery); Bulk Plants; Gasoline RVP 7: Standing Loss - External Floating Roof w/ Primary Seal
4040024 0	RBT	Petroleum and Solvent Evaporation; Petroleum Liquids Storage (non-Refinery); Bulk Plants; Specify Liquid: Standing Loss - Ext. Floating Roof w/ Secondary Seal
4040024 1	BTP/B PS	Petroleum and Solvent Evaporation; Petroleum Liquids Storage (non-Refinery); Bulk Plants; Gasoline RVP 13: Standing Loss - Ext. Floating Roof w/ Secondary Seal
4040024 8	BTP/B PS	Petroleum and Solvent Evaporation; Petroleum Liquids Storage (non-Refinery); Bulk Plants; Gasoline RVP 10/13/7: Withdrawal Loss - Ext. Float Roof (Pri/Sec Seal)
4040024 9	RBT	Petroleum and Solvent Evaporation; Petroleum Liquids Storage (non-Refinery); Bulk Plants; Specify Liquid: External Floating Roof (Primary/Secondary Seal)
4040025 0	BTP/B PS	Petroleum and Solvent Evaporation; Petroleum Liquids Storage (non-Refinery); Bulk Plants; Loading Racks
4040025 1	BTP/B PS	Petroleum and Solvent Evaporation; Petroleum Liquids Storage (non-Refinery); Bulk Plants; Valves, Flanges, and Pumps
4040025 2	BTP/B PS	Petroleum and Solvent Evaporation; Petroleum Liquids Storage (non-Refinery); Bulk Plants; Miscellaneous Losses/Leaks: Vapor Collection Losses
4040025 3	BTP/B PS	Petroleum and Solvent Evaporation; Petroleum Liquids Storage (non-Refinery); Bulk Plants; Miscellaneous Losses/Leaks: Vapor Control Unit Losses
4040026 0	RBT	Petroleum and Solvent Evaporation; Petroleum Liquids Storage (non-Refinery); Bulk Plants; Specify Liquid: Standing Loss - Internal Floating Roof w/ Primary Seal
4040026 1	BTP/B PS	Petroleum and Solvent Evaporation; Petroleum Liquids Storage (non-Refinery); Bulk Plants; Gasoline RVP 13: Standing Loss - Int. Floating Roof w/ Primary Seal
4040026 2	BTP/B PS	Petroleum and Solvent Evaporation; Petroleum Liquids Storage (non-Refinery); Bulk Plants; Gasoline RVP 10: Standing Loss - Int. Floating Roof w/ Primary Seal
4040026 3	BTP/B PS	Petroleum and Solvent Evaporation; Petroleum Liquids Storage (non-Refinery); Bulk Plants; Gasoline RVP 7: Standing Loss - Internal Floating Roof w/ Primary Seal
4040027 0	BTP/B PS	Petroleum and Solvent Evaporation; Petroleum Liquids Storage (non-Refinery); Bulk Plants; Specify Liquid: Standing Loss - Int. Floating Roof w/ Secondary Seal
4040027 1	BTP/B PS	Petroleum and Solvent Evaporation; Petroleum Liquids Storage (non-Refinery); Bulk Plants; Gasoline RVP 13: Standing Loss - Int. Floating Roof w/ Secondary Seal
4040027 2	BTP/B PS	Petroleum and Solvent Evaporation; Petroleum Liquids Storage (non-Refinery); Bulk Plants; Gasoline RVP 10: Standing Loss - Int. Floating Roof w/ Secondary Seal
4040027 3	BTP/B PS	Petroleum and Solvent Evaporation; Petroleum Liquids Storage (non-Refinery); Bulk Plants; Gasoline RVP 7: Standing Loss - Int. Floating Roof w/ Secondary Seal
4040027 8	BTP/B PS	Petroleum and Solvent Evaporation; Petroleum Liquids Storage (non-Refinery); Bulk Plants; Gasoline RVP 10/13/7: Withdrawal Loss - Int. Float Roof (Pri/Sec Seal)

SCC	Type	Description
4040027 9	BTP/B PS	Petroleum and Solvent Evaporation; Petroleum Liquids Storage (non-Refinery); Bulk Plants; Specify Liquid: Internal Floating Roof (Primary/Secondary Seal)
4040040 1	BTP/B PS	Petroleum and Solvent Evaporation; Petroleum Liquids Storage (non-Refinery); Petroleum Products - Underground Tanks; Gasoline RVP 13: Breathing Loss
4040040 2	BTP/B PS	Petroleum and Solvent Evaporation; Petroleum Liquids Storage (non-Refinery); Petroleum Products - Underground Tanks; Gasoline RVP 13: Working Loss
4040040 3	BTP/B PS	Petroleum and Solvent Evaporation; Petroleum Liquids Storage (non-Refinery); Petroleum Products - Underground Tanks; Gasoline RVP 10: Breathing Loss
4040040 4	BTP/B PS	Petroleum and Solvent Evaporation; Petroleum Liquids Storage (non-Refinery); Petroleum Products - Underground Tanks; Gasoline RVP 10: Working Loss
4040040 5	BTP/B PS	Petroleum and Solvent Evaporation; Petroleum Liquids Storage (non-Refinery); Petroleum Products - Underground Tanks; Gasoline RVP 7: Breathing Loss
4040040 6	BTP/B PS	Petroleum and Solvent Evaporation; Petroleum Liquids Storage (non-Refinery); Petroleum Products - Underground Tanks; Gasoline RVP 7: Working Loss
4060010 1	BTP/B PS	Petroleum and Solvent Evaporation; Transportation and Marketing of Petroleum Products; Tank Cars and Trucks; Gasoline: Splash Loading **
4060012 6	BTP/B PS	Petroleum and Solvent Evaporation; Transportation and Marketing of Petroleum Products; Tank Cars and Trucks; Gasoline: Submerged Loading **
4060013 1	BTP/B PS	Petroleum and Solvent Evaporation; Transportation and Marketing of Petroleum Products; Tank Cars and Trucks; Gasoline: Submerged Loading (Normal Service)
4060013 6	BTP/B PS	Petroleum and Solvent Evaporation; Transportation and Marketing of Petroleum Products; Tank Cars and Trucks; Gasoline: Splash Loading (Normal Service)
4060014 1	BTP/B PS	Petroleum and Solvent Evaporation; Transportation and Marketing of Petroleum Products; Tank Cars and Trucks; Gasoline: Submerged Loading (Balanced Service)
4060014 4	BTP/B PS	Petroleum and Solvent Evaporation; Transportation and Marketing of Petroleum Products; Tank Cars and Trucks; Gasoline: Splash Loading (Balanced Service)
4060014 7	BTP/B PS	Petroleum and Solvent Evaporation; Transportation and Marketing of Petroleum Products; Tank Cars and Trucks; Gasoline: Submerged Loading (Clean Tanks)
4060016 2	BTP/B PS	Petroleum and Solvent Evaporation; Transportation and Marketing of Petroleum Products; Tank Cars and Trucks; Gasoline: Loaded with Fuel (Transit Losses)
4060016 3	BTP/B PS	Petroleum and Solvent Evaporation; Transportation and Marketing of Petroleum Products; Tank Cars and Trucks; Gasoline: Return with Vapor (Transit Losses)
4060019 9	BTP/B PS	Petroleum and Solvent Evaporation; Transportation and Marketing of Petroleum Products; Tank Cars and Trucks; Not Classified **
4060023 1	RBT	Petroleum and Solvent Evaporation; Transportation and Marketing of Petroleum Products; Marine Vessels; Gasoline: Loading Tankers: Cleaned and Vapor Free Tanks
4060023 2	RBT	Petroleum and Solvent Evaporation; Transportation and Marketing of Petroleum Products; Marine Vessels; Gasoline: Loading Tankers

SCC	Type	Description
40600233	BTP/BPS	Petroleum and Solvent Evaporation; Transportation and Marketing of Petroleum Products; Marine Vessels; Gasoline: Loading Barges: Cleaned and Vapor Free Tanks
40600234	RBT	Petroleum and Solvent Evaporation; Transportation and Marketing of Petroleum Products; Marine Vessels; Gasoline: Loading Tankers: Ballasted Tank
40600235	BTP/BPS	Petroleum and Solvent Evaporation;Transportation and Marketing of Petroleum Products;Marine Vessels;Gasoline: Ocean Barges Loading - Ballasted Tank
40600236	RBT	Petroleum and Solvent Evaporation; Transportation and Marketing of Petroleum Products; Marine Vessels; Gasoline: Loading Tankers: Uncleaned Tanks
40600237	RBT	Petroleum and Solvent Evaporation;Transportation and Marketing of Petroleum Products;Marine Vessels;Gasoline: Ocean Barges Loading - Uncleaned Tanks
40600238	RBT	Petroleum and Solvent Evaporation; Transportation and Marketing of Petroleum Products; Marine Vessels; Gasoline: Loading Barges: Uncleaned Tanks
40600239	RBT	Petroleum and Solvent Evaporation; Transportation and Marketing of Petroleum Products; Marine Vessels; Gasoline: Tankers: Ballasted Tank
40600240	RBT	Petroleum and Solvent Evaporation; Transportation and Marketing of Petroleum Products; Marine Vessels; Gasoline: Loading Barges: Average Tank Condition
40600241	BTP/BPS	Petroleum and Solvent Evaporation; Transportation and Marketing of Petroleum Products; Marine Vessels; Gasoline: Tanker Ballasting
40600299	RBT	Petroleum and Solvent Evaporation; Transportation and Marketing of Petroleum Products; Marine Vessels; Not Classified **
40600301	BTP/BPS	Petroleum and Solvent Evaporation; Transportation and Marketing of Petroleum Products; Gasoline Retail Operations - Stage I; Splash Filling
40600302	BTP/BPS	Petroleum and Solvent Evaporation; Transportation and Marketing of Petroleum Products; Gasoline Retail Operations - Stage I; Submerged Filling w/o Controls
40600305	BTP/BPS	Petroleum and Solvent Evaporation; Transportation and Marketing of Petroleum Products; Gasoline Retail Operations - Stage I; Unloading **
40600306	BTP/BPS	Petroleum and Solvent Evaporation; Transportation and Marketing of Petroleum Products; Gasoline Retail Operations - Stage I; Balanced Submerged Filling
40600307	BTP/BPS	Petroleum and Solvent Evaporation; Transportation and Marketing of Petroleum Products; Gasoline Retail Operations - Stage I; Underground Tank Breathing and Emptying
40600399	BTP/BPS	Petroleum and Solvent Evaporation; Transportation and Marketing of Petroleum Products; Gasoline Retail Operations - Stage I; Not Classified **
40600401	BTP/BPS	Petroleum and Solvent Evaporation; Transportation and Marketing of Petroleum Products; Filling Vehicle Gas Tanks - Stage II; Vapor Loss w/o Controls
40600501	RBT	Petroleum and Solvent Evaporation; Transportation and Marketing of Petroleum Products; Pipeline Petroleum Transport - General - All Products; Pipeline Leaks
40600502	RBT	Petroleum and Solvent Evaporation; Transportation and Marketing of Petroleum Products; Pipeline Petroleum Transport - General - All Products; Pipeline Venting
40600503	RBT	Petroleum and Solvent Evaporation; Transportation and Marketing of Petroleum Products; Pipeline Petroleum Transport - General - All Products; Pump Station
40600504	RBT	Petroleum and Solvent Evaporation; Transportation and Marketing of Petroleum Products; Pipeline Petroleum Transport - General - All Products; Pump Station Leaks
40600602	BTP/BPS	Petroleum and Solvent Evaporation; Transportation and Marketing of Petroleum Products; Consumer (Corporate) Fleet Refueling - Stage II; Liquid Spill Loss w/o Controls

SCC	Type	Description
40600701	BTP/BPS	Petroleum and Solvent Evaporation; Transportation and Marketing of Petroleum Products; Consumer (Corporate) Fleet Refueling - Stage I; Splash Filling
40600702	BTP/BPS	Petroleum and Solvent Evaporation; Transportation and Marketing of Petroleum Products; Consumer (Corporate) Fleet Refueling - Stage I; Submerged Filling w/o Controls
40600706	BTP/BPS	Petroleum and Solvent Evaporation; Transportation and Marketing of Petroleum Products; Consumer (Corporate) Fleet Refueling - Stage I; Balanced Submerged Filling
40600707	BTP/BPS	Petroleum and Solvent Evaporation; Transportation and Marketing of Petroleum Products; Consumer (Corporate) Fleet Refueling - Stage I; Underground Tank Breathing and Emptying
40688801	BTP/BPS	Petroleum and Solvent Evaporation; Transportation and Marketing of Petroleum Products; Fugitive Emissions; Specify in Comments Field
2501050120	RBT	Storage and Transport; Petroleum and Petroleum Product Storage; Bulk Terminals: All Evaporative Losses; Gasoline
2501055120	BTP/BPS	Storage and Transport; Petroleum and Petroleum Product Storage; Bulk Plants: All Evaporative Losses; Gasoline
2501060050	BTP/BPS	Storage and Transport; Petroleum and Petroleum Product Storage; Gasoline Service Stations; Stage 1: Total
2501060051	BTP/BPS	Storage and Transport; Petroleum and Petroleum Product Storage; Gasoline Service Stations; Stage 1: Submerged Filling
2501060052	BTP/BPS	Storage and Transport; Petroleum and Petroleum Product Storage; Gasoline Service Stations; Stage 1: Splash Filling
2501060053	BTP/BPS	Storage and Transport; Petroleum and Petroleum Product Storage; Gasoline Service Stations; Stage 1: Balanced Submerged Filling
2501060200	BTP/BPS	Storage and Transport; Petroleum and Petroleum Product Storage; Gasoline Service Stations; Underground Tank: Total
2501060201	BTP/BPS	Storage and Transport; Petroleum and Petroleum Product Storage; Gasoline Service Stations; Underground Tank: Breathing and Emptying
2501995000	BTP/BPS	Storage and Transport; Petroleum and Petroleum Product Storage; All Storage Types: Working Loss; Total: All Products
2505000120	RBT	Storage and Transport; Petroleum and Petroleum Product Transport; All Transport Types; Gasoline
2505020120	RBT	Storage and Transport; Petroleum and Petroleum Product Transport; Marine Vessel; Gasoline
2505020121	RBT	Storage and Transport; Petroleum and Petroleum Product Transport; Marine Vessel; Gasoline - Barge
2505030120	BTP/BPS	Storage and Transport; Petroleum and Petroleum Product Transport; Truck; Gasoline
2505040120	RBT	Storage and Transport; Petroleum and Petroleum Product Transport; Pipeline; Gasoline
2660000000	BTP/BPS	Waste Disposal, Treatment, and Recovery; Leaking Underground Storage Tanks; Leaking Underground Storage Tanks; Total: All Storage Types