Technical Support Document: Preparation of Emissions Inventories For the 2002-based Platform, Version 3, Criteria Air Pollutants

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TABLE OF CONTENTS

Acronyms

BEIS	Biogenic Emissions Inventory System
CAIR	Clean Air Interstate Rule
CAMD	EPA's Clean Air Markets Division
CAP	Criteria Air Pollutant
CEM	Continuous Emissions Monitoring
CHIEF	Clearinghouse for Inventories and Emissions Factors
CMAQ	Community Multiscale Air Quality model
CMV	Commercial marine vessel
CO	Carbon monoxide
EGU	Electric generating units
EPA	Environmental Protection Agency
EMFAC	Emission Factor (California's onroad mobile model)
FAA	Federal Aviation Administration
FIPS	Federal Information Processing Standards
GF	Growth factor
HAP	Hazardous Air Pollutant
IPM	Integrated Planning Model
ITN	Itinerant
MOBILE	OTAQ's model for estimation of onroad mobile emissions factors
NEEDS	National Electric Energy Database System
NEI	National Emission Inventory
NESHAP	National Emission Standards for Hazardous Air Pollutants
NH_3	Ammonia
NMIM	National Mobile Inventory Model
NONROAD	OTAQ's model for estimation of nonroad mobile emissions
NO_X	Nitrogen oxides
OAQPS	EPA's Office of Air Quality Planning and Standards
OTAQ	EPA's Office of Transportation and Air Quality
ORD	EPA's Office of Research and Development
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
RIA	Regulatory Impact Analysis
RPO	Regional Planning Organization
SCC	Source Classification Code
SMOKE	Sparse Matrix Operator Kernel Emissions
SO_2	Sulfur dioxide
TAF	Terminal Area Forecast
TCEQ	Texas Commission on Environmental Quality
TSD	Technical support document
VOC	Volatile organic compounds
VMT	Vehicle miles traveled
WRAP	Western Regional Air Partnership

List of Tables

List of Figures

List of Appendices

1 Introduction

The U.S. Environmental Protection Agency (EPA), hereto referred to as "we," has developed a 2002-based air quality modeling platform. This document describes the emissions inventory and emissions modeling for this platform for Criteria Air Pollutants (CAPs). This is the 2002 Platform version 3 (v3), because the emission inventories we used are primarily from v3 of the 2002 National Emission Inventory (NEI) (http://www.epa.gov/ttn/chief/eiinformation.html). From this point on, we refer to it simply as the "2002 Platform." This document describes the approach and data used to produce the emission inputs to the air quality model. The air quality modeling, meteorological inputs and boundary conditions will be described in separate volumes of a 2002 Platform report, which, when completed, will be posted on www.epa.gov/ttn/scram. A multi-pollutant version of the 2002 Platform, which includes hazardous air pollutants (HAPs) in addition to CAPs, will also be available as a separate volume at the above address.

The 2002 Platform for CAPs uses the Community Multiscale Air Quality (CMAQ) model (http://www.epa.gov/AMD/CMAQ/) for the purposes of modeling ozone (O3) and particulate matter (PM). The version of CMAQ we used requires hourly and gridded emissions of species from the following inventory pollutants: carbon monoxide (CO), nitrogen oxides (NO_X), volatile organic compounds (VOC), sulfur dioxide (SO_2), ammonia (NH_3), particulate matter less than or equal to 10 microns (PM_{10}), and individual component species for particulate matter less than or equal to 2.5 microns ($PM_{2.5}$).

The effort to create the emission inputs for the 2002 Platform included

(1) development of emission inventories for a 2002 model evaluation case,
(2) development of emission inventories for a 2002 base case and projected years consistent with that base,
(3) updates to the emissions modeling tools,
(4) updates to the emissions modeling ancillary files used with the tools, and
(5) execution of the tools.

The primary emissions modeling tool used to create the CMAQ model-ready emissions was the Sparse Matrix Operator Kernel Emissions (SMOKE) modeling system. We used this tool to create emissions files for a 36 km national grid, a 12 km Eastern grid and a 12 km Western grid for the following cases:

- 2002 evaluation
- 2002 base case
- 2009 base case
- 2014 base case
- 2020 base case
- 2030 base case

The differences between the 2002 evaluation and the 2002 base case are that the evaluation case uses 2002-specific fire emissions and 2002-specific continuous emission monitoring (CEM) data for electric generating units (EGUs), whereas the 2002 base case includes an average 2002 scenario for fires and EGUs for which future years can be compared.

The 2002 Platform builds upon the concepts, tools and emissions modeling data from EPA's 2001 Platform, which was most recently developed for the Regulatory Impact Analyses for the National Ambient Air Quality Standards for Particle Pollution (EPA, 2006a), referred to here as "PM NAAQS." An earlier version of the 2001 Platform was used for the Clean Air Interstate Rule Analysis (EPA, 2005a), referred to here as "CAIR." This document references emissions documentation for the PM NAAQS and CAIR and highlights the similarities and differences between the latest version of the 2001 Platform and the 2002 Platform.

This volume contains five sections and several appendices. Section 2 describes the 2002 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 projection year inventories. Section 5 provides references. Appendices A through J provide additional details about specific technical methods and emissions data summaries.

Electronic copies of the data used with SMOKE for the CAP 2002 Platform are available at the emissions modeling clearinghouse, http://www.epa.gov/ttn/chief/emch/, under the section entitled "CAP 2002-Based Platform, Version 3." This is referred to as the "2002v3CAP site" throughout this document.

2 2002 emission inventories and approaches

Section 2 describes the 2002 emissions data created for input to SMOKE. The primary basis for the 2002 emission inputs for the 2002 Platform is the 2002 National Emission Inventory (NEI), which includes emissions of CO, NO_X, VOC, SO_2, NH_3, PM_{10}, and $PM_{2.5}$ as well as hazardous air pollutants (HAPs). The HAP emissions are part of the 2002 multi-pollutant (CAP+HAP) component of the 2002 Platform; as described earlier, this multi-pollutant component will be documented in a separate volume of the 2002 Platform report.

Documentation for the 2002 NEI can be found at: http://www.epa.gov/ttn/chief/net/2002inventory.html#documentation. Version 3 of the 2002 NEI was used for the 2002 Platform. For inventories outside of the United States, which include Canada, Mexico and offshore emissions, we used the latest available base-year inventories that also had consistent future-year inventories.

The 2002 NEI includes five sectors: nonpoint (formerly called "stationary area") sources, point sources, nonroad mobile sources, onroad mobile sources, and fires. The fires portion of the inventory includes emissions from wildfires and prescribed burning computed as hour-specific point sources. For purposes of preparing the CMAQ-ready emissions, we split the 2002 emissions inventory into several additional "platform" sectors for use in emissions modeling, and we added biogenic emissions and emissions from sources other than the NEI such as the Canadian, Mexican and offshore inventories. The significance of an emissions modeling or "platform" sector is that it is run through all of the SMOKE programs except the final merge (Mrggrid) independently from the other sectors. The final merge program combines the sector-specific gridded, speciated and temporalized emissions together to create the CMAQ emission inputs.

Table 2-1 presents the sectors in the 2002 Platform for CAPs. The sector abbreviations are provided in italics; these abbreviations are used in the SMOKE modeling scripts and inventory file names, and throughout the remainder of this document. We did not use all sectors for all modeling cases; in particular, we used the ptfire and nonptfire platform sectors only for the 2002 model performance evaluation. We used the avefire platform sector for all modeling cases except for the model performance evaluation. The rationale for using average fires in the 2002 base case and future-year cases rather than the 2002 year-specific fires (ptfire and nonptfire) is described in Section 2.3.3.

Table 2-1. Platform sectors used in emissions modeling for the CAP 2002 Platform

PLATFORM SECTOR	2002 NEI SECTOR	Description and resolution of the data input to SMOKE
IPM sector: ***ptipm***	Point	NEI point source EGUs mapped to the Integrated Planning Model (IPM) model using the National Electric Energy Database System (NEEDS) database. Hourly files for continuous emission monitoring (CEM) sources are included only for the 2002 evaluation case. Day-specific emissions for non-CEM sources created for input into SMOKE.
Non-IPM sector: ***ptnonipm***	Point	All NEI point source records not matched to the ptipm sector, annual resolution.
Point source fire sector: ***ptfire***	Fires	Point source day-specific wildfires and prescribed fires for 2002. This sector used only for the 2002 evaluation case.
Nonpt fire sector: ***nonptfire***	Fires and Nonpoint	Prescribed fires for 2002 for which day-specific data were not available, county and annual resolution. This sector used only for the 2002 evaluation case.
Average-fire sector: ***avefire***	NA	Average-year wildfire and prescribed fire emissions derived from the 2001 Platform avefire sector, county and annual resolution. Used for the 2002 base year and the future base model runs, but not for the model evaluation case.
Agricultural sector: ***ag***	Nonpoint	NH_3 emissions from NEI nonpoint livestock and fertilizer application sources, county and annual resolution.
Area fugitive dust sector: ***afdust***	Nonpoint	PM_{10} and $PM_{2.5}$ from fugitive dust sources from the NEI nonpoint inventory (e.g., building construction, road construction, paved roads, unpaved roads, agricultural dust), county and annual resolution.
Remaining nonpoint sector: ***nonpt***	Nonpoint	All nonpoint sources not otherwise included in other SMOKE sectors, county and annual resolution.
Nonroad sector: ***nonroad***	Mobile: Nonroad	Monthly nonroad emissions from the National Mobile Inventory Model (NMIM) using NONROAD2005, other than for California. Monthly emissions for California created using annual emissions submitted by the California Air Resources Board (CARB) for the 2002 NEI.
Aircraft, locomotive, marine: ***alm***	Mobile: Nonroad	Aircraft, locomotive, commercial marine vessel emissions sources, county and annual resolution.

PLATFORM SECTOR	2002 NEI SECTOR	Description and resolution of the data input to SMOKE
Onroad: *onroad*	Mobile: onroad	Monthly onroad emissions from NMIM using MOBILE6, other than for California. Monthly emissions for California created using annual emissions submitted by CARB for the 2002 NEI.
Biogenic: *biog*	NA	Hour-specific, grid cell-specific emissions generated from the BEIS3.13 model (includes emissions in Canada and Mexico).
Other point sources not from the NEI: *othpt*	NA	Point sources from Canada's 2000 inventory, Mexico's 1999 inventory, and offshore point sources from the 2001 platform, annual resolution.
Other nonpoint and nonroad not from the NEI: *othar*	NA	Canada (province resolution) and Mexico (municipio resolution) nonpoint and nonroad mobile inventories, annual resolution.
Other onroad sources not from the NEI: *othon*	NA	Canada (province resolution) and Mexico (municipio resolution) onroad mobile inventories, annual resolution.

Annual emission summaries for 2002 and the future years covered by this platform are provided in Section 4. Table 4-1 provides a summary of 2002 Platform emissions for the U.S. anthropogenic sectors (i.e., excluding biogenic emissions). Table 4-2 provides a summary of emissions for the anthropogenic sectors containing Canadian, Mexican and offshore sources.

The emission inventories for input to SMOKE for the 2002 base and evaluation case are available at the 2002v3CAP site under the link "Data Files" (see "2002emis"directory). The "readme" file provided indicates the particular zipped files associated with each platform sector.

The remainder of Section 2 provides details of the data contained in each of the sectors. Different levels of detail are provided for different sectors depending upon the availability of reference information for the data, the degree of changes or manipulation of the data needed for preparing it for input to SMOKE, and errors discovered after emissions modeling was completed.

2.1 2002 Point sources (ptipm 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 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).

We created two platform sectors from the 2002 point source NEI, v3 for input into SMOKE: the Integrated Planning Model (IPM) sector (ptipm) and the non-IPM sector (ptnonipm). The ptnonipm emissions were provided to SMOKE as annual emissions. The ptipm were provided as hourly emissions data for CEM sources and as day-specific emissions for non-CEM sources. We further describe the approach for creating the day-specific non-CEM emissions in Section 2.1.1.

Documentation for the development of the point source NEI is at:
http://www.epa.gov/ttn/chief/net/2002inventory.html#documentation

The changes made to the NEI point sources prior to modeling are as follows:

- The tribal data, which do not use state/county Federal Information Processing Standards (FIPS) codes in the NEI, but rather use the tribal code, were assigned a FIPS code of 88XXX, where XXX is the 3-digit tribal code in the NEI. We made this change because SMOKE requires the state/county FIPS code.
- We defaulted stack parameters for some point sources when modeling in SMOKE. SMOKE uses an ancillary file, called the PSTK file, which provides default stack parameters by SCC code to either gap fill stack parameters if they are missing in the NEI or to correct stack parameters if they are outside the ranges hard-coded in SMOKE for acceptable values. The SMOKE PSTK file is contained in the ancillary file directory of the 2002v3CAP site (http://www.epa.gov/ttn/chief/emch/).
- We applied a transport fraction to all SCCs that we identified as PM fugitive dust, to prevent the overestimation of fugitive dust impacts in the grid modeling as described in Section 2.2.1.

The point source file was separated into ptipm and ptnonipm sectors to facilitate the use of different SMOKE temporal processing techniques and future year projection techniques for these sectors. These sectors are described in the following subsections.

2.1.1 IPM sector (ptipm)

This sector contains emissions from EGUs in the 2002 NEI that we were able match to the 2006 NEEDS database (http://www.epa.gov/airmarkets/progsregs/epa-ipm/index.html), which is used by the IPM, version 3.0. The IPM model provides future year emission inventories for the universe of EGUs contained in the NEEDS database. As described below, this matching was done in order to (1) provide consistency between the 2002 EGU sources and future year EGU emissions for sources which are forecasted by IPM and (2) avoid double counting in projecting point source emissions.

The 2002 NEI point source inventory contains emissions estimates for both EGU and non-EGU sources. The IPM is used to predict the future year emissions for the EGU sources. The remaining non-EGU point sources are projected by applying projection and control factors to the base year emissions. It was therefore necessary to identify and separate into separate sectors all sources that are projected via the IPM from those that are not. This procedure prevents double-counting or dropping significant emissions in creating the future-year emissions. The matching process relies on imperfect data; consequently, we experienced a small degree of dropped and/or double-counted emissions for sources that we could not match. We believe that the unmatched units are small because we have reviewed both the NEI and the NEEDS database to ensure that all significant EGUs have been captured in the matching process.

Methodology to split the EGU from the non-EGU sources

Because the IPM v3.0 units are based on the 2006 NEEDS database, we also used this NEEDS database to identify the set of EGUs in the 2002 NEI point source data to assign to the ptipm sector. Because of the inconsistencies in identification information for EGU units in the various available data sets, we performed an extensive analysis to link the NEEDS units to the NEI for the purpose of splitting the 2002 NEI file into ptipm and ptnonipm sectors. The available data sets include the 2006 NEEDS, the EPA's Clean Air Markets Division (CAMD) hourly CEM program data and the 2002 NEI. The 2002 NEI point source file includes ORIS Plant IDs and CAMD Boiler IDs for most of the EGUs, to indicate where substitution of hourly CEM emissions can be reliably performed. However, many of the smaller emitters in CAMD's hourly CEM programs are not identified by ORIS Plant IDs in the 2002 NEI, due to uncertainties in source identification and inconsistencies in the way a unit is defined between the NEI and CAMD datasets. In addition, the NEEDS database includes a larger universe of many smaller emitting EGUs, which are not included in the CAMD hourly CEM programs.

The first step in the process to link the NEEDS units to the NEI was to identify all sources in the NEI that might potentially be IPM/NEEDS units. This included any sources in the NEI with an ORIS Plant ID or Boiler ID or any facilities or units with an SIC or NAICS code that indicated electrical generation. We also performed a manual search of the NEI (using plant names, and any other helpful information in NEEDS and NEI, such as county) for any NEEDS units with significant generating capacities that were not already matched to the NEI. We performed the manual search task to account for any large NEEDS generators that may be a cogeneration unit located within an industrial (not a primarily electric generating station) facility.

We then built a table of CAP emissions totals for all emission units identified in the previous steps to perform the actual tagging of units as "ptipm" sources. In addition to unit-level emissions sums, this table also included the number of different SCCs at the unit and the first and last SCC codes (as sorted in ascending order) for each unit. The following procedures were used to flag the units for inclusion in the ptipm sector:

(1) We compared the NEI ORIS Plant IDs and CAMD Unit IDs to the IDs in the NEEDS database (note that we only included NEEDS units with a start year of 2002 or earlier since post-2002 NEEDS units would not be reflected in the 2002 NEI). Units that matched were included in the ptipm sector.

(2) We manually matched NEI units that had large 2002 NO_X and SO_2 emissions with units in the NEEDS database using facility names, county locations, fuel and size as indicators. Those units that matched the NEEDS data using these fields were included in the ptipm sector. For example, we matched one large NEI emitter with an SCC indicating it was burning petroleum coke to a NEEDS unit described as a "Coal Steam" unit.

(3) We assigned NEI units which had SCC codes that are not associated with combustion processes covered by IPM to the ptnonipm sector. We further checked that the NEI NO_X and SO_2 emissions at these units were low emissions, to give further confidence to our ptnonipm assignment. For example, any cooling towers, coal storage pile fugitives, or mining operations at a facility with EGU boilers were *not* put into the ptipm sector, because IPM does not provide emissions projections for such units. Similarly, we also assigned any NEI units where the SCCs and emissions indicated they were generating electricity from the combustion of landfill gas to the ptnonipm sector, because IPM does not provide emissions projections for such units. We assigned units burning municipal waste or biomass to the ptnonipm sector for the same reason.

(4) We further reviewed the NEI units that remained unassigned after the above steps to identify those units with the largest NO_X emissions or with any combustion-related SCCs. After manually reviewing these individually, we found that the largest emitting such units were IPM-related, and flagged them to be included in the ptipm sector.

The above review identified a few significant ptipm units that would not have been noted otherwise. In particular, some NEI units with large emissions and clear indications that they were EGUs did not appear in the NEEDS database, presumably because they had shut down after 2002 and before the 2006 date-of-record used for NEEDS. These units were included in the ptipm sector, so that their 2002 emissions would not be projected for future years as part of the ptnonipm sector. In addition to the industrial cogeneration units already matched to NEEDS, we found a few large NEI emitters with Industrial Process-related SCCs, i.e., their SCC codes began with 399 or 301900; these were confirmed to be EGU boilers with matching NEEDS entries, and thus were included in the ptipm sector. We determined two other such large emitting units with similar SCCs to be blast furnace flares which we assigned to the ptnonipm sector.

During the review of the industrial cogeneration units in NEEDS, we could sometimes identify the associated NEI facility, but not a specific emissions unit at that facility matching a NEEDS unit. In such cases, the NEEDS unit was excluded from the future-year ptipm sector emissions, and the entire NEI facility was included in the ptnonipm sector.

Creation of temporally resolved emissions for the ptipm sector

Another reason we separated out the ptipm sources was due to the difference in the temporal resolution of the data input to SMOKE. The ptipm sector used the available hourly CEM data in a manner that is an improvement over past platforms. For sources with CEMs, we used the actual hourly CEM data for the 2002 evaluation case. The hourly CEM data were obtained from the CAMD Data and Maps website[2]. The SMOKE modeling system matches the ORIS facility and Boiler IDs in the NEI ORL file to the same fields in the CEM data. This allowed us to use the hourly SO_2 and NO_X CEM emissions directly from the CEM data file. We used the heat input from the hourly CEM data to allocate the NEI annual values for all other pollutants from CEM sources, because hourly data for these other pollutants are not available with the hourly CEM.

For sources not matching the CEM data ("non-CEM" sources), we computed daily emissions from the NEI annual emissions using a standard query language (SQL) program and state-average CEM data. To allocate annual emissions to each month, we created state-specific, three-year averages of 2001-2003 CEM data. These average annual-to-month factors were assigned to non-CEM sources by state. To allocate the monthly emissions to each day, we used the 2002 CEM data to compute state-specific month-to-day factors, averaged across all units in each state. The resulting daily emissions were input into SMOKE. The daily-to-hourly allocation was performed in SMOKE using diurnal profiles. The development of these diurnal ptipm-specific profiles, which are considered ancillary data for SMOKE, is described in Section 3.3.3.

[2] http://camddataandmaps.epa.gov/gdm/index.cfm?fuseaction=prepackaged.progressresults_smoke

For the 2002 base case we do not use year-specific CEM data, and for future-year scenarios, there are no CEM data available for specific units. Thus, for the base and future-year cases, we used the above procedures (i.e., same procedures as "non-CEM" sources) for computing daily emissions for input to SMOKE for all ptipm sources.

2.1.2 Non-IPM sector (ptnonipm)

The non-IPM (ptnonipm) sector contains all 2002 NEI point sources that we did not include in the IPM (ptipm) sector[3]. The ptnonipm sector contains fugitive dust PM emissions from vehicular traffic on paved or unpaved roads at an industrial facility or coal handling at a coal mine[4]. Prior to input to SMOKE, we adjusted the fugitive dust PM emissions by applying county-specific fugitive dust transportable fraction factors (less than 1). This is discussed further in Section 2.2.1.

For some geographic areas, some of the sources in the ptnonipm sector belong to source categories that are contained in other sectors. This occurs in the inventory when states, tribes or local programs report certain inventory emissions as point sources because they have specific geographic coordinates for these sources. They may use point source SCCs (8-digit) or non-point, onroad or nonroad (10-digit) SCCs. In the 2002 NEI, examples of these types of sources include: onroad vehicular travel at a ski resort in California, equipment emissions at ski resort in California, airport ground support emissions in Minnesota, and aircraft emissions, gas stations and livestock (i.e., animal husbandry) in a number of locations.

We reviewed these sources to determine whether there were any cases for which the emissions were double counted with those in other sectors. Except for the airport ground support emissions in Minnesota (shown in Table 2-2), we did not double count any other emissions. The double-counted airport ground support emissions are very small, representing less than 0.05 % of the ptnonipm sector nationally (less than 1% in Minnesota) for all pollutants other than CO. The percent double counted for CO for the ptnonipm sector is 0.24% nationally (17% in Minnesota). Considering all sectors, the double counted CO is only 0.38% of CO emissions in Minnesota.

Table 2-2. Airport Ground Support Equipment Emissions in ptnonipm (double counted)

	VOC [tons/yr]	NO_X [tons/yr]	CO [tons/yr]	NH3 [tons/yr]	SO_2 [tons/yr]	PM2.5 [tons/yr]	PM10 [tons/yr]
ptnonipm airport ground support emissions (occurring only in the State of Minnesota)	300	395	8047.3	0	34	13	14

2.2 2002 Nonpoint sources (afdust, ag, nonpt)

We created several sectors from the 2002 nonpoint NEI. All of these are at county-level and annual resolution. We removed the nonpoint tribal-submitted emissions as we did not know the

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[3] Except for the day-specific point source fire emissions data which are included in a separate sector, as discussed in section 2.3.1.

[4] Point source fugitive dust emissions, which represent a very small amount of PM, were treated as a separate sector in the 2001 Platform.

extent to which they may be double counted with the county-level emissions. In addition, the tribal data would have been dropped during SMOKE processing since there are no spatial surrogates for tribal data in the 2002 Platform.

The documentation for the nonpoint sector of the 2002 NEI is available at: http://www.epa.gov/ttn/chief/net/2002inventory.html

In the rest of this section, we describe in more detail each of the platform sectors into which we separated the 2002 nonpoint NEI, and the changes we made to these data.

2.2.1 Area Fugitive dust sector (afdust)

The area-source fugitive dust (afdust) sector contains PM_{10} and $PM_{2.5}$ emission estimates for 2002 NEI nonpoint SCCs identified as dust sources by inventory experts. This sector is separated from other nonpoint sectors to make it easier to apply a “transport fraction” which reduces emissions based on diminished transport at the scale of our modeling. Application of the transport fraction prevents the overestimation of fugitive dust impacts in the grid modeling as compared to ambient samples. Categories included in this sector are paved roads, unpaved roads and airstrips, construction (residential, industrial, road and total) agriculture production and all of the mining 10-digit SCCs beginning with the digits “2325.” It does not include fugitive dust from grain elevators because these are elevated sources.

We created the afdust sector from the 2002 NEI based on SCCs and pollutant codes (i.e., PM_{10} and $PM_{2.5}$) that are considered “fugitive”. A complete list of all possible fugitive dust SCCs (including both 8-digit point source SCCs and 10-digit nonpoint SCCs) is provided at: http://www.epa.gov/ttn/chief/emch/invent/tf_scc_list2002nei_v2.xls. However, not all of the SCCs in this file are present in the 2002 NEI. The SCCs included in the 2002 NEI that comprise the 2002 platform afdust sector (which are a subset of the SCCs in the web link) are provided in Table 2-3.

Table 2-3. SCCs in the afdust platform sector

2002 SCC	2002 SCC Description
2275085000	Mobile Sources;Aircraft;Unpaved Airstrips;Total
2294000000	Mobile Sources;Paved Roads;All Paved Roads;Total: Fugitives
2296000000	Mobile Sources;Unpaved Roads;All Unpaved Roads;Total: Fugitives
2296005000	Mobile Sources;Unpaved Roads;Public Unpaved Roads;Total: Fugitives
2296010000	Mobile Sources;Unpaved Roads;Industrial Unpaved Roads;Total: Fugitives
2311000000	Industrial Processes;Construction: SIC 15 - 17;All Processes;Total
2311010000	Industrial Processes;Construction: SIC 15 - 17;Residential;Total
2311010040	Industrial Processes;Construction: SIC 15 - 17;Residential;Ground Excavations
2311010070	Industrial Processes;Construction: SIC 15 - 17;Residential;Vehicle Traffic
2311020000	Industrial Processes;Construction: SIC 15 - 17;Industrial/Commercial/Institutional;Total
2311020040	Industrial Processes;Construction: SIC 15 - 17;Industrial/Commercial/Institutional;Ground Excavations
2311030000	Industrial Processes;Construction: SIC 15 - 17;Road Construction;Total
2325000000	Industrial Processes;Mining and Quarrying: SIC 14;All Processes;Total
2801000000	Miscellaneous Area Sources;Agriculture Production - Crops;Agriculture - Crops;Total
2801000002	Miscellaneous Area Sources;Agriculture Production - Crops;Agriculture - Crops;Planting
2801000003	Miscellaneous Area Sources;Agriculture Production - Crops;Agriculture - Crops;Tilling
2801000005	Miscellaneous Area Sources;Agriculture Production - Crops;Agriculture - Crops;Harvesting
2801000007	Miscellaneous Area Sources;Agriculture Production - Crops;Agriculture - Crops;Loading
2805000000	Miscellaneous Area Sources;Agriculture Production - Livestock;Agriculture - Livestock;Total
2805001000	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

Our approach was to apply the transportable fractions by county (all afdust SCCs in the same county would receive the same factor). The approach used to calculate the county fractions and the fractions themselves are available at:
http://www.epa.gov/ttn/chief/emch/invent/transportable_fraction_080305_rev.pdf
As the approach paper mentions, a limitation of the transportable fraction approach is the lack of monthly variability which would be expected due to seasonal changes in vegetative cover.
An electronic version of the county-level transport fractions can be found at:
http://www.epa.gov/ttn/chief/emch/invent/transportfractions052506rev.xls

After the CMAQ modeling was completed, we discovered that the transportable fraction factors for $PM_{2.5}$ were inadvertently not applied; therefore, the $PM_{2.5}$ emissions from this sector are overestimated in the current version (v3) of the 2002 Platform.

Table 2-4 shows the differences in $PM_{2.5}$ and its component species (defined in 3.3.2) across all sectors with and without application of the transportable factor. Note that the below summary is across all 50 states and the District of Columbia (i.e., including Alaska and Hawaii), whereas most other summaries in this document are for just the conterminous U.S. To create this table, we correctly applied the transportable fraction to the afdust sector in order to compare the resultant emissions (labeled as "*with transport factor*") with those in the 2002 Platform (labeled "*without transport factor*").

Table 2-4. Summary of speciated $PM_{2.5}$ emissions (tons) without and with the application of the transport factor for all 50 states.

Sector	PM2.5	POC	PEC	PSO4	PNO3	PMFINE
Afdust – without transport factor	***1,830,271***	***88,766***	***3,112***	***4,589***	***3,212***	***1,730,664***
alm	86,954	13,173	57,419	5,787	82	10,486
avefire	684,034	392,910	66,731	7,045	2,247	215,101
nonpt	1,101,688	476,170	85,586	28,446	3,153	508,332
nonroad	218,025	67,227	130,774	775	414	18,818
onroad	146,973	38,160	79,928	1,097	174	27,605
ptipm	501,998	23,348	15,005	67,438	1,096	395,110
ptnonipm	372,330	53,054	22,051	56,033	3,258	237,927
Grand Total- without transport factor	4,942,273	1,152,809	460,606	171,211	13,637	3,144,043
	PM2.5	**POC**	**PEC**	**PSO4**	**PNO3**	**PMFINE**
Afdust – with transport factor	***1,041,837***	***46,307***	***1,539***	***2,758***	***1,743***	***989,490***
alm	86,954	13,173	57,419	5,787	82	10,486
avefire	684,034	392,910	66,731	7,045	2,247	215,101
nonpt	1,101,688	476,170	85,586	28,446	3,153	508,332
nonroad	218,025	67,227	130,774	775	414	18,818
onroad	146,973	38,160	79,928	1,097	174	27,605
ptipm	501,998	23,348	15,005	67,438	1,096	395,110
ptnonipm	372,330	53,054	22,051	56,033	3,258	237,927
Grand Total- with transport factor	4,153,839	1,110,350	459,033	169,379	12,167	2,402,870
Difference in Grand Total (tons)	788,434	42,459	1,573	1,832	1,470	741,173
% Diff	19.0%	3.8%	0.3%	1.1%	12.1%	30.8%

2.2.2 Agricultural Ammonia sector (ag)

The agricultural NH_3 “ag” sector is comprised of livestock and agricultural fertilizer application emissions from the nonpoint sector of the 2002 NEI. In building this sector we extracted livestock and fertilizer emissions based on the SCC. The livestock SCCs are listed in Table 2-5, and the fertilizer SCCs are listed in Table 2-6.

Table 2-5. Livestock SCCs extracted from the 2002 NEI nonpoint inventory to create the ag platform sector

SCC	SCC Description*
2805000000	Agriculture - Livestock;Total
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

SCC	SCC Description*
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
2805020001	Cattle and Calves Waste Emissions;Milk Cows
2805020002	Cattle and Calves Waste Emissions;Beef Cows
2805020003	Cattle and Calves Waste Emissions;Heifers and Heifer Calves
2805020004	Cattle and Calves Waste Emissions;Steers, Steer Calves, Bulls, and Bull Calves
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
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"

The "ag" sector includes all of the NH_3 emissions from fertilizer from the NEI. However, the "ag" sector does include all of the livestock ammonia emissions, as there are also significant NH_3 emissions from livestock in the point source inventory. Most of the point source livestock NH_3

emissions were reported by the states of Kansas and Minnesota. For these two states, farms with animal operations were provided as point sources using the following SCCs[5]:

- 30202000: Industrial Processes; Food and Agriculture; Beef Cattle Feedlots; Hogs and Swines
- 30202001: Industrial Processes; Food and Agriculture; Beef Cattle Feedlots; Feedlots General
- 30202101: Industrial Processes; Food and Agriculture; Eggs and Poultry Production; Manure Handling: Dry
- 30203099: Industrial Processes; Food and Agriculture; Dairy Products; Other Not Classified

There are also livestock NH_3 emissions in the point source inventory with SCCs of 39999999 (Industrial Processes; Miscellaneous Manufacturing Industries; Miscellaneous Industrial Processes; Other Not Classified) and 30288801 (Industrial Processes; Food and Agriculture; Fugitive Emissions; Specify in Comments Field). We identified these sources as livestock NH_3 point sources based on their facility name. The reason why we needed to identify livestock NH_3 in the ptnonipm sector was to properly implement the emission projection techniques for livestock sources, which cover all livestock sources, not only those in the ag sector, but also those in the ptnonipm sector. This is discussed further in Section 4.2.1.

Table 2-6. Fertilizer SCCs extracted from the 2002 NEI for inclusion in the "ag" sector

2002 SCC	2002 SCC Description*
2801700001	Anhydrous Ammonia
2801700002	Aqueous Ammonia
2801700003	Nitrogen Solutions
2801700004	Urea
2801700005	Ammonium Nitrate
2801700006	Ammonium Sulfate
2801700007	Ammonium Thiosulfate
2801700010	N-P-K (multi-grade nutrient fertilizers)
2801700011	Calcium Ammonium Nitrate
2801700012	Potassium Nitrate
2801700013	Diammonium Phosphate
2801700014	Monoammonium Phosphate
2801700015	Liquid Ammonium Polyphosphate
2801700099	Miscellaneous Fertilizers

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

[5] These point source emissions are also identified by the segment ID, which is one of the following: "SWINE", "CATTLE", "DAIRY", or "PLTRY".

2.2.3 Other nonpoint sources (nonpt)

Nonpoint sources that were not subdivided into the afdust, ag or nonptfire (Section 2.3.2) sectors were assigned to the "nonpt" sector. This sector is similar to the "oarea" sector in the 2001 Platform. The differences are that:

- the nonpt sector contains agricultural burning and open burning, whereas in the 2001 platform, these source categories were not in "oarea" but rather were in the fires sector;
- the nonpt sector does not include Canada and Mexico emissions (which are in the 2002 Platform "othar" sector); whereas in the 2001 Platform they are in the "oarea" sector;
- the nonpt sector includes estimates for portable fuel container (PFC) emissions, which were not included in the 2001 Platform. The development of these emission estimates are explained in this section.

In preparing the nonpt sector we excluded catastrophic releases (SCC 28300XX000) since we found that these emissions were dominated by tire burning (SCC 28300000000), which is an episodic, location-specific emissions category. Tire burning accounts for significant emissions of particulate matter in some parts of the country. An example of such an event is the Starlight Lane Tire Fire, which occurred in Roanoke, Virginia, and burned for 24 days in March 2002, emitting approximately 4000 tons of $PM_{2.5}$. Because such sources are reported by a very small number of states, and are inventoried as county annual totals without the information in the NEI to temporally and spatially allocate the emissions to the time and location where the event occurred, we excluded catastrophic releases from the 2002 Platform.

The nonpt sector includes emission estimates for PFCs, also known as "gas cans." Inventories for PFCs were recently developed for EPA's Mobile Source Air Toxics (MSAT) rule (EPA, 2007a) and were incorporated into the 2002 NEI v3. These inventories were not part of the 2001 Platform or part of earlier versions of the 2002 NEI. They are also not included in the nonpoint NEI documentation (as of the date of this document) since they were added between version 2 (v2) and v3 of the 2002 NEI, so we provide more detail on these emissions below.

The PFC inventory consists of ten SCCs (listed in Table 2-7) that represent five distinct sources of PFC emissions, further distinguished by residential or commercial use. The five sources are:

- Emissions associated with filling the gas cans at the gas pump
  - (1) Displacement of the vapor within the can
  - (2) Spillage of gasoline while filling the can
- Emissions associated with transporting the gas can to the piece of nonroad equipment
  - (3) Spillage of gasoline during transport
- Emissions (adjusted for changes in ambient temperature) associated with storage of the gasoline in the PFCs
  - (4) Emissions due to evaporation (i.e., diurnal emissions)
  - (5) Emissions due to permeation

Table 2-7. Portable Fuel Container SCCs.

PFC SCC	SCC 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

* All descriptions include "Storage and Transport;Petroleum and Petroleum Product Storage" as the beginning of the description.

Note that spillage and vapor displacement associated with using PFCs to refuel nonroad equipment are included in the nonroad inventory. To prevent double counting, these two processes are not included in the above SCCs.

Detailed documentation of the methods used to estimate national and statewide VOC inventories for PFCs are described in a technical support document (Landman, 2007). Statewide total annual VOC inventories were allocated to counties using county-level fuel consumption ratios from the NONROAD model. This methodology is described in a technical support document for national-scale modeling in the MSAT rule (EPA, 2007b). Of note from this documentation, the developers derived the 2002 PFC inventory by linearly interpolating inventories developed for 1999 and 2010.

2.3 Fires (ptfire, nonptfire and avefire)

Wildfire and prescribed burning emissions are contained in the ptfire, nonptfire and avefire sectors. The ptfire sector has emissions provided at geographic coordinates (point locations) and has daily emissions values, whereas the nonptfire and avefire sectors are county-summed inventories and have annual total emissions values. For the 2002 evaluation case, we modeled 2002 year-specific fires using the emissions from the ptfire and nonptfire sectors. For the 2002 base case, these sectors were replaced by the avefire sector.

For the 2002 Platform, the following SCCs from the 2002 NEI are considered "fires" (note that the actual SCC description includes "Miscellaneous Area Sources" as the first tier level).

Table 2-8. Universe of 2002 NEI SCCs representing emissions in the ptfire, nonptfire and avefire modeling sectors

SCC	2002 SCC Description *
2810001000	Other Combustion;Forest Wildfires;Total
28100010F0	Other Combustion;Forest Wildfires;Flaming
28100010S0	Other Combustion;Forest Wildfires;Smoldering
2810005000	Other Combustion;Managed Burning, Slash (Logging Debris);Total
28100050F0	Other Combustion;Managed Burning, Slash (Logging Debris);Flaming
2810015000	Other Combustion;Prescribed Burning for Forest Management;Total
28100150F0	Other Combustion;Prescribed Burning for Forest Management;Flaming
28100150F1	Other Combustion;Prescribed Burning for Forest Management;Flaming Natural
2810020000	Other Combustion;Prescribed Burning of Rangeland;Total
28100200F0	Other Combustion;Prescribed Burning of Rangeland;Flaming

* all SCC descriptions begin with "Miscellaneous Area Sources;"

The universe of sources included with fires sectors for the 2002 Platform differs from the 2001 Platform in that the 2002 Platform fire sectors exclude agricultural burning and other open burning sources. These sources are in the nonpt sector of the 2002 Platform rather than the fire sectors. We chose to keep agricultural burning and other open burning sources in the nonpt sector because these categories were not factored into the development of the average fire sector (as described in 2.3.3). Additionally, their year-to-year impacts are not as variable as wildfires and prescribed/managed burns.

2.3.1 Day-specific point source fires (ptfire)

The ptfire sector includes wildfire and prescribed[6] burning emissions occurring in 2002, which were used for the 2002 model evaluation case. We did not include emissions from this sector in the 2002 base case or any of the future year cases. This sector includes emissions for all 2002 wildfires and most prescribed burns with daily estimates of each fire's emissions. It includes the 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.

The SCCs in this sector are listed in Table 2-9.

[6] For purposes of this document prescribed burning also includes managed burning, i.e., "Other Combustion; Managed Burning, Slash (Logging Debris)"

Table 2-9. SCCs in the ptfire sector.

SCC	2002 SCC Description *
2810001000	Other Combustion;Forest Wildfires;Total
28100010F0	Other Combustion;Forest Wildfires;Flaming
28100010S0	Other Combustion;Forest Wildfires;Smoldering
2810005000	Other Combustion;Managed Burning, Slash (Logging Debris);Total
28100050F0	Other Combustion;Managed Burning, Slash (Logging Debris);Flaming
2810015000	Other Combustion;Prescribed Burning for Forest Management;Total
28100150F0	Other Combustion;Prescribed Burning for Forest Management;Flaming
28100150F1	Other Combustion;Prescribed Burning for Forest Management;Flaming Natural
2810020000	Other Combustion;Prescribed Burning of Rangeland;Total
28100200F0	Other Combustion;Prescribed Burning of Rangeland;Flaming

* all SCC descriptions begin with "Miscellaneous Area Sources;"

The "F" and the "S" indicate whether the process is flaming (F) or smoldering (S). The inventory development approach assumed that smoldering occurs in the same grid cell as the flaming emissions for wildfires only, and on the day after the flaming emissions.

The use of point source and day-specific data for fires is a new feature to EPA's modeling platform. In the 2001 Platform, all fire emissions were treated and modeled exclusively in the first (surface) model layer at the county resolution, and spatially allocated to grid cells using surrogates related to forest land. In the 2001 Platform, emissions were temporally allocated with monthly and diurnal profiles (meaning each day of the month burns uniformly) using state-specific and regional profiles.

The new point source day-specific emission estimates for 2002 fires were developed as a joint effort of the Western Regional Air Partnership (WRAP) and the U.S. EPA. Specifically, the development of the wildfire emissions inventory for the CAPs was conducted by Air Sciences, Inc., managed by the WRAP and funded by the Regional Planning Organizations (RPOs). The U.S. EPA added emission estimates for 29 HAPs, using emission factors. The prescribed fire inventory was developed for these same pollutants by EC/R, Inc. using methods consistent with the wildfire inventory.

The development of wildfire inventory started with the ICS-209 reports compiled at http://www.nifc.gov/fire_info/fire_stats.htm by the National Fire Information Center in Boise, Idaho. Air Sciences, Inc. reviewed the data and made corrections and improvements to the fire size, location, start and end dates, and fuel type and loading. The default source of information on fuel type and loading was the National Fire Danger Rating System (NFDRS), http://www.wfas.net/content/view/29/44/. Fuel moisture information from the Wildland Fire Assessment System, http://www.wfas.net/content/view/23/38/ was input to the Fire Emissions Production System model to produce a "look-up" matrix of fuel consumption and emissions for the RPO regions, NFDRS Fuel Type and a range of moistures. This "look-up" matrix was the basis for estimating emissions for each fire on each day. Documentation for the Wildfire Inventory prepared by the WRAP for all the RPOs is at http://www.wrapair.org/forums/fejf/tasks/FEJFtask7InterRPO.html. (Air Sciences, et. al., 2007)

The prescribed fire emissions estimates were computed using this same matrix, but EC/R obtained the acres burned and date-location information directly from the RPOs. Only 38 States provided information on prescribed burning, but these are believed to be the States that conduct most of the burning. Of these, only Virginia's data had insufficient spatial detail to develop a point source inventory, and the fires in some state's data were only spatially resolved to the county centroid. The data for Georgia were only temporally resolved to the month of the burn. For Georgia, we summed the monthly emissions to create an annual total by county which we included in the nonptfire sector. We do not have Virginia's prescribed burning data in our platform in either ptfire or nonptfire sectors. Additional documentation for the prescribed fire emission inventory development is provided in Appendix A.

The ptfire data files input to SMOKE utilize a new format developed to facilitate SMOKE's computation of plume rise (discussed in Section 3.2.4). The data that change each day such as pollutant emissions were included in the "FIREEMIS" day-specific (PTDAY) ORL file; the parameters that are constant for the year, such as a list of all fires, were included in a separate fire inventory (PTINV) file. For ease of processing, we chose to include both HAPs and CAPs in the FIREEMIS file. For the 2002 Platform, there is one fire inventory file and 24 "FIREEMIS" files. Twelve of these files contain day-specific emissions for individual months, and twelve contain the emissions for the last day of each month. We used separate files containing emissions for the last day of each month, because we processed each month through SMOKE separately. Since emissions are in local time, we needed to include the last few hours from the previous month in the SMOKE intermediate files.

In addition to the day-specific pollutant emissions, the ptfire inventories contained data on the acres burned and fuel consumption for each day. As described in Section 3.2.4, these additional parameters are used in SMOKE for the plume rise algorithm.

Subsequent to modeling, we identified three errors in the ptfire sector emissions. These errors only affect the 2002 model evaluation case because the ptfire sector emissions were not used for the 2002 base case or future-year cases. These errors are:

1. The calculation of SO_2 emissions for prescribed burning in the NEI v3 used the emission factor for NH_3.
2. The fuel loading values (tons fuel consumed per acre burned) used in the plume rise calculation were a factor of 24 too high because the data originally used to construct the SMOKE ORL files came from hourly data which were summed across 24 hours to generate day-specific data. The fuel loading values were mistakenly summed along with the emissions data.
3. Several states for which the prescribed burning data were not sufficient to develop point-level day specific emission estimates, but were sufficient to develop county-level annual emission estimates were inadvertently dropped and excluded from the 2002 NEI v3. These states are: Connecticut, Delaware, Hawaii, Maine, Massachusetts, New Hampshire, New York, Pennsylvania, Rhode Island, Vermont, and Virginia. While we are unsure of the impact of the prescribed burning emissions for Virginia, we believe the prescribed burning for the other states is small.

2.3.2 County-level fires (nonptfire)

The nonptfire sector consists of all of the prescribed burning and managed burning emission sources for which emissions are not available at the spatial or temporal resolution required for processing in the ptfire sector. The SCCs in this sector are listed in Table 2-10.

Table 2-10. SCCs in the nonptfire sector

SCC	2002 SCC Description *
2810005000	Other Combustion;Managed Burning, Slash (Logging Debris);Total
28100050F0	Other Combustion;Managed Burning, Slash (Logging Debris);Flaming
28100150F0	Other Combustion;Prescribed Burning for Forest Management;Flaming

* all SCC descriptions begin with "Miscellaneous Area Sources;"

Note that there are no wildfires in this sector. The nonptfire emissions were generated using: (1) point source fire emissions for managed and prescribed burning in Georgia, as discussed in Section 2.3.1 above, and (2) nonpoint emissions for managed burning (slash burning) for those states without point source managed burning emissions (i.e., Maryland, North Carolina, and Texas).

In order to retain the monthly resolution provided by the ptfire file for Georgia, we developed SCC-specific, Georgia-specific profiles for use with the nonptfire sector (only used for the evaluation case). Note that the SO_2 emissions for Georgia in the nonptfire sector suffer from the same error as the Georgia fire emissions in the ptfires sector (see Section 2.3.1).

2.3.3 Average fires (avefire)

The average fire sector includes emissions from wildfires, prescribed burning and managed burning. We used this sector for the 2002 base case, and all future year cases. As noted above, avefire emissions are annual, county-level emissions.

The purpose of the avefire sector is to represent emissions for a typical or average year's fires for use in projection year inventories since future year fires are not known. Using an average of multiple years of data reduces the possibility that a single-year's high or low fire activity would unduly affect future year model-predicted concentrations.

The specific SCCs in the avefire sector are listed in Table 2-11.

Table 2-11. Average fire SCCs

SCC	2002 SCC Description *
2810001000	Other Combustion;Forest Wildfires;Total
2810005000	Other Combustion;Managed Burning, Slash (Logging Debris);Total
2810015000	Other Combustion;Prescribed Burning for Forest Management;Total

* all SCC descriptions begin with "Miscellaneous Area Sources;"

We created the avefire sector for the 2002 Platform by removing agricultural and open burning from the 2001 Platform avefire sector (EPA, 2005a), since these categories are in the 2002 nonpt sector. Table 2-12 compares the avefire emissions to the 2002-specific fire emissions (sum of ptfire and nonptfire).

Table 2-12. Comparison of 2002 Platform avefire emissions with 2002-specific fire (sum of ptfire and nonptfire) emissions

State	Tons CO avefire	Tons CO 2002 fires	CO % diff	Tons NH3 avefire	Tons NH3 2002 fires	NH3 % diff	Tons NOX avefire	Tons NOX 2002 fires	NOX % diff	Tons PM2.5 avefire	Tons PM2.5 2002 fires	Tons PM2.5 % diff	Tons SO2 avefire	Tons SO2 2002 fires	SO2 % diff	Tons VOC avefire	Tons VOC 2002 fires	VOC % diff
Alabama	175,141	294,496	-41%	752	4,708	-84%	3,814	3,060	25%	13,938	24,150	-42%	983	4,645	-79%	8,951	67,718	-87%
Arizona	440,419	1,071,505	-59%	2,020	17,142	-88%	10,532	6,953	51%	37,151	85,126	-56%	2,888	5,743	-50%	21,385	246,406	-91%
Arkansas	123,698	67,776	83%	556	1,083	-49%	2,654	406	>100%	10,315	5,359	92%	728	1,071	-32%	5,821	15,582	-63%
California	1,157,187	654,793	77%	5,117	10,473	-51%	24,563	8,100	>100%	97,302	54,565	78%	6,735	4,842	39%	54,619	150,565	-64%
Colorado	288,013	966,816	-70%	1,299	15,467	-92%	6,271	7,688	-18%	24,054	77,744	-69%	1,719	5,600	-69%	13,610	222,363	-94%
Connecticut	667	4	>100%	3	0	NA	14	0	>100%	56	0	NA	4	0	NA	31	1	>100%
Delaware	1,332	93	>100%	5	1	>100%	23	1	>100%	87	7	>100%	6	0	NA	64	15	>100%
District of Columbia	1	0	NA	0	0	NA	0	0	NA	0	0	NA	0	0	NA	0	0	NA
Florida	1,193,146	879,032	36%	5,366	14,058	-62%	25,600	8,924	>100%	99,484	71,956	38%	7,018	13,959	-50%	56,159	201,396	-72%
Georgia	350,925	380,011	-8%	1,299	6,076	-79%	7,955	4,184	90%	24,082	31,316	-23%	2,010	5,865	-66%	21,834	87,388	-75%
Idaho	630,971	62,678	>100%	2,856	1,002	>100%	14,024	696	>100%	52,808	5,170	>100%	3,845	604	>100%	29,989	14,405	>100%
Illinois	3,323	2,589	28%	15	41	-63%	71	20	>100%	277	207	34%	20	32	-39%	156	418	-63%
Indiana	4,124	163	>100%	19	3	>100%	88	2	>100%	344	13	>100%	24	2	>100%	194	35	>100%
Iowa	4,185	1,087	>100%	19	17	8%	90	7	>100%	349	86	>100%	25	17	42%	197	250	-21%
Kansas	17,600	1,251	>100%	79	20	>100%	378	10	>100%	1,468	100	>100%	103	15	>100%	828	268	>100%
Kentucky	61,812	2,238	>100%	278	34	>100%	1,326	21	>100%	5,155	180	>100%	364	17	>100%	2,909	511	>100%
Louisiana	151,659	43,452	>100%	682	693	-2%	3,254	310	>100%	12,647	3,466	>100%	892	675	32%	7,137	9,987	-29%
Maine	26,592	77	>100%	115	1	>100%	566	1	>100%	2,127	6	>100%	150	0	NA	1,258	17	>100%
Maryland	6,129	45	>100%	24	0	>100%	137	1	>100%	531	5	>100%	32	0	NA	353	6	>100%
Massachusetts	15,878	289	>100%	71	5	>100%	341	3	>100%	1,324	23	>100%	93	2	>100%	747	66	>100%
Michigan	15,380	408	>100%	69	6	>100%	330	3	>100%	1,283	32	>100%	91	5	>100%	724	93	>100%
Minnesota	107,237	43,058	>100%	482	686	-30%	2,300	294	>100%	8,943	3,427	>100%	631	430	46%	5,047	8,321	-39%
Mississippi	178,646	11,794	>100%	804	184	>100%	3,833	121	>100%	14,897	960	>100%	1,051	116	>100%	8,407	2,705	>100%
Missouri	31,611	2,911	>100%	142	45	>100%	678	31	>100%	2,636	238	>100%	186	32	>100%	1,488	663	>100%
Montana	203,759	180,536	13%	946	2,888	-67%	5,187	1,369	>100%	17,311	14,473	20%	1,422	1,322	8%	10,085	41,519	-76%
Nebraska	17,780	500	>100%	80	8	>100%	381	3	>100%	1,483	39	>100%	105	8	>100%	837	112	>100%
Nevada	227,965	23,560	>100%	1,026	376	>100%	4,910	262	>100%	19,018	1,944	>100%	1,346	172	>100%	10,740	5,403	99%
New Hampshire	6,398	30	>100%	29	0	NA	137	0	NA	534	2	>100%	38	0	NA	301	7	>100%
New Jersey	10,375	284	>100%	47	4	>100%	223	3	>100%	865	23	>100%	61	2	>100%	488	64	>100%
New Mexico	583,216	137,289	>100%	2,626	2,195	20%	12,582	1,232	>100%	48,662	11,132	>100%	3,450	917	>100%	27,488	31,566	-13%
New York	19,195	313	>100%	86	5	>100%	412	3	>100%	1,601	25	>100%	113	2	>100%	903	71	>100%
North Carolina	429,388	330,303	30%	532	306	74%	11,424	9,095	26%	9,870	1,582	>100%	696	257	>100%	58,889	57,744	2%
North Dakota	11,204	8,573	31%	50	136	-63%	240	61	>100%	934	684	37%	66	58	14%	527	1,967	-73%

State	Tons CO avefire	Tons CO 2002 fires	CO % diff	Tons NH3 avefire	Tons NH3 2002 fires	NH3 % diff	Tons NOX avefire	Tons NOX 2002 fires	NOX % diff	Tons PM2.5 avefire	Tons PM2.5 2002 fires	Tons PM2.5 % diff	Tons SO2 avefire	Tons SO2 2002 fires	SO2 % diff	Tons VOC avefire	Tons VOC 2002 fires	VOC % diff
Ohio	3,787	8,802	-57%	17	141	-88%	81	95	-14%	316	724	-56%	22	132	-83%	178	1,955	-91%
Oklahoma	79,672	4,790	>100%	359	75	>100%	1,709	37	>100%	6,644	381	>100%	469	58	>100%	3,749	1,095	>100%
Oregon	778,194	2,280,250	-66%	3,542	36,480	-90%	17,857	23,587	-24%	65,350	186,965	-65%	4,896	15,355	-68%	37,328	524,433	-93%
Pennsylvania	5,450	65	>100%	25	1	>100%	117	1	>100%	454	5	>100%	32	0	NA	256	14	>100%
Rhode Island	171	0	>100%	1	0	>100%	4	0	>100%	14	0	NA	1	0	NA	8	0	NA
South Carolina	109,880	97,437	13%	494	1,551	-68%	2,357	1,032	>100%	9,163	7,996	15%	646	1,490	-57%	5,171	22,252	-77%
South Dakota	84,689	4,841	>100%	381	77	>100%	1,817	31	>100%	7,062	384	>100%	498	27	>100%	3,985	1,104	>100%
Tennessee	47,175	914	>100%	212	14	>100%	1,012	9	>100%	3,934	72	>100%	277	6	>100%	2,220	207	>100%
Texas	256,966	27,640	>100%	1,118	273	>100%	4,890	226	>100%	21,578	2,379	>100%	1,178	174	>100%	13,201	4,080	>100%
Utah	328,713	234,566	40%	1,479	3,751	-61%	7,052	2,439	>100%	27,412	19,241	42%	1,934	1,581	22%	15,469	53,948	-71%
Vermont	8,347	69	>100%	38	1	>100%	179	1	>100%	696	5	>100%	49	0	NA	393	16	>100%
Virginia	67,866	1,249	>100%	305	19	>100%	1,456	12	>100%	5,659	100	>100%	399	8	>100%	3,194	285	>100%
Washington	52,086	109,827	-53%	248	1,756	-86%	1,484	1,295	15%	4,487	9,110	-51%	407	1,264	-68%	2,674	25,258	-89%
West Virginia	36,578	646	>100%	165	10	>100%	785	6	>100%	3,050	51	>100%	215	4	>100%	1,721	147	>100%
Wisconsin	11,924	2,563	>100%	54	41	32%	256	20	>100%	994	206	>100%	70	37	88%	561	398	41%
Wyoming	188,099	97,672	93%	846	1,561	-46%	4,035	961	>100%	15,686	7,975	97%	1,106	682	62%	8,852	22,462	-61%
sum	8,554,551	8,039,286	6%	36,777	123,414	-70%	189,428	82,613	>100%	684,035	629,635	9%	49,094	67,229	-27%	451,127	1,825,284	-75%

2.4 Biogenic sources (biog)

For CMAQ, we computed the biogenic emissions based on 2002 meteorology data using the BEIS3.13 model from SMOKE.

The BEIS3.13 model creates gridded, hourly, model-species emissions from vegetation and soils. It estimates CO, VOC, and NO_X emissions for the U.S., Mexico, and Canada. The BEIS3.13 model is described further in: http://www.cmascenter.org/conference/2005/abstracts/2_7.pdf (Schwede, et. al, 2005).

The inputs to BEIS include:

- temperature data at 10 meters which were obtained from the CMAQ meteorological input files,
- land-use data from the Biogenic Emissions Landuse Database, version 3 (BELD3). BELD3 data provides data on the 230 vegetation classes at 1 km resolution over most of North America; the same land-use data were used for the 2001 platform.

2.5 2002 Mobile sources (onroad, nonroad, alm)

We created three sectors from the mobile source emissions in the 2002 NEI: onroad, nonroad and a sector containing emissions for aircraft, locomotive and commercial marine vessels (alm). We created these three separate sectors to handle differences in emissions processing related to the temporal nature of the inventories and differences in projection methods.

All three sectors are at county and SCC resolution. The alm emissions input to SMOKE contain tribal data (state FIPS code was set to "88" similarly to point sources as discussed in Section 2.1), but these data are not in the CMAQ files since they were dropped during the SMOKE spatial allocation process.

The onroad and nonroad sectors utilize emissions generated by the EPA's Office of Transportation and Air Quality (OTAQ) using NMIM (EPA, 2005b) for all of the U.S. except for California.[7] The NMIM relies on calculations from the MOBILE6 and NONROAD2005 models as described below, and in the NEI documentation. Inputs to NMIM are posted with the 2002 Emission Inventory. The direct link is: ftp://ftp.epa.gov/EmisInventory/2002finalnei/mobile_sector_data/ncd_files/ncd20070727_2002.zip. The NMIM creates the onroad and nonroad emissions on a month-specific basis that accounts for temperature, fuel types, and other variables that vary by month. Inventory documentation for the 2002 NEI v3 onroad and nonroad sectors is also posted with other 2002 NEI documentation; the direct link is: ftp://ftp.epa.gov/EmisInventory/2002finalnei/documentation/mobile/2002_mobile_nei_version_3_report_092807.pdf.

[7] Although OTAQ generated emissions using NMIM for California, these were not used in the 2002 NEI version 3, but rather were replaced by state-submitted emissions.

While aircraft, locomotive, and commercial marine sources are considered nonroad sources in the 2002 NEI, they comprise a separate sector for the 2002 platform denoted as "alm." We developed the alm sector for the convenience of emission processing and projections. The NMIM-based nonroad emissions are monthly whereas the alm emissions are annual. In addition, the NMIM-based nonroad emissions are projected using NMIM, whereas the alm emissions use national, annual activity-based projection factors. Documentation for "alm" inventory development is available in several separate documents posted at http://www.epa.gov/ttn/chief/net/2002inventory.html#documentation, and additional revisions to this documentation are provided in Section 2.5.3.

2.5.1 Onroad mobile sources (onroad)

This sector includes exhaust, evaporative, brakewear and tirewear emissions from onroad sources derived from NMIM (except for California), which contained the version of MOBILE6 used for the final MSAT rule (EPA, 2007a). A summary of the 2002 vehicle miles traveled (VMT) inputs (along with future year VMT used in the projections and discussed in Section 4.3.1) is contained in Appendix I.

We did not include the refueling onroad emissions generated by NMIM in the onroad sector, because the NEI treats onroad refueling as a stationary source, and it is in the nonpt sector (gasoline distribution, Stage II, SCC=2501060100). We therefore removed the refueling emissions from the NMIM outputs prior to generating the onroad emission files for SMOKE.

Similar to the 2001 Platform, the 2002 Platform onroad sector contains VOC emissions separately for exhaust and evaporative modes, which allowed us to use mode-specific speciation profiles. For the 2002 Platform, the inventory includes PM_{10} and $PM_{2.5}$ emissions for three modes[8]: exhaust (EXH), brakewear (BRK) and tirewear (TIR), which similarly facilitated mode-appropriate speciation profiles. The emission modes are included as part of the pollutant name for the SMOKE emission inputs. For example, exhaust and evaporative modes for VOC are indicated by EXH__VOC and EVP__VOC, respectively. Since the mode is part of the pollutant name, the SCCs provided to SMOKE use a 10th digit of zero, instead of the letter that would otherwise denote the emission mode.

The onroad emission estimation from NMIM is improved over the version used for the 2001 Platform as follows

- We made MOBILE6 Model adjustments for VOC to account for vehicle "cold starts" which increase VOC emissions at cold temperatures. Newer vehicles meeting Tier 2 have higher emissions than previously estimated when the engine is first started at temperatures below 50 F. A detailed discussion of these adjustments can be found in the document "Cold Temperature Effects on Vehicle HC Emissions," (EPA, 2006b).
- We made MOBILE6 Model adjustments to correct the handling of oxygenates, which affects VOC and HAP estimates.
- We updated the external MOBILE6 data input files which account for the introduction of new California highway vehicle emission standards, beginning with the 2004 model year. These standards have been formally adopted by 11 states (California, Connecticut,

[8] PM_{10} and $PM_{2.5}$ in the 2001 Platform were not broken out by mode.

Maine, Massachusetts, New Jersey, New York, Oregon, Pennsylvania, Rhode Island, Vermont and Washington). These standards supersede the federal certification standards for highway vehicles sold in those states.
- We improved the county-level gasoline Reid Vapor Pressure (RVP) estimates based on an updated analysis of fuels. Previously, the fuel survey results from a few counties in a state were used for all counties in the state. However, often the surveyed counties would have RVP control programs, so that the other counties in the state, without controls, would have inappropriately low RVP. We changed the RVP for counties without fuel surveys and without RVP control to use federally regulated RVP levels instead.
- Emissions in the 2002 Platform include the modes for VOC, PM_{10} and $PM_{2.5}$, whereas emissions in the 2001 Platform had mode-specific emissions for VOC only.

Because the California Air Resources Board (CARB) has their own onroad mobile source estimation model (EMFAC2002), which is tailored to specific California mobile sources, we used the CARB-submitted data for the 2002 NEI v3 as well as the platform. CARB provided EPA with annual-total onroad mobile emissions. We adjusted these emissions using NMIM-based California emissions to (1) temporalize the emissions to monthly resolution and (2) to provide them on a consistent basis (i.e., same SCCs and modes) as the NMIM-derived data. CARB updated their model (EMFAC2007) prior to the completion of our modeling, but they were not able to provide the results in time for use with version 3 of the 2002 Platform. The updated emissions, however, were used in the development of the projection year emissions as discussed in Section 4.3.1.

2.5.2 Nonroad mobile sources –NMIM-based nonroad (nonroad)

This sector includes monthly exhaust, evaporative and refueling emissions from nonroad engines (not including commercial marine, aircraft, and locomotives) derived from NMIM. The NMIM relied on the version of the NONROAD2005 model used for the marine (spark ignited) SI and small SI engine proposed rule, published May 18, 2007 (EPA, 2007c). As with the onroad sector, we used the NMIM monthly emissions for all states except California.

Like the onroad emissions, NMIM provides nonroad emissions for VOC by three emission modes: exhaust, evaporative and refueling. Unlike the onroad sector, refueling emissions for nonroad sources are not included in the nonpt sector. Rather, we kept these emissions in the nonroad sector.

The version of NONROAD used for the 2002 Platform has the following improvements over previous versions of this model:

<u>General</u>
- Added the ability to estimate effects of ethanol blends on fuel hose and tank permeation.
- Improved RVP data as discussed in Section 2.5.1.

<u>Small SI inputs</u>
- Revised tank permeation and hose permeation based on EPA and industry test data (and small revisions to tank sizes).
- Added fuel tank diffusion losses to diurnal emissions based on test data.

- Updated emission factors and deterioration rates for Phase 2 engines based on new test data.
- Corrected technology mix for snow blowers to account for 4-stoke engines (previously assumed all 2-stroke).
- Added hot soak and running loss emission estimates for handheld equipment.

Recreational Marine inputs

- Revised all brake specific fuel consumption (BSFC) inputs based on re-analysis of data (no significant effect on emissions).
- Revised PM emission factor for all 2-stroke engines based on oil consumption and scavenging estimates.
- Revised evaporative-related temperature profiles and personal watercraft hose permeation (minor changes).
- Revised fuel tank and hose permeation based on new EPA and industry test data.
- Added hot soak and running loss emission estimates for all recreational marine.
- Updated model inputs for high performance sterndrive/inboard engines >600 hp.

The NEI nonroad data for California provided by CARB are annual emissions that do not have the mode-specific data for VOC (exhaust, evaporative, and refueling). We created monthly, mode-specific emissions for California's nonroad emissions (except for alm sources) using NMIM results for California. Details on this process are documented separately (Strum, 2007). The process erroneously dropped emissions for certain sources (FIPS code/SCC combinations) that were not computed via NMIM; however, as shown in Table 2-13 below, the error is small.

Table 2-13. Magnitude of error in California monthly nonroad emission files

Pollutant	Calif. Annual Emis (tons)	Calif. Annual Emis after monthly dissaggregation (tons)	Diff (tons)	% difference
CO	1,058,968	1,061,607	-2,639	-0.2%
NH3	161	161	0	0.0%
NOX	240,256	241,190	-934	-0.4%
PM10	18,590	18,634	-44	-0.2%
PM25	16,334	16,374	-40	-0.2%
SO2	1,015	1,017	-2	-0.2%
VOC	148,269	148,692	-423	-0.3%

The largest errors in NO_X emissions occur in San Francisco (06075) and Colusa (06011) counties, and the largest errors in VOC occur in Glenn (06021) and Modoc (06049) counties.

2.5.3 Nonroad mobile sources: aircraft, locomotive and commercial marine (alm)

The aircraft, locomotive and commercial marine (alm) sector contains annual emissions for the SCCs listed in Table 2-14. These emissions are consistent with the 2002 NEI v3. Note that some aircraft emissions for California, Illinois, and Minnesota are also contained in the ptnonipm sector, as described above.

Table 2-14. SCCs extracted for the aircraft, locomotive and commercial marine (alm) sector

SCC	SCC Description
2275000000	Mobile Sources;Aircraft;All Aircraft Types and Operations;Total
2275001000	Mobile Sources;Aircraft;Military Aircraft;Total
2275020000	Mobile Sources;Aircraft;Commercial Aircraft;Total: All Types
2275050000	Mobile Sources;Aircraft;General Aviation;Total
2275060000	Mobile Sources;Aircraft;Air Taxi;Total
2280002100	Mobile Sources;Marine Vessels, Commercial;Diesel;Port emissions
2280002200	Mobile Sources;Marine Vessels, Commercial;Diesel;Underway emissions
2280003100	Mobile Sources;Marine Vessels, Commercial;Residual;Port emissions
2280003200	Mobile Sources;Marine Vessels, Commercial;Residual;Underway emissions
2280004000	Mobile Sources;Marine Vessels, Commercial;Gasoline;Total, All Vessel Types
2285002006	Mobile Sources;Railroad Equipment;Diesel;Line Haul Locomotives: Class I Operations
2285002007	Mobile Sources;Railroad Equipment;Diesel;Line Haul Locomotives: Class II / III Operations
2285002008	Mobile Sources;Railroad Equipment;Diesel;Line Haul Locomotives: Passenger Trains (Amtrak)
2285002009	Mobile Sources;Railroad Equipment;Diesel;Line Haul Locomotives: Commuter Lines
2285002010	Mobile Sources;Railroad Equipment;Diesel;Yard Locomotives

The documentation of the 2002 NEI for the alm sector is available at http://www.epa.gov/ttn/chief/net/2002inventory.html#documentation. It does not include a description of the changes to some locomotive and commercial marine sources from v2 of the 2002 NEI, which were made in conjunction with the development of the 2002 Platform. The updates reflect changes to national total emissions, which were made as part of the proposed Locomotive/Marine Rule (EPA, 2007d). The updates affect the following SCCs:

2285002006	Mobile Sources;Railroad Equipment;Diesel;Line Haul Locomotives: Class I Operations
2285002007	Mobile Sources;Railroad Equipment;Diesel;Line Haul Locomotives: Class II / III Operations
2285002008	Mobile Sources;Railroad Equipment;Diesel;Line Haul Locomotives: Passenger Trains (Amtrak)
2285002009	Mobile Sources;Railroad Equipment;Diesel;Line Haul Locomotives: Commuter Lines
2285002010	Mobile Sources;Railroad Equipment;Diesel;Yard Locomotives
2280002000	Mobile Sources;Marine Vessels, Commercial;Diesel;Port and Underway emissions combined

To preserve the state-submitted data from the 2002 NEI v2, we adjusted only the EPA-generated emissions for the above SCCs. They were adjusted such that the sum of the v2 state-submitted emissions and the revised EPA-generated emissions matched OTAQ's national totals.

In addition, since SCCs for diesel port and underway are combined in OTAQ's estimates (but are estimated separately in the 2002 NEI), the 2002 NEI v3 emissions were allocated to port and underway SCCs based using the same proportions as used in the 2002 NEI v2.

2.6 Emissions from Canada, Mexico and Offshore Drilling Platforms (othpt, othar, othon)

The emissions from Canada, Mexico, and Offshore Drilling Platforms are included as part of three sectors: othpt, othar, and othon. The "oth" refers to the fact that these emissions are "other" than those in the 2002 NEI, and the last two digits provide the SMOKE source types: "pt" for point, "ar" for "area", and "on" for onroad mobile. Except for Mexico's emissions, the 2002 Platform used datasets previously used for the 2001 Platform.

For Canada we used emissions for 2000 since these were the most recent set of emissions which were available at the time the 2002 Platform was developed.

For Mexico we used emissions for 1999 (Eastern Research Group Inc., 2006) which were developed as part of a partnership between 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). Unlike the Mexico inventory used for the 2001 Platform that covered only the northern border states, this inventory includes emissions from all states in Mexico. The emissions values in the northern border states have also been updated since we used the 2001 Platform emissions.

The offshore emissions include point source offshore oil and gas drilling platforms. We used the same data as used in the 2001 Platform. Based on the CAIR emission inventory documentation (EPA, 2005a), the offshore sources were provided by the Texas Commission on Environmental Quality (TCEQ). This inventory included emissions for 1992, and was grown to 2002 based on instructions from TCEQ.

Table 2-15 summarizes the data in the "oth" sectors.

Table 2-15. Summary of the othpt, othar and othon sectors in the 2002 Platform.

Sector	Components	Changes from 2001 Platform
othpt	Mexico, 1999, point	Used updated version of Mexico's 1999 inventory
	Canada, 2000, point	
	Offshore, 2002, point	
othar	Mexico, 1999, nonpoint	Used updated version of Mexico's 1999 inventory
	Mexico, 1999, nonroad	Used updated version of Mexico's 1999 inventory
	Canada, 2000, nonpoint	Dropped emissions for SCC 2806015000 (Domestic Animal Waste) and SCC 2810003000 (Cigarette Smoke).
	Canada, 2000, nonroad	
othon	Mexico, 1999, onroad	Used updated version of Mexico's 1999 inventory
	Canada, 1995, onroad	

3 Emissions modeling summary

The CMAQ model requires hourly emissions of specific gas and particle species for the horizontal and vertical grid cells contained within the modeled region (i.e., modeling domain). To provide emissions in the form and format required by CMAQ, 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, this pre-processing step transforms these emissions from their original temporal resolution, pollutant resolution, and spatial resolution into the data required by CMAQ.

As seen in Section 2, the temporal resolution of the emissions input to SMOKE for the 2002 Platform varies across sectors, and may be hourly, monthly, or annual total emissions. The spatial resolution, which also can be different for different sectors, may be individual point sources or county totals (province totals for Canada, municipio totals for Mexico). The pollutants for all sectors except for biogenics are those inventoried for the NEI. The pre-processing steps involving temporal allocation, spatial allocation, pollutant speciation, and vertical allocation of point sources are referred to as emissions modeling. This section provides some basic information about the tools and data files used for emissions modeling as part of the 2002 Platform for CAPs. Since we devoted Section 2 to describing the emissions inventories, we have limited this section's descriptions of data to the ancillary data SMOKE uses to perform the emissions modeling steps

All SMOKE inputs and scripts for the 2002 Platform emissions are available at the Clearinghouse for Inventories and Emissions Factors (CHIEF) Emissions Modeling Clearinghouse (EMCH) website, http://www.epa.gov/ttn/chief/emch/index.html#2002.

3.1 The SMOKE modeling system

We used SMOKE to pre-process the raw emissions to create the emissions inputs for CMAQ. The SMOKE version 2.4 source code and executables can be used to reproduce our emissions modeling, and these are available from the Community Multiscale Analysis System (CMAS) Center at http://www.cmascenter.org. The scripts used for running SMOKE are available on the CHIEF website provided previously in this section.

We made revisions to the SMOKE model for this effort, resulting in SMOKE version 2.4. These revisions are documented in the SMOKE release notes for SMOKE versions 2.3 and 2.4, available with the SMOKE documentation at http://www.smoke-model.org. Although the release of SMOKE version 2.4 happened after we completed our modeling, SMOKE version 2.4 provides essentially the same version of SMOKE used for the 2002-based modeling platform.

Major updates to SMOKE that we developed for the 2002 Platform include:

- Support of point-source, day-specific wildfire and prescribed burning fires
- Extended ORL format that includes more metadata fields, particularly fields about the source of the inventory data for each record (e.g., state, EPA).
- New capabilities for temporal allocation using CEM hourly emissions data from EGUs
- The ability to use surrogate data files from the Spatial Surrogate Tool
- Support for multiple and nonsequential days in the temporal processor
- New processing scripts that make it easier to process more sectors than the traditional sectors of nonpoint, point, onroad, nonroad, and biogenics.

3.2 Key emissions modeling settings

Each sector is processed separately through SMOKE, up until the final merge program (Mrggrid), which combines 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 for 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: “point” indicates that SMOKE maps the source from a point location 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 3.3.1). The “Speciation” column indicates that all sectors use the SMOKE speciation step, though biogenics speciation is done within BEIS3 and not as a separate SMOKE step. The “Inventory resolution” column shows the inventory temporal resolution from which SMOKE needs to calculate hourly emissions. Finally, the “plume rise” column indicates the sectors for which SMOKE computes vertical plume rise and creates merged emissions that are 3-dimensional instead of one layer.

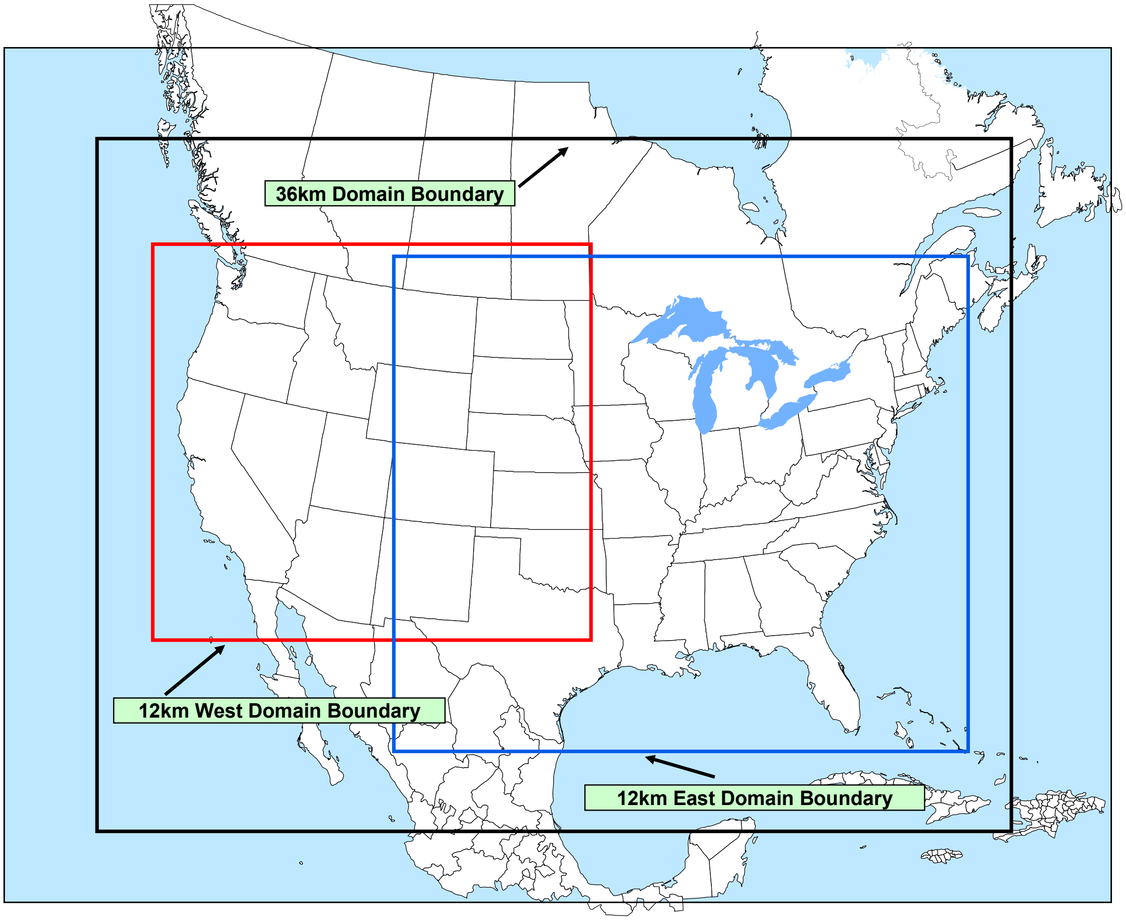
Table 3-1. Key emissions modeling steps by sector

Platform sector	Spatial	Speciation	Inventory resolution	Plume rise
ptipm	point	Yes	daily & hourly	Yes
ptnonipm	point	Yes	annual	Yes
othpt	point	Yes	annual	Yes
nonroad	surrogates & area-to-point	Yes	monthly	
othar	surrogates	Yes	annual	
alm	surrogates & area-to-point	Yes	annual	
onroad	surrogates	Yes	monthly	
othon	surrogates	Yes	annual	
nonpt	surrogates & area-to-point	Yes	annual	
ag	surrogates	Yes	annual	
afdust	surrogates	Yes	annual	
biog	pre-gridded landuse	in BEIS	hourly	
ptfire	point	Yes	daily	Yes
nonptfire	surrogates	Yes	annual	
avefire	surrogates	Yes	annual	

3.2.1 Spatial configuration

For the 2002 Platform, we ran SMOKE and CMAQ for modeling domains with 36 km and 12 km spatial resolution. Figure 3-1 shows the 36 km CONtinental United States “CONUS” modeling domain, the 12 km eastern domain (EUS), and the 12 km western domain (WUS).

Figure 3-1. CMAQ modeling domain



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

Table 3-2. Descriptions of the 2002-based 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
US 36 km or CONUS-36	36 km	Entire conterminous US plus some of Mexico/Canada	US36KM_148X112	'LAM_40N97W', -2736.D3, -2088.D3, 36.D3, 36.D3, 148, 112, 1
Big East 12 km	12 km	Goes west to Colorado, covers some Mexico/Canada	EUS12_279X240	'LAM_40N97W', -1008.D3 , -1620.D3, 12.D3, 12.D3, 279, 240, 1
West 12 km	12 km	Goes east to Oklahoma, covers some of Mexico/Canada	US12_213X192	'LAM_40N97W', -2412.D3 , -972.D3, 12.D3, 12.D3, 213, 192, 1

Section 3.3.1 provides the details on the spatial surrogates and area-to-point data used to accomplish spatial allocation with SMOKE.

3.2.2 Chemical speciation configuration

The emissions modeling step for chemical speciation creates "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 2002 Platform is the Carbon Bond 05 (CB05) mechanism (Yarwood, 2005). This is an updated mechanism from CB4, which had been used in the 2001 Platform. Table 3-3 lists the model species produced by SMOKE for use in CMAQ with the CB05.

Table 3-3. Model Species produced by SMOKE for CB05

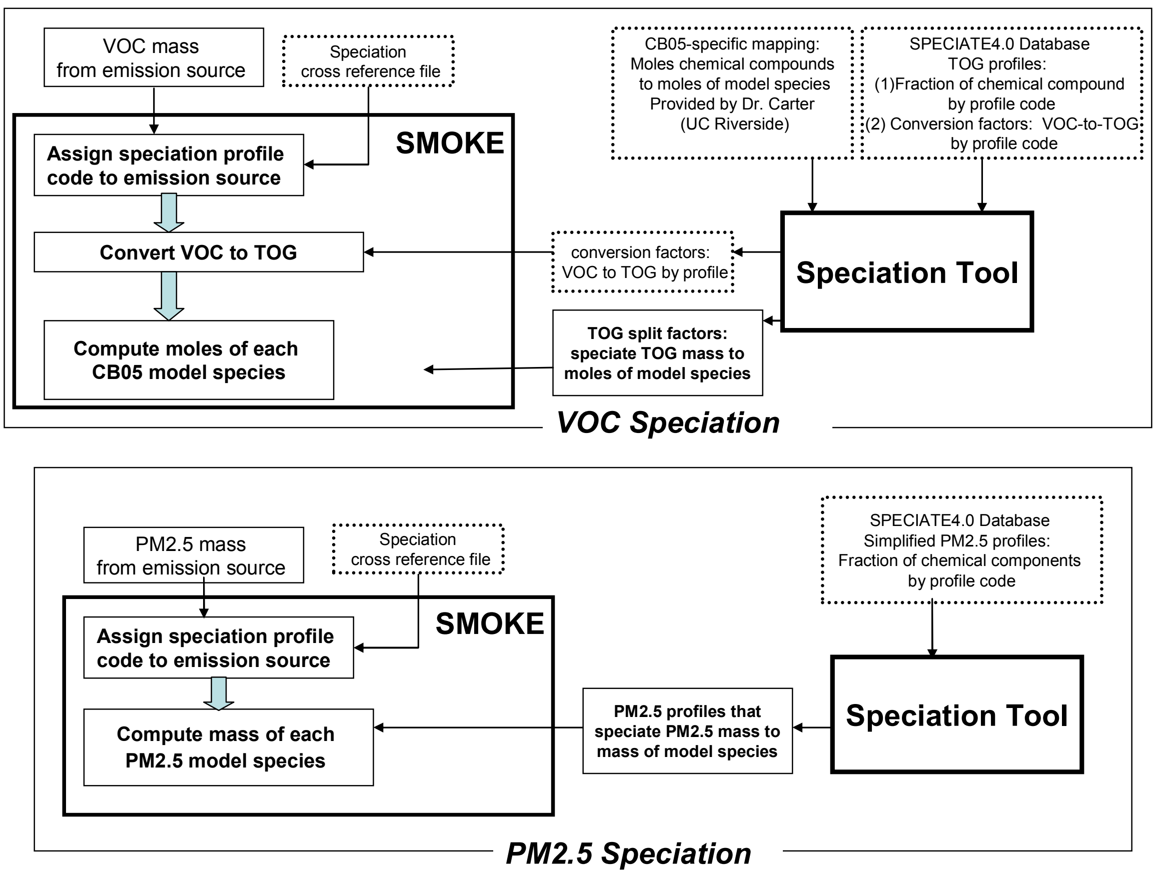
Inventory Pollutant	Model Species	Model species description
CO	CO	Carbon monoxide
NOX	NO	Nitrogen oxide
	NO2	Nitrogen dioxide
SO2	SO2	Sulfur dioxide
	SULF	Sulfuric acid vapor
NH3	NH3	Ammonia
VOC	ALD2	Acetaldehyde
	ALDX	Propionaldehyde and higher aldehydes
	ETH	Ethene
	ETHA	Ethane
	ETOH	Ethanol
	FORM	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
Various additional VOC species from the biogenics model which do not map to the above model species	TERP	Terpenes
PM10	PMC	Coarse PM > 2.5 microns and ≤ 10 microns
PM2.5	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

For VOC, the speciation approach involves three major steps, as performed by SMOKE:

- Assignment of speciation profiles to each emission source
- Conversion of VOC from the emission source to TOG
- Application of speciation profiles that disaggregate TOG into CB05 model species.

The approach for PM2.5 emissions is somewhat simpler, since it does not requite the second step. Figure 3-2 shows the steps involved in chemical speciation for both VOC and $PM_{2.5}$, and it identifies the underlying inputs used to develop the CB05-based ancillary files for the 2002 Platform for CAPs.

Figure 3-2. Chemical Speciation Approach Used for the 2002-based Platform



Section 3.3.2 provides the details about the data files used to accomplish these speciation processing steps.

3.2.3 Temporal processing configuration

Table 3-4 summarizes the temporal aspect of the emissions processing configuration. It compares the key approaches we used for temporal processing across the sectors. We control temporal aspect of SMOKE processing through (a) the scripts T_TYPE (Temporal type) and M_TYPE (Merge type) settings and (b) the ancillary data files described in Section 3.3.3.

Table 3-4. Temporal Settings Used for the Platform Sectors in SMOKE

Platform sector	Inventory resolution	Monthly profiles used?	Daily temporal approach [1,2]	Merge processing approach [1,3]	Process Holidays as separate days?
ptipm	daily & hourly		all	all	yes
ptnonipm	annual	yes	mwdss	all	yes
othpt	annual	yes	mwdss	all	
nonroad	monthly		mwdss	mwdss	yes
othar	annual	yes	mwdss	mwdss	
alm	annual	yes	mwdss	mwdss	
onroad	monthly		week	week	yes
othon	annual	yes	mwdss*	mwdss*	
nonpt	annual	yes	mwdss	mwdss	yes
ag	annual	yes	aveday	aveday	
afdust	annual	yes	aveday	aveday	
biog	hourly		n/a	n/a	
ptfire	daily		all	all	
nonptfire	annual	yes	aveday	aveday	

[1] **Definitions for processing resolution:**
all = hourly emissions computed for every day of the year, inventory is already daily
week = hourly emissions computed for all days in one "representative" week, representing all weeks for each month, which means emissions have day-of-week variation, but not week-to-week variation within the month
mwdss= hourly emissions for one representative Monday, representative weekday, representative Saturday and representative Sunday for each month, which means emissions have variation between Mondays, other weekdays, Saturdays and Sundays within the month, but not week-to-week variation within the month. Also Tuesdays, Wednesdays and Thursdays are treated the same.
aveday = hourly emissions computed for one representative day of each month, which means emissions for all days of each month are the same.

[2] **Daily temporal approach** refers to the temporal approach for getting daily emissions from the inventory using the Temporal program. The values given are SMOKE's T_TYPE setting.

[3] **Merge processing approach** refers to the days used to represent other days in the month for the merge step. If not "all", then the SMOKE merge step just run for representative days, which could include holidays as indicated by the rightmost column. The values given are SMOKE's M_TYPE setting.
* We discovered after the modeling that "week" would have been a more appropriate setting because this sector includes weekly profiles that vary across days of the week.

In addition to the resolution, temporal processing includes a ramp-up period for several days prior to January 1, 2002, which is intended to mitigate the effects of initial condition concentrations. The same procedures were used for all grids, but with different ramp-up periods for each grid:

- 36 km: 10 days (Dec 22 - Dec 31)
- 12 km (East): 3 days (Dec 29 - Dec 31)
- 12 km (West): 2 days (Dec 30 - Dec 31)

For most sectors, our approach used the emissions from December 2002 to fill in surrogate emissions for the end of December 2001. In particular, for sectors not requiring vertical plume rise calculations (i.e., SMOKE-area and mobile sectors, including nonptfire and avefire), we used December 2002 emissions (representative days) for December 2001. For othpt and ptnonipm, we used December 2002 emissions (representative days) with 2001 meteorology for plume rise. For ptipm, we applied temporal profiles to the annual inventory (rather than using day-specific December emissions), with 2001 meteorology for plume rise. For ptfire, we used the day-specific December 2002 emissions directly (i.e., no representative days), using 2002 meteorology for plume rise. For biogenics, we processed December 2001 emissions using 2001 meteorology.

3.2.4 Vertical allocation of day-specific fire emissions

We used SMOKE to compute vertical plume rise for all of the SMOKE point-source sectors, which is typically done for emissions modeling for CMAQ. One new feature of the vertical allocation for the 2002 Platform was the modeling of wildfires and prescribed burning fires as point sources with plume rise.

The ptfire inventory contains data on the acres burned (acres per day) and fuel consumption (tons fuel per acre) for each day. SMOKE uses these additional parameters to estimate plume rise of emissions into layers above the surface model layer. Specifically, SMOKE uses these data to calculate heat flux, which is then used to estimate plume rise. In addition to the acres burned and fuel consumption, SMOKE needs the heat content of the fuel to compute heat flux. We assumed the heat content to be 8000 Btu/lb of fuel for all fires, because specific data on the fuels were unavailable in the inventory. Since SMOKE can use a fire-specific heat content value, we inserted the default 8000 Btu/lb value into the SMOKE-ready fire inventory data for all fires.

The plume rise algorithm applied to the fires is a modification of the Briggs algorithm [Briggs, 1971 and 1972] with a stack height of zero and a heat release estimated from the fuel loading and fire size. The SMOKE program Laypoint uses the Briggs algorithm to determine the plume top and bottom, and then computes the plumes' distributions into the vertical layers that the plumes intersect. Laypoint uses the pressure difference across each layer over the pressure difference across the entire plume as a weighting factor to assign the emissions to layers. This approach gives plume fractions by layer and source. See http://www.smoke-model.org/version2.4/ for full documentation of Laypoint and the new day-specific formats for the fire files.

The ptfire inventory includes both flaming and smoldering emissions. Smoldering emissions also have plume rise subject to the meteorological conditions on the day they occur. No distinction in the SMOKE processing is made with respect to flaming or smoldering other than the different SCCs.

3.3 Emissions modeling ancillary files

In this section we summarize the ancillary data that SMOKE used to perform spatial allocation, chemical speciation, and temporal allocation for the 2002 Platform. The ancillary data files provide the specific inventory resolution at which spatial, speciation, and temporal factors are applied. For the 2002 Platform, we generally applied spatial factors by country/SCC, speciation factors by pollutant/SCC, and temporal factors by some combination of country, state, county, SCC, and pollutant.

3.3.1 Spatial allocation ancillary files

As described in Section 3.2.1, we performed spatial allocation for a national 36 km domain, an Eastern 12 km domain, and a Western 12 km domain. To do this, SMOKE used national 36 km and 12 km spatial surrogates and a SMOKE area-to-point data file. The spatial data files we used can be obtained from the files listed below, available from the 2002v3CAP website.

- **36km_surg_2002v3mpCAP_smokeformat.zip**: surrogate files for 36 km spatial resolution
- **12km_surg_2002v3mpCAP_smokeformat.zip**: surrogate files for 12 km spatial resolution
- **ancillary_2002v3mpCAP_smokeformat.zip:** spatial related data included are the grid description (GRIDDESC), surrogate description (SRGDESC), surrogate cross reference file (AGREF), and area-to-point (ARTOPNT) file

The 12 km surrogates cover the entire CONUS domain, though they are used directly as inputs for the two separate Eastern and Western Domains shown in Figure 3-1. The SMOKE model windowed the Eastern and Western grids while it created these emissions. The remainder of this subsection provides further detail on the origin of the data used for the spatial surrogates and area-to-point data.

3.3.1.1 Surrogates for U.S. Emissions

There are 66 spatial surrogates available for spatially allocating U.S. county-level emissions to the CMAQ 36 km and 12 km grid cells. As described in Section 3.3.1.2, an area-to-point approach overrides the use of surrogates for some sources. Table 3-5 lists the codes and descriptions of the surrogates.

Table 3-5. U.S. Surrogates Available for the 2002 Platform

Code	Surrogate Description	Code	Surrogate Description
N/A	Area-to-point approach (see 3.3.1.2)	515	Commercial plus Institutional Land
100	Population	520	Commercial plus Industrial plus Institutional
110	Housing	525	Golf Courses + Institutional +Industrial + Commercial
120	Urban Population	527	Single Family Residential
130	Rural Population	530	Residential - High Density
137	Housing Change	535	Residential + Commercial + Industrial + Institutional + Government
140	Housing Change and Population	540	Retail Trade
150	Residential Heating - Natural Gas	545	Personal Repair
160	Residential Heating - Wood	550	Retail Trade plus Personal Repair
165	0.5 Residential Heating - Wood plus 0.5 Low Intensity Residential	555	Professional/Technical plus General Government
170	Residential Heating - Distillate Oil	560	Hospital
180	Residential Heating - Coal	565	Medical Office/Clinic
190	Residential Heating - LP Gas	570	Heavy and High Tech Industrial
200	Urban Primary Road Miles	575	Light and High Tech Industrial
210	Rural Primary Road Miles	580	Food, Drug, Chemical Industrial
220	Urban Secondary Road Miles	585	Metals and Minerals Industrial
230	Rural Secondary Road Miles	590	Heavy Industrial
240	Total Road Miles	595	Light Industrial
250	Urban Primary plus Rural Primary	596	Industrial plus Institutional plus Hospitals
255	0.75 Total Roadway Miles plus 0.25 Population	600	Gas Stations
260	Total Railroad Miles	650	Refineries and Tank Farms
270	Class 1 Railroad Miles	675	Refineries and Tank Farms and Gas Stations
280	Class 2 and 3 Railroad Miles	700	Airport Areas
300	Low Intensity Residential	710	Airport Points
310	Total Agriculture	720	Military Airports
312	Orchards/Vineyards	800	Marine Ports
320	Forest Land	807	Navigable Waterway Miles
330	Strip Mines/Quarries	810	Navigable Waterway Activity
340	Land	850	Golf Courses
350	Water	860	Mines
400	Rural Land Area	870	Wastewater Treatment Facilities
500	Commercial Land	880	Drycleaners
505	Industrial Land	890	Commercial Timber
510	Commercial plus Industrial		

We did not use all of the available surrogates to spatially allocate sources in the 2002 Platform; that is, some surrogates in Table 3-5 were not assigned to any SCCs. Appendix B provides the U.S. emissions assigned by the available surrogates for the CONUS domain region.

Creation of surrogates and shapefiles
We used the Surrogate Tool (Eyth, 2006) to generate all of the surrogates. The shapefiles we input to the Surrogate Tool are provided and documented at http://www.epa.gov/ttn/chief/emch/spatial/spatialsurrogate.html. The document ftp://ftp.epa.gov/EmisInventory/emiss_shp2006/us/list_of_shapefiles.pdf provides a list and summary of these shapefiles. The shapefiles used for the surrogate attributes (e.g., population, agricultural land, marine ports) are the same as those used for the 2001 Platform with two exceptions: we developed new shapefiles for the "population change" and "oil and gas" surrogates. We developed these shapefiles to enable the Surrogate Tool to generate these complex surrogates, which utilize data with different formats (e.g., point locations of refineries and tank farms versus polygon data for gas stations). Combining the data within a new shapefile allowed us generate the surrogates using the Surrogate Tool.

County boundaries
For the 2001 Platform, we had used the same surrogates in Table 3-5; however, we regenerated these surrogates prior to use in the 2002 Platform due to changes in the political boundaries. Specifically, we included changes to boundaries for Broomfield County, CO and the incorporation of the city of Clifton Forge, VA into a county, since these changes occurred between 2001 and 2002.

We also improved the county boundaries used for computing the water surrogate, which SMOKE used to spatially allocate pleasure craft emissions. For the water surrogate, we created county boundaries that extend a half-mile (804.7 meters) from the coastline into the oceans, bays, and Great Lakes. This was done because pleasure craft, and in particular personal watercraft, are not expected, on average, to go more than one half of a mile from the coast. For all other surrogates, county boundaries extend much farther over water; boundaries include all of the Great Lakes, bays, sounds, and extend outward into the ocean by approximately 3 miles.

The detailed steps in developing the county boundaries for the 2002 Platform are provided in ftp://ftp.epa.gov/EmisInventory/emiss_shp2006/us/metadata_for_2002_county_boundary_shapefiles_rev.pdf.

Other spatial surrogate improvements since the 2001 Platform
Other improvements made to the U.S. surrogates and surrogate assignments from the 2001 Platform are:

1. The commercial cooking nonpoint emissions (SCCs 2302002000, 2302002100, 2302002200, 2302003000, 2302003100 and 2302003200) were assigned to surrogate 500 (Commercial Land). Commercial cooking emissions in the 2001 Platform had been assigned to surrogate 580 (Food, Drug, Chemical Industrial land), which relates to the location of industrial processes rather than commercial establishments.
2. The residential wood combustion emissions for wood stoves and fireplace inserts were assigned to surrogate 165 "50% low intensity residential land and 50% residential heating –wood". This represents a change from the 2001 Platform which utilized surrogate 160, "residential heating--wood," for these sources. Surrogate 160 reflects the use of wood as the primary heating source. We changed to surrogate 165 because we believe that the new surrogate does a better job of including areas where residential wood burning may occur that is not solely used as a primary heat source.

3. The residential wood combustion emissions for fireplaces were assigned to the "low intensity residential land" surrogate, rather than "residential heating—wood," which was used in the 2001 Platform. We made this change because fireplaces are not generally used as a primary source of home heating. In addition, "low intensity residential land" gives a spatial pattern for fireplace wood combustion that better fits a common sense view of where more fireplace usage is likely to occur.
4. We assigned surrogates to SCCs in the 2002 NEI that were not in the 2001 Platform, and we updated the cross reference file linking SCCs to surrogates to include these new SCCs.
5. We assigned surrogates to the portable fuel container (PFC) emissions (described in Section 2.2.3). Emissions from these sources were not in the 2001 Platform. Table 3-6 provides these assignments.

Table 3-6. Surrogates assigned to Portable Fuel Container Emission Categories

SCC	Description	Surrogate	Code
2501011011	Residential Portable Fuel Containers: Permeation	Single family dwelling*	527
2501011012	Residential Portable Fuel Containers: Evaporation	Single family dwelling	527
2501011013	Residential Portable Fuel Containers: Spillage During Transport	Total road miles	240
2501011014	Residential Portable Fuel Containers: Refilling at the Pump: Vapor Displacement	Gasoline stations	600
2501011015	Residential Portable Fuel Containers: Refilling at the Pump: Spillage	Gasoline stations	600
2501012011	Commercial Portable Fuel Containers: Permeation	golf courses + commercial + industrial + institutional area	525
2501012012	Commercial Portable Fuel Containers: Evaporation	golf courses + commercial + industrial + institutional area	525
2501012013	Commercial Portable Fuel Containers: Spillage During Transport	Total road miles	240
2501012014	Commercial Portable Fuel Containers: Refilling at the Pump: Vapor Displacement	Gasoline stations	600
2501012015	Commercial Portable Fuel Containers: Refilling at the Pump: Spillage	Gasoline stations	600

* this surrogate had not previously been used in the 2001-based platform, other than as a secondary surrogate for counties that had no data for surrogate 300, Low Intensity Residential Land

Errors resulting from surrogates

We discovered an error in surrogate 525 for Lincoln County, WY after we had already used these data. The error caused emissions allocated with this surrogate to be approximately double what they should have been in one grid cell (46, 66) and 50% too high overall in Lincoln County. This error occurred in processing emissions for the 2002 evaluation case (36 km resolution only), but not the 2002 base case or future-year cases. The correct data are provided in the 2002v3CAP site.

3.3.1.2 Allocation Method for Airport-Related Sources in the U.S.

There are numerous airport-related emission sources in the 2002 NEI, such as aircraft, airport ground support equipment, and jet refueling. Most of these emissions are contained in sectors with county-level resolution – alm (aircraft), nonroad (airport ground support) and nonpt (jet refueling).

Similar to the 2001 Platform, we used the SMOKE "area-to-point" approach to allocate the emissions to airport locations, rather than using airport spatial surrogates, which we found exclude many airports. Under this approach, SMOKE allocates county emissions to one or more grid cells using an "ARTOPNT" ancillary file that contains (1) geographic coordinates of airport locations and (2) allocation factors based on airport-specific aircraft activity. For the 2002 Platform, each airport was assigned to a single location, and therefore the emissions associated with each airport were allocated to a single grid cell.

For the 2002 Platform, we created a new 2002-specific ARTOPNT file. The geographic coordinates and 2002-specific activity information (i.e., landing and takeoffs) used for allocating emissions to multiple airports in a county were largely taken from the "supplemental" geographic information system (GIS) data provided with the 2002 NEI, posted under the "Inventory Data" section" ("Mobile Sector Data") at ftp://ftp.epa.gov/EmisInventory/2002finalnei/mobile_sector_data/ncd_files/gis_allocation. The supplemental data includes geographic coordinates and landing and takeoff (LTO) information for specific airports, which were used in the development of the aircraft emissions in the 2002 NEI v3.

We made a few changes to the geographic information from the NEI supplemental GIS data as follows:

1. We added geographic coordinates when the locations were missing from the NEI supplemental data. We obtains these geographic coordinates from a 2003 Bureau of Transportation Statistics (BTS) "Master Coordinate file", which we downloaded from the Aviation Support Tables at http://www.transtats.bts.gov/ (the actual data set we used is no longer available).
2. We changed state/county FIPS codes in the NEI supplemental GIS data when the state/county FIPS codes were inconsistent with the geographic coordinates. We used Google Earth to determine that the coordinates were the correct locations for airports in these cases.
3. We added airport locations to the ARTOPNT file when counties that contained emissions in the 2002 NEI did not appear in the NEI supplemental GIS data. To do this, we used the 2003 BTS data, referenced in item 1. For the few cases where we were unable to find airports in BTS for counties with airport-related emissions in the NEI, we used airports from other counties. In this situation, we used the state/county FIPS code from the NEI, and the geographic coordinates from the BTS. This mainly occurred in the small Virginia city-counties, where airport-related emissions in the 2002 NEI may have been inadvertently assigned to counties without airports. These cases are documented in the ARTOPNT file, since they create an inconsistency between the county codes and the geographic coordinates.

3.3.1.3 Surrogates for Canada and Mexico Emission Inventories

We used the 2001 Platform surrogates for Canada to spatially allocate the Canadian emissions for the 2002 Platform. Detailed documentation about the Canadian spatial surrogates, their development, and the data are available at: http://www.epa.gov/ttn/chief/emch/spatial/newsurrogate.html.

As in the 2001 Platform, only the population surrogate was used to grid sources in the Mexico emission inventory, provided by municipios (analogous to U.S. counties). We updated this surrogate from the 1999-based population surrogate used in the 2001 Platform to include additional municipios and updated 2000 population data. We created this updated population surrogate using the Surrogate Tool.

The update to include additional municipios was required because the updated Mexican inventories (discussed in Section 2.6) include more municipios than the inventories used for the 2001 Platform. We obtained the municipio boundaries from the Institute for the Environment, Center for Environmental Modeling and Policy Development at the University of North Carolina at Chapel Hill. Municipio population data from the year 2000 were obtained from www.inegi.gob.mx for only those Mexican states that are within the CONUS 36 km national domain. These states are shown in Figure 3-3.

The shapefiles used in the Surrogate Tool are available at http://www.epa.gov/ttn/chief/emch/spatial/spatialsurrogate.html and the 12 km and 36 km surrogate files are on the 2002v3CAP site. Note that the population is "zero" in the Mexico_pop shapefile for municipios that are part of states located outside the 36 km CONUS domain.

Figure 3-3. Mexican States included in the 36 km Modeling Domain

3.3.2 Chemical speciation ancillary files

The following data file, provided at the 2002v3CAP site, contains the SMOKE inputs used for chemical speciation of the inventory species to the CMAQ model species. SMOKE environmental variable names, used in the file names, are shown in capital letters in parentheses:

- **ancillary_2002v3mpCAP_smokeformat.zip:** includes speciation cross reference (GSREF), speciation VOC-to-TOG conversion factors (GSCNV) and speciation profiles (GSPRO)

For VOC speciation, we generated SMOKE-ready TOG-to-model species profiles for the CB05 chemical mechanism using the Speciation Tool (Eyth, 2006). We also used the Speciation Tool to generate a SMOKE-ready file ("GSCNV") containing profile-specific VOC-to-TOG conversion factors. The use of profile-specific factors is a procedural improvement from the SCC-specific approach that was used in the 2001 Platform, since it allows changes to profile assignments by SCC without requiring changes to the VOC-to-TOG conversion factors.

One problem identified after using the "GSCNV" file created for 2002 is that it was missing some entries for mode-specific VOC, "EVP__VOC" and "EXH__VOC." Because most of the missing entries were not assigned to emissions in 2002 or had a conversion factor of 1.0 (the default used if the entry is missing), the impact on the speciated VOC was small. Note that this issue was corrected for future-year cases, creating a trivial inconsistency between the 2002 base and future year-base cases.

For $PM_{2.5}$, neither the mass-based $PM_{2.5}$ profiles nor the $PM_{2.5}$ emissions have to be further converted for use in SMOKE, though the Speciation Tool was used to convert the profiles from a database format to SMOKE-ready format.

The TOG and $PM_{2.5}$ speciation factors that are the basis of the chemical speciation approach were developed from the SPECIATE4.0 database (http://www.epa.gov/ttn/chief/software/speciate/index.html) which is EPA's repository of TOG and PM speciation profiles of air pollution sources. EPA developed SPECIATE 4.0 through a collaboration involving EPA's Office of Research and Development (ORD) and EPA's Office of Air Quality Planning and Standards (OAQPS) at Research Triangle Park, NC, and Environment Canada (EPA, 2006c). The SPECIATE4.0 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 $PM_{2.5}$. The 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. These simplified components are:

- PSO4 : primary particulate sulfate
- PNO3: primary particulate nitrate
- PEC: primary particulate elemental carbon
- POC: primary particulate organic carbon
- PMFINE: other primary particulate, less than 2.5 micrograms in diameter

Note that in the 2001 Platform, "POA" was used instead of POC. While POC represents only the carbon mass of the organic carbon $PM_{2.5}$ components, POA has a 20% increase in the $PM_{2.5}$ fraction compared to POC. This additional amount of mass is intended to account for other atoms in the organic carbon particles, such as hydrogen and oxygen. For the 2002 Platform, we decided to use emissions of POC and to make any organic fraction adjustments part of the post-processing of CMAQ outputs.

The assignment of profiles in the SPECIATE4.0 database to emissions sources was done in two steps:

(1) an initial profile assignment list was prepared with the SPECIATE4.0 database
(2) the list was completed and reviewed by emission inventory development, emission modeling and emission factor staff in the EPA's OAQPS and the EPA's ORD.

For VOC speciation factors, recommendations for mobile sources and upstream (i.e., petroleum distribution) sources were obtained from subject experts at OTAQ.

Speciation profiles for use with BEIS are not included in SPECIATE. We added the BEIS3.13 profiles to the SMOKE speciation profiles for CMAQ for CB05. The profile code associated with BEIS3.13 profiles for use with CB05 is "B10C5."

Appendix C provides tables with the VOC and $PM_{2.5}$ inventory mass assigned to each of the profiles for the U.S. states included in the domain for 2002.

For certain gasoline-related sources, we assigned different profiles for the future-year cases (2009 and beyond) than for the 2002 base and evaluation cases in order to account for the influx of ethanol fuel in the 2007 timeframe and beyond. Table 3-7 and Table 3-8 describe these profiles for 2002 and the future years, respectively.

Table 3-7. Gasoline-related speciation profiles used for 2002

Profile Code (SPECIATE4.0)	Profile Description	Sources Using this Profile, 2002
1305	Industry Average (circa 1990) Gasoline Composite (Hot Soak + Diurnal) Evaporative	Evaporative emissions from onroad and nonroad gasoline-fueled mobile sources
1313	Industry Average (circa 1990) Gasoline Exhaust	Exhaust emissions from onroad and nonroad gasoline-fueled mobile sources
8737	Composite Profile - Non-oxygenated Gasoline Headspace Vapor	Gasoline evaporative processes that occur at ambient temperature including vehicle refueling, PFC, storage tanks and transport of gasoline
8734	Composite Profile – Non-oxygenated Gasoline	Gasoline Service Stations, Stage I Splash Filling

Table 3-8. Gasoline-related speciation profiles used for future years

Profile Code (SPECIATE4.0)	Profile Description	Sources Using this Profile for years 2009, 2014, 2020 and 2030
1301	20% Ethanol Composite (Hot Soak + Diurnal) Evaporative	Evaporative emissions from onroad and nonroad gasoline-fueled mobile sources
1314	10% Ethanol Exhaust	Exhaust emissions from onroad and nonroad gasoline-fueled mobile sources
8736	Composite Profile - Ethanol Blended Gasoline Headspace Vapor	Gasoline evaporative processes that occur at ambient temperature including vehicle refueling, PFC, storage tanks and transport of gasoline
8733	Composite Profile – Ethanol Blended Gasoline	Gasoline Service Stations, Stage I Splash Filling

We discovered a few problems in the assignments after we completed the air quality model runs. The data provided at the 2002v3CAP site correct these problems, and the GSCNV problem discussed previously. The two assignment problems and corrections are:

- For aircraft VOC, we initially used profile 2752 (Aircraft - Atlanta - August 27, 1990), but this was changed to profile 1098 (Aircraft Landing/Takeoff (LTO) – Commercial) based on recommendations from the Federal Aviation Administration.
- For SCCs 30400398 and 30400399 (both described as "Industrial Processes;Secondary Metal Production;Grey Iron Foundries;Other Not Classified") we inadvertently used profile 1098 (Aircraft Landing/Takeoff (LTO) – Commercial). This was changed to profile 1089 (Secondary Metal Production - Gray Iron Foundries - Pouring/Casting).

3.3.3 Temporal allocation ancillary files

The emissions modeling step for temporal allocation creates the 2002 hourly emission inputs for CMAQ by adjusting the emissions from the inventory resolution (annual, monthly, daily or hourly) that are input into SMOKE. The temporal resolution of each of the platform sectors prior to their input into SMOKE is included in the sector descriptions from Table 2-1 and repeated in the discussion of temporal settings in Table 3-4.

The monthly, weekly, and diurnal temporal profiles and associated cross references used to create the 2002 hourly emissions inputs for CMAQ were generally based on the temporal allocation data used for the 2001 Platform. We modified or corrected profiles for particular categories where updated data were available, and added new profile assignments for new SCCs that were not in the 2001 inventory.

The following data file, provided at the 2002v3CAP site, contains the files used for temporal allocation of the inventory emissions to hourly emissions. SMOKE environmental variable names, used in the file names, are shown in capital letters in parentheses:

- **ancillary_2002v3mpCAP_smokeformat.zip:** includes temporal cross reference files used across all inventory sectors (ATREF, MTREF, and PTREF) and for ptipm sector (used for electric generating units) for the evaluation case (PTREF) and, temporal profiles (ATPRO, MTPRO, and PTPRO)

The remainder of this section discusses the development of the new temporal profiles or profile assignments listed below:

- ptipm: updated diurnal profiles for non-CEM sources
- onroad and nonroad: updated weekly profiles
- nonpt (PFC): assignment of monthly, weekly and diurnal profiles
- ag (fertilizer): correction of monthly profiles

Diurnal Profiles for Electric Generating Units (ptipm)

We updated the state-specific and pollutant-specific diurnal profiles for use in allocating the day-specific emissions for non-CEM sources in the ptipm sector. We used the 2002 CEM data to create state-specific, day-to-hour factors, averaged over the whole year and all units in each state. We calculated the diurnal factors using CEM SO_2 and NO_X emissions and heat input. We computed SO_2 and NO_X-specific factors from the CEM data for these pollutants. All other pollutants used the hourly heat input data. We assigned the resulting profiles by state and pollutant.

Onroad Mobile: Weekly Profiles

We use weekly profiles to allocate the monthly total mobile source emissions to each day of the week. We changed the weekly profiles for onroad mobile sources to account for differences in the weekly pattern of heavy duty and light duty vehicles in urban versus rural areas. These changes were made based on guidance and references (Chinkin, et. al, 2002 and the Highway Capacity Manual, 2000) provided by subject experts at OTAQ. In the 2001 Platform, we used two profiles for weekly variation that did not vary by vehicle type; they varied only by urban versus rural roadway.

Field study data (Chinkin, et. al, 2002) indicate that the fraction of weekend emissions for light duty vehicles (LDVs) on rural roadways is larger than what was used in the 2001 Platform. The opposite effect is shown for heavy duty vehicles (HDVs) on rural roads on weekends. For urban roadways, the data for LDVs indicates somewhat greater activity during weekdays versus weekends, whereas the data for HDVs indicates much greater activity on the weekdays versus weekends. These weekday versus weekend relationships for LDVs and HDVs are consistent with data collected by the Minnesota Department of Transportation and published in the Highway Capacity Manual (2000).

Tables 3-9 and 3-10 show the 2002 Platform weekly profiles for onroad mobile sources as compared to those used in the 2001 Platform for rural and urban roadways, respectively.

Table 3-9. Onroad Mobile Weekly Profiles for Rural Roadways: 2002 Platform vs 2001 Platform

		Profile Weights and Percent (%) of emissions*							
Profile code	**Vehicle Type**	**Mon**	**Tues**	**Wed**	**Thur**	**Fri**	**Sat**	**Sun**	**Sum**
		2002 Platform							
20022	HDV	1678 (16.8%)	1678 (16.8%)	1678 (16.8%)	1678 (16.8%)	1594 (15.9%)	881 (8.8%)	814 (8.8%)	10001
20021	LDV	1205 (12.1%)	1205 (12.1%)	1205 (12.1%)	1205 (12.1%)	1825 (18.3%)	1530 (15.3%)	1825 (18.3%)	10000
		2001 Platform							
2002	ALL TYPES	101 (14.3%)	100 (14.2%)	100 (14.2%)	109 (15.5%)	111 (15.8%)	94 (13.4%)	89 (12.6%)	704
*** Percent of emissions = 100*WEIGHT/SUM**									

Table 3-10. Onroad Mobile Weekly Profiles for Urban Roadways: 2002 Platform vs 2001 Platform

		Profile Weights and Percent (%) of emissions*							
Profile code	**Vehicle Type**	**Mon**	**Tues**	**Wed**	**Thur**	**Fri**	**Sat**	**Sun**	**Sum**
		2002 Platform							
20032	HDV	1770 (17.7%)	1770 (17.7%)	1770 (17.7%)	1770 (17.7%)	1717 (17.2%)	696 (7.0%)	505 (5.0%)	9998
20031	LDV	1475 (14.8%)	1475 (14.8%)	1475 (14.8%)	1475 (14.8%)	1595 (16.0%)	1342 (13.4%)	1163 (11.6%)	10000
		2001 Platform							
2003	ALL TYPES	109 (15.6%)	108 (15.4%)	106 (15.1%)	114 (16.3%)	109 (15.6%)	86 (12.3%)	68 (9.7%)	700
*** Percent of emissions = 100*WEIGHT/SUM**									

<u>Nonroad mobile: Weekly Profiles</u>

We updated the nonroad weekly profiles for allocating monthly nonroad sector emissions to weekdays versus weekends using data provided in the NONROAD model's technical memorandum "Weekday and Weekend Day Temporal Allocation of Activity In The Draft NONROAD2004 Model" (EPA, 2004). This reference provides default activity allocation fractions for weekend days versus weekdays by nonroad equipment types. Table 3-11 summarizes the updates.

Table 3-11. Updated Nonroad Mobile Weekly Profiles

Equipment Category	Previous Weekly Profile Code and description	Week-day fraction from OTAQ memorandum *	Weekend day fraction from OTAQ memorandum *	2002 Platform Weekly Profile Code
Recreational	7: all days are the same	0.1111	0.2222	9
Construction	7: all days are the same	0.1667	0.0833	18
Industrial	7: all days are the same	0.1667	0.0833	18
Residential Lawn and Garden	7: all days are the same for lawn mowers 17: 0.16 wkday; 0.10 wknd for other residential eqmt.	0.1111	0.2222	9
Commercial Lawn and Garden	17: 0.16 wkday; 0.10 wknd	0.1600	0.1000	17
Agricultural	17: 0.16 wkday; 0.10 wknd	0.1667	0.0833	18
Light Commercial	17: 0.16 wkday; 0.10 wknd	0.1667	0.0833	18
Logging	17: 0.16 wkday; 0.10 wknd	0.1667	0.0833	18
Airport Service	7: all days are the same	0.1429	0.1429	7
Railway Maintenance	7: all days are the same	0.1800	0.0500	19
Recreational Marine	7: all days are the same	0.0600	0.3500	16
Transportation A/C Refrigeration	7: all days are the same	0.1429	0.1429	7
Underground Mining	7: all days are the same	0.1667	0.0833	18
Oil Field Equipment	7: all days are the same	0.1429	0.1429	7

* The values are the fractions of weekly activity allocated to each weekday and each weekend day. To get the fraction for all weekdays, multiply the weekday fraction by 5. Similarly, to get the weekend fraction, multiply the weekend day fraction by 2. All equipment types within a category (e.g., excavators within the construction equipment category) are assigned the weekday and weekend day fractions for that category.

Monthly, Weekly and Diurnal Profiles for Portable Fuel Containers (PFC)

We assigned temporal profiles to allocate the annual PFC emissions in the nonpt sector using several existing temporal profiles, since we did not have data to create new profiles specific to these new SCCs for the 2002 Platform. Table 3-12 lists the profile assignments.

Table 3-12. Temporal Profile Assignments for Portable Fuel Containers

SCC	Temporal Profile: Monthly Variation*	Temporal Profile: Day of Week Variation	Temporal Profile: Diurnal variation*
2501011011: Residential PFC: Permeation	Code=4, from Jan-Dec: 13 13 91 91 91 137 137 137 92 92 92 13 Rationale: less during colder months, more during hotter months	Code=7 no day of week variation since the variation is caused by temperature which is not related to day of week	Code=36, 12am to 11pm 11 8 7 6 7 7 9 10 16 25 43 60 76 88 94 103 97 89 75 60 51 32 18 11, Variation reflects higher temperatures at middle of day
2501011012: Residential PFC: Evaporation	Code=4, Same rationale as SCC 2501011011	Code=7, Same rationale as SCC 2501011011	Code=36, Same rationale as SCC 2501011011
2501011013: Residential PFC: Spillage During Transport	Code=33, *from Jan-Dec: 63 63 87 87 87 100 100 100 83 83 83 63 Rationale: slightly more activity in hotter months (more use of gas cans for lawnmowers, boats)	Code=9, use same as residential lawn and garden temporal profile (0.1111 wkdy, 0.22222 wknd)	Code=14 12am to 11pm: 0 0 0 0 0 0 0 0 714 714 714 714 714 714 714 714 714 714 714 714 714 714 0 0, Equal activity from 8am to 10pm, no activity from 10pm to 8am Rationale: Most of activity to be done during daytime.
2501011014: Residential PFC: Refilling at the Pump: Vapor Displacement	Code=33, Same rationale as SCC 2501011013	Code=9, use same as residential lawn and garden temporal profile Same rationale as SCC 2501011013	CODE=14 , Same rationale as SCC 2501011013
2501011015: Residential PFC: Refilling at the Pump: Spillage	Code=33, Same rationale as for SCC 2501011013	Code=9 Same rationale as for SCC 2501011013	CODE=14, Same rationale as 2501011013
2501012011: Commercial PFC: Permeation	Code=4, Same rationale as SCC 2501011011	Code=7 Same rationale as SCC 2501011011	Code=36 Same rationale as SCC 2501011011
2501012012: Commercial PFC: Evaporation	Code=4, Same rationale as SCC 2501011011	Code=7 Same rationale as SCC 2501011011	Code=36 Same rationale as SCC 2501011011
2501012013: Commercial PFC: Spillage During Transport	Code=33, *from Jan-Dec: 63 63 87 87 87 100 100 100 83 83 83 63. Rationale: slightly more commercial activity in hotter months (more use of gas cans for lawnmowers, boats)	Code = 17, same as commercial lawn and garden (weekday=0.16, weekend=0.100)	CODE=13, 12am to 11pm, 0 0 0 0 0 0 0 0 769 769 769 769 769 769 769 769 769 769 769 769 769 0 0 0, Equal activity from 8am to 9pm, no activity from 9pm to 8am. Rationale: Most of activity to be done during daytime.
2501012014: Commercial PFC: Refilling at the Pump: Vapor Displacement	Code = 33, Same rationale as SCC 2501012013	Code = 17, Same rationale as SCC 2501012013	Code=13, Same rationale as SCC 2501012013
2501012015: Commercial PFC: Refilling at the Pump: Spillage	Code = 33, Same rationale as SCC 2501012013	Code = 17, Same rationale as SCC 2501012013	Code=13, Same rationale as SCC 2501012013

* arrays of values in table represent profile weights

Monthly Fertilizer Profiles

We modified the monthly profiles for fertilizer SCCs for eight northern states (Illinois, Indiana, Iowa, Minnesota, Nebraska, New York, Ohio and Wisconsin) to shift emissions from December to earlier in the fall (i.e., September through November). We made this change based on the understanding that fall fertilizer applications are made before snow covers the ground.

4 Development of Future Year Emission Inventories

This section describes the methods we used for developing future-year emissions for 2009, 2014, 2020, and 2030. The projection methodology varied by sector. For some sectors, we relied on the output of models that incorporate activity changes and control programs to estimate future-year emissions. For other sectors we applied projection factors and/or percent reductions to account for emissions growth based on activity growth and/or emission reductions due to control programs controls or closures. The following bullets summarize the projection methods used for sources in the various sectors:

- **IPM sector (ptipm):** Unit-specific estimates from IPM, version 3.1.
- **Non-IPM sector (ptnonipm):** Projection factors and percent reductions that reflect emission reductions due to control programs, plant closures, and settlements; used consistent projections approaches for ptnonipm livestock, aircraft and gasoline stage II emissions as are used for the sectors that contain the bulk of these emissions.
- **Average fires sector (avefire):** No growth or control.
- **Agricultural sector (ag):** Projection factors for livestock estimates based on expected changes in animal population; no growth or control for fertilizer NH_3.
- **Area fugitive dust sector (afdust):** Projection factors for dust categories related to livestock estimates based on expected changes in animal population; no growth or control for other categories in this sector.
- **Remaining Nonpoint sector (nonpt):** Projection factors and percent reductions that reflect emission reductions due to control programs. Residential wood combustion projections based on growth in lower-emitting stoves and a reduction in higher emitting stoves. PFC projection factors reflecting impact of MSAT rule. Gasoline stage II projection factors based on NMIM-estimated VOC refueling estimates for future years.
- **Nonroad mobile sector (nonroad):** Output from the NONROAD2005 model, which was run using NMIM;
- **Aircraft, locomotive, commercial marine sector (alm):** Terminal area forecast information for aircraft, as aggregated to the national level, accounting for projected changes in landing/takeoff activity. Projection factors for commercial marine and locomotives which reflect activity growth and controls, as generated by national estimates provided by subject experts at EPA's OTAQ.
- **Onroad mobile sector (onroad):** Output of onroad mobile sources emission from the MOBILE6 model (not including refueling emissions), which was run using NMIM.
- **Other onroad sector (othon):** Year-specific, future-year Canadian emissions (obtained from Environment Canada) grown and controlled from the data used in the 2002 base case. 1999 emissions for Mexico for all future-year scenarios.
- **Other nonroad/nonpoint (othar):** Same description applies as "other onroad."

- **Other Point (othpt):** Same description applies as "other onroad," plus the 2002 inventory of offshore emissions for all future-year scenarios.
- **Biogenic:** 2002 emissions used for all future-year scenarios.

Table 4-1 provides a summary of anthropogenic national total emissions by sector and pollutant. A more detailed summary by sector, state, and pollutant for the U.S. is provided in Appendix D. This information is also available electronically at the 2002v3CAP site, which also contains annual total emissions by state and sector after application of chemical speciation factors.

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

Table 4-1. Summaries by Sector of 2002, 2009, 2014, 2020 and 2030 base year emissions for the Continental United States (48 states + District of Columbia).

Year	Sector	[tons/yr] VOC	[tons/yr] NO_X	[tons/yr] CO	[tons/yr] SO_2	[tons/yr] NH3	[tons/yr] PM10	[tons/yr] PM2.5
2002	afdust	0	0	0	0	0	8,901,461	1,830,271
	ag	0	0	0	0	3,251,990	0	0
	alm	123,676	2,259,844	806,471	312,313	904	97,039	86,719
	avefire	451,127	189,428	8,554,550	49,094	36,777	796,229	684,034
	nonpt	7,929,917	1,531,602	7,526,723	1,250,265	135,542	1,377,055	1,100,884
	nonroad	2,873,622	2,176,159	21,386,059	187,284	1,859	227,875	216,658
	onroad	4,847,990	7,786,709	59,810,866	242,379	290,708	205,914	146,003
	ptipm	42,378	4,618,944	605,148	10,359,102	29,991	608,718	501,998
	ptnonipm	1,425,158	2,368,987	3,195,469	2,249,550	154,180	603,606	372,330
2002 Total		**17,693,869**	**20,931,673**	**101,885,285**	**14,649,986**	**3,901,951**	**12,817,898**	**4,938,898**
2009	afdust	0	0	0	0	0	8,902,659	1,830,492
	ag	0	0	0	0	3,349,298	0	0
	alm	129,545	2,052,643	852,496	239,443	1,010	97,768	87,150
	avefire	451,127	189,428	8,554,550	49,094	36,777	796,229	684,034
	nonpt	7,723,351	1,529,620	7,361,301	1,250,024	135,342	1,354,159	1,077,637
	nonroad	2,305,942	1,839,505	15,897,170	32,307	2,104	181,111	171,230
	onroad	3,134,889	4,723,144	35,085,683	35,839	307,508	161,499	100,549
	ptipm	42,768	2,390,659	648,345	5,557,430	36,806	490,783	368,016
	ptnonipm	1,147,179	2,173,721	3,186,791	2,069,813	155,022	570,222	352,304
2009 Total		**14,934,802**	**14,898,719**	**71,586,336**	**9,233,950**	**4,023,868**	**12,554,430**	**4,671,411**
2014	afdust	0	0	0	0	0	8,903,518	1,830,650
	ag	0	0	0	0	3,418,828	0	0
	alm	133,744	2,005,296	905,473	227,419	1,087	98,752	87,586
	avefire	451,127	189,428	8,554,550	49,094	36,777	796,229	684,034
	nonpt	7,547,362	1,528,204	7,243,136	1,249,852	135,199	1,337,804	1,061,032
	nonroad	2,017,473	1,467,923	14,667,974	2,976	2,296	146,716	137,921
	onroad	2,526,203	2,981,427	30,393,359	31,058	331,002	137,481	74,819
	ptipm	46,093	2,104,728	716,731	4,869,100	41,755	561,556	433,471
	ptnonipm	1,145,581	2,163,011	3,190,969	2,044,379	156,433	569,401	351,814
2014 Total		**13,867,583**	**12,440,017**	**65,672,193**	**8,473,877**	**4,123,379**	**12,551,458**	**4,661,327**
2020	afdust	0	0	0	0	0	8,904,542	1,830,838
	ag	0	0	0	0	3,502,212	0	0
	alm	140,269	2,020,926	973,765	257,552	1,200	102,735	90,712
	avefire	451,127	189,428	8,554,550	49,094	36,777	796,229	684,034
	nonpt	7,515,029	1,526,504	7,101,297	1,249,645	135,028	1,318,174	1,041,101
	nonroad	1,830,241	1,094,566	15,069,996	3,196	2,536	107,009	99,368
	onroad	2,089,022	1,942,023	29,281,916	34,962	361,913	132,567	65,185
	ptipm	48,994	1,991,510	735,819	4,532,415	43,843	740,401	605,467
	ptnonipm	1,145,622	2,165,705	3,195,527	2,044,547	158,127	569,416	351,825
2020 Total		**13,220,304**	**10,930,663**	**64,912,870**	**8,171,411**	**4,241,636**	**12,671,074**	**4,768,531**

Year	Sector	[tons/yr] VOC	[tons/yr] NO_X	[tons/yr] CO	[tons/yr] SO_2	[tons/yr] NH3	[tons/yr] PM10	[tons/yr] PM2.5
2030	afdust	0	0	0	0	0	8,904,542	1,830,838
	ag	0	0	0	0	3,502,212	0	0
	alm	151,923	2,204,535	1,077,221	374,356	1,434	116,926	103,378
	avefire	451,127	189,428	8,554,550	49,094	36,777	796,229	684,034
	nonpt	7,515,029	1,526,504	7,101,297	1,249,645	135,028	1,318,174	1,041,101
	nonroad	1,896,401	882,616	16,715,105	3,688	2,922	85,964	77,869
	onroad	1,929,231	1,492,560	32,051,657	41,286	417,113	148,999	70,121
	ptipm	48,994	1,991,510	735,819	4,532,415	43,843	740,401	605,467
	ptnonipm	1,145,622	2,165,705	3,195,527	2,044,547	158,127	569,416	351,825
2030 Total		**13,138,328**	**10,452,858**	**69,431,177**	**8,295,030**	**4,297,455**	**12,680,651**	**4,764,633**

Table 4-2. Summaries by Sector for the Other ("oth") -Canada, Mexico, and Offshore-2002, 2009, 2014, and 2020 base year emissions within the 36 km domain

Year	Country & Sector	[tons/yr] VOC	[tons/yr] NO_X	[tons/yr] CO	[tons/yr] SO_2	[tons/yr] NH3	[tons/yr] PM10	[tons/yr] PM2.5
2002	Canada othar	1,878,996	1,060,097	4,282,782	227,942	569,738	1,462,643	400,493
	Canada othon	410,981	874,564	5,810,763	26,376	18,332	19,692	18,071
	Canada othpt	237,957	628,175	1,149,266	2,115,572	23,866	241,081	129,342
	Canada Subtotal	**2,527,933**	**2,562,836**	**11,242,811**	**2,369,890**	**611,937**	**1,723,417**	**547,906**
	Mexico othar	586,842	249,045	644,733	101,047	486,484	143,816	92,861
	Mexico othon	183,563	147,519	1,456,285	8,276	2,549	6,960	6,377
	Mexico othpt	113,044	258,510	88,957	980,359	0	125,385	88,132
	Mexico Subtotal	**883,448**	**655,074**	**2,189,976**	**1,089,682**	**489,033**	**276,161**	**187,370**
	Off-shore othpt	70,329	26,628	6,205	0	0	0	0
2002 Total		**6,893,091**	**6,462,448**	**26,871,779**	**6,919,144**	**2,201,939**	**3,999,156**	**1,470,552**
2009	Canada othar	1,991,247	1,108,211	5,358,685	221,081	281,785	1,491,052	459,915
	Canada othon	201,050	465,181	3,738,918	2,258	24,034	7,339	6,729
	Canada othpt	319,478	654,572	1,326,302	1,964,497	21,384	264,692	159,141
	Canada Subtotal	**2,511,774**	**2,227,963**	**10,423,905**	**2,187,836**	**327,204**	**1,763,084**	**625,785**
	Mexico othar	586,842	249,045	644,733	101,047	486,484	143,816	92,861
	Mexico othon	183,429	147,419	1,455,121	8,270	2,547	6,955	6,372
	Mexico othpt	113,044	258,510	88,957	980,359	0	125,385	88,132
	Mexico Subtotal	**883,314**	**654,974**	**2,188,811**	**1,089,676**	**489,031**	**276,156**	**187,366**
	Off-shore othpt	70,329	26,628	6,205	0	0	0	0
2009 Total		**6,860,506**	**5,792,503**	**25,231,637**	**6,555,024**	**1,632,469**	**4,078,481**	**1,626,301**

Year	Country & Sector	[tons/yr] VOC	[tons/yr] NO_X	[tons/yr] CO	[tons/yr] SO_2	[tons/yr] NH3	[tons/yr] PM10	[tons/yr] PM2.5
2014	Canada othar	2,070,071	1,131,722	5,421,618	223,415	319,077	1,866,812	488,006
	Canada othon	149,687	281,663	3,593,196	2,606	27,876	4,294	3,972
	Canada othpt	332,121	662,111	1,378,551	1,965,484	23,315	276,689	165,517
	Canada Subtotal	**2,551,879**	**2,075,496**	**10,393,365**	**2,191,504**	**370,267**	**2,147,795**	**657,495**
	Mexico othar	586,842	249,045	644,733	101,047	486,484	143,816	92,861
	Mexico othon	183,429	147,419	1,455,121	8,270	2,547	6,955	6,372
	Mexico othpt	113,044	258,510	88,957	980,359	0	125,385	88,132
	Mexico Subtotal	**883,314**	**654,974**	**2,188,811**	**1,089,676**	**489,031**	**276,156**	**187,366**
	Off-shore othpt	70,329	26,628	6,205	0	0	0	0
2014 Total		**6,940,715**	**5,487,569**	**25,170,557**	**6,562,360**	**1,718,597**	**4,847,903**	**1,689,721**
2020	Canada othar	2,063,413	1,126,276	5,021,305	222,949	346,364	1,723,387	476,603
	Canada othon	132,289	185,106	3,535,542	2,910	31,167	3,384	3,140
	Canada othpt	342,612	667,650	1,428,595	1,946,907	25,228	286,923	171,448
	Canada Subtotal	**2,538,314**	**1,979,032**	**9,985,441**	**2,172,766**	**402,759**	**2,013,695**	**651,191**
	Mexico othar	586,842	249,045	644,733	101,047	486,484	143,816	92,861
	Mexico othon	183,429	147,419	1,455,121	8,270	2,547	6,955	6,372
	Mexico othpt	113,044	258,510	88,957	980,359	0	125,385	88,132
	Mexico Subtotal	**883,314**	**654,974**	**2,188,811**	**1,089,676**	**489,031**	**276,156**	**187,366**
	Off-shore othpt	70,329	26,628	6,205	0	0	0	0
2020 Total		**6,913,585**	**5,294,641**	**24,354,709**	**6,524,883**	**1,783,580**	**4,579,702**	**1,677,114**

4.1 Stationary Source Projections: IPM sector (ptipm)

The future-year data for the ptipm sector were created by the IPM model version 3.0. The EPA Clean Air Markets Division (CAMD) manages the development of this model and maintains a website dedicated to documenting the latest IPM version: http://www.epa.gov/airmarkets/progsregs/epa-ipm/index.html. At the time we developed this report, the IPM 3.0 documentation is provided as a summary table (http://www.epa.gov/airmarkets/progsregs/epa-ipm/docs/summary2006.pdf) with references to the more textual documentation available for IPM version 2.1.9 (http://www.epa.gov/airmarkets/progsregs/epa-ipm/past-modeling.html#version2004).

We used IPM results for 2010 to represent 2009, 2015 to represent 2014, and we used the 2020 IPM results for 2020. We also used the 2020 results for 2030, since we chose only to project mobile sources to 2030, and the IPM results were only available up until 2025.

4.2 Stationary Source Projections: non-IPM sectors (ptnonipm, nonpt, ag, afdust)

Projections of U.S. stationary sources other than ptipm involved applying growth factors and/or controls to certain categories within the ptnonipm, nonpt, ag and afdust platform sectors. This subsection provides details on the data and projection methods used for these sectors. In estimating future-year emissions, we assumed no emissions growth for many stationary non-IPM sources. This "no-growth" assumption is based on an examination of historical emissions and economic data. While we are working toward improving this approach in future emissions platforms, we are still using this assumption for this platform. 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, 2006a).

4.2.1 Livestock emissions growth (ag, ptnonipm)

Growth in emissions from livestock in the ag, afdust and ptnonipm sectors was based on projections of growth in animal population. Table 4-3 provides the growth factors for animal categories. 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). For dairy cows and turkeys we assumed that there would be no growth in emissions. 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. Thus, we do not believe that production forecasts provide representative estimates of the future number of cows and turkeys; therefore, we did not use these forecasts 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 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 we suspect the excretion value will be changing, but we assumed no change because we did not have a quantitative estimate.

Table 4-3. Growth factors for Animal Operations

Animal Category	Projection factors used in the 2002 platform		
	2009	2014	2020
Dairy Cow	1.000	1.000	1.000
Beef	1.010	1.016	1.025
Pork	1.042	1.071	1.107
Broilers	1.161	1.275	1.413
Turkeys	1.000	1.000	1.000
Layers	1.112	1.192	1.289
Poultry Average	1.125	1.214	1.321
Overall Average	1.044	1.075	1.112

Appendix E provides the animal population data and regression curves used to derive the growth factors. Appendix F provides the cross references of livestock sources in the ag, afdust and ptnonipm sectors to the animal categories in Table 4-3.

4.2.2 Residential wood combustion growth (nonpt)

We projected residential wood combustion emissions based on the expected increase in the number of low-emitting wood stoves and the corresponding decrease in other types of wood stoves. As newer, cleaner woodstoves replace older, higher-polluting wood stoves, there will be an overall reduction of the emissions from these sources. The approach cited here was developed as part of a modeling exercise to estimate the expected benefits of the woodstoves change-out program (http://www.epa.gov/woodstoves/index.html). Details of this approach can be found in Section 2.3.3 of the PM NAAQS Regulatory Impact Analysis (EPA, 2006a). There are two differences between the 2001 and 2002 Platforms for emissions from woodstoves. First, we did not include the Libby Montana woodstove change-out program in our future-year scenarios, because we did not include local control programs in the future emissions from sources in other stationary source sectors. Second, the 2002 Platform contains an additional SCC for outdoor wood burning equipment (SCC 2104008070), which was not present in the 2001 Platform. We have assumed the same 1% per year growth rate for this new SCC as for fireplaces.

The specific assumptions we made were:

- Fireplaces, SCC=2104008001: increase 1%/yr
- Old woodstoves, SCC=2104008002, 2104008010, or 2104008051: decrease 2%/yr
- New woodstoves, SCC=2104008003, 2104008004, 2104008030, 2104008050, 2104008052 or 2104008053: increase 2%/yr

For the general woodstoves and fireplaces category (SCC 2104008000) we computed a weighted average distribution based on 19.4% fireplaces, 71.6% old woodstoves, 9.1% new woodstoves using 2002 Platform emissions for $PM_{2.5}$. These fractions are based on the fraction of emissions from these processes in the states that did not have the "general woodstoves and fireplaces" SCC in the 2002 NEI. This approach results in an overall decrease of 1.056% per year for this source category.

Table 4-4 presents the projection factors used to project 2002 emissions for residential wood combustion.

Table 4-4. Projection Factors for Residential Wood Combustion Sources

SCC and Description*	2009 Factor	2014 Factor	2020 Factor
2104008000: Total: Woodstoves and Fireplaces	0.9261	0.8733	0.8099
2104008001: Fireplaces: General 2104008070: Outdoor Wood Burning Equipment	1.0700	1.1200	1.1800
2104008002: Fireplaces: Insert; non-EPA certified 2104008010: Woodstoves: General 2104008051: Non-catalytic Woodstoves: Non-EPA certified	0.8600	0.7600	0.6400
2104008003: Fireplaces: Insert; EPA certified; non-catalytic 2104008004: Fireplaces: Insert; EPA certified; catalytic 2104008030: Catalytic Woodstoves: General 2104008050: Non-catalytic Woodstoves: EPA certified 2104008052: Non-catalytic Woodstoves: Low Emitting 2104008053: Non-catalytic Woodstoves: Pellet Fired	1.1400	1.2400	1.3600

*All descriptions begin with: "Stationary Source Fuel Combustion;Residential;Wood"

4.2.3 Gasoline Stage II growth and control (nonpt, ptnonipm)

Emissions from Stage II gasoline operations in the 2002 NEI are contained in both nonpt and ptnonipm sectors. The only SCC in the nonpt inventory used for gasoline Stage II emissions is 2501060100 (Storage and Transport; Petroleum and Petroleum Product Storage; Gasoline Service Stations; Stage II: Total). The following SIC and SCC codes are associated with gasoline Stage II emissions in the ptnonipm sector:

- SIC 5541 (Automotive Dealers & Service Stations, Gasoline Service Stations, Gasoline service stations)
- SCC 40600401 (Petroleum and Solvent Evaporation;Transportation and Marketing of Petroleum Products;Filling Vehicle Gas Tanks - Stage II;Vapor Loss w/o Controls)
- SCC 40600402 (Petroleum and Solvent Evaporation;Transportation and Marketing of Petroleum Products;Filling Vehicle Gas Tanks - Stage II;Liquid Spill Loss w/o Controls)
- SCC 40600403 (Petroleum and Solvent Evaporation;Transportation and Marketing of Petroleum Products;Filling Vehicle Gas Tanks - Stage II;Vapor Loss w/o Controls)
- SCC 40600499 (Petroleum and Solvent Evaporation;Transportation and Marketing of Petroleum Products;Filling Vehicle Gas Tanks - Stage II;Not Classified

We used a consistent approach across nonpt and ptnonipm to projection these gasoline stage II emissions. The approach involved computing VOC-specific projection factors from the NMIM results for onroad refueling, using ratios of future–year emissions to 2002 emissions. The approach accounts for three elements of refueling growth and control: (1) activity growth (due to VMT growth as input into NMIM), (2) emissions reductions from Stage II control programs at gasoline stations, and (3) emissions reductions resulting from the phase in over time of newer vehicles with onboard Stage II vehicle controls. We assumed that all areas with Stage II controls in 2002 continue to have Stage II controls in all future calendar years.

We computed the VOC projection factors at a county-specific, annual resolution as shown below:

$$PF_{[\text{county, future year}]} = VOC\_RFL_{[\text{county, future year}]}/VOC\_RFL_{[\text{county, 2002}]}$$

where VOC_RFL is the VOC refueling emissions for onroad sources from NMIM.

We applied these projection factors to both nonpt and ptnonipm sector gasoline stage II sources.

For Stage II sources in the ptnonipm sector, we attempted to apply the county-specific projection factors to sources which had SIC=5541 and any of the four SCC codes identified above. We did not intend to apply these projection factors to sources unless the SIC was 5541 in order to avoid inappropriately adjusting refueling at industrial plants. However, the SIC information was inadvertently dropped when the projection factors were applied in SMOKE. As a result, all point sources with the above SCCs were projected, except for situations in which no sources in the county had SIC=5541. If no sources in a county had SIC=5541, then the sources in that county did not get projected using a county-level VOC refueling ratio, because we only used the county ratios for counties meeting both the SCC and SIC criteria.

The impact of the projection of refueling emissions for which the SIC was not 5541 is small, as shown Table 4-5.

Table 4-5. Emissions for which Stage II projection factors were misapplied to 2002 emissions

State	2002 ptnonipm VOC emissions: All gas stage II processes (tons)	2002 ptnonipm VOC emissions: Gas stage II processes with SIC= 5541 (tons)	Percent of 2002 ptnonipm stage II emissions with SIC=5541	2002 emissions with SIC not equal to 5541 (tons) *
California	1,605	1,465	91.2%	141
Colorado	10,620	10,343	97.4%	278
Kentucky	190	186	97.9%	4
North Carolina	10	5	53.2%	5
Tribal Data	28	28	100.0%	0
OVERALL	**12,453**	**12,026**	**96.6%**	427

* These are the emissions for which the projection factor was misapplied

Table 4-6 shows the 2002 and future year base emissions from nonpt (SCC 2501060100) and ptnonipm (SCCs 40600401, 40600402, 40600403 or 40600499) gasoline Stage II emissions.

Table 4-6. Summary of Gasoline Stage II emissions in base and future years

State	Gas Stage II VOC 2002 nonpt (tons)	Gas Stage II VOC 2002 ptnonipm (tons)	Gas Stage II VOC 2009 nonpt (tons)	Gas Stage II VOC 2009 ptnonipm (tons)	Gas Stage II VOC 2014 nonpt (tons)	Gas Stage II VOC 2014 ptnonipm (tons)	Gas Stage II VOC 2020 nonpt (tons)	Gas Stage II VOC 2020 ptnonipm (tons)
Alabama	8454.14	0.35	4424.07	0.35	2672.87	0.35	2058.77	0.35
Alaska	869.85		440.56		284.85		232.69	
Arizona	7274.86		4147.52		2716.34		2302.96	
Arkansas	4874.82		2651.05		1637.63		1266.12	
California	6305.46	1654.57	4958.29	1406.41	4749.46	1412.50	4964.58	1526.07
Colorado	389.43	10620.49	224.77	5856.45	145.09	3827.40	119.31	3201.51
Connecticut	620.74		488.66		451.98		455.72	
Delaware	515.23		279.86		201.41		179.55	
District of Columbia	104.17		71.16		61.45		61.46	
Florida	20296.20	27.48	11144.60	27.48	7569.32	27.48	6321.63	27.48
Georgia	11009.57	9.00	5969.52	9.00	4158.67	9.00	3525.35	9.00
Hawaii	1446.07		749.93		451.93		350.30	
Idaho	1962.14		1155.07		738.32		589.50	
Illinois	8988.01	11.99	4858.77	11.99	3278.41	11.99	2794.47	11.99
Indiana	10085.06	0.04	5235.92	0.04	3292.99	0.04	2658.95	0.04
Iowa	4455.61		2719.04		1661.18		1185.14	
Kansas	3709.81	0.13	1966.17	0.13	1216.80	0.13	965.28	0.13
Kentucky	5234.34	189.68	2811.89	154.20	1782.57	148.50	1438.65	157.31
Louisiana	5989.40	32.00	3106.67	28.15	1920.49	28.15	1532.46	28.15
Maine	1182.79		668.96		438.10		362.24	
Maryland	3211.88	16.25	1745.82	16.10	1293.54	16.10	1163.80	16.10
Massachussetts	1521.74	7.54	982.13	7.54	855.69	7.54	860.85	7.54
Michigan	14611.55	31.28	7641.00	31.15	4716.80	31.15	3678.22	31.15
Minnesota	7953.52		4215.70		2420.42		1795.29	
Mississippi	4843.45		2348.00		1362.94		1090.95	
Missouri	7212.07	63.62	4087.16	62.88	2650.45	62.88	2159.25	62.88
Montana	1316.50		707.96		439.91		350.43	

State	Gas Stage II VOC 2002 nonpt (tons)	Gas Stage II VOC 2002 ptnonipm (tons)	Gas Stage II VOC 2009 nonpt (tons)	Gas Stage II VOC 2009 ptnonipm (tons)	Gas Stage II VOC 2014 nonpt (tons)	Gas Stage II VOC 2014 ptnonipm (tons)	Gas Stage II VOC 2020 nonpt (tons)	Gas Stage II VOC 2020 ptnonipm (tons)
Nebraska	2496.80		1329.64		830.41		655.97	
Nevada	575.71		431.08		369.47		377.03	
New Hampshire	804.47	0.98	466.12	0.98	340.31	0.98	298.89	0.98
New Jersey	2414.61	0.20	1275.65	0.19	918.02	0.19	814.69	0.19
New Mexico	3139.37		1752.34		1109.15		892.66	
New York	14137.71	1.35	7558.69	1.35	4938.55	1.35	3896.01	1.35
North Carolina	13233.72	9.85	6716.51	5.10	4253.41	3.41	3384.61	2.75
North Dakota	910.39		480.03		294.59		231.08	
Ohio	3863.81	16.81	2137.92	16.75	1350.95	16.75	1151.85	16.75
Oklahoma	6228.32		3288.87		2106.15		1684.52	
Oregon	3674.14		2527.28		1846.14		1358.46	
Pennsyvlania	9529.87	1.79	5199.12	1.79	3567.25	1.79	2950.73	1.79
Rhode Island	253.80		181.14		148.82		135.06	
South Carolina	7538.41		3752.20		2340.16		1824.07	
South Dakota	1071.45		560.17		346.79		270.72	
Tennessee	9529.66		5956.74		3891.25		2850.29	
Texas	17925.90	17.42	8840.39	17.42	6255.26	17.42	5624.26	17.42
Utah	3382.00	0.14	2217.93	0.14	1489.03	0.14	1154.85	0.14
Vermont	262.32		188.78		159.23		155.70	
Virginia	9188.74	46.85	4480.18	44.86	2987.58	44.86	2398.67	44.86
Washington	4179.39	0.97	2851.10	0.97	2264.70	0.97	1899.43	0.97
West Virginia	3231.73	0.43	1483.11	0.43	933.98	0.43	703.70	0.43
Wisconsin	5687.27	0.12	2992.99	0.12	1773.68	0.12	1573.23	0.12
Wyoming	1099.70		557.27		351.06		273.73	
Tribal Data		27.58		18.00		11.58		10.29

4.2.4 Portable fuel container growth and control (nonpt)

We obtained future-year VOC emissions from Portable Fuel Containers (PFCs) from inventories developed and modeled for EPA's MSAT rule (EPA, 2007a and EPA, 2007b). Additional information on the PFC inventories can be found in Section 2.2.3, above. The future-year emissions reflect projected increases in fuel consumption, state programs to reduce PFC emissions, standards promulgated in the MSAT rule, and impacts of the Renewable Fuel Standard (RFS) on gasoline volatility. Future-year emissions for PFCs were available for 2010, 2015, 2020, and 2030. In creating the inventories for the 2002 Platform, we used the 2010 and 2015 emissions to represent 2009 and 2014, respectively. The PFCs emissions for 2020 were used in our platform inventories for 2020 as well as for 2030 in order to be consistent with the approach of using 2020 nonpt emissions for the 2030 scenario.

Although we could have used the projected PFC inventories directly, we chose to compute projection factors based on future and 2002 PFC emissions by SCC, since we used this approach for other sources in the nonpt sector. We developed and applied the factors by State and SCC because differences in VOC projection factors did not vary across counties within the state. This is because the impacts of differences in average gasoline properties on VOC within a state were not accounted for in the PFC inventories. Appendix H provides the 2002 and future-year PFC inventories, along with the resulting projection factors for PFC VOC emissions.

4.2.5 Stationary Source control programs/plant closures (ptnonipm, nonpt)

We applied emissions reduction factors to the 2002 emissions for particular sources in the ptnonipm and nonpt sectors to reflect the impact of stationary-source control programs and plant closures. Our approach differed from what we did for similar sources in the 2001 Platform, because we did not apply controls from ozone and $PM_{2.5}$ State Implementation Plans. Since the available SIP control data were limited to incomplete sets of controls from only four SIPs, we decided that it was inconsistent to apply these data when other SIPs were not represented.

Other aspects of our future-year base controls included the following:

- We did not include MACT rules where compliance dates were prior to 2002.
- We included plant closures (i.e., emissions were zeroed out for future years) where information indicated that the plant was actually closed. However, plants projected to close in the future (post-2007) were not removed in the future years.
- In addition to plant closures, we included the effects on ptnonipm sector emissions of the NO_X SIP Call and Department of Justice Settlements and Consent Decrees. We also included estimated impacts of HAP standards per Section 112, 129 of the Clean Air Act on ptnonipm and nonpt sector emissions, based on expected CAP co-benefits to sources in these sectors.
- The same reductions were applied across all years with the exception of refinery facility/SCC reductions in the states and pollutants listed in Table 4-7. The refinery Consent Decrees are the only set of controls in which some of the compliance dates are beyond 2008. Refinery reductions associated with compliance dates after December 31, 2008 were not applied for the 2009 projection. Similarly, reductions with compliance dates after December 31, 2013

were not applied for the 2014 projection. The latest compliance date is in 2015; therefore all controls were applied for the 2020 projection.

- We applied all of the control programs as replacement controls, which means that any existing percent reductions ("baseline control efficiency") reported in the NEI were removed prior to the addition of the percent reductions due to these control programs.

Table 4-7. States with post-2009 and post-2014 refinery controls

Post-2009 refinery controls	NOx	SO2	PM
California	X	X	
Colorado	X	X	X
Illinois	X	X	X
Louisiana	X		
Mississippi	X		
Montana	X	X	X
New Mexico	X		
Ohio	X	X	X
Oklahoma	X		
Pennsylvania	X	X	X
Texas	X	X	X
Utah	X	X	X
Post-2014 refinery controls			
Washington	X		

After we modeled the future-year emissions, we discovered that an issue in the 2002 NEI v3 point source baseline control efficiency caused an overestimation of $PM_{2.5}$ emission reductions. The $PM_{2.5}$ estimates developed by augmenting based on a PM_{10} estimate (to gap fill presumably missing emissions) for a source did not carry forward the baseline control efficiency associated with PM_{10}. For these sources, the $PM_{2.5}$ baseline control efficiency was missing. Since we would expect similar control efficiencies for $PM_{2.5}$ and PM_{10}, the application of control programs for $PM_{2.5}$ for these presumably already-controlled sources likely overestimated the actual reduction, resulting in underestimated $PM_{2.5}$ in the future year inventory. We estimated the impact of this underestimation to be less than 1500 tons of $PM_{2.5}$. To put this into perspective, the entire ptnonipm $PM_{2.5}$ inventory contains about 370,000 and 350,000 total tons in 2002 and 2020, respectively. Therefore, the potential over-control is less than 0.5% of ptnonipm $PM_{2.5}$ in 2020.

Table 4-8 lists the ptnonipm and nonpt control programs and the affected pollutants.

Table 4-8. Control programs applied to the stationary sources in ptnonipm and nonpt inventory sectors

Control Strategies **(Grouped by Affected Pollutants or Standard and Approach Used to Apply to the Inventory)**	**Pollutants Affected**	**Approach or Reference:**
PTNONIPM Controls		
NO_X SIP Call (Phase II): Cement Manufacturing Large Boiler/Turbine Units Large IC Engines	NOx	1
DOJ Settlements: plant SCC controls Alcoa, TX MOTIVA, DE	NOx, SO2	2
Refinery Consent Decrees: plant/SCC controls	NOx, PM, SO2	3
Closures, pre-2007: plant control of 100% Auto plants Pulp and Paper Plants closed in preparation for 2005 inventory	all	4
Industrial Boiler/Process Heater plant/SCC controls for PM	PM	5
MACT rules, national, VOC: national applied by SCC, MACT Boat Manufacturing Polymers and Resins III (Phenolic Resins) Polymers and Resins IV (Phenolic Resins) Wood Building Products Surface Coating Generic MACT II: Spandex Production, Ethylene manufacture Large Appliances Miscellaneous Organic NESHAP (MON): Alkyd Resins, Chelating Agents, Explosives, Phthalate Plasicizers, Polyester Resins, Polymerized Vinylidene Chloride Manufacturing Nutritional Yeast Oil and Natural Gas Petroleum Refineries -Catalytic Cracking, Catalytic Reforming, & Sulfur Plant Units Pesticide Active Ingredient Production Publicly Owned Treatment Works Reinforced Plastics Rubber Tire Manufacturing Asphalt Processing & Roofing Combustion Sources at Kraft, Soda, and Sulfite Paper Mills Fabric Printing, Coating and Dyeing Iron & Steel Foundries Metal: Can, Coil Metal Furniture Miscellaneous Metal Parts & Products Municipal Solid Waste Landfills Paper and Other Web Plastic Parts Plywood and Composite Wood Products Wet Formed Fiberglass Production Wood Building Products Surface Coating Carbon Black Production Cellulose Products Manufacturing Cyanide Chemical Manufacturing	VOC	EPA, 2007e

Control Strategies (Grouped by Affected Pollutants or Standard and Approach Used to Apply to the Inventory)	Pollutants Affected	Approach or Reference:
Friction Products Manufacturing Leather Finishing Operations Miscellaneous Coating Manufacturing Organic Liquids Distribution (Non-Gasoline) Refractory Products Manufacturing Sites Remediation		
Solid Waste Rules (Section 129d/111d) Hospital/Medical/Infectious Waste Incinerator Regulations	NOx, PM, SO2	EPA, 2005a
MACT rules, national, PM: **Portland Cement Manufacturing** **Secondary Aluminum**	PM	6
MACT rules, plant-level, VOC: **Auto Plants**	VOC	7
MACT rules, plant-level, PM & SO_2: **Lime Manufacturing**	PM, SO2	8
MACT rules, plant-level, PM: **Taconite Ore**	PM	9
NONPT Controls		
Municipal Waste Landfills: project factor of 0.25 applied,	VOC	EPA, 2007e

APPROACHES:

1. Used *Emission Budget Inventories* report (EPA, 1999) for list of SCCs for application of controls, and for percent reductions (except IC Engines). Used Federal Register on Response to Court decisions (Federal Register, 2004) for IC Engine percent reductions and geographic applicability
2. For ALCOA consent decree, used http:// cfpub.epa.gov/compliance/cases/index.cfm; for MOTIVA: used information sent by State of Delaware
3. Used data provided by Brenda Shine, EPA, OAQPS
4. Closures obtained from EPA sector leads; most verified using the world wide web.
5. Used data list of plants provided by project lead from 2001-based platform; required mapping the 2001 plants to 2002 NEI plants due to plant id changes across inventory years
6. Same as used in CAIR, except added SCCs appeared to be covered by the rule: both reductions based on preamble to final rule. (Portland Cement used a weighted average across two processes)
7. Percent reductions recommended and plants to apply to reduction to were based on recommendations by rule lead engineer, and are consistent with the reference: EPA, 2007e
8. Percent reductions recommended are determined from the existing plant estimated baselines and estimated reductions as shown in the Federal Register Notice for the rule. SO2 % reduction will therefore be 6147/30,783 = 20% and PM10 and PM2.5 reductions will both be 3786/13588 = 28%
9. Same approach used in CAIR: FR notice estimates reductions of "PM emissions by 10,538 tpy, a reduction of about 62%." Used same list of plants as were identified based on tonnage and SCC from CAIR.

4.3 Mobile source projections

Onroad and nonroad mobile source emissions for each future year were generated using NMIM in a manner consistent with the 2002 base year NEI emissions. A complete set of the inputs for future year NMIM calculations are available as part of the documentation for the upcoming rule, "Control of Emissions of Air Pollution from Locomotive Engines and Marine Compression-Ignition Engines Less Than 30 Liters per Cylinder (Regulatory Impact Analysis)." When this rule is final, a database with all of the NMIM inputs will be available in the rule docket (see http://www.epa.gov/otaq/marine.htm#regs).

For non-NMIM generated mobile sources (i.e., aircraft, locomotives, and commercial marine vessels), projection factors were computed and applied to the corresponding 2002 inventories. These projection factors reflect the combined effects of growth and reductions from national control programs.

A description of the projection approach used for each of the mobile source sectors is provided in the sections below.

4.3.1 Onroad

Onroad emissions for all of the U.S. other than California were projected for 2009, 2014, 2020 and 2030 using NMIM. These future year emissions account for increased activity (vehicle miles traveled) and changes in fuels, fleet turnover, and inspection and maintenance programs that account for implementation of national and local regulations.

We generated future-year VMT (input to NMIM) using Annual Energy Outlook (AEO) growth estimates (using 2006 AEO estimates) by vehicle type. Appendix G provides the VMT projection methodology.

The NMIM future year inputs also accounted for national and some local control programs. For national control programs, they incorporated the expected impacts of national regulations promulgated prior to July 2007; these include the "Tier 2 Rule," the "2007 Onroad Heavy-Duty Rule," the Final "Mobile Source Air Toxics Rule" (MSAT Final), and the "Renewable Fuel Standard" (RFS).

For the state and voluntary programs, we included the National Low Emission Vehicle Program (NLEV) and Ozone Transport Commission (OTC) LEV program (http://www.epa.gov/otaq/lev-nlev.htm) in the future year inventories. These were included based on state submission of the relevant external files. These programs affect northeastern states. We also modeled reformulated gasoline opt-in programs using state-submitted external files and EPA fuel tables. In addition, we assumed that all state programs existing in 2002 continued in all future calendar years.

We included programs that might affect future VMT (e.g., public transportation, car-pooling, congestion pricing) only if states submitted VMT that modeled these programs. We do not have documentation from the states describing whether or not such programs were incorporated in states' VMT estimates.

We did not include state regulations or voluntary programs that encourage no refueling or evening refueling on Ozone Action Days. We also did not include diesel retrofit and anti-idling programs affecting school buses and diesel trucks.

We did not use NMIM to generate future year onroad emissions for California, because the 2002 base year estimates were based on EMFAC2002, as submitted as part of the NEI by CARB. For California, we chose an approach that would maintain consistency between the base year and future year emissions. This approach involved computing projection factors from a consistent set of future and 2002-year data based on the EMFAC2007 model provided by CARB. We generated projection factors by dividing the EMFAC2007-based emissions for the future years by the EMFAC2007-based emissions for 2002. We then applied the projection factors to the 2002 emission estimates from on EMFAC2002. Due to time considerations, we were unable to incorporate the 2002 emissions from EMFAC2007 directly into the onroad sector of the 2002 Platform.

Where possible, we applied the projection factors at the county, SCC, mode and pollutant level. This could not be done where the 2002 emissions were zero, and the future emissions were greater than zero. In this case we applied more aggregated ratios at the state, SCC and pollutant level. We also applied onroad-total, state-level ratios to project exhaust PM_{10} and exhaust $PM_{2.5.}$ We applied these projection factors to the 2002 inventory uniformly, such that all onroad SCCs and all counties had the same projection factors for each of these pollutants. The reason we computed an aggregated factor was to generate a consistent statewide future-to-base trend for these pollutants as had been estimated by CARB using EMFAC2007. When we applied projection factors for these pollutants at the SCC level (i.e., by vehicle type), the onroad statewide trend we computed was different from the CARB trend. We determined this to be due to the difference in the distribution of emissions by vehicle class between the EMFAC2007 and EMFAC2002 inventories for 2002.

4.3.2 Nonroad

With the exception of California, U.S. emissions for the nonroad sector (defined as the equipment types covered by NMIM) were projected for 2009, 2014, 2020 and 2030 using NMIM. These future-year emissions account for increases in activity (based on NONROAD model default growth estimates) and changes in fuels and engines that reflect implementation of national regulations and local control programs.

The national regulations incorporated in the modeling are those promulgated prior to July 2007, and beginning about 1990. Recent rules include:

- "Clean Air Nonroad Diesel Final Rule - Tier 4" (http://www.epa.gov/nonroad-diesel/2004fr.htm), published June 29, 2004, and,
- Control of Emissions From Nonroad Large Spark-Ignition Engines, and Recreational Engines (Marine and Land-Based), November 8, 2002 ("Pentathalon Rule").

Not included is the "Proposed Emission Standards for New Nonroad Spark-ignition Engines, Equipment, and Vessels" ("Bond Rule"), proposed April 17, 2007, or the "Proposal for More Stringent Emissions Standards for Locomotives and Marine Compression-Ignition Engines", published April 3, 2007. We have not included voluntary programs such as programs encouraging either no refueling or evening refueling on Ozone Action Days and diesel retrofit programs.

The NMIM was not used to generate future-year nonroad emissions for California, other than for NH_3. We used the NMIM for California future nonroad NH_3 emissions because CARB did not provide these data for any nonroad vehicle types. As we did for onroad emissions, we chose a projection approach that would maintain consistency between the base year and future-year emissions for nonroad emissions in California. We divided the OFFROAD2007 future-year emissions by the OFFROAD2007 estimates for 2002. We then applied these projection factors to the 2002 estimates in the 2002 Platform which were based on an earlier version of California's nonroad model. As in the case of the California onroad emissions, we were unable to incorporate the 2002 emissions from OFFROAD2007 directly into nonroad sector of the 2002 Platform.

Where possible, we applied the projection factors using at the county, SCC, mode, and pollutant level. In many cases, the SCCs used in the OFFROAD2007 model were more detailed than those in the earlier California data, and we therefore developed and applied projection factors at a more aggregate level. Table 4-9 shows the aggregation of California SCCs that we needed to make to apply to the more general SCCs in the 2002 NEI.

Table 4-9. SCC Aggregation approach for computing projection factors for California nonroad emissions.

SCC in NEI	Description	Aggregated SCCs used for projection factor
2260002000	Off-highway Vehicle Gasoline, 2-Stroke;Construction and Mining Equipment;Total	use 2265002***(sum across all construction and mining equip.)
2260003000	Off-highway Vehicle Gasoline, 2-Stroke;Industrial Equipment;Total	use 2265003***(sum across all indust equip.)
2260004000	Off-highway Vehicle Gasoline, 2-Stroke;Lawn and Garden Equipment;All	use 2265004*** + 2260004*** (sum across all gas lawn and garden.)
2260006000	Off-highway Vehicle Gasoline, 2-Stroke;Commercial Equipment;Total	use 2265006*** + (sum across all gas commercial equip)
2260007000	Off-highway Vehicle Gasoline, 2-Stroke;Logging Equipment;Total	use 2265007*** + (sum across all gas logging equip)
2265001020	Off-highway Vehicle Gasoline, 4-Stroke;Recreational Equipment;Snowmobiles	use 2 stroke snowmobiles (2260001020)
2265002000	Off-highway Vehicle Gasoline, 4-Stroke;Construction and Mining Equipment;Total	use 2265002***(sum across all construction and mining equip.)
2265003000	Off-highway Vehicle Gasoline, 4-Stroke;Industrial Equipment;Total	use 2265003***(sum across all indust equip.)
2265004000	Off-highway Vehicle Gasoline, 4-Stroke;Lawn and Garden Equipment;All	use 2265004*** + 2260004*** (sum across all gas lawn and garden.)
2265005000	Off-highway Vehicle Gasoline, 4-Stroke;Agricultural Equipment;Total	use 2265005***(sum across all agriculture equip.)
2265006000	Off-highway Vehicle Gasoline, 4-Stroke;Commercial Equipment;Total	use 2265006*** + (sum across all gas commercial equip)
2265007000	Off-highway Vehicle Gasoline, 4-Stroke;Logging Equipment;Total	use 2265007*** + (sum across all gas logging equip)
2265008000	Off-highway Vehicle Gasoline, 4-Stroke;Airport Ground Support Equipment;Total	use 2265008005
2268003000	CNG;Industrial Equipment;All	use 2268003***(sum across all indust equip.)

SCC in NEI	Description	Aggregated SCCs used for projection factor
2268006000	CNG;Commercial Equipment;All	use 2268003***(sum across all commercia equip.)
2268008000	CNG;Airport Ground Support Equipment;All	use 2268008005 airport ground support equip CNG
2270002000	Off-highway Vehicle Diesel;Construction and Mining Equipment;Total	use 2270002***(sum across all construction and mining equip.)
2270003000	Off-highway Vehicle Diesel;Industrial Equipment;Total	use 2270003***(sum across all indust equip.)
2270003060	Off-highway Vehicle Diesel;Industrial Equipment;ACRefrigeration	use 2270003***(sum across all indust equip.)
2270004000	Off-highway Vehicle Diesel;Lawn and Garden Equipment;All	use 2270004*** (sum across all gas lawn and garden diesel.)
2270005000	Off-highway Vehicle Diesel;Agricultural Equipment;Total	use 2270005***(sum across all agriculture equip. diesel)
2270006000	Off-highway Vehicle Diesel;Commercial Equipment;Total	use 2270006*** + (sum across all gas commercial equip diesel)
2270007000	Off-highway Vehicle Diesel;Logging Equipment;Total	use 2270007015
2270008000	Off-highway Vehicle Diesel;Airport Ground Support Equipment;Total	use 2270008005
2282005000	Pleasure Craft;Gasoline 2-Stroke;Total	use 2282005*** (sum across 2stroke gas pleasurecraft)
2282010000	Pleasure Craft;Gasoline 4-Stroke;Total	use 2282010005
2282020000	Pleasure Craft;Diesel;Total	use 228202**** (sum of diesel pleasure craft)

There were no corresponding OFFROAD2007 emissions for SO_2 for compressed natural gas fueled equipment; therefore, the future-year emissions remained at the same levels as in the 2002 NEI.

4.3.3 Aircraft (alm, ptnonipm)

We projected aircraft emissions based solely on activity growth using on 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. Projected ITN information is available from the Federal Aviation Administration's (FAA) Terminal Area Forecast (TAF) System (http://www.apo.data.faa.gov/main/taf.asp (publication date February 2006). This information is available for approximately 3300 individual airports, for all years up to 2025. We aggregated and applied this information at the national level by summing the airport-specific (U.S. airports only) ITN operations to national totals by year and by aircraft operation, for each of the four operations: commercial, general, air taxi, military. We computed growth factors for each operation type by dividing future-year ITN by 2002-year ITN. We assigned factors to inventory SCCs based on the operation. We used the commercial aircraft growth factor for the broad SCC representing all aircraft types and operations (SCC 2275000000).

The methods that the FAA used for developing the ITN data in the TAF are documented in http://www.faa.gov/data_statistics/aviation/taf_reports/media/TAF_Summary_Report_FY2005-2025.pdf.

Because the TAF estimates go out to the year 2025, we used the emissions estimated for 2025 in our 2030 scenario. Table 4-10 provides the national level growth factors for aircraft.

Table 4-10. Factors used to grow aircraft emissions

Year	Commercial aircraft (SCC 2275020000)	Air Taxi (SCC 2275060000)	General aviation (SCC 2275050000)	Military (SCC 2275010000)
2030	1.482	1.646	1.185	0.965
2020	1.329	1.502	1.130	0.964
2014	1.168	1.351	1.070	0.963
2009	1.047	1.240	1.000	0.963

Because the above SCCs are also found in the point source inventory for a few states (as discussed in Section 2.5.3), we also applied the growth factors above to aircraft emissions for these SCCs in the ptnonipm sector. We also applied the above growth factors to four additional point source SCCs, listed in Table 4-11[9].

Table 4-11. Point Source SCCs representing aircraft emissions

SCC	SCC description	Projection Factor based on…	Comment
27501015	Internal Combustion Engines;Fixed Wing Aircraft L & TO Exhaust;Military;Jet Engine: JP-5	Military aircraft 2275010000	SCC is in 2002 NEI for FIPS = 49045, 06059, 06065 06037, 12033
27502011	Internal Combustion Engines;Fixed Wing Aircraft L & TO Exhaust;Commercial;Jet Engine: Jet A	Commercial aircraft 2275020000	SCC is in 2002 NEI for FIPS = 06037, 06059, 06065, 06071
27505001	Internal Combustion Engines;Fixed Wing Aircraft L & TO Exhaust;Civil;Piston Engine: Aviation Gas	General aviation 2275050000	SCC is in 2002 NEI for FIPS = 06037, 06059, 06065, 06071, 88206 (tribal)
27505011	Internal Combustion Engines;Fixed Wing Aircraft L & TO Exhaust;Civil;Jet Engine: Jet A	General aviation 2275050000	SCC is in 2002 NEI for FIPS = 06037, 06059, 06065, 06071, 88206 (tribal)

We did not apply growth factors to any point sources with SCC 27602011 (Internal Combustion Engines; Rotary Wing Aircraft L & TO Exhaust; Commercial; Jet Engine: Jet A) because the plant names associated with these point sources appeared to represent industrial facilities rather than airports. This SCC is only in one county, Santa Barbara, California (State/County FIPS 06083).

None of our aircraft emission projections account for any control programs. We 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 2% in 2015 and 3% in 2020. However, this rule has not yet been adopted as an EPA (or U.S.) rule; therefore, the effects of this rule were not included in the future-year emissions projections.

[9] Aircraft emissions were submitted as point sources by California, Illinois, and Minnesota, as described in section 2.5.3.

4.3.4 Locomotives (alm)

Future locomotive emissions were calculated using projection factors which were computed based on national annual summaries of locomotive emissions in 2002 and future years, as provided by OTAQ. Appendix J provides these national annual summaries.

The future-year locomotive emissions account for increased fuel consumption based on Energy Information Administration (EIA) fuel consumption projections for freight rail (EPA, 2007d), and emissions reductions resulting from emissions standards prior to the Locomotive-Marine rule, which was proposed April 7, 2007. These standards are:

- "Clean Air Nonroad Diesel Final Rule - Tier 4" (http://www.epa.gov/nonroad-diesel/2004fr.htm), published June 29, 2004. This rule lowered diesel sulfur content.
- Locomotive Emissions Final Rulemaking, signed December 17, 1997.

Voluntary retrofits under the National Clean Diesel Campaign (http://www.epa.gov/otaq/diesel/index.htm) are not included in our projections.

4.3.5 Commercial marine vessels (alm)

The 2002 commercial marine vessel (CMV) emissions include separate estimates (via separate SCCs) for ports versus underway emissions (underway emissions occur while the ship is traveling along shipping lanes).

Future emissions diesel and residual-fueled CMVs were calculated using national level projection factors computed from national, annual U.S. emission summaries for CMV by fuel type (summed across ports and underway) for 2002 and each of the future years. These data account for both growth and the effects of controls. Appendix J provides these national annual summaries.

Emissions growth was based on activity data, as follows:

- For diesel-fueled vessels, growth is based on EIA fuel consumption projections for domestic shipping.
- For residual-fueled vessels, growth is based freight tonnage as well as future changes in fleet makeup.

Emissions reductions from the following control programs were included in the development of the projection factors:

- Clean Air Nonroad Diesel Final Rule - Tier 4" (http://www.epa.gov/nonroad-diesel/2004fr.htm), published June 29, 2004. This rule lowered diesel sulfur content.
- Emission Standards for Commercial Marine Diesel Engines (published December 29, 1999).
- Tier 1 Marine Diesel Engines—Final Emission Standards (published February 28, 2003).

Note that we used the same projection factor for both port and underway CMV emissions.

The development of the future-year CMV national, annual inventories is described in more detail in the regulatory impact analysis for the Proposed Locomotive and Marine Rule (EPA, 2007e).

The future year data do not include emissions for gasoline-powered commercial marine vessels. Since the 2002 emissions for these vessels were relatively low, we used the 2002 emissions for each of the future year scenarios (i.e., projection factor of 1). For residual-fueled CMV, the future year data include emissions for all CAPs except NH_3. Since NH_3 emissions from residual-fueled CMV are thought to be based on the amount of fuel consumed, similar to SO_2 from residual-fueled CMV, the projection factor for SO_2 was used to project NH_3.

4.4 Canada, Mexico, and Offshore sources (othar, othon, othpt)

Future-year inventories were not available for Mexico or offshore sources. As a result, all future-year scenarios contain the same inventories as were used for 2002 for Mexico and offshore sources.

For Canada, we used future year inventories supplied by Environment Canada for 2010, 2015, 2020, and 2030. These are the same inventories as were used in the 2001 Platform. We used the 2010 and 2015 emissions for our 2009 and 2014 scenarios; the 2020 emissions were used in both the 2020 and 2030 scenarios. The future-year Canadian emissions are consistent with the base year emissions, as described in Section 2.6.

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