APPENDIX H

2011 BASE-YEAR EMISSIONS INVENTORY FOR INDIANA'S PORTION OF THE CINCINNATI HAMILTON, OHIO-KENTUCKY-INDIANA (OH-KY-IN), 2008 8-HOUR OZONE NONATTAINMENT AREA

Lawrenceburg Township, Dearborn County, Indiana

Developed By:
The Indiana Department of Environmental Management

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LAWRENCEBURG TOWNSHIP, DEARBORN COUNTY, INDIANA

1.0 INTRODUCTION

On May 21, 2012, United States Environmental Protection Agency (U.S. EPA) designated Lawrenceburg Township in Dearborn County, Indiana as a portion of the Cincinnati-Hamilton, Ohio-Kentucky-Indiana (OH-KY-IN), 2008 8-Hour Ozone Nonattainment Area (77 FR 30118) and classified the area "Marginal" under Subpart 2 of Part D of Title I of the Clean Air Act (CAA). The CAA requires areas designated nonattainment for the National Ambient Air Quality Standards (NAAQS) for ozone to develop SIPs to expeditiously attain and maintain the standard.

Indiana is submitting this 2011 Base-Year Emissions Inventory for Indiana's Portion of the Cincinnati-Hamilton, OH-KY-IN, area in accordance with Section 182(a)(1) of the 1990 Clean Air Act Amendments (CAAA) and is part of the Request for Redesignation and Maintenance Plan for Attainment of Indiana's portion of the Cincinnati-Hamilton, OH-KY-IN, 2008 8-Hour Ozone Nonattainment Area.

2.0 BACKGROUND

The Cincinnati-Hamilton, OH-KY-IN area (which included Lawrenceburg Township, Dearborn County, Indiana) was subjected to nonattainment area rulemaking under the 1997 8-hour ozone standard. Indiana submitted the final Request for Redesignation and Maintenance Plan for Ozone Attainment of the 1997 8-Hour Ozone Nonattainment Area for Indiana's portion of the Cincinnati-Hamilton, OH-KY-IN, nonattainment area, Lawrenceburg Township in Dearborn County, Indiana on January 21, 2010. U.S. EPA subsequently redesignated Lawrenceburg Township to attainment and classified it as maintenance under the 1997 8-hour ozone standard on May 11, 2010.

On March 27, 2008, U.S. EPA significantly strengthened the 8-hour ozone standard to a level of 0.075 parts per million (ppm). An exceedance of the 2008 8-hour ozone NAAQS occurs when a monitor measures ozone above 0.075 ppm on average for an 8-hour period. A violation occurs when the average of the annual fourth highest daily maximum 8-hour ozone values over three consecutive years is greater than 0.075 ppm. This three-year average is termed the "design value" for the monitor. The design value for the nonattainment area is the highest monitor design value in the area. This designation subjected the area to requirements, including development of a plan to reduce oxides of nitrogen (NO_x) and volatile organic compounds (VOCs) emissions and a demonstration that the area would meet the 2008 8-hour ozone NAAQS by July 20, 2015. However, in the 2008 Ozone Implementation Rule, U.S. EPA extended the compliance date to December 31, 2015.[1]

[1] http://www.gpo.gov/fdsys/pkg/FR-2013-06-06/pdf/2013-13233.pdf

3.0 BASE-YEAR EMISSIONS INVENTORY

U.S. EPA's proposed 2008 ozone standard SIP requirements rule recommends states use 2011 as the base-year to fulfill the Emission Inventory requirements. The year 2011 is also a required reporting year for U.S. EPA's National Emissions Inventory (NEI) submission under the existing Air Emission Reporting Requirements Rule. NEIs are a collaborative process between U.S. EPA, states, localities, and tribes (S/L/T) to build a comprehensive national inventory.

In consultation with U.S. EPA, Kentucky, Ohio, and other stakeholders, the base-year of 2011 was selected for this demonstration. The Indiana Department of Environmental Management (IDEM) has prepared a comprehensive and accurate inventory of ozone precursor emissions (i.e. NO_x and VOCs) for Dearborn County, Indiana organized by anthropogenic source categories: electric-generating units (EGUs), non-EGUs, non-point (area), non-road, and on-road. IDEM's Office of Air Quality (OAQ) collects data, calculates, and stores emissions for point sources on an annual basis in the Emission Inventory Tracking System (EMITS). These point source emissions are uploaded to the NEI each year. Indiana has elected to use U.S. EPA's 2011 National Emissions Inventory (NEI)[2] for point, non-point, and non-road (area) anthropogenic emission sources. On-road values were back casted from emission factors produced by U.S. EPA's 2014 version of the MOVES software program. Biogenic emissions are not included in these summaries.

3.1 Point (EGU and Non-EGU)

Indiana submitted point source data through the Emission Inventory System (EIS) and has provided feedback to U.S. EPA on a variety of other estimates. Point Source data was collected through the Indiana's Emission Statement program (326 IAC 2-6). Data is collected electronically or submitted on hardcopy. All data is collated into the Emission Inventory Tracking System developed by the State of Indiana and submitted to U.S. EPA through the EIS Gateway. U.S. EPA has added to this inventory, incorporating data from various sources, such as data submitted to the Clean Air Markets Database, and adding other sources such as airport operations which are now handled as point sources in the database (see Section 3.11 of the "2011 National Emissions Inventory, version 2 Technical Support Document" Attachment 1).

3.2 Non-Point

Nonpoint sources were developed by U.S. EPA with comments provided by the state, see inset from section 3.1.7 U.S. EPA nonpoint data from the "2011 National Emissions Inventory, version 2 Technical Support Document" (Attachment 1);

[2] http://www3.epa.gov/ttn/chief/net/2011inventory.html

> For the 2011 NEI, the U.S. EPA developed emission estimates for many nonpoint sectors in collaboration with a consortium of state and regional planning organizations called the Eastern Regional Technical Advisory Committee (ERTAC, http://www.ertac.us/). This task is referred to by ERTAC as the "Area Source Comparability" project on the ERTAC website, and a subgroup was developed to work on this project. The purpose of the subgroup and project was to agree on methodologies, emission factors, and SCCs for a number of important nonpoint sectors, allowing U.S. EPA to prepare the emissions estimates for all states using the group's final approaches. During the 2011 NEI inventory development cycle, S/L/T agencies could accept the ERTAC/EPA estimates to fulfill their nonpoint emissions reporting requirements. U.S. EPA encouraged S/L/T agencies that did not use U.S. EPA's estimates or tools to improve upon these "default" methodologies and submit further improved data.

Section 3 Stationary sources details the emission estimation methods, sources of data for inputs, where states provided input and how controls were taken into account.

3.3 Non-Road

Nonroad sources were also developed by U.S. EPA using the National Mobile Inventory Model. See Section 4.5 of the "2011 National Emissions Inventory, version 2 Technical Support Document" (Attachment 1) for more information on the inputs and the estimation techniques.

3.4 On-Road

Onroad sources were estimated by the Ohio-Kentucky-Indiana Regional Council of Governments. As stated within the document;

> This report was prepared for the Ohio Environmental Protection Agency (Ohio EPA), the Kentucky Department for Air Quality (KDAQ), and IDEM. The Cincinnati 2008 Ozone Nonattainment Area includes a portion of Dearborn County Indiana, the counties of Boone, Campbell, Kenton in Kentucky, and the counties of Butler, Clermont, Clinton, Hamilton, and Warren in Ohio.

IDEM will be using these estimates for the Emissions Inventory to align with the Conformity Inventories. See Appendix F.

4.0 TEMPORAL ALLOCATION OF ANNUAL EMISSIONS

Indiana has used U.S. EPA's temporal files found on the Emissions Modeling Clearinghouse[3] to estimate the average ozone season day emissions following the guidance from the Greg Stella memo, "Temporal Allocation of Annual Emissions Using EMCH Temporal Profiles".[4]

[3] http://www3.epa.gov/ttn/chief/emch/index.html
[4] http://www3.epa.gov/ttn/chief/emch/temporal/temporal_factors_042902.pdf

4.1 Summary and Detailed Tables

The following tables contain summaries and detailed data on the Dearborn County Inventory. The tables show the tons per ozone season (unless otherwise noted) estimates based upon the U.S. EPA NEI data tables using the above and attached references.

Table 4.1 Tons Ozone Season Day Emissions by Data Category

County	Data Category	NOx	VOC
Dearborn	EGU	15.10	0.27
Dearborn	Nonpoint	0.40	1.75
Dearborn	Nonroad	0.63	0.46
Dearborn	Point	2.71	4.02
Dearborn	Onroad	0.86	1.03

Table 4.2 Tons per Ozone Season Day Emissions by SCC Level One

County	Data Category	SCC Level One	NOx	VOC
Dearborn	EGU	External Combustion Boilers	14.618	0.263
Dearborn	EGU	Internal Combustion Engines	0.481	0.007
Dearborn	Nonpoint	Industrial Processes	0.000	0.004
Dearborn	Nonpoint	Miscellaneous Area Sources	0.001	0.000
Dearborn	Nonpoint	Mobile Sources	0.131	0.006
Dearborn	Nonpoint	Solvent Utilization		0.961
Dearborn	Nonpoint	Stationary Source Fuel Combustion	0.210	0.424
Dearborn	Nonpoint	Storage and Transport		0.234
Dearborn	Nonpoint	Waste Disposal, Treatment, and Recovery	0.057	0.119
Dearborn	Nonroad	Mobile Sources	0.633	0.458
Dearborn	Point	External Combustion Boilers	1.461	0.005
Dearborn	Point	Industrial Processes	0.815	2.572
Dearborn	Point	Internal Combustion Engines	0.432	0.019
Dearborn	Point	Mobile Sources	0.000	0.000
Dearborn	Point	Petroleum and Solvent Evaporation	0.000	1.424
Dearborn	Onroad	Mobile	0.86	1.03

Table 4.3 Tons per Ozone Season Day Emissions by SCC Level Two

County	Data Category	SCC Level One	SCC Level Two	NOx	VOC
Dearborn	EGU	External Combustion Boilers	Electric Generation	14.618	0.263
Dearborn	EGU	Internal Combustion Engines	Electric Generation	0.481	0.007
Dearborn	Nonpoint	Industrial Processes	Food and Kindred Products: SIC 20		0.004
Dearborn	Nonpoint	Industrial Processes	Oil and Gas Exploration and Production	0.000	0.000
Dearborn	Nonpoint	Miscellaneous Area Sources	Agriculture Production - Crops - as nonpoint	0.000	0.000
Dearborn	Nonpoint	Miscellaneous Area Sources	Other Combustion	0.000	0.000
Dearborn	Nonpoint	Mobile Sources	Marine Vessels, Commercial	0.000	0.000
Dearborn	Nonpoint	Mobile Sources	Railroad Equipment	0.131	0.006
Dearborn	Nonpoint	Solvent Utilization	Dry Cleaning		0.001
Dearborn	Nonpoint	Solvent Utilization	Graphic Arts		0.002
Dearborn	Nonpoint	Solvent Utilization	Miscellaneous Non-industrial: Commercial		0.092
Dearborn	Nonpoint	Solvent Utilization	Miscellaneous Non-industrial: Consumer and Commercial		0.574
Dearborn	Nonpoint	Solvent Utilization	Surface Coating		0.293
Dearborn	Nonpoint	Stationary Source Fuel Combustion	Commercial/Institutional	0.082	0.003
Dearborn	Nonpoint	Stationary Source Fuel Combustion	Industrial	0.015	0.001
Dearborn	Nonpoint	Stationary Source Fuel Combustion	Residential	0.112	0.420
Dearborn	Nonpoint	Storage and Transport	Petroleum and Petroleum Product Storage		0.231
Dearborn	Nonpoint	Storage and Transport	Petroleum and Petroleum Product Transport		0.003
Dearborn	Nonpoint	Waste Disposal, Treatment, and Recovery	Open Burning	0.057	0.117
Dearborn	Nonpoint	Waste Disposal, Treatment, and Recovery	Wastewater Treatment		0.003
Dearborn	Nonroad	Mobile Sources	CNG	0.002	0.000
Dearborn	Nonroad	Mobile Sources	LPG	0.024	0.006
Dearborn	Nonroad	Mobile Sources	Off-highway Vehicle Diesel	0.519	0.045
Dearborn	Nonroad	Mobile Sources	Off-highway Vehicle Gasoline, 2-Stroke	0.002	0.081
Dearborn	Nonroad	Mobile Sources	Off-highway Vehicle Gasoline, 4-Stroke	0.050	0.190
Dearborn	Nonroad	Mobile Sources	Pleasure Craft	0.036	0.136

Dearborn	Nonroad	Mobile Sources	Railroad Equipment	0.000	0.000
Dearborn	Point	External Combustion Boilers	Commercial/Institutional	1.461	0.005
Dearborn	Point	External Combustion Boilers	Industrial	0.000	0.000
Dearborn	Point	Industrial Processes	Food and Agriculture		2.545
Dearborn	Point	Industrial Processes	In-process Fuel Use	0.010	0.001
Dearborn	Point	Industrial Processes	Mineral Products	0.805	0.026
Dearborn	Point	Industrial Processes	Miscellaneous Manufacturing Industries		0.000
Dearborn	Point	Internal Combustion Engines	Industrial	0.432	0.019
Dearborn	Point	Mobile Sources	Aircraft	0.000	0.000
Dearborn	Point	Petroleum and Solvent Evaporation	Organic Chemical Storage		0.054
Dearborn	Point	Petroleum and Solvent Evaporation	Organic Solvent Evaporation		0.029
Dearborn	Point	Petroleum and Solvent Evaporation	Petroleum Liquids Storage (non-Refinery)		0.000
Dearborn	Point	Petroleum and Solvent Evaporation	Surface Coating Operations	0.000	1.340
Dearborn	Onroad	Mobile	On Highway	0.86	1.03

Table 4.4 Tons per Ozone Season Day Emissions by SCC

County	Data Category	SCC	NOx	VOC
Dearborn	EGU	10100202	5.406	0.049
Dearborn	EGU	10100203	9.191	0.215
Dearborn	EGU	10100501	0.020	0.000
Dearborn	EGU	20100201	0.481	0.007
Dearborn	Nonpoint	2102001000	0.000	0.000
Dearborn	Nonpoint	2102002000	0.000	0.000
Dearborn	Nonpoint	2102004001	0.000	0.000
Dearborn	Nonpoint	2102004002	0.000	0.000
Dearborn	Nonpoint	2102005000	0.000	0.000
Dearborn	Nonpoint	2102006000	0.014	0.001
Dearborn	Nonpoint	2102007000	0.000	0.000
Dearborn	Nonpoint	2102008000	0.001	0.000
Dearborn	Nonpoint	2102011000	0.000	0.000
Dearborn	Nonpoint	2103001000	0.000	0.000
Dearborn	Nonpoint	2103002000	0.000	0.000
Dearborn	Nonpoint	2103004001	0.001	0.000
Dearborn	Nonpoint	2103004002	0.026	
Dearborn	Nonpoint	2103005000	0.000	0.000
Dearborn	Nonpoint	2103006000	0.051	0.003
Dearborn	Nonpoint	2103007000	0.000	0.000
Dearborn	Nonpoint	2103008000	0.003	0.000
Dearborn	Nonpoint	2103011000	0.000	0.000
Dearborn	Nonpoint	2104001000	0.000	0.000
Dearborn	Nonpoint	2104002000	0.000	0.000
Dearborn	Nonpoint	2104004000	0.003	0.000
Dearborn	Nonpoint	2104006000	0.031	0.002
Dearborn	Nonpoint	2104007000	0.048	0.002
Dearborn	Nonpoint	2104008100	0.002	0.017
Dearborn	Nonpoint	2104008210	0.002	0.037
Dearborn	Nonpoint	2104008220	0.001	0.003
Dearborn	Nonpoint	2104008230	0.000	0.001
Dearborn	Nonpoint	2104008310	0.002	0.045
Dearborn	Nonpoint	2104008320	0.001	0.003
Dearborn	Nonpoint	2104008330	0.000	0.001
Dearborn	Nonpoint	2104008400	0.001	0.000
Dearborn	Nonpoint	2104008510	0.008	0.052
Dearborn	Nonpoint	2104008610	0.007	0.241
Dearborn	Nonpoint	2104008700	0.001	0.009
Dearborn	Nonpoint	2104009000	0.001	0.008

Dearborn	Nonpoint	2104011000	0.003	0.000
Dearborn	Nonpoint	2280002200	0.000	0.000
Dearborn	Nonpoint	2285002006	0.074	0.004
Dearborn	Nonpoint	2285002007	0.057	0.002
Dearborn	Nonpoint	2302002100		0.001
Dearborn	Nonpoint	2302002200		0.002
Dearborn	Nonpoint	2302003000		0.000
Dearborn	Nonpoint	2302003100		0.000
Dearborn	Nonpoint	2302003200		0.000
Dearborn	Nonpoint	2310000220	0.000	0.000
Dearborn	Nonpoint	2310000330	0.000	0.000
Dearborn	Nonpoint	2310000550		0.000
Dearborn	Nonpoint	2310000660	0.000	0.000
Dearborn	Nonpoint	2310010100	0.000	0.000
Dearborn	Nonpoint	2310010200	0.000	0.000
Dearborn	Nonpoint	2310010300		0.000
Dearborn	Nonpoint	2310011000	0.000	0.000
Dearborn	Nonpoint	2310011201		0.000
Dearborn	Nonpoint	2310011501		0.000
Dearborn	Nonpoint	2310011502		0.000
Dearborn	Nonpoint	2310011503		0.000
Dearborn	Nonpoint	2310011505		0.000
Dearborn	Nonpoint	2310021010	0.000	0.000
Dearborn	Nonpoint	2310021030		0.000
Dearborn	Nonpoint	2310021100	0.000	0.000
Dearborn	Nonpoint	2310021202	0.000	0.000
Dearborn	Nonpoint	2310021251	0.000	0.000
Dearborn	Nonpoint	2310021300		0.000
Dearborn	Nonpoint	2310021302	0.000	0.000
Dearborn	Nonpoint	2310021351	0.000	0.000
Dearborn	Nonpoint	2310021400	0.000	0.000
Dearborn	Nonpoint	2310021501		0.000
Dearborn	Nonpoint	2310021502		0.000
Dearborn	Nonpoint	2310021503		0.000
Dearborn	Nonpoint	2310021505		0.000
Dearborn	Nonpoint	2310021506		0.000
Dearborn	Nonpoint	2310021603	0.000	0.000
Dearborn	Nonpoint	2310111100		0.000
Dearborn	Nonpoint	2310111401		0.000
Dearborn	Nonpoint	2310121100		0.000
Dearborn	Nonpoint	2310121401		0.000

Dearborn	Nonpoint	2310121700	0.000	0.000
Dearborn	Nonpoint	2401001000		0.160
Dearborn	Nonpoint	2401005000		0.022
Dearborn	Nonpoint	2401008000		0.000
Dearborn	Nonpoint	2401015000		0.001
Dearborn	Nonpoint	2401020000		0.011
Dearborn	Nonpoint	2401055000		0.003
Dearborn	Nonpoint	2401090000		0.050
Dearborn	Nonpoint	2401100000		0.041
Dearborn	Nonpoint	2401200000		0.004
Dearborn	Nonpoint	2420000000		0.001
Dearborn	Nonpoint	2425000000		0.002
Dearborn	Nonpoint	2460100000		0.129
Dearborn	Nonpoint	2460200000		0.123
Dearborn	Nonpoint	2460400000		0.093
Dearborn	Nonpoint	2460500000		0.065
Dearborn	Nonpoint	2460600000		0.039
Dearborn	Nonpoint	2460800000		0.121
Dearborn	Nonpoint	2460900000		0.005
Dearborn	Nonpoint	2461021000		0.002
Dearborn	Nonpoint	2461022000		0.010
Dearborn	Nonpoint	2461850000		0.080
Dearborn	Nonpoint	2501011011		0.020
Dearborn	Nonpoint	2501011012		0.039
Dearborn	Nonpoint	2501011014		0.002
Dearborn	Nonpoint	2501012011		0.001
Dearborn	Nonpoint	2501012012		0.001
Dearborn	Nonpoint	2501012014		0.003
Dearborn	Nonpoint	2501050120		0.000
Dearborn	Nonpoint	2501055120		0.000
Dearborn	Nonpoint	2501060051		0.000
Dearborn	Nonpoint	2501060052		0.057
Dearborn	Nonpoint	2501060053		0.041
Dearborn	Nonpoint	2501060201		0.051
Dearborn	Nonpoint	2501080050		0.015
Dearborn	Nonpoint	2501080100		0.001
Dearborn	Nonpoint	2505030120		0.003
Dearborn	Nonpoint	2505040120		0.000
Dearborn	Nonpoint	2610000100	0.001	0.005
Dearborn	Nonpoint	2610000400	0.001	0.003
Dearborn	Nonpoint	2610000500	0.034	0.078

Dearborn	Nonpoint	2610030000	0.022	0.031
Dearborn	Nonpoint	2630020000		0.003
Dearborn	Nonpoint	2801500000	0.000	0.000
Dearborn	Nonpoint	2810060100	0.000	0.000
Dearborn	Nonroad	2260002006	0.000	0.001
Dearborn	Nonroad	2260002009	0.000	0.000
Dearborn	Nonroad	2260002021	0.000	0.000
Dearborn	Nonroad	2260002027	0.000	0.000
Dearborn	Nonroad	2260002039	0.000	0.007
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Dearborn	Nonroad	2260003030	0.000	0.000
Dearborn	Nonroad	2260003040	0.000	0.000
Dearborn	Nonroad	2260004015	0.000	0.000
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Dearborn	Nonroad	2260004020	0.000	0.006
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Dearborn	Nonroad	2260004026	0.000	0.007
Dearborn	Nonroad	2260004030	0.000	0.005
Dearborn	Nonroad	2260004031	0.000	0.007
Dearborn	Nonroad	2260004035	0.000	0.007
Dearborn	Nonroad	2260004036	0.000	0.011
Dearborn	Nonroad	2260004071	0.000	0.000
Dearborn	Nonroad	2260005035	0.000	0.000
Dearborn	Nonroad	2260006005	0.000	0.000
Dearborn	Nonroad	2260006010	0.000	0.003
Dearborn	Nonroad	2260006015	0.000	0.000
Dearborn	Nonroad	2260006035	0.000	0.000
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Dearborn	Nonroad	2265002024	0.000	0.000
Dearborn	Nonroad	2265002027	0.000	0.000
Dearborn	Nonroad	2265002030	0.001	0.002
Dearborn	Nonroad	2265002033	0.000	0.000
Dearborn	Nonroad	2265002039	0.001	0.001
Dearborn	Nonroad	2265002042	0.000	0.000

Dearborn	Nonroad	2265002045	0.000	0.000
Dearborn	Nonroad	2265002054	0.000	0.000
Dearborn	Nonroad	2265002057	0.000	0.000
Dearborn	Nonroad	2265002060	0.001	0.001
Dearborn	Nonroad	2265002066	0.001	0.001
Dearborn	Nonroad	2265002072	0.000	0.000
Dearborn	Nonroad	2265002078	0.000	0.000
Dearborn	Nonroad	2265002081	0.000	0.000
Dearborn	Nonroad	2265003010	0.000	0.000
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Dearborn	Nonroad	2265003030	0.000	0.000
Dearborn	Nonroad	2265003040	0.000	0.000
Dearborn	Nonroad	2265003050	0.000	0.000
Dearborn	Nonroad	2265003060	0.000	0.000
Dearborn	Nonroad	2265003070	0.000	0.000
Dearborn	Nonroad	2265004010	0.003	0.034
Dearborn	Nonroad	2265004011	0.001	0.008
Dearborn	Nonroad	2265004015	0.000	0.003
Dearborn	Nonroad	2265004016	0.001	0.005
Dearborn	Nonroad	2265004025	0.000	0.000
Dearborn	Nonroad	2265004026	0.000	0.000
Dearborn	Nonroad	2265004030	0.000	0.000
Dearborn	Nonroad	2265004031	0.001	0.003
Dearborn	Nonroad	2265004035	0.000	0.003
Dearborn	Nonroad	2265004036	0.001	0.003
Dearborn	Nonroad	2265004040	0.001	0.004
Dearborn	Nonroad	2265004041	0.000	0.000
Dearborn	Nonroad	2265004046	0.000	0.001
Dearborn	Nonroad	2265004051	0.000	0.001
Dearborn	Nonroad	2265004055	0.009	0.036
Dearborn	Nonroad	2265004056	0.002	0.004
Dearborn	Nonroad	2265004066	0.000	0.001
Dearborn	Nonroad	2265004071	0.006	0.015
Dearborn	Nonroad	2265004075	0.000	0.002
Dearborn	Nonroad	2265004076	0.000	0.001
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Dearborn	Nonroad	2265005025	0.000	0.000
Dearborn	Nonroad	2265005030	0.000	0.000
Dearborn	Nonroad	2265005035	0.000	0.001

Dearborn	Nonroad	2265005040	0.000	0.001
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Dearborn	Nonroad	2265005055	0.000	0.000
Dearborn	Nonroad	2265005060	0.000	0.000
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Dearborn	Nonroad	2265006010	0.002	0.005
Dearborn	Nonroad	2265006015	0.001	0.002
Dearborn	Nonroad	2265006025	0.002	0.004
Dearborn	Nonroad	2265006030	0.003	0.010
Dearborn	Nonroad	2265006035	0.000	0.000
Dearborn	Nonroad	2265007010	0.000	0.001
Dearborn	Nonroad	2265007015	0.000	0.000
Dearborn	Nonroad	2267002003	0.000	0.000
Dearborn	Nonroad	2267002015	0.000	0.000
Dearborn	Nonroad	2267002021	0.000	0.000
Dearborn	Nonroad	2267002024	0.000	0.000
Dearborn	Nonroad	2267002030	0.000	0.000
Dearborn	Nonroad	2267002033	0.000	0.000
Dearborn	Nonroad	2267002039	0.000	0.000
Dearborn	Nonroad	2267002045	0.000	0.000
Dearborn	Nonroad	2267002054	0.000	0.000
Dearborn	Nonroad	2267002057	0.000	0.000
Dearborn	Nonroad	2267002060	0.000	0.000
Dearborn	Nonroad	2267002066	0.000	0.000
Dearborn	Nonroad	2267002072	0.000	0.000
Dearborn	Nonroad	2267002081	0.000	0.000
Dearborn	Nonroad	2267003010	0.000	0.000
Dearborn	Nonroad	2267003020	0.019	0.005
Dearborn	Nonroad	2267003030	0.000	0.000
Dearborn	Nonroad	2267003040	0.000	0.000
Dearborn	Nonroad	2267003050	0.000	0.000
Dearborn	Nonroad	2267003070	0.000	0.000
Dearborn	Nonroad	2267004066	0.000	0.000
Dearborn	Nonroad	2267005055	0.000	0.000
Dearborn	Nonroad	2267005060	0.000	0.000
Dearborn	Nonroad	2267006005	0.002	0.000
Dearborn	Nonroad	2267006010	0.000	0.000
Dearborn	Nonroad	2267006015	0.000	0.000
Dearborn	Nonroad	2267006025	0.000	0.000
Dearborn	Nonroad	2267006030	0.000	0.000
Dearborn	Nonroad	2267006035	0.000	0.000

Dearborn	Nonroad	2268002081	0.000	0.000
Dearborn	Nonroad	2268003020	0.001	0.000
Dearborn	Nonroad	2268003030	0.000	0.000
Dearborn	Nonroad	2268003040	0.000	0.000
Dearborn	Nonroad	2268003060	0.000	0.000
Dearborn	Nonroad	2268003070	0.000	0.000
Dearborn	Nonroad	2268005055	0.000	0.000
Dearborn	Nonroad	2268005060	0.000	0.000
Dearborn	Nonroad	2268006005	0.001	0.000
Dearborn	Nonroad	2268006010	0.000	0.000
Dearborn	Nonroad	2268006015	0.000	0.000
Dearborn	Nonroad	2268006020	0.000	0.000
Dearborn	Nonroad	2270002003	0.001	0.000
Dearborn	Nonroad	2270002006	0.000	0.000
Dearborn	Nonroad	2270002009	0.000	0.000
Dearborn	Nonroad	2270002015	0.006	0.001
Dearborn	Nonroad	2270002018	0.024	0.001
Dearborn	Nonroad	2270002021	0.001	0.000
Dearborn	Nonroad	2270002024	0.001	0.000
Dearborn	Nonroad	2270002027	0.000	0.000
Dearborn	Nonroad	2270002030	0.004	0.000
Dearborn	Nonroad	2270002033	0.008	0.001
Dearborn	Nonroad	2270002036	0.048	0.004
Dearborn	Nonroad	2270002039	0.001	0.000
Dearborn	Nonroad	2270002042	0.000	0.000
Dearborn	Nonroad	2270002045	0.007	0.000
Dearborn	Nonroad	2270002048	0.012	0.001
Dearborn	Nonroad	2270002051	0.043	0.003
Dearborn	Nonroad	2270002054	0.006	0.000
Dearborn	Nonroad	2270002057	0.006	0.000
Dearborn	Nonroad	2270002060	0.056	0.004
Dearborn	Nonroad	2270002066	0.019	0.004
Dearborn	Nonroad	2270002069	0.056	0.004
Dearborn	Nonroad	2270002072	0.007	0.002
Dearborn	Nonroad	2270002075	0.006	0.000
Dearborn	Nonroad	2270002078	0.000	0.000
Dearborn	Nonroad	2270002081	0.006	0.000
Dearborn	Nonroad	2270003010	0.001	0.000
Dearborn	Nonroad	2270003020	0.006	0.000
Dearborn	Nonroad	2270003030	0.003	0.000
Dearborn	Nonroad	2270003040	0.004	0.000

Dearborn	Nonroad	2270003050	0.000	0.000
Dearborn	Nonroad	2270003060	0.017	0.001
Dearborn	Nonroad	2270003070	0.003	0.000
Dearborn	Nonroad	2270004031	0.000	0.000
Dearborn	Nonroad	2270004036	0.000	0.000
Dearborn	Nonroad	2270004046	0.003	0.000
Dearborn	Nonroad	2270004056	0.001	0.000
Dearborn	Nonroad	2270004066	0.004	0.000
Dearborn	Nonroad	2270004071	0.000	0.000
Dearborn	Nonroad	2270004076	0.000	0.000
Dearborn	Nonroad	2270005010	0.000	0.000
Dearborn	Nonroad	2270005015	0.112	0.010
Dearborn	Nonroad	2270005020	0.012	0.001
Dearborn	Nonroad	2270005025	0.000	0.000
Dearborn	Nonroad	2270005030	0.000	0.000
Dearborn	Nonroad	2270005035	0.001	0.000
Dearborn	Nonroad	2270005040	0.000	0.000
Dearborn	Nonroad	2270005045	0.001	0.000
Dearborn	Nonroad	2270005055	0.002	0.000
Dearborn	Nonroad	2270005060	0.001	0.000
Dearborn	Nonroad	2270006005	0.012	0.001
Dearborn	Nonroad	2270006010	0.003	0.000
Dearborn	Nonroad	2270006015	0.006	0.001
Dearborn	Nonroad	2270006025	0.003	0.001
Dearborn	Nonroad	2270006030	0.000	0.000
Dearborn	Nonroad	2270006035	0.000	0.000
Dearborn	Nonroad	2270007015	0.004	0.000
Dearborn	Nonroad	2282005010	0.008	0.105
Dearborn	Nonroad	2282005015	0.002	0.014
Dearborn	Nonroad	2282010005	0.014	0.016
Dearborn	Nonroad	2282020005	0.013	0.001
Dearborn	Nonroad	2282020010	0.000	0.000
Dearborn	Nonroad	2285002015	0.000	0.000
Dearborn	Nonroad	2285004015	0.000	0.000
Dearborn	Nonroad	2285006015	0.000	0.000
Dearborn	Point	10200602	0.000	0.000
Dearborn	Point	10300205	1.455	0.005
Dearborn	Point	10300401	0.000	0.000
Dearborn	Point	10300601	0.006	0.001
Dearborn	Point	20200102	0.001	0.000
Dearborn	Point	20200252	0.276	0.010

Dearborn	Point	20200253	0.155	0.009
Dearborn	Point	2275050011	0.000	0.000
Dearborn	Point	2275050012	0.000	0.000
Dearborn	Point	30201002		0.019
Dearborn	Point	30201004		0.027
Dearborn	Point	30201010		2.372
Dearborn	Point	30201199		0.004
Dearborn	Point	30288801		0.124
Dearborn	Point	30501402	0.805	0.026
Dearborn	Point	39000699	0.010	0.001
Dearborn	Point	39000989	0.000	0.000
Dearborn	Point	39999989		0.000
Dearborn	Point	40100205		0.029
Dearborn	Point	40200101		0.404
Dearborn	Point	40200401		0.147
Dearborn	Point	40200601	0.000	0.075
Dearborn	Point	40200710		0.000
Dearborn	Point	40200901		0.705
Dearborn	Point	40299998		0.009
Dearborn	Point	40400414		0.000
Dearborn	Point	40700809		0.032
Dearborn	Point	40700810		0.023
Dearborn	Onroad		0.86	1.03

Table 4.5 Point Source Emissions (Tons per Year)

County	SCC Level Two	NOx	VOC
Dearborn	Aircraft	1.63793981481481E-05	3.52189379084967E-05
Dearborn	Commercial/Institutional	1.46097374335119	5.25321743311939E-03
Dearborn	Electric Generation	15.0981352207556	0.270365129750509
Dearborn	Food and Agriculture		2.5453284218169
Dearborn	Industrial	0.432571965642113	1.88359780381689E-02
Dearborn	In-process Fuel Use	1.01307189542484E-02	5.38834422657952E-04
Dearborn	Mineral Products	0.805038126361656	0.025968954248366
Dearborn	Miscellaneous Manufacturing Industries		0
Dearborn	Organic Chemical Storage		0.054348916023867
Dearborn	Organic Solvent Evaporation		2.93980666118743E-02
Dearborn	Petroleum Liquids Storage (non-Refinery)		1.4111366268229E-05
Dearborn	Surface Coating Operations	0	1.33993492680407

Table 4.5 Point Source Emissions (Tons per Ozone Season Day)

County	SCC Level Two	NOx	VOC
Dearborn	Aircraft	1.63793981481481E-05	3.52189379084967E-05
Dearborn	Commercial/Institutional	1.46097374335119	5.25321743311939E-03
Dearborn	Electric Generation	15.0981352207556	0.270365129750509
Dearborn	Food and Agriculture		2.5453284218169
Dearborn	Industrial	0.432571965642113	1.88359780381689E-02
Dearborn	In-process Fuel Use	1.01307189542484E-02	5.38834422657952E-04
Dearborn	Mineral Products	0.805038126361656	0.025968954248366
Dearborn	Miscellaneous Manufacturing Industries		0
Dearborn	Organic Chemical Storage		0.054348916023867
Dearborn	Organic Solvent Evaporation		2.93980666118743E-02
Dearborn	Petroleum Liquids Storage (non-Refinery)		1.4111366268229E-05

Technical Support Document (TSD)

Preparation of Emissions Inventories for the Version 6.1, 2011 Emissions Modeling Platform

November 30, 2014

U.S. Environmental Protection Agency
Office of Air and Radiation
Office of Air Quality Planning and Standards
Air Quality Assessment Division

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Acronyms

ACI	Activated Carbon Injection
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
AIM	Architectural and Industrial Maintenance (coatings)
ARW	Advanced Research WRF
BAFM	Benzene, Acetaldehyde, Formaldehyde and Methanol
BEIS3.14	Biogenic Emissions Inventory System, version 3.14
BELD3	Biogenic Emissions Land use Database, version 3
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 Incineration
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 (2010b) -- OTAQ's model for estimation of onroad mobile emissions – replaces the use of the MOBILE model
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
RRF	Relative Response Factor
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
WGA	Western Governors' Association
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 for 2011 based on the 2011 National Emissions Inventory, version 1 (2011NEIv1). 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 2011 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 2011NEIv1, although there are some differences between the platform inventories and the 2011NEIv1 emissions.

This 2011 modeling platform includes all criteria air pollutants and precursors (CAPs) and the following hazardous air pollutants (HAPs): chlorine (Cl), hydrogen chloride (HCl), benzene, acetaldehyde, formaldehyde and methanol. The latter four HAPs are also abbreviated as BAFM. This platform is called the "CAP-BAFM 2011-Based Platform, version 6.1" because it is primarily a CAP platform with BAFM species included. Here, "version 6.1" denotes an evolution from the 2011-based platform, version 6, with improvements due to the use of newer data and methods. For the rest of this document, the platform that is described is referred to as the "2011 platform" or "2011v6.1". Future updates to the 2011 platform will include a version qualifier such as "2011 Platform v6.2", and so on.

The 2011v6.1 platform was used to support the 2015 National Ambient Air Quality Standards (NAAQS) for ozone along with other special studies. The air quality model used for this rule is the Comprehensive Air Quality Model with Extensions (CAM_X) model (http://www.camx.com/), version 6.10; however, emissions are first processed for the Community Multiscale Air Quality (CMAQ) model (http://www.epa.gov/AMD/CMAQ/), version 5.0.1 and then converted to CAM_X-ready format. Both CAM_X and CMAQ support modeling ozone (O_3) and particulate matter (PM), and require as input hourly and gridded emissions of chemical species that correspond to CAPs and specific HAPs. The chemical mechanism used by CAM_X for this platform is called Carbon Bond 2005 (CB05) with chlorine chemistry. CB05 allows explicit treatment of BAFM and includes HAP emissions of HCl and Cl.

The 2011v6.1 platform consists of three 'complete' emissions cases: the 2011 base case (i.e., 2011ef_v6), the 2018 base case (i.e., 2018ef_v6) and the 2025 base case (i.e., 2025ef_v6). In the case abbreviations, the 2011, 2018 and 2025 are the year represented by the emissions; the "e" stands for evaluation, meaning that year-specific data for fires and EGUs are used, and the "f" represents that this was the sixth set of emissions modeled for the 2011v6.x platform, where "x" represents "1" for the set of emissions documented in this technical support document (TSD). Table 1-1 provides more information on these emissions cases. The purpose of the 2011 base case is to represent the year 2011 in a manner consistent with the methods used in corresponding future-year cases, including the 2018 and 2025 future year base cases, as well as any additional future year control and source apportionment cases.

For regulatory applications, the outputs from the 2011 base case are used in conjunction with the outputs from the 2018 and 2025 base cases in the relative response factor (RRF) calculations to identify future areas of nonattainment. For more information on the use of RRFs and air quality modeling, see "Guidance on the Use of Models and Other Analyses for Demonstrating Attainment of Air Quality Goals for Ozone, PM 2.5, and Regional Haze", available from http://www.epa.gov/ttn/scram/guidance/guide/final-03-pm-rh-guidance.pdf. This document is available on EPA's Emissions Modeling Clearinghouse website, http://www.epa.gov/ttn/chief/emch/, under the section entitled "2011-based Modeling Platform (2011v6 Platform)".

Table 1-1. List of cases in the 2011 Version 6 Emissions Modeling Platform

Case Name	Abbreviation	Description
2011 base case	2011ef_v6	2011 case relevant for air quality model evaluation purposes and for computing relative response factors with 2018 and 2025 scenario(s). Uses 2011NEIv1 and some other inventory data, with hourly 2011 continuous emissions monitoring System (CEMS) data for Electrical Generating Units (EGUs), hourly onroad mobile emissions, and 2011 day-specific wild and prescribed fire data.
2018 base case	2018ef_v6	2018 "base case" scenario, representing the best estimate for the future year that incorporates estimates of the impact of current "on-the-books" regulations, without including implementation of controls needed to attain current $PM_{2.5}$ annual and 24-hour standards (12 µg/m^3 and 35 µg/m^3, respectively) and ozone 8-hour standard (75 ppb).
2025 base case	2025ef_v6	2025 "base case" scenario, representing the best estimate for the future year that incorporates estimates of the impact of current "on-the-books" regulations, without including implementation of controls needed to attain current $PM_{2.5}$ annual and 24-hour standards (12 µg/m^3 and 35 µg/m^3, respectively) and ozone 8-hour standard (75 ppb).

A brief summary of the emissions data used in the 2011v6.1 platform follows:

1) Point and nonpoint sources are based on the 2011NEIv1.
2) Onroad mobile sources are based on year 2011 emissions computed using the Sparse Matrix Operator Kernel Emission (SMOKE) interface to emission factors developed with the version of Motor Vehicle Emissions Simulator (MOVES) that represents the final Tier 3 Vehicle Emission and Fuel Standards (http://www.epa.gov/OTAQ/tier3.htm).
3) Nonroad mobile sources are based on the 2011NEIv1, except for some additions of VOC in California where there were HAP emissions but no VOCs in 2011NEIv1.
4) Commercial marine vessels (CMV) are based on the 2011NEIv1, 2010 regional planning organization (RPO) inventories in the Midwest, and a separate year-2002-based (projected to 2011) inventory for Class 3 CMV vessels. Additional minor changes were made to point sources as described in Section 2.1.

The 2011v6.1 platform cases are very similar to the 2011v6 cases 2011ed and 2018ed that were released for public comment via the Federal Register notices 78 FR 70935 and 79 FR 2437, respectively. The differences in the 2011ef and 2018ef cases were: the commercial marine vessel emissions in California used state-provided values, MOVES Tier3FRM was used for onroad mobile source emissions, updated spatial surrogates were used for oil and gas emissions, and the meteorological fields used. The latter of which affected biogenic emissions, the meteorologically-adjusted values of fugitive dust emissions, and the temporal profiles for agricultural and residential wood emissions. Due to the timing of the modeling, these cases do not reflect incorporation of any comments provided from the Federal Register notices.

The primary emissions modeling tool used to create the air quality model-ready emissions was the SMOKE modeling system (http://www.smoke-model.org/). SMOKE version 3.5.1 was used to create emissions files for a 12-km national grid that includes all of the contiguous states "12US2", shown in

Figure 3-1. Boundary conditions for this grid were obtained from a 2011 run of GEOS-Chem (http://geos-chem.org/). Electronic copies of the data used as input to SMOKE for the 2011 Platform are available from the Emissions Modeling Clearinghouse website, http://www.epa.gov/ttn/chief/emch/.

The gridded meteorological model used for the emissions modeling was developed using the Weather Research and Forecasting Model (WRF, http://wrf-model.org) version 3.4, Advanced Research WRF (ARW) core (Skamarock, et al., 2008). The WRF Model is a mesoscale numerical weather prediction system developed for both operational forecasting and atmospheric research applications. WRF was run for 2011 over a domain covering the continental United States at a 12km resolution with 35 vertical layers. The WRF data was 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 "11g".

This document contains five sections and several appendices. Section 2 describes the 2011 inventories input to SMOKE. Section 3 describes the emissions modeling and the ancillary files used with the emission inventories. Section 4, describes the development of the 2018 and 2025 inventories (projected from 2011). Data summaries comparing the 2011, 2018 and 2025 base cases are provided in Section 5. Section 6 provides references. The Appendices provide additional details about specific technical methods.

2 2011 Emission Inventories and Approaches

This section describes the 2011 emissions data that make up the 2011 platform. The starting point for the 2011 stationary source emission inputs is the 2011NEIv1. Emissions of NO_X, SO_2, VOC and PM emissions decrease from values in the 2008 NEI version 3 for most source sectors, with a couple of notable exceptions including increased industrial NO_X, VOC and CO associated with increased oil and gas sector emissions and improved emission estimates; slightly increased VOC, CO and NH_3 from fuel combustion; and increased wildfire emissions. Documentation for the 2011NEIv1, including a Technical Support Document (TSD), is available at http://www.epa.gov/ttn/chief/net/2011inventory.html#inventorydoc.

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 state data, but are often augmented by EPA because they are voluntarily submitted. EPA uses the Emissions Inventory System (EIS) to compile the NEI. EIS includes hundreds of automated QA checks to help improve data quality, and also supports tracking release point (e.g., stack) coordinates separately from facility coordinates. EPA collaborated extensively with S/L/T agencies to ensure a high quality of data in the 2011NEIv1. Tangible benefits of this collaboration are seen in improved data quality from past first version inventories, improved completeness and avoided duplication between point and nonpoint source categories such as industrial boilers. Onroad mobile source emissions in the 2011NEIv1 were developed using MOVES2010b; however, the 2011 emissions modeling platform used a different version of MOVES, hence forth referred to as "MOVESTier3FRM" that facilitated the representation of the final Tier 3 standards in future years. When given the same inputs, these two versions of MOVES produce similar emissions estimates for the year 2011.

The 2011 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 2011NEIv1 uses 60 sectors to further describe the emissions, with an additional biogenic sector generated from a summation of the gridded, hourly 2011 biogenic data used in the 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 2011 platform. As explained below, the non-NEI emissions component to the 2011 platform primarily includes: different version of MOVES-based onroad mobile source emissions, non-meteorologically-adjusted road dust, year-2010 commercial marine vessel (CMV) emissions in the Midwest (http://www.ladco.org/), and Class 3 CMV data developed by EPA.

Fire emissions in 2011NEIv2 were developed based on Version 2 of the Satellite Mapping Automated Reanalysis Tool for Fire Incident Reconciliation (SMARTFIRE) system (Sullivan, et al., 2008). SMARTFIRE2 was the first version of SMARTFIRE to assign all fires as either prescribed burning or wildfire categories. In past inventories, a significant number of fires were published as unclassified, which impacted the emissions values and diurnal emissions pattern. Recent updates to SMARTFIRE include improved emission factors for prescribed burning.

For the purposes of preparing the air quality model-ready emissions, the 2011NEIv1 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. For CAMx applications, the CMAQ-ready emissions are then converted into the format needed by CAMx by a convertor program.

Table 2-1 presents the sectors in the 2011 platform and how they generally relate to the 2011NEIv1 as a starting point. As discussed in greater detail in Table 2-2, the emissions in some of these sectors were modified from the 2011NEIv1 emissions for the 2011 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 2011 emissions modeling platform

Platform Sector: *abbreviation*	NEI Data Category	Description and resolution of the data input to SMOKE
EGU non-peaking units: ***ptegu***	Point	2011 NEI point source EGUs determined to operate as non-peaking units based on criteria discussed in Section 2.1. For future year emissions, these units are mapped to the Integrated Planning Model (IPM) model using the National Electric Energy Database System (NEEDS) version 5.13. The 2011NEIv1 emissions are replaced with hourly 2011 CEMS values for NO_X and SO_2, where the units match. Other pollutants are scaled from 2011NEIv1 using CEMS heat input. Emissions for all sources not matched to CEMS data come from 2011NEIv1. Annual resolution for non-matched sources, hourly for CEMS sources.
EGU peaking units: ***ptegu_pk***	Point	Same as ptegu sector, but limited to EGUs that are determined to operate as peaking units, as discussed in Section 2.1. All sources in this sector have CEMS data for 2011 and are therefore hourly.
Point source oil and gas: ***pt_oilgas***	Point	2011NEIv1 point sources with oil and gas production emissions processes. Annual resolution.
Remaining non-EGU point: ***ptnonipm***	Point	All 2011NEIv1 point source records not matched to the ptegu, ptegu_pk, and pt_oilgas sectors, except for offshore point sources that are in the othpt sector. Includes all aircraft emissions and some rail yard emissions. Annual resolution.
Agricultural: ***ag***	Nonpoint	NH_3 emissions from 2011NEIv1 nonpoint livestock and fertilizer application, county and annual resolution.
Area fugitive dust: ***afdust***	Nonpoint	PM_{10} and $PM_{2.5}$ from fugitive dust sources from the 2011NEIv1 nonpoint inventory including building construction, road construction, and agricultural dust, and road dust; however, unpaved and paved road dust emissions differ from the NEI in that do not have a precipitation adjustment. Instead, the emissions modeling adjustment applies a transport fraction and a meteorology-based (precipitation and snow/ice cover) zero-out. County and annual resolution.
Nonpoint source oil and gas: ***np_oilgas***	Nonpoint	2011NEIv1 nonpoint sources from oil and gas-related processes. County and annual resolution.
Residential Wood Combustion: ***rwc***	Nonpoint	2011NEIv1 NEI nonpoint sources with Residential Wood Combustion (RWC) processes. County and annual resolution.
Class 1 & 2 CMV and locomotives: ***c1c2rail***	Nonpoint	Locomotives and primarily category 1 (C1) and category 2 (C2) commercial marine vessel (CMV) emissions sources from the 2011NEIv1 nonpoint inventory. Midwestern states' CMV emissions, including Class 3 sources, are from a separate year 2010 emissions inventory. County and annual resolution.

Platform Sector: *abbreviation*	NEI Data Category	Description and resolution of the data input to SMOKE
commercial marine: ***c3marine***	Nonpoint	Category 3 (C3) CMV emissions projected to 2011 from year 2002 values. These emissions are not from the NEI, but rather were developed for the rule called "Control of Emissions from New Marine Compression-Ignition Engines at or Above 30 Liters per Cylinder", usually described as the Emissions Control Area- International Maritime Organization (ECA-IMO) study: http://www.epa.gov/otaq/oceanvessels.htm. (EPA-420-F-10-041, August 2010). U.S. states-only emissions (zero in Midwest); see othpt sector for all non-U.S. emissions. Treated as point sources to reflect shipping lanes, annual resolution.
Remaining nonpoint: ***nonpt***	Nonpoint	2011NEIv1 nonpoint sources not otherwise removed from modeling or included in other platform sectors; county and annual resolution.
Nonroad: ***nonroad***	Nonroad	2011NEIv1 nonroad equipment emissions developed with the National Mobile Inventory Model (NMIM) using NONROAD2008 version NR08a. NMIM was used for all states except California and Texas, which submitted their own emissions to the 2011NEIv1. County and monthly resolution.
Onroad non-refueling: ***onroad***	Onroad	2011 onroad mobile source gasoline and diesel vehicles from parking lots and moving vehicles. Includes the following modes: exhaust, extended idle, evaporative, permeation, and brake and tire wear. For all states except California and Texas, based on monthly MOVES emissions tables from MOVESTier3FRM. Texas emissions are from the 2011NEIv1 and are based on MOVES 2010b, and California emissions are based on Emission Factor (EMFAC). MOVES-based emissions computed for each hour and model grid cell using monthly and annual activity data (e.g., VMT, vehicle population).
Onroad refueling: ***onroad_rfl***	Onroad	2011 onroad mobile gasoline and diesel vehicle refueling emissions. For all states (including Texas and California), based on MOVESTier3FRM emissions tables. Computed for each hour and model grid cell using monthly and annual activity data (e.g., VMT, vehicle population).
Point source fires: ***ptfire***	Fires	Point source day-specific wildfires and prescribed fires for 2011 computed using SMARTFIRE2, except for Georgia-submitted emissions. Consistent with 2011NEIv1.
Other point sources not from the 2011 NEI: ***othpt***	N/A	Point sources from Canada's 2006 inventory and Mexico's Phase III 2012 inventory, annual resolution. Mexico's inventory is year 2012 and grown from year 1999 (ERG, 2009; Wolf, 2009). Also includes all non-U.S. C3 CMV and U.S. offshore oil production, which are unchanged from the 2008 NEI point source annual emissions.
Other non-NEI nonpoint and nonroad: ***othar***	N/A	Annual year 2006 Canada (province resolution) and year 2012 (grown from 1999) Mexico Phase III (municipio resolution) nonpoint and nonroad mobile inventories.
Other non-NEI onroad sources: ***othon***	N/A	Year 2006 Canada (province resolution) and year 2012 (grown from 1999) Mexico Phase III (municipio resolution) onroad mobile inventories, annual resolution.
Biogenic: ***beis***	Nonpoint	Year 2011, hour-specific, grid cell-specific emissions generated from the BEIS3.14 model with SMOKE, including emissions in Canada and Mexico.

Table 2-2 provides a brief by-sector overview of the most significant differences between the 2011 emissions platform and the 2011NEIv1. Only those sectors with significant differences between the 2011NEIv1 and the 2011 emissions modeling platform are listed. For some sectors, such as non-EGU point (ptnonipm), these changes are very minor and localized. In contrast, other sectors such as C3 commercial marine (c3marine) are either completely replaced or have significant and detailed edits based on review of available alternative data. The specific by-sector updates to the 2011 platform are described in greater detail later in this section under each by-sector subsection.

Table 2-2. Summary of significant changes between 2011 platform and 2011NEIv1 by sector

Platform Sector	Summary of Significant Inventory Differences of 2011 Platform vs. 2011NEIv1
IPM sectors: ***ptegu & ptegu_pk***	1) Based on 2011NEIv1 and 2011 CEMS data analysis, added ORIS Boiler IDs to some units (greater than 1,000 tons of NO_X or SO_2) with missing or incorrect values to allow for hourly CEMS data processing. 2) Added CEMS matches to additional units identified as CEMS sources. 3) Hourly NO_X and SO_2 CEMS data replaces annual NO_X and SO_2 NEI data in the air quality model inputs.
Remaining non-EGU (IPM) sector: ***ptnonipm***	1) Based on items above (ptegu & ptegu_pk), made additional matches to IPM_YN codes and ORIS facility codes that caused several sources to move into the ptegu and ptegu_pk sectors. This edit prevents double counting of EGU emissions in the future years. 2) Included 2011 ethanol plant facilities from EPA's Office of Transportation and Air Quality (OTAQ) that were not identified in the 2011 NEIv1.
Area fugitive dust: ***afdust***	1) Replaced EPA-provided emission estimates for paved and unpaved road dust with "non-met-adjusted" emissions; i.e., the meteorology/precipitation reduction included in the 2011NEIv1 is backed-out. 2) All emissions in this sector are processed (adjusted) to reflect land use (transport) and meteorological effects such as rain and snow cover that significantly reduce PM emissions input to the air quality model. These adjusted emissions are known as the afdust_adj emissions.
Remaining nonpoint sector: ***nonpt***	1) Split the 2011NEIv1 nonpoint file into the platform sectors afdust, ag, np_oilgas, rwc, c3marine, and c1c2rail. 2) Used agricultural fires emissions from daily inventory aggregated to monthly values, whereas the NEI only stores annual values.
Class 1 & 2 CMV and locomotives: ***c1c2rail***	Replaced Midwest RPO states c1c2 CMV emissions with comprehensive year 2010 RPO inventory.
C3 commercial marine: ***c3marine***	1) Used non-2011NEIv1-based data. Rather used year-2011 point sources as projected from 2002 from the ECA-IMO project. 2) Midwest RPO states replaced with 2010 RPO inventory (see c1c2rail sector).
Nonroad sector: ***nonroad***	1) States other than Texas: monthly rather than annual + small VOC adjustments in California. 2) Texas: replaced with annual 2011 Texas data apportioned to months using EPA's 2011 nonroad estimates.

Platform Sector	Summary of Significant Inventory Differences of 2011 Platform vs. 2011NEIv1
Onroad non-refueling: ***onroad***	1) For all states except California and Texas: Year 2011 emissions for all pollutants and modes (exhaust, evaporative, permeation, extended idle, tire and brake wear) from all vehicle types are based on emission factors from the version of MOVESTier3FRM, as opposed to MOVES 2010b which was used for the 2011NEIv1. Processed with 2011 meteorology using SMOKE-MOVES (discussed later). 2) For California and Texas: merged in 2011 California and Texas data to post-adjust SMOKE-MOVES data (discussed later).
Onroad non-refueling: ***onroad_rfl***	For all states including California: Year 2011 emissions for all pollutants AND all vehicle types are based on MOVESTier3FRM emission factor tables processed with 2011 meteorology using SMOKE-MOVES (discussed later). Therefore, these emissions are identical to the 2011NEIv1 for states that did not submit refueling emissions, but are inconsistent with 2011NEIv1 for states that did submit point and nonpoint refueling since the 2011NEIv1 kept state-submissions over EPA data.

The emission inventories in SMOKE input format for the 2011 base case are available from the Emissions Modeling Clearinghouse website http://www.epa.gov/ttn/chief/emch/index.html#2011. The inventories "readme" file indicates the particular zipped files associated with each platform sector. A number of reports were developed for the 2011 platform. Descriptions of the available data and reports are available from the FTP site at ftp://ftp.epa.gov/EmisInventory/2011v6/v1platform. The types of reports include state summaries of inventory pollutants and model species by modeling platform sector for 2011, 2018 and 2025 in the Microsoft® Excel® files "2011ef_v6_11g_state_sector_totals.xlsx", "2018ef_v6_11g_state_sector_totals.xlsx", and "2025ef_v6_11g_state_sector_totals.xlsx", with a comparison of the emissions in the three cases in the file "2011ef_2018ef_2025ef_state_sector_comparison.xlsx". Annual and summer NO_x and VOC emission totals by county and modeling platform sector are available in the files "2011ef_2025ef_county_sector_comparisons_NOX.xlsx" and "2011ef_2025ef_county_sector_comparisons_VOC.xlsx". Summaries by state and source classification code (SCC), including SCC descriptions, by modeling sector for anthropogenic 2025 emissions are available in the file "2025ef_state_scc_summaries.zip". A comparison of the complete list of inventory files, ancillary files, and parameter settings for the 2011, 2018 and 2025 modeling cases is available in the file "2011ef_2018ef_2025ef_case_inputs.xlsx".

The remainder of Section 2 provides details about the data contained in each of the 2011 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 2011 platform emissions are significantly different from the 2011NEIv1.

2.1 2011 NEI point sources (ptegu, ptegu_pk, 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, which 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 United States. The offshore oil platform (othpt sector) and category 3 CMV emissions (c3marine and othpt sectors) are processed by SMOKE as point source inventories, as described in Section 2.5.1 and Section 2.4.2, respectively. A comprehensive description on how EGU emissions were characterized and estimated in the 2011 NEI can be found in Section 3.10 in the 2011NEIv1 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 http://www.cmascenter.org/smoke/documentation/3.5.1/html/ch08s02s10.html#d0e44906). After moving offshore oil platforms into the othpt sector, and dropping sources without true locations (i.e., FIPS code ends in 777), initial versions of the other four platform point source sectors were created from the remaining 2011NEIv1 point sources. The point sectors are: the EGU sector for non-peaking units (ptegu), the EGU sector for peaking units (ptegu_pk), 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 EGU sectors are further split into "peaking" (ptegu_pk) and non-peaking units to allow for better analysis of the impact of peaking units. 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).

In addition to the emissions summaries described in Section 1, two other specialized point source summaries are available on the Emissions Modeling Clearinghouse website. A summary report of stack parameters for the point source sectors, including cross references to CEMS data via ORIS IDs, can be found in the file ftp://ftp.epa.gov/EmisInventory/2011v6/v1platform/reports/2011_emissions/2011ec_stack_parameter_report.xlsx. Although this report was created for the older 2011ec emissions case, this part of the inventory was unchanged for the 2011ef case. A comparison of the 2011NEIv1 EGU emissions with the 2011 CEMS data is available in the same directory in the file "2011_EGUs_NEI_CEMS.xlsx".

The inventory pollutants processed through SMOKE for both all point source sectors were: CO, NO_X, VOC, SO_2, NH_3, PM_{10}, and $PM_{2.5}$ and the following HAPs: HCl (pollutant code = 7647010), and Cl (code = 7782505). The inventory BAFM from these sectors was not used, instead VOC was speciated to these pollutants without any use (i.e., integration) and the VOC HAP pollutants from the inventory were ignored (VOC integration is discussed in detail in Section 3.2.1.1).

The ptnonipm and pt_oilgas sector emissions were provided to SMOKE as annual emissions. For those ptegu and ptegu_pk sources with CEMS data (that could be matched to the 2011NEIv1), 2011 hourly CEMS NO_X and SO_2 emissions were used (rather than NEI emissions) and 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 non-CEMS sources in the ptegu and ptegu_pk sectors, 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.

Changes made to the point-based sectors from the 2011NEIv1 for the 2011 platform were briefly described in Table 2-2. One of these changes involved splitting the stacks, units and facilities into the ptnonipm, pt_oilgas, ptegu and ptegu_pk sectors. Sources were included in the ptegu or ptegu_pk sectors only when it was determined that these sources were reflected in the future-year IPM output data. These changes and other updates to the point source sectors for the 2011 platform are discussed in the following sections.

2.1.1 EGU non-peaking units sector (ptegu)

The ptegu and ptegu_pk (see Section 2.1.2) sectors contain emissions from EGUs in the 2011NEIv1 point inventory that could be matched to units found in the NEEDS v5.13 database. It was necessary to put these EGUs into separate sectors in the platform because IPM projects future emissions for the EGUs defined in the NEEDS database, and emissions for sources in the ptegu and ptegu_pk sectors are replaced with IPM outputs in the future year modeling case. Sources not matched to units found in NEEDS are placed into the pt_oilgas (see Section 2.1.3) or ptnonipm (see Section 2.1.4) sectors and are projected to the future year using projection and control factors. It is important that the matching between the NEI and NEEDS database be as complete as possible because there can be double counting of emissions in the future year if emissions for units are projected by IPM are not properly matched to the units in the NEI.

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. Many of these matches are stored within EIS. In some cases, it was difficult to match the sources between the databases due to different facility names in the two data systems and due to differences in how the units are defined, thereby resulting in matches that are not always one-to-one. Some additional matches were made in the modeling platform to accommodate some of these situations as described later in this section. The NEEDS v5.13 database can be found at http://www.epa.gov/powersectormodeling/BaseCasev513.html, along with additional information about IPM.

Some units in the ptegu and ptegu_pk sectors are matched to CEMS data via ORIS facility codes and boiler ID. For these units, SMOKE replaces the 2011 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 SCC codes for these sources come from the NEI. 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 just not matched to a CEMS unit, the emissions from that source would still be modeled using the annual emission value in the NEI. EIS stores many matches from EIS units to the ORIS facility codes and boiler IDs used to reference the CEMS data. Some additional matches were made in the modeling platform as described later in this section.

In the SMOKE point flat file, emission records for point sources matched to CEMS data have values filled 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 CAMD 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 CAMD hourly CEMS programs. Therefore, there will be more units in the NEEDS database than have CEMS data.

For sources not matched to CEMS data ("non-CEMS" sources), 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. For future-year scenarios, there are no CEMS data available for specific units, but the shape of the CEMS profiles is preserved for sources that are carried into the future year. This method keeps the temporal behavior of the base and future year cases as consistent as possible. See Section 3.3.2 for more details on the temporalization approach for ptegu sources.

Finding additional matches between the NEI, NEEDS, and CEMS data

Several analytical steps were performed to better link the NEEDS units to the 2011NEIv1, along with implementing better matching to the CEMS data cross-referenced using "ORIS" facility and boiler IDs. The steps described in the 2011NEIv1 TSD have some detail on how the values in the IPM_YN column were assigned. For the modeling platform, an initial ptipm/ptnonipm split was determined using the values in the SMOKE point source flat file variable "IPM_YN", which is populated based on an EIS alternative facility identifier. Because EIS expects the matches to be one-to-one for an entire unit, if the units are not defined in the same way in EIS and NEEDS, one-to-many or many-to-many matches can only be stored in EIS with specified "end dates" and will not export directly to the flat file. However, one-to-many and many-to-many matches to the IPM_YN values were placed into the SMOKE input file through a postprocessing step. This requires the additional of additional "dummy" records in the SMOKE file that will be overlaid with CEMS data when SMOKE is run.

Additional matches between the NEI and NEEDS were identified by identifying units in IPM outputs that were not yet matched to NEI data, and by looking for units identified in the NEI with facility type codes identifying them as EGUs or facility names that indicated they were EGUs. In each case, priority was given to units with larger emissions (e.g., > 300TPY of NO_x or SO_2). The units in each data set that did not yet have matches within the same county were compared to one another on the basis of their plant names and locations. In some cases, IDs were similar but were mismatched only due to a missing leading zero in one of the databases. In other cases, a facility level match was specified, but a unit/boiler level match was not yet identified and therefore the units at the facility were compared to one another on the basis of design capacity and naming. For any new matches that were found, values that represented the NEEDS IDs were filled in to the IPM_YN in the modeling platform flat files. When possible, these matches were loaded into EIS.

A similar matching process was used to identify additional matches between the 2011NEIv1 and CEMS data. To determine whether a NEI unit matched a CEMS unit, the CEMS units were compared to facilities in the NEI that were not yet identified as a CEMS unit on the basis of their county FIPS codes, locations, and total emissions of NO_x and SO_2. Additional CEMS matches that were found were applied to the FF10 file by specifying values for ORIS_FACILITY_CODE, ORIS_BOILER_ID. Because IPM uses a concatenation of the ORIS facility code and boiler ID, values were also filled in to the IPM_YN field for these units.

As a result of identifying additional matches through this analysis, many EGUs that otherwise would have remained in the ptnonipm sector were moved to the ptegu sector. Many new CEMS assignments

[2] The year to day profiles use NOx and SO2 CEMS for NOx and SO2, respectively. For all other pollutants, they use heat input CEMS data.

were loaded into EIS for use in future inventories. Note that SMOKE can perform matches of CEMS data down to the stack or release point level.

2.1.2 EGU peaking units sector (ptegu_pk)

The ptegu_pk sector includes sources identified by EPA as peaking units. The units were separated into this sector to facilitate analyses of the impact of peaking units. Aside from their inclusion in this sector, in all other ways they are treated in the same way as CEMS sources in the ptegu sector because all of them are matched to CEMS data. To identify units for inclusion in this sector, EPA required them to satisfy two tests: (1) the capacity factor was less than 10% over a 3 year average (2010-2012), and (2) the capacity factor was less than 20% in each of the 3 years. Here, "capacity factor" means either: (1) The ratio of a unit's actual annual electric output (expressed in MWe/hr) to the unit's nameplate capacity (or maximum observed hourly gross load (in MWe/hr) if greater than the nameplate capacity) times 8760 hours; or (2) The ratio of a unit's annual heat input (in million BTUs or equivalent units of measure) to the unit's maximum rated hourly heat input rate (in million BTUs per hour or equivalent units of measure) times 8,760 hours. The list of units in the ptegu_pk sector is provided in the file (see the file ftp://ftp.epa.gov/EmisInventory/2011v6/v1platform/reports/2011_emissions/Peakers_CAMD_2011.080213_NEI_IPM_match.xls).

2.1.3 Point source oil and gas sector (pt_oilgas)

The pt_oilgas sector includes sources with the SCCs specified in the list in Table 2-3. The emissions and other source characteristics in the pt_oilgas sector are submitted by states, while 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. The nonpoint emissions can be found in the np_oilgas sector. More information on the development of the 2011 oil and gas emissions can be found in Section 3.21 of the 2011NEIv1 TSD.

Table 2-3. Point source oil and gas sector SCCs

SCC	SCC Description*
31000309	IP;OGP;Natural Gas Processing Facilities;Compressor Seals
31000310	IP;OGP;Natural Gas Processing Facilities;Pump Seals
31000311	IP;OGP;Natural Gas Processing Facilities;Flanges and Connections
31000321	IP;OGP;Natural Gas Processing Facilities;Glycol Dehydrators: Niagaran Formation (Mich.)
31000322	IP;OGP;Natural Gas Processing Facilities;Glycol Dehydrators: Prairie du Chien Formation (Mich.)
31000323	IP;OGP;Natural Gas Processing Facilities;Glycol Dehydrators: Antrim Formation (Mich.)
31000324	IP;OGP;Natural Gas Processing Facilities;Pneumatic Controllers Low Bleed
31000325	IP;OGP;Natural Gas Processing Facilities;Pneumatic Controllers High Bleed >6 scfm
31000401	IP;OGP;Process Heaters;Distillate Oil (No. 2)
31000402	IP;OGP;Process Heaters;Residual Oil
31000403	IP;OGP;Process Heaters;Crude Oil
31000404	IP;OGP;Process Heaters;Natural Gas
31000405	IP;OGP;Process Heaters;Process Gas
31000406	IP;OGP;Process Heaters;Propane/Butane
31000411	IP;OGP;Process Heaters;Distillate Oil (No. 2): Steam Generators
31000412	IP;OGP;Process Heaters;Residual Oil: Steam Generators

SCC	SCC Description*
31000413	IP;OGP;Process Heaters;Crude Oil: Steam Generators
31000414	IP;OGP;Process Heaters;Natural Gas: Steam Generators
31000415	IP;OGP;Process Heaters;Process Gas: Steam Generators
31000502	IP;OGP;Liquid Waste Treatment;Liquid - Liquid Separator
31000503	IP;OGP;Liquid Waste Treatment;Oil-Water Separator
31000504	IP;OGP;Liquid Waste Treatment;Oil-Sludge-Waste Water Pit
31000506	IP;OGP;Liquid Waste Treatment;Oil-Water Separation Wastewater Holding Tanks
31088801	IP;OGP;Fugitive Emissions;Specify in Comments Field
31088802	IP;OGP;Fugitive Emissions;Specify in Comments Field
31088803	IP;OGP;Fugitive Emissions;Specify in Comments Field
31088804	IP;OGP;Fugitive Emissions;Specify in Comments Field
31088805	IP;OGP;Fugitive Emissions;Specify in Comments Field
31088811	IP;OGP;Fugitive Emissions;Fugitive Emissions
31700101	Industrial Processes;NGTS;Natural Gas Transmission and Storage Facilities;Pneumatic Controllers Low Bleed
40400300	PSE;PLS;OGFSWT;Fixed Roof Tank: Flashing Loss
40400301	PSE;PLS;OGFSWT;Fixed Roof Tank: Breathing Loss
40400302	PSE;PLS;OGFSWT;Fixed Roof Tank: Working Loss
40400303	PSE;PLS;OGFSWT;External Floating Roof Tank with Primary Seals: Standing Loss
40400304	PSE;PLS;OGFSWT;External Floating Roof Tank with Secondary Seals: Standing Loss
40400305	PSE;PLS;OGFSWT;Internal Floating Roof Tank: Standing Loss
40400306	PSE;PLS;OGFSWT;External Floating Roof Tank: Withdrawal Loss
40400307	PSE;PLS;OGFSWT;Internal Floating Roof Tank: Withdrawal Loss
40400311	PSE;PLS;OGFSWT;Fixed Roof Tank, Condensate, working+breathing+flashing losses
40400312	PSE;PLS;OGFSWT;Fixed Roof Tank, Crude Oil, working+breathing+flashing losses
40400313	PSE;PLS;OGFSWT;Fixed Roof Tank, Lube Oil, working+breathing+flashing losses
40400314	PSE;PLS;OGFSWT;Fixed Roof Tank, Specialty Chem-working+breathing+flashing losses
40400315	PSE;PLS;OGFSWT;Fixed Roof Tank, Produced water, working+breathing+flashing losses
40400316	PSE;PLS;OGFSWT;Fixed Roof Tank, Diesel, working+breathing+flashing losses
40400321	PSE;PLS;OGFSWT;External Floating Roof Tank, Condensate, working+breathing+flashing losses
40400322	PSE;PLS;OGFSWT;External Floating Roof Tank, Crude Oil, working+breathing+flashing losses
40400323	PSE;PLS;OGFSWT;External Floating Roof Tank, Lube Oil, working+breathing+flashing losses
40400324	PSE;PLS;OGFSWT;External Floating Roof Tank, Specialty Chem-working+breathing+flashing losses
40400325	PSE;PLS;OGFSWT;External Floating Roof Tank, Produced water, working+breathing+flashing losses
40400326	PSE;PLS;OGFSWT;External Floating Roof Tank, Diesel, working+breathing+flashing losses
40400331	PSE;PLS;OGFSWT;Internal Floating Roof Tank, Condensate, working+breathing+flashing losses
40400332	PSE;PLS;OGFSWT;Internal Floating Roof Tank, Crude Oil, working+breathing+flashing losses
40400334	PSE;PLS;OGFSWT;Internal Floating Roof Tank, Specialty Chem-working+breathing+flashing losses
40400335	PSE;PLS;OGFSWT;Internal Floating Roof Tank, Produced water, working+breathing+flashing losses

*IP;OGP = Industrial Processes;Oil and Gas Production and
PSE;PLS;OGFSWT=Petroleum and Solvent Evaporation;Petroleum Liquids Storage (non-Refinery);Oil and Gas Field Storage and Working Tanks

2.1.4 Non-IPM sector (ptnonipm)

Except for some minor exceptions, the non-IPM (ptnonipm) sector contains the 2011NEIv1 point sources that are not in the ptegu, ptegu_pk, 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 sector also includes some ethanol plants that have been identified by EPA but are not in 2011NEIv1.

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. Some point sources in the 2011NEIv1 that are not included in any modeling sectors are:

- Sources with state/county FIPS code ending with "777". These sources represent mobile (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 therefore difficult to allocate to specific places and days for modeling. Therefore, these sources are dropped from the point-based sectors in the modeling platform.
- Offshore oil records with FIPS=85000 were not updated from the 2008NEIv3 and are processed in the othpt sector as discussed in Section 2.5.1.

Additional Ethanol facilities

Another difference between the 2011NEIv1 data and the modeling platform is the addition of some ethanol production facilities identified by EPA but were not found in the NEI. For some rule development work, EPA developed a list of corn ethanol facilities for 2011. Many of these ethanol facilities were included in the 2011NEIv1, but those that were not matched were added to the ptnonipm sector in a separate FF10-format inventory file. Locations and FIPS codes for these ethanol plants were verified using web searches and Google Earth. EPA believes that some of these sources are not included in the NEI as point sources because they do not meet the 100 ton/year potential-to-emit threshold for NEI point sources. In other cases, EPA is following up with states to evaluate whether the state data should include these point sources.

Emission rates for the ethanol plants were obtained from EPA's updated spreadsheet model for upstream impacts developed for the Renewable Fuel Standard (RFS2) rule (EPA, 2010a). Plant emission rates for criteria pollutants used to estimate impacts for years 2011 (assumed the same in 2018 and 2025) are given in Table 2-4.

Table 2-4. Corn Ethanol Plant Criteria Pollutant Emission Factors (grams per gallon produced)

Corn Ethanol Plant Type	VOC	CO	NO_X	PM_{10}	$PM_{2.5}$	SO_2	NH_3
Dry Mill Natural Gas (NG)	2.29	0.58	0.99	0.94	0.23	0.01	0.00
Dry Mill NG (wet distillers grains with solubles (DGS))	2.27	0.37	0.63	0.91	0.20	0.00	0.00
Dry Mill Biogas	2.29	0.62	1.05	0.94	0.23	0.01	0.00
Dry Mill Biogas (wet DGS)	2.27	0.39	0.67	0.91	0.20	0.00	0.00
Dry Mill Coal	2.31	2.65	4.17	3.81	1.71	4.52	0.00
Dry Mill Coal (wet DGS)	2.31	2.65	2.65	2.74	1.14	2.87	0.00
Dry Mill Biomass	2.42	2.55	3.65	1.28	0.36	0.14	0.00
Dry Mill Biomass (wet DGS)	2.35	1.62	2.32	1.12	0.28	0.09	0.00

Corn Ethanol Plant Type	VOC	CO	NO_X	PM_{10}	$PM_{2.5}$	SO_2	NH_3
Wet Mill NG	2.35	1.62	1.77	1.12	0.28	0.09	0.00
Wet Mill Coal	2.33	1.04	5.51	4.76	2.21	5.97	0.00

Air toxic emission rates were estimated by applying toxic to VOC ratios in Table 2-5 were multiplied by facility production estimates for 2011 and 2018 based on analyses performed for the industry characterization described in Chapter 1 of the RFS2 final rule regulatory impact analysis. For air toxics except ethanol, the toxic-to-VOC ratios were developed using emission inventory data from the 2005 NEI (EPA, 2009a).

Table 2-5. Toxic-to-VOC Ratios for Corn Ethanol Plants

	Acetaldehyde	Acrolein	Benzene	1,3-Butadiene	Formaldehyde
Wet Mill NG	0.02580	0.00131	0.00060	2.82371E-08	0.00127
Wet Mill Coal	0.08242	0.00015	0.00048	2.82371E-08	0.00108
Dry Mill NG	0.01089	0.00131	0.00060	2.82371E-08	0.00127
Dry Mill Coal	0.02328	0.00102	0.00017	2.82371E-08	0.00119

2.2 2011 nonpoint sources (afdust, ag, np_oilgas, rwc, nonpt)

Several modeling platform sectors were created from the 2011NEIv1 nonpoint inventory. This section describes the *stationary* nonpoint sources. Locomotives, C1 and C2 CMV, and C3 CMV are also included the 2011NEIv1 nonpoint data category, but are mobile sources that are described in Sections 2.4.1 and 2.4.2 as the c1c2rail and c3marine sectors, respectively. The 2011NEIv1 TSD available from http://www.epa.gov/ttn/chief/net/2011inventory.html includes documentation for the nonpoint sector of the 2011NEIv1.

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 emissions modeling sector inventories start with the NEI data. Several source categories were not included in the modeling platform inventories for the following reasons: 1) these sources are only reported by a small number of states or agencies, 2) these sources are 'atypical' and have small emissions, and/or 3) EPA has have other data the Agency believes to be more accurate. Table 2-6 provides a list of SCCs removed from the nonpoint sectors, justification for their removal, and the national annual NO_X, VOC and NH_3 emission totals. The following subsections describe how the remaining sources in the 2011NEIv1 nonpoint inventory were separated into 2011 modeling platform sectors, along with any data that were updated replaced with non-NEI data.

Table 2-6. 2011NEIv1 nonpoint sources removed from the 2011 platform

SCC	Description	Reason for Removal	NO_X*	VOC*	NH_3*
2280003100	Marine Vessels, Commercial; Residual; Port emissions	Replaced with OTAQ ECA-IMO dataset -see Section 2.4.2	62,906	2,411	23
2280003200	Marine Vessels, Commercial; Residual; Underway emissions		817,367	30,846	151
2294000000	Paved Roads; All Paved Roads; Total: Fugitives	Replaced with emissions NOT reduced via precipitation – see Section 2.2.1			
2294010000	Paved Roads; All Other Public Paved Roads; Total: Fugitives				
2501060100	Gasoline Stage 2 refueling: Total	Replaced with MOVES T3FRM-based estimates –see Section 2.3.2		154,349	
2501060101	Gasoline Stage 2 refueling: Displacement Loss/Uncontrolled			6,731	
2501060102	Gasoline Stage 2 refueling: Displacement Loss/Controlled			6,890	
2501060103	Gasoline Stage 2 refueling: Spillage			2,771	
2810005001	Managed Burning, Slash (Logging Debris);Pile Burning	Replaced with SMARTFIRE 2 estimates -see Section 2.6	84.5	95	
2810005002	Managed Burning, Slash (Logging Debris);Broadcast Burning		0	0	
2810020000	Prescribed Rangeland Burning; Unspecified				
2810090000	Open Fire; Not categorized				
2275087000	Aircraft; In-flight (non-Landing-Takeoff cycle);Total	Dropped because they are atypical and sparsely-reported categories with small emissions			
2806010000	Domestic Animals Waste Emissions; Cats; Total				294
2806015000	Domestic Animals Waste Emissions; Dogs; Total				1,674
2807020001	Wild Animals Waste Emissions; Bears; Black Bears				3
2807020002	Wild Animals Waste Emissions; Bears; Grizzly Bears				0
2807025000	Wild Animals Waste Emissions; Elk; Total				1,425
2807030000	Wild Animals Waste Emissions; Deer; Total				1,431
2807040000	Wild Animals Waste Emissions; Birds; Total				0
2810003000	Cigarette Smoke; Total		2	43	4
2810010000	Human Perspiration and Respiration; Total				2,742
2830000000	Catastrophic/Accidental Releases; All; Total		0	167	0
2830010000	Catastrophic/Accidental Releases; Transportation Accidents; Total			0	
2862000000	Swimming Pools; Total (Commercial, Residential, Public);Total			198	

* **Emission units are short tons**

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), http://www.epa.gov/ttn/chief/conference/ei19/session9/pouliot_pres.pdf, and in "Fugitive Dust Modeling for the 2008 Emissions Modeling Platform" (Adelman, 2012). The purpose of applying the transport fraction and meteorological adjustments is to reduce the overestimation of fugitive dust in the grid modeling as compared to ambient observations. 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 2-7.

Table 2-7. SCCs in the afdust platform sector

SCC	**SCC Description**
2275085000	Industrial Processes;Construction: SIC 15 - 17;All Processes;Vehicle Traffic
2294000000	Industrial Processes;Construction: SIC 15 - 17;Industrial/Commercial/Institutional;Total
2294005000	Industrial Processes;Construction: SIC 15 - 17;Residential;Total
2294010000	Industrial Processes;Construction: SIC 15 - 17;Road Construction;Total
2296000000	Industrial Processes;Construction: SIC 15 - 17;Special Trade Construction;Total
2296005000	Industrial Processes;Mining and Quarrying: SIC 14;All Processes;Total
2296010000	Industrial Processes;Mining and Quarrying: SIC 14;Crushed and Broken Stone;Total
2311000070	Industrial Processes;Mining and Quarrying: SIC 14;Sand and Gravel;Total
2311010000	Miscellaneous Area Sources;Agriculture Production - Crops;Agriculture - Crops;Harvesting
2311020000	Miscellaneous Area Sources;Agriculture Production - Crops;Agriculture - Crops;Planting
2311030000	Miscellaneous Area Sources;Agriculture Production - Crops;Agriculture - Crops;Tilling
2311040000	Miscellaneous Area Sources;Agriculture Production - Crops;Agriculture - Crops;Total
2325000000	Miscellaneous Area Sources;Agriculture Production - Crops;Agriculture - Crops;Transport
2325020000	Miscellaneous Area Sources;Agriculture Production - Livestock;Beef cattle - finishing operations on feedlots (drylots);Dust Kicked-up by Hooves (use 28-05-020, -001, -002, or -003 for Waste
2325030000	Mobile Sources;Aircraft;Unpaved Airstrips;Total
2801000000	Mobile Sources;Paved Roads;All Other Public Paved Roads;Total: Fugitives
2801000002	Mobile Sources;Paved Roads;All Paved Roads;Total: Fugitives
2801000003	Mobile Sources;Paved Roads;Interstate/Arterial;Total: Fugitives
2801000005	Mobile Sources;Unpaved Roads;All Unpaved Roads;Total: Fugitives
2801000008	Mobile Sources;Unpaved Roads;Industrial Unpaved Roads;Total: Fugitives
2805001000	Mobile Sources;Unpaved Roads;Public Unpaved Roads;Total: Fugitives

The dust emissions in the modeling platform are not the same as the 2011NEIv1 emissions because the NEI paved and unpaved road dust emissions include a built-in precipitation reduction that is based on average meteorological data, which is at a coarser temporal and spatial resolution than the modeling platform meteorological adjustment. Due to this, in the platform paved and unpaved road emissions data was used that did not include any precipitation-based reduction. This allows the entire sector to be processed consistently so that the same grid-specific transport fractions and meteorological adjustments can be applied. Where states submitted afdust data, it was assumed that the state-submitted data were not met-adjusted and therefore the meteorological adjustments were still applied. Thus, it is possible that these sources may have been adjusted twice. Even with that possibility, air quality modeling shows that in general, dust is frequently overestimated in the air quality modeling results.

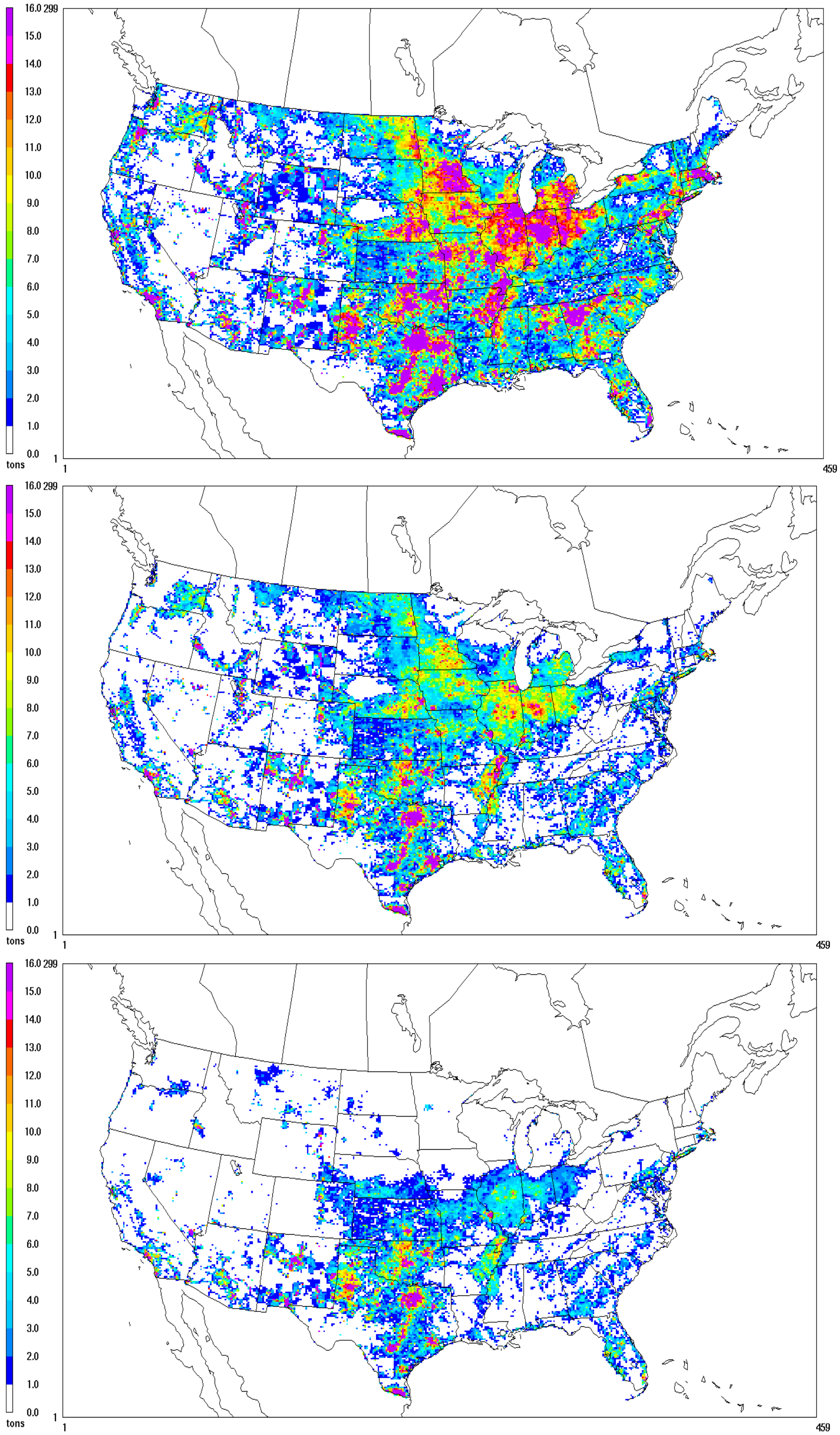
The total impacts of the transport fraction and meteorological adjustments for 2011NEIv1 are shown in Table 2-8, where the starting inventory numbers include unadjusted paved and unpaved road dust, so they do not match the NEI values which include a different type of adjustment. The amount of the reduction ranges from about 6% in New Hampshire to almost 73% in Nevada. Figure 2-1 shows the impact of each step of the adjustment for January 2008, using the 2008 NEI as an example. The raw NEI afdust $PM_{2.5}$ emissions – prior to transport fraction meteorological adjustments – are shown at the top of Figure 2-1. The afdust emissions after the application of the transport fraction, but prior to meteorological adjustments are shown in the middle of Figure 2-1. Finally, the resulting emissions after both transport fraction and meteorological adjustments are shown at the bottom of Figure 2-1. The top and middle plots show 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. Comparing the bottom and middle plots shows how the meteorological impacts of precipitation, along with snow cover in the north, further reduce the dust emissions.

Table 2-8. Total Impact of Fugitive Dust Adjustments to Unadjusted 2011 Inventory

State	Unadjusted PM10	Unadjusted PM2_5	Change in PM10	Change in PM2_5	PM10 Reduction	PM2_5 Reduction
Alabama	378,873	47,158	-310,750	-38,597	18.0%	18.2%
Arizona	237,361	30,015	-78,519	-9,778	66.9%	67.4%
Arkansas	421,958	58,648	-305,611	-40,757	27.6%	30.5%
California	255,889	38,664	-119,035	-17,930	53.5%	53.6%
Colorado	244,630	40,421	-130,598	-20,991	46.6%	48.1%
Connecticut	29,067	4,393	-25,877	-3,912	11.0%	10.9%
Delaware	11,477	2,046	-7,968	-1,431	30.6%	30.1%
District of Columbia	2,115	337	-1,596	-254	24.5%	24.6%
Florida	292,797	39,636	-181,017	-24,333	38.2%	38.6%
Georgia	733,478	90,041	-593,644	-72,027	19.1%	20.0%
Idaho	432,116	49,294	-291,880	-32,897	32.5%	33.3%
Illinois	763,665	123,680	-472,806	-76,086	38.1%	38.5%
Indiana	603,153	85,151	-435,027	-60,660	27.9%	28.8%
Iowa	590,528	96,070	-339,349	-54,855	42.5%	42.9%
Kansas	748,652	118,902	-353,311	-54,854	52.8%	53.9%
Kentucky	199,744	29,496	-160,640	-23,511	19.6%	20.3%
Louisiana	236,787	35,730	-162,780	-24,086	31.3%	32.6%
Maine	50,547	7,016	-43,643	-6,078	13.7%	13.4%
Maryland	49,225	8,361	-37,192	-6,287	24.4%	24.8%
Massachusetts	205,561	22,444	-177,808	-19,370	13.5%	13.7%

State	Unadjusted PM10	Unadjusted PM2_5	Change in PM10	Change in PM2_5	PM10 Reduction	PM2_5 Reduction
Michigan	462,324	61,969	-353,225	-47,137	23.6%	23.9%
Minnesota	336,791	64,253	-217,036	-41,145	35.6%	36.0%
Mississippi	956,702	107,965	-782,249	-86,685	18.2%	19.7%
Missouri	1,064,146	130,995	-780,595	-94,576	26.6%	27.8%
Montana	385,541	50,583	-266,046	-33,521	31.0%	33.7%
Nebraska	591,457	85,206	-316,917	-45,198	46.4%	47.0%
Nevada	152,191	19,538	-43,681	-5,307	71.3%	72.8%
New Hampshire	25,540	3,766	-23,836	-3,515	6.7%	6.7%
New Jersey	24,273	5,412	-19,215	-4,255	20.8%	21.4%
New Mexico	924,497	95,871	-352,117	-36,344	61.9%	62.1%
New York	274,114	37,493	-236,431	-31,990	13.7%	14.7%
North Carolina	186,650	33,409	-146,918	-26,184	21.3%	21.6%
North Dakota	354,107	59,113	-218,630	-36,286	38.3%	38.6%
Ohio	414,902	64,609	-319,831	-49,298	22.9%	23.7%
Oklahoma	733,749	87,864	-385,344	-44,585	47.5%	49.3%
Oregon	348,093	40,596	-268,605	-30,516	22.8%	24.8%
Pennsylvania	208,246	30,344	-179,990	-26,158	13.6%	13.8%
Rhode Island	4,765	731	-3,628	-564	23.9%	22.8%
South Carolina	259,350	31,494	-198,175	-24,002	23.6%	23.8%
South Dakota	262,935	44,587	-155,937	-26,215	40.7%	41.2%
Tennessee	139,732	25,357	-107,964	-19,514	22.7%	23.0%
Texas	2,573,682	304,550	-1,278,048	-146,122	50.3%	52.0%
Utah	196,554	21,589	-113,838	-12,464	42.1%	42.3%
Vermont	67,690	7,563	-61,423	-6,855	9.3%	9.4%
Virginia	131,797	19,374	-108,701	-15,895	17.5%	18.0%
Washington	174,969	27,999	-99,720	-15,425	43.0%	44.9%
West Virginia	85,956	10,652	-79,745	-9,888	7.2%	7.2%
Wisconsin	239,851	41,669	-164,113	-28,542	31.6%	31.5%
Wyoming	434,090	45,350	-264,580	-27,467	39.0%	39.4%
CONUS Total	18,502,317	2,487,403	-12,698,646	-1,614,445	-68.6%	-64.9%

Figure 2-1. Example of January $PM_{2.5}$ afdust emissions: raw 2008 NEI (top), after application of transport fraction (middle) and final post-meteorological adjusted (bottom)



2.2.2 Agricultural ammonia sector (ag)

The agricultural NH_3 (ag) sector includes livestock and agricultural fertilizer application emissions from the 2011NEIv1 nonpoint inventory. The livestock and fertilizer emissions in this sector are based only on the SCCs listed in Table 2-9 and Table 2-10. 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 ammonia emissions, as there are also a small amount of NH_3 emissions from livestock feedlots in the ptnonipm inventory (as point sources) in California (175 tons) and Wisconsin (125 tons).

Table 2-9. 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
2805020000	Cattle and Calves Waste Emissions;Milk Total
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)
2805030001	Poultry Waste Emissions;Pullet Chicks and Pullets less than 13 weeks old
2805030002	Poultry Waste Emissions;Pullets 13 weeks old and older but less than 20 weeks old
2805030003	Poultry Waste Emissions;Layers
2805030004	Poultry Waste Emissions;Broilers
2805030007	Poultry Waste Emissions;Ducks
2805030008	Poultry Waste Emissions;Geese
2805030009	Poultry Waste Emissions;Turkeys
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

SCC	SCC Description*
2805040000	Sheep and Lambs Waste Emissions;Total
2805045000	Goats Waste Emissions;Not Elsewhere Classified
2805045002	Goats Waste Emissions;Angora Goats
2805045003	Goats Waste Emissions;Milk Goats
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 2-10. 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
2801700008	Other Straight Nitrate
2801700009	Ammonium Phosphates
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.

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. EPA estimated emissions for all counties with 2011 oil and gas activity data with the Oil and Gas Tool, and many S/L/T agencies also submitted nonpoint oil and gas data. 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. For more information on the development of the oil and gas emissions in the 2011NEIv1, see Section 3.21 of the 2011NEIv1 TSD. A complete list of SCCs for the np_oilgas modeling platform sector is provided in Appendix A. See the pt_oilgas sector (section 2.1.3) for more information on point source oil and gas sources.

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:

conventional (not EPA certified); EPA certified, catalytic; and EPA certified, noncatalytic. Generally speaking, the conventional units were constructed prior to 1988. Units constructed after 1988 had to meet EPA emission standards and they are either catalytic or non-catalytic. For more information on the development of the residential wood combustion emissions, see Section 3.14 of the 2011NEIv1 TSD. The SCCs in the rwc sector are shown in Table 2-11.

Table 2-11. 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
2104008300	SSFC;Residential;Wood;Woodstove: freestanding, general
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 2011NEIv1 nonpoint inventory are described in Section 2.4.1. There are too many SCCs 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;
- 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;
- agricultural burning and orchard heating;
- miscellaneous area sources such as cremation, hospitals, lamp breakage, and automotive repair shops.

Most sources in this sector have annual emissions that are temporally allocated to hourly values using temporal profiles. The annual agricultural burning estimates are treated as monthly values. The annual values in the 2011NEIv1 were split into monthly emissions by aggregating the data up to monthly values from daily estimates of emissions.

2.3 2011 onroad mobile sources (onroad, onroad_rfl)

Onroad mobile sources include emissions 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 and gasoline vehicles. The sector characterizes emissions from off-network processes (e.g. starts, hot soak, and extended idle) as well as from on-network processes (i.e., from vehicles moving along the roads). For the 2011 platform, as indicated in Table 2-1, the 2011 onroad emissions are separated into two sectors: (1) "onroad" and (2) "onroad_rfl". The onroad and onroad_rfl sectors are processed separately to allow for different spatial allocation to be applied to onroad refueling, which is allocated using a gas station surrogate, versus onroad vehicles, which are allocated using surrogates based on roads and population. Except for California and Texas, all onroad and onroad refueling emissions are generated using the SMOKE-MOVES emissions modeling framework that leverages MOVES generated outputs (http://www.epa.gov/otaq/models/moves/index.htm) and hourly meteorology. All tribal data from the mobile sectors have been dropped because the emissions are small, the emissions could be double-counted with state-provided onroad emissions, all tribal data was developed using the older model MOBILE6, and because spatial surrogate data is not currently available.

2.3.1 Onroad non-refueling (onroad)

For the continental U.S., EPA used a modeling framework that took into account the temperature sensitivity of the on-road emissions. Specifically, EPA used MOVES inputs for representative counties, vehicle miles traveled (VMT) and vehicle population (VPOP) 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 EPA in 2010 and is in use by states and regional planning organizations for regional air quality modeling of onroad mobile sources. SMOKE-MOVES requires that emission rate "lookup" tables be generated by MOVES which differentiate 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., EPA used an automated process to run MOVES to produce emission factors by temperature and speed for a series of "representative counties," to which every other county was mapped. Using the MOVES emission rates, SMOKE selects appropriate emissions rates for each county, hourly temperature, SCC, and speed bin and multiplied the emission rate by activity (VMT (vehicle miles travelled) or VPOP (vehicle population)) to produce emissions. These calculations were done for every county and grid cell, in the continental U.S. for each hour of the year.

Using SMOKE-MOVES for creating the model-ready emissions requires numerous 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 MOVES 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 a list of temperatures and activity data
5) Run MOVES to create emission factor tables
6) Run SMOKE to apply the emission factors to activity data (VMT and VPOP) to calculate emissions
7) Aggregate the results to the county-SCC level for summaries and quality assurance

The onroad emissions inputs are similar to the emissions in the onroad data category of the 2011NEIv1, described in more detail in Section 4.6 of the 2011NEIv1 TSD. Specifically the platform and 2011NEIv1 have identical:

- MOVES County databases (CDBs)
- Fuels
- Representative counties
- Fuel months
- Meteorology
- Activity data (VMT, VPOP, speed)
- Extended idle adjustments

Despite the commonalities, there are some key differences between the two onroad emission inventories:

- The 2011NEIv1 used MOVES2010b to create the emission factor (EF) tables, while the 2011v6.1 platform used the MOVESTier3FRM (specifically, model "Moves 20121002f" and the default database "movesdb20121002l_truncatedgfre") for the EFs.
- The 2011 platform used a different post-processor to create EFs 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 treatment of Texas and California emissions differs between the two inventories (see below for more details).
- The list of emission modes differ between the two inventories. Both SMOKE-MOVES runs were generated at the same level of detail, but the NEI emissions were aggregated into 4 all-inclusive modes: exhaust (including extended idle), evaporative (including permeation), brake wear, and tire wear. The list of modes and the corresponding MOVES processes mapped to them are listed in Table 2-12.

Table 2-12. Onroad emission modes

Mode	Description	MOVES process IDs
EXH	Exhaust, including running and starts, excluding extended idle	1;2;15;16
EXT	Extended idle exhaust from long-haul trucks	17;90
APU[3]	Auxiliary Power Unit exhaust from long-haul trucks	91
EVP	Evaporative emissions, including vapor venting and fuel leaks, excluding permeation	12;13
EPM	Evaporative permeation	11
RFL	Refueling	18;19
BRK	Brake wear	9
TIR	Tire wear	10

For more detailed information on methods used to develop the onroad emissions and input data sets and on running SMOKE-MOVES, see the 2011NEIv1 TSD.

The California and Texas onroad emissions were created through a hybrid approach of combining state-supplied annual emissions (from the 2011NEIv1) with EPA developed SMOKE-MOVES runs. Through this approach, the platform was able to reflect California's unique rules and Texas' detailed modeling, 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 California's and Texas' onroad emissions based on SMOKE-MOVES results were:

1) Run CA/TX using EPA inputs through SMOKE-MOVES to produce hourly 2011 emissions hereafter known as "EPA estimates". These EPA estimates for CA/TX are run in a separate sector called "onroad_catx".
2) Calculate ratios between state-supplied emissions and EPA estimates[4]. For Texas, these ratios were calculated for each county/SCC7 (fuel and vehicle type)/pollutant combination. For California, these were calculated for each county/SCC3 (fuel type)/pollutant combination. These were not calculated at a greater resolution because California's emissions did not provide data for all vehicle types.
3) Create an adjustment factor file (CFPRO) that includes EPA-to-state estimate ratios. For extended idle adjustments, each specific state ratio (county/SCC Group (7 or 3)/pollutant) was multiplied by the extended idle adjustment factor (see the 2011NEIv1 TSD for details).
4) Rerun CA/TX through SMOKE-MOVES using EPA inputs and the new adjustment factor file.

Through this process, adjusted model-ready files were created that sum to California's and Texas' annual totals, but have the temporal and spatial patterns reflecting the highly resolved meteorology and SMOKE-MOVES. After adjusting the emissions, this sector is called "onroad_catx_adj". Note that in

[3] APU emissions are only in the future year projections of the MOVESTier3FRM version of the model. As part of the HD GHG rule, a certain percentage of long-haul combination trucks will start to use APU's instead of extended idle for hotelling overnight.

[4] These ratios were created for all matching pollutants. These ratios were duplicated for all appropriate modeling species. For example, 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, and PMFINE (For more details on NO_X and PM speciation, see Sections 3.2.3 and 3.2.2). For VOC model-species, if there was an exact match (e.g., BENZENE), EPA used that HAP pollutant ratio. For other VOC-based model-species that didn't exist in the NEI inventory, EPA used VOC ratios.

emission summaries, the emissions from the “onroad” and “onroad_catx_adj” sectors are summed and designated as the emissions for the onroad sector.

2.3.2 Onroad refueling (onroad_rfl)

Onroad refueling is modeled very similarly to other onroad emissions, and were generated using MOVESTier3FRM. The onroad_rfl emissions are spatially allocated to gas station locations (see Section 3.4.1). Because the refueling emission factors use the same SCCs as the other onroad models, refueling was run in a separate sector from the other onroad mobile sources to allow for the different spatial allocation. To facilitate this, the refueling EFs were separated from the other emission factors into rate-per-distance (RPD) refueling and rate-per-vehicle (RPV) refueling tables[5]. SMOKE-MOVES was run using these EF tables as inputs, and spatially allocated using a gas stations spatial surrogate. Lastly, the SMOKE program Mrggrid combined RPD refueling and RPV refueling into a single onroad_rfl model-ready output for final processing with the other sectors prior to use in CMAQ. EPA SMOKE-MOVES generated emissions for onroad refueling were used without any adjustments for all states, including California and Texas. These emissions were used instead of state submissions to provide a consistent approach nationwide and also because most states did not submit refueling emissions for diesel fuel. Since the 2011NEIv1 includes the state-submitted emissions, the platform and the NEI refueling emissions in the nonpoint category are inconsistent for states that submitted refueling emissions. For states that didn’t submit emissions, the approaches are similar but not identical because of differences in the MOVES version, specifically 2010b for the NEI and Tier3FRM for the modeling platform.

2.4 2011 nonroad mobile sources (c1c2rail, c3marine, nonroad)

The nonroad mobile source emission modeling sectors consist of nonroad equipment emissions (nonroad) and locomotive and commercial marine vessel (CMV) emissions divided into two nonroad sectors: “c1c2rail” and “c3marine”.

2.4.1 Class 1/Class 2 Commercial Marine Vessels and Locomotives and (c1c2rail)

The c1c2rail sector contains locomotive and smaller CMV sources, except for railway maintenance locomotives and C3 CMV sources outside of the Midwest states. The “c1c2” portion of this sector name refers to the Class 1 and 2 CMV emissions, not the railway emissions. Railway maintenance emissions are included in the nonroad sector. The C3 CMV emissions are in the c3marine sector. All emissions in this sector are annual and at the county-SCC resolution.

The starting point for the c1c2rail sector is the 2011NEIv1 nonpoint inventory for all but specific Midwest states, which are instead derived from the Great Lakes 2010 CMV inventory. As discussed in Table 2-1 and Table 2-2, the modeling platform emissions for the c1c2rail SCCs were extracted from the NEI nonpoint inventory. For more information on CMV sources in the NEI, see Section 4.3 of the 2011NEIv1 TSD. For more information on locomotives, see Section 4.4 of the 2011NEIv1 TSD. Table 2-13 lists the NEI SCCs included in the c1c2rail sector of the modeling platform.

Table 2-13. 2011NEIv1 SCCs extracted for the starting point in c1c2rail development

SCC	Description: Mobile Sources prefix for all
2280002100	Marine Vessels; Commercial; Diesel; Port
2280002200	Marine Vessels; Commercial; Diesel; Underway

[5] The Moves2smk post-processing script has command line arguments that will either consolidate or split out the refueling EF.

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

The difference between the 2011NEIv1 and the modeling platform for this sector is due to the availability of alternative data from the Midwest RPO. Year-2010 emissions were received from the Lake Michigan Air Directors Consortium for tug boats, Great Lakes vessels ("Lakers") and inland waterways for states within the Midwest RPO and Minnesota, hereafter simply referred to as "MWRPO" (http://www.ladco.org/). The states in the MWRPO are: Illinois, Indiana, Michigan, Minnesota, Ohio and Wisconsin. These MWRPO CMV emissions include coverage for bordering states/counties along the inland waterways such as the Mississippi and Ohio rivers in Iowa, Missouri, Kentucky, West Virginia, Pennsylvania and New York. The LADCO 2010 inventory was used to replace EPA-estimated CMV emissions in the MWRPO states, but was not used to replace the 2011NEIv1 emissions in the bordering non-MWRPO states.

Some modifications to the MWRPO CMV data were made prior to SMOKE processing:

- Emissions provided at the level of NEI Shape IDs were aggregated to county-level.
- The 2011NEIv1 was used to determine which counties had ports; for those counties that had ports, 90% of emissions in the MWPRO inventory were assigned as underway (SCC=2280002200) and 10% were assigned as port emissions (SCC=2280002100).
- Emissions were converted to short tons and PM2.5 was added by assuming it is equal to 92% of PM10 at the suggestion of the MWRPO.
- Tugs were assigned a unique SCC (2280002021) to allow for unique spatial allocation (see Section 3.4.1).
- Tugs were assigned from MWRPO total to counties based on 2011NEIv1 county-level activity information for tug vessels.

Because the Great Lakes vessels include all CMV activity on the Great Lakes, EPA-estimated C3 CMV (c3marine) sector emissions (discussed in the following section) in the MWRPO states were removed to avoid potential double-counting of C3 CMV with the LADCO inventory in the MWRPO states.

2.4.2 Class 3 commercial marine vessels (c3marine)

The U.S. C3 CMV inventory was developed based on a 4-km resolution ASCII raster format dataset used since the Emissions Control Area-International Marine Organization (ECA-IMO) project began in 2005, then known as the Sulfur Emissions Control Area (SECA). The ECA-IMO data are used instead of the 2011NEIv1 data for the modeling platform because accompanying estimates of emission projections for future years are available. In addition, the inventory preserves shipping lanes in federal waters while these are not stored within the NEI data. Keeping the sources in this sector separate from smaller CMV sources allows for the emissions to be elevated above the surface layer within the AQ model. The ECA-IMO data are used for all states with C3 CMV emissions. For the MWPRO states, the ECA-IMO C3 CMV emissions in the Great Lakes are assumed to be misclassified as C3 vessels for which emissions are included in the c1c2rail sector as part of the LADCO inventory, therefore the ECA-IMO emissions are not included in the c3marine sector.

The development of this ECA-IMO-based C3 CMV inventory is discussed below; however, all non-U.S. emissions (Canadian emissions and emissions farther offshore than U.S. waters) are processed in the "othpt" sector, discussed later in Section 2.5.1. This splitting of the C3 CMV emissions from the farther offshore emissions allows for easier summaries of U.S.-only and state or county total emissions.

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 often burn residual fuel. The emissions in this sector are comprised of primarily foreign-flagged ocean-going vessels, referred to as C3 CMV ships. The c3marine inventory 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 (EPA-420-F-10-041, August 2010) project 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 Emission Control Areas is at: http://www.epa.gov/oms/oceanvessels.htm.

The ECA-IMO emissions data were converted to SMOKE point-source ORL input format as described in http://www.epa.gov/ttn/chief/conference/ei17/session6/mason.pdf. 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. Counties were assigned as extending up to 200nm from the coast because this was the distance to the edge of the U.S. Exclusive Economic Zone (EEZ), a distance that defines the outer limits of ECA-IMO controls for these vessels.

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). 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 2-14. The emissions were converted to SMOKE point source inventory format, allowing for the emissions to be allocated to modeling layers above the surface layer. 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 in Table 2-14. 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 domain used by EPA in recent years.

For California, we scaled the resulting ECA-IMO 2011 emissions by county to match those provided by CARB for year 2011 because CARB has had distinct projection and control approaches for this sector since 2002. These CARB C3 CMV emissions are documented in a staff report available at: http://www.arb.ca.gov/regact/2010/offroadlsi10/offroadisor.pdf. The CMV emissions obtained from the CARB nonroad mobile dataset include the 2011 regulations to reduce emissions from diesel engines on commercial harbor craft operated within California waters and 24 nautical miles of the California shoreline. These emissions were developed using Version 1 of the California Emissions Projection Analysis Model (CEPAM) that supports various California off-road regulations. The locomotive emissions were obtained from the CARB trains dataset "ARMJ_RF#2002_ANNUAL_TRAINS.txt".

Documentation of the CARB offroad mobile methodology, including c1c2rail sector data, is provided at: http://www.arb.ca.gov/msei/categories.htm#offroad_motor_vehicles.

The geographic regions listed in the table are shown in Figure 2-2. The East Coast and Gulf Coast regions were divided along a line roughly through Key Largo (longitude 80° 26' West). The Canadian near-shore emissions were assigned to province-level FIPS codes and paired those to region classifications for British Columbia (North Pacific), Ontario (Great Lakes) and Nova Scotia (East Coast).

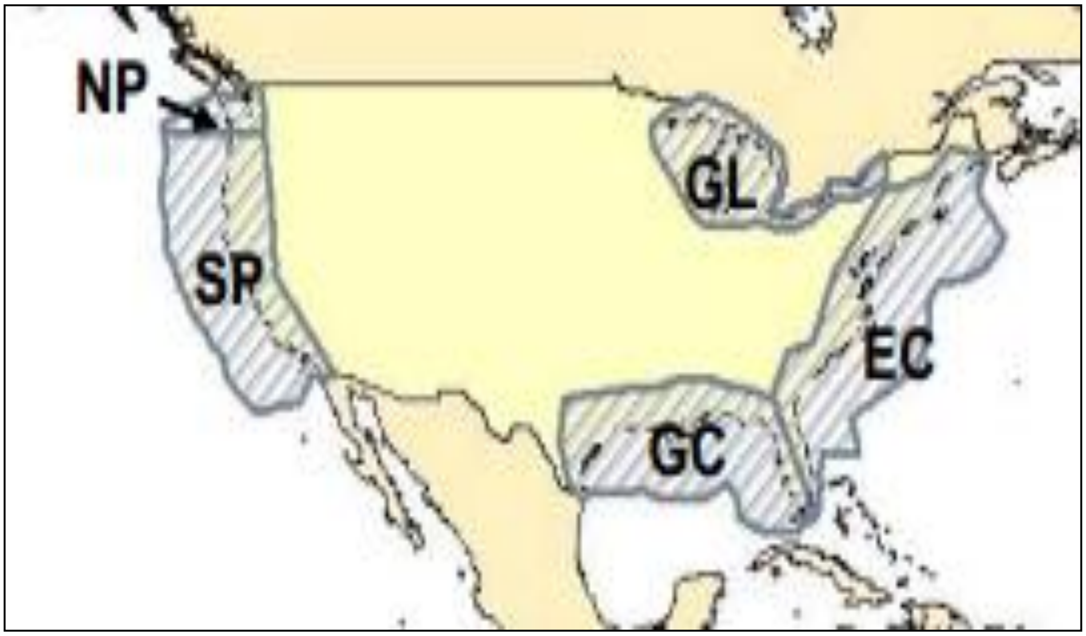
Table 2-14. Growth factors to project the 2002 ECA-IMO inventory to 2011

Region	**EEZ FIPS**	**NO_X**	**PM_{10}**	**$PM_{2.5}$**	**VOC (HC)**	**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

* Technically, these are not really "FIPS" state-county codes, but are treated as such in the inventory and emissions processing.

The assignment of U.S. state/county FIPS codes was restricted to state-federal water boundaries data from the Mineral Management Service (MMS) that extend approximately 3 to 10 nautical miles (nm) off shore. Emissions outside the 3 to 10 mile MMS boundary, but within the approximately 200 nm EEZ boundaries in Figure 2-2, were projected to year 2011 using the same regional adjustment factors as the U.S. emissions; however, the state/county FIPS codes were assigned as "EEZ" codes and these emissions processed in the "othpt" sector (see Section 2.5.1). Note that state boundaries in the Great Lakes are an exception, extending through the middle of each lake such that all emissions in the Great Lakes are assigned to a U.S. county or Ontario. This holds true for MWRPO states and other states such as Pennsylvania and New York. The classification of emissions to U.S. and Canadian FIPS codes is needed to avoid double-counting of C3 CMV U.S. emissions in the Great Lakes because, as discussed in the previous section, all CMV emissions in the Midwest RPO are processed in the "c1c2rail" sector.

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



The emissions were converted to SMOKE point source inventory format, allowing for the emissions to be allocated to modeling layers above the surface layer. 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 in Table 2-14. 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 domain used by EPA in recent years[6].

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 c3marine speciation and Section 3.3.6 for details on temporal allocation.

2.4.3 Nonroad mobile equipment sources: (nonroad)

The nonroad equipment emissions are equivalent to the emissions in the nonroad data category of the 2011NEIv1, with the exception that the modeling platform emissions also include monthly totals. All nonroad emissions are compiled at the county/SCC level. NMIM (EPA, 2005) creates the nonroad emissions on a month-specific basis that accounts for temperature, fuel types, and other variables that vary by month. The nonroad sector includes monthly exhaust, evaporative and refueling emissions from nonroad engines (not including commercial marine, aircraft, and locomotives) that EPA derived from NMIM for all states except California and Texas. Additional details on the development of the 2011NEIv1 nonroad emissions are available in Section 4.5 the 2011NEIv1 TSD.

[6] 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.

California year 2011 nonroad emissions were submitted to the 2011NEIv1 and are also documented in a staff report (ARB, 2010a). The nonroad sector emissions in California were developed using a modular approach and include all rulemakings and updates in place by December 2010. These emissions were developed using Version 1 of the CEPAM which supports various California off-road regulations such as in-use diesel retrofits (ARB, 2007), Diesel Risk-Reduction Plan (ARB, 2000) and 2007 State Implementation Plans (SIPS) for the South Coast and San Joaquin Valley air basins (ARB, 2010b).

The CARB-supplied 2011NEIv1 nonroad annual inventory emissions values were converted to monthly values by using the aforementioned EPA NMIM monthly inventories to compute monthly ratios by county, SCC7 (fuel, engine type, and equipment type group), mode, and pollutant. SCC7 ratios were used because the SCCs in the CARB inventory did not align with many of the SCCs in EPA NMIM inventory. By aggregating up to SCC7, the two inventories had a more consistent coverage of sources. Some VOC emissions were added to California to account for situations when VOC HAP emissions were included in the inventory, but there were no VOC emissions. These additional VOC emissions were computed by summing benzene, acetaldehyde, and formaldehyde for the specific sources.

Texas year 2011 nonroad emissions were also submitted to the NEI. The 2011NEIv1 nonroad annual inventory emissions values were converted to monthly values by using EPA's NMIM monthly inventories to compute monthly ratios by county, SCC7, mode, and poll[7].

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

The emissions from Canada, Mexico, and non-U.S. offshore Class 3 Commercial Marine Vessels (C3 CMV) and drilling platforms are included as part of three emissions modeling sectors: othpt, othar, 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 third and fourth characters provide the SMOKE source types: "pt" for point, "ar" for "area and nonroad mobile", and "on" for onroad mobile.

For Canada, year-2006 Canadian emissions were the starting point with the addition of several modifications to these inventories. The SCCs in these inventories were changed to the generic 39999999 and the industrial code information was removed to preserve confidentiality. The Canadian point sources are split into three inventory files:

- ptinv_canada_point_2006_orl_13aug2013_v3_orl.txt: contains point sources for all pollutants except VOC;
- ptinv_canada_point_cb5_2006_orl_13aug2013_v1_orl.txt: contains VOC emissions split into CB05 species;
- ptinv_canada_point_uog_2006_orl_02mar2009_v0_orl.txt: contains oil and gas-related sources.

For Mexico, emissions for year 2012 are projections of their 1999 inventory originally developed by Eastern Research Group Inc., (ERG, 2006; ERG, 2009; Wolf, 2009) as part of a partnership between

[7] If there was no match at county/SCC7/mode/poll, the allocation would fall back to state/SCC7/mode/poll. If that did not find a match, then state/SCC7 was used. For a few situations, that would also fail to match and the monthly emissions were allocated with a similar SCC7.

Mexico's Secretariat of the Environment and Natural Resources (Secretaría de Medio Ambiente y Recursos Naturales-SEMARNAT) and National Institute of Ecology (Instituto Nacional de Ecología-INE), the U.S. EPA, the Western Governors' Association (WGA), and the North American Commission for Environmental Cooperation (CEC). This inventory includes emissions from all states in Mexico. A background on the development of year-2012 Mexico emissions from the 1999 inventory is available at: http://www.wrapair.org/forums/ef/inventories/MNEI/index.html.

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

As discussed in Section 2.4.2, the ECA-IMO-based C3 CMV emissions for non-U.S. states are processed in the othpt sector. These C3 CMV emissions include those assigned to Canada, those assigned to the Exclusive Economic Zone (EEZ, defined as those emissions just beyond U.S. waters approximately 3-10 miles offshore, extending to about 200 nautical miles from the U.S. coastline), and all other offshore emissions –far offshore and non-U.S. These emissions are included in the othpt sector for simplicity of creating U.S.-only emissions summaries. Otherwise, these emissions are developed in the same way as the U.S. C3 CMV emissions in the c3marine sector.

For Canadian point sources, other than some minor formatting changes, the Canada-provided year-2006 emissions were modified as follows:

i. Speciated VOC emissions from the Acid Deposition and Oxidant Model (ADOM) chemical mechanism were not included because EPA modeling uses speciated emissions from the CB5 chemical mechanism, which Canada also provided.

ii. Excessively high CO emissions were removed from Babine Forest Products Ltd (British Columbia SMOKE plantid='5188') in the point inventory. This change was made at EPA's discretion because the value of the emissions was impossibly large.

iii. The county part of the state/county FIPS code field in the SMOKE inputs were modified in the point inventory from "000" to "001" to enable matching to existing temporal profiles.

iv. An update to the 2007 platform version was the removal of three units that closed in 2010: Grand Lake Generating Station in New Brunswick (PLANTID='1708', POINTID='130011'), Raffinerie de Montreal-Est in Quebec (PLANTID='3127', POINITD='53202982') and Kidd Metallurgical Site in Ontario (PLANTID='2815', POINTID='ON500004').

Mexico point-format year-2012 inventories projected from the 1999 Mexico NEI were used essentially as-is with only minor formatting changes. The othpt sector also includes point source offshore oil and gas drilling platforms that are beyond U.S. state-county boundaries in the Gulf of Mexico. For these offshore emissions, the 2008 NEI version 3 point source inventory data were used because the 2011 data were not yet available. This is consistent with the 2011NEIv1. Updated offshore oil and gas drilling emissions are expected to be incorporated into version 2 of the 2011 NEI. The 2008-based offshore emission sources were provided by the Mineral Management Services (MMS).

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

For Canada, year-2006 emissions provided by Canada and unchanged from EPA 2007 platform were used. Inventory files were provided for area fugitive dust, agricultural, commercial marine, railroad, nonroad, aircraft, and other area sources. The following adjustments were made to the original files:

i. Wildfires or prescribed burning were not included because Canada does not include these inventory data in their modeling. Note that SMARTFIRE 2 is used for U.S. sources only.

ii. In-flight aircraft emissions were not included because these sources are not included in the U.S. modeling.

iii. A 75% reduction ("transport fraction") was applied to PM for the road dust, agricultural, and construction emissions in the Canadian "afdust" inventory. This approach is more simplistic than the county-specific approach used for the U.S., but a comparable approach was not available for Canada.

iv. Wind erosion (SCC=2730100000) and cigarette smoke (SCC=2810060000) emissions were removed from the nonpoint (nonpt) inventory because these emissions are not modeled in the U.S. inventory.

v. Quebec $PM_{2.5}$ emissions (2,000 tons/yr) were removed for one SCC (2305070000) for Industrial Processes, Mineral Processes, Gypsum, Plaster Products due to corrupt fields after conversion to SMOKE input format.

vi. C3 CMV SCCs (22800030X0) records were removed because, as discussed in Section 2.5.1, these emissions are included in the (ECA-IMO derived) othpt sector, which covers not only emissions close to Canada but also emissions far at sea. Canada was involved in the inventory development of the ECA-IMO C3 CMV inventory.

For Mexico nonpoint-format year-2012 inventories, the only significant modification was the removal of domestic ammonia (SCC=5555555555) (ERG, 2009; Wolf, 2009).

2.5.3 Onroad mobile sources from Canada and Mexico (othon)

Both year-2006 Canada and year-2012 Mexico inventories (ERG, 2009; Wolf, 2009) were converted from their original SMOKE One-Record per Line (ORL) and Inventory Data Analyzer (IDA) formats, respectively, into the SMOKE Flat File 2010 (FF10) inventory format: http://www.cmascenter.org/smoke/documentation/3.5/html/ch08s02s07.html. Otherwise, these inventories were used as-is. The emission values in the Canada-provided Canadian inventories were unchanged from the 2007 platform.

2.6 Fires (ptfire)

Wildfire and prescribed burning emissions are contained in the ptfire sector. The ptfire sector has emissions provided at geographic coordinates (point locations) and has daily emissions values. The ptfire sector excludes agricultural burning and other open burning sources that are included in the nonpt sector. Emissions are day-specific and include satellite-derived latitude/longitude of the fire's origin and other parameters associated with the emissions such as acres burned and fuel load, which allow estimation of plume rise. Emissions for the SCCs listed in Table 2-15 are treated as point sources and are consistent with the fires stored in the Events data category of the 2011NEIv1. For more information on the development of the 2011NEIv1 fire inventory, see Section 5.1 of the 2011NEIv1 TSD.

Table 2-15. 2011 Platform SCCs representing emissions in the ptfire modeling sector

SCC	SCC Description*
2810001000	Other Combustion; Forest Wildfires; Total
2810015000	Other Combustion; Prescribed Burning for Forest Management; Total
2811015000	Other Combustion-as Event; Prescribed Burning for Forest Management; Total
2811090000	Other Combustion-as Event; Prescribed Forest Burning ;Unspecified

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

The point source day-specific emission estimates for 2011 fires rely on SMARTFIRE 2 (Sullivan, et al., 2008), which uses the National Oceanic and Atmospheric Administration's (NOAA's) Hazard Mapping System (HMS) fire location information as input. Additional inputs include the CONSUMEv3.0 software application (Joint Fire Science Program, 2009) and the Fuel Characteristic Classification System (FCCS) fuel-loading database to estimate fire emissions from wildfires and prescribed burns on a daily basis. The method involves the reconciliation of ICS-209 reports (Incident Status Summary Reports) with satellite-based fire detections to determine spatial and temporal information about the fires. A functional diagram of the SMARTFIRE 2 process of reconciling fires with ICS-209 reports is available in the documentation (Raffuse, et al., 2007). Once the fire reconciliation process is completed, the emissions are calculated using the U.S. Forest Service's CONSUMEv3.0 fuel consumption model and the FCCS fuel-loading database in the BlueSky Framework (Ottmar, et. al., 2007).

SMARTFIRE 2 estimates were used directly for all states except Georgia and Florida. For Georgia, the satellite-derived emissions were removed from the ptfire inventory and replaced with a separate state-supplied ptfire inventory. Adjustments were also made to Florida as described in Section 5.1.4 of the 2011NEIv1 TSD. These changes made the data in the ptfire inventory consistent with the data in the 2011NEIv1.

2.7 Biogenic sources (biog)

The biogenic emissions were computed based on the 11g version of the 2011 meteorology data using the Biogenic Emission Inventory System, version 3.14 (BEIS3.14) model within SMOKE. The BEIS3.14 model 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 U.S., Mexico, and Canada. The BEIS3.14 model is described further in:
http://www.cmascenter.org/conference/2008/slides/pouliot_tale_two_cmas08.ppt.
The inputs to BEIS include:

- Temperature data at 2 meters, which were obtained from the meteorological input files to the air quality model,
- Land-use data from the Biogenic Emissions Land use Database, version 3 (BELD3). BELD3 data provides data on the 230 vegetation classes at 1-km resolution over most of North America.

To provide a sense of the scope and spatial distribution of the emissions, plots of annual BEIS outputs for isoprene and NO for 2011 are shown in Figure 2-3 and Figure 2-4, respectively.

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.

Figure 2-3. Annual NO emissions output from BEIS 3.14 for 2011

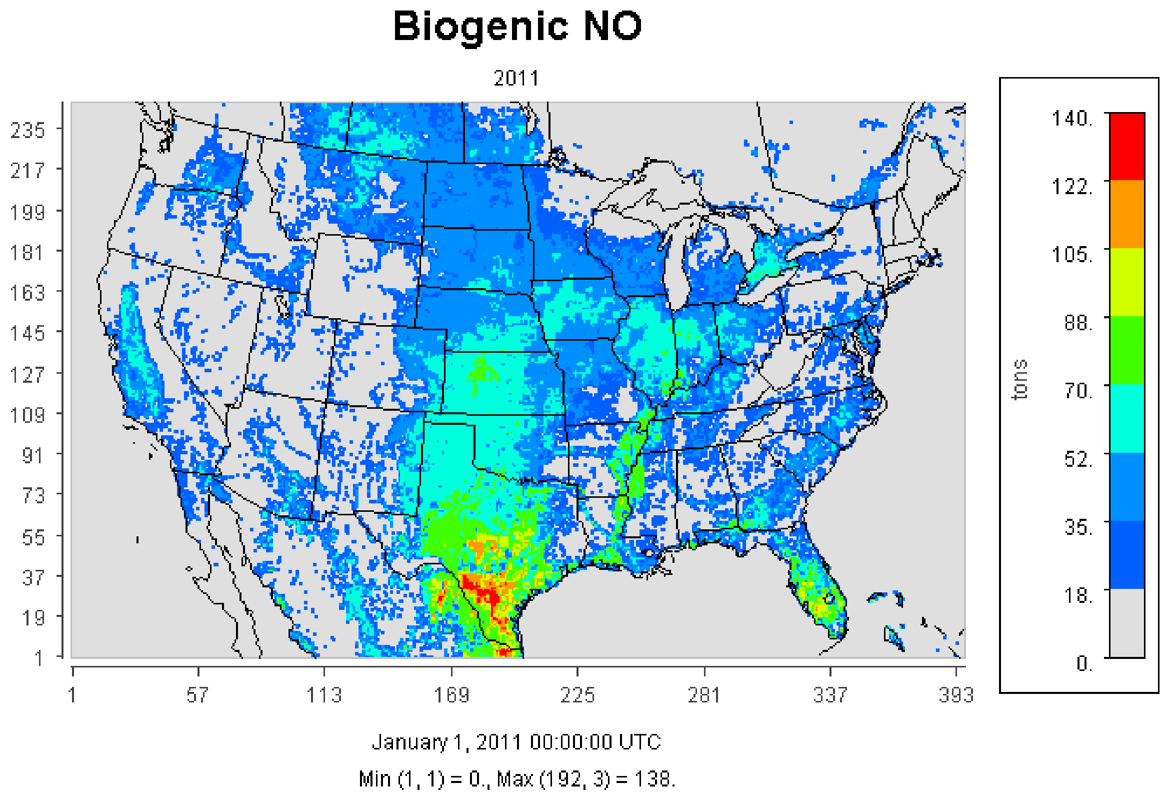
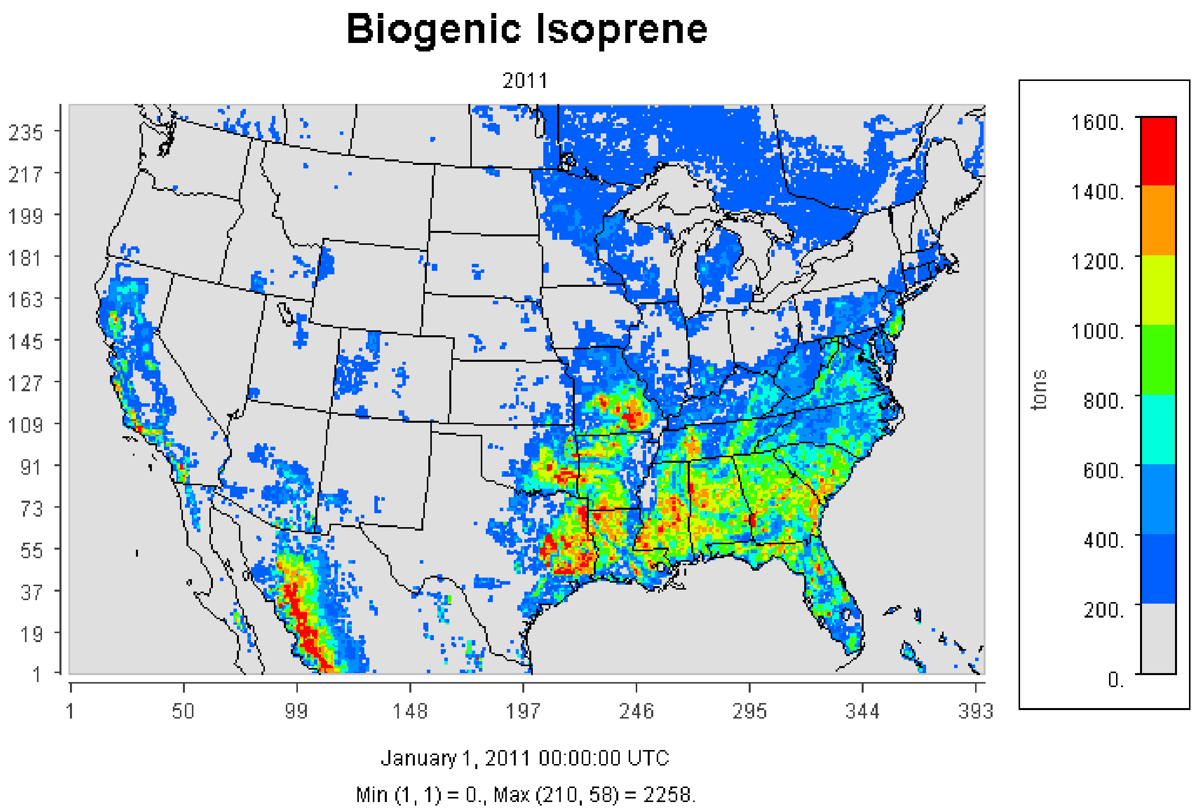


Figure 2-4. Annual isoprene emissions output from BEIS 3.14 for 2011



3 Emissions Modeling Summary

Both the CMAQ and CAM_X models require 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 layer of the sources does not need to be 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, which also can be different for different sectors, may be individual point sources, county/province/municipio totals, or gridded emissions. 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 2011NEIv1 were 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 2011v6 platform are available from the CHIEF Emissions Modeling Clearinghouse website (see Section 1).

SMOKE version 3.5.1 was used to pre-process the raw emissions inventories into emissions inputs for CMAQ. For projects that used CAMx, the CMAQ emissions were converted into the CAMx formats using CAMx convertor programs. 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 quality assurance 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: here “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 c3marine, othpt, and ptfire sectors are the only sectors with only "in-line" emissions, meaning that all of the emissions are placed in aloft layers and there are no emissions for those sectors in the two-dimensional, layer-1 files created by SMOKE.

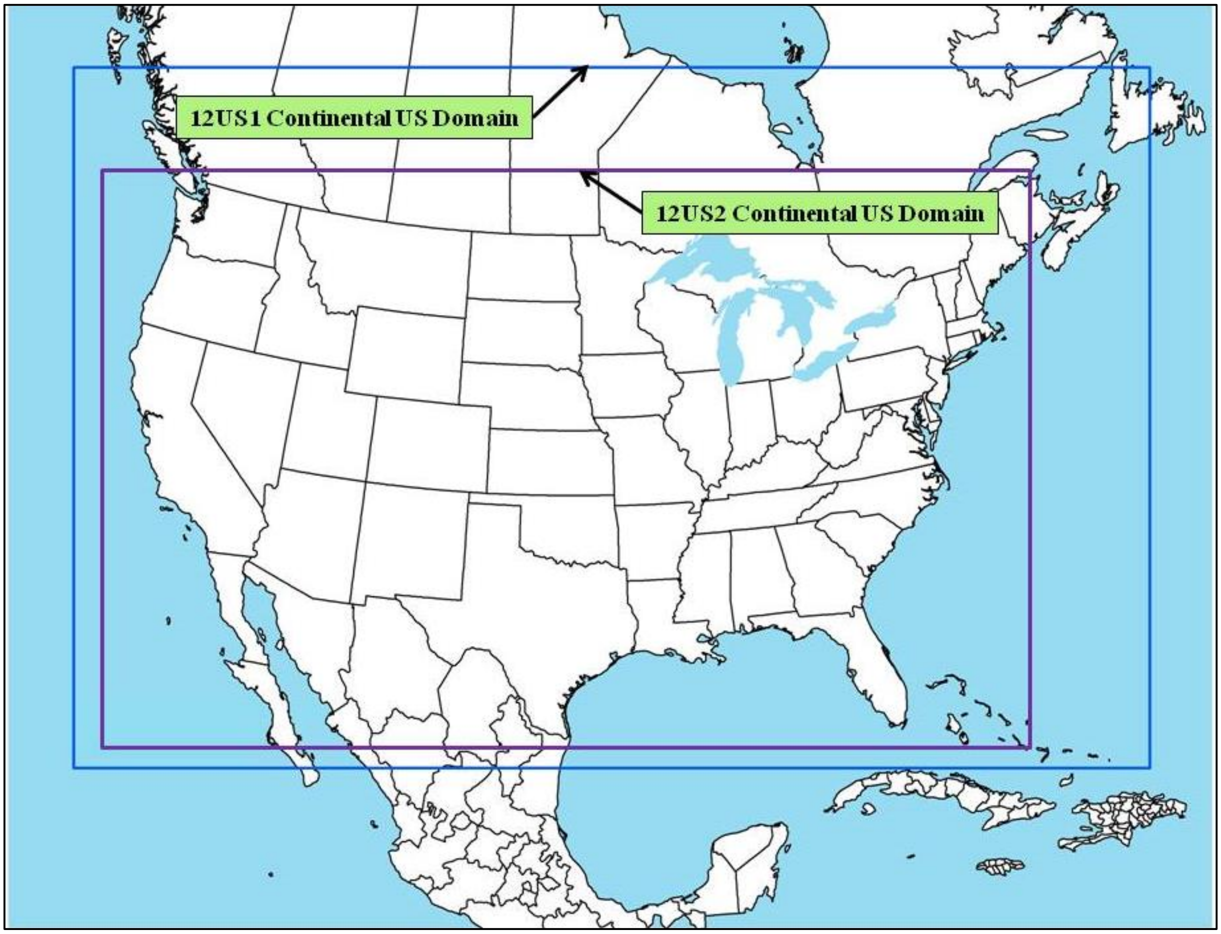
Table 3-1. Key emissions modeling steps by sector.

Platform sector	Spatial	Speciation	Inventory resolution	Plume rise
afdust	Surrogates	Yes	annual	
ag	Surrogates	Yes	annual (some monthly)	
beis	Pre-gridded land use	in BEIS3.14	computed hourly	
c1c2rail	Surrogates	Yes	annual	
c3marine	Point	Yes	annual	in-line
nonpt	Surrogates & area-to-point	Yes	annual (some monthly)	
nonroad	Surrogates & area-to-point	Yes	monthly	
np_oilgas	Surrogates	Yes	annual	
onroad	Surrogates	Yes	monthly activity, computed hourly	
onroad_rfl	Surrogates	Yes	monthly activity, computed hourly	
othar	Surrogates	Yes	annual	
othon	Surrogates	Yes	annual	
othpt	Point	Yes	annual	in-line
pt_oilgas	Point	Yes	annual	in-line
ptegu	Point	Yes	daily & hourly	in-line
ptegu_pk	Point	Yes	daily & hourly	in-line
ptfire	Point	Yes	daily	in-line
ptnonipm	Point	Yes	annual	in-line
rwc	Surrogates	Yes	annual	

SMOKE has the option of grouping sources so that they are treated as a single stack when computing plume rise. For the 2011 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 lat/lons 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 were obtained from a 2011 run of GEOS-Chem.

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

Section 3.4 provides the details on the spatial surrogates and area-to-point data used to accomplish spatial allocation with SMOKE.

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 or groups of species, called “model species.” The chemical mechanism used for the 2011 platform is the CB05 mechanism (Yarwood, 2005). The same base chemical mechanism is used within both CMAQ and CAM_X, but the implementation differs slightly between the two models. The specific versions of CMAQ and CAMx used in applications of this platform include secondary organic aerosol (SOA) and HONO enhancements.

From the perspective of emissions preparation, the CB05 with SOA mechanism is the same as was used in the 2007 platform. Table 3-3 lists the model species produced by SMOKE for use in CMAQ and CAM_X. It should be noted that the BENZENE model species is not part of CB05 in that the concentrations of BENZENE do not provide any feedback into the chemical reactions (i.e., it is not “inside” the chemical mechanism). Rather, benzene is used as a reactive tracer and as such is impacted by the CB05 chemistry. BENZENE, along with several reactive CB05 species (such as TOL and XYL) plays a role in SOA formation.

The TOG and $PM_{2.5}$ speciation factors that are the basis of the chemical speciation approach were developed from the SPECIATE 4.3 database (http://www.epa.gov/ttn/chief/software/speciate), which is EPA's repository of TOG and PM speciation profiles of air pollution sources. However, a few of the profiles used in the v6 platform will be published in later versions of the SPECIATE database after the release of this documentation. The SPECIATE database development and maintenance is a collaboration involving EPA’s ORD, OTAQ, and the Office of Air Quality Planning and Standards (OAQPS), in cooperation with Environment Canada (EPA, 2006a). 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 $PM_{2.5}$.

Speciation profiles and cross-references for 2011v6 platform are available in spreadsheet form from ftp://ftp.epa.gov/EmisInventory/2011v6/v1platform/reports/speciation_profiles/. The profiles are in the Excel files “gspro_2011.xlsx” and “gspro_combo_2011.xlsx, gsref_2011.xlsx”. The cross reference information is in “gsref_2011.xlsx”, and differences between 2011 and 2018 speciation profiles are shown in “2011ed_2018ed_gspro_differences.xlsx”. A spreadsheet showing emission totals for each speciation profile for the 2011ed case by modeling sector is available in the file “2011ed_speciation_profile_CAPs_feb112014.xlsx”. Note that the emissions totals differ slightly from the 2011ef case, as do some of the VOC to TOG conversion factors. However, the reports still convey the relative importance of each speciation profile in terms of emissions affected.

Table 3-3. Emission model species produced for CB05 with SOA for CMAQ5.0.1 and CAM_X*

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	ALD2	Acetaldehyde
	ALDX	Propionaldehyde and higher aldehydes
	BENZENE	Benzene (not part of CB05)
	CH4	Methane[8]
	ETH	Ethene
	ETHA	Ethane
	ETOH	Ethanol
	FORM	Formaldehyde
	IOLE	Internal olefin carbon bond (R-C=C-R)
	ISOP	Isoprene
	MEOH	Methanol
	OLE	Terminal olefin carbon bond (R-C=C)
	PAR	Paraffin carbon bond
	TOL	Toluene and other monoalkyl aromatics
	XYL	Xylene and other polyalkyl aromatics
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
$PM_{2.5}$[9]	PEC	Particulate elemental carbon ≤ 2.5 microns
	PNO3	Particulate nitrate ≤ 2.5 microns
	POC	Particulate organic carbon (carbon only) ≤ 2.5 microns
	PSO4	Particulate Sulfate ≤ 2.5 microns
	PMFINE	Other particulate matter ≤ 2.5 microns
Sea-salt species (non – anthropogenic)[10]	PCL	Particulate chloride
	PNA	Particulate sodium

*The same species names are used for the CAM_X model with exceptions as follows:
1. CL2 is not used in CAM_X
2. CAM_X particulate sodium is NA (in CMAQ it is PNA)
3. CAM_X uses different names for species that are both in CBO5 and SOA for the following: TOLA=TOL, XYLA=XYL, ISP=ISOP, TRP=TERP. They are duplicate species in CAM_X that are used in the SOA chemistry. CMAQ uses the same names in CB05 and SOA for these species.
4. CAM_X uses a different name for sesquiterpenes: CMAQ SESQ = CAM_X SQT
5. CAM_X particulate species have different names for organic carbon, coarse particulate matter and other particulate mass: CMAQ uses POC, PMC, PMFINE, and PMOTHR, while CAM_X uses POA, CPRM, FCRS, and FPRM, respectively.

3.2.1 VOC speciation

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

The VOC speciation includes HAP emissions from the 2011NEIv1 in the speciation process. Instead of speciating VOC to generate all of the species listed in Table 3-3, emissions of four specific HAPs: benzene, acetaldehyde, formaldehyde and methanol (collectively known as "BAFM") from the NEI were "integrated" with the NEI VOC. The integration process (described in more detail below) 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 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. EPA believes that generally, the HAP emissions from the NEI are more representative of emissions of these compounds than their generation via VOC speciation.

The BAFM HAPs (benzene, acetaldehyde, formaldehyde and methanol) were chosen because, with the exception of BENZENE, they are the only explicit VOC HAPs in the base version of CMAQ 5.0.1 (CAPs only with chlorine chemistry) model. Explicit means that they are not lumped chemical groups like the other CB05 species. These "explicit VOC HAPs" are model species that participate in the modeled chemistry using the CB05 chemical mechanism. The use of these HAP emission estimates along with VOC is called "HAP-CAP integration". BENZENE was chosen because it is a model species in the base version of CMAQ 5.0.1, and there was a desire to keep its emissions consistent between multi-pollutant and base versions of CMAQ.

For specific sources, especially within the onroad and onroad_rfl sectors, the integration included ethanol. To differentiate when a source was integrating BAFM versus EBAFM (ethanol in addition to BAFM), the speciation profiles that do not include ethanol are referred to as an "E-profile" (to be used when the ethanol comes from the inventory pollutant). For example, use E10 headspace gasoline evaporative speciation profile 8763 when ethanol is speciated from VOC, but use 8763E when ethanol is obtained directly from the inventory.

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 and the particular sources to integrate via the NHAPEXCLUDE file (which actually provides the sources to be *excluded* from integration[11]). 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[12]. 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. EPA

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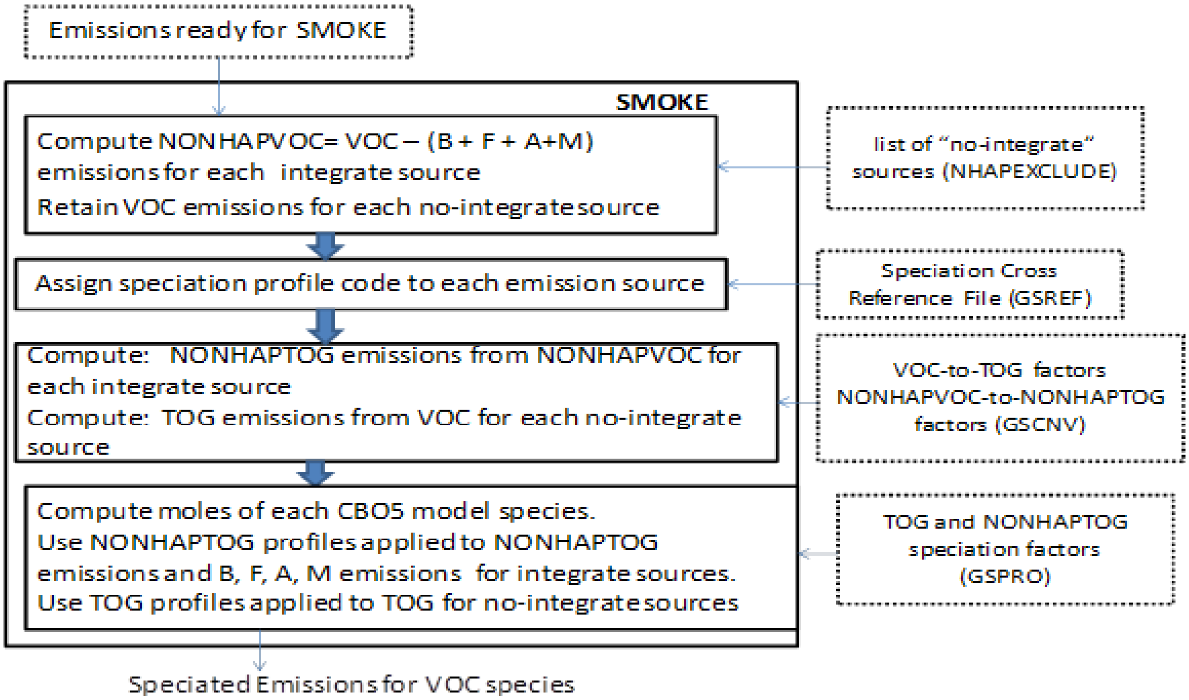
[8] Technically, CH_4 is not a VOC but part of TOG. Although emissions of CH_4 are derived, the AQ models do not use these emissions because the anthropogenic emissions are dwarfed by the CH_4 already in the atmosphere.
[9] For CMAQ 5.0, $PM_{2.5}$ is speciated into a finer set of PM components. Listed in this table are the AE5 species
[10] These emissions are created outside of SMOKE
[11] In SMOKE version 3.5, 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.
[12] 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 BAFM.

considered CAP-HAP integration for all sectors and developed “integration criteria” for some of them (see Section 3.2.1.3 for details).

The process of partial integration for BAFM is illustrated in Figure 3-2 that the BAFM records in the input inventories do not need to be removed from any sources in a partially integrated sector because SMOKE does this automatically using the INVTABLE configuration. For EBAFM integration, this process is identical to that shown in the figure except for the addition of ethanol (E) to the list of subtracted HAP pollutants. For full integration, the process would be very similar except that the NHAPEXCLUDE file would not be used and all sources in the sector would be integrated.

Figure 3-2. Process of integrating BAFM with VOC for use in VOC Speciation



In SMOKE, the INVTABLE allows the user to specify both the particular HAPs to integrate. Two different types of INVTABLE files are included for use with different sectors of the platform. For sectors that had no integration across the entire sector (see Table 3-4), EPA created a “no HAP use” INVTABLE in which the “KEEP” flag is set to “N” for BAFM pollutants. Thus, any BAFM pollutants in the inventory input into SMOKE are automatically dropped. This approach both avoids double-counting of these species and assumes that the VOC speciation is the best available approach for these species for sectors using this approach. The second INVTABLE, used for sectors in which one or more sources are integrated, causes SMOKE to keep the inventory BAFM pollutants and indicates that they are to be integrated with VOC. This is done by setting the “VOC or TOG component” field to “V” for all four HAP pollutants. This type of INVTABLE is further differentiated into a version for those sectors that integrate BAFM and another for those that integrate EBAFM, such as the onroad and onroad_rfl sectors.

Table 3-4. Integration approach for BAFM and EBAFM for each platform sector

Platform Sector	Approach for Integrating NEI emissions of Benzene (B), Acetaldehyde (A), Formaldehyde (F), Methanol (M), and Ethanol (E)
ptegu	No integration
ptegu_pk	No integration
ptnonipm	No integration
ptfire	No integration
othar	No integration
othon	No integration
ag	N/A – sector contains no VOC
afdust	N/A – sector contains no VOC
biog	N/A – sector contains no inventory pollutant "VOC"; but rather specific VOC species
nonpt	Partial integration (BAFM and EBAFM)
np_oilgas	Partial integration (BAFM)
pt_oilgas	Partial integration (BAFM)
rwc	Partial integration (BAFM)
nonroad	Partial integration (BAFM)
c1c2rail	Partial integration (BAFM)
othpt	Partial integration (BAFM)
c3marine	Full integration (BAFM)
onroad	Full integration (EBAFM and BAFM)
onroad_rfl	Full integration (EBAFM and BAFM)

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 (GSPRO_COMBO)

SMOKE can compute speciation profiles from mixtures of other profiles in user-specified proportions. The combinations are specified in the GSPRO_COMBO ancillary file by pollutant (including pollutant mode, e.g., EXH__VOC), state and county (i.e., state/county FIPS code) and time period (i.e., month).This feature was used to speciate onroad and nonroad mobile and gasoline-related 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. SMOKE computes the resultant profile using the fraction of each specific profile assigned by county, month and emission mode.

The GSREF file indicates that a specific source uses a combination file with the profile code “COMBO”. Because the GSPRO_COMBO file does not differentiate by SCC and there are various levels of integration across sectors, sector specific GSPRO_COMBO files are used. For the onroad and onroad_rfl sectors, the GSPRO_COMBO uses E-profiles (i.e. there is EBAFM integration). Different profile combinations are specified by the mode (e.g. exhaust, evaporative, refueling, etc.) by changing the pollutant name (e.g. EXH__NONHAPTOG, EVP__NONHAPTOG, RFL__NONHAPTOG). For the nonpt sector, a combination of BAFM and EBAFM integration is used. Due to the lack of SCC-specificity in the GSPRO_COMBO, the only way to differentiate the sources that should use BAFM integrated profiles versus E-profiles is by changing the pollutant name. For example, EPA changed the pollutant name for the PFC future year inventory so the integration would use EVP__NONHAPVOC to correctly select the E-profile combinations, while other sources used NONHAPVOC to select the typical BAFM profiles.

3.2.1.3 Additional sector specific details

The decision to integrate HAPs into the speciation was made on a sector by sector basis. For some sectors there is no integration (VOC is speciated directly), for some sectors there is full integration (all sources are integrated), and for other sectors there is partial integration (some sources are not integrated and other sources are integrated). The integrated HAPs are either BAFM (BAFM HAPs subtracted from VOC) or EBAFM (ethanol and BAFM HAPs subtracted from VOC). Table 3-4 summarizes the integration for each platform sector.

For the c1c2rail sector, EPA integrated BAFM for most sources from the 2011NEIv1. There were a few sources that had zero BAFM; therefore, they were not integrated. The MWRPO and CARB inventories (see Section 2.4.1) did not include HAPs; therefore, all non-NEI source emissions in the c1c2rail sector were not integrated. For California, the CARB inventory TOG was converted to VOC by dividing the inventory TOG by the available VOC-to-TOG speciation factor.

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. c3marine sector. The rest of the sources in othpt are not integrated, thus the sector is partially integrated.

For the onroad and onroad_rfl sectors, there are series of unique speciation issues. First, SMOKE-MOVES (see Sections 2.3.1 and 2.3.2) is used to estimate these sectors, meaning both the MEPROC and INVTABLE files are involved in controlling which pollutants are ingested and speciated. Second, these sectors have estimates of TOG as well as VOC; therefore, TOG can be speciated directly. Third, the gasoline sources use full integration of EBAFM (i.e. use E-profiles) and the diesel sources use full integration of BAFM. Fourth, the onroad sector utilizes 7 different modes for speciation: exhaust, extended idle, auxiliary power units, evaporative, permeation (gasoline vehicles only), brake wear, and tire wear (See Table 2-12 for more details). The onroad_rfl sector utilizes an additional mode: refueling. Fifth, the gasoline exhaust profiles were updated to 8750a (revision to Gasoline Exhaust - Reformulated gasoline) and 8751a (revision to Gasoline Exhaust - E10 ethanol gasoline)[13]. Sixth, for California and Texas, EPA applied adjustment factors to SMOKE-MOVES to produce California and Texas adjusted model-ready files (see Section 2.3.1 for details). By applying the ratios through SMOKE-MOVES, the CARB and Texas inventories are essentially speciated to match EPA estimated speciation grid cell by grid cell. The future year CARB inventories did not have BAFM, so EPA estimates of BAFM were adjusted using VOC adjustment factors for California only.

For the nonroad sector, CNG or LPG sources (SCCs beginning with 2268 or 2267) are not integrated because NMIM computed only VOC and not any HAPs for these SCCs. All other nonroad sources were integrated except in California. For California, the CARB inventory TOG was converted to VOC by dividing the inventory TOG by the available VOC-to-TOG speciation factor. SMOKE later applies the same VOC-to-TOG factor prior to computing speciated emissions. The CARB-based nonroad data includes exhaust and evaporative mode-specific data for VOC, but does not contain refueling. The CARB inventory does not include HAP estimates for all sources; therefore, the sources which have VOC but do not have BAFM or BAFM is greater than VOC are not integrated. The remaining sources are integrated. The future year CARB inventories did not have BAFM so all sources for California were

[13] These revised profiles are expected to be in the yet to be released SPECIATE 4.4.

not integrated. Similar to onroad, the gasoline exhaust profiles were updated to 8750a and 8751a (this is true nation-wide).

For the ptnonipm sector, the 2011, 2018 and 2025 runs were not integrated. This was an oversight— it should have been partial integration because the 2011 ethanol inventory (SCC 30125010) provided by OTAQ includes BAFM. In the future year, ptnonipm should be partially integrated because both the ethanol and biodiesel inventories (SCC 30125010) provided by OTAQ include BAFM. Aircraft emissions use the profile 5565b which is chemically equivalent to 5565 (aircraft exhaust) in SPECIATE 4.3 database. The profile numbers are differentiated from each other because a draft version of 5565 was used in previous modeling platforms.

For most sources in the rwc sector, the VOC emissions were greater than or equal to BAFM, and BAFM was not zero, so those sources were integrated, although a few specific sources that did not meet these criteria could not be integrated.

For the oil and gas sources in np_oilgas and pt_oilgas, the basins studied in WRAP Phase III have basin-specific VOC speciation that takes into account the distinct composition of gas. ENVIRON developed these basin-specific profiles using gas composition analysis data obtained from operators through surveys. ENVIRON separated out emissions and speciation from conventional/tight sands/shale gas from coal-bed methane (CBM) gas sources. Table 3-5 lists the basin and gas composition specific profiles used for the sources in the WRAP Phase III basins. For oil and gas sources outside of the WRAP Phase III basins, the profiles did not vary by region or basin (see Table 3-6). Table 3-7 lists the WRAP Phase III counties.

Table 3-5. VOC profiles for WRAP Phase III basins

Profile Code	**Description**
DJFLA	D-J Basin Flashing Gas Composition for Condensate
DJVNT	D-J Basin Produced Gas Composition
PNC01	Piceance Basin Gas Composition at Conventional Wells
PNC02	Piceance Basin Gas Composition at Oil Wells
PNC03	Piceance Basin Flashing Gas Composition for Condensate
PRBCO	Powder River Basin Produced Gas Composition for Conventional Wells
PRM01	Permian Basin Produced Gas Composition
SSJCO	South San Juan Basin Produced Gas Composition for Conventional Wells
SWE01	Wyoming Flashing Gas Composition
SWFLA	SW Wyoming Basin Flash Gas Composition
SWVNT	SW Wyoming Basin Vented Gas Composition
UNT02	Uinta Basin Gas Composition at Conventional Wells
UNT03	Uinta Basin Flashing Gas Composition for Oil
UNT04	Uinta Basin Flashing Gas Composition for Condensate
WRBCO	Wind River Basin Produced Gas Composition for Conventional Wells

Table 3-6. National VOC profiles for oil and gas

profile	**Description**
0000	Over All Average
0001	External Combustion Boiler - Residual Oil

profile	Description
0002	External Combustion Boiler - Distillate Oil
0003	External Combustion Boiler - Natural Gas
0004	External Combustion Boiler - Refinery Gas
0007	Natural Gas Turbine
0008	Reciprocating Diesel Engine
0051	Flares - Natural Gas
0296	Fixed Roof Tank - Crude Oil Production
1001	Internal Combustion Engine - Natural Gas
1010	Oil and Gas Production - Fugitives - Unclassified
1011	Oil and Gas Production - Fugitives - Valves and Fittings - Liquid Service
1012	Oil and Gas Production - Fugitives - Valves and Fittings - Gas Service
1207	Well Heads (Water Flood) Composite
2487	Composite of 7 Emission Profiles from Crude Oil Storage Tanks - 1993
2489	Composite of 15 Fugitive Emission Profiles from Petroleum Storage Facilities - 1993

Table 3-7. Counties included in the WRAP Dataset

FIPS	State	County
08001	CO	Adams
08005	CO	Arapahoe
08007	CO	Archuleta
08013	CO	Boulder
08014	CO	Broomfield
08029	CO	Delta
08031	CO	Denver
08039	CO	Elbert
08043	CO	Fremont
08045	CO	Garfield
08051	CO	Gunnison
08059	CO	Jefferson
08063	CO	Kit Carson
08067	CO	La Plata
08069	CO	Larimer
08073	CO	Lincoln
08075	CO	Logan
08077	CO	Mesa
08081	CO	Moffat
08087	CO	Morgan
08095	CO	Phillips
08097	CO	Pitkin
08103	CO	Rio Blanco
08107	CO	Routt
08115	CO	Sedgwick
08121	CO	Washington

FIPS	State	County
08123	CO	Weld
08125	CO	Yuma
30003	MT	Big Horn
30075	MT	Powder River
35005	NM	Chaves
35015	NM	Eddy
35015	NM	Lea
35031	NM	Mc Kinley
35039	NM	Rio Arriba
35041	NM	Roosevelt
35043	NM	Sandoval
35045	NM	San Juan
48003	TX	Andrews
48033	TX	Borden
48079	TX	Cochran
48081	TX	Coke
48103	TX	Crane
48105	TX	Crockett
48107	TX	Crosby
48109	TX	Culberson
48115	TX	Dawson
48125	TX	Dickens
48135	TX	Ector
48141	TX	El Paso
48151	TX	Fisher
48165	TX	Gaines

FIPS	State	County
48169	TX	Garza
48173	TX	Glasscock
48219	TX	Hockley
48227	TX	Howard
48229	TX	Hudspeth
48235	TX	Irion
48263	TX	Kent
48269	TX	King
48301	TX	Loving
48303	TX	Lubbock
48305	TX	Lynn
48317	TX	Martin
48329	TX	Midland
48335	TX	Mitchell
48353	TX	Nolan
48371	TX	Pecos
48383	TX	Reagan
48389	TX	Reeves
48413	TX	Schleicher
48415	TX	Scurry
48431	TX	Sterling
48435	TX	Sutton
48445	TX	Terry
48451	TX	Tom Green
48461	TX	Upton
48475	TX	Ward

FIPS	State	County
48495	TX	Winkler
48501	TX	Yoakum
49007	UT	Carbon
49009	UT	Daggett
49013	UT	Duchesne
49015	UT	Emery
49019	UT	Grand
49043	UT	Summit

FIPS	State	County
49047	UT	Uintah
56001	WY	Albany
56005	WY	Campbell
56007	WY	Carbon
56009	WY	Converse
56011	WY	Crook
56013	WY	Fremont
56019	WY	Johnson

FIPS	State	County
56023	WY	Lincoln
56025	WY	Natrona
56027	WY	Niobrara
56033	WY	Sheridan
56035	WY	Sublette
56037	WY	Sweetwater
56041	WY	Uinta
56045	WY	Weston

For the biog sector, the speciation profiles used by BEIS are not included in SPECIATE. The 2011 platform uses BEIS3.14, which includes a new species (SESQ) that was mapped to the model species SESQT. The profile code associated with BEIS3.14 profiles for use with CB05 uses the profile: "B10C5."

For the nonpt sector, where VOC emissions were greater than or equal to BAFM and BAFM was not zero, the sources were integrated. 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. For the future year, PFC and the cellulosic sources were integrated EBAFM (i.e. used E-profiles) because ethanol was present in those inventories.

3.2.1.4 Future year speciation

The VOC speciation approach used for the future year case is customized to account for the impact of fuel changes. These changes affect the onroad, onroad_rfl, nonroad, and parts of the nonpt and ptnonipm sectors.

Speciation profiles for VOC in the nonroad, onroad and onroad_rfl sectors account for the changes in ethanol content of fuels across years. A description of the actual fuel formulations for 2011 can be found in the 2011NEIv1 TSD, and for 2018 and 2025 see Section 4.3. For 2011, EPA used "COMBO" profiles to model combinations of profiles for E0 and E10 fuel use. For 2018 and 2025, EPA used "COMBO" profiles to model combinations of E10, E15, and E85 fuel use. The speciation of onroad exhaust VOC also accounts for a portion of the vehicle fleet meeting Tier 2 standards in that different exhaust profiles are available for pre-Tier 2 versus Tier 2 vehicles. Thus for onroad gasoline, VOC speciation uses different COMBO profiles to take into account both the increase in ethanol use, and the increase in Tier 2 vehicles in the future case.

The speciation changes from fuels in the nonpt sector are for PFCs and fuel distribution operations associated with the BTP distribution. 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. RBT fuel distribution and BPS speciation does not change across the modeling cases because this is considered upstream from the introduction of ethanol into the fuel. For PFCs, ethanol was present in the future inventories and therefore EBAFM profiles were used to integrate ethanol in the future year speciation. The mapping of fuel distribution SCCs to PFC, BTP, BPS, and RBT emissions categories can be found in Appendix B.

Table 3-8 summarizes the different profiles utilized for the fuel-related sources in each of the sectors for 2011 and the future year cases. This table indicates when “E-profiles” were used instead of BAFM integrated profiles. The term “COMBO” indicates that a combination of the profiles listed was used to speciate that subcategory using the GSPRO_COMBO file. Although some of the component profiles are the same between 2018 and 2025, for example “onroad, gasoline exhaust”, the proportion of each profile within the GSPRO_COMBO differs between the two future years.

Table 3-8. Select VOC profiles 2011 versus 2018 and 2025

sector	Sub-category	2011		2018		2025	
onroad	gasoline exhaust	COMBO		COMBO		COMBO	
		8750aE	Pre-Tier 2 E0 exhaust	8751aE	Pre-Tier 2 E10 exhaust	8751aE	Pre-Tier 2 E10 exhaust
		8751aE	Pre-Tier 2 E10 exhaust	8757E	Tier 2 E10 Exhaust	8757E	Tier 2 E10 Exhaust
		8756E	Tier 2 E0 Exhaust	8758E	Tier 2 E15 Exhaust	8758E	Tier 2 E15 Exhaust
		8757E	Tier 2 E10 Exhaust	8855E	Tier 2 E85 Exhaust	8855E	Tier 2 E85 Exhaust
onroad	gasoline evap-orative	COMBO		COMBO		COMBO	
		8753E	E0 Evap	8754E	E10 Evap	8754E	E10 Evap
		8754E	E10 Evap	8872E	E15 Evap	8872E	E15 Evap
				8934E	E85 Evap	8934E	E85 Evap
onroad	gasoline perm-eation	COMBO		COMBO		COMBO	
		8766E	E0 evap perm	8769E	E10 evap perm	8769E	E10 evap perm
		8769E	E10 evap perm	8770E	E15 evap perm	8770E	E15 evap perm
				8934E	E85 Evap	8934E	E85 Evap
onroad_rfl	gasoline refueling	COMBO		COMBO		COMBO	
		8869E	E0 Headspace	8870E	E10 Headspace	8870E	E10 Headspace
		8870E	E10 Headspace	8871E	E15 Headspace	8871E	E15 Headspace
				8934E	E85 Evap	8934E	E85 Evap

sector	Sub-category	2011		2018		2025	
onroad	diesel exhaust [14]	87710	Weighted diesel exh 0.94	877P0	Weighted diesel exh 0.78	877EIT3	Weighted diesel exh 0.52
onroad	diesel extended idle	877P0	Weighted diesel exh 0.78	877EIT3	Weighted diesel exh 0.52	877T3	Weighted diesel exh 0.69
onroad	diesel APU		N/A	8774	Pre-2007 MY HDD exhaust	8774	Pre-2007 MY HDD exhaust
onroad	diesel evap-orative	4547	Diesel Headspace	4547	Diesel Headspace	4547	Diesel Headspace
onroad_rfl	diesel refueling	4547	Diesel Headspace	4547	Diesel Headspace	4547	Diesel Headspace
nonroad	gasoline exhaust	COMBO 8750a 8751a	 Pre-Tier 2 E0 exhaust Pre-Tier 2 E10 exhaust	8751a	Pre-Tier 2 E10 exhaust	8751a	Pre-Tier 2 E10 exhaust
nonroad	gasoline evap-orative	COMBO 8753 8754	 E0 evap E10 evap	8754	E10 evap	8754	E10 evap
nonroad	gasoline refueling	COMBO 8869 8870	 E0 Headspace E10 Headspace	8870	E10 Headspace	8870	E10 Headspace
nonroad	diesel exhaust	8774	Pre-2007 MY HDD exhaust	8774	Pre-2007 MY HDD exhaust	8774	Pre-2007 MY HDD exhaust
nonroad	diesel evap-orative	4547	Diesel Headspace	4547	Diesel Headspace	4547	Diesel Headspace
nonroad	diesel refueling	4547	Diesel Headspace	4547	Diesel Headspace	4547	Diesel Headspace
nonpt/ptnonipm	PFC	COMBO 8869 8870	 E0 Headspace E10 Headspace	COMBO 8870E 8871E 8934E	 E10 Headspace E15 Headspace E85 Evap	COMBO 8870E 8871E 8934E	 E10 Headspace E15 Headspace E85 Evap
	BTP	COMBO		COMBO		COMBO	

[14] For the weighted diesel exhaust and extended idle profiles, the fraction in the description refers to the fraction of profile 8774 vs profile 8775. For example, profile "877P0" is made of 0.78 profile 8774 and 0.22 profile 8775.

sector	Sub-category	2011		2018		2025	
nonpt/ ptnonipm		8869	E0 Headspace	8870	E10 Headspace	8870	E10 Headspace
		8870	E10 Headspace	8871	E15 Headspace	8871	E15 Headspace
				8934	E85 Evap	8934	E85 Evap
nonpt/ ptnonipm	BPS/RBT	8869	E0 Headspace	8869	E0 Headspace	8869	E0 Headspace

3.2.2 PM speciation

3.2.2.1 AE5 versus AE6 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. For CMAQ 4.7.1 modeling, these “simplified” components (AE5) are all that is needed. For CMAQ 5.0.1, there is a new thermodynamic equilibrium aerosol modeling tool (ISORROPIA) v2 mechanism that needs additional PM components (AE6), which are further subsets of PMFINE (see Table 3-9). EPA speciated $PM_{2.5}$ so that it included both AE5 and AE6 PM model species without causing any double counting. Therefore, emissions from this platform can be used with either CMAQ 4.7.1 or CMAQ 5.0.1.

Table 3-9. PM model species: AE5 versus AE6

species name	species description	AE5	AE6
POC	organic carbon	Y	Y
PEC	elemental carbon	Y	Y
PSO4	Sulfate	Y	Y
PNO3	Nitrate	Y	Y
PMFINE	unspeciated $PM_{2.5}$	Y	N
PNH4	ammonium	N	Y
PNCOM	non-carbon organic matter	N	Y
PFE	Iron	N	Y
PAL	aluminum	N	Y
PSI	Silica	N	Y
PTI	titanium	N	Y
PCA	calcium	N	Y
PMG	magnesium	N	Y
PK	potassium	N	Y
PMN	manganese	N	Y
PNA	sodium	N	Y
PCL	chloride	N	Y
PH2O	Water	N	Y
PMOTHR	$PM_{2.5}$ not in other AE6 species	N	Y

The majority of the 2011 platform PM profiles come from the 911XX series which include updated AE6 speciation[15]. The 2011ef, 2018ef, and 2025ef state-sector totals workbooks include state totals of the PM emissions for each state for most sectors that include PM.

3.2.2.2 Onroad PM speciation

Unlike other sectors, the onroad sector has pre-speciated PM. This speciated PM comes from the MOVES model and is processed through the SMOKE-MOVES system (see Section 2.3.1). Unfortunately, the MOVES speciated PM does not map 1-to-1 to the AE5 speciation (nor the AE6 speciation) needed for CMAQ modeling. Table 3-10 shows the relationship between MOVES[16] exhaust $PM_{2.5}$ related species and CMAQ AE5 PM species.

Table 3-10. MOVES exhaust PM species versus AE5 species

MOVES2010b Pollutant Name	Variable name for Equations	Relation to AE5 model species
Primary Exhaust PM2.5 – Total	PM25_TOTAL	
Primary $PM_{2.5}$ - Organic Carbon	PM25OM	Sum of POC, PNO3 and PMFINE
Primary $PM_{2.5}$ - Elemental Carbon	PM25EC	PEC
Primary $PM_{2.5}$ - Sulfate Particulate	PM25SO4	PSO4

MOVES species are related as follows:

$$PM25\_TOTAL = PM25EC + PM25OM + PSO4$$

The five CMAQ AE5 species also sum to total $PM_{2.5}$:

$$PM_{2.5} = POC+PEC+PNO3+PSO4+PMFINE$$

The basic problem is to differentiate MOVES species "PM25OM" into the component AE5 species (POC, PNO3 and PMFINE). The Moves2smkEF post-processor script takes the MOVES species (EF tables) and calculates the appropriate AE5 $PM_{2.5}$ species and converts them into a format that is appropriate for SMOKE (see http://www.cmascenter.org/smoke/documentation/3.5.1/html/ch05s02s04.html for details on the Moves2smkEF script). For a more detailed discussion of the derivation of these equations, see Appendix C.

For brake wear and tire wear PM, total $PM_{2.5}$ (not speciated) comes directly from MOVES. These PM modes are speciated by SMOKE. PMFINE from onroad exhaust is further speciated by SMOKE into the component AE6 species.

For California and Texas, adjustment factors were applied to SMOKE-MOVES to produce California and Texas adjusted model-ready files (see Section 2.3.1 for details). California and Texas 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 and Texas inventories are essentially speciated to match EPA estimated speciation grid cell by grid cell.

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[15] The exceptions are 5674 (Marine Vessel – Marine Engine – Heavy Fuel Oil) used for c3marine and 92018 (Draft Cigarette Smoke – Simplified) used in nonpt.

[16] The Tier3 FRM MOVES model has the same PM components as MOVES2010b. MOVES2014 has a one-to-one mapping of PM species to CMAQ PM species.

3.2.3 NO_X speciation

NO_X can be speciated into NO, NO2, and/or HONO. For the non-mobile sources, EPA used a single profile "NHONO" to split NO_X into NO and NO_2. For the mobile sources except for onroad (including nonroad, c1c2rail, c3marine, othon sectors) and for specific SCCs in othar and ptnonipm, the profile "HONO" splits NO_X into NO, NO_2, and HONO. Table 3-11 gives the split factor for these two profiles.

Table 3-11. 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

The onroad sector does not use the "HONO" profile to speciate NO_X. MOVES2010b 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 http://www.epa.gov/otaq/models/moves/documents/420r12022.pdf. HONO is not calculated directly by the Tier 3 proposal version of MOVES. For these EF tables, the calculation of HONO and the NO_2 fraction are calculated externally by the moves2smk script[17]. The SMOKE-MOVES system then models these species directly without further speciation.

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 hour. This process is typically done by applying temporal profiles to the inventories in this order: monthly, day of the week, and diurnal.

The temporal profiles and associated cross references used to create the hourly emissions inputs for the 2011 air quality modeling platform were similar to those used for the 2007 platform. The temporal factors applied to the inventory are selected using some combination of country, state, county, SCC, and pollutant. Table 3-12 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).

[17] A specific version of the moves2smk script was developed to do this calculation of HONO. The typical version assumes that HONO was calculated directly by MOVES2010b.

Table 3-12. 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
ptegu	Daily & hourly		all	all	Yes
ptegu_pk	Daily & hourly		all	all	Yes
ptnonipm	Annual	yes	mwdss	mwdss	Yes
pt_oilgas	Annual	yes	mwdss	mwdss	Yes
ptfire	Daily		all	all	Yes
othpt	Annual	yes	mwdss	mwdss	
nonroad	Monthly		mwdss	mwdss	Yes
othar	Annual	yes	week	week	
c1c2rail	Annual	yes	mwdss	mwdss	
c3marine	Annual	yes	aveday	aveday	
onroad	Annual & monthly[1]		all	all	Yes
onroad_rfl	Annual & monthly[2]		all	all	Yes
othon	Annual	yes	week	week	
nonpt	Annual & monthly	yes	all	all	Yes
np_oilgas	Annual	yes	mwdss	mwdss	Yes
rwc	Annual	no	met-based	All	Yes
ag	Annual	yes	all	all	Yes
afdust_adj	Annual	yes	week	all	Yes
beis	Hourly		n/a	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.
2. Note the annual and monthly "inventory" actually refers to the activity data (VMT and VPOP) for onroad_rfl. The actual emissions are computed on an hourly basis.

The following values are used in the table: The value "all" means that hourly emissions 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, 2011, which is intended to mitigate the effects of initial condition concentrations. The ramp-up period was 10 days (December 22-31, 2010). For most sectors, emissions from December 2011 were used to fill in surrogate emissions for the end of December 2010. In particular, December 2011 emissions (representative days) were used for December 2010. For biogenic emissions, December 2010 emissions were processed using 2010 meteorology.

3.3.1 Use of FF10 format for finer than annual emissions

The Flat File 2010 format (FF10) inventory format for SMOKE provides a more consolidated format for monthly, daily, and hourly emissions inventories than previous formats supported. Previously, to process monthly inventory data required the use of 12 separate inventory files. 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 3.5.1 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 (e.g. the nonpt sector). 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, and the ag burning inventory within the nonpt sector.

3.3.2 Electric Generating Utility temporalization (ptegu, ptegu_pk)

3.3.2.1 Base year temporal allocation of EGUs

The 2011NEIv1 annual EGU emissions are allocated to hourly emissions using the following 3-step methodology: annual value to month, month to day, and day to hour. 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. Prior to temporal allocation, as many sources as possible were matched to CEMS data via ORIS facility code and boiler ID. EIS stores a base set of previously matched units via alternate facility and unit IDs. For any units not yet matched, reports were generated by unit to identify potential matches with the NEI. The reports included FIPS state/county code, facility name, and NOx and SO_2 emissions. Units were considered matches if the FIPS state/county code matched, the facility name was similar, and the NOx and SO_2 emissions were similar.

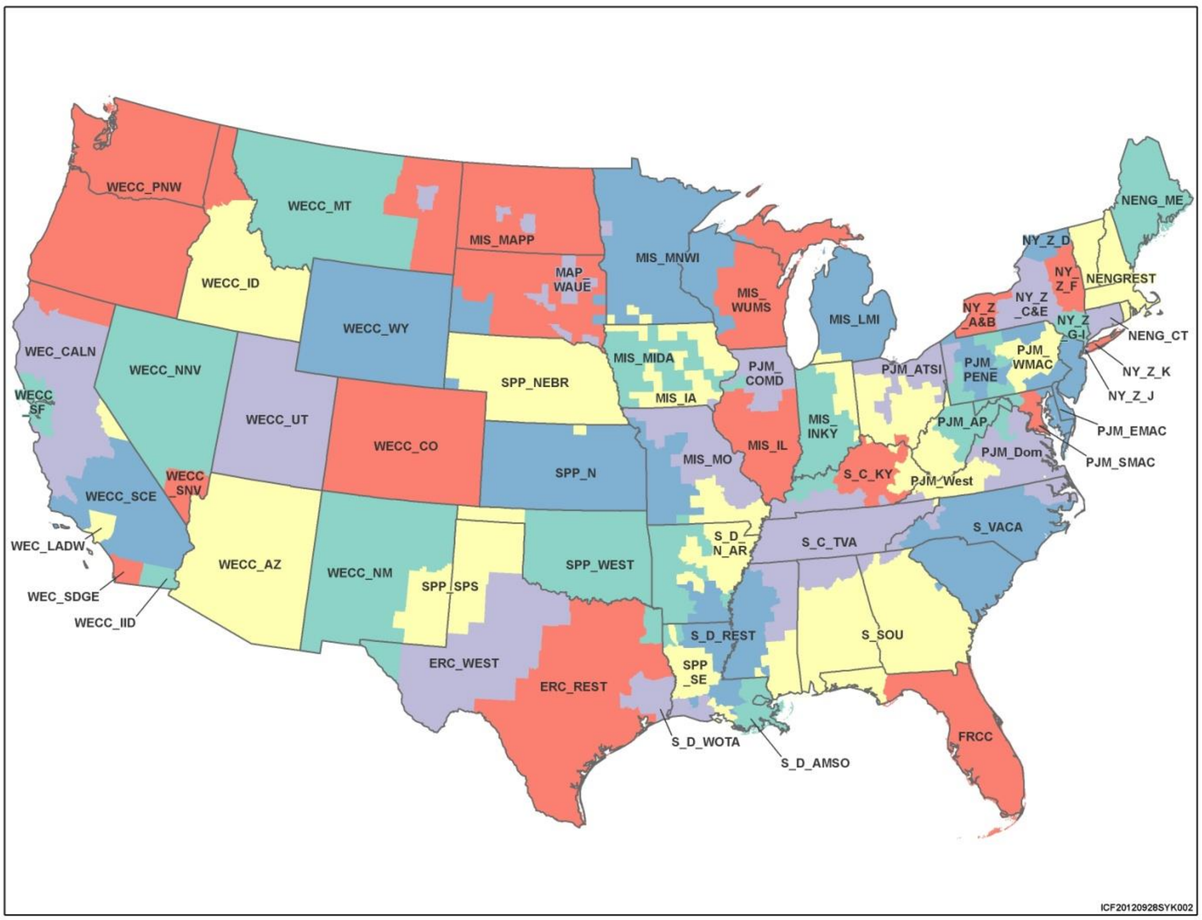
For sources not matched to CEMS measurements, the first two steps of the allocation are done outside of SMOKE. For sources in the ptegu and ptegu_pk sectors that are matched to CEMS data, annual totals of the emissions may be different than the annual values in 2011NEIv1 because the CEMS data actually replaces the inventory data. All units in the ptegu_pk sector with non-zero emissions for 2011 were matched to CEMS data.

For units not matched to CEMS data, 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 3-3. These factors are based 2011 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 and SO_2, and heat input. An overall composite profile was also computed and was used in a few cases in which the fuel-specific profile was too irregular, or there were no CEMS units with the specified fuel in the region containing the unit. 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 is used to allocate all other pollutants.

Daily "temporal allocation" of units with CEMS was performed using a procedure similar to that in the first step 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 2011 CEMS data. Separate allocation factors were computed for NOx, SO_2, and heat input for the fuels coal, natural gas, and other. 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 is used to allocate all other pollutants.

For units with associated CEMS data, hourly emissions use the hourly CEMS values as described above for NOx and SO2, while other pollutants are allocated according to heat input values. For units without CEMS data, temporal profiles from days to hours are computed based on the region- and fuel-specific average day-to-hour factors derived from the CEMS data for those fuels and regions using data from the entire year. For NEI units not matched to specific CEMS units, CEMS heat input data is used to allocate all pollutants (including NO_x and SO_2). SMOKE then allocates the daily emissions data to hours using the profiles obtained from the CEMS data for the analysis base year.

Figure 3-3. IPM Regions for EPA Base Case v5.13



3.3.2.2 Future year temporal allocation of EGUs

IPM provides unit-level emission projections of average winter (representing October through April) and average summer (representing May through September) values. These annualized emissions are allocated to hourly emissions using a 3-step methodology: annualized summer/winter value to month, month to day, and day to hour. The first two steps are done outside of SMOKE and the third step is done by SMOKE using daily emissions files created from the first two steps. This approach maximizes the use of the CEMS data from the air quality analysis year (e.g., 2011).

For CEMS-matched units, the 2011 based CEMS were scaled so that their seasonal emissions matched IPM totals. In other words, EPA created a set of artificial CEMS data which had the same temporal pattern as 2011, but for which the seasonal total emissions matched IPM's predictions for 2018 and 2025. Except for the scaling of CEMS data, the procedure for allocating the emissions of CEMS matched units is the same as the base year (see Section 3.3.2.1). For sources not matched to CEMS units, the allocation of the IPM seasonal emissions to months was done using average fuel-specific season-to-month factors generated for each of the 64 IPM regions shown in Figure 3-3. These factors are based on a single year of CEMS data consistent with the modeling base year, in this case 2011. Similar to the base year, profiles were created for coal, natural gas, and "other" fuel. For each fuel, separate profiles were computed for NO_x, SO_2, and heat input. An overall composite profile was also computed in the event that a fuel-specific profile was too irregular or in the case when a unit changed fuels between the base and future year and there were previously no units with that fuel in the specific region. Except for the season-to-month allocation, the procedure for allocating the emissions of units not matched to CEMS units is the same as the base year.

Units with year-specific impacts in the season-to-month allocations, such as long-duration downtimes for maintenance or installation of controls that occur only in one year were temporalized using average profiles instead of using the anomalous profile for the base year. These situations are determined by analysis of the base and future year data. Note that IPM uses load data (reflecting the shape of demand) corresponding to the load in each IPM region that occurred in the base year of the air quality modeling analysis, such as 2011.

Some refinements to the above approach were made in some special cases:

- When emissions were substantially higher for units with limited hours of operation in the base year, an averaged profile was used.
- When a unit switched fuels in the future year to a fuel not used in the base year, the profile was selected according to the new type of fuel. If the unit was a CEMS unit in the base year, it was treated as a non-matched unit in the future years.
- When a CEMS unit operated in only one season in the base year, but IPM predicted that there were emissions in both seasons, an average profile was used for the future year unit during both seasons.
- New units coming on line used the appropriate region and fuel-specific profiles
- Units that are not new but had no emissions in 2011 were treated like new units.

For more information on the development of IPM emission estimates and the temporalization of those, see http://www.epa.gov/powersectormodeling/BaseCasev513.html, in particular the Air Quality Modeling Flat File Documentation and accompanying inputs.

3.3.3 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 is 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.

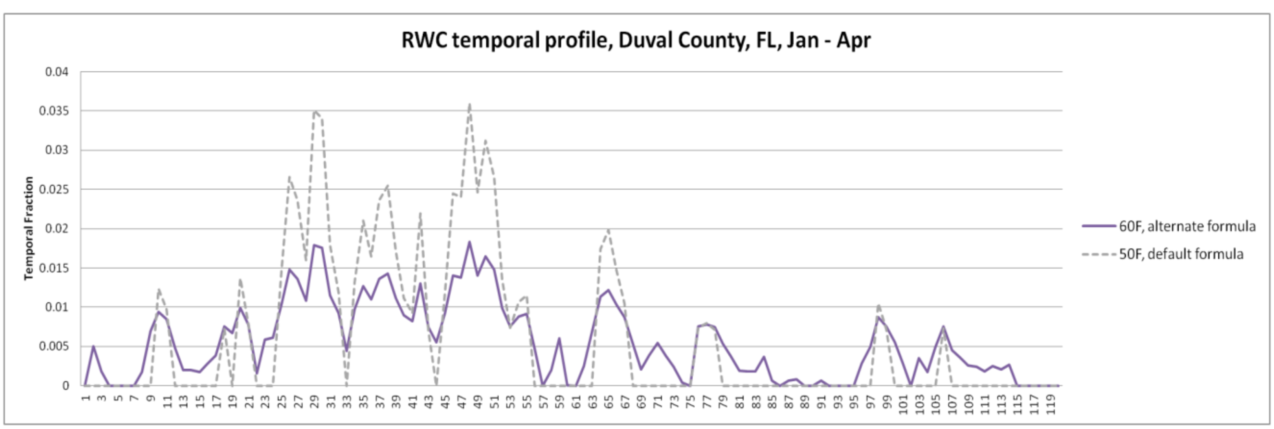
The SMOKE program GenTPRO provides a method for developing meteorology-based temporalization. Currently, the program can utilize three types of temporal algorithms: annual-to-day temporalization for residential wood combustion (RWC), month-to-hour temporalization for agricultural livestock ammonia, and a generic meteorology-based algorithm for other situations. For the 2011 platform, 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 http://www.cmascenter.org/smoke/documentation/3.5.1/html/ch05s03s07.html, respectively.

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.

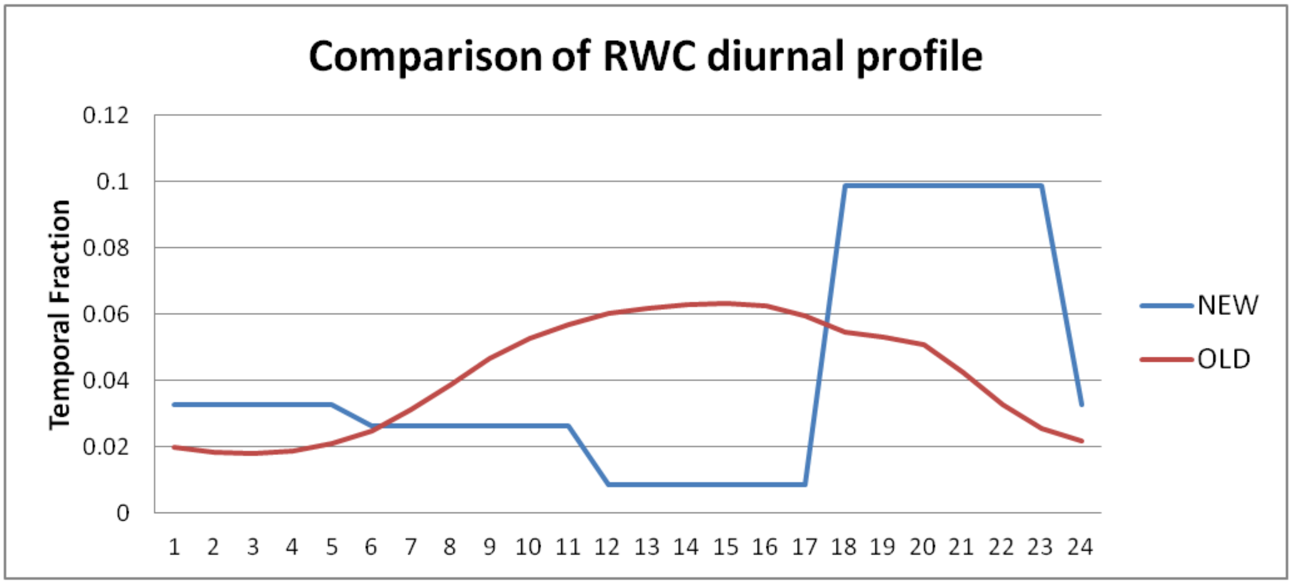
Figure 3-4 illustrates the impact of changing the temperature threshold for a warm climate county. The plot shows the temporal fraction by day for Duval County, Florida for the first four months of 2007. The default 50 ˚F threshold creates large spikes on a few days, while the 60 ˚F threshold dampens these spikes and distributes a small amount of emissions to the days that have a minimum temperature between 50 and 60 ˚F.

Figure 3-4. Example of RWC temporalization in 2007 using a 50 versus 60 ˚F threshold



The diurnal profile for used for most RWC sources (see Figure 3-5) 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, NY (Wang *et al.* 2011) for various seasons and day of the week and found that the new RWC profile generally tracked the concentration based temporal patterns.

Figure 3-5. 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) were updated 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 (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 3-6 is based on a conventional single-stage heat load unit burning red oak in Syracuse, New York. As shown in Figure 3-7, 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 MN DNR survey (MDNR, 2008) and are illustrated in Figure 3-8. 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 3-6. Diurnal profile for OHH, based on heat load (BTU/hr)

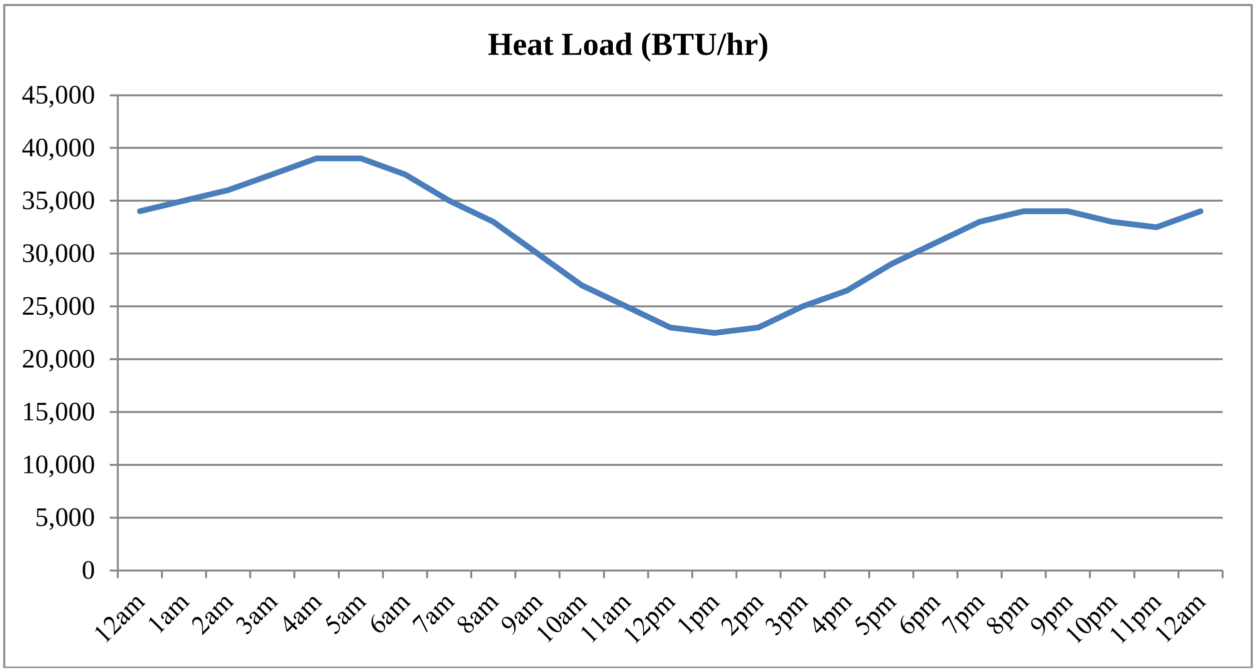


Figure 3-7. Day-of-week temporal profiles for OHH and Recreational RWC

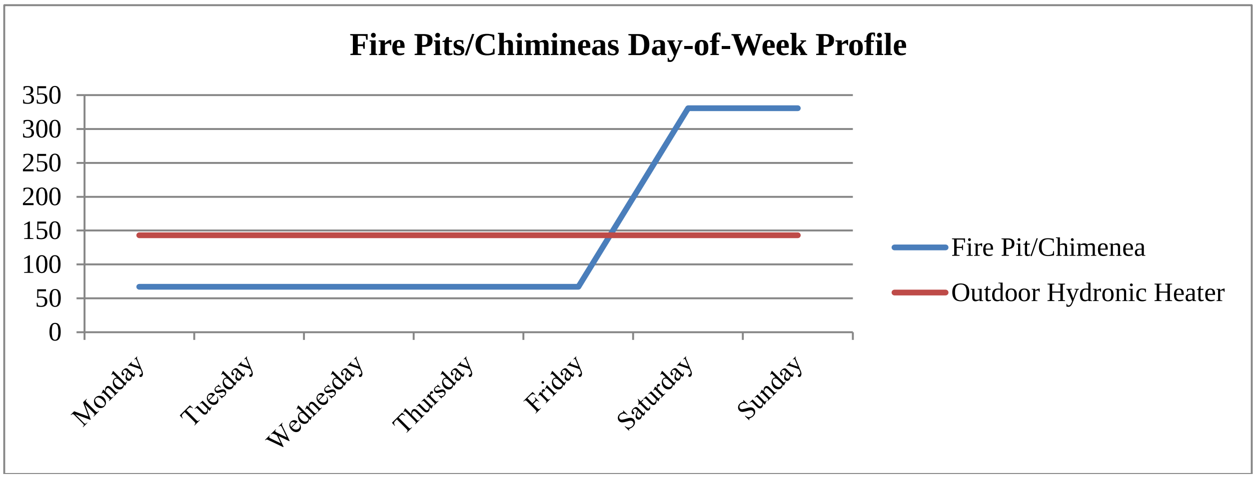
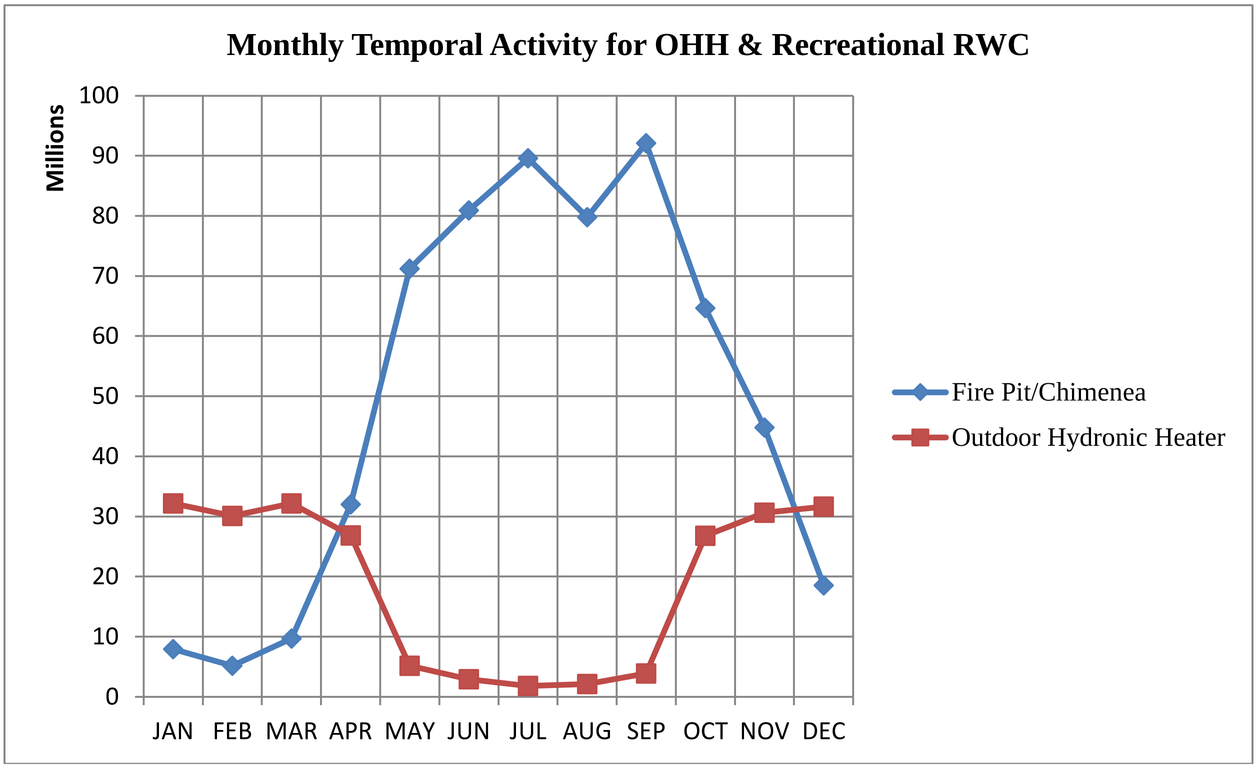


Figure 3-8. Annual-to-month temporal profiles for OHH and recreational RWC



3.3.4 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 EPA 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 NH3 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

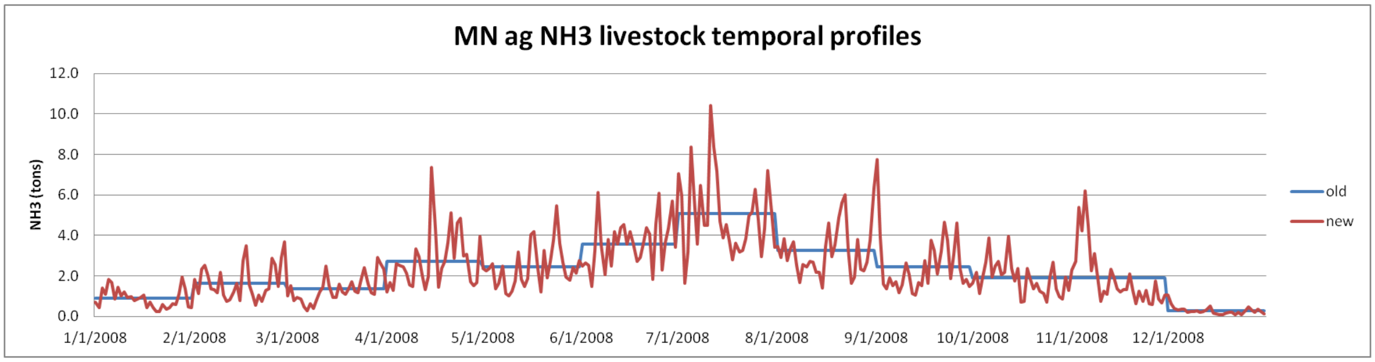
- $PE_{i,h}$ = Percentage of emissions in county *i* on hour *h*
- $E_{i,h}$ = Emission rate in county *i* on hour *h*
- $T_{i,h}$ = Ambient temperature (Kelvin) in county *i* on hour *h*
- $V_{i,h}$ = Wind speed (meter/sec) in county *i* (minimum wind speed is 0.1 meter/sec)
- $AR_{i,h}$ = Aerodynamic 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[18].

[18] SMOKE v3.5.1 will correctly read in a monthly inventory and apply GenTPRO ag NH3 month-to-hour temporalization. However, SMOKE v3.5 beta incorrectly applied an annual-to-month temporal profile on top of a monthly inventory when

Figure 3-9 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 3-9. Example of new animal NH_3 emissions temporalization approach, summed to daily emissions



3.3.5 Onroad mobile temporalization (onroad, onroad_rfl)

For the onroad and onroad_rfl sectors, 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 updates to the diurnal temporal profiles for the 2011 platform.

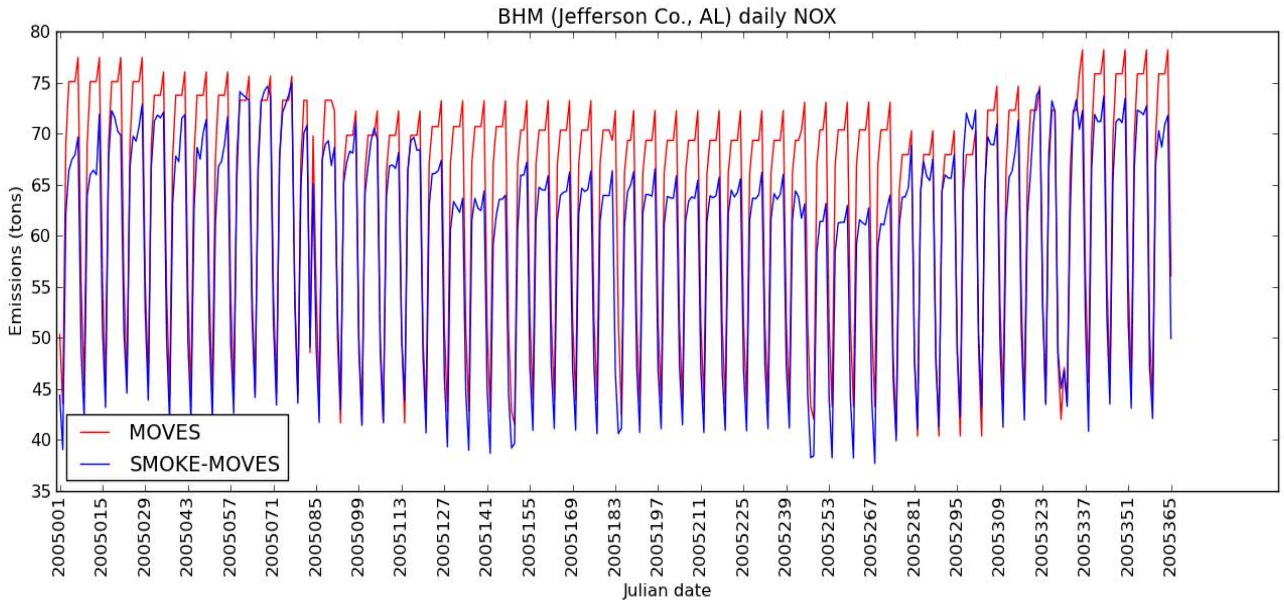
Meteorology is not used in the development of the temporal profiles, but rather it impacts the calculation of the hourly emissions through the program Movesmrg. The result is that the emissions vary at the hourly level by grid cell. More specifically, the on-network (RPD) and the off-network (RPV and RPP) processes use the gridded meteorology (MCIP) directly. Movesmrg determines the temperature for each hour and grid cell and uses that information to select the appropriate emission factor (EF) for the specified SCC/pollutant/mode combination. In the previous platform, RPP used county level minimum and maximum temperature ranges for the day to determine the appropriate EF. This potentially overestimated the temperature range for any particular grid cell, which would result in increased emissions for vapor-venting. In the 2011 platform (and the 2011NEIv1), RPP was updated to use the gridded minimum and maximum temperature for the day. This more spatially resolved temperature range produces more accurate emissions for each grid cell. The combination of these three processes (RPD, RPV, and RPP) is the total onroad sector emissions, while the combination of the two processes (RPD, RPV) for the refueling mode only is the total onroad_rfl sector emissions. Both sectors show a strong meteorological influence on their temporal patterns (see the 2011NEIv1 TSD for more details).

Figure 3-10 illustrates the difference between temporalization of the onroad sector used in the 2005 and earlier platforms and the meteorological influence via SMOKE-MOVES. In the plot, the "MOVES" inventory is a monthly inventory that is temporalized by SCC to day-of-week and hour. Similar temporalization is done for the VMT in SMOKE-MOVES, but the meteorologically varying EFs add an additional variation on top of the temporalization. Note, the SMOKE-MOVES run is based on the 2005 platform and previous temporalization of VMT to facilitate the comparison of the results. In the figure, the MOVES emissions have a repeating pattern within the month, while the SMOKE-MOVES shows

temporalizing with GenTPRO ag NH_3 profiles. As an interim solution, a flat monthly profile was applied to the states with a monthly ag NH3 inventory.

day-to-day (and hour-to-hour) variability. In addition, the MOVES emissions have an artificial jump between months which is due to the inventory providing new emissions for each month that are then temporalized within the month but not between months. The SMOKE-MOVES emissions have a smoother transition between the months.

Figure 3-10. Example of SMOKE-MOVES temporal variability of NO_X emissions

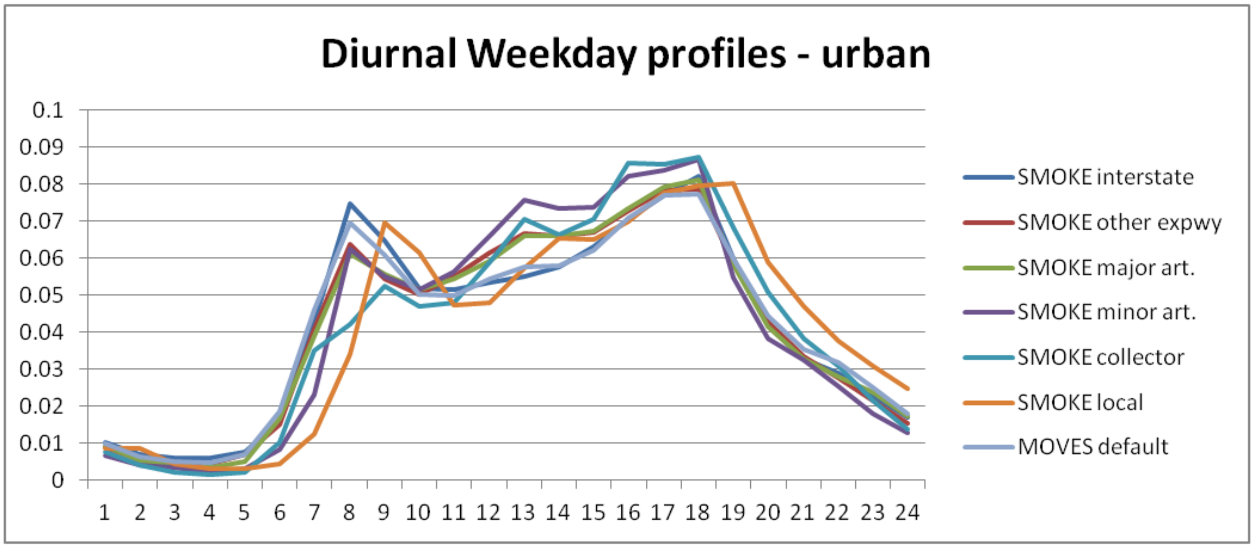


For the onroad and onroad_rfl sectors, the "inventories" referred to in Table 3-12 actually consist of activity data. For RPP and RPV processes, the VPOP inventory is annual and does not need temporalization. For RPD, the VMT inventory is monthly and was temporalized to days of the week and then to hourly VMT 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' process 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 EF. In other words, two SMOKE-MOVES runs with identical annual VMT, meteorology, and MOVES EF, will have different total emissions if the temporalization of VMT changes.

In previous platforms, the diurnal profile for VMT[19] varied by road type but not by vehicle type (see Figure 3-11). These profiles were used throughout the nation.

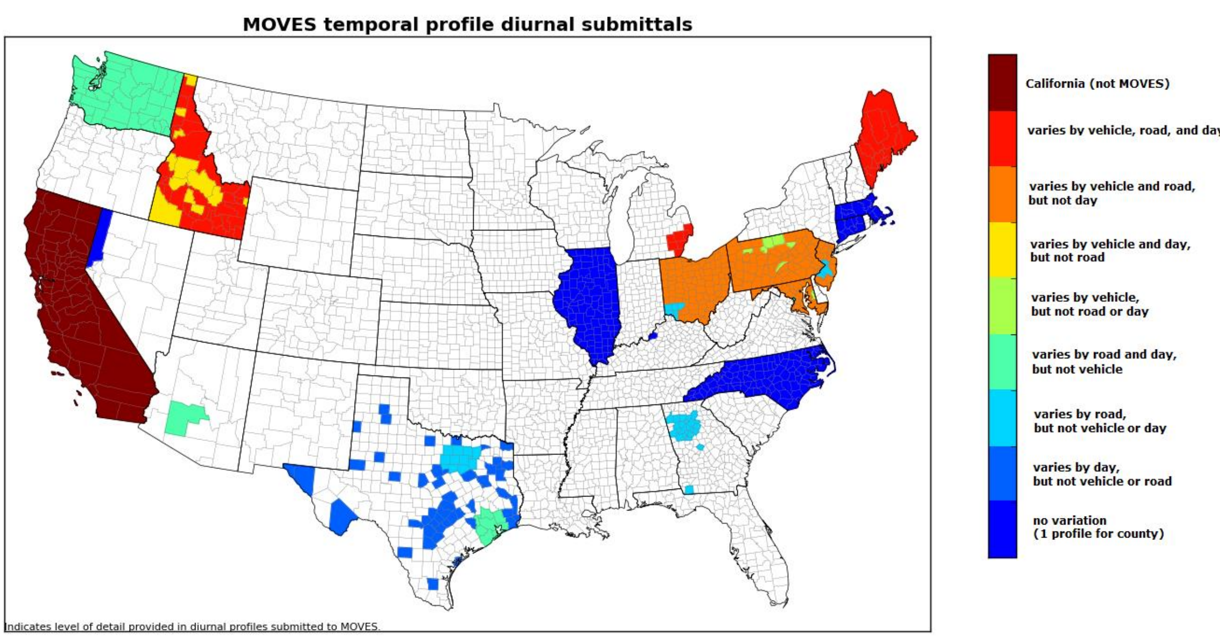
[19] These same profiles were used for onroad emissions in the 2005 platform.

Figure 3-11. Previous onroad diurnal weekday profiles for urban roads



EPA wanted to create new diurnal profiles that could differentiate by vehicle type as well as by road type and would potentially vary over geography. The 2011NEIv1 process provided an opportunity to update the diurnal profile with information submitted by states. States submitted MOVES county databases (CDBs) that included information on the distribution of VMT by hour of day and by day of week[20] (see the 2011NEIv1 TSD for details on the submittal process for onroad). EPA decided not to update the day of week profile because MOVES only differentiated weekday versus weekend while the default SMOKE profiles differentiated each of the 7 days. EPA mined the state submitted MOVES CDBs for non-default diurnal profiles[21]. The list of potential diurnal profiles was then analyzed to see whether the profiles varied by vehicle type, road type, weekday vs. weekend, and by county within a state (see Figure 3-12).

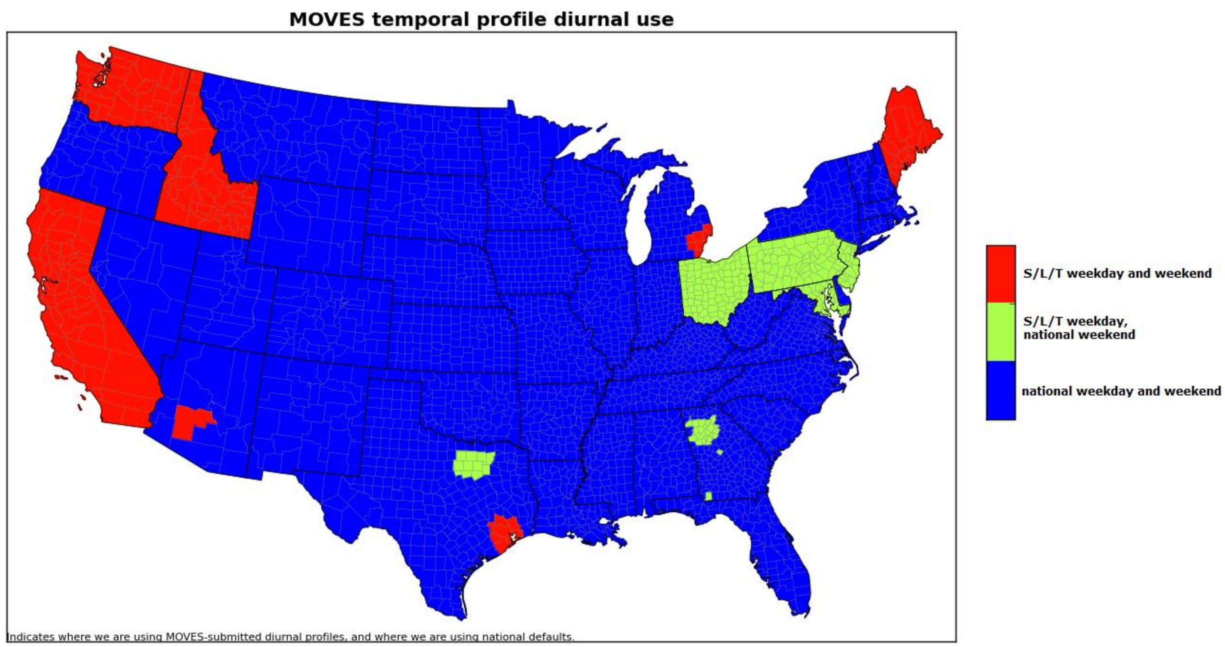
Figure 3-12. Variation in MOVES diurnal profiles



[20] The MOVES tables are the hourvmtfraction and the dayvmtfraction.
[21] 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.

EPA attempted to maximize the use of state and/or county specific diurnal profiles. If a specific state or county's profiles varied by vehicle type or/and road type, then the submitted profile was used. If the profile had less variability than the old SMOKE defaults (i.e. neither varied by vehicle type nor road type), then a new default profile would be used (see below for description of new profiles). This analysis was done separately for weekdays and for weekends, therefore some areas had submitted profiles for weekdays but defaults for weekends. The result was a set of profiles that varied geographically depending on whether or not the profile was submitted and the characteristics of the profiles (see Figure 3-13).

Figure 3-13. Use of submitted versus new national default profiles



A new set of diurnal profiles was developed from the submitted profiles that varied by both vehicle type and road type. Before developing the national profiles, there needs to be a mapping between MOVES road types and SMOKE road types (i.e., the last three digits of the SCC) and between MOVES source types and SMOKE vehicle types. The mapping between road types is relatively straight forward (see Table 3-13). Basically the road types are consolidated into 4 types in MOVES, therefore the new profiles will not differentiate at the level of the SMOKE road type. For example, the SMOKE "urban interstate" (SCCLAST3=230) will have the same profile as the SMOKE "urban other freeways and expressways" (SCCLAST3=250). The mapping between MOVES source type and SMOKE vehicle type is more complicated; it is a many-to-many mapping (see the 2011NEIv1 TSD for more details).

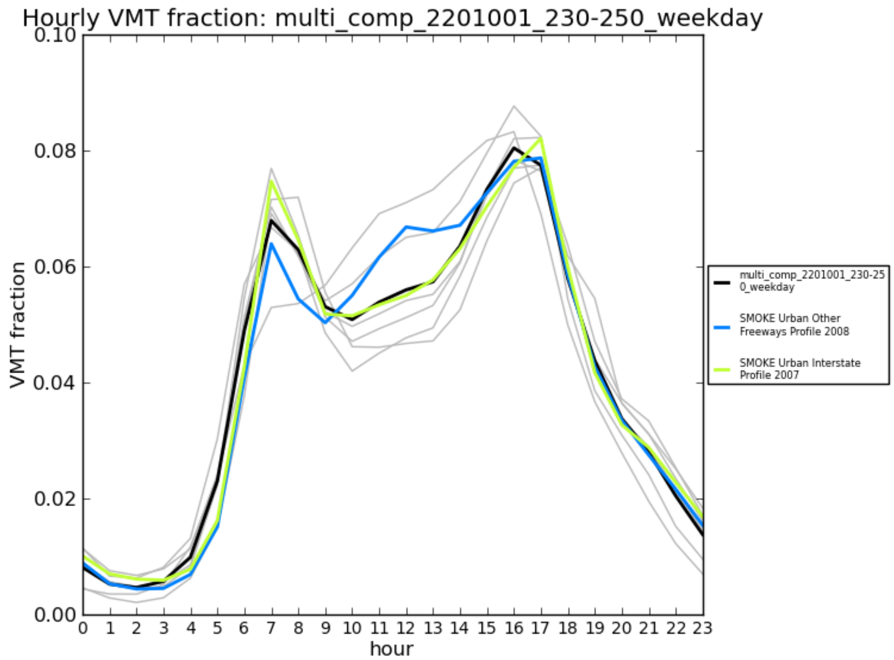
Table 3-13. Mapping of MOVES to SMOKE road types

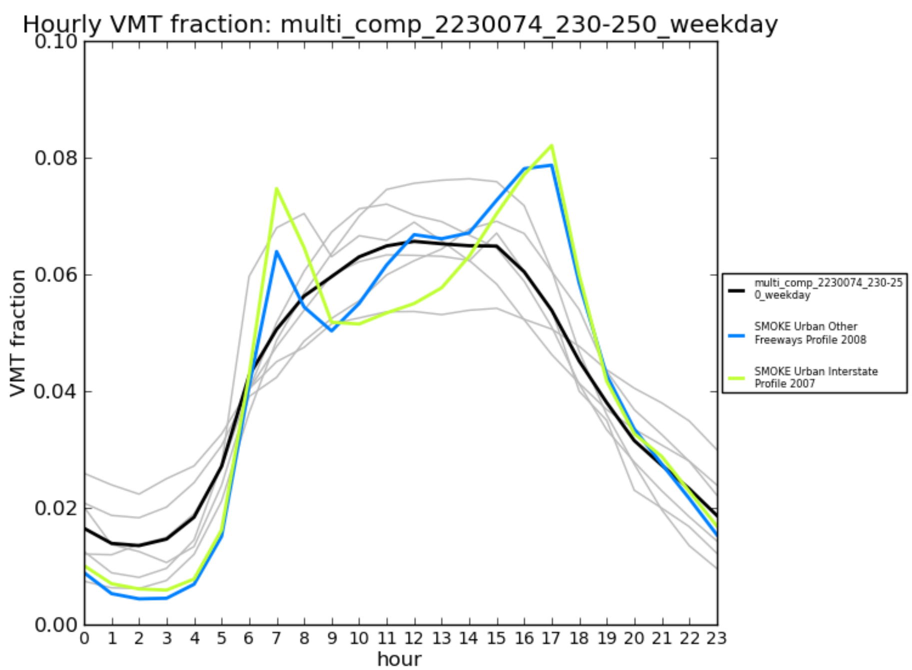
MOVES roadtype ID	Description	SMOKE SCCLAST3	Description
2	Rural Restricted Access	110	Rural Interstate: Total
3	Rural Unrestricted Access	130	Rural Other Principal Arterial: Total
		150	Rural Minor Arterial: Total
		170	Rural Major Collector: Total
		190	Rural Minor Collector: Total
		210	Rural Local: Total
4	Urban Restricted Access	230	Urban Interstate: Total
		250	Urban Other Freeways and Expressways: Total
5	Urban Unrestricted Access	270	Urban Other Principal Arterial: Total
		290	Urban Minor Arterial: Total
		310	Urban Collector: Total
		330	Urban Local: Total

For the purposes of constructing the SMOKE diurnal profiles, all MOVES profiles for the road type and for any overlapping source types are averaged together to create a single diurnal profile for a specific county, SMOKE road type, SMOKE vehicle type, and weekday or weekend . This process is also used for creating SMOKE versions of the submitted profile in the non-default regions (described above). The states that submitted profiles that varied by vehicle and road types for weekdays were: Idaho, Maine, Michigan, New Jersey, Ohio, and Pennsylvania. The states that submitted profiles that varied by vehicle and road types for weekends were: Idaho, Maine, and Michigan. EPA created individual profiles for each state (averaging over the counties within) to create a single profile by state, vehicle type, road type, and weekday or weekend. The states individual profiles were averaged together to create a new default profile[22]. Figure 3-14 shows two new default profiles for light duty gas vehicles (LDGV, SCC7 2201001) and heavy, heavy duty diesel vehicles (HHDDV, SCC7 2230074) on restricted urban roadways (interstates and freeways, SCCLAST3=230 and 250) for weekdays. The grey lines are the individual state profiles, the black line is the new default profile, and the 2 colored lines are the previous SMOKE default profiles. Note that there are two previous SMOKE profiles for this road type, but that they don't vary by vehicle. In contrast, the new default profile does vary by vehicle and places more LDGV VMT (left plot) in the rush hours while placing HHDDV VMT (right plot) predominately in the middle of the day with a longer tail into the evening hours and early morning. For a full list of the default profiles, see ftp://ftp.epa.gov/EmisInventory/2011v6/v1platform/reports/temporal_profiles/onroad_default_hourly_profile_plots_2011ed.zip.

[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.

Figure 3-14. Updated national default profiles for LDGV vs. HHDDV, urban restricted weekday





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. For Texas, the profiles used were a combination of state supplied (via MOVES CDBs) and new national defaults. Although EPA adjusted the total emissions to match California's and Texas' submittals to the

[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.

2011NEIv1, 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 and Texas' onroad emissions, see the 2011NEIv1 TSD.

3.3.6 Additional sector specific details (afdust, beis, c1c2rail, c3marine, nonpt, ptfire)

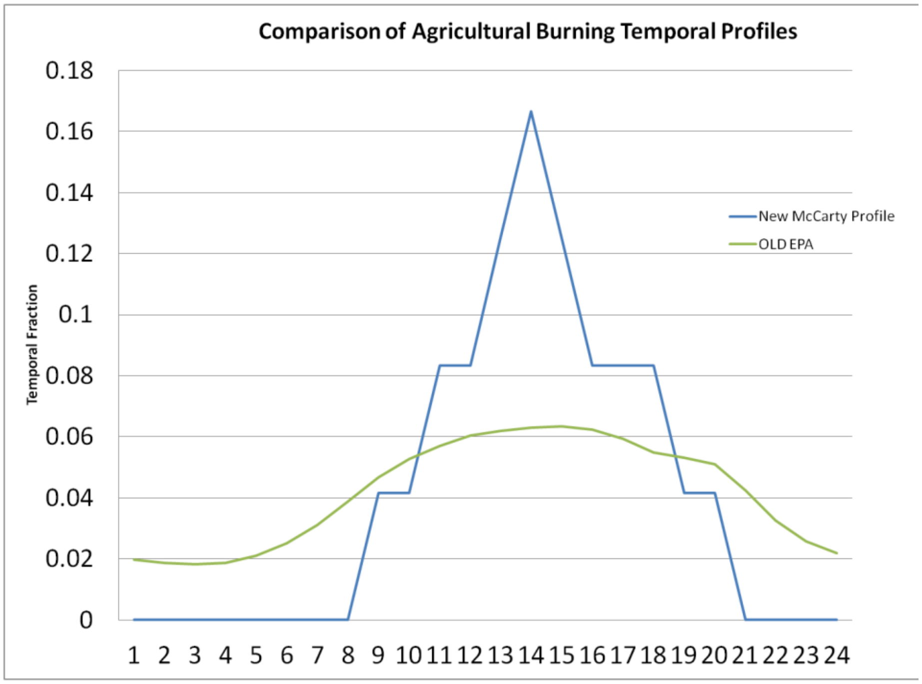
For the afdust sector, meteorology is not used in the development of the temporal profiles, but it is used to reduce the total emissions based on meteorological conditions. These adjustments are applied through sector-specific scripts, beginning with the application of land use-based gridded transport 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://www.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 computed using appropriate emission factors according to the vegetation in each model grid cell, while taking the meteorological data into account.

For the c1c2rail and c3marine sectors, emissions are allocated with flat monthly and day of week profiles, and most emissions are also allocated with flat hourly profiles.

For the nonpt sector, most the inventories are annual except for the agricultural burning (SCC 2801500000) inventory which was allocated to months by adding up the available values for each day of the month. For all agricultural burning, the diurnal temporal profile used reflected the fact that burning occurs during the daylight hours - see Figure 3-15 (McCarty et al., 2009). This puts most of the emissions during the work day and suppresses the emissions during the middle of the night. All states used a uniform profile for each day of the week for all agricultural burning emissions, except for the following states that for which EPA used state-specific day of week profiles: Arkansas, Kansas, Louisiana, Minnesota, Missouri, Nebraska, Oklahoma, and Texas.

Figure 3-15. Agricultural burning diurnal temporal profile



For the ptfire sector, the inventories are in the daily point fire format ORL PTDAY. The ptfire sector is used in the model evaluation case (2011ed and in the future base case (2018ed). 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 NMIM. For California, a monthly inventory was created from CARB's annual inventory using EPA-estimated NMIM monthly results to compute monthly ratios by pollutant and SCC7 and these ratios were applied to the CARB inventory to create a monthly inventory.

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., 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. 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.

Additional documentation on the 2011 spatial surrogates is available at ftp://ftp.epa.gov/EmisInventory/2011v6/v1platform/reports/spatial_surrogates/ in the files US_SpatialSurrogate_Documentation_v091113.pdf and US_SpatialSurrogate_Workbook_v093013.xlsx. The spatial cross reference file is in gsref_2011.xlsx. Plots of the spatial surrogates are available in all_surrogate_maps_2011platform_12US1_v2.pdf. Note that these are plots of the surrogate fractions summed by grid cell, so grid cells that overlap multiple counties can show values greater than one. These maps are only to give an idea of the spatial distribution of the surrogates. Allocations of CAP emissions to each of the surrogate codes is given in 2011ed_spatial_surrogate_CAPs_feb112014.xlsx.

3.4.1 Spatial Surrogates for U.S. emissions

There are more than 70 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 some sources. Table 3-14 lists the codes and descriptions of the surrogates. The surrogates in bold have been updated with 2010-based data, including 2010 census data at the block group level, 2010 American Community Survey Data for heating fuels, 2010 TIGER/Line data for railroads and roads, the 2006 National Land Cover Database, 2011 gas station and dry cleaner data, and the 2012 National Transportation Atlas Data for rail-lines, ports and navigable waterways. Surrogates for ports (801) and shipping lanes (802) were developed based on the 2011NEIv1 shapefiles: Ports_032310_wrf and ShippingLanes_111309FINAL_wrf, but also included shipping lane data in the Great Lakes and support vessel activity data in the Gulf of Mexico.

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 http://www.ie.unc.edu/cempd/projects/mims/spatial/ and http://www.cmascenter.org/help/documentation.cfm?MODEL=spatial_allocator&VERSION=3.6&temp_id=99999.

Table 3-14. U.S. Surrogates available for the 2011 modeling platform.

Code	Surrogate Description	Code	Surrogate Description
N/A	Area-to-point approach (see 3.3.1.2)	520	Commercial plus Industrial plus Institutional
100	Population	525	Golf Courses + Institutional +Industrial + Commercial
110	Housing	527	Single Family Residential
120	Urban Population	530	Residential - High Density
130	Rural Population	535	Residential + Commercial + Industrial + Institutional + Government
137	Housing Change	540	Retail Trade
140	Housing Change and Population	545	Personal Repair
150	Residential Heating - Natural Gas	550	Retail Trade plus Personal Repair
160	Residential Heating – Wood	555	Professional/Technical plus General Government
165	0.5 Residential Heating - Wood plus 0.5 Low Intensity Residential	560	Hospital
170	Residential Heating - Distillate Oil	565	Medical Office/Clinic
180	Residential Heating – Coal	570	Heavy and High Tech Industrial
190	Residential Heating - LP Gas	575	Light and High Tech Industrial
200	Urban Primary Road Miles	580	Food, Drug, Chemical Industrial
210	Rural Primary Road Miles	585	Metals and Minerals Industrial
220	Urban Secondary Road Miles	590	Heavy Industrial
230	Rural Secondary Road Miles	595	Light Industrial
240	Total Road Miles	596	Industrial plus Institutional plus Hospitals
250	Urban Primary plus Rural Primary	600	Gas Stations
255	0.75 Total Roadway Miles plus 0.25 Population	650	Refineries and Tank Farms
260	Total Railroad Miles	675	Refineries and Tank Farms and Gas Stations
270	Class 1 Railroad Miles	680	Oil & Gas Wells, IHS Energy, Inc. and USGS

Code	Surrogate Description	Code	Surrogate Description
261	NTAD Total Railroad Density	700	Airport Areas
271	NTAD Class 1, 2, 3 Railroad Density	710	Airport Points
280	Class 2 and 3 Railroad Miles	720	Military Airports
300	Low Intensity Residential	800	Marine Ports
310	Total Agriculture	801	NEI Ports
312	Orchards/Vineyards	802	NEI Shipping Lanes
320	Forest Land	807	Navigable Waterway Miles
330	Strip Mines/Quarries	808	Gulf Tug Zone Area
340	Land	810	Navigable Waterway Activity
350	Water	812	Midwest Shipping Lanes
400	Rural Land Area	850	Golf Courses
500	Commercial Land	860	Mines
505	Industrial Land	870	Wastewater Treatment Facilities
510	Commercial plus Industrial	880	Drycleaners
515	Commercial plus Institutional Land	890	Commercial Timber

For the onroad sector, the on-network (RPD) emissions were spatially allocated to roadways, and the off-network (RPP and RPV) emissions were allocated to population. For the onroad_rfl sector, the emissions were spatially allocated to gas station locations. For the oil and gas sources in the np_oilgas sector, the spatial surrogates were updated to those shown in Table 3-15 using 2011 data consistent with what was used to develop the 2011NEI nonpoint oil and gas emissions. Note that the “Oil & Gas Wells, IHS Energy, Inc. and USGS” (680) is older and based on circa-2005 data. These surrogates were based on the same GIS data of well locations and related attributes as was used to develop the 2011NEIv1 data for the oil and gas sector. The data sources included Drilling Info (DI) Desktop’s HPDI database (Drilling Info, 2012) aggregated to grid cell levels, along with data from Oil and Gas Commission (OGC) websites. Well completion data from HPDI was supplemented by implementing the methodology for counting oil and gas well completions developed for the U.S. National Greenhouse Gas Inventory. Under that methodology, both completion date and date of first production from HPDI were used to identify wells completed during 2011. In total, over 1.08 million unique well locations were compiled from the various data sources. The well locations cover 33 states and 1,193 counties (ERG, 2014).

Table 3-15. Spatial Surrogates for Oil and Gas Sources

Surrogate Code	Surrogate Description
681	Spud count - Oil Wells
682	Spud count - Horizontally-drilled wells
683	Produced Water at all wells
684	Completions at Gas and CBM Wells
685	Completions at Oil Wells
686	Completions at all wells
687	Feet drilled at all wells
688	Spud count - Gas and CBM Wells
689	Gas production at all wells
692	Spud count - All Wells
693	Well count - all wells

694	Oil production at oil wells
695	Well count - oil wells
697	Oil production at Gas and CBM Wells
698	Well counts - Gas and 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 3-14 were not assigned to any SCCs, although many of the "unused" surrogates are actually used to "gap fill" other surrogates that are assigned. 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 3-16 shows the total of CAP emissions (i.e., NH_3, NOx, $PM_{2.5}$, SO_2, and VOC) by sector.

Table 3-16. Selected 2011 CAP emissions by sector for U.S. Surrogates*

Sector	Srg. Code	Description	NH3	NOX	PM2_5	SO2	VOC
afdust	130	Rural Population	0	0	1,102,192	0	0
afdust	140	Housing Change and Population	0	0	162,157	0	0
afdust	240	Total Road Miles	0	0	287,531	0	0
afdust	310	Total Agriculture	0	0	896,741	0	0
afdust	330	Strip Mines/Quarries	0	0	59,782	0	0
afdust	400	Rural Land Area	0	0	1	0	0
ag	310	Total Agriculture	3,524,607	0	0	0	0
c1c2rail	261	NTAD Total Railroad Density	2	13,840	16,621	249	861
c1c2rail	271	NTAD Class 1 2 3 Railroad Density	332	733,500	896,099	7,388	38,881
c1c2rail	280	Class 2 and 3 Railroad Miles	13	42,220	48,316	293	1,632
c1c2rail	802	Shipping Lanes	335	529,920	662,303	11,490	12,970
c1c2rail	808	Gulf Tug Zone Area	0	4,031	5,742	1,247	145
c1c2rail	820	Ports NEI2011 NOx	24	69,021	86,742	2,492	2,165
nonpt	100	Population	0	0	0	0	1,221,647
nonpt	140	Housing Change and Population	1	23,368	66,271	8	134,851
nonpt	150	Residential Heating - Natural Gas	41,132	218,591	4,235	1,441	12,721
nonpt	170	Residential Heating - Distillate Oil	2,122	42,645	4,519	91,994	1,420
nonpt	180	Residential Heating - Coal	325	1,388	796	8,658	1,624
nonpt	190	Residential Heating - LP Gas	151	39,636	195	752	1,462
nonpt	240	Total Road Miles	0	0	0	0	6,825
nonpt	250	Urban Primary plus Rural Primary	0	0	0	0	102,793
nonpt	260	Total Railroad Miles	0	0	0	0	2,195
nonpt	300	Low Intensity Residential	3,849	18,563	96,738	3,082	40,575
nonpt	310	Total Agriculture	3,435	64,432	140,559	26,212	474,539
nonpt	312	Orchards/Vineyards	27	874	1,199	2,559	1,061
nonpt	320	Forest Land	7	21	165	0	154

Sector	Srg. Code	Description	NH3	NOX	PM2_5	SO2	VOC
nonpt	400	Rural Land Area	0	1,036	43	30	79
nonpt	500	Commercial Land	2,367	1	86,448	585	26,503
nonpt	505	Industrial Land	86,938	235,940	108,508	198,909	117,339
nonpt	510	Commercial plus Industrial	5	178	27	109	224,947
nonpt	515	Commercial plus Institutional Land	1,438	188,184	21,307	62,460	21,329
nonpt	520	Commercial plus Industrial plus Institutional	0	0	0	0	11,252
nonpt	525	Golf Courses plus Institutional plus Industrial plus Commercial	0	0	0	0	0
nonpt	527	Single Family Residential	0	0	0	0	0
nonpt	535	Residential + Commercial + Industrial + Institutional + Government	23	2	145	0	334,081
nonpt	540	Retail Trade (COM1)	0	0	0	0	1,375
nonpt	545	Personal Repair (COM3)	0	0	93	0	62,913
nonpt	555	Professional/Technical (COM4) plus General Government (GOV1)	0	0	0	0	2,872
nonpt	560	Hospital (COM6)	0	0	0	0	9
nonpt	575	Light and High Tech Industrial (IND2 + IND5)	0	0	0	0	2,554
nonpt	580	Food, Drug, Chemical Industrial (IND3)	0	610	313	171	10,532
nonpt	585	Metals and Minerals Industrial (IND4)	0	23	140	8	443
nonpt	590	Heavy Industrial (IND1)	10	4,362	5,441	1,131	145,088
nonpt	595	Light Industrial (IND2)	0	1	238	0	80,245
nonpt	600	Gas Stations	0	0	0	0	413,518
nonpt	650	Refineries and Tank Farms	0	0	0	0	130,222
nonpt	675	Refineries and Tank Farms and Gas Stations	0	0	0	0	1,203
nonpt	700	Airport Areas	0	0	0	0	32,030
nonpt	801	Port Areas	0	51	1	0	12,526
nonpt	870	Wastewater Treatment Facilities	1,015	13	1	1	4,988
nonpt	880	Drycleaners	0	0	0	0	10,026
nonroad	100	Population	40	39,475	2,824	85	5,030
nonroad	140	Housing Change and Population	554	537,249	45,058	1,255	78,526
nonroad	261	NTAD Total Railroad Density	2	2,673	310	5	568
nonroad	300	Low Intensity Residential	106	26,637	4,324	138	202,928
nonroad	310	Total Agriculture	481	488,224	39,037	910	57,473
nonroad	350	Water	213	143,196	12,397	337	614,849

Sector	Srg. Code	Description	NH3	NOX	PM2_5	SO2	VOC
nonroad	400	Rural Land Area	157	25,667	16,711	194	620,788
nonroad	505	Industrial Land	452	146,871	5,809	411	32,978
nonroad	510	Commercial plus Industrial	382	131,572	9,888	348	139,291
nonroad	520	Commercial plus Industrial plus Institutional	42	21,395	7,569	65	93,164
nonroad	525	Golf Courses plus Institutional plus Industrial plus Commercial	163	49,146	8,792	223	162,672
nonroad	850	Golf Courses	12	2,394	112	17	7,092
nonroad	860	Mines	2	2,931	341	5	594
nonroad	890	Commercial Timber	19	12,979	1,486	38	8,680
np_oilgas	400	Rural Land Area	0	1	0	0	50
np_oilgas	680	Oil and Gas Wells	0	24	1	0	85
np_oilgas	681	Spud count - Oil Wells	0	0	0	0	6,244
np_oilgas	682	Spud count - Horizontally-drilled wells	0	2,297	87	4	145
np_oilgas	683	Produced Water at all wells	0	0	0	0	44,469
np_oilgas	684	Completions at Gas and CBM Wells	0	257	7	580	7,460
np_oilgas	685	Completions at Oil Wells	0	19	0	205	28,017
np_oilgas	686	Completions at all wells	0	3,801	112	50	63,924
np_oilgas	687	Feet drilled at all wells	0	33,433	1,409	41	9,576
np_oilgas	688	Spud count - Gas and CBM Wells	0	0	0	0	1,810
np_oilgas	689	Gas production at all wells	0	50,926	3,859	89,370	153,277
np_oilgas	692	Spud count	0	35,655	972	1,816	4,414
np_oilgas	693	Well count - all wells	0	26,838	509	258	89,423
np_oilgas	694	Oil production at Oil wells	0	1,018	0	9,254	618,190
np_oilgas	695	Well count - oil wells	0	107,011	3,429	68	422,416
np_oilgas	697	Oil production at gas wells	0	244	0	0	319,117
np_oilgas	698	Well count - gas wells	0	391,705	6,816	4,615	504,599
onroad	100	Population	0	1,217,387	20,480	1,207	1,503,878
onroad	120	Urban Population	11,021	383,680	17,175	2,820	107,083
onroad	130	Rural Population	5,614	219,432	8,260	1,289	47,988
onroad	200	Urban Primary Road Miles	59,212	1,928,303	85,642	13,115	447,741
onroad	210	Rural Primary Road Miles	26,058	1,328,031	49,969	5,770	199,185
onroad	220	Urban Secondary Road Miles	6,321	207,553	9,305	1,536	56,296
onroad	230	Rural Secondary Road Miles	9,899	382,320	14,314	2,179	83,071
onroad_rfl	600	Gas Stations	0	0	0	0	157,629
rwc	165	0.5 Residential Heating - Wood plus 0.5 Low Intensity Residential	20,415	35,818	389,655	9,010	448,753

* Note: Onroad emissions numbers are from the 2011ed case, but the distribution for 2011ef is similar

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 emissions as point sources. For the modeling platform, EPA used the SMOKE "area-to-point" approach for only airport ground support equipment (nonroad sector), and jet refueling (nonpt sector). The approach is described in detail in the 2002 platform documentation: http://www.epa.gov/scram001/reports/Emissions%20TSD%20Vol1_02-28-08.pdf.The ARTOPNT file that lists the nonpoint sources to locate using point data was unchanged from the 2005-based platform.

3.4.3 Surrogates for Canada and Mexico emission inventories

The surrogates for Canada to spatially allocate the 2006 Canadian emissions are unchanged from the 2007 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). Per Environment Canada, the surrogates are based on 2001 Canadian census data. The Canadian surrogates used for this platform are listed in Table 3-17. The leading "9" was added to the surrogate codes to avoid duplicate surrogate numbers with U.S. surrogates. Some new surrogates for Mexico became available in the 2011 platform. The surrogates 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 3-18. 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 3-17. Canadian Spatial Surrogates

Code	Description	Code	Description
9100	Population	9493	Warehousing and storage
9101	Total dwelling	9494	Total Transport and warehouse
9102	Urban dwelling	9511	Publishing and information services
9103	Rural dwelling	9512	Motion picture and sound recording industries
9104	Total Employment	9513	Broadcasting and telecommunications
9106	ALL_INDUST	9514	Data processing services
9111	Farms	9516	Total Info and culture
9113	Forestry and logging	9521	Monetary authorities - central bank
9114	Fishing hunting and trapping	9522	Credit intermediation activities
9115	Agriculture and forestry activities	9523	Securities commodity contracts and other financial investment activities
9116	Total Resources	9524	Insurance carriers and related activities
9211	Oil and Gas Extraction	9526	Funds and other financial vehicles
9212	Mining except oil and gas	9528	Total Banks
9213	Mining and Oil and Gas Extract activities	9531	Real estate
9219	Mining-unspecified	9532	Rental and leasing services
9221	Total Mining	9533	Lessors of non-financial intangible assets (except copyrighted works)
9222	Utilities	9534	Total Real estate
9231	Construction except land subdivision and land development	9541	Professional scientific and technical services

Code	Description	Code	Description
9232	Land subdivision and land development	9551	Management of companies and enterprises
9233	Total Land Development	9561	Administrative and support services
9308	Food manufacturing	9562	Waste management and remediation services
9309	Beverage and tobacco product manufacturing	9611	Education Services
9313	Textile mills	9621	Ambulatory health care services
9314	Textile product mills	9622	Hospitals
9315	Clothing manufacturing	9623	Nursing and residential care facilities
9316	Leather and allied product manufacturing	9624	Social assistance
9321	Wood product manufacturing	9625	Total Service
9322	Paper manufacturing	9711	Performing arts spectator sports and related industries
9323	Printing and related support activities	9712	Heritage institutions
9324	Petroleum and coal products manufacturing	9713	Amusement gambling and recreation industries
9325	Chemical manufacturing	9721	Accommodation services
9326	Plastics and rubber products manufacturing	9722	Food services and drinking places
9327	Non-metallic mineral product manufacturing	9723	Total Tourism
9331	Primary Metal Manufacturing	9811	Repair and maintenance
9332	Fabricated metal product manufacturing	9812	Personal and laundry services
9333	Machinery manufacturing	9813	Religious grant-making civic and professional and similar organizations
9334	Computer and Electronic manufacturing	9814	Private households
9335	Electrical equipment appliance and component manufacturing	9815	Total other services
9336	Transportation equipment manufacturing	9911	Federal government public administration
9337	Furniture and related product manufacturing	9912	Provincial and territorial public administration (9121 to 9129)
9338	Miscellaneous manufacturing	9913	Local municipal and regional public administration (9131 to 9139)
9339	Total Manufacturing	9914	Aboriginal public administration
9411	Farm product wholesaler-distributors	9919	International and other extra-territorial public administration
9412	Petroleum product wholesaler-distributors	9920	Total Government
9413	Food beverage and tobacco wholesaler-distributors	9921	Commercial Fuel Combustion
9414	Personal and household goods wholesaler-distributors	9922	TOTAL DISTRIBUTION AND RETAIL
9415	Motor vehicle and parts wholesaler-distributors	9923	TOTAL INSTITUTIONAL AND GOVERNEMNT
9416	Building material and supplies wholesaler-distributors	9924	Primary Industry

Code	Description	Code	Description
9417	Machinery equipment and supplies wholesaler-distributors	9925	Manufacturing and Assembly
9418	Miscellaneous wholesaler-distributors	9926	Distribution and Retail (no petroleum)
9419	Wholesale agents and brokers	9927	Commercial Services
9420	Total Wholesale	9928	Commercial Meat cooking
9441	Motor vehicle and parts dealers	9929	HIGHJET
9442	Furniture and home furnishings stores	9930	LOWMEDJET
9443	Electronics and appliance stores	9931	OTHERJET
9444	Building material and garden equipment and supplies dealers	9932	CANRAIL
9445	Food and beverage stores	9933	Forest fires
9446	Health and personal care stores	9941	PAVED ROADS
9447	Gasoline stations	9942	UNPAVED ROADS
9448	clothing and clothing accessories stores	9943	HIGHWAY
9451	Sporting goods hobby book and music stores	9944	ROAD
9452	General Merchandise stores	9945	Commercial Marine Vessels
9453	Miscellaneous store retailers	9946	Construction and mining
9454	Non-store retailers	9947	Agriculture Construction and mining
9455	Total Retail	9950	Intersection of Forest and Housing
9481	Air transportation	9960	TOTBEEF
9482	Rail transportation	9970	TOTPOUL
9483	Water Transportation	9980	TOTSWIN
9484	Truck transportation	9990	TOTFERT
9485	Transit and ground passenger transportation	9993	Trail
9486	Pipeline transportation	9994	ALLROADS
9487	Scenic and sightseeing transportation	9995	30UNPAVED_70trail
9488	Support activities for transportation	9996	Urban area
9491	Postal service	9997	CHBOISQC
9492	Couriers and messengers	9991	Traffic

Table 3-18. CAPs Allocated to Mexican and Canadian Spatial Surrogates

Srg code	Description	NH_3	NO_X	PM_{2_5}	SO_2	VOC
22	MEX Total Road Miles	15,965	370,867	34,396	13,713	375,276
10	MEX Population	0	0	0	0	431,231
12	MEX Housing	0	161,013	17,483	2,123	452,685
14	MEX Residential Heating - Wood	0	20,093	211,525	2,859	380,572
16	MEX Residential Heating - Distillate Oil	0	38	0	11	2
20	MEX Residential Heating - LP Gas	0	25,303	787	63	614
22	MEX Total Road Miles	0	0	0	0	3,513
24	MEX Total Railroads Miles	0	74,969	1,669	663	2,824
26	MEX Total Agriculture	679,212	164,144	72,372	2,127	43,958
28	MEX Forest Land	0	16,224	67,683	660	79,018

Srg code	Description	NH_3	NO_X	PM_{2_5}	SO_2	VOC
32	MEX Commercial Land	0	125,211	7,726	0	286,982
34	MEX Industrial Land	0	45,831	5,684	59,201	133,440
36	MEX Commercial plus Industrial Land	0	0	0	0	332,495
38	MEX Commercial plus Institutional Land	0	6,400	216	84	28,293
40	Residential (RES1-4)+Commercial+Industrial+Institutional+ Government	0	8	20	0	241,710
42	MEX Personal Repair (COM3)	0	0	0	0	33,616
44	MEX Airports Area	0	14,639	0	1,149	6,857
46	MEX Marine Ports	0	124,951	2,991	1,482	1,099
48	Brick Kilns - Mexico	0	776	6,691	0	10,244
50	Mobile sources - Border Crossing - Mexico	0	454	0	0	2,668
9100	CAN Population	603	0	276	0	304
9101	CAN total dwelling	643	46,256	12,783	14,698	32,944
9106	CAN ALL_INDUST	133	21,526	381	3,921	2
9113	CAN Forestry and logging	1,582	8,561	28,622	1,809	36,114
9115	CAN Agriculture and forestry activities	160	239,553	25,318	9,092	26,526
9116	CAN Total Resources	0	17	0	0	5
9212	CAN Mining except oil and gas	0	0	5,391	0	0
9221	CAN Total Mining	42	2,292	45,374	728	26
9222	CAN Utilities	189	14,882	369	1,124	255
9233	CAN Total Land Development	17	20,789	1,928	981	2,551
9308	CAN Food manufacturing	0	0	0	0	4,535
9323	CAN Printing and related support activities	0	0	0	0	25,203
9324	CAN Petroleum and coal products manufacturing	0	0	2,402	0	0
9327	CAN Non-metallic mineral product manufacturing	0	238	7,708	2,941	1,218
9331	CAN Primary Metal Manufacturing	0	98	5,062	12	6
9412	CAN Petroleum product wholesaler-distributors	0	0	0	0	70,125
9416	CAN Building material and supplies wholesaler-distributors	2	0	1,461	3,259	560
9448	CAN clothing and clothing accessories stores	0	0	0	0	328
9562	CAN Waste management and remediation services	165	893	1,596	1,998	16,551
9921	CAN Commercial Fuel Combustion	494	33,816	2,750	35,471	850
9924	CAN Primary Industry	0	0	0	0	219,282
9925	CAN Manufacturing and Assembly	0	0	0	0	139,227
9931	CAN OTHERJET	9	14,388	548	1,139	7,629
9932	CAN CANRAIL	109	122,694	4,093	5,737	3,304

Srg code	Description	NH_3	NO_X	PM $_{2\_5}$	SO_2	VOC
9942	CAN UNPAVED ROADS	40	3,462	3,499	48	152,674
9945	CAN Commercial Marine Vessels	28	45,454	6,404	14,325	61,139
9946	CAN Construction and mining	247	156,770	10,070	5,667	17,180
9947	CAN Agriculture Construction and mining	19	37,452	536	26	32,683
9950	CAN Intersection of Forest and Housing	1,053	11,700	120,045	1,671	173,130
9960	CAN TOTBEEF	176,156	0	7,420	0	317,394
9970	CAN TOTPOUL	74,204	0	2	0	264
9980	CAN TOTSWIN	122,094	0	996	0	3,186
9990	CAN TOTFERT	178,791	0	9,279	0	0
9991	CAN traffic	22,294	550,896	10,888	5,548	285,104
9994	CAN ALLROADS	0	0	55,468	0	0
9995	CAN 30UNPAVED_70trail	0	0	106,707	0	0
9996	CAN urban_area	0	0	284	0	0

4 Development of 2018 and 2025 Base-Case Emissions

This section describes the methods used for developing the 2018 and 2025 future-year base-case emissions. The future base-case projection methodologies vary by sector. With the exceptions discussed in Section 4.2, the 2018 and 2025 base cases represent predicted emissions in the absence of any further controls beyond those Federal and State measures already promulgated or under reconsideration before emissions processing began in November, 2013. The future base-case scenario reflects projected economic changes and fuel usage for EGU and mobile sectors. The 2018 and 2025 EGU projected inventories represent demand growth, fuel resource availability, generating technology cost and performance, and other economic factors affecting power sector behavior. They also reflect the expected 2018 and 2025 emissions effects due to environmental rules and regulations, consent decrees and settlements, plant closures, control devices updated since 2011, and forecast unit construction through the calendar years 2018 and 2025, respectively. In this analysis, the projected EGU emissions include the Final Mercury and Air Toxics (MATS) rule announced on December 21, 2011 and the Clean Air Interstate Rule (CAIR) issued March 10, 2005. More information on the EGU base case can be found at http://www.epa.gov/powersectormodeling/BaseCasev513.html.

For mobile sources (onroad, onroad_rfl, nonroad, c1c2rail and c3marine sectors), all national measures for which data were available at the time of modeling have been included. The Tier 3 standards finalized in March, 2014 are represented (see http://www.epa.gov/otaq/tier3.htm). Efforts made to include some regional haze and state-reported local controls as part of a larger effort to include more local control information on stationary non-EGU sources are described further in Section 4.2. The following bullets summarize the projection methods used for sources in the various sectors, while additional details and data sources are given in the following subsections and Table 4-1.

- EGU sector (ptegu and ptegu_pk): Unit-specific estimates from IPM version 5.13, including CAIR and Final MATS.
- Non-IPM sector (ptnonipm): Projection factors and percent reductions reflect comments received during the development of the Cross-State Air Pollution Rule (CSAPR) along with emission reductions due to national and local rules, control programs, plant closures, consent decrees and settlements. Projection for corn ethanol and biodiesel plants, refineries and upstream impacts take into account Annual Energy Outlook (AEO) fuel volume projections. Airport-specific terminal area forecast (TAF) data were used for aircraft to account for projected changes in landing/takeoff activity.
- Point and nonpoint oil and gas sectors (pt_oilgas and np_oilgas): Regional projection factors by product type using AEO 2013 projections to years 2018 and 2025. Cobenefits of stationary engines CAP-cobenefit reductions (RICE NESHAP) and New Source Performance Standards (NSPS) VOC controls reflected for select source categories.
- Fires sector (ptfire): No growth or control – 2011 estimates used directly.
- Agricultural sector (ag): Projection factors for livestock estimates based on expected changes in animal population from 2005 Department of Agriculture data, updated according to EPA experts in July 2012; fertilizer application NH_3 emissions projections include upstream impacts from EISA.
- Area fugitive dust sector (afdust): Projection factors for dust categories related to livestock estimates based on expected changes in animal population and upstream impacts from EISA.
- Residential Wood Combustion (rwc): Projection factors that reflect assumed growth of wood burning appliances based on sales data, equipment replacement rates and change outs. These changes include a growth in lower-emitting stoves and a reduction in higher emitting stoves.

- Remaining Nonpoint sector (nonpt): Projection factors implement comments received during Cross State Air Pollution Rule development and emission reductions due to control programs. PFC projection factors reflecting impact of the final Mobile Source Air Toxics (MSAT2) rule. Upstream impacts from AEO fuel volume, including cellulosic ethanol plants, are reflected.
- Nonroad mobile sector (nonroad): Other than for California and Texas, this sector uses data from a run of NMIM that utilized NONROAD2008a, using future-year equipment population estimates and control programs to years 2018 and 2025. The inputs were either state-supplied as part of the 2011NEIv1 process or using national level inputs. Final controls from the final locomotive-marine and small spark ignition OTAQ rules are included. California and Texas-specific data were provided by CARB and TCEQ, respectively.
- Locomotive, and non-Class 3 commercial marine sector (c1c2rail): Projection factors for Class 1 and Class 2 commercial marine and locomotives reflect final locomotive-marine controls and fuel volume projections from AEO.
- Class 3 commercial marine vessel (c3marine): Base-year 2011 emissions grown and controlled to 2018 and 2025, incorporating controls based on Emissions Control Area (ECA) and International Marine Organization (IMO) global NO_X and SO_2 controls.
- Onroad mobile, not including refueling (onroad): MOVESTier3FRM-based emissions factors for years 2018 and 2025 were developed using the same representative counties, state-supplied data, meteorology, and procedures that were used to produce the 2011 emission factors described in Section 2.3.1. California and TCEQ-specific data were provided by CARB and TCEQ, respectively. This sector includes all non-refueling onroad mobile emissions (exhaust, extended idle, auxiliary power units, evaporative, evaporative permeation, brake wear and tire wear modes).
- Onroad refueling mode (onroad_rfl): the same projection approach is used as for the onroad sector and processing is described in Section 2.3.2, in that emission factors are from MOVESTier3FRM and that California and Texas did not include state supplied emissions.
- Other onroad (othar): No growth or control for Canada because data are not available. Mexico inventory data were grown from year 1999 to 2018 and retained at year 2018 values for 2025.
- Other nonroad/nonpoint (othon): No growth or control for Canada. Mexico inventory data were grown from year 1999 to 2018 and retained at year 2018 values for 2025.
- Other point (othpt): No growth or control for Canada and offshore oil. Mexico inventory data were grown from 1999 to year 2018 and retained at year 2018 values for 2025. Non-U.S. C3 CMV data projected using the same methodology as the c3marine sector.
- Biogenic: 2011 emissions computed with "11g" meteorology are used for all future-year scenarios.

Table 4-1 summarizes the control strategies and growth assumptions by source type that were used to create the U.S. 2018 and 2025 base-case emissions from the 2011v6.1 base-case inventories. Lists of the control, closures, projection packets (datasets) used to create 2018 and 2025 future year base-case scenario inventories from the 2011 base case are provided on the FTP site. These packets were processed through EPA's Control Strategy Tool (CoST) to create future year inventories. CoST is described here: http://www.epa.gov/ttnecas1/cost.htm. The CoST packets are formatted in the same way as those needed for SMOKE. .

Table 4-1. Control strategies and growth assumptions for creating the 2018 and 2025 base-case emissions inventories from the 2011 base case

Control Strategies and/or growth assumptions (grouped by standard and approach used to apply to the inventory)	**CAPs affected**	**Section**
Non-EGU Point (ptnonipm and pt_oilgas sectors) Controls and Growth Assumptions		
Ethanol plants adjustments for AEO volumes	All	4.2.1.1
Biodiesel plants adjustments for AEO volumes	All	4.2.1.2
Ethanol distribution vapor losses adjustments due to AEO volumes	VOC	4.2.1.6
Refinery upstream adjustments for AEO volumes	All	4.2.1.7
Livestock emissions growth from year 2011 to years 2018 and 2025, also including upstream RFS2 impacts on agricultural-related activities such as pesticide and fertilizer production	All	4.2.2
Oil and gas production AEO-based regional growth factors and VOC NSPS controls	All	4.2.4
Reciprocating Internal Combustion Engines (RICE) NESHAP with reconsiderations	NO_X, CO, PM, SO_2	4.2.3
State fuel sulfur content rules for fuel oil – as of July, 2012, effective only in Maine, Massachusetts, New Jersey, New York and Vermont	SO_2	4.2.6
Industrial/Commercial/Institutional Boilers and Process Heaters MACT with Reconsideration Amendments	CO, PM, SO_2, VOC	4.2.7
NESHAP: Portland Cement census-division level based on Industrial Sector Integrated Solutions (ISIS) policy emissions to years 2018 and 2025. The ISIS results are from the ISIS-Cement model runs for the NESHAP and NSPS analysis of August 2013 and include closures.	All	4.2.8
Future baseline inventory improvements received from states and a 2005 platform NODA and comments from the CSAPR proposal, including local controls, fuel switching, unit closures and consent decrees	All	4.2.9
Facility and unit closures obtained from various sources such as states, industry and web posting, EPA staff and post-2011 inventory submittals	All	4.2.10
Aircraft growth via Itinerant (ITN) operations at airports to 2018 and 2025	All	4.2.10
Lafarge and Saint Gobain consent decrees	NO_X, PM, SO_2	4.2.9.3
Consent decrees on companies (based on information from the Office of Enforcement and Compliance Assurance – OECA) apportioned to plants owned/operated by the companies	CO, NO_X, PM, SO_2, VOC	4.2.9.3
Refinery Consent Decrees: plant/unit controls	NO_X, SO_2	4.2.9.3
Commercial and Industrial Solid Waste Incineration (CISWI) revised NSPS	PM, SO_2	4.2.11.1
Nonpoint (afdust, ag, nonpt np_oilgas, and rwc sectors) Controls and Growth Assumptions		
MSAT2 and RFS2 impacts on portable fuel container growth and control from 2011 to years 2018 and 2025	VOC	4.2.1.3
Cellulosic ethanol and diesel emissions from AEO volumes	All	4.2.1.4
Ethanol transport working losses inventory from AEO volumes	VOC	4.2.1.5
Ethanol distribution vapor losses adjustments from AEO volumes	VOC	4.2.1.6
Livestock emissions growth from year 2011 to years 2018 and 2025, also including upstream RFS2 impacts on agricultural-related activities such as pesticide and fertilizer production	All	4.2.2
Oil and gas production AEO-based regional growth factors and VOC NSPS controls	All	4.2.4
Reciprocating Internal Combustion Engines (RICE) NESHAP with reconsiderations	NO_X, CO, PM, SO_2	4.2.3
State fuel sulfur content rules for fuel oil – as of July, 2012, effective only in Maine, Massachusetts, New Jersey, New York and Vermont	SO_2	4.2.6
Residential wood combustion growth and change-outs from year 2011 to years 2018 and 2025	All	4.2.3

Control Strategies and/or growth assumptions (grouped by standard and approach used to apply to the inventory)	CAPs affected	Section
Future baseline inventory improvements received from states	NO_X, VOC	4.2.9
Onroad Mobile Controls (All national in-force regulations are modeled. The list includes key recent mobile control strategies but is not exhaustive.)		
National Onroad Rules: All onroad control programs finalized as of the date of the model run, including most recently: Tier-3 Vehicle Emissions and Fuel Standards Program: March, 2014 Light-Duty Vehicle Greenhouse Gas Rule for Model-Year 2017-2025: October, 2012 Heavy (and Medium)-Duty Greenhouse Gas Rule: September, 2011 Renewable Fuel Standard Program (RFS2): March, 2010 Light Duty Vehicle Greenhouse Gas Rule for Model-Year 2012-2016: May, 2010 Final Mobile Source Air Toxics Rule (MSAT2): February, 2007 2007 Heavy-Duty Highway Rule: January, 2001 Tier 2 Vehicle and Gasoline Sulfur Program: February, 2000 National Low Emission Vehicle Program (NLEV): March, 1998	All	4.3
Local Onroad Programs: California LEVIII Program Ozone Transport Commission (OTC) LEV Program: January,1995 Inspection and Maintenance programs Fuel programs (also affect gasoline nonroad equipment) Stage II refueling control programs	VOC	4.3
Nonroad Mobile Controls (All national in-force regulations are modeled. The list includes recent key mobile control strategies but is not exhaustive.)		
National Nonroad Controls: All nonroad control programs finalized as of the date of the model run, including most recently: Emissions Standards for New Nonroad Spark-Ignition Engines, Equipment, and Vessels: October, 2008 Control of Emissions of Air Pollution from Locomotives and Marine Compression-Ignition Engines Less than 30 Liters per Cylinder: March, 2008 Clean Air Nonroad Diesel Final Rule – Tier 4: May, 2004	All	4.4
Locomotives: Control of Emissions of Air Pollution from Locomotives and Marine Compression-Ignition Engines Less than 30 Liters per Cylinder: March, 2008 Clean Air Nonroad Diesel Final Rule – Tier 4: May, 2004	All	4.4.1
Commercial Marine: Category 3 marine diesel engines Clean Air Act and International Maritime Organization standards: April, 2010 Control of Emissions of Air Pollution from Locomotives and Marine Compression-Ignition Engines Less than 30 Liters per Cylinder: March, 2008 Clean Air Nonroad Diesel Final Rule – Tier 4: May, 2004	All	4.4.2

A quick background on the Control Strategy Tool (CoST)

CoST is used to apply most non-EGU projection/growth factors, controls and facility/unit/stack-level closures to the 2011 emissions modeling inventories to create inventories for years 2018 and 2025 for the following sectors: afdust, ag, c1c2rail, nonpt, np_oilgas, ptnonipm, pt_oilgas and rwc. The CoST training manual is available at: http://www.cmascenter.org/help/model_docs/cost/2.5/CoST_UsersGuide_2012-08-01_Final.pdf. The CoST development document, which is a more thorough but dated document of how to build and format CoST input files (packets) is available at: http://www.epa.gov/ttnecas1/models/CoST_Development%20Document_2010-06-09.pdf.

CoST allows the user to apply projection factors, controls and closures at various geographic and inventory key field resolutions. CoST provides the user with the ability to perform numerous quality assurance routines as well as create SMOKE-ready future year inventories. There are also available linkages to existing and user-defined control measures databases and it is up to the user to determine how control strategies are developed and applied. EPA typically creates individual CoST datasets or "packets" that represent specific intended purposes. For example, aircraft projections for airports are in a separate PROJECTION packet from residential wood combustion sales/appliance turnover-based projections. CoST uses three packet types as described below:

1. CLOSURE: Applied first in CoST. This packet can be used to zero-out (close) point source emissions at resolutions as broad as a facility to as specific as a stack. EPA used these types of packets for known post-2011 controls as well as information on closures provided by states on specific facilities, units or stacks. This packet type is only used in the ptnonipm sector in the 2011 platform.
2. PROJECTION: This packet allows the user to increase or decrease emissions for virtually any geographic and/or inventory source level. Projection factors are applied as simple scalars to the 2011 emissions inventories prior to the application of any possible subsequent CONTROLs. A PROJECTION packet is necessary whenever emissions increase from 2011 and is also desirable when information is based more on activity assumptions rather than known controls. EPA used PROJECTION packet(s) in every non-EGU modeling sector in the 2011 platform.
3. CONTROL: These packets are applied after any/all CLOSURE and PROJECTION packet entries. The user has similar level of control as PROJECTION packets regarding specificity of geographic and/or inventory source level application. Control factors are expressed as a percent reduction (0 to 100) and can be applied in addition to any pre-existing inventory control, or as a replacement control where inventory controls are first backed out prior to the application of a more-stringent replacement control.

As mentioned above, CoST first applies any/all CLOSURE information for point sources, then applies PROJECTION packet information, followed by CONTROL packets. A hierarchy is used by CoST to separately apply PROJECTION and CONTROL packets. In short, in a separate process for PROJECTION and CONTROL packets, more specific information is applied in lieu of less-specific information in ANY other packets. For example, a facility-level PROJECTION factor will be replaced by a unit-level, or facility and pollutant-level PROJECTION factor. It is important to note that this hierarchy does not apply intra-packet types; for example, CONTROL packet entries are applied irrespective of PROJECTION packet hierarchies. A more specific example: a state/SCC-level PROJECTION factor will be applied before a stack/pollutant-level CONTROL factor that impacts the same inventory record. However, an inventory source that is subject to a CLOSURE packet record is removed from consideration of subsequent PROJECTION and CONTROL packets.

The implication for this hierarchy and intra-packet independence is important to understand and quality assure when creating future year strategies. For example, with consent decrees, settlements and state comments, the goal is typically to achieve a targeted reduction (from the 2011NEIv1) or a targeted 2018 (or 2025) emissions value. Therefore, as encountered with this 2018 base case, consent decrees and state comments for specific cement kilns (expressed as CONTROL packet entries), needed to be applied instead of (not in addition to) the more general approach of the PROJECTION packet entries for cement manufacturing. By processing CoST control strategies with PROJECTION and CONTROL packets separated by type of measure/program and also by consent decree and state comments, it is possible to show actual changes from the 2011 inventory to the 2018 and 2025 inventory for each packet.

Ultimately, CoST concatenates all PROJECTION packets into one PROJECTION dataset and uses a hierarchal matching approach, a sample subset of which is shown in Table 4-2, to assign PROJECTION factors to the inventory. For example, a packet entry with Ranking=1 will supersede all other potential inventory matches from other packets. CoST then computes the projected emissions from all PROJECTION packet matches and then performs a similar routine for all CONTROL packets. Therefore, when summarizing "emissions reduced" from CONTROL packets, it is important to note that these reductions are not relative to the 2011 inventory, but rather, to the intermediate inventory ***after*** application of any/all PROJECTION packet matches. It is also important not all 70+ hierarchy options are shown. The fields listed in Table 4-2 are not necessarily named the same in CoST, but rather are similar to those in the SMOKE FF10 inventories; for example, "REGION_CD" is the county-state-county FIPS code (e.g., Harris county Texas is 48201) and "STATE" would be the 2-digit state FIPS code with three trailing zeroes (e.g., Texas is 48000).

Table 4-2. Subset of CoST Packet Matching Hierarchy

Rank	Matching Hierarchy	Inventory Type
1	REGION_CD, FACILITY_ID, UNIT_ID, REL_POINT_ID, PROCESS_ID, SCC, POLL	point
2	REGION_CD, FACILITY_ID, UNIT_ID, REL_POINT_ID, PROCESS_ID, POLL	point
3	REGION_CD, FACILITY_ID, UNIT_ID, REL_POINT_ID, SCC, POLL	point
4	REGION_CD, FACILITY_ID, UNIT_ID, REL_POINT_ID, POLL	point
5	REGION_CD, FACILITY_ID, UNIT_ID, SCC, POLL	point
6	REGION_CD, FACILITY_ID, UNIT_ID, POLL	point
7	REGION_CD, FACILITY_ID, SCC, POLL	point
8	REGION_CD, FACILITY_ID, POLL	point
9	REGION_CD, FACILITY_ID, UNIT_ID, REL_POINT_ID, PROCESS_ID	point
10	REGION_CD, FACILITY_ID, UNIT_ID, REL_POINT_ID	point
11	REGION_CD, FACILITY_ID, UNIT_ID	point
12	REGION_CD, FACILITY_ID	point
13	REGION_CD, NAICS, SCC, POLL	point, nonpoint
14	REGION_CD, NAICS, POLL	point, nonpoint
15	STATE, NAICS, POLL	point, nonpoint
16	REGION_CD, NAICS	point, nonpoint
17	NAICS	point, nonpoint
18	REGION_CD, SCC, POLL	point, nonpoint
19	STATE, SCC, POLL	point, nonpoint
20	SCC, POLL	point, nonpoint
21	REGION_CD, SCC	point, nonpoint
22	STATE, SCC	point, nonpoint
23	SCC	point, nonpoint
24	REGION_CD, POLL	point, nonpoint
25	REGION_CD	point, nonpoint
26	STATE, POLL	point, nonpoint
27	STATE	point, nonpoint
28	POLL	point, nonpoint

The remainder of this section is organized either by source sector or by specific emissions category within a source sector for which a distinct set of data were used or developed for the purpose of projections for the 2018 and 2025 base cases. This organization allows consolidation of the discussion of the emissions categories that are contained in multiple sectors, because the data and approaches used across the sectors are consistent and do not need to be repeated. Sector names associated with the emissions categories are provided in parentheses.

A list of inventory datasets used for this and all cases is provided on the FTP site. The ancillary input data in the future-year scenarios are very similar to those used in the 2011 base case except for the speciation profiles used for gasoline-related sources, which change in the future to account for increased ethanol usage in gasoline. The specific speciation profile changes are discussed in Section 3.2.1.

4.1 Stationary source projections: EGU sectors (ptegu, ptegu_pk)

The future-year data for the ptipm sector used in the air quality modeling were created by the Integrated Planning Model (IPM) version 5.13 (v5.13) Final MATS (Mercury and Air Toxics Standards) of (http://www.epa.gov/airmarkt/progsregs/epa-ipm/index.html). The IPM is a multiregional, dynamic, deterministic linear programming model of the U.S. electric power sector. Version 5.13 reflects state rules, consent decrees and announced shutdowns through August, 2013. IPM 5.13 was significantly updated from the previous version 4.10 and represents electricity demand projections for the Annual Energy Outlook (AEO) 2013. The scenario used for this modeling represents the implementation of the Clean Air Interstate Rule, the Mercury and Air Toxics Standards, and the final actions EPA has taken to implement the Regional Haze Rule. More details on the IPM v5.13 base case scenarios can be found at http://www.epa.gov/powersectormodeling/BaseCasev513.html.

Directly emitted PM emissions (i.e., $PM_{2.5}$ and PM_{10}) from the EGU sector are computed via a post processing routine that applies emission factors to the IPM-estimated fuel throughput based on fuel, configuration and controls to compute the filterable and condensable components of PM. This methodology is documented in the air quality modeling flat file documentation available here: http://www.epa.gov/powersectormodeling/docs/v513/FlatFile_Methodology.pdf. This postprocessing step also apportions the regional emissions down to the unit-level emissions used for air quality modeling. A single IPM run is postprocessed once for each output year to get results for both 2018 and 2025. As part of the development of the flat file, a cross reference between the 2011NEIv1 and IPM is used to help populate stack parameters and other related information. This cross reference is available from http://www.epa.gov/powersectormodeling/docs/v513/FlatFile_Inputs.xls. The emissions in the flat file created from the IPM outputs are temporalized into the hourly emissions needed by the air quality model as described in Section 3.3.2.

4.2 Stationary source projections: non-EGU sectors (afdust, ag, nonpt, np_oilgas, ptnonipm, pt_oilgas, rwc)

To project U.S. stationary sources other than the ptipm sector, growth factors and/or controls were applied to certain categories within the afdust, ag, nonpt, np_oilgas, ptnonipm, pt_oilgas and rwc platform sectors. This subsection provides details on the data and projection methods used for these sectors. In estimating future-year emissions, EPA assumed that emissions growth does not track with economic growth for many stationary non-IPM sources. This “no-growth” assumption is based on an examination of historical emissions and economic data. While EPA is working toward improving the projection approach in future emissions platforms, the Agency is still using the no-growth assumption for the 2011 platform unless states provided specific growth factors for 2018 or other years beyond 2018. More details on the rationale for this approach can be found in Appendix D of the Regulatory Impact Assessment for the PM NAAQS rule (EPA, 2006b).

For many sources, EPA applied emissions reduction factors (CONTROL packets) to the 2011 base case emissions for particular sources in the ptnonipm, nonpt and two oil and gas sectors (np_oilgas and pt_oilgas) to reflect the impact of stationary-source national and local-scale control programs including consent decrees. Information on plant, unit and stack closures (CLOSURE packets) is restricted to the ptnonipm sector. Some of the controls described in this section were obtained from comments on the Cross-State Air Pollution Rule (CSAPR) proposal.

The contents of the controls, local adjustments and closures for the 2018 and 2025 base cases are described in the following subsections. Year-specific projection factors (PROJECTION packets) for years 2018 and 2025 were used for creating the 2018 and 2025 base cases unless noted otherwise. The contents of these projection packets (and control reductions) are provided in the following sections where feasible. However, some sectors used growth or control factors that varied geographically and their contents could not be provided in the following sections (e.g., facilities and units subject to the Boiler MACT reconsideration has thousands of records). This section is divided into several subsections that are summarized in Table 4-3. Note that future year inventories were used rather than projection or control packets for some sources.

Table 4-3. Summary of non-EGU stationary projections subsections

Subsection	**Title**	**Sector(s)**	**Brief Description**
4.2.1	Mobile source upstream future year inventories and adjustments	nonpt ptnonipm	1) Point and non-point inventories received from OTAQ that account for the upstream impact of AEO fuel volume projections. 2) Point and non-point adjustment factors that EPA applied to the 2011 inventory to reflect AEO fuel volumes in 2018, with 2025 held at year 2018 values. 3) LDGHG adjustments made for year 2025
4.2.2	Upstream agricultural and livestock adjustments	afdust, ag, nonpt, ptnonipm	Adjustment factors reflect impacts on agriculture related processes due to increased ethanol use under the EISA mandate.
4.2.3	Residential wood combustion projections	rwc	Adjustment factors that reflect the change in RWC emissions by appliance type, including wood stove change-outs and accounting for estimated future sales and replacement rates.
4.2.4	Oil and Gas projections	np_oilgas, pt_oilgas	Projection packet reflecting regional AEO-based growth for oil and gas production as well as VOC NSPS controls for select sources.
4.2.3	RICE NESHAP controls	nonpt, np_oilgas, ptnonipm, pt_oilgas	Control packet reflecting RICE NESHAP with reconsideration amendments.
4.2.6	Fuel sulfur rule controls	nonpt ptnonipm	Control packet reflecting state and local fuel sulfur rules, including ULSD.
4.2.7	Industrial Boiler MACT reconsideration controls	ptnonipm	Control packet reflecting ICI Boiler MACT reconsideration reductions.
4.2.8	Portland cement NESHAP projections	ptnonipm	Year 2018 and 2025 ISIS policy cases reflecting the Portland Cement NESHAP, including closures, controls at existing kilns and an inventory containing new kilns constructed after 2011 that account for shifting capacity from some closed units to open units.

Subsection	Title	Sector(s)	Brief Description
4.2.3	State comments and consent decrees/settlements	nonpt, ptnonipm	Projection and control packets reflecting numerous sources of consent decree/settlement information as well as state comments and data regarding 2018, with limited information beyond year 2018.
4.2.9	Aircraft projections	ptnonipm	Airport-specific projections to years 2018 and 2025 based on FAA itinerary activity estimates.
4.2.10	Remaining non-EGU controls and closures	ptnonipm	All other controls and plant/unit/stack closures information not covered in previous subsections

4.2.1 Mobile source upstream future year inventories and adjustments (nonpt, ptnonipm)

EPA incorporated adjustments for some stationary source categories to account for expected impacts of renewable fuel requirements under EISA, as estimated by Annual Energy Outlook (AEO) 2013, as well as impacts of recent 2017-2025 light duty vehicle greenhouse gas emission standards and heavy-duty greenhouse gas standards. These fuel requirements not only impact emissions associated with highway vehicles and nonroad engines, but also emissions associated with point and nonpoint sources. The "upstream" emission impacts of the renewable fuels mandate are associated with all stages of biofuel production and distribution, including biomass production (agriculture, forestry), fertilizer and pesticide production and transport, biomass transport, biomass refining (corn or cellulosic ethanol production facilities), biofuel transport to blending/distribution terminals, and distribution of finished fuels to retail outlets. These impacts are accounted for in the 2018 inventories. Except for cellulosic diesel, there was not a significant change in biofuel volumes between 2018 and 2025 (Table 4-4); thus the same biofuel adjustments were used for 2025. There are also impacts on domestic crude emissions upstream of petroleum refineries, due to displacement of gasoline and diesel fuel with biofuels, but these are not accounted for in these projections as these data were not available. Greenhouse gas standards also affect production and distribution of gasoline and diesel fuels, but the impacts of these rules will be very small in 2018 and were not accounted for in this analysis. However, the effects are substantial for 2025 and were thus accounted for in the inventories for that year.

Based on the Annual Energy Outlook 2013 (early release) energy use of 15.47 quad (10^{15} BTU) (Department of Energy, 2012), EPA estimated the 2011 ethanol volume as 11.1 billion gallons (Bgal). EPA assumed that an unadjusted 2018 inventory, which does not account for the impacts of the EISA renewable fuel mandate, would have comparable ethanol volumes to 2011. However, analyses done to support the RFS2 rule (EPA, 2010a) suggested a significant increase in renewable fuel volumes in 2018 (see Table 4-4). Adjustments applied to the inventories (described in the following subsections) reflect the impacts on emissions due to the difference between the 2011 ethanol volumes and the renewable fuel volumes shown in Table 4-4. In 2018 and 2025, EPA assumed 1 Bgal of ethanol would be used as E85, 10 Bgal as E10, and about 4 Bgal as E15.

Table 4-4. Renewable Fuel Volumes Assumed for Stationary Source Adjustments.

Renewable Fuel	2018 Volume (Bgal) AEO 2013	2025 Volume (Bgal) AEO 2013
Corn Ethanol	14.7	14.7
Cellulosic Ethanol	0.235	0.235
Imported Ethanol	1.1	0.94
Biodiesel	1.9	1.9
Renewable Diesel	0.236	0.236
Cellulosic Diesel	0.118	0.472

4.2.1.1 Corn Ethanol plants inventory (ptnonipm)

Future year inventories: "ethanol_plants_2018ed_NEI" and "ethanol_plants_2018ed_OTAQ"

As discussed in Section 2.1.4, EPA supplemented the 2011 NEI with corn ethanol plants that EPA OTAQ identified. The 2011 emissions were projected to account for the increased domestic corn ethanol production assumed in this modeling, specifically an increase from 13.9 Bgal in 2011 to 14.7 Bgal by 2018. Since biofuels were not projected to change significantly between 2018 and 2025 the year 2018 inventory was used for year 2025. The projection was applied to all pollutants and all facilities equally. Table 4-5 provides the summaries of estimated emissions for the corn ethanol plants in year 2011 and 2018[24].

Table 4-5. 2011 and 2018/2025 corn ethanol plant emissions [tons]

Pollutant	2011	2018/2025
CO	15,934	16,858
NH_3	726	768
NO_X	18,048	19,095
PM_{10}	10,602	11,217
$PM_{2.5}$	5,995	6,343
SO_2	34,608	36,294
VOC	19,654	21,115

4.2.1.2 Biodiesel plants inventory (ptnonipm)

New Future year inventory: "Biodiesel_Plants_2018_ff10"

EPA OTAQ developed an inventory of biodiesel plants for 2018. Plant location and production volume data came from the Tier 3 proposed rule.[25,26] The total volume of biodiesel came from the AEO 2013 early release, 1.3 BG for 2018. To reach the total volume of biodiesel, plants that had current production volumes were assumed to be at 100% production and the remaining volume was split among plants with planned production. Once facility-level production capacities were scaled, emission factors were applied based on soybean oil feedstock. These emission factors in Table 4-6 are in tons per million gallons (Mgal) and were obtained from EPA's spreadsheet model for upstream EISA impacts developed for the RFS2 rule (EPA, 2010a). Inventories were modeled as point sources with Google Earth and web searching validating facility coordinates and correcting state-county FIPS. Table 4-7 provides the 2018 biodiesel plant emissions estimates. Since biofuels were not projected to change significantly between 2018 and 2025 the year 2018 inventory was used for year 2025. Emissions in 2011 are assumed to be near zero, and HAP emissions in 2018 and 2025 are nearly zero.

Table 4-6. Emission Factors for Biodiesel Plants (Tons/Mgal)

Pollutant	Emission Factor
VOC	4.3981E-02
CO	5.0069E-01
NO_X	8.0790E-01
PM_{10}	6.8240E-02

[24] The 2011 emissions are the sum of the NEI and OTAQ facilities. The same is true for 2018 and 2025.
[25] US EPA 2014.Regulatory Impact Analysis for Tier 3 Vehicle Emission and Fuel Standards Program. EPA-420-RD-143-0052.
[26] Cook, R. 2014. Development of Air Quality Reference Case Upstream and Portable Fuel Container Inventories for Tier 3 Final Rule. Memorandum to Docket EPA-HQ-OAR-2010-0162.

Pollutant	Emission Factor
$PM_{2.5}$	6.8240E-02
SO_2	5.9445E-03
NH_3	0
Acetaldehyde	2.4783E-07
Acrolein	2.1290E-07
Benzene	3.2458E-08
1,3-Butadiene	0
Formaldehyde	1.5354E-06
Ethanol	0

Table 4-7. 2018/2025 biodiesel plant emissions [tons]

Pollutant	2018
CO	649
NO_X	1048
PM_{10}	89
$PM_{2.5}$	89
SO_2	8
VOC	57

4.2.1.3 Portable fuel container inventory (nonpt)

Future year inventory: "2018_PFC_inventory_FF10_revision2"

EPA used future-year VOC emissions from Portable Fuel Containers (PFCs) from inventories developed and modeled for EPA's MSAT2 rule (EPA, 2007a). The 10 PFC SCCs are summarized below (note that the full SCC descriptions for these SCCs include "Storage and Transport; Petroleum and Petroleum Product Storage" as the beginning of the description).

- 2501011011 Residential Portable Fuel Containers: Permeation
- 2501011012 Residential Portable Fuel Containers: Evaporation
- 2501011013 Residential Portable Fuel Containers: Spillage During Transport
- 2501011014 Residential Portable Fuel Containers: Refilling at the Pump: Vapor Displacement
- 2501011015 Residential Portable Fuel Containers: Refilling at the Pump: Spillage
- 2501012011 Commercial Portable Fuel Containers: Permeation
- 2501012012 Commercial Portable Fuel Containers: Evaporation
- 2501012013 Commercial Portable Fuel Containers: Spillage During Transport
- 2501012014 Commercial Portable Fuel Containers: Refilling at the Pump: Vapor Displacement
- 2501012015 Commercial Portable Fuel Containers: Refilling at the Pump: Spillage

The future-year emissions reflect projected increases in fuel consumption, state programs to reduce PFC emissions, standards promulgated in the MSAT2 rule, and impacts of the EISA on gasoline volatility. OTAQ provided year 2018 and 2025 PFC emissions that include estimated Reid Vapor Pressure (RVP) and oxygenate impacts on VOC emissions, and more importantly, large increases in ethanol emissions from RFS2. These emission estimates also include refueling from the NONROAD model for gas can vapor displacement, changes in tank permeation and diurnal emissions from evaporation. Because the future year PFC inventories contain ethanol in addition to benzene, EPA developed a VOC E-profile that integrated ethanol and benzene; see Section 3.2.1.1 for more details. Emissions for 2011, 2018 and 2025 are provided in Section 5.

Table 4-8. PFC emissions for 2011, 2018 and 2025 [tons]

Pollutant	2011	2018	2025
VOC	198,395	29,119	34,269
Benzene	786	645	752
Ethanol	0	3,719	4,448

4.2.1.4 Cellulosic fuel production inventory (nonpt)

New Future year inventory: "2018_cellulosic_inventory"

Depending on available feedstock, cellulosic plants are likely to produce fuel through either a biochemical process or a thermochemical process. OTAQ developed county-level inventories for biochemical and thermochemical cellulosic fuel production for 2018 to reflect AEO2013er renewable fuel volumes. Emissions factors for each cellulosic biofuel refinery reflect the fuel production technology used rather than the fuel produced. Emission rates in Table 4-9 and Table 4-10 were used to develop cellulosic plant inventories. Criteria pollutant emission rates are in tons per RIN gallon. Emission factors from the cellulosic diesel work in the Tier 3 NPRM were used as the emission factors for the thermochemical plants. Cellulosic ethanol VOC and related HAP emission factors from the Tier 3 NPRM were used as the biochemical VOC and related HAP emission factors.[27] Because the future year cellulosic inventory contains ethanol, a VOC E-profile that integrated ethanol was used, see Sections 3.2.1.1 and 3.2.1.3 for more details.

Plants were treated as area sources spread across the entire area of whatever county they were considered to be located in. Cellulosic biofuel refinery siting was based on utilizing the lowest cost feedstock, accounting for the cost of the feedstock itself as well as feedstock storage and the transportation of the feedstock to the cellulosic biofuel refinery. The total number of cellulosic biofuel refineries was projected using volumes from AEO2013 (early release). The methodology used to determine most likely plant locations is described in Section 1.8.1.3 of the RFS2 RIA (EPA, 2010a). Table 4-11 provides the year 2018 cellulosic plant emissions estimates. Since biofuels were not projected to change significantly between 2018 and 2025 the year 2018 inventory was used for year 2025.

Table 4-9. Criteria Pollutant Emission Factors for Cellulosic Plants (Tons/RIN gallon)

Cellulosic Plant Type	VOC	CO	NO_x	PM_{10}	$PM_{2.5}$	SO_x	NH_3
Thermochemical	5.92E-07	8.7E-06	1.31E-05	1.56E-06	7.81E-07	1.17E-06	1.44E-10
Biochemical	1.82E-06	1.29E-05	1.85E-05	3.08E-06	1.23E-06	6.89E-07	0

[27] It should be noted that in the Tier 3 NPRM we meant to use different cellulosic ethanol non-VOC CAP emission factors depending on which feedstock the plant was using but instead used the same emission factors (based on a forest waste feedstock) for all the plants. This was corrected by using emission factors for the non-VOC CAPS that were based on a stover feedstock for the biochemical plants.

Table 4-10. Toxic Emission Factors for Cellulosic Plants (Tons/RIN gallon)

Plant Type	Acetaldehyde	Acrolein	Benzene	1,3-Butadiene	Formaldehyde	Ethanol
Thermochemical	2.95E-08	1.27E-09	9.61E-10	0	5.07E-09	2.09E-07
Biochemical	3.98E-07	1.11E-08	1.39E-08	0	2.28E-08	6.41E-07

Table 4-11. 2018/2025 cellulosic plant emissions [tons]

Pollutant	**Emissions**
Acrolein	1
Formaldehyde	4
Benzene	1
Acetaldehyde	21
CO	6,088
Ethanol	146
NH_3	0.1
NO_X	9,199
PM_{10}	1,088
$PM_{2.5}$	547
SO_2	819
VOC	414

4.2.1.5 Ethanol working loss inventory (nonpt)

New Future year inventory: "Ethanol_transport_vapor_2018rg_ref_v1"

The year 2018inventory was provided by OTAQ to represent upstream impacts of loading and unloading at ethanol terminals. Since biofuels were not projected to change significantly between 2018 and 2025, the 2018 inventory was used for year 2025. Emissions are entirely evaporative and were computed by county for truck, rail and waterway loading and unloading and intermodal transfers (e.g., highway to rail). Inventory totals are summarized in Table 4-12. The leading descriptions are "Industrial Processes; Food and Agriculture; Ethanol Production" for each SCC.

Table 4-12. 2018/2025 VOC working losses (Emissions) due to ethanol transport [tons]

SCC	**Description**	**Emissions**
30205031	Denatured Ethanol Storage Working Loss	23,420
30205052	Ethanol Loadout to Truck	14,425
30205053	Ethanol Loadout to Railcar	10,484

4.2.1.6 Vapor losses from transport and distribution of gasoline and gasoline/ethanol blends (nonpt, ptnonipm)

Packet: "PROJECTION_2011_2018_distribution_upstream_OTAQ_Tier3FRM" and "PROJECTION_2011v6_2025_distribution_upstream.csv"

OTAQ developed county-level inventory adjustments for gasoline and gasoline/ethanol blend transport and distribution for 2018 and 2025, to account for losses for the processes such as truck, rail and waterways loading/unloading and intermodal transfers such as highway-to-rail, highways-to-waterways, and all other possible combinations of transfers. Adjustments for 2018 account for impacts of the EISA mandate, and the 2025 adjustments account for additional impacts of greenhouse gas emission standards for motor vehicles on transported volumes. These emissions are entirely evaporative and therefore limited to VOC.

A 2018 inventory which included impacts of the EISA mandate was developed by adjusting the 2007 platform inventory. These adjustments were made using an updated version of EPA's spreadsheet model for upstream emission impacts, developed for the RFS2 rule[28]. The methodology used to make these adjustments is described in a 2014 memorandum included in the docket for the EPA Tier 3 rule.[29] The resulting adjustments are provided in Table 4-13. Separate adjustments were applied to refinery to bulk terminal (RBT), bulk plant storage (BPS), and bulk terminal to gasoline dispensing pump (BTP) components. Emissions for the BTP component are greater than the RBT and BPS components. See Appendix B for the complete cross-walk between SCC, and state-SCC for BTP components, and each type of petroleum transport and storage. An additional adjustment was applied for 2025 at a national scale to account for impacts of gasoline volume reductions of the 2017-2025 light-duty greenhouse gas rule.

Table 4-13. Adjustment factors applied to storage and transport emissions

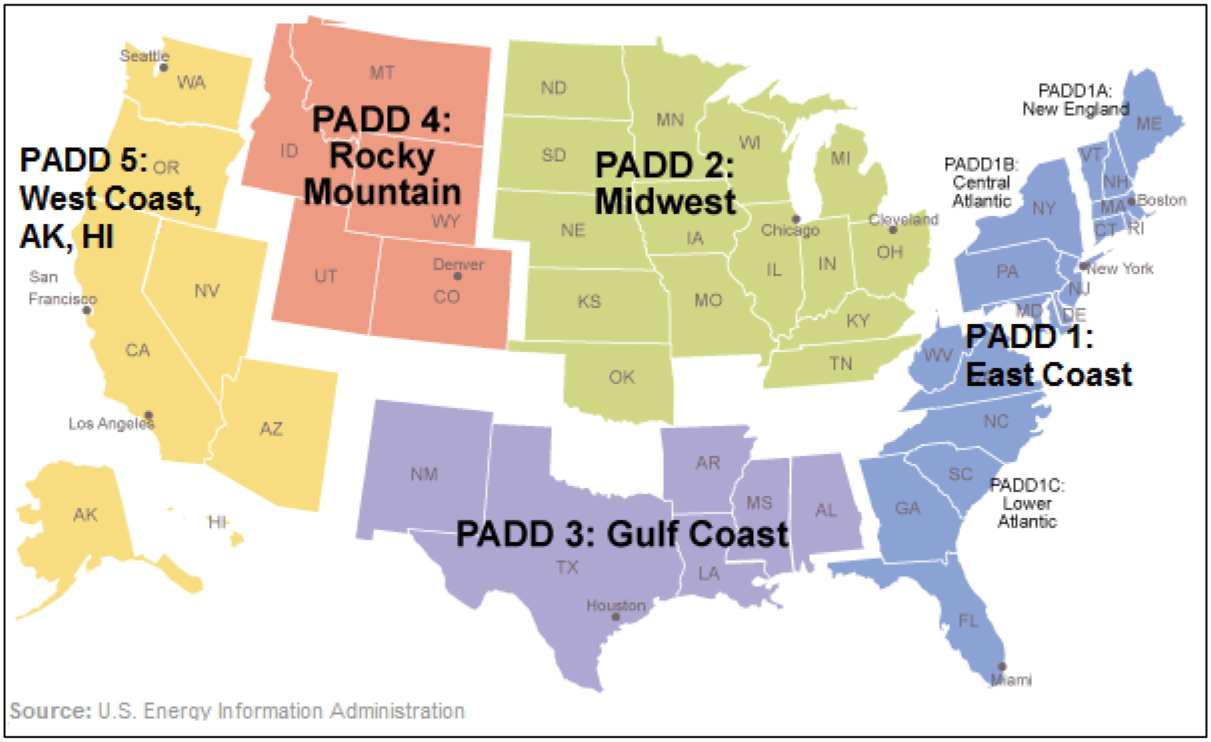
Process	**PADD**	**Pollutant**	**2018 Adjustment Factor**	**2025 Adjustment Factor[30]**
BTP	1	VOC	0.9515	0.87843
		benzene	0.9905	0.87843
	2	VOC	0.9619	0.87843
		benzene	0.9882	0.87843
	3	VOC	0.9778	0.87843
		benzene	0.9879	0.87843
	4	VOC	0.8983	0.87843
		benzene	0.9885	0.87843
	5	VOC	0.9430	0.87843
		benzene	0.9901	0.87843
RBT/BPS	All	VOC	0.9553	0.87843
		benzene	0.9893	0.87843

[28] U.S. EPA. 2013. Spreadsheet "upstream_emissions_rev T3.xls.

[29] U. S. EPA. Development of Air Quality Reference Case Upstream and Portable Fuel Container Inventories for the Tier 3 Final Rule. Memorandum from Rich Cook, Margaret Zawacki and Zoltan Jung to the Docket. February 25, 2014. Docket EPA-HQ-OAR-2011-0135.

[30] The 2025 adjustment factors are in addition to the 2018 adjustment factors, i.e. to go from 2011 to 2025, one would need to apply both adjustments.

Figure 4-1. Map of Petroleum Administration for Defense Districts (PADD)



Ethanol emissions were estimated in SMOKE by applying the ethanol to VOC ratios from headspace profiles to VOC emissions for E10 and E15, and an evaporative emissions profile for E85. These ratios are 0.065 for E10, 0.272 for E15, and 0.61 for E85. The E10 and E15 profiles were obtained from an ORD analysis of fuel samples from EPAct exhaust test program[31] and have been submitted for incorporation into the EPA's SPECIATE database. The E85 profile was obtained from data collected as part of the CRC E-80 test program (Environ, 2008) and has also been submitted for incorporation into EPA's SPECIATE database. For more details on the change in speciation profiles between 2011 and 2018, see Section 3.2.1.4.

4.2.1.7 Pipeline and Refinery adjustments (ptnonipm)

Packets: "PROJECTION_pipelines_refineries_2018ed" and "PROJECTION_2011v6_2025_pipelines_refineries.csv"

Pipeline usage and refinery emissions were adjusted to account for impacts of the 2017-2025 light duty vehicle greenhouse gas emission standards, as well as renewable fuel volume projections. These adjustments were developed by EPA OTAQ and impact processes such as process heaters, catalytic cracking units, blowdown systems, wastewater treatment, condensers, cooling towers, flares and fugitive emissions. A portion of these impacts are discussed in this section, with additional impacts due to transport discussed in the onroad and c1c2rail sectors (see Sections 4.3.1 and 4.4.1, respectively).

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[31] U.S. EPA. 2011. Hydrocarbon Composition of Gasoline Vapor Emissions from Enclosed Fuel Tanks. Office of Research and Development and Office of Transportation and Air Quality. Report No. EPA-420-R-11-018. EPA Docket EPA-HQ-OAR-2011-0135.

Calculation of the emission inventory impacts of decreased gasoline and diesel production, due to renewable fuel volume projections, on nationwide refinery emissions was done in EPA's spreadsheet model for upstream emission impacts (EPA, 2009b). Emission inventory changes reflecting these impacts were used to develop adjustment factors that were applied to inventories for each petroleum refinery in the U.S. (Table 4-14). These impacts of decreased production were assumed to be spread evenly across all U. S. refineries. Toxic emissions were estimated in SMOKE by applying speciation to VOC emissions. It should be noted that the adjustment factors in Table 4-14 are estimated relative to that portion of refinery emissions associated with gasoline and diesel fuel production. Production of jet fuel, still gas and other products also produce emissions. If these emissions were included, the adjustment factors would not be as large.

Table 4-14. 2018 and 2025 adjustment factors applied to petroleum pipelines and refinery emissions associated with gasoline and diesel fuel production.

	2018 Factors			**2025 Factors**		
Pollutant	**Pipelines**	**Refineries**	**Both**	**Pipelines**	**Refineries**	**Both**
CO	0.9964	0.9776	0.9741	0.9875	0.8603	0.8495
NO_X	0.9819	0.9867	0.9688	0.9286	0.8683	0.8063
PM_{10}	0.9967	0.9839	0.9806	0.9899	0.8659	0.8571
$PM_{2.5}$	0.9975	0.9789	0.9765	0.9930	0.8615	0.8555
SO_2	0.9981	0.9781	0.9763	0.9910	0.8608	0.8530
NH_3	n/a	0.9517	0.9517	n/a	0.8376	0.8376
VOC	0.999	0.9719	0.9710	0.9963	0.8554	0.8522

4.2.2 Upstream agricultural and Livestock adjustments (afdust, ag, nonpt, ptnonipm)

Packet: "PROJECTION_2011_2018_ag_including_upstream_OTAQ_25nov2013_v1" and "PROJECTION_2011_2025_ag_including_upstream_OTAQ_25nov2013.txt"

Inventory adjustments were previously developed for 2017 and 2030 as part of final RFS2 rule modeling[32]. Although 2018 and 2025 were modeled for this rule rather than 2017 and 2030, EPA continued to use the 2017 and 2030 adjustments. Impacts on farm equipment emissions were not accounted for, however. Emission rates from the GREET model (fertilizer and pesticide production)[33] or based on the 2002 National Emissions Inventory (fertilizer and pesticide application, agricultural dust, livestock waste) were combined with estimates of agricultural impacts from FASOM (Forest and Agricultural Section Optimization Model). Since FASOM modeling used a reference case of 13.2 billion gallons of ethanol, impacts used in the modeling for this rule are underestimates.

Adjustment factors are provided in Table 4-15. These adjustments were applied equally to all counties having any of the affected sources. This is an area of uncertainty in the inventories, since there would likely be variation from one county to another depending on how much of the predicted agricultural changes occurred in which counties. By using percent change adjustments rather than attempting to calculate absolute ton changes in each county, EPA has attempted to minimize the inventory distortions that could occur if the calculated change for a given county was out of proportion to the reference case emissions for that county. For instance, a different approach could estimate reductions that were larger than the reference

[32] U. S. Environmental Protection Agency. 2010. Renewable Fuel Standard Program (RFS2) Regulatory Impact Analysis. Assessment and Standards Division, Office of Transportation and Air Quality, Ann Arbor, MI. Report No. EPA-420-R-10-006, February, 2010. Available at <http://www.epa.gov/otaq/fuels/renewablefuels/regulations.htm>.

[33] GREET, version 1.8c. Available at < http://greet.es.anl.gov/>.

case emissions, since there was no linkage between the 2011NEIv1 inventories and the FASOM modeling. The specific sources (SCCs) and affected pollutants that these adjustments were applied to are listed in a docket reference[34].

Table 4-15. Adjustments to modeling platform agricultural emissions for 2018 and 2025

Source Description	**2018 Adjustment**	**2025 Adjustment**
Nitrogen fertilizer application	1.0242	1.0573
Fertilizer production, mixing/blending	1.0603	1.0603
Pesticide production	0.9544	0.9954
Agricultural tilling/loading dust	1.0079	1.0265
Agricultural burning	1.000	1.000
Livestock dust	0.9868	0.9983
Livestock waste	0.9901	0.9983

For the animal waste sources, EPA also estimated animal population growth in ammonia (NH_3) and dust (PM_{10} and $PM_{2.5}$) emissions from livestock in the ag, afdust, and ptnonipm sectors. Therefore, a composite set of projection factors is needed for animal operations that also reflect the minor 0.99% decrease resulting from the EISA mandate. These composite projection factors by animal category are provided in Table 4-16. As discussed below, dairy cows and turkeys are assumed to have no growth in animal population, and therefore the projection factor for these animals is the same as the upstream agriculture-related projection factor.

Table 4-16. Composite NH_3 projection factors to years 2018 and 2025 for animal operations

Animal Category	**2018 Factor**	**2025 Factor**
Dairy Cow	0.9901	0.9743
Beef	0.9851	0.9727
Pork	1.0582	1.1164
Broilers	1.0904	1.1283
Turkeys	0.9290	0.9190
Layers	1.0629	1.0926
Poultry Average	1.0557	1.0826
Overall Average	1.0310	1.0408

Except for dairy cows and turkey production, the animal projection factors are derived from national-level animal population projections from the U.S. Department of Agriculture (USDA) and the Food and Agriculture Policy and Research Institute (FAPRI). This methodology was initiated in 2005 for the 2005 NEI, but was updated on July 24, 2012 in support of the 2007v5 platform (EPA, 2012) and 2011 to 2018 and 2025 animal population projections were computed for these 2011v6 projections those future years. For dairy cows, EPA assumed that there would be no growth in emissions based on little change in U.S. dairy cow populations from year 2011 through 2025 according to linear regression analyses of the FAPRI projections. This assumption was based on an analysis of historical trends in the number of such animals compared to production rates. Although productions rates have increased, the number of animals has declined. Based on this analysis, EPA concluded that production forecasts do not provide representative estimates of the future number of cows and turkeys; therefore, these forecasts were not used for estimating future-year emissions from these animals. In particular, the dairy cow population is projected to decrease in the future as it has for the past few decades; however, milk production will be increasing over the same

[34] U. S. EPA. 2011. Spreadsheet "agricultural sector adjustments.xls." Docket EPA–HQ–OAR–2011–0135.

period. Note that the ammonia emissions from dairies are not directly related to animal population but also nitrogen excretion. With the cow numbers going down and the production going up the excretion value will change, but no change was assumed because a quantitative estimate was not available. Appendix D provides the animal population data and regression curves used to derive the growth factors.

4.2.3 Residential wood combustion growth (nonpt)

Packet: "PROJECTION_2011v6_2018bau_RWC_25nov2013.txt" and "PROJECTION_2011v6_2025bau_RWC_25nov2013.txt"

EPA used a "business as usual" (BAU) approach to Residential Wood Combustion (RWC) projections that does not account for national New Source Performance Standards (NSPS) for wood stoves, since they are currently in the comment-seeking process from proposal (EPA, 2013a and available at: http://www2.epa.gov/residential-wood-heaters/proposed-new-source-performance-standards-residential-wood-heaters). EPA projected residential wood combustion (RWC) emissions to years 2018 and 2025 based on expected increases and decreases in various residential wood burning appliances. As newer, cleaner woodstoves replace ***some*** older, higher-polluting wood stoves, there will be an overall reduction of the emissions from older "dirty" stoves but an overall increase in total RWC due to population and sales trends in all other types of wood burning devices such as indoor furnaces and outdoor hydronic heaters (OHH). It is important to note that our RWC projection methodology does not explicitly account for state or local residential wood control programs. There are a number state and local rules in place, specifically in California, Oregon and Washington. However, at this time, EPA does not have enough detailed information to calculate state specific or local area growth rates. Therefore, with the exception of California, Oregon and Washington, EPA is using national level growth rates for each RWC SCC category. After discussions with California air districts, regional office contacts and EPA experts, EPA decided to simply hold RWC emissions flat (unchanged) for all SCCs in California, Oregon and Washington.

The development of projected growth in RWC emissions to years 2018 and 2025 starts with the projected growth in RWC appliances derived from year 2012 appliance shipments reported in the Regulatory Impact Analysis (RIA) for Proposed Residential Wood Heaters NSPS Revision Final Report (EPA, 2013b), also available at: http://www2.epa.gov/sites/production/files/2013-12/documents/ria-20140103.pdf. The 2012 shipments are based on 2008 shipment data and revenue forecasts from a Frost & Sullivan Market Report (Frost & Sullivan, 2010). Next, to be consistent with the RIA (EPA, 2013b), growth rates for new appliances for certified wood stoves, pellet stoves, indoor furnaces and OHH were based on forecasted revenue (real GDP) growth rate of 2.0% per year from 2013 through 2025 as predicted by the U.S. Bureau of Economic Analysis (BEA, 2012). While this approach is not perfectly correlated, in the absence of specific shipment projections, the RIA assumes the overall trend in the projection is reasonable. The growth rates for appliances not listed in the RIA (fireplaces, outdoor wood burning devices (not elsewhere classified) and residential fire logs) are estimated based on the average growth in the number of houses between 2002 and 2012, about 1% (U.S. Census, 2012).

In addition to new appliance sales and forecasts extrapolating beyond 2012, assumptions on the replacement of older, existing appliances are needed. Based on long lifetimes, no replacement of fireplaces, outdoor wood burning devices (not elsewhere classified) or residential fire logs is assumed. It is assumed that 95% of new woodstoves will replace older non-EPA certified freestanding stoves (pre-1988 NSPS) and 5% will replace existing EPA-certified catalytic and non-catalytic stoves that currently meet the 1988 NSPS (Houck, 2011).

EPA RWC NSPS experts assume that 10% of new pellet stoves and OHH replace older units and that because of their short lifespan, that 10% of indoor furnaces are replaced each year. These are the same assumptions used in the 2007 emissions modeling platform (EPA, 2012d). The resulting growth factors for these appliance types varies by appliance type and also by pollutant because the emission rates, from EPA RWC tool (EPA, 2013rwc), vary by appliance type and pollutant. For our non-NSPS projection approach, the projection factors are the same for all pollutants except for EPA certified woodstoves of all types. For EPA certified units, the projection factors for PM are lower than those for all other pollutants. The projection factors also vary because the total number of existing units in 2011 varies greatly between appliance types.

California did not report detailed SCCs in the 2011NEIv1, simply reporting emissions from general fireplaces (SCC=2104008100) and general woodstoves (SCC=2104008300). California, Oregon and Washington also have state-level RWC control programs, including local burn bans in place. Without appliance counts in California at specific appliance types (e.g., certified versus non-certified), and an inability to incorporate significant local RWC control programs/burn bans for a future year inventory, EPA decided to leave all RWC emissions unchanged in the future for all three states. The RWC projections factors for states other than California, Oregon and Washington are provided in Table 4-17Table 4-18. EPA-certified woodstoves (inserts and freestanding) utilize different projection factors for direct PM than all other pollutants.

Table 4-17. Non-West Coast RWC projection factors

Pollutant	SCC	Description	2018 Factor	2025 Factor
All	2104008100	Fireplace: general	1.072	1.149
All	2104008210	Woodstove: fireplace inserts; non-EPA certified	0.897	0.78
PM	2104008220	Woodstove: fireplace inserts; EPA certified; non-catalytic	1.076	1.162
All other	2104008220	Woodstove: fireplace inserts; EPA certified; non-catalytic	1.181	1.389
PM	2104008230	Woodstove: fireplace inserts; EPA certified; catalytic	1.081	1.174
All other	2104008230	Woodstove: fireplace inserts; EPA certified; catalytic	1.181	1.389
All	2104008300	Woodstove: freestanding, general	1.171	1.368
All	2104008310	Woodstove: freestanding, non-EPA certified	0.98	0.957
PM	2104008320	Woodstove: freestanding, EPA certified, non-catalytic	1.076	1.162
All other	2104008320	Woodstove: freestanding, EPA certified, non-catalytic	1.181	1.389
PM	2104008330	Woodstove: freestanding, EPA certified, catalytic	1.081	1.174
All other	2104008330	Woodstove: freestanding, EPA certified, catalytic	1.181	1.389
All	2104008400	Woodstove: pellet-fired, general (freestanding or FP insert)	1.645	2.385
All	2104008510	IF: Indoor Furnaces: cordwood-fired, non-EPA certified	1.103	1.315
All	2104008610	OHH: Outdoor Hydronic heaters	1.237	1.509
All	2104008700	Outdoor wood burning device, NEC (e.g., fire-pits, chimneas)	1.072	1.149
All	2104009000	Residential firelog total; all combustor types	1.072	1.149

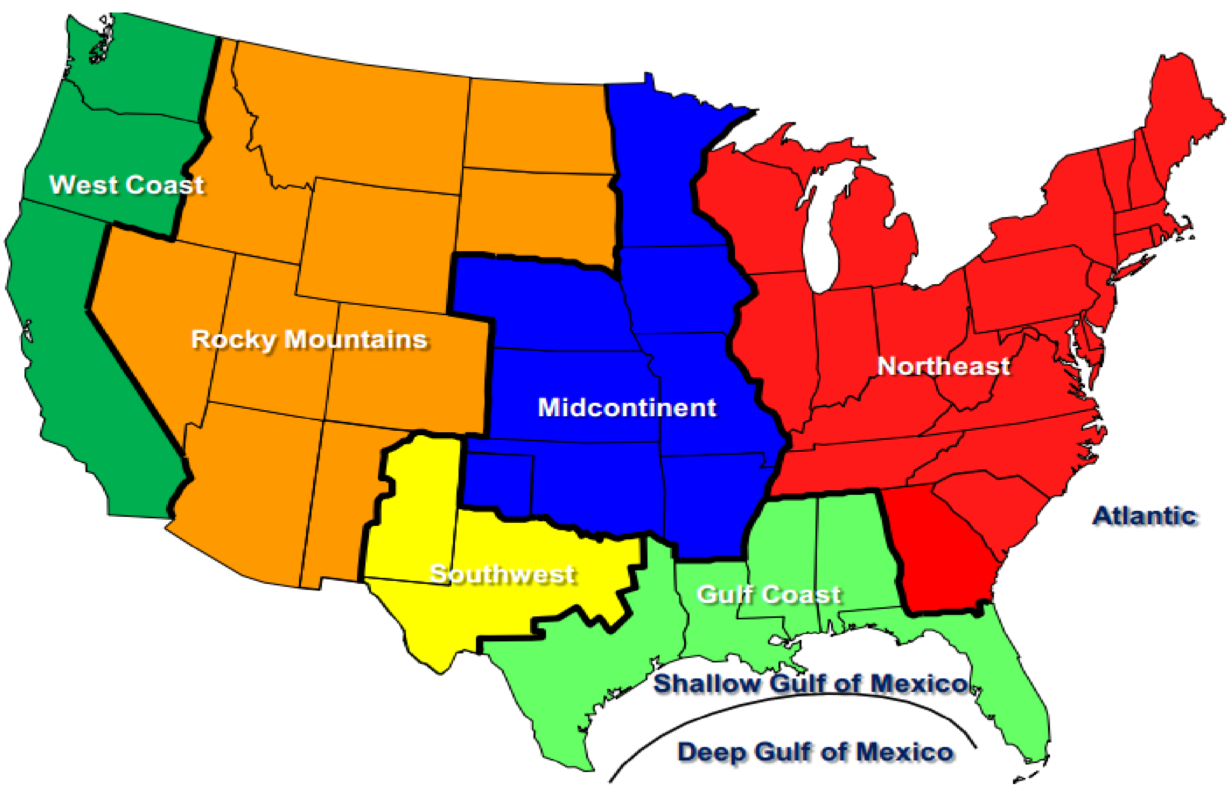
4.2.4 Oil and Gas projections (np_oilgas, pt_oilgas)

Packet: "PROJECTION_2011v6_2018_oilgas_27nov2013.txt" and "PROJECTION_2011v6_2025_oilgas_06mar2014.txt"

The oil and gas point (pt_oilgas) and nonpoint (np_oilgas) sectors are modeled separately from the remaining point (ptnonipm) and nonpoint (nonpt) sector emissions primarily to better track/isolate and summarize the oil and gas projections from 2011 to future years. EPA is aware that these emissions inventories are subject to much scrutiny in the base year (2011) as well as growth and control assumptions in the coming years. Our initial approach at projecting these emissions is a simple regional-level Annual Energy Outlook (AEO) 2013-based methodology with some associated VOC reduction factors for sources that would be subject to New Source Performance Standards (NSPS). The methodology EPA describes here was a result of a coordinated effort between EPA OAQPS and EPA Office of Atmospheric Programs (OAP) Climate Change Division (CCD).

The AEO-2013 regional growth factors are based on 2011 to 2018 and 2025 oil production, gas production and combined oil and gas production trends, available in Supplemental tables for regional detail, Table 131 and Table 132 at: http://www.eia.gov/forecasts/aeo/tables_ref.cfm. These National Energy Modeling System (NEMS) regions are shown in Figure 4-2 and demonstrate one of the many limitations of this projection strategy: projections are not based on oil/gas basin but rather, much larger geographic regions. A county-NEMS region cross-walk was developed to assign counties in New Mexico and Texas to specific NEMS regions.

Figure 4-2. Oil and Gas NEMS Regions



The AEO-2013 provides regional growth factors for oil production and gas production; however, numerous sources (SCCs) in the 2011 platform are ambiguous regarding the type of product being extracted/produced. These sources were assigned to a combined oil and gas category set of factors where oil and natural gas production levels were summed using a barrel-of-oil equivalent of 0.178 barrels of crude oil to 1000 cubic feet of natural gas. The AEO-based projection factors for each products type and NEMS region, provided in Table 4-18, are applied to for all pollutants and SCCs in the point and nonpoint oil and gas sector inventories, with the exception of VOC for select SCCs. The two character region codes (e.g., “NE” for Northeast region) are relevant in the following discussion on VOC projection factors.

Table 4-18. AEO-based Projection Factors

Region	2018			2025		
	Oil	**Gas**	**Oil/Gas**	**Oil**	**Gas**	**Oil/Gas**
Northeast (NE)	1.238	1.596	1.572	1.301	2.059	2.009
Gulf Coast (GC)	1.853	1.246	1.368	1.743	1.486	1.538
Midcontinent (MC)	1.165	0.910	0.955	1.272	0.890	0.958
Southwest (SW)	1.391	1.043	1.173	1.190	0.985	1.062
Rocky Mountains (RM)	1.642	1.098	1.243	1.588	1.097	1.228
West Coast (WC)	0.865	0.993	0.888	0.879	0.828	0.870

For select VOC processes, SCCs were identified that were likely to be affected by NSPS and verified with EPA OAP and OAQPS oil and gas sector experts. NSPS reductions for VOC-only were applied in composite with AEO-based regional growth factors to create a set of "net" growth factors. These NSPS VOC reductions are consistent with EPA OAP-led Climate Action Report, available at: http://www.state.gov/e/oes/rls/rpts/car6/index.htm. The VOC NSPS reductions specifically, are discussed in Section 2 of the "Methodologies for U.S. Greenhouse Gas Emissions Projections" document available at: http://www.state.gov/documents/organization/219472.pdf. These composite projection factors for VOC NSPS sources are provided in Table 4-19.

There were several assumptions in the application of NSPS VOC reductions. NSPS VOC reductions were only applied to increases (if any) of emissions from 2011 to future years as provided by the AEO projection factor. If AEO-based gas or oil production was projected to decrease in future years versus 2011, then NSPS reductions had no impact. One exception, highlighted in Table 4-19, is for natural gas well completions; these "one-shot" activities are generally short-term year to year processes and therefore NSPS reductions are applied to the entire future year projected estimates. Other important assumptions are:

- Emissions change linearly with production-level changes (AEO projections)
- In the absence of local/state rules, existing equipment will continue to be used and there is no replacement of capital that would be affected by the NSPS; the NSPS only affects growth for processes other than natural gas well completions.
- Engine-related regulatory impacts are accounted for separately (see RICE NESHAP in the following section)
- EPA did not attempt to account for or quantify the potential reductions due to the oil and natural gas NESHAP
- Secondary emissions related to NSPS reductions were not accounted for (e.g., NO_X emissions arising from the combustion of VOC emissions)

EPA acknowledges that these assumptions are not ideal, particularly the linear scaling of production changes to emissions for all processes. EPA hopes that future refinement of this methodology, particularly for large processes with highly-reactive pollutants such as glycol dehydrators, improve this aspect of oil and gas projections. Note, reductions from the RICE NESHAP impact some oil and gas sources (see next Section). EPA is also aware that early release AEO 2014 projections (available at: http://www.eia.gov/forecasts/aeo/er/pdf/0383er(2014).pdf) became available in December 2013. Overall, it appears that oil production increases significantly in the draft AEO 2014 compared to the AEO 2013 projections, about 22% higher by 2018 in the draft AEO 2014 projection versus the AEO 2013 projection. There appears to be less significant increase, about 11%, in projections for natural gas in the draft 2014 AEO versus AEO 2013.

Table 4-19. Oil and Gas sector VOC Projection Factors for NSPS sources

SCCs	SCC Level 4	NSPS Source	NSPS Reduction	Resource	Region	2018 AEO Factor	2018 VOC NSPS (Final) Factor	2025 AEO Factor	2025 VOC NSPS (Final) Factor
2310030210; 2310030300; 2310021010	Gas Well Tanks - Flashing & Standing/Working/Breathing, Uncontrolled; Gas Well Water Tank Losses; Storage Tanks: Condensate	Storage Tanks	70.3%	Gas	NE	1.596	1.177	2.059	1.315
					GC	1.246	1.073	1.486	1.144
					MC	0.910	0.910	0.890	0.890
					SW	1.043	1.013	0.985	0.985
					RM	1.098	1.029	1.097	1.0288
					WC	0.993	0.993	0.828	0.828
2310010200; 2310011020	Oil Well Tanks - Flashing & Standing/Working/Breathing; Storage Tanks: Crude Oil			Oil	NE	1.238	1.071	1.301	1.089
					GC	1.853	1.253	1.743	1.221
					MC	1.165	1.049	1.272	1.0378
					SW	1.391	1.116	1.190	1.056
					RM	1.642	1.191	1.588	1.175
					WC	0.865	0.865	0.879	0.879
31000222; 2310121700; 2310021601; 2310021602	Drilling and Well Completion; Gas Well Completion: All Processes; Gas Well Venting - Initial Completions; Gas Well Venting – Recompletions	Gas Well Completions	95.0%	Gas	NE	1.596	0.080	2.059	0.1030
					GC	1.246	0.062	1.486	0.0743
					MC	0.910	0.045	0.890	0.0445
					SW	1.043	0.052	0.985	0.0493
					RM	1.098	0.055	1.097	0.0985
					WC	0.993	0.050	0.828	0.0429
2310021300	Gas Well Pneumatic Devices	Pneumatic controllers	77.0%	Gas	NE	1.596	1.137	2.059	1.244
					GC	1.246	1.056	1.486	1.112
					MC	0.910	0.910	0.890	0.890
					SW	1.043	1.010	0.985	0.985
					RM	1.098	1.023	1.097	1.022
					WC	0.993	0.993	0.828	0.828
31000325; 31000324	Pneumatic Controllers High Bleed >6 scfm; Pneumatic Controllers Low Bleed		100.0%	Gas	NE	1.596	1.000	2.059	1.000
					GC	1.246	1.000	1.486	1.000
					MC	0.910	0.910	0.890	0.890
					SW	1.043	1.000	0.985	0.985
					RM	1.098	1.000	1.097	1.000
					WC	0.993	0.993	0.828	0.828
2310010300	Oil Well Pneumatic Devices		77.0%	Oil	NE	1.238	1.055	1.301	1.069
					GC	1.853	1.196	1.743	1.171
					MC	1.165	1.038	1.272	1.063
					SW	1.391	1.090	1.190	1.044
					RM	1.642	1.148	1.588	1.135
					WC	0.865	0.865	0.879	0.879
31000309	Compressor Seals	Compressor Seals	79.9%	Gas	NE	1.596	1.120	2.059	1.213
					GC	1.246	1.049	1.486	1.098
					MC	0.910	0.910	0.890	0.890
					SW	1.043	1.009	0.985	0.985
					RM	1.098	1.020	1.097	1.019
					WC	0.993	0.993	0.828	0.828

4.2.5 RICE NESHAP (nonpt, ptnonipm, np_oilgas, pt_oilgas)

Packet: CONTROL_RICE_incl_SO2_2007v5_27nov2013.txt

There are three rulemakings for National Emission Standards for Hazardous Air Pollutants (NESHAP) for Reciprocating Internal Combustion Engines (RICE). These rules reduce HAPs from existing and new RICE sources. In order to meet the standards, existing sources with certain types of engines will need to install controls. In addition to reducing HAPs, these controls have co-benefits that also reduce CAPs, specifically, CO, NO_X, VOC, PM, and SO_2. In 2014 and beyond, compliance dates have passed for all three rules; thus all three rules are included in the emissions projection. These RICE reductions also reflect the recent (proposed January, 2012) Reconsideration Amendments, which results in significantly less stringent NO_X controls (fewer reductions) than the 2010 final rules.

The rules can be found at http://www.epa.gov/ttn/atw/icengines/ and are listed below:

- National Emission Standards for Hazardous Air Pollutants for Reciprocating Internal Combustion Engines; Final Rule (69 FR 33473) published 06/15/04
- National Emission Standards for Hazardous Air Pollutants for Reciprocating Internal Combustion Engines; Final Rule (FR 9648) published 03/03/10
- National Emission Standards for Hazardous Air Pollutants for Reciprocating Internal Combustion Engines; Final Rule (75 FR 51570) published 08/20/2010

The difference among these three rules is that they focus on different types of engines, different facility types (major for HAPs, versus area for HAPs) and different engine sizes based on horsepower. In addition, they have different compliance dates, though all are after 2011 and fully implemented prior to 2018. EPA projects CAPs from the 2011NEIv1 RICE sources, based on the requirements of the rule for existing sources only because the inventory includes only existing sources and the current projection approach does not estimate emissions from new sources.

The Regulatory Impact Analysis (RIA) for the Reconsideration of the Existing Stationary Compression Ignition (CI) Engines NESHAP: Final Report (EPA, 2013ci) is available at: http://www.epa.gov/ttn/ecas/regdata/RIAs/RICE_NESHAPreconsideration_Compression_Ignition_Engines_RIA_final2013_EPA.pdf. The Regulatory Impact Analysis (RIA) for Reconsideration of the Existing Stationary Spark Ignition (SI) RICE NESHAP: Final Report (EPA, 2013si) is available at: http://www.epa.gov/ttn/ecas/regdata/RIAs/NESHAP_RICE_Spark_Ignition_RIA_finalreconsideration2013_EPA.pdf. Together, EPA calls these the RICE NESHAP amendment RIA's for SI and CI engines. From these RICE NESHAP RIA documents, EPA obtained cumulative RICE reductions for all SCCs represented by CI and SI engines. These aggregate reductions and percent reductions from baseline emissions (not the 2011NEIv1) are provided in Table 4-20.

Table 4-20. Summary RICE NESHAP SI and CI percent reductions prior to 2011NEIv1 analysis

	CO	**NO_X**	**PM**	**SO_2**	**VOC**
RIA Baseline: SI engines	637,756	932,377			127,170
RIA Reductions: SI engines	22,211	9,648			9,147
RIA Baseline: CI engines	81,145		19,369	11,053	79,965
RIA Reductions: CI engines	14,238		2,818	5,100	27,142
RIA Cumulative Reductions	36,449	9,638	2,818	5,100	36,289

	CO	NO_X	PM	SO_2	VOC
SI % reduction	3.5%	1.0%	n/a	n/a	7.2%
CI % reduction	17.5%	n/a	14.5%	46.1%	33.9%

These RIA percent reductions were used as an upper-bound for reducing emissions from RICE SCCs in the 2011NEIv1 point and nonpoint modeling sectors (ptnonipm, nonpt, pt_oilgas and np_oilgas). To begin with, the RIA inventories are based on the 2005 NEI, so EPA wanted to ensure that our 2011 reductions did not exceed those in the RICE RIA documents. For the 2011 platform EPA worked with EPA RICE NESHAP experts and developed a fairly simple approach to estimate RICE NESHAP reductions. Most SCCs in the inventory are not broken down by horsepower size range, mode of operation (e.g., emergency mode), nor major versus area source type. Therefore, EPA summed NEI emissions nationally by-SCC for RICE sources and also for sources that were at least partially IC engines (e.g., "Boiler and IC engines"). Then, EPA applied the RIA percent reductions to the 2011NEIv1 for SCCs where national totals exceeded 100 tons; EPA chose 100 tons as a threshold arbitrarily, assuming there would be little to no application of RICE NESHAP controls on smaller sources. Next, EPA aggregated these national reductions by engine type (CI vs. SI) and pollutant and compared these to the RIA reductions. As expected, for most pollutants and engine types, our cumulative reductions were significantly less than those in the RIA. The only exception was for SO2 CI engines, where EPA opted to scale the RIA percent reduction from 46.1% to 10.2% for four broad nonpoint SCCs that were not restricted to only RICE engines. These four SCCs were the "Boilers and IC Engines" or "All processes" that would presumably contain some fraction of non-RICE component. Reducing the SO_2 percent reduction for these four SCCs resulted in slightly less than 5,100 tons of SO_2 reductions overall from only RICE NESHAP controls. However, more specific CoST projection packets would later override these RICE NESHAP reductions. Recall the CoST hierarchy discussed earlier; these RICE NESHAP reductions are national by pollutant and SCC and thus easily overridden by more-specific information such as state-level fuel sulfur rules (discussed in the next section). Impacts of the RICE NESHAP controls on nonpt, ptnonipm, pt_oilgas and np_oilgas sector emissions are provided in Table 4-21.

Table 4-21. National by-sector reductions from RICE Reconsideration Controls

Pollutant	Nonpoint Oil & Gas (np_oilgas)	Point Oil & Gas (pt_oilgas)	Nonpoint (nonpt)	Point (ptnonipm)	Total
CO	1,865	95	8,838	7,167	17,964
NO_X	1,101	94	1,976	2,033	5,205
PM_{10}	0	0	1,201	300	1,501
$PM_{2.5}$	0	0	1,120	282	1,402
SO_2	1,699	0	1,571	1,049	4,319
VOC	6,249	52	1,304	4,074	11,679

4.2.6 Fuel sulfur rules (nonpt, ptnonipm)

Packet: CONTROL_SULF_2011v6_2018_27nov2013.txt

Fuel sulfur rules that were signed by November, 2013 are limited to Connecticut, Maine, Massachusetts, New Jersey, New York, Pennsylvania and Vermont. The fuel limits for these states are incremental starting after year 2012, but are fully implemented before June 30, 2018 in all of these states. Other states in the Northeast and Mid-Atlantic had pending sulfur rules but were not finalized prior to November, 2013 -the completion date of the 2011 platform projections. Background on most of these enforceable and pending fuel sulfur rules can be found here: http://www.ilta.org/LegislativeandRegulatory/MVNRLM/NEUSASulfur%20Rules_09.2010.pdf. A more recent update to the status of fuel sulfur rules is provided here: http://www.eia.gov/todayinenergy/detail.cfm?id=5890#.

Connecticut

A public hearing on proposed regulations on fuel sulfur limits for heating oil via Connecticut State Agencies section 221-174-19b was held on October 9, 2013 (see http://www.ct.gov/deep/cwp/view.asp?A=2586&Q=530284). Effective July 1, 2018 maximum fuel sulfur content limits for distillate, residual and kerosene fuels go into effect. For distillate fuel oil or distillate fuel oil blended with biodiesel, these new limits must not exceed 15 ppm, a 99.5% reduction from 3000 ppm in the baseline and down from 500 ppm effective July 1, 2014. Residual oil or residual fuel oil blended with biodiesel fuel must not exceed 3000 ppm, a 70% reduction from today's 1% fuel content assumption for smaller stationary sources. For kerosene, a 15 ppm limit replaces the existing 500 ppm limit, a 97% reduction.

Maine

The Maine Law Legislative Document (LD) 1662 sets a fuel sulfur rule effective January 1, 2014 that reduces sulfur to 15 ppm for distillate fuel, resulting in a 99.5% reduction from 3,000 ppm assumed in year 2008. Maine Law LD 1662 also states that #5 and #6 fuel oils must not exceed 0.5% by weight (500 ppm), which is a 75% reduction from an assumed 2% baseline sulfur content in 2008. These Maine sulfur content reductions are discussed here: http://www.mainelegislature.org/legis/bills/bills_124th/billpdfs/SP062701.pdf.

Massachusetts

The Massachusetts Department of Environmental Protection issued a commitment in their State Implementation Plan (SIP) to adopt Phase 2 ultra-low sulfur diesel (ULSD) limits by year 2016. Similar to Maine, this will reduce the sulfur content in distillate fuel to 15 ppm, a 99.5% reduction from the 3,000 ppm baseline. Additional details on the phase-in of ULSD can be found here: http://www.mass.gov/dep/service/online/boilwbk.pdf

New Jersey

The New Jersey Department of Environmental Protection adopted sulfur fuel content rules for kerosene and home heating distillate oil. For distillate oil, the ULSD limit of 15 ppm yields a 99.5% reduction from the 3,000 ppm baseline. For kerosene, the same 15 ppm limit is adopted, resulting in a 97% reduction from an assumed 2,000 ppm baseline. More details on these fuel sulfur limits in New Jersey can be found here: http://njtoday.net/2010/09/01/nj-adopts-rule-limiting-sulfur-content-in-fuel-oil/

New York

New York also signed a law requiring ULSD to replace distillate heating oil #2, which results in a fuel sulfur content limit of 15 ppm, a 99.5% reduction from the 3,000 ppm baseline. The ULSD law (A.8642-A/S.1145-C) can be found here: http://switchboard.nrdc.org/blogs/rkassel/governor_paterson_signs_new_la.html and here: http://green.blogs.nytimes.com/2010/07/20/new-york-mandates-cleaner-heating-oil/. New York City also includes limits by year 2015 on #4 and #6 residual oils, where fuel sulfur content must not exceed 0.5% by weight (500 ppm), a 75% reduction from an assumed 2% baseline sulfur content in 2008. By 2030, these sources must burn ULSD (15 ppm). The NYC updated Air Code, updated from the NY DEP is discussed here: http://www.nyc.gov/html/dep/html/news/dep_stories_p3-109.shtml.

Pennsylvania
Legislation has been proposed in Pennsylvania that would reduce allowable sulfur levels to 15 ppm for distillate oil, a 99.5% reduction from the 3,000 ppm baseline. While EPA typically do not include proposed rulemakings in our base projection scenarios without direction from state agencies, the existence of similar, finalized standards in neighboring Northeast census region states such as New Jersey and New York suggest this will become finalized prior to 2018. EPA can revise this, and potential application to other fuels, based on state comment or regulatory changes.

Vermont
Vermont ULSD fuel and date requirements for home heating oil are similar to those adopted in Massachusetts: a 99.5% reduction to 15 ppm from the 3,000 ppm baseline.

A summary of the sulfur rules by state, with emissions reductions is provided in Table 4-22.

Table 4-22. Summary of fuel sulfur rules by state

State/ Metro	Fuel	% reduction	2011 Emissions	2018/2025 Emissions	2018/2025 Reductions
CT	Distillate	99.5	12,535	347	12,188
CT	Kerosene	97			
CT	Residual	70			
ME	Distillate	99.5	7,041	706	6,335
ME	Residual	75			
MA	Distillate	99.5	19,540	98	19,443
NJ	Distillate	99.5	6,146	31	6,115
NJ	Kerosene	96.25			
NY	Distillate	99.5	32,984	1,027	31,957
NYC	Residual	75			
PA	Distillate	99.5	14,634	73	14,561
VT	Distillate	99.5	997	5	992

4.2.7 Industrial Boiler MACT reconsideration (ptnonipm)
Packet: CONTROL_BlrMACT_ptnonipm_20XX_2011v6

The Industrial/Commercial/Institutional Boilers and Process Heaters MACT Rule, hereafter simply referred to as the "Boiler MACT" was promulgated on January 31, 2013 based on reconsideration. Background information on the Boiler MACT can be found at: http://www.epa.gov/ttn/atw/boiler/boilerpg.html. The Boiler MACT promulgates national emission standards for the control of HAPs (NESHAP) for new and existing industrial, commercial, and institutional (ICI) boilers and process heaters at major sources of HAPs. The expected cobenefit for CAPs at these facilities is significant and greatest for SO_2 with lesser impacts for direct PM, CO and VOC.

Boiler MACT reductions were computed from a non-NEI database of ICI boilers. As seen in the Boiler MACT Reconsideration RIA (http://www.epa.gov/ttn/atw/boiler/boilersriaproposalrecon111201.pdf), this Boiler MACT Information Collection Request (ICR) dataset computed over 558,000 tons of SO_2 reductions by year 2015. However, the Boiler MACT ICR database and reductions are based on the assumption that if a unit *could* burn oil, it *did* burn oil, and often to capacity. With high oil prices and many of these units also able to burn cheaper natural gas, the 2011NEIv1 inventory has a lot more gas combustion and a lot less oil combustion than the boiler MACT database. For this reason, EPA decided to target units that potentially could be subject to the Boiler MACT and compute preliminary reductions for several CAPs prior to building a control packet.

Step 1: Extract facilities/sources potentially subject to Boiler MACT

EPA did not attempt to map each ICR unit to the NEI units, instead choosing to use a more general approach to extract NEI sources that would be potentially subject to, and hence have emissions reduced by the Boiler MACT. The NEI includes a field that indicates whether a facility is a major source of HAPs and/or CAPs. This field in our FF10 point inventory modeling file is called “FACIL_CATEGORY_CODE” and the possible values for that field are shown in Table 4-23. Because the Boiler MACT rule applies to only major sources of HAPs, EPA restricted the universe of facilities potentially subject to the Boiler MACT to those classified as HAP major or unknown (UNK). The third column indicates whether the facility was a candidate for extraction as being potentially subject to the Boiler MACT.

Table 4-23. Facility types potentially subject to Boiler MACT reductions

Code	Facility Category	Subject to Boiler MACT?	Description
CAP	CAP Major	N	Facility is Major based upon 40 CFR 70 Major Source definition paragraph 2 (100 tpy any CAP. Also meets paragraph 3 definition, but NOT paragraph 1 definition).
HAP	HAP Major	Y	Facility is Major based upon only 40 CFR 70 Major Source definition paragraph 1 (10/25 tpy HAPs).
HAPCAP	HAP and CAP Major	Y	Facility meets both paragraph 1 and 2 of 40 CFR 70 Major Source definitions (10/25 tpy HAPs and 100 tpy any CAP).
HAPOZN	HAP and O3 n/a Major	Y	Facility meets both paragraph 1 and 3 of 40 CFR 70 Major Source definitions (10/25 tpy HAPs and Ozone n/a area lesser tons for NO_X or VOC).
NON	Non-Major	N	Facility's Potential To Emit is below all 40 CFR 70 Major Source threshold definitions without a FESOP.
OZN	O3 n/a Major	N	Facility is Major based upon only 40 CFR 70 Major Source definition paragraph 3 (Ozone n/a area lesser tons for NO_X or VOC).
SYN	Synthetic non-Major	N	Facility has a FESOP which limits its Potential To Emit below all three 40 CFR 70 Major Source definitions.
UNK	Unknown	N	Facility category per 40 CFR 70 Major Source definitions is unknown.

From these facilities EPA extracted records (process level / release point level emissions) from our modeling file with industrial, commercial, institutional boiler or process heater SCCs. A complete list of these SCCs is provided in Appendix E. The resultant data are the NEI sources potentially subject to the Boiler MACT.

Step 2: Match fuel types and control reductions to the NEI SCCs

After obtaining the subset of 2011NEIv1 sources potentially subject to the Boiler MACT, EPA assigned each inventory SCC to a fuel type. The reductions are based on the ICR fuel types and associated controls from an April 2010 “Baseline Memo.pdf” memorandum available on the Regulations.gov website (http://www.regulations.gov/#!documentDetail;D=EPA-HQ-OAR-2002-0058-0802) under docket # EPA-HQ-OAR-2002-0058-0802. These ICR fuel types and associated default controls were mapped to SCCs in our inventory using the cross-walk provided in Table 4-24. The previously-mentioned Appendix E also maps the complete list of inventory SCCs to these ICR fuel categories.

Table 4-24. Default Boiler MACT fuel percent % reductions by ICR fuel type

ICR Fuel Category	SCC Fuel Category(s)	CO	$PM_{2.5}$	SO_2	VOC
Coal	coal, petroleum coke, waste coal	98.9	95.8	95	98.9
gas 1 (other)	gasified coal, hydrogen, liquefied petroleum gas (LPG), propane/butane, refinery gas	1	1	1	1
gas 2	digester gas, gas, landfill gas, process gas	99.97	0	95	99.97
Bagasse	Bagasse	95.3	90	95	95.3
dry biomass	Wood	95.8	99.1	95	95.8
gas 1 (natural gas)	natural gas, unknown	1	1	1	1
heavy liquid	coal-based Synfuel, crude oil, liquid waste, methanol, residual oil, waste oil	99.9	98.3	95	99.9
light liquid	distillate oil, gasoline, kerosene, oil, other oil	99.9	93	95	99.9
wet biomass	solid waste, wood/bark waste	85.5	99.2	95	85.5

The impacts of these Boiler MACT reductions on the controllable facilities and units are provided in Table 4-25. Controls were applied as "replacement" controls to prevent over-control of units that had existing controls. However, this assumes that the inventory correctly reflects units with controls, so it is likely that some units that are not recorded as controlled in the 2011NEIv1 but are actually controlled were reduced more than they should have. Overall, the CO and $PM_{2.5}$ reductions are reasonably close to the year-2015 expected reductions in the Boiler MACT Reconsideration RIA: http://www.epa.gov/ttn/atw/boiler/boilersriaproposalrecon111201.pdf. It is worth noting that the SO_2 reductions in the preamble (http://www.epa.gov/ttn/atw/boiler/fr21mr11m.pdf) were estimated at 442,000 tons; the additional SO_2 reductions in the reconsideration are from an additional cobenefit from more stringent HCl controls. The 2011NEIv1 SO_2 emissions are actually less than the estimated Boiler MACT reductions, likely a result of numerous units undergoing fuel switching from coal or oil to natural gas via changing energy prices between the Boiler MACT RIA analyses and the 2011NEIv1. It is also worth noting that EPA did not attempt to quantify the reductions of nonpoint ICI boiler emissions from Boiler MACT controls.

Table 4-25. Summary of Boiler MACT reductions (tons) compared to Reconsideration RIA reductions

Pollutant	2011 Emissions	Controlled Emissions	Reductions	RIA Reductions
CO	267,685	66,682	201,003	187,000
$PM_{2.5}$	34,586	10,819	24,654	25,601
SO_2	301,748	35,553	276,195	558,430
VOC	19,295	6,984	12,311	n/a

4.2.8 Portland Cement NESHAP projections (ptnonipm)

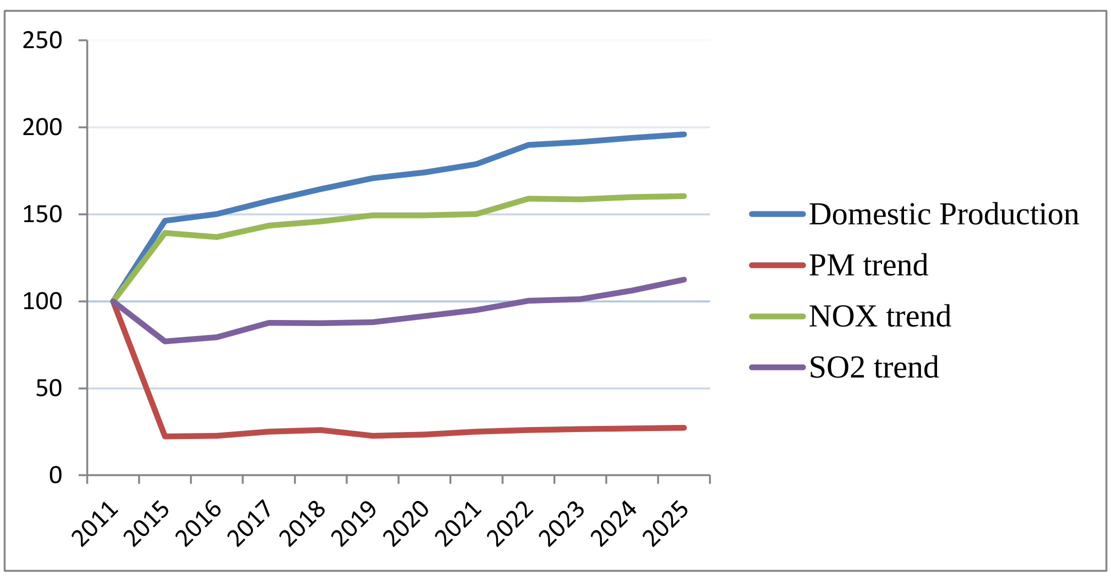
As indicated in Table 4-1, the Industrial Sectors Integrated Solutions (ISIS) model (EPA, 2010b) was used to project the cement industry component of the ptnonipm emissions modeling sector to 2018 and 2025. This approach provided reductions of criteria and select hazardous air pollutants. The ISIS cement emissions were developed in support for the Portland Cement NESHAPs and the NSPS for the Portland cement manufacturing industry.

The ISIS model produced a Portland Cement NESHAP policy case of multi-pollutant emissions for individual cement kilns (emission inventory units) that were relevant for years 2015 through 2030. These ISIS-based emissions are reflected using a CoST packet for all existing kilns that are not impacted by more local information from states (or consent decrees) –see next section- and two cement inventories for new kilns:

1) Inventories: "cement_newkilns_year2018_from_ISIS2013_NEI2011v1" and "cement_newkilns_year_2025_from_ISIS2013_NEI2011v1_08nov2013_v0.csv"
Contains information on new cement kilns constructed after year 2011,
2) Inventory: "cement_newkilns_year_2018_from_ISIS2013_NEI2011v1_NONPOINT_v0.csv" and "cement_newkilns_year_2025_from_ISIS2013_NEI2011v1_NONPOINT_12nov2013_v0.csv"
Contains information ISIS-generated, but not-permitted, new cement kilns constructed after year 2011,
3) Packet: "PROJECTION_2011_2018_ISIS_cement_by_CENSUS_DIVISION_04dec2013.txt" and "PROJECTION_2011_2025_ISIS_cement_by_CENSUS_DIVISION_25nov2013.txt"
Contains U.S. census division level based projection factors for each NEI unit (kiln) based on ISIS updated policy case emissions at existing cement kilns. The units that closed before 2018 (and 2025) are included in the 2018 (and 2025) base case but are included in other CoST packets that reflect state comments and consent decrees (discussed in the next section).

The ISIS model, version August 2013 was used for these projections. Recent data updates include updated matching of kilns to better capture recent retirements, capacity additions and projections of capacity additions from Portland Cement Association (PCA) Plant Information Summary of December 31, 2010 and feedback from Portland Cement NESHAP reconsideration comments. Updated cement consumption projections are based on a post-recession (July 2012) PCA long-term cement consumption outlook. Updated emissions controls in 2015 from the NESHAP are also reflected. Overall, as seen in Figure 4-3, domestic production of cement grows significantly between 2011 and 2015, then more slowly through 2018. Meanwhile, emissions from NESHAP-regulated pollutants such as PM and SO_2 drop significantly based on regulated emissions rates. Emissions for NO_X increase, though not as much as production because the ISIS model continues the recent trend in the cement sector of the replacement of lower capacity, inefficient wet and long dry kilns with bigger and more efficient preheater and precalciner kilns.

Figure 4-3. Cement sector trends in domestic production versus normalized emissions



Multiple regulatory requirements such as the NESHAP and NSPS currently apply to the cement industry to reduce CAP and HAP emissions. Additionally, state and local regulatory requirements might apply to individual cement facilities depending on their locations relative to ozone and $PM_{2.5}$ nonattainment areas. The ISIS model provides the emission reduction strategy that balances: 1) optimal (least cost) industry operation, 2) cost-effective controls to meet the demand for cement, and 3) emission reduction requirements over the time period of interest.

The first step in using ISIS 2018 and 2025 projected emissions is matching the kilns in future years to those in the 2011NEIv1. For kilns that were new in 2018 and/or 2025, EPA used two different approaches for modeling. For kilns already permitted, known locations (coordinates) allowed us to process these as point sources. However, the ISIS model also created "generic" kilns in specific geographically strategic locations (counties) to cover the need for increased production/capacity in future years. Because these generic kilns are not permitted and the location in these counties is uncertain, EPA decided to model these as county-level to avoid placing large emissions sources from a model (ISIS) artifact in one grid cell. These nonpoint source kilns were then spatially allocated based on industrial land activity in the county. A list of all new point and nonpoint inventory cement kilns in 2018 and 2025 are provided in Table 4-26. Note that as production continues to increase beyond 2018, that additional new kilns are needed in 2025.

Table 4-26. Locations of new ISIS-generated cement kilns

Year(s)	ISIS ID	Permitted?	Facility Name	FIPS	State	County
Both	FLNEW2	Y	Vulcan	12001	FL	Aluchua
2025	FLNEW1	Y	American Cement Company	12119	FL	
Both	GANEW1	Y	Houston American Cement	13153	GA	Houston
Both	NCNEW1	Y	Titan America LLC	37129	NC	New Hanover
Both	NewGA2	N	n/a	13153	GA	Houston
Both	NewPA8	N	n/a	42011	PA	Berks
Both	NewSC1	N	n/a	45035	SC	Dorchester
Both	NewTX1	N	n/a	48029	TX	Bexar
Both	NewTX10	N	n/a	48091	TX	Comal
Both	NewWA1	N	n/a	53033	WA	King
2025	NewAZ2	N	n/a	04025	AZ	Yavapai
2025	NewCO2	N	n/a	08043	CO	Freemont
2025	NewOK2	N	n/a	40123	OK	Pontotoc
2025	NewPA8	N	n/a	42095	PA	Northampton
2025	NewTX4	N	n/a	48029	TX	Bexar
2025	NewTX5	N	n/a	48091	TX	Comal
2025	NewTX12	N	n/a	48209	TX	Hays

While ISIS provides by-kiln emissions for each future year, EPA cement kilns experts preferred that the Agency project existing cement kilns based on a more-smooth geographic approach to reduce the "on"/"off" switching that ISIS assigns to each kiln based on production and capacity demands. It would be inefficient and unrealistic to project existing cement kilns to operate as essentially 0% or 100% capacity based strictly on ISIS output. Therefore, EPA developed a U.S. Census Division approach where ISIS emissions in 2011 and future years, that matched the 2011NEIv1 (e.g., not new ISIS kilns), were aggregated by pollutant for each year within each of the 9 census divisions in the contiguous U.S. (http://www.eia.gov/consumption/commercial/images/cendivco.gif). These aggregate emissions were used to create 2018/2011 and 2025/2011 emissions ratios for each pollutant and geographic area. The projection ratios, provided in Table 4-27, were then applied to all 2011NEIv1 cement kilns –except for kilns where specific local information (e.g., consent decrees/settlements/local information).

Table 4-27. U.S. Census Division ISIS-based projection factors for existing kilns

		NO_X		$PM_{2.5}$		SO_2		VOC	
Region	**Division**	**2018**	**2025**	**2018**	**2025**	**2018**	**2025**	**2018**	**2025**
Midwest	East North Central	2.024	2.053	0.106	0.144	1.800	3.034	0.527	0.670
Midwest	West North Central	0.930	1.279	0.614	0.673	0.695	1.262	0.317	0.492
Northeast	Middle Atlantic	1.853	1.221	0.058	0.119	0.904	0.867	0.561	0.569
Northeast	New England	2.560	2.560	0.004	0.004	3.563	3.563	0.713	0.713
South	East South Central	0.999	0.999	0.109	0.109	0.402	0.402	0.323	0.323
South	South Atlantic	1.042	1.077	0.284	0.339	0.911	0.936	0.413	0.420
South	West South Central	1.220	1.526	0.079	0.174	0.484	0.664	0.225	0.252
West	Mountain	1.453	1.321	2.542	1.032	1.917	1.366	0.310	0.345
West	Pacific	1.465	1.465	0.001	0.006	0.300	0.251	0.321	0.290

For all ISIS future year emissions, PM_{10} is assigned as 0.85 of total PM provided by ISIS, and $PM_{2.5}$ is assigned as 0.45 of total PM. All new ISIS-generated kilns, point and nonpoint format, are assigned as Precalciner kilns (SCC=30500623). While ISIS provides emissions for mercury, EPA did not retain these in our modeling.

Table 4-28 shows the magnitude of the ISIS-based cement industry emissions changes between the 2011NEIv1 and future year projection scenarios. Kilns that matched the 2011NEIv1 were simply projected to future years based on U.S. census division aggregate changes in ISIS predictions. There are some local exceptions where EPA did not use ISIS-based projections for cement kilns where local information from consent decrees/settlements and state comments were used instead. Cement kilns projected using these non-ISIS information are not reflected here in Table 4-28. EPA also split out ISIS-based new kilns in future years with permitted (as of August 2013) kilns modeled as point sources and "generic" ISIS-generated kilns as nonpoint sources.

Table 4-28. ISIS-based cement industry change (tons/yr)

				New kilns in 2018		New kilns in 2025					
Poll	**2011 NEIv1**	**2018 projected**	**2025 projected**	**Permitted (point)**	**ISIS-generated (nonpoint)**	**Permitted (point)**	**ISIS-generated (nonpoint)**	**Total 2018**	**Total 2025**	**Diff 2018 - 2011**	**Diff 2025 - 2011**
NO_X	53,874	71,205	76,647	3,751	6,836	4,795	14,812	81,792	96,254	27,919	42,380
$PM_{2.5}$	1,772	722	668	8	15	11	33	745	712	-1,027	-1,060
SO_2	17,065	18,629	26,368	1,775	3,263	2,004	7,409	23,667	32,781	6,602	15,716
VOC	2,690	903	1,073	91	167	117	361	1,161	1,551	-1,529	-1,139

4.2.9 State comments and consent decrees/settlements (nonpt, ptnonipm)

This subsection describes the numerous (12 in all) CoST PROJECTION and CONTROL packets developed to reflect a wide range of information on future year non-EGU point and nonpoint source projections. In general, this information is derived from:

- comments received from the Cross-State Air Pollution proposal
- local and state comments over the past several years,
- consent decrees and settlements, and
- EPA staff data mining and analyses

4.2.9.1 Comments from Cross-State Air Pollution Rule (2010)

EPA released a Notice of Data Availability (NODA) after the CSAPR proposal to seek comments and improvements from states and outside agencies. The goal was to improve the future baseline emissions modeling platform prior to processing the Final CSAPR. EPA received several control programs and other responses that were used for future year projections. However, this effort was performed on a version of the 2005 modeling platform, which used the 2005NEIv2 as a base year starting point for future year projections. Now with the 2011 platform using the 2011NEIv1 for most non-EGU point and nonpoint sources, many of these controls and data improvements were removed from the 2018 and 2025 base case projections. But for those controls, closures and consent decree information that are implemented after 2011, EPA used these controls/data after EPA mapped them to the correct SCCs and/or facilities in the 2011 NEI. This subsection breaks down the controls used for the nonpt and ptnonipm sectors separately, and also describes the consent decrees separately. EPA used July 1, 2011 as the cut-off date for assuming whether controls were included in the 2011 NEI. For example, if a control had a compliance date of December 2011 EPA would assume that the 2011 NEI emissions did not reflect this control and EPA would need to reflect this control in our future base cases. It is important to note that these controls are not comprehensive for all state/counties and source categories. These only represent post-year 2011 controls for those areas and categories where EPA received usable feedback from the CSAPR comments and related 2005 platform NODA.

Packet: "CONTROLS_CSAPR_consent_2011v6.csv"

These controls reflect consent decree and settlements that were identified in our preparation of the Final CSAPR emissions modeling platform. These controls generally consist of one or more facilities and target future year reductions. After EPA removed all consent decrees with compliance dates prior to late-2011, EPA matched the remaining controls to the 2011 NEI using a combination of EIS facility codes, "agy_facility_id", "agy_point_id" and searching the EIS. Then, EPA recomputed the percent reductions such that the future year emissions would match those for facilities originally projected from the 2005 NEI-based platform –these consent decrees were released from 2007 through 2010, when the 2005 NEI was the general baseline. EPA did not retain consent decree controls if the emissions in the 2011NEI were less than the controlled future year emissions based on the 2005 platform. EPA were left with consent decree controls in twelve states (AL, CA, IN, KS, KY, LA, MI, MS, OH, TN, TX, WY) that accounted for 2,731 tons of NO_X and 10,891 tons of SO_2 cumulative reductions in 2025.

Packet: "CONTROL_CSAPR_ptnonipm_2011v6_22nov2013.txt"

EPA created a CONTROL packet for the ptnonipm sector that contains reductions needed to achieve post year-2011 emissions values from the CSAPR response to comments. These reductions reflect fuel switching, cleaner fuels, and permit targets via specific information on control equipment and unit and facility zero-outs in the following states: Georgia, New Hampshire, New York and Virginia. Cumulatively, these controls reduce NO_X by 655 tons and SO_2 by 7,221 tons.

Packet: "PROJECTION_CSAPR_WVunit_ptnonipm_2012_2011v6_21nov2013.txt"

This packet contains the only post-2011 unit-level growth projection resulting from CSAPR comments. The Sunoco Chemicals Neal Plant in Wayne County West Virginia replaced a 155MM Btu/hour coal-fired boiler with a 96.72 MM Btu/hour natural gas-fired unit in 2010. This closure is already reflected in the 2011 NEI; however, in 2012, a new natural gas unit was slated to operate and therefore EPA scaled emissions at an existing natural gas boiler to match these 2012 emission targets provided to us by West Virginia via CSAPR comments. This packet simply results in an extra 22.5 tons of NO_X and minimal increased emissions for PM and SO_2.

4.2.9.2 State comments since spring of 2013

The following packets were derived from information received from several states since the spring of 2013 regarding point and nonpoint projections to year 2018.

Packets:
For 2018:
"PROJECTION_VA_ME_TCEQ_AL_comments_2011v6_2018_03dec2013.txt"
"CONTROL_VA_ME_TCEQ_comments_2011v6_2018_03dec2013.txt"
For 2025:
"PROJECTION_VA_ME_TCEQ_AL_comments_2011v6_2019_03dec2013.txt"
"CONTROL_VA_ME_TCEQ_comments_2011v6_2019_03dec2013.txt"

These packets represent primarily local closures and expected changes in future year emissions, in some cases, specified as year 2018 or 2019 (furthest out-year for Texas), but otherwise simply to be used rather than the 2011 NEI values for general future year modeling. These comments from Alabama, Maine, Texas and Virginia were received in the spring through early fall of 2013. The CONTROL packet was used for specific stack/unit closures and emissions reductions. Deciding which packet type to use (PROJECTION or CONTROL) for applying state comments in CoST is fairly subjective. EPA is forced to use PROJECTION packets when emissions increase, and if EPA can get away with using only 1 type of packet (PROJECTION or CONTROL) for a single source of comments, AND, the choice does not result in different final projected values, then the packet type that best fits was used. For example, if a set of state comments results in emissions increasing and decreasing at various stacks and other CoST packets do not apply, then the packet type choice does not matter. If, however, EPA chose to represent emission decreases as a PROJECTION packet entry, and another CoST CONTROL packet applies to that source, then EPA are applying two different sources of reductions –not ideal. Our goal is for state comments to pass through to the final future year inventory as-is. For this reason, EPA does not quantify emission changes for these packets separately. The cumulative impact of these emissions is shown in Table 4-29. Note that the widespread Texas NAICS-level economic-based growth factors and impacts are discussed separately.

Table 4-29. Impacts of most non-EGU point source state comments received in 2013

State	Pollutant	2011NEIv1	2018 Projection	2025 Projection	2018 Change	2025 Change
Alabama	NO_X	2,941	3,062	3,062	120	120
Alabama	SO_2	1,156	1,168	1,168	12	12
Maine	NO_X	178	45	45	-134	-134
Maine	SO_2	2,069	666	666	-1,463	-1,463
Texas	NO_X	3,337	712	712	-2,625	-2,625
Texas	SO_2	8,461	229	220	-8,233	-8,242
Texas	VOC	469	65	65	-404	-404
Virginia	NO_X	8,065	4,531	4,531	-3,534	-3,534
Virginia	SO_2	1,646	2	2	-1,644	-1,644

Packet:
For 2018: "PROJECTION_TCEQ_ptnonipm_NAICS_comments_2011v6_2018_04dec2013.txt"
For 2025: "PROJECTION_TCEQ_ptnonipm_NAICS_comments_2011v6_2025_11feb2014.txt"

This packet represents county-specific economic-based NAICS-level projections provided by the Texas Commission on Environmental Quality (TCEQ) for minor source emissions. Growth factors are based on projections of gross product for various types of industry, population and various economy.com data. EPA did not apply these projections to oil and gas sources, opting to use the consistent regional/fuel-based approach discussed in Section 4.2.4. A summary of these minor source ptnonipm sector projection impacts for Texas are provided in Table 4-30. Note that there are 2 values for 2011 emissions. This is because no-growth in 2018 was replaced with growth not equal to 1.000 in 2025 for some source categories. Therefore, the 2025 projections impact more source categories than the 2018 projections.

Table 4-30. Minor source ptnonipm sector NAICS-level projections for Texas

Pollutant	2011 NEIv1 for 2018	2011 NEIv1 for 2025	2018 Increase	2025 Increase
CO	114,817	130,957	21,879	40,506
NH_3	2,099	2,506	520	959
NO_X	138,389	161,498	19,609	37,159
PM_{10}	21,146	28,493	4,898	9,531
$PM_{2.5}$	17,301	23,833	4,084	7,786
SO_2	21,432	44,198	6,601	13,406
VOC	62,386	81,824	17,285	32,858

Packet:
For 2018: "PROJECTION_TCEQ_AREA_comments_2011v6_2018_04dec2013.txt"
For 2025: "PROJECTION_TCEQ_AREA_comments_2011v6_2025_04dec2013.txt"

This packet represents nonpt sector 2011-based projections for years 2018 and 2025 for Texas as provided by TCEQ. These county-level and SCC-specific projections are based on a combination of economy.com and Annual Energy Outlook (AEO) data. EPA did not apply these projections to oil and gas sources, opting to use the consistent regional/fuel-based approach discussed in Section 4.2.4. EPA also did not apply these projections to the Residential Wood Combustion sector which were the same for every RWC SCC and county, opting instead to use our national-based but SCC-specific approach discussed in Section 4.2.3. A summary of these nonpt sector changes in Texas is provided in Table 4-31.

Table 4-31. Minor source nonpt sector projections for Texas

Pollutant	2011NEIv1	2018 Projection	2025 Projection	2018 Increase	2025 Increase
CO	68,967	83,299	85,760	14,333	16,793
NH_3	2,659	2,720	2,742	60	83
NO_X	32,581	34,329	34,752	1,748	2,171
PM_{10}	19,999	24,416	26,835	4,416	6,836
$PM_{2.5}$	15,520	19,268	21,465	3,747	5,944
SO_2	9,099	8,805	8,795	-293	304
VOC	239,657	256,046	264,750	16,389	25,093

4.2.9.3 Consent decrees and settlements

These packets were derived in prior emissions modeling platforms, dating back to the 2005 NEI and 2008 NEI. EPA updated this information based on information in the 2011NEIv1 and analysis for compliance dates. Many of these consent decrees were already in place in 2011 and therefore removed from consideration for projections. New information (e.g., Cabot Corporation) has also been obtained since the spring of 2013 and has been included in our projections. Consent decrees or settlements released after November are not included. EPA also does not reflect consent decrees that do not have obvious quantifiable reductions for important emissions modeling pollutants (CAPs).

Packet: "CONTROL_ConsentDecree_Cabot_BlackPowderPlants_03dec2013_v0.txt"

This Cabot Corporation Clean Air Act settlement (release date of November 19, 2013) targets NO_X and SO_2 reductions of 1,975 and 12,380 tons, respectively, from three carbon black manufacturing plants in Louisiana and Texas. More information on this settlement can be found at: http://www2.epa.gov/enforcement/cabot-corporation-clean-air-act-settlement#reductions.

Because EPA did not have specific stack-level information on this settlement, the Agency apportioned the total reductions proportionally to each of the three facilities such that each process in all the facilities was assigned the same percent reduction and that the cumulative NO_X and SO_2 reductions would be achieved.

Packet: "CONTROLS_Refineries_additional_consent_2011NEI_v1_25nov2013_v1.txt"

This packet consists of two settlements. The BP Whiting settlement (released May 23, 2012) is available at: http://www2.epa.gov/enforcement/bp-whiting-settlement. The Marathon Petroleum Company, Detroit Refinery environmental mitigation project (released April 5, 2012) is available at: http://www2.epa.gov/enforcement/marathon-petroleum-company-lp-and-catlettsburg-refining-llc-settlement.

The initial application of these settlements was to the 2008 NEI. Therefore, to be consistent with previous future year estimates for these facilities, EPA modified existing computed reductions from the 2008 such that future year estimates from the 2011NEIv1 matched those done with the 2008 NEI. These settlements reduce NO_X by 78 tons at the Detroit Refinery and NO_X and SO_2 by 780 and 150 tons, respectively, at the Indiana BP Whiting facility.

Packet: "CONTROL_OECA_2011v6_25nov2013.txt"

The Office of Enforcement and Compliance Assurance (OECA) provided emission reduction information for several consent decrees while EPA was preparing emissions for the 2005 NEI-based modeling platform (http://www.epa.gov/ttn/chief/emch/toxics/proposed_toxics_rule_main.pdf). The press releases for these consent decrees are available on EPA's enforcement website (http://www.epa.gov/enforcement/) and some were available with quantitative emission reductions that EPA was able to convert into a control packet. These petroleum refinery settlements are available at: http://www2.epa.gov/enforcement/petroleum-refinery-national-case-results. These settlements were released in the 2003-2010 time period and include information for a few corporations but with aggregate reductions over numerous facilities under these companies and subsidiaries. Therefore, EPA developed an initial table of 2008 NEI emissions summed over all affected facilities for each company. Then EPA merged the multi-facility expected reductions from each of these consent decrees to develop an overall future year (post-compliance date) emissions estimate for each company after all controls/reductions are implemented. Using this methodology, the emissions reductions were apportioned to each plant owned/operated by each company using the same percent reduction from the 2005 NEI emissions.

Now that EPA is using the 2011 NEIv1, EPA expected that some of these consent decree controls/reductions would have already been applied by 2011. EPA did not want to over-control any particular plant. Therefore, EPA computed facility-specific reductions based on the controlled emissions from the 2008 NEI. For example, as seen in Table, SO_2 emissions at all Cargill facilities were reduced about 24% in the 2008 NEI: from 6,921 tons to 5,280 tons. In the 2011NEIv1, SO_2 emissions at these same Cargill facilities totaled 6,263 tons, so only approximately 1,000 tons, a 16% cumulative reduction over all Cargill facilities, were needed to achieve the 5,280 consent decree target.

The column "2008 NEI Controlled" in Table 4-32 was our target for year 2018 emissions. However, many of these facilities are ethanol plants and are therefore projected separately using EPA OTAQ's national projections for ethanol plants (see Section 4.2.1). This is a biggest issue for the Cargill facilities, a majority of which are defined as ethanol plants. Note in Table 4-32, the "applicable" (non-ethanol plants) 2011NEIv1 emissions available for OECA consent decree controls is significantly less than the sum of all Cargill facility emissions. The discrepancies between actual and applicable 2011 NEI emissions for the other OECA facilities are primarily a result of CoST hierarchy assignments. In short, more-specific (more resolved than facility/pollutant of the OECA packet) control information from other CoST packets are used for some of these stacks/units/facilities.

Table 4-32. Target company-wide reductions from OECA consent decree information

Corporation	Pollutant	2008 NEI (tons)	2008 NEI Controlled (tons)	Reductions from 2008 (tons)	2011NEIv1 Emissions (tons)	2011NEIv1 applicable (tons)	Actual 2018/2015 Reductions
Cargill	CO	10,889	262	10,627	6,045	401	394
	NO_X	2,265	1,478	787	1,714	806	111
	SO_2	6,921	5,280	1,642	6,263	849	172
Conoco Phillips	NO_X	14,331	7,334	6,997	9,391	9,070	2,932
Sunoco	NO_X	4,506	1,975	2,531	3,235	3,154	1,231
	$PM_{2.5}$	1,030	585	445	1,072	714	379
Valero	NO_X	8,212	6,109	2,103	6,676	4,913	966
	$PM_{2.5}$	2,554	1,955	599	2,338	1,883	718
	SO_2	11,479	2,903	8,575	6,040	4,807	3,367
Total	CO	10,889	262	10,627	6,045	401	394
	NO_X	29,314	16,896	12,418	21,016	17,943	5,240
	$PM_{2.5}$	3,584	2,540	1,044	3,410	2,597	1,097
	SO_2	18,400	8,183	10,217	12,303	5,656	3,539

Packet: "CONTROL_LaFarge_StGobain_ptnonipm_2011v6_22nov2013.txt"

This control packet includes settlements for all 15 U.S. plants owned by Saint-Gobain Containers, Inc., the nation's second largest container glass manufacturer, and all 13 U.S. plants owned by the Lafarge Company and two subsidiaries, the nation's second largest manufacturer of Portland cement. These settlements, released January 21, 2010, are the first system-wide settlements for these sectors under the Clean Air Act and require pollution control upgrades, acceptance of enforceable emission limits, and payment of civil penalties. The settlements require various NO_X and SO_2 controls, some of which (SO_2 scrubbers) also reduce PM emissions. A couple of Lafarge kilns were also scheduled to be shut down. One of these units was shutdown prior to 2011 and as expected, is not in the 2011NEIv1. However, a Lafarge kiln in Joppa, Illinois was unexpectedly found in the 2011NEIv1 and communication with the Illinois DEP indicated that this unit was not closed as of the summer of 2012. More information on the Lafarge settlement can be found here: http://www2.epa.gov/enforcement/lafarge-north-america-inc-clean-air-act-settlement. More information on the Saint-Gobain settlement is available here: http://www2.epa.gov/enforcement/saint-gobain-containers-inc-clean-air-act-settlement. Many of the controls for the units at these facilities were implemented prior to 2011 and were therefore removed from the CONTROL packet; however, cumulatively, there is still significant reductions post-2011: 9,210 tons of NO_X, 214 tons of $PM_{2.5}$ and 11,777 tons of SO_2.

4.2.9.4 EPA staff data mining

Packet: "CONTROLS_Regional_Haze_2011v6.csv"

This packet includes a set of NO_X and SO_2 reductions provided by EPA's OAQPS Air Quality Policy Division (AQPD) visibility experts. These reductions reflect expected emissions reductions and future year caps for facilities of various industries (e.g., cement kilns, taconite, steel, pulp and paper and mining industries) in the following states: Georgia, Idaho, Michigan, Minnesota, Montana, New York, Ohio, Tennessee, Virginia and Wisconsin. Cumulatively, 28,618 tons of NO_X and 20,686 tons of SO_2 are reduced by these controls in 2025.

4.2.10 Aircraft projections (ptnonipm)

Aircraft emissions are contained in the ptnonipm inventory. These 2011 point-source emissions are projected to future years by applying activity growth using data on itinerant (ITN) operations at airports. The ITN operations are defined as aircraft take-offs whereby the aircraft leaves the airport vicinity and lands at another airport, or aircraft landings whereby the aircraft has arrived from outside the airport vicinity. EPA used projected ITN information available from the Federal Aviation Administration's (FAA) Terminal Area Forecast (TAF) System: http://www.apo.data.faa.gov/main/taf.asp (publication date March, 2013). This information is available for approximately 3,300 individual airports, for all years up to 2030. The methods that the FAA used for developing the ITN data in the TAF are documented in: http://www.faa.gov/about/office_org/headquarters_offices/apl/aviation_forecasts/taf_reports/media/TAF_summary_report_FY20112040.pdf.

None of our aircraft emission projections account for any control programs. EPA considered the NO_X standard adopted by the International Civil Aviation Organization's (ICAO) Committee on Aviation Environmental Protection (CAEP) in February 2004, which is expected to reduce NO_X by approximately 3% by 2020. However, this rule has not yet been adopted as an EPA (or U.S.) rule; therefore, its effects were not included in the future-year emissions projections.

EPA developed two sets of projection factors for aircraft. The first set was a simple national (U.S.) aggregation, used primarily for airports with very little activity, by ITN operation type (commercial, general aviation, military and air taxi) to be used as a default method for projecting from 2011 to 2018. The second set of projection factors was by airport, where EPA projected project emissions for each individual airport with significant ITN activity.

Packet:
For 2018: "PROJECTION_2011_2018_aircraft_21nov2013.txt"
For 2025: "PROJECTION_2011_2025_aircraft_21nov2013.txt"

In this case, EPA simply summed the ITN operations to national totals by year and aircraft operation and computed projection factors as future-year ITN by 2011-year ITN. EPA assigned factors to inventory SCCs based on the operation type shown in Table 4-33.

Table 4-33. Default national-level factors used to project 2011 base-case aircraft emissions to 2018 and 2025

SCC	Description	2018 Factor	2025 Factor
2265008005	Commercial Aircraft: 4-stroke Airport Ground Support Equipment	1.1741	1.3796
2267008005	Commercial Aircraft: LPG Airport Ground Support Equipment	1.1741	1.3796
2268008005	Commercial Aircraft: CNG Airport Ground Support Equipment	1.1741	1.3796
2270008005	Commercial Aircraft: Diesel Airport Ground Support Equipment	1.1741	1.3796
2275000000	All Aircraft Types and Operations	1.1741	1.3796
2275001000	Military Aircraft, Total	0.9972	0.9973
2275020000	Commercial Aviation, Total	1.1741	1.3796
2275050000	General Aviation, Total	1.0199	1.0515

SCC	Description	2018 Factor	2025 Factor
2275050011	General Aviation, Piston	1.0199	1.0515
2275050012	General Aviation, Turbine	1.0199	1.0515
2275060000	Air Taxi, Total	0.9417	0.9402
2275060011	Air Taxi, Total: Air Taxi, Piston	0.9417	0.9402
2275060012	Air Taxi, Total: Air Taxi, Turbine	0.9417	0.9402
2275070000	Commercial Aircraft: Aircraft Auxiliary Power Units, Total	1.1741	1.3796
27501015	Internal Combustion Engines; Fixed Wing Aircraft L & TO Exhaust; Military; Jet Engine: JP-5	0.9972	0.9973
27502011	Internal Combustion Engines; Fixed Wing Aircraft L & TO Exhaust; Commercial; Jet Engine: Jet A	1.1741	1.3796
27505001	Internal Combustion Engines; Fixed Wing Aircraft L & TO Exhaust; Civil; Piston Engine: Aviation Gas	1.0199	1.0515
27505011	Internal Combustion Engines; Fixed Wing Aircraft L & TO Exhaust; Civil; Jet Engine: Jet A	1.0199	1.0515

Packet:
For 2018: "PROJECTION_2011_2018_aircraft_by_airport_21nov2013.txt"
For 2025: "PROJECTION_2011_2025_aircraft_by_airport_21nov2013.txt"

The second set of projection factors was by airport, where EPA projected emissions for each individual airport based on the following criteria:

- ITN activity in year 2011 are greater than 1000 for any of the four available modes: commercial, general aviation, military and air taxi;
- ITN airport matched to 2011NEIv1
- ITN activity is not the same for 2011, 2018 and 2025 AND 2035. The rational here is that these ITN data add no value if 2011 ITN data are used for all future years. These airports were projected based on the national default method.
- A hierarchal assignment was applied when the airport emissions in the NEI did not match the type of ITN information. For example, if an airport in the 2011NEIv1 contained only general aviation emissions (based on NEI SCC), and the ITN data for that airport did not contain general aviation, then commercial aviation activity was used to project these emissions. There were 11 of 15 possible hierarchal assignments used in our projection methodology where EPA assigned a "fallback" ITN projection method to an NEI airport SCC, and most of these assignments were linked to very small NEI emissions.

Most of the significant airports, and hence increased emissions, are projected via the airport-specific projection packet. Overall, aircraft NO_X emissions increase approximately 17% between 2011 and 2018 and 37% by 2025.

4.2.11 Remaining non-EGU controls and closures (ptnonipm)

This section describes all remaining non-EGU stationary source reductions and closures not already discussed. These CONTROL packets and CLOSURE packets generally have lesser national-level impact on future year projections than many of the items above. However, these impacts can be significant locally – particularly plant closures.

4.2.11.1 CISWI controls (ptnonipm)

Packet: CONTROL_CISWI_2011v6_22nov2013.txt

On March 21, 2011, EPA promulgated the revised NSPS and emission guidelines for Commercial and Industrial Solid Waste Incineration (CISWI) units. This was a response to the voluntary remand that was granted in 2001 and the vacatur and remand of the CISWI definition rule in 2007. In addition, the standards re-development included the 5-year technology review of the new source performance standards and emission guidelines required under Section 129 of the Clean Air Act (CAA). The history of the CISWI implementation is documented here: http://www.epa.gov/ttn/atw/129/ciwi/ciwipg.html. Baseline and CISWI rule impacts associated with the CISWI rule are documented here: http://www.epa.gov/ttn/atw/129/ciwi/baseline_emission_reductions_memo.pdf. EPA mapped the units from the CISWI baseline and controlled dataset to the 2011NEIv1 inventory and because the baseline CISWI emissions and the 2011NEIv1 emissions were not the same, EPA computed percent reductions such that our future year emissions matched the CISWI controlled dataset values. CISWI reductions limited to SO_2 reductions of 1,427 and 1,413 tons in Arkansas and Louisiana, respectively.

4.2.11.2 Remaining facility closures

Packets:
"CLOSURES_EIS_2011NEIv1_sep2013_25nov2013_v1.txt" &
"CLOSURES_2008_Merged_12nov2013_v0.txt"

This section describes two CLOSURE packets. The first "EIS" packet is from a September 11, 2013 Emissions Inventory System (http://www.epa.gov/ttnchie1/eis/gateway/) report of post-2011 permanent facility shutdowns, based on facility status code "PS". The second "Merged" packet is from a concatenation of previous facility and unit-level closure information used in the 2008 NEI-based emissions modeling platform (http://epa.gov/ttn/chief/emch/2007v5/2007v5_2020base_EmisMod_TSD_13dec2012.pdf). The "EIS" closures impact facilities in 12 states while the "Merged" packet closures are spread out over 34 states. The cumulative reductions in emissions from this packet are shown in Table 4-34.

Table 4-34. Reductions from all EIS-based and remaining information facility/unit-level closures

Pollutant	Reductions
CO	1,420
NH_3	441
NO_X	3,117
PM_{10}	1,858
$PM_{2.5}$	1,613
SO_2	26,073
VOC	2,207

4.3 Mobile source projections

Mobile source monthly inventories of onroad and nonroad mobile emissions were created for 2018 and 2025 using a combination of the SMOKE-MOVES and the NMIM models. The 2018 and 2025 onroad emissions account for changes in activity data and the impact of on-the-books rules including: the Light-Duty Vehicle Tier 2 Rule (EPA, 2000), the 2007 Heavy Duty Diesel Rule (http://www.epa.gov/otaq/highway-diesel/), the Mobile Source Air Toxics (MSAT2) Rule (EPA, 2007a), the Renewable Fuel Standard (RFS2) (EPA, 2010a), the Light Duty Vehicle GHG/CAFE standards for Model-Year 2012-2016 (EPA, 2010c), the Heavy-Duty Vehicle Greenhouse Gas Rule (EPA, 2011a), the Light Duty Vehicle GHG Rule for Model-Year 2017-2025, and the Tier 3 Motor Vehicle Emission and Fuel Standards (Tier3 FRM) Rule (http://www.epa.gov/otaq/tier3.htm). Local inspection and maintenance (I/M) and other onroad mobile programs are included such as California LEVIII, the National Low Emissions Vehicle (LEV) and Ozone

Transport Commission (OTC) LEV regulations (http://www.epa.gov/otaq/lev-nlev.htm), local fuel programs, and Stage II refueling control programs.

Nonroad mobile emissions reductions for these years include reductions to locomotives, various nonroad engines including diesel engines and various marine engine types, fuel sulfur content, and evaporative emissions standards.

Onroad mobile sources are comprised of several components and are discussed in the next subsection (4.3.1). Monthly nonroad mobile emission projections are discussed in subsection 4.4. Locomotives and Class 1 and Class 2 commercial marine vessel (C1/C2 CMV) projections are discussed in subsection 4.5, and Class 3 (C3) CMV projected emissions are discussed in subsection 4.4.2.

4.3.1 Onroad mobile (onroad and onroad_rfl)

The onroad emissions for 2018 and 2025 use the same SMOKE-MOVES system as for the base year (see Sections 2.3.1 and 2.3.2). Meteorology, speed, spatial and temporal surrogates, representative counties, and fuel months were the same as for 2011, discussed above.

4.3.1.1 VMT and vehicle population

Estimates of total national Vehicle Miles Travelled (VMT) in 2018 and 2025 came from DOE's Annual Energy Outlook (AEO) 2013 (http://www.eia.gov/forecasts/aeo/) transportation projections (http://www.eia.gov/forecasts/aeo/sector_transportation.cfm), specifically the reference case (release dates April 15th-May 2nd 2013). Trends were developed by calculating ratios between 2011 AEO and 2018 AEO[35] estimates and renormalizing the trends so that a projection of the 2011NEIv1 VMT would match the AEO's 2018 total VMT (across all vehicle types). These ratios were developed for light versus heavy duty and for gasoline versus diesel vehicle types. This same method was used to project 2011 NEIv1 VMT to 2025 with the incorporation of 2025 AEO estimates. The projection factors, the national 2011NEIv1 VMT ("VMT_2011") by vehicle type (SCC7), and the default future VMT ("VMT_2018" and VMT_2025") by vehicle type are show in Table 4-35.

Table 4-35. Projection factors for 2018 and 2025 VMT (in millions of miles)

Classification	SCC7	Description	VMT 2011	Ratio 2018	VMT 2018	Ratio 2025	VMT 2025
light_gas	2201001	Light Duty Gasoline Vehicles (LDGV)	1,595,751	1.0226	1,631,840	1.1206	1,828,577
light_gas	2201020	Light Duty Gasoline Trucks 1 & 2 (M6) = LDGT1 (M5)	682,930	1.0226	698,375	1.1206	782,572
light_gas	2201040	Light Duty Gasoline Trucks 3 & 4 (M6) = LDGT2 (M5)	351,812	1.0226	359,768	1.1206	403,143
heavy_gas	2201070	Heavy Duty Gasoline Vehicles 2B thru 8B & Buses (HDGV)	98,334	1.1056	108,714	1.2641	137,428
light_gas	2201080	Motorcycles (MC)	19,744	1.0226	20,190	1.1206	22,624
light_diesel	2230001	Light Duty Diesel Vehicles (LDDV)	4,764	3.8885	18,526	5.9148	109,581
light_diesel	2230060	Light Duty Diesel Trucks 1 thru 4 (M6) (LDDT)	13,389	3.8885	52,063	5.9148	307,946
heavy_diesel	2230071	Heavy Duty Diesel Vehicles (HDDV) Class 2B	6,080	1.2753	7,753	1.4378	11,148

[35] By "2011 AEO," "2018 AEO," and "2025 AEO," this refers to the AEO2013's estimates of national VMT in those specific calendar years.

Classification	SCC7	Description	VMT 2011	Ratio 2018	VMT 2018	Ratio 2025	VMT 2025
heavy_diesel	2230072	Heavy Duty Diesel Vehicles (HDDV) Class 3, 4, & 5	30,625	1.2753	39,055	1.4378	56,156
heavy_diesel	2230073	Heavy Duty Diesel Vehicles (HDDV) Class 6 & 7	48,998	1.2753	62,486	1.4378	89,846
heavy_diesel	2230074	Heavy Duty Diesel Vehicles (HDDV) Class 8A & 8B	131,503	1.2753	167,704	1.4378	241,133
heavy_diesel	2230075	Heavy Duty Diesel Buses (School & Transit)	8,938	1.2753	11,399	1.4378	16,390

These national SCC7 ratios were applied to the 2011NEIv1 VMT to create an EPA estimate of 2018 and 2025 VMT at the county, SCC level[36].

Vehicle population (VPOP) was developed by creating VMT/VPOP ratios from the 2011NEIv1 VMT and 2011NEIv1 VPOP at the county, vehicle type (SCC7) level. These ratios were applied to the 2018 VMT to create a 2018 VPOP. This process was repeated using the 2025 VMT to create the 2025 VPOP.

4.3.1.2 Set up and Run MOVES to create EF

Emission factor tables were created by running SMOKE-MOVES using the same procedures and models as described for 2011 (see the 2011NEIv1 TSD and Section 2.3). The same meteorology and the same representative counties were used. Changes between 2011 and future years (2018 or 2025) are predominantly VMT, fuels, national and local rules, and the model-year distribution of the fleet, which is built into MOVES. Fleet turnover resulted in a greater fraction of newer vehicles meeting stricter emission standards. The similarities and differences between the two runs are described in Table 4-36.

Table 4-36. Comparison of MOVES runs for 2018 and 2025

Element	2018 T3FRM	2025 T3FRM
Code	MOVES20121002f	MOVES20121002f
Default database	movesdb20121002l_truncatedgfre	movesdb20121002l_truncatedgfreim
VMT and VPOP	CDBs and state DBs for 26 states for 2018 dated 9/23/2013	CDBs and state DBs for 26 states for 2025 dated 1/17/2014
Hydrocarbon speciation	T3FRM2018_natinv_HCspec_SS_M	T3FRM2030_natinv_HCspec_SS_M
Fuels	tier3frm2018ctrlfuels_03152013	oaqps2025fuels_20140116
CA LEVIII	ca_standards_SS_20130905 (16 states)	ca_standards_SS_20130905 (16 states)
Tier 3 controls	tier3ctldbs_090513	tier3ctldbs_090513

The following states were modeled as having adopted the California LEV III program (see Table 4-37)

Table 4-37. CA LEVIII program states

FIPS	State Name
06	California
09	Connecticut

[36] A few states/regional organizations provided 2018 projections. Those were incorporated into the 2018ed modeling but were not consistently available for 2025. Therefore, these state/regional organization projections were not incorporated into the 2018ef nor the 2025ef cases because EPA wanted to keep the projections of VMT consistent between 2018ef and 2025ef.

FIPS	State Name
10	Delaware
23	Maine
24	Maryland
25	Massachusetts
34	New Jersey
36	New York
41	Oregon
42	Pennsylvania
44	Rhode Island
50	Vermont
53	Washington

Fuels were projected into the future using estimates from the AEO2013 (http://www.eia.gov/forecasts/aeo/), release dates April 15th-May 2nd 2013. The AEO2013 projection includes partial implementation of RFS2 in 2018 and assumes that all fuels have an ethanol content of E10 or greater. The regional fuels in 2011 were projected to 2018 so that some of the regional variation is preserved but the totals match AEO2013. The 2025 fuels were identical to the 2018 fuels. For details on the 2018 and 2025 speciation of onroad, which is strongly dependent on the fuels, see Section 3.2.1.4.

4.3.1.3 National, California, and Texas adjustments

A set of adjustments were done in SMOKE-MOVES to create 2018 and 2025 emissions: extended idle, California emissions, and Texas emissions.

The first set of adjustment factors was for extended idle (EXT) and auxiliary power units (APU). This uses the same approach as was used in 2011 (see the 2011NEIv1 TSD for details) except for the VPOP was updated to be consistent with 2018 or 2025, depending on the future year case. These adjustments were by county, vehicle type (long-haul truck SCCs only), and mode (EXT or APU) and impacted the RPV process only.

The second set of adjustment factors was meant to incorporate future year emissions provided by California. The same approach as was used in 2011 was used to match the emissions totals provided by CARB (see Section 2.3.1). The only differences between the 2011 approach and that applied for 2018 are that the latter uses the 2018 emissions from CARB and the 2018 SMOKE-MOVES output (EPA estimates), where the 2018 "CARB emissions" were created by interpolating between the 2017 and 2020 CARB emissions. For 2025, the process was repeated using 2025 emissions provided by CARB and the 2025 SMOKE-MOVES output (EPA estimates). The provided CARB emissions were produced from working draft versions of EMFAC2011-LD and EMFAC2011-HD and include the following heavy duty regulations: chip reflash, extended idling, public fleet, trash trucks, drayage trucks, and trucks and buses. It does not include the GHG/smartway regulations for trucks, or the low carbon fuel standard. These adjustment factors are by county, SCC3, pollutant and impact all processes (RPD, RPV, and RPP).

The third set of adjustment factors was meant to incorporate emissions provided by Texas. Conceptually, EPA used the trend of 2011 to 2018 based on EPA's estimates to project Texas' submitted emissions for 2011. Mathematically, this is equivalent to taking the Texas adjustment factors derived for 2011 (see Section 2.3.1 for details) and applying them directly to EPA's 2018 run. These adjustment factors are by county, SCC7, pollutant and impact all processes. The same process was repeated for 2025 by taking the Texas adjustment factors derived for 2011 and applying them to the EPA's 2025 run.

Because these adjustment factors are multiplicative, a single set of adjustment factors may be created by multiplying the three adjustment factors together taking care to match process (RPD, RPV, or RPP), mode, pollutant, SCC, and county. Movesmrg uses the composite adjustment factor file (CFPRO) to estimate 2018 or 2025 emissions that incorporates each of these adjustments (or a subset of them depending on county, mode, and process).

4.4 Nonroad mobile source projections (c1c2rail, c3marine, nonroad)

The projection of locomotives and Class 1 and 2 commercial marine vessels to 2018 and 2025 is described in Section 4.4.1. These sources are treated in shapes in the NEI but are considered at the county-level in the modeling platform. The projection of the larger Class 3 commercial marine vessels, treated as point sources in the modeling platform, is described in Section 4.4.2. Most of the remaining sources in the nonroad sector are projected by running the NMIM model with fuels and vehicle populations appropriate to 2018 and 2025, as described in Section 4.4.3.

4.4.1 Locomotives and Class 1 & 2 commercial marine vessels (c1c2rail)

There are three distinct components used to craft year 2018 and 2025 inventories from the 2011 base case. The first component of the future year c1c2rail inventory is the non-California data projected from the 2011 base case. The second component is the CARB-supplied year 2017 and 2025 data for California. The third component is a set of EPA OTAQ-provided county-specific emissions adjustments that account for different fuel transport characteristics resulting from AEO2013 renewable fuel projections and the 2017-2025 light duty vehicle greenhouse gas standards.

Step 1: Project non-California CMV and rail emissions

Packet:
For 2018: "PROJECTION_2011_2018_c1c2rail_BASE_noRFS2_05dec2013.txt"
For 2025: "PROJECTION_2011_2025_c1c2rail_BASE_noRFS2_11feb2014.txt"

This packet creates an intermediate set of future year emissions for all states except California. This packet does not reflect emission impacts from projected renewable fuel volumes, these impacts are applied for all states in Step 3. This packet consists of national projection factors by SCC and pollutant between 2011 and future years that reflect the May 2004 "Tier 4 emissions standards and fuel requirements" (http://www.epa.gov/otaq/documents/nonroad-diesel/420r04007.pdf) as well as the March 2008 "Final locomotive-marine rule" controls (http://www.epa.gov/otaq/regs/nonroad/420f08004.pdf). These projection ratios are provided in Table 4-38.

Table 4-38. Non-California intermediate projection factors for locomotives and Class 1 and Class 2 Commercial Marine Vessel Emissions

SCC	Description	Poll	2018 Factor	2025 Factor
2280002XXX	Marine Vessels, Commercial;Diesel;Underway & port emissions	CO	0.9525	0.9547
2280002XXX	Marine Vessels, Commercial;Diesel;Underway & port emissions	NO_X	0.7623	0.5372
2280002XXX	Marine Vessels, Commercial;Diesel;Underway & port emissions	PM	0.6755	0.4906
2280002XXX	Marine Vessels, Commercial;Diesel;Underway & port emissions	SO_2	0.1275	0.0691
2280002XXX	Marine Vessels, Commercial;Diesel;Underway & port emissions	VOC	0.7715	0.5233
2285002006	Railroad Equipment;Diesel;Line Haul Locomotives: Class I Operations	CO	1.175	1.2489

SCC	Description	Poll	2018 Factor	2025 Factor
2285002006	Railroad Equipment;Diesel;Line Haul Locomotives: Class I Operations	NO_X	0.8123	0.6207
2285002006	Railroad Equipment;Diesel;Line Haul Locomotives: Class I Operations	PM	0.6764	0.4574
2285002006	Railroad Equipment;Diesel;Line Haul Locomotives: Class I Operations	SO_2	0.0319	0.0356
2285002006	Railroad Equipment;Diesel;Line Haul Locomotives: Class I Operations	VOC	0.6116	0.4299
2285002007	Railroad Equipment;Diesel;Line Haul Locomotives: Class II / III Operations	CO	1.175	1.2489
2285002007	Railroad Equipment;Diesel;Line Haul Locomotives: Class II / III Operations	NO_X	1.0576	1.0646
2285002007	Railroad Equipment;Diesel;Line Haul Locomotives: Class II / III Operations	PM	1.0241	1.0118
2285002007	Railroad Equipment;Diesel;Line Haul Locomotives: Class II / III Operations	SO_2	0.0319	0.0357
2285002007	Railroad Equipment;Diesel;Line Haul Locomotives: Class II / III Operations	VOC	1.1175	1.2489
2285002008	Railroad Equipment;Diesel;Line Haul Locomotives: Passenger Trains (Amtrak)	CO	1.0574	1.1180
2285002008	Railroad Equipment;Diesel;Line Haul Locomotives: Passenger Trains (Amtrak)	NO_X	0.6635	0.4582
2285002008	Railroad Equipment;Diesel;Line Haul Locomotives: Passenger Trains (Amtrak)	PM	0.6052	0.3369
2285002008	Railroad Equipment;Diesel;Line Haul Locomotives: Passenger Trains (Amtrak)	SO_2	0.0303	0.0331
2285002008	Railroad Equipment;Diesel;Line Haul Locomotives: Passenger Trains (Amtrak)	VOC	0.5316	0.2751
2285002009	Railroad Equipment;Diesel;Line Haul Locomotives: Commuter Lines	CO	1.0574	1.1180
2285002009	Railroad Equipment;Diesel;Line Haul Locomotives: Commuter Lines	NO_X	0.6635	0.4582
2285002009	Railroad Equipment;Diesel;Line Haul Locomotives: Commuter Lines	PM	0.6052	0.3369
2285002009	Railroad Equipment;Diesel;Line Haul Locomotives: Commuter Lines	SO_2	0.0303	0.0330
2285002009	Railroad Equipment;Diesel;Line Haul Locomotives: Commuter Lines	VOC	0.5316	0.2751
2285002010	Railroad Equipment;Diesel;Yard Locomotives	CO	1.175	1.2489
2285002010	Railroad Equipment;Diesel;Yard Locomotives	NO_X	0.9767	0.8366
2285002010	Railroad Equipment;Diesel;Yard Locomotives	PM	0.9436	0.8096
2285002010	Railroad Equipment;Diesel;Yard Locomotives	SO_2	0.0320	0.0356
2285002010	Railroad Equipment;Diesel;Yard Locomotives	VOC	0.9388	0.7666

The future-year locomotive emissions account for increased fuel consumption based on Energy Information Administration (EIA) fuel consumption projections for freight rail, and emissions reductions resulting from emissions standards from the Final Locomotive-Marine rule (EPA, 2009d). This rule lowered diesel sulfur content and tightened emission standards for existing and new locomotives and marine diesel emissions to lower future-year PM, SO_2, and NO_X, and is documented at: http://www.epa.gov/otaq/marine.htm#2008final.

EPA applied HAP factors for VOC HAPs by using the VOC projection factors to obtain 1,3-butadiene, acetaldehyde, acrolein, benzene, and formaldehyde. C1/C2 diesel emissions (SCC = 2280002100 and 2280002200) were projected based on the Final Locomotive Marine rule national-level factors. Similar to locomotives, VOC HAPs were projected based on the VOC factor.

Step 2: Intermediate California year 2018 and 2025 inventories

Obtained from CARB, the locomotive, and class 1 and 2 commercial marine emissions used for California reflect year 2017 (used for 2018) and year 2025 and include nonroad rules reflected in the December 2010 Rulemaking Inventory (http://www.arb.ca.gov/regact/2010/offroadlsi10/offroadisor.pdf), those in the March 2011 Rule Inventory, the Off-Road Construction Rule Inventory for "In-Use Diesel", cargo handling equipment rules in place as of 2011 (see http://www.arb.ca.gov/ports/cargo/cargo.htm), and the 2007 and 2010 regulations to reduce emissions diesel engines on commercial harbor craft operated within California waters and 24 nautical miles of the California baseline.

The C1/C2 CMV emissions were obtained from the CARB nonroad mobile dataset "ARMJ_RF#2002_ANNUAL_MOBILE.txt". These emissions were developed using Version 1 of the CEPAM which supports various California off-road regulations. The locomotive emissions were obtained from the CARB trains dataset "ARMJ_RF#2002_ANNUAL_TRAINS.txt". Documentation of the CARB offroad methodology, including c1c2rail sector data, is provided here: http://www.arb.ca.gov/msei/categories.htm#offroad_motor_vehicles. EPA converted the CARB inventory TOG to VOC by dividing the inventory TOG by the available VOC-to-TOG speciation factor.

Step 3: Adjusting 2018 and 2025 c1c2rail emissions to reflect 2017-2025 light duty vehicle greenhouse gas standards and renewable fuel volume projections

Rail and barges are used to transport fuel from production facilities to bulk terminals. To account for emissions associated with this transport, C1/C2 and rail inventories were adjusted to account for differences in ethanol volumes and emission rates between the base year and future years.

In EPA's Tier 3 final rule, impacts of these modes of transport of fuel on combustion emissions from the C1 and C2 CMV and rail inventories were estimated for 2018, based on AEO 2013 projections.[37] The adjusted national inventory impacts were allocated to individual counties using factors developed from the Oak Ridge analysis of ethanol transport (Oak Ridge National Laboratory, 2009). EPA OTAQ was unable to provide year 2025-specfic impacts; therefore, these year-2018 impacts were then applied to the unadjusted inventory for the 2025 projected inventories.

Emissions from updated renewable fuel volume projections are not included in the previously-discussed non-California loco-marine rule-based projections (Step 1) and CARB 2017 and 2025 inventories (Step 2). Nationally, these additional emissions are modest and are shown in Table 4-39. In addition, for year 2025 projections, very minor scalar adjustments (a decrease of a fraction of a percent) were applied to rail and c1c2 CMV emissions to reflect the minor impact of the Light-Duty Vehicle Greenhouse Gas (LDGHG) Rule (EPA, 2012b). The overall differences between 2011 and future year c1c2rail sector emissions, reflecting final rules (Loco-Marine, and LDGHG 2017-2025), and renewable fuel volume projections, are provided in Table 4-40. These sector totals include all U.S. states as well as offshore and Puerto Rico.

Table 4-39. C1/C2 and locomotive emission adjustments in 2018 and 2025

Pollutant	C1/C2 CMV	Locomotives
CO	-855	1,715
NH_3	-2	5
NO_X	-3,635	8,346
PM_{10}	-139	198
$PM_{2.5}$	-155	-10
SO_2	-296	80
VOC	-136	357

Table 4-40. Difference in c1c2rail sector emissions between 2011 and future years

Pollutant	2011	2018	2025	Difference 2018 - 2011	Difference 2025 - 2011
CO	242,771	255,496	274,511	12,725	31,740
NH_3	707	712	709	5	2
NO_X	1,392,532	1,129,284	849,112	-263,248	-543,420
PM_{10}	46,142	31,963	22,704	-14,179	-23,438
$PM_{2.5}$	43,491	29,893	21,186	-13,598	-22,305
SO_2	23,160	3,161	1,514	-19,999	-21,646

[37] Cook, R. 2014. Development of Air Quality Reference Case Upstream and Portable Fuel Container Inventories for Tier 3 Final Rule. Memorandum to Docket EPA-HQ-OAR-2010-0162.

Pollutant	2011	2018	2025	Difference 2018 - 2011	Difference 2025 - 2011
VOC	56,543	33,334	28,077	-23,209	-28,466

4.4.2 Class 3 commercial marine vessels (c3marine)

As discussed in Section 2.4.2, the c3marine sector emissions data were developed for year 2002 and projected to year 2011 for the 2011 base case. The ECA-IMO project provides pollutant and geographic-specific projection factors to year 2011, and also projection factors to years 2018 and 2025 that reflect assumed growth and final ECA-IMO controls. The ECA-IMO rule, published in December 2009, applies to Category 3 (C3) diesel engines (engines with per cylinder displacement at or above 30 liters) installed on U.S. vessels. The ECA-IMO rule includes an implementation of Tier 2 and Tier 3 NO_X limits for C3 engines beginning in 2011 and 2016, respectively. The ECA-IMO rule also imposes fuel sulfur limits of 1,000 ppm (0.1%) by 2015 in the ECA region -generally within 200 nautical miles of the U.S. and Canadian coastlines, as well as 5,000 ppm (0.5%) for "global" areas –those areas outside the ECA region. For comparison, with the exception of some local areas, year 2011 sulfur content limits are as high as 15,000 ppm (1.5%) in U.S. waters and 45,000 ppm (4.5%) in global areas. More information on the ECA-IMO rule can be found in the Category 3 marine diesel engines Regulatory Impact Assessment: http://www.epa.gov/otaq/oceanvessels.htm.

Projection factors for creating the year 2018 and 2025 c3marine inventories from the 2011 base case are provided in Table 4-41. Background on the region and Exclusive Economic Zone (EEZ) FIPS is provided in the discussion on the c3marine inventory for 2011 –Section 2.4.2. The impact of the Tier 2 and Tier 3 NO_X engine standards is less noticeable because of the inevitable delay in fleet turnover for these new engines; however, the immediate and drastic cuts in fuel sulfur content are obvious. VOC and CO are mostly unaffected by the engine and fuel standards, thus providing an idea on how much these emissions would have grown without ECA-IMO controls. VOC HAPs are assigned the same growth rates as VOC.

Table 4-41. Growth factors to project the 2011 ECA-IMO inventory to 2018 and 2025

Region	EEZ FIPS	Year	2018 and 2025 Adjustments Relative to 2011					
			NO_X	PM_{10}	$PM_{2.5}$	VOC (HC)	CO	SO_2
East Coast (EC)	85004	2018	1.068	0.556	0.556	1.361	1.361	0.136
		2025	0.890	0.756	0.756	1.852	1.852	0.185
Gulf Coast (GC)	85003	2018	0.960	0.504	0.504	1.222	1.222	0.122
		2025	0.721	0.615	0.615	1.492	1.492	0.149
North Pacific (NP)	85001	2018	1.014	0.501	0.501	1.255	1.255	0.126
		2025	0.846	0.629	0.629	1.575	1.575	0.158
South Pacific (SP)	85002	2018	1.121	0.593	0.593	1.421	1.420	0.144
		2025	0.965	0.858	0.858	2.028	2.027	0.211
Great Lakes (GL)	n/a	2018	1.027	0.444	0.444	1.125	1.125	0.113
		2025	0.998	0.500	0.500	1.266	1.266	0.127
Outside ECA	98001	2018	1.217	1.356	1.356	1.356	1.356	1.356
		2025	1.463	0.409	0.405	1.858	1.858	0.337

As discussed in Section 2.4.2, emissions outside the 3 to 10 mile coastal boundary but within the approximately 200 nm EEZ boundaries were projected to years 2018 and 2025 using the same regional adjustment factors as the U.S. emissions; however, the FIPS codes were assigned as "EEZ" FIPS and these, as well as Canada C3 CMV, emissions are processed in the "othpt" sector (see Section 2.5.1 and 4.4.1). Note that state boundaries in the Great Lakes are an exception, extending through the middle of each lake such that all emissions in the Great Lakes are assigned to a U.S. county or Ontario. The classification of emissions to U.S. and Canadian FIPS codes is needed to avoid double-counting of C3 CMV U.S. emissions in the Great Lakes because, as discussed in Section 2.4.1, all CMV emissions in the Midwest RPO are processed in the "c1c2rail" sector.

4.4.3 Other nonroad mobile sources (nonroad)

This sector includes monthly exhaust, evaporative and refueling emissions from nonroad engines (not including commercial marine, aircraft, and locomotives) derived from NMIM for all states except California and Texas. Similar to the onroad emissions, NMIM provides nonroad emissions for VOC by three emission modes: exhaust, evaporative and refueling.

With the exception of California and Texas, U.S. emissions for the nonroad sector (defined as the equipment types covered by the NONROAD model) were created using a consistent NMIM-based approach as was used for 2011. Specifically, NMIM utilized NONROAD2008a including future-year equipment population estimates, control programs to the years 2018 and 2025, and inputs either state-supplied as part of the 2011NEIv1 process or national level inputs. Fuels for 2018 and 2025 were assumed to be E10 everywhere for nonroad equipment. The fuels were developed from the MOVES fuels, which in turn were developed to be consistent with AEO2013 projections for 2018 and 2025. The databases used in the 2018 run were NMIM county database "NCD20130731_nei2018dv1" and fuels database "tier3frm2018ctrlfuels_03152013_e10fuelsNMIM." EPA inadvertently used a 2025 inventory from an earlier platform. The 2018 and 2025 emissions account for increases in activity (based on NONROAD model default growth estimates of future-year equipment population), changes in fuels and engines that reflect implementation of national regulations and local control programs that impact each year differently due to engine turnover. For details on the 2018 and 2025 speciation of nonroad, see Section 3.2.1.4.

The version of NONROAD used was the current public release, NR08a, which models all in-force nonroad controls. Recent rules include:

- "Clean Air Nonroad Diesel Final Rule - Tier 4", published June, 2004: http://www.epa.gov/otaq/nonroad-diesel.htm
- Control of Emissions from Nonroad Large Spark-Ignition Engines, and Recreational Engines (Marine and Land-Based), November 8, 2002 ("Pentathalon Rule").
- OTAQ's Small Engine Spark Ignition ("Bond") Rule, October, 2008: http://www.epa.gov/otaq/smallsi.htm

Not included are voluntary local programs such as encouraging either no refueling or evening refueling on Ozone Action Days.

California and Texas nonroad emissions

Similar to the 2011 base nonroad mobile, NMIM was not used to generate future-year nonroad emissions for California, other than for NH_3. EPA used NMIM for California future nonroad NH_3 emissions because CARB did not provide these data for any nonroad vehicle types. For the rest of the pollutants, the CARB-supplied 2017 and 2025 nonroad annual inventories were distributed to monthly emissions values by using the respective year 2018 and 2025 NMIM monthly inventories to compute monthly ratios by county, SCC7, mode and pollutant, which was consistent with the approach in 2011 (see Section 2.4.3). Some adjustments to the CARB inventory were needed to convert the provided TOG to VOC. See Section 3.2.1.3 for details on speciation of California nonroad data see Section 3.2.1.3)[38]. . The CARB nonroad emissions include

[38] In addition, airport equipment was removed from CARB's inventory because these sources were modeled elsewhere.

nonroad rules reflected in the December 2010 Rulemaking Inventory (http://www.arb.ca.gov/regact/2010/offroadlsi10/offroadisor.pdf) and those in the March 2011 Rule Inventory, the Off-Road Construction Rule Inventory for "In-Use Diesel".

For Texas, EPA combined Texas' submitted estimates for 2011 with EPA projections of nonroad emissions into 2018 and 2025. Conceptually, EPA used the trend of 2011 to 2018 or 2025 based on EPA's estimates to project Texas' submitted emissions for 2011. Specifically, projections were based on state-wide SCC7, mode, poll ratios[39] of 2018 and 2025 NMIM to 2011 NMIM. These ratios were then applied to Texas' submitted 2011 emissions inventory, which had already been distributed to a monthly inventory (see Section 2.4.3), to create a 2018 and 2025 monthly nonroad inventories.

4.5 "Other Emissions": Offshore Class 3 commercial marine vessels and drilling platforms, Canada and Mexico (othpt, othar, and othon)

Recall from Section 2.5, that emissions from Canada, Mexico, and non-U.S. offshore Class 3 Commercial Marine Vessels (C3 CMV) and drilling platforms are included as part of three emissions modeling sectors: othpt, othar, and othon. Non C3 CMV emissions for Canada and offshore sources were not projected to future years, and are therefore the same as those used in the 2011 base case. Canada did not provide future-year emissions that were consistent with the base year emissions. The Mexico emissions are based on year 1999 but projected to year 2018 for both the 2018 and 2025 future base cases. A background on the development of year-2018 Mexico emissions from the 1999 inventory is available at: http://www.wrapair.org/forums/ef/inventories/MNEI/index.html.

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

As discussed in Section 2.5.1, the ECA-IMO-based C3 CMV emissions for non-U.S. states are processed in the othpt sector. These C3 CMV emissions include those assigned to Canada, those assigned to the Exclusive Economic Zone (defined as those emissions just beyond U.S. waters approximately 3-10 miles offshore, extending to about 200 nautical miles from the U.S. coastline), and all other offshore emissions – far offshore and non-U.S. EPA processed these emissions in the othpt sector for simplicity of creating U.S.-only emissions summaries. Otherwise, these emissions are processed in the same way as the U.S. C3 CMV emissions in the c3marine sector. The projection factors for the othpt C3 CMV emissions vary by geographic and region as shown in Table 4-41. C3 CMV emissions in British Columbia were assigned as North Pacific, Ontario as Great Lakes, and all other eastern Canada provinces as East Coast.

Mexico point-format year-2018 inventories are used essentially as-is with only minor formatting changes. The othpt sector also includes point source offshore oil and gas drilling platforms that are beyond U.S. state-county boundaries in the Gulf of Mexico. EPA used emissions from the 2008NEIv2 point source inventory for both 2011 and 2018. EPA expects updated offshore oil and gas drilling emissions in the next version of the 2011 NEI (Version 2).

[39] These ratios were initially attempted by county/SCC7/mode/pollutant, but due to significantly different distributions of certain source types between EPA and TCEQ's emissions, this created unreasonable growth in certain areas. The above approach was used except in the following, relatively limited conditions. If a state/SCC7/mode/pollutant was in EPA 2018 and 2025 emissions but not in EPA's 2011 emissions, 2018 and 2025 EPA emissions were used in the final inventory. If a state/SCC7/mode/pollutant was in TCEQ's 2011 emissions but was not in EPA's 2018 and 2025 emissions, then state/SCC3/mode/pollutant ratios were used to project to 2018 and 2025.

4.5.2 Area, nonroad mobile and onroad mobile sources from Canada and Mexico (other, othon)

Both year-2006 Canada and year-2018 Mexico inventories were converted from their original SMOKE One-Record per Line (ORL) and Inventory Data Analyzer (IDA) formats, respectively, to SMOKE Flat File 10 (FF10) inventory format: http://www.cmascenter.org/smoke/documentation/3.5/html/ch08s02s07.html. Otherwise, these inventories were used as-is.

5 Emission Summaries

The following tables summarize emissions differences between the 2011 evaluation case, the 2018 base case, and the 2025 base case. 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 and onroad refueling (onroad_rfl) sector totals are post-SMOKE-MOVES totals, representing air quality model-ready emission totals, and the onroad portion include CARB emissions for California. The "c3marine-US" sector represents c3marine sector emissions with U.S. FIPS only; these extend to roughly 3-5 miles offshore and all U.S. waters in the Great Lakes and also include all U.S. ports. The "c3marine, EEZ component" represents all non-U.S. c3marine emissions that are within the (up to) 200 nautical mile Exclusive Economic Zone (EEZ) boundary but outside of U.S. state waters. Finally, the "c3marine, non-US non-EEZ component" represents all non-U.S. emissions outside of the (up to) 200nm offshore boundary, including all Canadian and Mexican c3marine emissions. The c3marine sector is discussed in Section 2.4.2. The "Off-shore othpt" sector is the non-Canada, non-Mexico component of the othpt sector – i.e., the offshore oil platform emissions from the 2008 NEI.

National emission totals by air quality model-ready sector are provided for all CAP emissions for the 2011 evaluation case in Table 5-1. The total of all sectors in the 2011 evaluation case are listed as "Con U.S. Total w/ ptfire". Table 5-2 provides national emissions totals by sector for all CAPs in the 2018 base case. Table 5-3 provides national emissions totals by sector for all CAPs in the 2025 base case.

Table 5-4 provides national-by sector emission summaries for CO for all the cases: 2011 evaluation case, 2018 base case, and 2025 base case, with percent change from 2011 to 2018 and 2011 to 2025. Table 5-5 through Table 5-10 provide the same summaries for NH_3, NO_X, $PM_{2.5}$, PM_{10}, SO_2 and VOC, respectively. Note that the same ptfire emissions are used in all cases.

Table 5-1. National by-sector CAP emissions summaries for the 2011 evaluation case

Sector	CO	NH3	NOX	PM10	PM2_5	SO2	VOC
afdust_adj				18,502,317	2,487,403		
ag		3,517,371					
c1c2rail	173,437	481	1,046,095	34,670	32,367	17,651	47,714
nonpt	3,046,375	142,323	832,166	715,709	533,248	392,638	3,792,612
np_oilgas	642,182	0	653,219	21,756	17,200	17,195	2,273,214
nonroad	13,952,389	2,627	1,630,409	162,420	154,660	4,031	2,024,633
onroad_adj	25,230,444	118,130	5,591,695	287,540	207,517	28,475	2,576,504
onroad_rfl							161,415
c3marine	12,425		124,725	4,279	3,909	38,645	4,954
ptfire	22,580,113	362,910	347,103	2,362,132	2,005,142	177,107	5,174,593
ptegu	719,414	21,644	1,925,742	259,011	188,811	4,596,656	32,288
ptegu_pk	8,662	425	21,941	2,159	1,886	28,476	783
ptnonipm	2,565,936	74,841	1,767,748	491,837	338,447	1,071,950	872,433
pt_oilgas	20,579	112	17,026	1,833	1,810	55,142	87,842
rwc	2,578,229	20,343	35,672	389,019	388,288	8,986	446,972
Con U.S. Total	**71,530,185**	**4,261,207**	**13,993,540**	**23,234,681**	**6,360,688**	**6,436,952**	**17,495,956**
Off-shore to EEZ*	130,419	0	610,664	16,961	15,525	133,606	81,286
Non-US SECA C3	17,169	0	202,516	17,199	15,823	127,563	7,297
Canada othar	2,810,350	386,147	462,996	810,747	248,907	61,179	932,322
Canada othon	3,303,239	17,572	392,209	11,075	7,712	4,046	199,939
Canada othpt**	560,661	15,543	369,993	65,782	39,828	825,675	157,170
Mexico othar	439,901	109,861	189,592	69,523	23,600	26,559	499,145
Mexico othon	423,978	3,247	76,880	7,593	6,970	1,413	73,888
Mexico othpt	116,609	0	414,399	137,512	101,884	828,418	83,838
Non-US Total	**7,802,326**	**532,370**	**2,719,249**	**1,136,392**	**460,249**	**2,008,459**	**2,034,885**

* "Offshore to EEZ" includes both the offshore point emissions, and the "Offshore to EEZ" c3marine emissions
** Canadian c3 emissions are included in "Canada othpt"

Table 5-2. National by-sector CAP emissions summaries for the 2018 base case

Sector	CO	NH3	NOX	PM10	PM2_5	SO2	VOC
afdust_adj				6,804,937	932,732		
ag		3,596,908					
c1c2rail	189,355	489	869,089	24,346	22,508	2,628	33,334
nonpt	3,058,148	142,384	847,975	720,106	536,477	304,514	3,634,506
np_oilgas	782,408	0	795,491	27,248	21,565	25,488	2,555,021
nonroad	12,377,375	2,900	1,071,612	107,005	100,949	1,868	1,360,554
onroad_adj	16,063,457	87,336	2,684,537	208,304	124,876	12,597	1,341,243
onroad_rfl							78,655
c3marine	17,518		136,147	2,338	2,129	5,354	6,678
ptfire	22,580,113	362,910	347,103	2,362,132	2,005,142	177,107	5,174,593
ptegu	748,085	39,366	1,434,376	249,897	194,123	1,424,574	38,701
ptegu_pk	11,253	439	9,959	248	215	3,432	315
ptnonipm	2,417,844	75,816	1,764,777	463,765	315,535	720,649	869,495
pt_oilgas	23,683	159	20,450	2,002	1,973	63,868	104,268
rwc	2,736,854	21,485	38,434	413,597	412,852	10,018	466,259
Con U.S. Total	**61,006,094**	**4,330,193**	**10,019,951**	**11,385,923**	**4,671,078**	**2,752,096**	**15,663,623**
Off-shore to EEZ*	146,323		635,570	9,630	8,841	18,746	88,045
Non-US SECA C3	23,318		246,579	23,327	21,462	173,124	9,896
Canada othar	2,810,350	386,147	462,996	810,747	248,907	61,179	932,322
Canada othon	3,303,239	17,572	392,209	11,075	7,712	4,046	199,939
Canada othpt	561,438	15,543	370,944	65,276	39,370	818,374	157,501
Mexico othar	527,917	109,840	226,341	70,916	47,191	19,286	577,078
Mexico othon	397,197	4,465	46,794	9,420	8,591	659	62,948
Mexico othpt	148,758		544,690	170,910	127,734	1,066,482	94,351
Non-US Total	**7,918,540**	**533,567**	**2,926,123**	**1,171,301**	**509,808**	**2,161,896**	**2,122,080**

Table 5-3. National by-sector CAP emissions summaries for the 2025 base case

Sector	CO	NH3	NOX	PM10	PM2_5	SO2	VOC
afdust_adj				6,848,008	940,823		
ag		3,676,962					
c1c2rail	208,308	487	666,150	17,188	15,835	1,228	24,012
nonpt	3,060,603	142,406	856,371	722,626	538,703	308,654	3,605,078
np_oilgas	866,014	0	874,359	29,135	23,493	26,761	2,550,615
nonroad	13,352,920	3,548	796,408	77,632	72,801	2,843	1,188,117
onroad_adj	12,540,692	86,413	1,491,639	181,686	91,249	11,843	1,004,875
onroad_rfl							55,129
c3marine	21,017		105,421	2,979	2,724	6,647	8,448
ptfire	22,580,113	362,910	347,103	2,362,132	2,005,142	177,107	5,174,593
ptegu	856,897	44,731	1,497,728	274,311	209,690	1,499,936	41,947
ptegu_pk	11,323	484	10,358	275	241	4,057	280
ptnonipm	2,480,398	75,640	1,802,732	472,733	322,368	751,697	881,162
pt_oilgas	24,742	196	22,370	2,093	2,061	69,621	106,744
rwc	2,932,569	22,924	41,716	443,780	443,021	11,373	489,136
Con U.S. Total	**58,935,596**	**4,416,700**	**8,512,357**	**11,434,578**	**4,668,151**	**2,871,765**	**15,130,136**
Off-shore to EEZ*	146,323		635,570	9,630	8,841	18,746	88,045
Non-US SECA C3	23,318		246,579	23,327	21,462	173,124	9,896
Canada othar	2,810,350	386,147	462,996	810,747	248,907	61,179	932,322
Canada othon	3,303,239	17,572	392,209	11,075	7,712	4,046	199,939
Canada othpt	561,438	15,543	370,944	65,276	39,370	818,374	157,501
Mexico othar	527,917	109,840	226,341	70,916	47,191	19,286	577,078
Mexico othon	397,197	4,465	46,794	9,420	8,591	659	62,948
Mexico othpt	148,758		544,690	170,910	127,734	1,066,482	94,351
Non-US Total	**7,918,540**	**533,567**	**2,926,123**	**1,171,301**	**509,808**	**2,161,896**	**2,122,080**

Table 5-4. National by-sector CO emissions (tons/yr) summaries and percent change

Sector	2011 CO	2018 CO	2025 CO	% change 2011 to 2018	% change 2011 to 2025
afdust_adj	0	0	0	0%	0%
ag	0	0	0	0%	0%
c1c2rail	230,407	243,619	262,605	6%	14%
c3marine	12,426	17,518	21,017	41%	69%
nonpt	3,046,776	3,058,568	3,061,022	0%	0%
nonroad	13,993,701	12,409,684	13,385,224	-11%	-4%
np_oilgas	642,179	782,405	866,011	22%	35%
onroad	25,230,442	16,063,457	12,540,692	-36%	-50%
pt_oilgas	22,217	25,493	26,544	15%	19%
ptegu	724,448	752,505	856,945	4%	18%
ptegu_pk	8,661	11,258	11,316	30%	31%
ptfire	22,584,187	22,580,113	22,580,113	0%	0%
ptnonipm	2,567,765	2,419,697	2,482,236	-6%	-3%
rwc	2,583,182	2,742,131	2,938,191	6%	14%
Grand Total	**71,646,391**	**61,106,449**	**59,031,918**	**-15%**	**-18%**
Off-shore to EEZ*	130,419	146,323	167,853	12%	29%
Non-US SECA C3	17,169	23,318	31,925	36%	86%
Canada othar	2,810,350	2,810,350	2,810,350	0%	0%
Canada othon	3,303,239	3,303,239	3,303,239	0%	0%
Canada othpt**	560,661	561,438	561,438	0%	0%
Mexico othar	439,901	527,917	527,917	20%	20%
Mexico othon	423,978	397,197	397,197	-6%	-6%
Mexico othpt	116,609	148,758	148,758	28%	28%
Non-US Total	**7,802,326**	**7,918,540**	**7,948,677**	**1%**	**1%**

Table 5-5. National by-sector NH_3 emissions (tons/yr) summaries and percent change

Sector	2011 NH3	2018 NH3	2025 NH3	% change 2011 to 2018	% change 2011 to 2025
afdust_adj	0	0	0	0%	0%
ag	3,522,231	3,601,811	3,681,929	2%	2%
c1c2rail	667	675	672	1%	1%
c3marine	0	0	0	0%	0%
nonpt	142,329	142,388	142,411	0%	0%
nonroad	2,616	2,886	3,528	10%	35%
np_oilgas	0	0	0	0%	0%
onroad	118,129	87,336	86,413	-26%	-27%
pt_oilgas	113	159	196	40%	73%
ptegu	21,947	39,548	44,644	80%	103%
ptegu_pk	428	436	480	2%	12%
ptfire	362,979	362,910	362,910	0%	0%
ptnonipm	74,781	75,754	75,578	1%	1%
rwc	20,402	21,549	22,992	6%	13%
Grand Total	**4,266,622**	**4,335,451**	**4,421,754**	**2%**	**4%**
Off-shore to EEZ*	0	0	0	0%	0%
Non-US SECA C3	0	0	0	0%	0%
Canada othar	386,147	386,147	386,147	0%	0%
Canada othon	17,572	17,572	17,572	0%	0%
Canada othpt**	15,543	15,543	15,543	0%	0%
Mexico othar	109,861	109,840	109,840	0%	0%
Mexico othon	3,247	4,465	4,465	38%	38%
Mexico othpt	0	0	0	0%	0%
Non-US Total	**532,370**	**533,567**	**533,567**	**0%**	**0%**

Table 5-6. National by-sector NO_x emissions (tons/yr) summaries and percent change

Sector	2011 NOx	2018 NOx	2025 NOx	% change 2011 to 2018	% change 2011 to 2025
afdust_adj	0	0	0	0%	0%
ag	0	0	0	0%	0%
c1c2rail	1,326,348	1,082,712	816,311	-18%	-38%
c3marine	124726	136,147	105,421	9%	-15%
nonpt	831,254	847,062	855,457	2%	3%
nonroad	1,620,552	1,067,278	795,064	-34%	-51%
np_oilgas	653214	795,488	874,356	22%	34%
onroad	5,591,694	2,684,537	1,491,639	-52%	-73%
pt_oilgas	22,091	25,970	27,885	18%	26%
ptegu	2,001,241	1,467,773	1,497,784	-27%	-25%
ptegu_pk	22,591	9,966	10,351	-56%	-54%
ptfire	347,109	347,103	347,103	0%	0%
ptnonipm	1,771,516	1,768,543	1,806,483	0%	2%
rwc	35,758	38,527	41,814	8%	17%
Grand Total	**14,348,094**	**10,271,108**	**8,669,670**	**-28%**	**-40%**
Off-shore to EEZ*	610,664	635,570	533,545	4%	-13%
Non-US SECA C3	202,516	246,579	296,490	22%	46%
Canada othar	462,996	462,996	462,996	0%	0%
Canada othon	392,209	392,209	392,209	0%	0%
Canada othpt**	369,993	370,944	370,944	0%	0%
Mexico othar	189,592	226,341	226,341	19%	19%
Mexico othon	76,880	46,794	46,794	-39%	-39%
Mexico othpt	414,399	544,690	544,690	31%	31%
Non-US Total	**2,719,249**	**2,926,123**	**2,874,009**	**8%**	**6%**

Table 5-7. National by-sector $PM_{2.5}$ emissions (tons/yr) summaries and percent change

Sector	2011 $PM_{2.5}$	2018 $PM_{2.5}$	2025 $PM_{2.5}$	% change 2011 to 2018	% change 2011 to 2025
afdust_adj	923,058	932,732	940,823	1%	2%
ag	0	0	0	0%	0%
c1c2rail	41,348	28,578	20,232	-31%	-51%
c3marine	3,910	2,129	2,724	-46%	-30%
nonpt	533,058	536,289	538,516	1%	1%
nonroad	154,053	100,522	72,568	-35%	-53%
np_oilgas	17,200	21,566	23,494	25%	37%
onroad	207,521	124,876	91,249	-40%	-56%
pt_oilgas	1,853	2,026	2,114	9%	14%
ptegu	193,877	199,191	209,695	3%	8%
ptegu_pk	1,884	215	241	-89%	-87%
ptfire	2,005,508	1,872,281	1,872,281	-7%	-7%
ptnonipm	339,398	316,128	322,957	-7%	-5%
rwc	389,086	413,700	443,924	6%	14%
Grand Total	**4,811,754**	**4,550,235**	**4,540,817**	**-5%**	**-6%**
Off-shore to EEZ*	15,525	8,841	11,594	-43%	-25%
Non-US SECA C3	15,823	21,462	6,411	36%	-59%
Canada othar	248,907	248,907	248,907	0%	0%
Canada othon	7,712	7,712	7,712	0%	0%
Canada othpt**	39,828	39,370	39,370	-1%	-1%
Mexico othar	23,600	47,191	47,191	100%	100%
Mexico othon	6,970	8,591	8,591	23%	23%
Mexico othpt	101,884	127,734	127,734	25%	25%
Non-US Total	**460,249**	**509,808**	**497,510**	**11%**	**8%**

Table 5-8. National by-sector PM_{10} emissions (tons/yr) summaries and percent change

Sector	2011 PM10	2018 PM10	2025 PM10	% change 2011 to 2018	% change 2011 to 2025
afdust_adj	6,726,726	6,804,937	6,848,008	1%	2%
ag	0	0	0	0%	0%
c1c2rail	43,930	30,603	21,719	-30%	-51%
c3marine	4,278	2,338	2,979	-45%	-30%
nonpt	715,771	720,171	722,692	1%	1%
nonroad	161,816	106,582	77,403	-34%	-52%
np_oilgas	21,753	27,249	29,136	25%	34%
onroad	287,541	208,304	181,686	-28%	-37%
pt_oilgas	1,885	2,062	2,153	9%	14%
ptegu	266,641	256,685	274,316	-4%	3%
ptegu_pk	2,161	247	275	-89%	-87%
ptfire	2,362,550	2,209,292	2,209,292	-6%	-6%
ptnonipm	495,912	466,201	475,323	-6%	-4%
rwc	389,815	414,444	444,683	6%	14%
Grand Total	**11,480,779**	**11,249,116**	**11,289,665**	**-2%**	**-2%**
Off-shore to EEZ*	16,961	9,630	12,648	-43%	-25%
Non-US SECA C3	17,199	23,327	7,033	36%	-59%
Canada othar	810,747	810,747	810,747	0%	0%
Canada othon	11,075	11,075	11,075	0%	0%
Canada othpt**	65,782	65,276	65,276	-1%	-1%
Mexico othar	69,523	70,916	70,916	2%	2%
Mexico othon	7,593	9,420	9,420	24%	24%
Mexico othpt	137,512	170,910	170,910	24%	24%
Non-US Total	**1,136,392**	**1,171,301**	**1,158,026**	**3%**	**2%**

Table 5-9. National by-sector SO_2 emissions (tons/yr) summaries and percent change

Sector	2011 SO_2	2018 SO_2	2025 SO2	% change 2011 to 2018	% change 2011 to 2025
afdust_adj	0	0	0	0%	0%
ag	0	0	0	0%	0%
c1c2rail	21,093	3,068	1,465	-85%	-93%
c3marine	38,645	5,354	6,647	-86%	-83%
nonpt	392,004	303,955	308,094	-22%	-21%
nonroad	4,010	1,861	2,845	-54%	-29%
np_oilgas	17,196	25,488	26,761	48%	56%
onroad	28,472	12,597	11,843	-56%	-58%
pt_oilgas	55,272	64,076	69,823	16%	26%
ptegu	4,636,758	1,443,845	1,500,061	-69%	-68%
ptegu_pk	28,584	3,433	4,058	-88%	-86%
ptfire	177,122	177,107	177,107	0%	0%
ptnonipm	1,071,820	720,578	751,617	-33%	-30%
rwc	9,003	10,033	11,388	11%	26%
Grand Total	**6,479,979**	**2,771,394**	**2,871,708**	**-57%**	**-56%**
Off-shore to EEZ*	133,606	18,746	24,872	-86%	-81%
Non-US SECA C3	127,563	173,124	43,084	36%	-66%
Canada othar	61,179	61,179	61,179	0%	0%
Canada othon	4,046	4,046	4,046	0%	0%
Canada othpt**	825,675	818,374	818,374	-1%	-1%
Mexico othar	26,559	19,286	19,286	-27%	-27%
Mexico othon	1,413	659	659	-53%	-53%
Mexico othpt	828,418	1,066,482	1,066,482	29%	29%
Non-US Total	**2,008,459**	**2,161,896**	**2,037,982**	**8%**	**1%**

Table 5-10. National by-sector VOC emissions (tons/yr) summaries and percent change

Sector	2011 VOC	2018 VOC	2025 VOC	% change 2011 to 2018	% change 2011 to 2025
afdust_adj	0	0	0	0%	0%
ag	0	0	0	0%	0%
c1c2rail	54,122	38,280	27,337	-29%	-49%
c3marine	4,954	6,678	8,448	35%	71%
nonpt	3,792,586	3,663,326	3,605,003	-3%	-5%
nonroad	2,049,724	1,374,906	1,197,404	-33%	-42%
np_oilgas	2,273,193	2,555,006	2,550,596	12%	12%
onroad	2,576,504	1,341,243	1,004,875	-48%	-61%
onroad_rfl	161,415	78,655	55,129	-51%	-66%
pt_oilgas	89,753	106,346	108,811	18%	21%
ptegu	32,376	39,228	41,948	21%	30%
ptegu_pk	783	313	280	-60%	-64%
ptfire	5,174,593	5,174,593	5,174,593	0%	0%
ptnonipm	872,643	869,688	881,341	0%	1%
rwc	447,599	466,927	489,848	4%	9%
Grand Total	**17,530,245**	**15,715,190**	**15,145,614**	**-10%**	**-14%**
Off-shore to EEZ*	81,286	88,045	97,216	8%	20%
Non-US SECA C3	7,297	9,896	13,550	36%	86%
Canada othar	932,322	932,322	932,322	0%	0%
Canada othon	199,939	199,939	199,939	0%	0%
Canada othpt**	157,170	157,501	157,501	0%	0%
Mexico othar	499,145	577,078	577,078	16%	16%
Mexico othon	73,888	62,948	62,948	-15%	-15%
Mexico othpt	83,838	94,351	94,351	13%	13%
Non-US Total	**2,034,885**	**2,122,080**	**2,134,905**	**4%**	**5%**

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APPENDIX I

Public Participation Process Documentation

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LEGAL NOTICE OF PUBLIC HEARING

Redesignation and Maintenance Plan in association with the 2008 8-Hour Ozone Standard for Lawrenceburg Township, Dearborn County, Indiana

Notice is hereby given under 40 CFR 51.102 that the Indiana Department of Environmental Management (IDEM) is accepting written comment and providing an opportunity for a public hearing regarding the Draft Redesignation Petition and Maintenance Plan in association with the 2008 8-hour ozone standard, for Lawrenceburg Township, Dearborn County, Indiana. All interested persons are invited and will be given reasonable opportunity to express their views concerning the submittal of the draft Redesignation Petition and Maintenance Plan.

Lawrenceburg Township, located in Dearborn County, Indiana, is part of the Cincinnati OH-KY-IN 2008 8-Hour Ozone Nonattainment Area. This area was designated as a "marginal" nonattainment area and subject to the requirements of Section 172 of the Clean Air Act (CAA). One of the compliance requirements mandated by Section 172(c) of the CAA is the development of a plan demonstrating that the area will meet the federal 8-hour air quality standard by the required attainment date. This Redesignation and Maintenance Plan is being drafted and submitted consistent with United States Environmental Protection Agency (U.S. EPA) guidance.

Copies of the draft documents will be available on or before September 3, 2015, to any person upon request at the following locations:

- Indiana Department of Environmental Management, Office of Air Quality, Indiana Government Center North, 100 North Senate Avenue, Room N1003, Indianapolis, Indiana

- Indiana Department of Environmental Management, Southeast Regional Office, 820 West Sweet Street, Brownstown, Indiana

- Lawrenceburg Public Library, 150 Mary Street, Lawrenceburg, Indiana

- Lawrenceburg City Building, 230 Walnut Street, Lawrenceburg, Indiana

The draft documents will also be available on the following web page:

http://www.in.gov/idem/airquality/2402.htm

Any person may submit written comments on the SIP revision and Technical Support Document in association with the Draft Redesignation Petition and Maintenance Plan in association with the 2008 8-hour ozone standard, for Lawrenceburg Township, Dearborn County, Indiana. Written comments should be directed to:

Mrs. Michele Boner
Indiana Department of Environmental Management
Office of Air Quality, Room 1003
100 North Senate Avenue
Indianapolis, Indiana 46204

Comments can also be submitted via fax (317) 233-5967 or e-mail at mboner@idem.IN.gov. Comments must be submitted by October 21, 2015. Interested parties may also present oral or written comments at the public hearing, if held. Oral statements will be heard, but for the accuracy of the record, statements should be submitted in writing. Written statements may be submitted to the attendant designated to receive written comments at the public hearing.

A public hearing on the Draft Redesignation Petition and Maintenance Plan in association with the 2008 8-hour ozone standard, for Lawrenceburg Township, Dearborn County, Indiana will be held if a public hearing request is received by October 7, 2015. If a hearing is requested, the hearing will be held on October 14, 2015. The hearing will convene at 6:00 p.m. local time in the Lawrenceburg Public Library, Ewbank Meeting Rooms 1 & 2, 150 Mary Street, Lawrenceburg, Indiana. If a request for a public hearing is not received by October 7, 2015, the hearing will be cancelled. Interested parties can check the online IDEM calendar at http://www.in.gov/activecalendar/EventList.aspx or contact Mrs. Michele Boner at (317) 233-6844, after October 7, 2015, to see if the hearing has been cancelled or will convene.

A transcript of the hearing and all written submissions provided at the public hearing shall be open to public inspection at IDEM and copies may be made available to any person upon payment of reproduction costs. Any person heard or represented at the hearing or requesting notice shall be given written notice of actions resulting from the hearing.

For additional information contact Mrs. Michele Boner, at the Indiana Department of Environmental Management, Office of Air Quality, Room N1003, Indiana Government Center North, 100 North Senate Avenue, Indianapolis, IN 46204 or call (317) 233-6844 or (800) 451-6027 ext. 3-6844 (in Indiana).

Speech and hearing impaired callers may contact the agency via the Indiana Relay Service at 1-800-743-3333.

INDIANA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
We Protect Hoosiers and Our Environment.
100 N. Senate Avenue • Indianapolis, IN 46204
(800) 451-6027 • (317) 232-8603 • www.idem.IN.gov

Michael R. Pence
Governor

Carol S. Comer
Commissioner

September 1, 2015

CERTIFICATE OF PUBLICATION

This is to certify that the Indiana Department of Environmental Management (IDEM) Notice of the opportunity for a Public Hearing regarding the following:

- DRAFT Request for Redesignation and Maintenance Plan for Ozone Attainment in the Indiana Portion of the Cincinnati-Hamilton, Ohio, Kentucky, Indiana (OH-KY-IN) 2008 8-Hour Ozone Nonattainment Area

was published on IDEM's web site on September 1, 2015. It is expected that it will remain posted on the site until at least October 21, 2015.

The notice in full was also available online at the following web address, under "Southeastern".

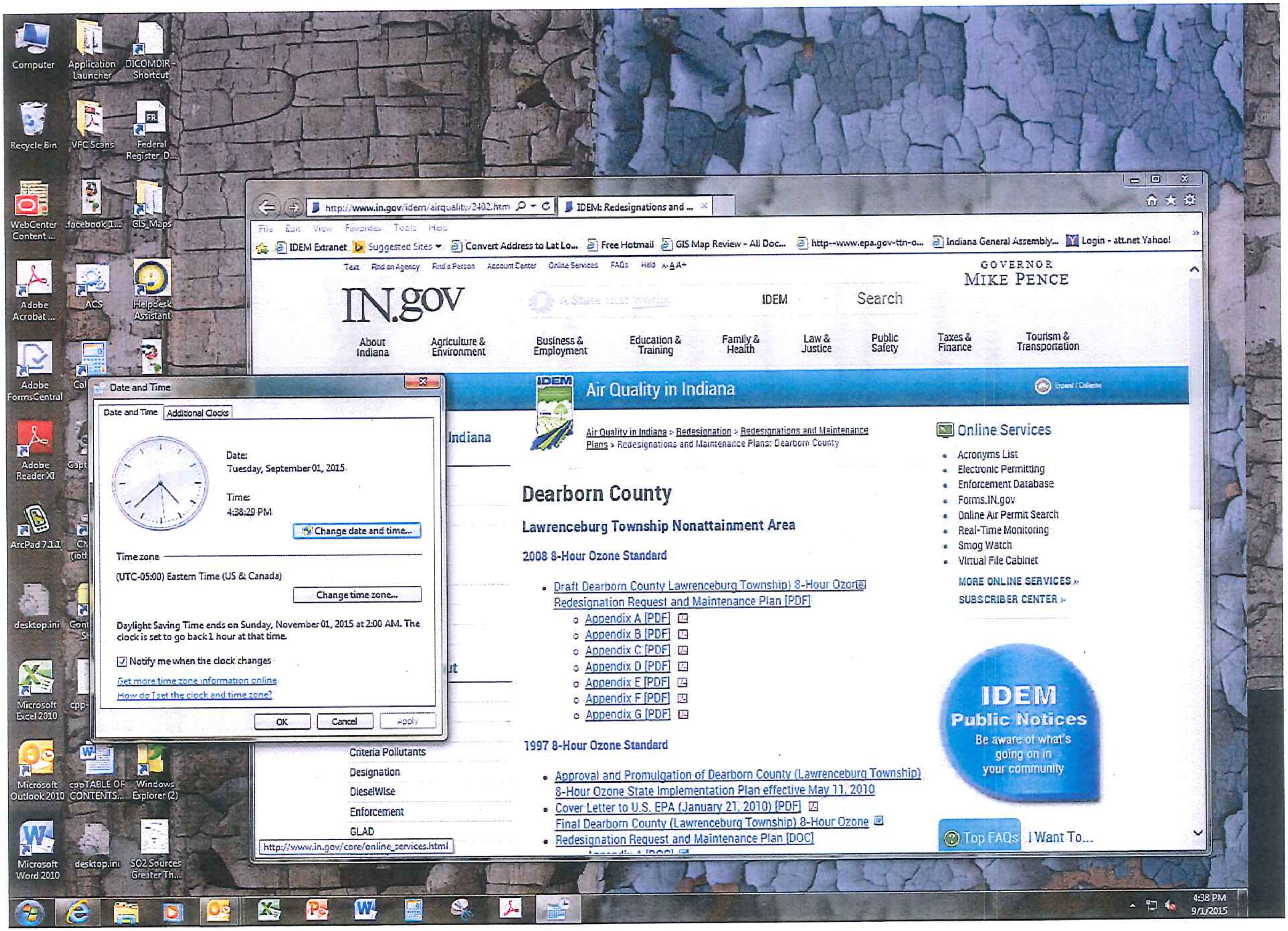
http://www.in.gov/idem/5474.htm

Web publication of the notice was at the request of Scott Deloney, Branch Chief, Programs Branch, Office of Air Quality, IDEM.

By:

Mike Finklestein
IDEM Webmaster

Attachments:
Copy of web page as published.



http://www.in.gov/idem/airquality/2402.htm
IDEM: Redesignations and ...
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Air Quality in Indiana
Air Quality in Indiana > Redesignation > Redesignations and Maintenance Plans > Redesignations and Maintenance Plans: Dearborn County
Dearborn County
Lawrenceburg Township Nonattainment Area
2008 8-Hour Ozone Standard
Draft Dearborn County Lawrenceburg Township) 8-Hour Ozone Redesignation Request and Maintenance Plan [PDF]
Appendix A [PDF]
Appendix B [PDF]
Appendix C [PDF]
Appendix D [PDF]
Appendix E [PDF]
Appendix F [PDF]
Appendix G [PDF]
1997 8-Hour Ozone Standard
Approval and Promulgation of Dearborn County (Lawrenceburg Township) 8-Hour Ozone State Implementation Plan effective May 11, 2010
Cover Letter to U.S. EPA (January 21, 2010) [PDF]
Final Dearborn County (Lawrenceburg Township) 8-Hour Ozone Redesignation Request and Maintenance Plan [DOC]
Online Services
Acronyms List
Electronic Permitting
Enforcement Database
Forms.IN.gov
Online Air Permit Search
Real-Time Monitoring
Smog Watch
Virtual File Cabinet
MORE ONLINE SERVICES »
SUBSCRIBER CENTER »
IDEM
Public Notices
Be aware of what's going on in your community
Top FAQs
I Want To...
Criteria Pollutants
Designation
DieselWise
Enforcement
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http://www.in.gov/core/online_services.html
Date and Time
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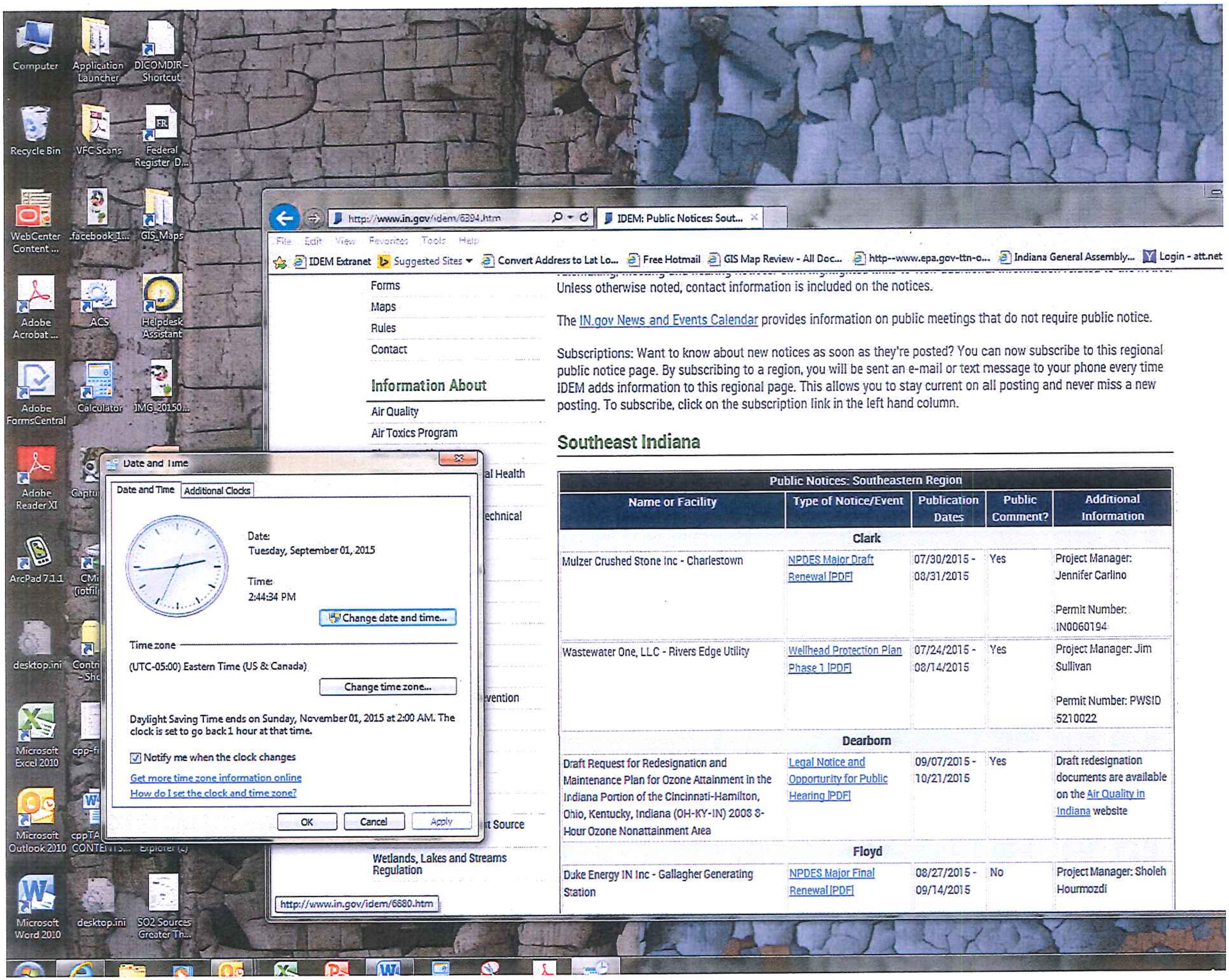
Date:
Tuesday, September 01, 2015
Time:
4:38:29 PM
Change date and time...
Time zone
(UTC-05:00) Eastern Time (US & Canada)
Change time zone...
Daylight Saving Time ends on Sunday, November 01, 2015 at 2:00 AM. The clock is set to go back 1 hour at that time.
Notify me when the clock changes
Get more time zone information online
How do I set the clock and time zone?
OK
Cancel
Apply
4:38 PM
9/1/2015



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Forms
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Unless otherwise noted, contact information is included on the notices.

The IN.gov News and Events Calendar provides information on public meetings that do not require public notice.

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Southeast Indiana

Public Notices: Southeastern Region

Name or Facility	Type of Notice/Event	Publication Dates	Public Comment?	Additional Information
Clark				
Mulzer Crushed Stone Inc - Charlestown	NPDES Major Draft Renewal [PDF]	07/30/2015 - 08/31/2015	Yes	Project Manager: Jennifer Carlino Permit Number: IN0060194
Wastewater One, LLC - Rivers Edge Utility	Wellhead Protection Plan Phase 1 [PDF]	07/24/2015 - 08/14/2015	Yes	Project Manager: Jim Sullivan Permit Number: PWSID 5210022
Dearborn				
Draft Request for Redesignation and Maintenance Plan for Ozone Attainment in the Indiana Portion of the Cincinnati-Hamilton, Ohio, Kentucky, Indiana (OH-KY-IN) 2008 8-Hour Ozone Nonattainment Area	Legal Notice and Opportunity for Public Hearing [PDF]	09/07/2015 - 10/21/2015	Yes	Draft redesignation documents are available on the Air Quality in Indiana website
Floyd				
Duke Energy IN Inc - Gallagher Generating Station	NPDES Major Final Renewal [PDF]	08/27/2015 - 09/14/2015	No	Project Manager: Sholeh Hourmozdi

Wetlands, Lakes and Streams Regulation

http://www.in.gov/idem/6680.htm

Date and Time

Date and Time | Additional Clocks

Date:
Tuesday, September 01, 2015

Time:
2:44:34 PM

Change date and time...

Time zone

(UTC-05:00) Eastern Time (US & Canada)

Change time zone...

Daylight Saving Time ends on Sunday, November 01, 2015 at 2:00 AM. The clock is set to go back 1 hour at that time.

Notify me when the clock changes

Get more time zone information online

How do I set the clock and time zone?

OK | Cancel | Apply