EPA/600/R-12/048 | July 31,2012 | www.epa.gov/ord

EPA
United States
Environmental Protection
Agency

Hierarchical Bayesian Model (HBM)-Derived Estimates of Air Quality for 2008: Annual Report

Eric S. Hall (EPA/ORD), Alison M. Eyth (EPA/OAR), Sharon B. Phillips (EPA/OAR), and Richard Mason (EPA/OAR)

Office of Research and Development
National Exposure Research Laboratory

Disclaimer

The information in this document has been funded wholly by the United States Environmental Protection Agency under a 'funds-in' interagency agreement RW75922615-01-3 with the Centers for Disease Control and Prevention (CDC). It has been subjected to the Agency's peer and administrative review and has been approved for publication as an EPA document.

EPA/600/R-12/048 | July 31,2012 | www.epa.gov/ord

United States
Environmental Protection
Agency

Hierarchical Bayesian Model (HBM)-Derived Estimates of Air Quality for 2008: Annual Report

Developed by the U.S. Environmental Protection Agency
Office of Research and Development (ORD)
National Exposure Research Laboratory (NERL) And
Office of Air and Radiation (OAR)
Office of Air Quality Planning and Standards (OAQPS)

Office of Research and Development
National Exposure Research Laboratory

Contributors:

Eric S. Hall (EPA/ORD)

Alison M. Eyth (EPA/OAR)

Sharon B. Phillips (EPA/OAR)

Richard Mason (EPA/OAR)

Project Officer

Eric S. Hall

National Exposure Research Laboratory (NERL)
109 T.W. Alexander Dr.
Durham, NC 27711-0001

Acknowledgements

The following people served as reviewers of this document and provided valuable comments that were included: Alexis Zubrow (EPA/OAR), Richard Mason (EPA/OAR), Norm Possiel (EPA/OAR), Kirk Baker (EPA/OAR), Carey Jang (EPA/OAR), Tyler Fox (EPA/OAR), Rachelle Duvall (EPA/ORD), Melinda Beaver (EPA/ORD), and OAR/OAQPS support contractors from Computer Sciences Corporation (CSC).

Table of Contents

List of Figures

List of Tables

1.0 Introduction

This report describes EPA's Hierarchical Bayesian model-generated (HBM) estimates of O_3 and $PM_{2.5}$ concentrations throughout the continental United States during the 2008 calendar year. HBM estimates provide the spatial and temporal variance of O_3 and $PM_{2.5}$, allowing estimation of their concentration values across the U.S., independent of where air quality monitors are physically located. HBM estimates are generated through the statistical 'fusion' of measured air quality monitor concentration values and air quality model predicted concentration values from EPA's Community Multiscale Air Quality (CMAQ) computer model. Information on EPA's air quality monitors, CMAQ model, and HBM model is included to provide the background and context for understanding the data output presented in this report.

The data contained in this report are an outgrowth of a collaborative research partnership between EPA scientists from the Office of Research and Development's (ORD) National Exposure Research Laboratory (NERL) and personnel from EPA's Office of Air and Radiation's (OAR) Office of Air Quality Planning and Standards (OAQPS). NERL's Human Exposure and Atmospheric Sciences Division (HEASD), Atmospheric Modeling and Analysis Division (AMAD), and Environmental Sciences Division (ESD), in conjunction with OAQPS, work together to provide air quality monitoring data and model estimates to the Centers for Disease Control and Prevention (CDC) for use in their Environmental Public Health Tracking (EPHT) Network.

CDC's EPHT Network supports linkage of air quality data with human health outcome data for use by various public health agencies throughout the U.S. The EPHT Network Program is a multidisciplinary collaboration that involves the ongoing collection, integration, analysis, interpretation, and dissemination of data from: environmental hazard monitoring activities; human exposure assessment information; and surveillance of noninfectious health conditions. As part of the National EPHT Program efforts, the CDC is leading the initiative to build the National EPHT Network (http://www.cdc.gov/nceh/tracking/default.htm). The National EPHT Program, with the EPHT Network as its cornerstone, is the CDC's response to requests calling for improved understanding of how the environment affects human health. The EPHT Network is designed to provide the means to identify, access, and organize hazard, exposure, and health data from a variety of sources and to examine, analyze and interpret those data based on their spatial and temporal characteristics. The EPHT Network is a standards-based, secure information network that was created to be used by many different entities, including epidemiologists, public health practitioners, and academic researchers, schools of public health, along with local, state, and federal agencies such as EPA. Levels of access to the data in the EPHT Network will vary among stakeholders based upon their role and their purpose for using the data. Data access will be carefully controlled to ensure compliance with federal and state privacy laws which address the use of health data and other protected personal information. The CDC's National EPHT Program is establishing the EPHT Network by collaborating with a wide range of partners with expertise from federal, state, and local health and environmental agencies; nongovernmental organizations (NGOs); state public health and environmental laboratories; and Schools of Public Health.

Since 2002, EPA has collaborated with the CDC on the development of the EPHT Network. On September 30, 2003, the Secretary of Health and Human Services (HHS) and the Administrator of EPA signed a joint Memorandum of Understanding (MOU) with the objective of advancing efforts to achieve mutual environmental public health goals.[1] HHS, acting through the CDC and the Agency for Toxic Substances and Disease Registry (ATSDR), and EPA agreed to expand their cooperative activities in support of the CDC EPHT Network and EPA's Central Data Exchange Node on the Environmental Information Exchange Network in the following areas:

- Collecting, analyzing and interpreting environmental and health data from both agencies (HHS and EPA).
- Collaborating on emerging information technology practices related to building, supporting, and operating the CDC EPHT Network and the Environmental Information Exchange Network.
- Developing and validating additional environmental public health indicators.
- Sharing reliable environmental and public health data between their respective networks in an efficient and effective manner.
- Consulting and informing each other about dissemination of results obtained through work carried out under the MOU and the associated Interagency Agreement (IAG) between EPA and CDC.

Under the auspices of the HHS/EPA MOU, a research project was implemented between 2004 and 2006 to investigate the utility of EPA-generated air quality estimates as an input to the EPHT Network. The relationship between air pollutants and human health is of interest to both Agencies. EPA

[1] Available at www.cdc.gov/nceh/tracking/epa_mou.htm

develops and funds ambient air quality monitoring networks to monitor air pollution and to provide data that may be used to mitigate its impact on our ecosystems and human health. (Note: AQS and AIRNow are EPA databases containing data collected from EPA's air quality monitoring networks.) Air quality monitoring data has been used by researchers to investigate the linkages between human health outcomes and air quality, and by environmental and public health professionals to develop environmental health indicators which provide measures of potential human health impacts. However, an analysis of the currently available methods for generating and characterizing air quality estimates that could be developed and delivered systematically, and which were also readily available to link with public health surveillance data, had not been previously attempted. EPA collaborated with the CDC and state public health agencies in New York, Maine, and Wisconsin on the Public Health Air Surveillance Evaluation (PHASE) project to address this issue. The project focused on generating concentration surfaces for ozone and $PM_{2.5}$, which were subsequently linked with asthma and cardiovascular disease data. Results of this research project indicated that using a Hierarchical Bayesian approach to statistically "combine" Community Multiscale Air Quality (CMAQ) model estimates and air quality monitoring data documented in EPA's AQS provided better overall estimates of air quality at locations without monitors than those obtained through other well-known, statistically-based estimating techniques (e.g., kriging).

Ambient air quality monitoring data stored in the Air Quality System (AQS), along with air quality modeling estimates from CMAQ, can be statistically combined, via a Hierarchical Bayesian statistical space-time modeling (HBM) system, to provide air quality estimates (hereafter referred to as Hierarchical Bayesian-derived air quality estimates). These Hierarchical Bayesian-derived air quality estimates serve as well-characterized inputs to the EPHT Network. The air quality monitor data, CMAQ modeling estimates, and the Hierarchical Bayesian-derived air quality estimates can be used to develop meaningful environmental public health indicators and to link ozone and $PM_{2.5}$ concentrations with health outcome data. The Hierarchical Bayesian-derived air quality estimates are based on EPA's current knowledge of predicting spatial and temporal variations in pollutant concentrations derived from multiple sources of information. EPA is continuing its research in this critical science area and is implementing this project to establish procedures for routinely generating the Hierarchical Bayesian-derived air quality estimates developed in the PHASE project. This effort will assist EPA in making both ambient air quality monitoring (raw) data and the Hierarchical Bayesian-derived air quality estimates available to the CDC EPHT Network through EPA's Central Data Exchange (CDX) Node on the Environmental Information Exchange Network.

Because of EPA's expertise related to generation, analysis, scientific visualization, and reporting of air quality monitoring data, air quality modeling estimates, and Hierarchical Bayesian-derived air quality estimates and associated research, the CDC approached EPA to provide technical support for incorporating air quality data and estimates into its EPHT Network. Because the air quality data generated could be used by EPA to achieve other research goals related to linking air quality data and health effects and performing cumulative risk assessments, EPA proposed an interagency agreement under which each agency would contribute funding and/or in-kind support to efficiently leverage the resources of both agencies. The major objective of this research is to provide data and guidance to CDC to assist them in tracking estimated population exposure to ozone and $PM_{2.5}$; estimating health impacts to individuals and susceptible subpopulations; guiding public health actions; and conducting analytical studies linking human health outcomes and environmental conditions.

This report is divided into five sections and three appendices. The first major section of the report describes the air quality data obtained from EPA's nationwide monitoring network and the importance of the monitoring data in determining health potential health risks. The second major section of the report details the emissions inventory data, how it is obtained and its role as a key input into air quality computer models. The third major section of the report describes the CMAQ computer model and its role in providing estimates of pollutant concentrations across the U.S. based on 12-km grid cells over the entire continental U.S. The fourth major section of the report explains the 'hierarchical' Bayesian statistical modeling system which is used to combine air quality monitoring data and air quality estimates from the CMAQ model into a continuous concentration surface which includes regions without air quality monitors. The fifth major section provides guidelines and requisite understanding that users must have when using the 'hierarchical' Bayesian statistical modeling system. The appendices provide detailed information on air quality data and the hierarchical Bayesian statistical modeling system.

2.0 Air Quality Data

To compare health outcomes with air quality measures, it is important to understand the origins of those measures and the methods for obtaining them. This section provides a brief overview of the origins and process of air quality regulation in this country. It provides a detailed discussion of ozone (O_3) and particulate matter ($PM_{2.5}$). The PHASE project focused on these two pollutants, since numerous studies have found them to be harmful to public health and the environment, and there was more extensive monitoring and modeling data available.

2.1 Introduction to Air Quality Impacts in the United States

2.1.1 The Clean Air Act

In 1970, the Clean Air Act (CAA) was signed into law. Under this law, EPA sets limits on how much of a pollutant can be in the air anywhere in the United States. This ensures that all Americans have the same basic health and environmental protections. The CAA has been amended several times to keep pace with new information. For more information on the CAA, go to http://www.epa.gov/oar/caa/.

Under the CAA, the U.S. EPA has established standards or limits for six air pollutants, known as the criteria air pollutants: carbon monoxide (CO), lead (Pb), nitrogen dioxide (NO_2), sulfur dioxide (SO_2), ozone (O_3), and particulate matter (PM). These standards, called the National Ambient Air Quality Standards (NAAQS), are designed to protect public health and the environment. The CAA established two types of air quality standards. Primary standards set limits to protect public health, including the health of "sensitive" populations such as asthmatics, children, and the elderly. Secondary standards set limits to protect public welfare, including protection against decreased visibility, damage to animals, crops, vegetation, and buildings. The law requires EPA to periodically review these standards. For more specific information on the NAAQS, go to www.epa.gov/air/criteria.html. For general information on the criteria pollutants, go to http://www.epa.gov/air/urbanair/. When these standards are not met, the area is designated as a nonattainment area. States must develop state implementation plans (SIPs) that explain the regulations and controls it will use to clean up the nonattainment areas. States with an EPA-approved SIP can request that the area be redesignated from nonattainment to attainment by providing three consecutive years of data showing NAAQS compliance. The state must also provide a maintenance plan to demonstrate how it will continue to comply with the NAAQS and demonstrate compliance over a 10-year period, and what corrective actions it will take should a NAAQS violation occur after redesignation. EPA must review and approve the NAAQS compliance data and the maintenance plan before redesignating the area; thus, a person may live in an area designated as non-attainment even though no NAAQS violation has been observed for quite some time. For more information on designations, go to http://www.epa.gov/ozonedesignations/ and http://www.epa.gov/pmdesignations.

2.1.2 Ozone

Ozone is a colorless gas composed of three oxygen atoms. Ground level ozone is formed when pollutants released from cars, power plants, and other sources react in the presence of heat and sunlight. It is the prime ingredient of what is commonly called "smog." When inhaled, ozone can cause acute respiratory problems, aggravate asthma, cause inflammation of lung tissue, and even temporarily decrease the lung capacity of healthy adults. Repeated exposure may permanently scar lung tissue. Toxicological, human exposure, and epidemiological studies were integrated by EPA in "Air Quality Criteria for Ozone and Related Photochemical Oxidants." It is available at http://www.epa.gov/ttn/naaqs/standards/ozone/s_o3_index.html. The current (as of October 2008) NAAQS for ozone, in place since 1997, is an 8-hour maximum of 0.075 parts per million [ppm] (for details, see http://www.epa.gov/ozonedesignations/). An 8-hour maximum is the maximum of the 24 possible running 8-hour average concentrations for each calendar day. The Clean Air Act requires EPA to review the NAAQS at least every five years and revise them as appropriate in accordance with Section 108 and Section 109 of the Act. The 'allowable' ozone values are shown in the table below:

Parts Per Million: Measurement—(ppm)	1997	2008
1-Hour Standard	0.12	0.12
8-Hour Standard	0.08	0.075

Table 2-1. Ozone Standard

2.1.3 Particulate Matter

PM air pollution is a complex mixture of small and large particles of varying origin that can contain hundreds of different chemicals, including cancer-causing agents like polycyclic aromatic hydrocarbons (PAH), as well as heavy metals such as arsenic and cadmium. PM air pollution results from direct emissions of particles as well as particles formed through chemical transformations of gaseous air pollutants. The characteristics, sources, and potential health effects of particulate matter depend on its source, the season, and atmospheric conditions.

As practical convention, PM is divided by size[2] into 2 classes with differing health concerns and potential sources. Particles less than 10 micrometers in diameter (PM_{10}) pose a health concern because they can be inhaled into and accumulate in the respiratory system. Particles less than 2.5 micrometers in diameter ($PM_{2.5}$) are referred to as "fine" particles. Because of their small size, fine particles can lodge deeply into the lungs. Sources of fine particles include all types of combustion (motor vehicles, power plants, wood burning, etc.) and some industrial processes. Particles with diameters between 2.5 and 10 micrometers ($PM_{10-2.5}$) are referred to as "coarse" or PMc. Sources of PMc include crushing or grinding operations and dust from paved or unpaved roads. The distribution of $PM_{2.5}$ and PMc, and PMc varies from the Eastern U.S. to arid western areas.

Epidemiological and toxicological studies have demonstrated associations between fine particles and respiratory and cardiovascular health effects, including irritation of the airways, coughing, decreased lung function, aggravated asthma, development of chronic bronchitis, irregular heartbeat, nonfatal heart attacks, and premature death in people with heart or lung disease. These studies are summarized and integrated in "Air Quality Criteria for Particulate Matter" (EPA 2004). This document and other technical documents related to PM standards are available at http://www.epa.gov/ttn/naaqs/standards/pm/s_pm_index.html. The current (as of March 2012) NAAQS for $PM_{2.5}$ includes both a 24-hour standard to protect against short-term effects, and an annual standard to protect against long-term effects. The annual average $PM_{2.5}$ concentration must not exceed 15 µg/m^3, and the 24-hr average concentration must not exceed 35 micrograms per cubic meter (µg/m^3). The current annual PM NAAQS was set in 1997 and the current 24-hr PM NAAQS was set in 2006 (for details, see http://www.epa.gov/air/criteria.html and http://www.epa.gov/oar/particlepollution/). The EPA quality assurance standards for $PM_{2.5}$ monitors specify that the coefficient of variation (CV = standard deviation/mean) of a monitor measurement must be less than 10%. The relative bias (tendency for measured values to be higher or lower than 'true' value) for $PM_{2.5}$ monitor measurements must be between the range of -10% to +10%. The 'allowable' $PM_{2.5}$ values are shown in the table below:

Micrograms Per Cubic Meter: Measurement - (µg/m3)	1997	2006
Annual Average	15	15
24-Hour Average	65	35

Table 2-2. $PM_{2.5}$ Standards

[2] The measure used to classify PM into sizes is the aerodynamic diameter. The measurement instruments used for PM are designed and operated to separate large particles from the smaller particles. For example, the $PM_{2.5}$ instrument only captures and thus measures particles with an aerodynamic diameter less than 2.5 micrometers. The EPA method to measure PMc is designed around taking the mathematical difference between measurements for PM_{10} and $PM_{2.5}$.

2.2 Ambient Air Quality Monitoring in the United States

2.2.1 Monitoring Networks

The Clean Air Act requires every state to establish a network of air monitoring stations for criteria pollutants, following specific guidelines for their location and operation. The monitoring stations in this network have been called the State and Local Air Monitoring Stations (SLAMS). The SLAMS network consists of approximately 4,000 monitoring sites whose distribution is largely determined by the needs of State and local air pollution control agencies. All ambient monitoring networks selected for use in SLAMS are tested periodically to assess the quality of the SLAMS data being produced. Measurement accuracy and precision are estimated for both automated and manual methods. The individual results of these tests for each method or analyzer are reported to EPA. Then, EPA calculates quarterly integrated estimates of precision and accuracy for the SLAMS data.

The National Air Monitoring Station network (NAMS) is about a 1,000-site subset of the SLAMS network, with emphasis on areas of maximum concentrations and high population density in urban and multi-source areas. The NAMS monitoring sites are designed to obtain more timely and detailed information about air quality in strategic locations and must meet more stringent monitor siting, equipment type, and quality assurance criteria. NAMS monitors also must submit detailed quarterly and annual monitoring results to EPA.

The SLAMS and NAMS networks experienced accelerated growth throughout the 1970s. The networks were further expanded in 1999 following the 1997 revision of the CAA to include separate standards for fine particles (PM) based on their link to serious health problems ranging from increased symptoms, hospital admissions, and emergency room visits, to premature death in people with heart or lung disease. While most of the monitors in these networks are located in populated areas of the country, "background" and rural monitors are an important part of these networks. For criteria pollutants other than ozone and $PM_{2.5}$, the number of monitors has declined. For more information on SLAMS and NAMS, as well as EPA's other air monitoring networks go to www.epa.gov/ttn/amtic.

In summary, state and local agencies and tribes implement a quality-assured monitoring network to measure air quality across the United States. EPA provides guidance to ensure a thorough understanding of the quality of the data produced by these networks. These monitoring data have been used to characterize the status of the nation's air quality and the trends across the U.S. (see www.epa.gov/airtrends).

2.2.2 Air Quality System Database

The Air Quality System (AQS) database contains ambient air pollution data collected by EPA, state, local, and tribal air pollution control agencies from thousands of monitoring stations (SLAMS and NAMS). AQS also contains meteorological data, descriptive information about each monitoring station (including its geographic location and its operator), and data quality assurance and quality control information. State and local agencies are required to submit their air quality monitoring data into AQS by the end of the quarter following the quarter in which the data were collected. This ensures timely submission of these data for use by state, local, and tribal agencies, EPA, and the public. EPA's Office of Air Quality Planning and Standards and other AQS users rely upon the data in AQS to assess air quality, assist in attainment vs. non-attainment designations, evaluate SIPs, perform modeling for permit review analysis, and perform other air quality management functions.

AQS was converted from a mainframe system to a UNIX-based Oracle system which is easily accessible to users through the Internet. This system went into production status in January 2002. Today, state, local, and tribal agencies submit their data directly to AQS. Registered users may also retrieve data through the AQS application and through the use of third-party software such as the Discoverer tool from Oracle Corporation. For more detailed information about the AQS database, go to http://www.epa.gov/ttn/airs/airsaqs/index.htm.

2.2.3 Advantages and Limitations of the Air Quality Monitoring and Reporting System

Air quality data is required to assess public health outcomes that are affected by poor air quality. The challenge is to get surrogates for air quality on time and spatial scales that are useful for Environmental Public Health Tracking activities.

The advantage of using ambient data from EPA monitoring networks for comparing with health outcomes is that these measurements of pollution concentrations are the best characterization of the concentration of a given pollutant at a given time and location, and require no further analysis. Furthermore, the data are supported by a comprehensive quality assurance program, ensuring data of known quality. One disadvantage of using the ambient data is that it is usually out of spatial and temporal alignment with health outcomes. This spatial and temporal 'misalignment' between air quality monitoring data and health outcomes is influenced by the following key factors: the living and/or working locations (microenvironments) where a person spends their time not being co-located with an air quality monitor; time(s)/date(s) when a patient experiences a health outcome/symptom (e.g., asthma attack) not coinciding with time(s)/date(s) when an air quality monitor records ambient concentrations of a pollutant high enough to affect the symptom (e.g., asthma attack either during or shortly after a high PM day). To compare/correlate ambient concentrations with acute health effects, daily local air quality data is needed. Spatial gaps exist in the air quality monitoring network, especially in rural areas, since the air quality monitoring network is designed to focus on measurement of pollutant concentrations in high population density areas. Temporal limits also exist. Samples from Federal Reference Method (FRM) $PM_{2.5}$ monitors are generally collected only one day in every three days, due in part to the time and costs involved in collecting and analyzing the samples. However, over the past several years Tapered Element Oscillating Microbalance (TEOM) monitors, which can automatically collect, analyze, and report $PM_{2.5}$ measurements on an hourly basis, have been introduced. These monitors are available in most of the major metropolitan areas and (as of March 2012) are being assessed for their equivalency to the FRM. Ozone is monitored daily, but mostly during the ozone season (the warmer months, approximately April through October). However, year-long data is extremely useful to evaluate whether ozone is a factor in health outcomes during the non-ozone seasons.

2.2.4 Use of Air Quality Monitoring Data

Air quality monitoring data has been used to provide the information for the following situations:

1. Assessing effectiveness of SIPs in addressing NAAQS nonattainment areas
2. Characterizing local, state, and national air quality status and trends
3. Associating health and environmental damage with air quality levels/concentrations

For the EPHT effort, EPA is providing air quality data to support efforts associated with (2), and (3) above. Data supporting (3) is generated by EPA through the use of its air quality data and its Hierarchical Bayesian space-time statistical model (HBM).

Most studies that associate air quality with health outcomes use air monitoring as a surrogate for exposure to the air pollutants being investigated. Many studies have used the monitoring networks operated by state and federal agencies in the implementation of Clean Air Act requirements. Some studies perform special monitoring that can better represent exposure to the air pollutants: community monitoring, near residences, in-house or work place monitoring, and personal monitoring. For the EPHT program, special monitoring is generally not supported, though it could be used on a case-by-case basis.

Many approaches may be used to assign exposure from monitors or estimate concentrations for a new time period or location based on existing data. On the simplest level for example, data from monitoring sites are averaged and applied to the population in an entire county, or the nearest monitor is assigned to a subject's address. At the next level, variogram analysis may be used to describe the spatial correlation of the data and interpolate concentrations across space. Such approaches work well for temporally and spatially robust data, but where data are missing (for example for $PM_{2.5}$ data with samples taken every third day), further assumptions and modeling are needed which add uncertainty into the interpolated concentrations. Finally, air quality monitoring data can be used with air quality modeling estimates (using emissions inventories) and incorporated into a Bayesian model to enhance the prediction of ambient air concentrations in space and time. There are two methods used in EPHT to provide estimates of ambient concentrations of air pollutants: air quality monitoring data and the Hierarchical Bayesian -derived air quality estimate, which is a statistical 'combination' of air quality monitor data and air quality modeling estimates.

Goal	Status
(1) Air data sets and metadata required for air quality indicators are available to EPHT state Grantees.	AQS data is available through state agencies and EPA's AirData and AirExplorer. EPA and CDC developed an interagency agreement, where EPA provides air quality data along with HBM modeling data, associated metadata, and technical reports that are delivered to CDC.
(2) Estimate the linkage or association of $PM_{2.5}$ and ozone on health to: a. Identify populations that may have higher risk of adverse health effects due to $PM_{2.5}$ and ozone, b. Generate hypothesis for further research, and c. Provide information to support prevention and pollution control strategies.	Regular discussions have been held on health-air linked indicators and CDC/HEI/EPA convened a workshop in January 2008. CDC has collaborated on a health impact assessment (HIA) with Emory University, EPA and state grantees that can be used to facilitate greater understanding of these linkages.
(3) Produce and disseminate basic indicators and other findings in electronic and print formats to provide the public, environmental health professionals, and policymakers, with current and easy-to-use information about air pollution and the impact on public health.	Templates and "how to" guides for $PM_{2.5}$ and ozone have been developed for routine indicators. Calculation techniques and presentations for the indicators have been developed.

Table 2-3. Public Health Surveillance Goals and Current Results

Ozone (daily 8-hr period with maximum concentration—ppm—by Federal Reference Method (FRM))
Number of days with maximum ozone concentration over the NAAQS (or other relevant benchmarks (by county and MSA)
Number of person-days with maximum 8-hr average ozone concentration over the NAAQS & other relevant benchmarks (by county and MSA)
$PM_{2.5}$ (daily 24-hr integrated samples by FRM)
Average ambient concentrations of particulate matter (< 2.5 microns in diameter) and compared to annual $PM_{2.5}$ NAAQS (by state).
% population exceeding annual $PM_{2.5}$ NAAQS (by state).
% of days with $PM_{2.5}$ concentration over the daily NAAQS (or other relevant benchmarks (by county and MSA)
Number of person-days with $PM_{2.5}$ concentration over the daily NAAQS & other relevant benchmarks (by county and MSA)

Table 2-4. Basic Air Quality Indicators

2.3 Air Quality Indicators Developed for the EPHT Network

Air quality indicators have been developed for use in the Environmental Public Health Tracking Network. The approach used divides "indicators" into two categories. First, basic air quality measures were developed to compare air quality levels over space and time within a public health context (e.g., using the NAAQS as a benchmark). Next, indicators were developed that mathematically link air quality.

2.3.1 Rationale for the Air Quality Indicators

The CDC EPHT Network is initially focusing on ozone and $PM_{2.5}$. These air quality indicators are based mainly around the NAAQS health findings and program-based measures (measurement, data and analysis methodologies). The indicators will allow comparisons across space and time for EPHT actions. They are in the context of health-based benchmarks. By bringing population into the measures, they roughly distinguish between potential exposures (at broad scale).

2.3.2 Air Quality Data Sources

The air quality data will be available based on the state/federal air program's data collection and processing. Air quality data management (EPA's Air Quality System—AQS) and delivery systems (AirData and AirExplorer) have been used in the PHASE project as the pilot test for air quality indicators.

2.3.3 Use of Air Quality Indicators for Public Health Practice

The basic indicators will be used to inform policymakers and the public regarding the degree of hazard within a state and across states (national). For example, the number of days per year that ozone is above the NAAQS can be used to communicate to sensitive populations (such as asthmatics) the number of days that they may be exposed to unhealthy levels of ozone. This is the same level used in the Air Quality Alerts that inform these sensitive populations when and how to reduce their exposure. These indicators, however, are not a surrogate measure of exposure and therefore will not be linked with health data.

3.0 Emissions Data

3.1 Introduction to the 2008 Emissions Data Development

The U.S. EPA developed an air quality modeling platform based on the 2008 National Emissions Inventory (NEI) to process year 2008 emission data for this project. This section provides a summary of the emissions inventory and emissions modeling techniques applied to Criteria Air Pollutants (CAPs) and selected Hazardous Air Pollutants (HAPs). This section also describes the approach and data used to produce emissions inputs to the air quality model. The air quality modeling, meteorological inputs and boundary conditions are described in a separate section.

Some techniques for the 2008 platform have been carried forward from the 2005v4 platform. . A complete description of the 2005v4 platform is available in "Technical Support Document: Preparation of Emissions Inventories for the Version 4, 2005-based Platform, U.S. EPA, Research Triangle Park, NC 27711, July 2010" (available from http://www.epa.gov/ttn/chief/emch/index.html#2005).

The Community Multiscale Air Quality (CMAQ) model (http://www.epa.gov/AMD/CMAQ/) is used to model ozone (O_3) and particulate matter (PM) for this project. CMAQ requires hourly and gridded emissions of 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 to10 microns (PM_{10}), and individual component species for particulate matter less than or equal to 2.5 microns ($PM_{2.5}$). In addition, the CMAQ CB05 with chlorine chemistry used here allows for explicit treatment of the VOC HAPs benzene, acetaldehyde, formaldehyde and methanol (BAFM) and includes anthropogenic HAP emissions of HCl and Cl.

The effort to create the 2008 emission inputs for this study included development of emission inventories for a 2008 model evaluation case, and application of emissions modeling tools to convert the inventories into the format and resolution needed by CMAQ. The 2008 evaluation case uses 2008-specific fire and continuous emission monitoring (CEM) data for electric generating units (EGUs).

The primary emissions modeling tool used to create the CMAQ model-ready emissions was the Sparse Matrix Operator Kernel Emissions (SMOKE) modeling system. SMOKE version 2.7 was used to create emissions files for a 12-km national grid. Additional information about SMOKE is available from http://www.smoke-model.org.

This summary contains two additional sections. Section 3.2 describes the inventories input to SMOKE and the ancillary files used along with the emission inventories. Section 3.3 describes the emissions modeling performed to convert the inventories into the format and resolution needed by CMAQ.

3.2 2008 Emission Inventories and Approaches

This section describes the emissions inventories created for input to SMOKE. The primary basis for the emission inputs for this project is the 2008 NEI, Version 1.7. This version of the NEI includes emissions of CO, NO_x, VOC, SO_2, NH_3, PM_{10}, $PM_{2.5}$, and selected HAPs. The modeling platform utilizes select HAPs: chlorine, HCl, benzene, acetaldehyde, formaldehyde, and methanol.

The 2008 NEI includes five source sectors: a) nonpoint (formerly called "stationary area") sources; b) point sources; c) nonroad mobile sources; d) onroad mobile sources; and e) fires. The fires portion of the inventory includes emissions from wildfires and prescribed burning computed as hour-specific point sources.

Electronic copies of inventories similar to those used for this project are available at the 2008 section emissions modeling clearinghouse: http://www.epa.gov/ttn/chief/emch/index.html#2008. Documentation for the 2008 NEI is available at http://www.epa.gov/ttn/chief/net/2008inventory.html#inventorydoc. For inventories outside of the United States, including Canada, Mexico and offshore emissions, the latest available base year inventories were used.

For purposes of preparing the CMAQ- ready emissions, the NEI is split into several additional emissions modeling "platform" sectors; and biogenic emissions are added along with emissions from other sources other than the NEI, such as the Canadian, Mexican, and offshore inventories. The significance of an emissions sector for the emissions modeling platform is that it is run through all of the SMOKE programs, except the final merge, independently from the other sectors. The final merge program called Mrggrid combines the sector- specific gridded, speciated and temporalized emissions to create the final CMAQ-ready emission inputs.

Table 3-1 presents the sectors in the emissions modeling platform used to develop 2008 emissions for this project. 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 section. Annual 2008 emission summaries for the U.S. anthropogenic sectors are shown in Table 3-2 (i.e., excluding biogenic emissions). Table 3-3 provides a summary of emissions for the anthropogenic sectors containing Canadian, Mexican and offshore sources.

2005v4 Platform Sector	2005 NEI Sector	Description and resolution of the data input to SMOKE
IPM sector: *ptipm*	Point	2005v2 NEI point source EGUs mapped to the Integrated Planning Model (IPM) model using year 2008 continuous emission monitoring (CEM) NOX and SO_2 emissions from the National Electric Energy Database System (NEEDS, 2006 version 3.02) database. Hourly files for CEM sources are included for the 2008 evaluation case used for this project. Day-specific emissions for non-CEM sources are year 2005 NEI-based estimates and were created for input into SMOKE.
Non-IPM sector: *ptnonipm*	Point	Year 2005 emissions for all 2005v2 NEI point source records not matched to the ptipm sector, annual resolution. Includes all aircraft emissions.
Point source fire sector: *ptfire*	Fires	Point source day-specific wildfires and prescribed fires for 2008.
Agricultural sector: ag	Nonpoint	Primarily 2002 NEI nonpoint NH_3 emissions from livestock and fertilizer application, county and annual resolution.
Area fugitive dust sector: *afdust*	Nonpoint	Primarily 2002 NEI nonpoint PM_{10} and $PM_{2.5}$ from fugitive dust sources (e.g., building construction, road construction, paved roads, unpaved roads, agricultural dust), county/annual resolution.
Remaining nonpoint sector: *nonpt*	Nonpoint	Primarily 2002 NEI nonpoint sources not otherwise included in other SMOKE sectors, county and annual resolution. Also includes updated Residential Wood Combustion emissions and year 2005 non-California Western Regional Air Partnership (WRAP) oil and gas "Phase II" inventory.
Nonroad sector: *nonroad*	Mobile: Nonroad	Year 2008 monthly nonroad emissions from the National Mobile Inventory Model (NMIM) using NONROAD2005 version nr05c-BondBase for all states except California. Monthly emissions for California created from annual emissions submitted by the California Air Resources Board (CARB) for the 2005v2 NEI linearly-interpolated with year 2009 emissions to create year 2008.
locomotive, and non-C3 commercial marine: *alm_no_c3*	Mobile: Nonroad	Year 2002 non-rail maintenance locomotives, and category 1 and category 2 commercial marine vessel (CMV) emissions sources, county and annual resolution. Unlike prior platforms, aircraft emissions are now included in the ptnonipm sector and category 3 CMV emissions are now contained in the seca_c3 sector
C3 commercial marine: *seca_c3*	Mobile : Nonroad	Annual point source formatted year 2008 category 3 (C3) CMV emissions, developed for the EPA rule called "Control of Emissions from New Marine Compression-Ignition Engines at or Above 30 Liters per Cylinder", usually described as the Area (ECA) study, originally called SO2 ("S") ECA.
Onroad California, NMIM-based, and MOVES sources not subject to temperature adjustments: *on_noadj*	Mobile: onroad	Year 2008 emissions consisting of two, monthly, county-level components: MOVES2010-based (December 2009) except for California and gasoline exhaust PM. California onroad, created using annual EMFAC-based emissions submitted by CARB for the 2005v2 NEI, linearly-interpolated with year 2009 EMFAC-based submissions.
Onroad cold-start gasoline exhaust mode vehicle from MOVES subject to temperature adjustments: *on_moves_startpm*	Mobile: onroad	Year 2008 monthly, county-level MOVES2010-based onroad gasoline emissions subject to temperature adjustments. Limited to exhaust mode only for PM species. California emissions not included. This sector is limited to cold start mode emissions that contain different temperature adjustment curves from running exhaust (see on_moves_runpm sector).
Onroad running gasoline exhaust mode vehicle from MOVES subject to temperature adjustments: *on_moves_runpm*	Mobile: onroad	Year 2008 monthly, county-level MOVES2010-based onroad gasoline emissions subject to temperature adjustments. Limited to exhaust mode only for PM species. California emissions not included. This sector is limited to running mode emissions that contain different temperature adjustment curves from cold start exhaust (see on_moves_startpm sector).
Biogenic: *beis*	N/A	Hour-specific, grid cell-specific emissions generated from the BEIS3.14 model -includes emissions in Canada and Mexico.
Other point sources not from the NEI: *othpt*	N/A	Point sources from Canada's 2006 inventory and Mexico's Phase III 1999 inventory, annual resolution. Also includes annual U.S. offshore oil 2005v2 NEI point source emissions.
Other nonpoint and nonroad not from the NEI: *othar*	N/A	Annual year 2006 Canada (province resolution) and year 1999 Mexico Phase III (municipio resolution) nonpoint and nonroad mobile inventories, annual resolution.
Other onroad sources not from the NEI: *othon*	N/A	Year 2006 Canada (province resolution) and year 1999 Mexico Phase III (municipio resolution) onroad mobile inventories, annual resolution.

Table 3-1. Platform Sectors Used in the Emission

Sector	CO	NH_3	NO_x	PM_{10}	PM_{25}	SO_2	VOC
afdust				8,858,992	1,030,391		
Ag		3,251,990					
alm_no_c3	270,007	773	1,924,925	59,366	56,687	154,016	67,690
nonpt	7,376,314	134,080	1,683,490	1,349,685	1,076,954	1,252,645	7,474,512
nonroad	17,902,244	2,042	2,010,786	192,016	182,151	103,787	2,514,819
onroad	37,903,749	163,735	8,001,667	179,470	102,494	66,370	3,147,282
ptfire	33,600,784	550,283	397,094	3,363,355	2,850,301	233,739	7,910,324
ptipm	578,111	20,997	3,360,926	612,992	507,501	9,083,244	40,075
ptnonipm	3,222,221	159,003	2,247,228	653,957	442,656	2,117,649	1,310,085
seca_c3	58,225		688,087	58,042	53,398	452,318	24,233
Con.US Total	**100,911,655**	**4,282,903**	**20,314,203**	**15,327,874**	**6,302,535**	**13,463,767**	**22,489,021**

Table 3-2. 2008 Continental United States Emissions by Sector (tons/yr in 48 states + D.C.)

Country & Sector	CO	NH3	NO_x	PM_{10}	$PM_{2.5}$	SO_2	VOC*
Canada othar	3,747,987	537,835	718,996	1,421,910	393,852	97,652	1,332,559
Canada othon	4,514,002	21,810	537,665	15,002	10,632	5,430	308,318
Canada othpt	1,147,801	21,138	861,223	117,254	68,114	1,762,340	448,629
Canada Subtotal	9,409,790	580,784	2,117,883	1,554,167	472,598	1,865,422	2,089,507
Mexico othar	350,557	254,600	171,099	75,556	49,023	82,643	429,264
Mexico othon	1,066,589	1,898	110,203	5,151	4,720	6,124	152,265
Mexico othpt	68,422	0	224,202	97,146	72,264	649,810	65,273
Mexico Subtotal	1,485,567	256,498	505,505	177,854	126,007	738,578	646,802
Offshore othpt	89,800	0	82,571	839	837	1,961	53,399
Offshore seca_c3	40,377	0	490,149	40,483	37,240	300,320	17,176
2008 TOTAL	**11,025,535**	**837,282**	**3,196,108**	**1,773,342**	**636,682**	**2,906,280**	**2,806,884**

* VOC is approximated from a sum of speciated VOC within the modeling domain

Table 3-3. 2008 Non-US Emissions by Sector (tons/yr for Canada, Mexico, Offshore)

3.2.1 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). Note that this section describes only NEI point sources within the contiguous U.S.. The offshore oil (othpt sector), fires (ptfire) and category 3 CMV emissions (c3marine sector) are point source formatted inventories discussed later in this section. Full documentation for the development of the 2008 NEI (EPA, 2012), is posted at: http://www.epa.gov/ttn/chief/net/2008inventory.html#inventorydoc

After removing offshore oil platforms into the othpt sector, two platform sectors for input into SMOKE were created from the remaining 2008 NEI point sources: the Integrated Planning Model (IPM) sector (ptipm) and the non-IPM sector (ptnonipm). This split facilitates the use of different SMOKE temporal processing and future year projection techniques for these sectors. The inventory pollutants processed through SMOKE for both ptipm and ptnonipm sectors were: CO, NOx, VOC, SO_2, NH_3, PM_{10}, $PM_{2.5}$, HCl and Cl. Inventory BAFM emissions from these sectors were not used and instead the VOC was speciated without any integration of VOC HAPs (integration is discussed in detail in Section3.3.4.

In the 2008 model evaluation case used in this study, for ptipm sector sources with CEM data that could be matched to the NEI, 2008 hourly SO_2 and NO_x emissions were used alongside annual emissions of all other pollutants. The hourly electric generating unit (EGU) emissions were obtained for SO_2 and NO_x emissions and heat input from EPA's Acid Rain Program. This data also contained heat input, which was used to allocate the annual emissions for other pollutants (e.g., VOC, $PM_{2.5}$, HCl) to hourly values. For unmatched EGU unit sources, annual emissions were temporalized to days using multi-year averages and to hours using state-specific averages.

The Non-EGU Stationary Point Sources (ptnonipm) emissions were provided to SMOKE as annual emissions. The emissions were developed as follows:

a. 2008 CAP and HAP were provided by States, locals and tribes under the Consolidated Emissions Reporting Rule
b. EPA corrected known issues and filled PM data gaps.
c. EPA added HAP data from the Toxic Release Inventory (TRI) where it was not provided by states/locals.
d. EPA provided data for airports and rail yards.
e. Off-shore platform data was added from Mineral Management Services (MMS).

The changes made to the 2008 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 state/county FIPS code of 88XXX, where XXX is the3-digit tribal code in the NEI. This change was made because SMOKE requires the state/county FIPS code.
- Stack parameters for some point sources were defaulted 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 specified.

3.2.1.1 IPM Sector (ptipm)

The ptipm sector contains emissions from EGUs in the 2008 NEI point inventory that could be matched to the units found in the NEEDS database, version 4.10 (http://www.epa.gov/airmarkets/progsregs/epa-ipm/ index.html), also used by IPM version 4.10. IPM provides future year emission inventories for the universe of EGUs contained in the NEEDS database. As described below, matching with NEEDS was done (1) to provide consistency between the 2008 EGU sources and future year EGU emissions for sources which are forecasted by IPM, and (2) to avoid double counting in projecting point source emissions.

The 2008 NEI point source inventory contains emissions estimates for both EGU and non-EGU sources. When future years are modeled, 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 two sectors: (1) sources that are projected via IPM (i.e., the "ptipm" sector) and (2) sources that are not (i.e., "the "ptnonipm" sector). This procedure prevents double-counting or dropping significant emissions when creating future-year emissions. The two sectors are modeled separately in the base year as well as the future years.

A primary reason the ptipm sources were separated from the other sources was due to the difference in the temporal resolution of the data input to SMOKE. The ptipm sector uses the available hourly CEM data via a method first implemented in the 2002 platform and still used for the 2008 platform. A great deal of detailed work was performed to match units in the 2005 NEI with units in the NEEDS database available at that time so the CEM data could be used. The information on the NEEDS matches was carried forward into the 2008 platform by loading them into the Emissions Inventory System (EIS) and writing them into the modeling files. Hourly CEM data for 2008 were obtained from the CAMD Data and Maps website[3]. For sources and pollutants with CEM data, the actual year 2008 hourly CEM data were used.

The SMOKE modeling system matches the ORIS Facility and Boiler IDs in the NEI SMOKE-ready file to the same fields in the CEM data, thereby allowing the hourly SO_2 and NOx CEM emissions to be read directly from the CEM data file. The heat input from the hourly CEM data was used to allocate the NEI annual values to hourly values for all other pollutants from CEM sources, because CEMs are not used to measure emissions of these pollutants.

[3] http://camddataandmaps.epa.gov/gdm/index.cfm?fuseaction=emissions.wizard

For sources not matching the CEM data ("non-CEM" sources), daily emissions were computed from the NEI annual emissions using a structured query language (SQL) program and state-average CEM data. To allocate annual emissions to each month, state-specific, three-year averages of 2006-2008 CEM data were created. These average annual-to-month factors were assigned to non-CEM sources by state. To allocate the monthly emissions to each day, the 2008 CEM data were used to compute state-specific month-to-day factors, which were then 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, considered ancillary data for SMOKE, is described in a later section.

3.2.1.2 Non-IPM Sector (ptnonipm)

The non-IPM (ptnonipm) sector contains all 2008 NEI point sources not included in the IPM (ptipm) sector[4] except for the offshore oil and day-specific fire emissions. The ptnonipm sector contains a small amount of fugitive dust PM emissions from vehicular traffic on paved or unpaved roads at industrial facilities or coal handling at coal mines.

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 they may use non- point, onroad or nonroad (10-digit) SCCs. In the 2008 NEI, examples of these types of sources include: aircraft and ground support emissions, livestock (i.e., cattle feedlots) in California, and rail yards.

Some adjustments were made to the 2008 NEI point inventory prior to its use in modeling. These include:

- Removing sources with state county codes ending in '777'. These are used for 'portable' point sources like asphalt plants.
- Removing sources with SCCs not typically used for modeling.
- Adjusting latitude-longitude coordinates for sources identified to be substantially outside the county in which they reside.

3.2.2 Nonpoint Sources (afdust, ag, nonpt)

Documentation for the nonpoint 2008 NEI is available at http://www.epa.gov/ttn/chief/net/2008inventory.html #inventorydoc. Prior to modeling with the nonpoint portion of the 2008 NEI, it was divided into the following sectors for which the data is processed in consistent ways: area fugitive dust (afdust), agricultural ammonia (ag), and the other nonpoint sources (nonpt). The nonpoint tribal-submitted emissions were removed to prevent possible double counting with the county-level emissions. Because the tribal nonpoint emissions are small, these omissions should not impact results at the 12-km scale used for modeling. This omission also eliminated the need to develop costly spatial surrogate data to allocate tribal data to grid cells during the SMOKE processing.

In the rest of this section, each of the platform sectors into which the 2008 nonpoint NEI was divided is described, as are any changes made to these data.

3.2.2.1 Area Fugitive Dust Sector (afdust)

The area-source fugitive dust (afdust) sector contains PM emission estimates for 2008 NEI nonpoint SCCs identified by EPA staff as fugitive dust sources. 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 point sources. 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/dustfractions/tf_scc_list2002nei_v2.xls. However, not all of the SCCs in this file are present in the 2008 NEI. Note that for this project, the fugitive dust emissions submitted by Kansas were replaced by EPA-estimated values due to a error in Kansas' data identified during data quality assurance.

This sector is separated from other nonpoint sectors to make it easier to apply a "transport fraction" that reduces emissions to reflect observed diminished transport from these sources 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. For this project, the transport fraction was computed dynamically for each grid cell as a function of the land use fraction and the hourly soil moisture. Dust transport was prevented when there was snow cover or when the surface soil layer was wet. For more information on this approach, see http://www.epa.gov/ttn/chief/conference/ei19/session9/pouliot.pdf.

3.2.2.2 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 2008 NEI. The livestock and fertilizer emissions were extracted based on SCC. The "ag" sector includes all of the NH_3 emissions from fertilizer contained in the NEI. However, the "ag" sector does not include all of the livestock ammonia emissions, as there are also a very small amount of NH_3 emissions from feedlot livestock in the point source inventory. Emissions were not included in the nonpoint ag inventory for counties for which they were in

[4] Except for the offshore oil and day-specific point source fire emissions data which are included in separate sectors, as discussed in sections 2.6 and 2.3.1, respectively.

the point source inventory. Therefore, no double counting occurred. Most of the point source livestock NH_3 emissions were reported by California.

3.2.2.3 *Other Nonpoint Sources (nonpt)*

Nonpoint sources that were not subdivided into the afdust, ag or nonpt sectors were assigned to the "nonpt" sector. In preparing the nonpt sector, catastrophic releases were excluded since these emissions were dominated by tire burning, which is an episodic, location-specific emissions category. Tire burning accounts for significant emissions of particulate matter in some parts of the country. Because such sources are reported by a very small number of states, and are inventoried as county/annual totals without the information needed to temporally and spatially allocate the emissions to the time and location where the event occurred, catastrophic releases were excluded.

The nonpt sector includes emission estimates for Portable Fuel Containers (PFCs), also known as "gas cans." The PFC inventory consists of five distinct sources of PFC emissions, further distinguished by residential or commercial use. The five sources are: (1) displacement of the vapor within the can; (2) spillage of gasoline while filling the can; (3) spillage of gasoline during transport; (4) emissions due to evaporation (i.e., diurnal emissions); and (5) emissions due to permeation. Note that spillage and vapor displacement associated with using PFCs to refuel nonroad equipment are included in the nonroad inventory.

3.2.4 *Day-Specific Point Source Fires (ptfire)*

Wildfire and prescribed burning emissions are contained in the ptfire sector. The ptfire sector has emissions provided at geographic coordinates (point locations) and has daily estimates of the emissions from each fires value. The ptfire sector for the 2008 Platform excludes agricultural burning and other open burning sources, which are included in the nonpt sector. The agricultural burning and other open burning sources are in the nonpt sector because these categories were not factored into the development of the ptfire sector. Additionally, their year-to-year impacts are not as variable as wildfires and non-agricultural prescribed/managed burns.

The ptfire sector includes a satellite derived latitude/longitude of the fire's origin and other parameters associated with the emissions such as acres burned and fuel load, which allow estimation of plume rise. Note that agricultural burning is not included in the ptfire sector but is included in the nonpt sector.

The point source day-specific emission estimates for 2008 fires rely on Sonoma Technology, Inc.'s Satellite Mapping Automated Reanalysis Tool for Fire Incident Reconciliation (SMARTFIRE) system (Sullivan, et al., 2008). The BlueSky Smoke Modeling Framework and SMARTFIRE were applied to develop day-specific wildland fire emissions for the continental United States. Using ICS-209 reports and satellite fire data, SMARTFIRE classifies each fire as either a wildfire (WF), wildland fire use (WFU), prescribed burn (RX), or unclassified.

Figure 3-1 shows a functional diagram of the SMARTFIRE process. SMARTFIRE involves the use of the National Oceanic and Atmospheric Administration's (NOAA's) Hazard Mapping System (HMS) fire location information as input combined with CONSUMEv3.0 (Joint Fire Science Program, 2009) and the Fuel Characteristic Classification System (FCCS) fuel- loading database to estimate fire emissions from wildfires and prescribed burns on a daily basis.

The SMARTFIRE system of reconciliation with ICS-209 reports is described in an Air and Waste Management Association report (Raffuse, et al., 2008). Once the fire reconciliation process is completed, the emissions are calculated using the U.S. Forest Service's CONSUMEv3.0 fuel consumption model and the FCCS fuel-loading database in the Bluesky Framework (Ottmar, et. al., 2007),The detection of fires with this method is satellite-based. Additional sources of information used in the fire classification process included MODIS satellite and fuel moistures derived from fire weather observational data.

The activity data and other information were used within the BlueSky Framework to model vegetation distribution, fuel consumption, and emission rates, respectively. Latitude and longitude locations were incorporated as a post processing step. The method to classify fires as WF, WFU, RX (FCCS > 0), and unclassified (FCCS > 0) involves the reconciliation of ICS-209 reports (Incident Status Summary Reports) with satellite-based fire detections to determine spatial and temporal information about the fires.

The ICS-209 reports for each large wildfire are created daily to enable fire incident commanders to track the status and resources assigned to each large fire (100 acre timber fire or 300 acre rangeland fire).Note that the distinction between wildfire and prescribed burn is not as precise as with ground-based methods. The fire size was based on the number of satellite pixels and a nominal fire size of 100 acres/pixel was assumed for a significant number of fire detections when the first detections were not matched to ICS 209 reports, so the fire size information is not as precise as ground-based methods.

Because the HMS satellite product from NOAA is based on daily detections, the emission inventory represents a time-integrated emission estimate. For example, a large smoldering fire will show up on satellite for many days and would count as acres burned on a daily basis; whereas a ground-based method would count the area burned only once even it burns over many days. Additional references for this method are provided in (McKenzie, et al., 2007), (Ottmar, et al., 2003), (Ottmar, et al., 2006), and (Anderson et al., 2004).

The SMOKE-ready "ORL" inventory files created from the raw daily fires contain both CAPs and HAPs. The BAFM HAP emissions from the inventory were obtained using VOC speciation profiles (i.e., a "no-integrate noHAP" use case). model-species emissions from vegetation and soils. It estimates CO, VOC, and NOX emissions for the U.S., Mexico, and Canada. The BEIS3.14 model is described further in: http://www.cmascenter.org/conference/2008/slides/pouliot_tale_two_ cmas08.ppt

3.2.5 Biogenic Sources (beis)

For CMAQ, biogenic emissions were computed based on 2008 meteorology data using the BEIS3.14 model within SMOKE. The BEIS3.14 model creates gridded, hourly,

The inputs to BEIS include:

- Temperature data at 2 meters from the CMAQ meteorological input files,
- Land-use data from the Biogenic Emissions Landuse Database, version 3 (BELD3) that provides data on the 230 vegetation classes at 1-km resolution over most of North America.

3.2.6 Mobile Sources (on_noadj, on_moves_runpm, on_moves_startpm, nonroad, c1c2rail, c3marine)

The 2008 onroad emissions are broken out into three sectors: (1) “on_moves_startpm”; (2) “on_moves_ runpm”; and (3) “on_noadj”. Aircraft emissions are in the nonEGU point inventory. The locomotive and commercial marine emissions are divided into two sectors: “c1c2rail” and “c3marine”, and the “nonroad” sector contains the remaining nonroad emissions. NMIM was used to compute emissions for the nonroad sectors. NMIM creates nonroad emissions on a month-specific basis that accounts for temperature, fuel types, and other variables that vary by month.

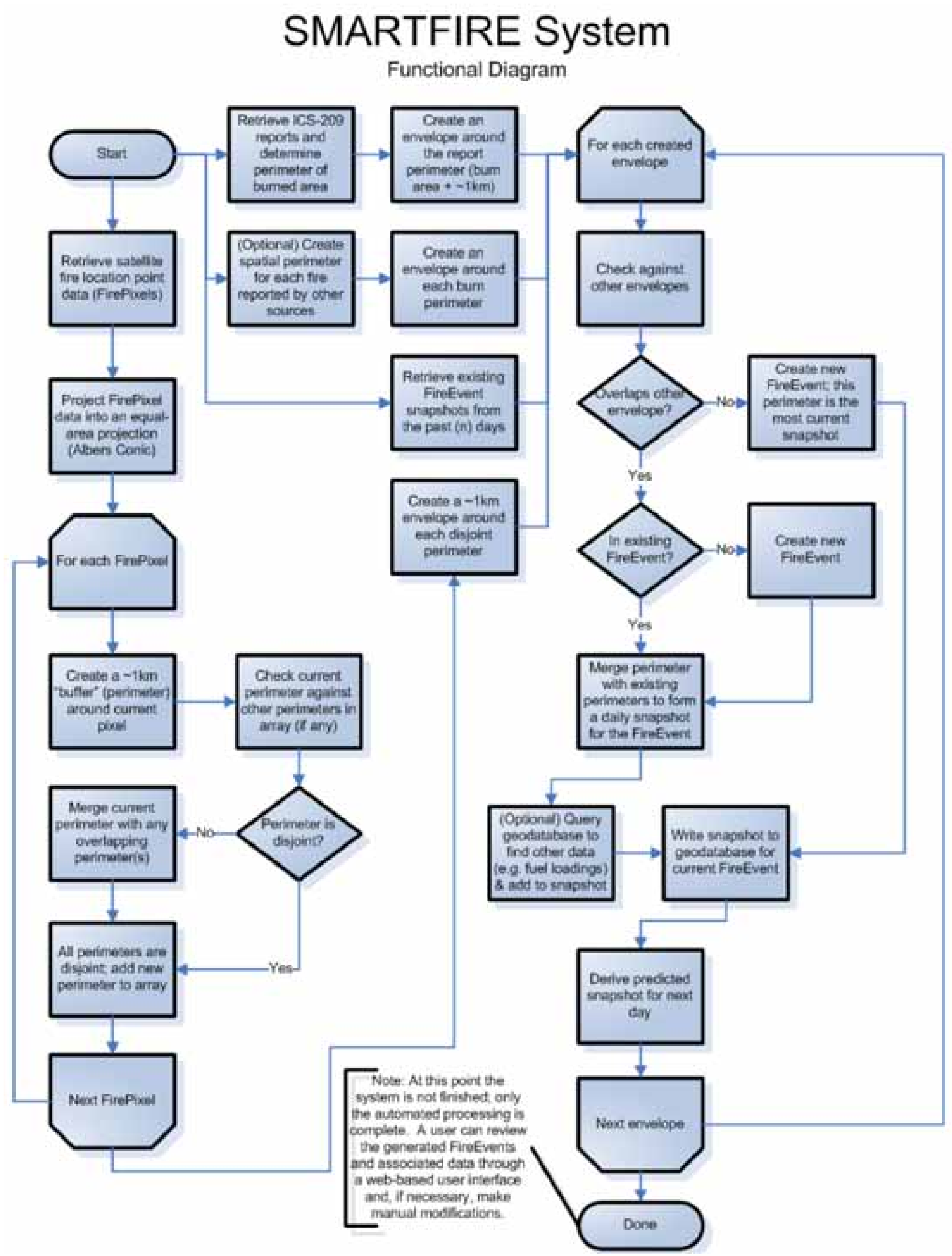


Figure 3-1. SMARTFIRE System

Onroad emissions were computed using MOVES2010 (see http://www.epa.gov/otaq/models/moves. MOVES2010 was used to create 2008 emissions by state and month and these emissions were then allocated to counties using NMIM-based county-level data. The reason for the state resolution was due to run-time issues that made a county-specific MOVES run for the nation infeasible.

The 2008 NMIM nonroad emissions were generated using updated activity (fuels, vehicle population, etc) data, but are otherwise similar in methodology to those generated for the 2005 NEI. Detailed inventory documentation for the 2008 NEI nonroad sectors is available at http://www.epa.gov/ttn/chief/net/2008inventory.html#inventorydoc. Note that the 2008 NEI includes state-submitted emissions data for nonroad, but the modeling performed for this platform does not incorporate state-submitted emissions for the onroad or nonroad sectors.

The residual fuel commercial marine vessel (CMV), also referred to as Category 3 (C3), consists of a set of approximately 4-km resolution point source format emissions; these are modeled separately as point sources in the “c3marine” sector, and were projected from year 2002 to year 2008 using OTAQ-supplied pollutant-specific growth factors.

With the exception of the c3marine point source-formatted sector, the mobile sectors are at county and SCC resolution. Tribal data from the c1c2rail sector have been dropped because spatial surrogate data is not available and the emissions are small. Also, NMIM and MOVES do not generate tribal data.

All mobile sectors that have benzene, acetaldehyde, formaldehyde or methanol present in the inventory data, use VOC “integration” of BAFM for input into the air quality model. A few categories of nonroad sources (CNG and LPG-fueled equipment) do not have BAFM and therefore utilize the “no-integrate”, “no-hap-use” case which means VOC from these sources is speciated to provide BAFM.

3.2.7 Adjustments to Onroad Mobile Source PM Emissions (on_moves_runpm, on_moves_startpm)

The on_moves_rupm and on_moves_startpm sectors contain MOVES2010 emissions for PM for onroad gasoline cold-start exhaust. These emissions (and the on_moves_runpm sector discussed in the next section) are processed separately from the remainder of the onroad mobile emissions because they are subject to hourly temperature adjustments, and these temperature adjustments are different for cold-start and running exhaust modes. Figure 3-2 shows how PM emissions increase with colder temperatures and how start exhaust emissions increase more than running exhaust emissions.

Temperature adjustments were applied to account for the strong sensitivity of PM exhaust emissions to temperatures below 72 ºF. Because it was not feasible to run MOVES for all of the gridded, hourly temperatures needed for modeling, emissions of PM exhaust at 72 ºF were created and temperature adjustments applied after the emissions were spatially and temporally allocated. The PM adjustments differed for starting versus running exhaust; and were applied to gridded, hourly intermediate files using the gridded hourly temperature data input to the CMAQ model. One result of this approach is that inventory summaries based on the raw SMOKE inputs for these sectors are not consistent with the final modeled emissions because they do not include the temperature adjustments. As a result, the post-processing for temperature adjustments included computing the adjusted emissions totals at state, county, and month resolution to use for summaries.

The MOVES outputs required additional processing to develop county-level monthly ORL files for input to SMOKE. As stated earlier, the spatial resolution of the MOVES data was at the state level and these data were allocated to county level prior to input into SMOKE. In addition, the exhaust PM emissions from MOVES were partially speciated. To retain the speciated elemental carbon and sulfate emissions from MOVES, the speciation step that is usually done in SMOKE was performed prior to SMOKE, and it was modified to allow the temperature adjustments to be done only on the species affected by temperature.

Finally, because the start emissions were broken out separately from running exhaust emissions, they were assigned to new SCCs (urban and rural parking areas) that allowed for the appropriate spatial and temporal profiles to be applied in SMOKE.

A list of the procedures performed to prepare the MOVES data for input into SMOKE is provided below.

i. State-level emissions were allocated to counties using state-county emission ratios by SCC, pollutant, and emissions mode (e.g., evaporative, exhaust) for each month. The ratios were computed using NMIM 2008 data.

ii. Start and run emissions were assigned to urban and rural SCCs based on the county-level ratio of emissions from urban versus rural local roads from the NMIM onroad gasoline data. For example, the LDGV start emissions in the state-total MOVES data (assigned SCC 2201001000) were split into urban (2201001370) and rural (2201001350) based on the ratio of LDGV urban (2201001330) and rural (2201001210) local roads.

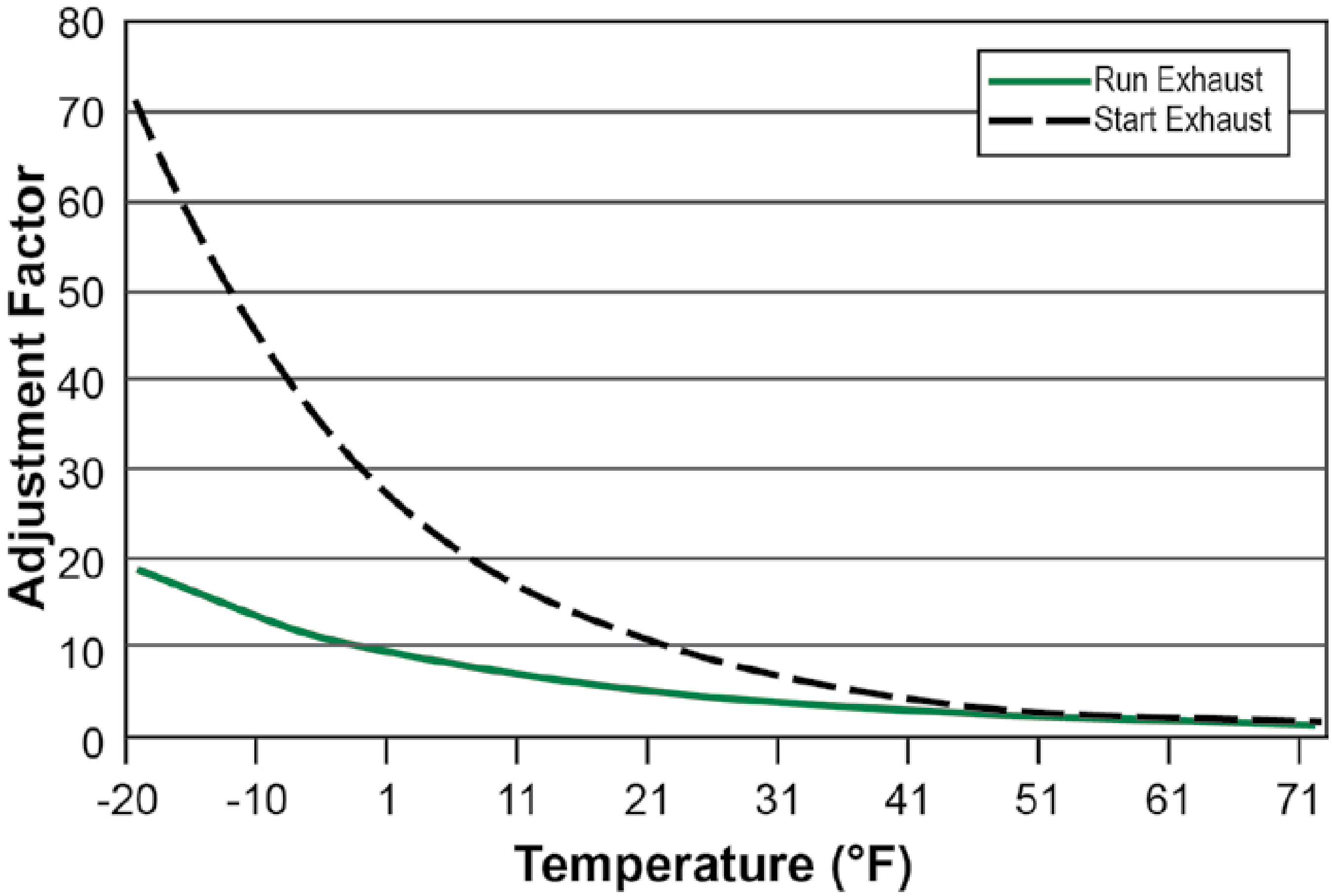


Figure 3-2. MOVES exhaust temperature adjustment functions.

iii. MOVES-based PM species at 72 ºF were converted to SMOKE-ready PM species. The SMOKE-ready species are listed below and the speciation technique used to obtain the SMOKE-ready species is further discussed in Appendix B of the 2005v4 emissions modeling platform documentation. Species subject to temperature adjustment below 72 ºF include "_72" in their names.

- PEC_72: unchanged from PM25EC.
- POC_72: modified PM25OC to remove metals, PNO_3 (computed from MOVES-based PM25EC), NH_4 (computed from MOVES-based PM25SO4 and PNO_3), and MOVES-based PM25SO4.
- PSO_4: unchanged from PM25SO4.
- PNO_3: computed from MOVES-based PM25EC.
- OTHER: sum of computed metals (fraction of MOVES-based PM25EC) and NH_4 (computed from PNO_3 and PSO_4).
- PMFINE_72: Computed from OTHER and fraction of POC_72.
- PMC_72: Computed as fraction of sum of PMFINE_72, PEC_72, POC_72, PSO_4, and PNO_3.

The result of these preprocessing steps is that SMOKE-ready PM emissions do not exactly match what MOVES provides. The emissions are conserved during allocation from the state to county, and from the generic total "start" SCCs to the two new parking SCCs that end in "350" and"370". PEC and PSO_4 components of $PM_{2.5}$ emissions are also conserved as they are simply renamed from the MOVES specie "PM25EC". However, as seen above, POC, PNO_3, and PMFINE components involve multiplying the MOVES PM species by components of an onroad gasoline exhaust speciation profile described in Appendix B of the 2005v4 platform documentation.

3.2.8 *Onroad Mobile Sources without Adjustments (on_noadj)*

The on_noadj sector consists of the remaining onroad mobile emissions not covered by the on_moves_startpm and on_ moves_runpm sectors. These monthly MOVES-based emissions were not temperature adjusted. MOVES outputs included emissions for the following pollutants and process combinations:

a. Diesel Exhaust: VOC, NO_x, NO, NO_2, SO2, $PM_{2.5}$, PM_{10}, NH_3, CO, 1,3-butadiene (106990), acetaldehyde (75070), acrolein (107028), benzene (71432), and formaldehyde (50000)

b. Gasoline Exhaust: VOC, NO_x, NO, NO_2, SO_2, NH_3, CO, 1,3-butadiene (106990), acetaldehyde (75070), acrolein (107028), benzene (71432), and formaldehyde (50000)

c. Evaporative: Non-refueling VOC and benzene

d. Brake and tire wear: Total (not speciated) $PM_{2.5}$ and PM_{10} from gasoline and diesel vehicles

Start and running mode exhaust MOVES emissions for pollutants other than PM do not require the same intermediate temperature adjustments and can therefore be processed with the remaining "no adjust" onroad mobile emissions. These emissions contain both running and parking sources and are pre-processed from state-level to county-level much like the on_moves_startpm and on_moves_runpm sectors already discussed. The preprocessing for these emissions did not require species calculations because the raw MOVES emissions translated directly to SMOKE inventory species.

Note that HONO was computed as a function of MOVES NO_x and NO and NO_2 were recomputed so that the total of the three species was equal to NOx from MOVES. Also, some pollutants output from MOVES are not included in this modeling, such as ethanol and CO_2. The remainder of this section discusses the pre-processing required to create monthly ORL files for the on_noadj sector.

Prior to processing with SMOKE, emissions were converted from monthly totals to monthly average-day based the on number of days in each month. Furthermore, this sector includes exhaust, evaporative, brake wear and tire wear emissions from onroad sources. This allowed the use of speciation profiles that are specific to each of these processes. For this project, the 2008 VMT database was based on 2002 VMT grown to 2008 based on Federal Highway Administration (FWHA) data, unless state-provided VMT was available.

Onroad refueling emissions for this 2008 platform are included in the nonpt and ptnonipm sectors from the 2008 NEI as a combination of state-submitted, where available, and EPA estimated values.

3.2.9 *Nonroad Mobile Sources—NMIM-Based Nonroad(nonroad)*

The nonroad sector includes monthly exhaust, evaporative and refueling emissions from nonroad engines (not including commercial marine, aircraft, and locomotives) derived from NMIM. The NMIM configuration relied on the version of the NONROAD2005 model (NR05c-BondBase) used for the marine spark ignited (SI) and small SI engine proposed rule, published May 18, 2008 (EPA, 2007c). For 2008, the NONROAD2005 model (NR05c-BondBase) is equivalent to NONROAD2008a, since it incorporated Bond rule revisions to some of the base case inputs and the Bond Rule controls did not take effect until future years. NMIM provides nonroad emissions for VOC by three emission modes: exhaust, evaporative and refueling. Unlike the onroad sector, refueling emissions are included for the nonroad sector.

NMIM was run with National County Database (NCD) NCD20100602 to create county-SCC emissions for the 2008 nonroad mobile CAP/HAP sources. Emissions were converted from monthly totals to monthly average- day based the on number of days in each month. EPA default inputs were replaced by state inputs where provided in NCD20100602. The 2008 NEI documentation describes this and all other details of the NMIM nonroad emissions development for the 2008 platform.

3.2.10. *Nonroad Mobile Sources: Commercial Marine C1, C2, and Locomotive (c1c2rail)*

The c1c2rail sector contains CAP and HAP emissions from locomotive and commercial marine sources, except for the category 3/residual-fuel (C_3) commercial marine vessels (CMV) found in the c3marine sector. The emissions in the c1c2rail sector are year 2008 and are composed of the following SCCs: 2280002100 (CMV diesel, ports), 2280002200 (CMV diesel, underway), 2285002006 (locomotives diesel line haul Class I), 2285002007 (locomotives diesel line haul Class II/III), 2285002008 (locomotives diesel line haul passenger trains), 2285002009 (locomotives diesel line haul commuter lines), and 2285002010 (locomotives diesel, yard).

For modeling purposes, the only additional change made to the nonroad data for the 2008 platform was to remove railway maintenance emissions (SCCs 2285002015, 2285004015, and 2285006015) because these are included in the nonroad NMIM monthly inventories. For more information, see the 2008 NEI documentation.

3.2.11 *Nonroad mobile sources: C3 commercial marine (c3marine)*

The raw c3marine sector emissions data were developed in an ASCII raster format used since the Emissions Control Area-International Marine Organization (ECA-IMO) project began in 2005, then known as the Sulfur Emissions Control Area (SECA). These emissions consist of large marine diesel engines (at or above 30 liters/cylinder) that until recently, were allowed to meet relatively modest emission requirements, often burning residual fuel. The emissions in this sector are comprised of primarily foreign-flagged ocean-going vessels, referred to as Category 3 (C3) ships.

The c3marine (ECA) inventory includes these ships in ports and underway mode and includes near-port auxiliary engines. An overview of the ECA-IMO project and future year goals for reduction of NO_x, SO_2, and PM_C emissions can be found at: http://www.epa.gov/nonroad/html.

The base year for the ECA inventory is 2002 and consists of these CAPs: PM_{10}, $PM_{2.5}$, CO, NO_x, SO_x (assumed to be SO_2), and Hydrocarbons (assumed to be VOC). EPA developed regional growth (activity-based) factors that were applied to create a 2008 inventory from the 2002 data. These growth factors are the same for all pollutants except NO_x, which includes a Tier 1 Standard. The factors are provided in Table 3-5 and mapped and documented in the following report: http://www.eoa.giv/ins/regs/bibriad/narube/cu/420r09007-chap2.pdf.

Region	NO_x	All_other pollutants
Alaska	1.114	1.179
East Coast	1.182	1.251
Gulf Coast	1.092	1.156
Hawaii	1.212	1.282
North Pacific (Washington)	1.114	1.179
South Pacific (Oregon and California)	1.212	1.282
Great Lakes	1.082	1.089

Table 3-5. Regional growth factors used to project 2002 C3 emissions to 2008

The raw ECA inventory started as a set of ASCII raster datasets at approximately 4-km resolution that was converted to SMOKE point-source ORL input format as described in this conference paper:

http://www.epa.gov/ttn/chief/conference/ei17/session6/mason_pres.pdf

This paper describes how the ASCII raster dataset was converted to latitude-longitude, mapped to state/county FIPS codes that extend up to 200 nautical miles (nm) from the coast, assigned stack parameters, and how the monthly ASCII raster dataset emissions were used to create monthly temporal profiles. Counties were assigned as extending up to 200nm from the coast because of this was the distance through the Exclusive Economic Zone (EEZ), a distance that would be used to define the outer limits of ECA-IMO controls for these vessels. The 2008 ECA-based C3 inventory delineates between ports and underway modes using 2008 NEI port shapefiles to assign point data as ports and all other point data as underway.

Factors were applied to compute HAP emissions (based on emissions ratios) to VOC to obtain HAP emissions values. Table 3-6 below shows these factors. Because HAPs were computed directly from the CAP inventory and the calculations are therefore consistent, the entire c3marine sector utilizes CAP-HAP VOC integration to use the VOC HAP species directly, rather than VOC speciation profiles.

The emissions were converted to SMOKE point source ORL format, allowing for the emissions to be allocated to modeling layers above the surface layer. All non-US emissions (i.e., in waters considered outside of the 200nm EEZ, and hence out of the U.S. territory) are assigned a dummy state/county FIPS code=98001.

Pollutant	Apply to	Pollutant Code	Factor
Acetaldehyde	VOC	75070	0.0002286
Benzene	VOC	71432	9.795E-06
Formaldehyde	VOC	50000	0.0015672

Table 3-6. HAP emission ratios for generation of HAP emissions from criteria emissions for C3 commercial marine vessels

The SMOKE-ready data were cropped from the original ECA-IMO data to cover only the 36-km CMAQ domain, which is the largest domain used for this effort, and larger than the 12km domain used in this project.

3.2.12 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 2008 NEI, and the third and fourth characters provide the SMOKE source types: "pt" for point, "ar" for "area and nonroad mobile", and "on" for onroad mobile. Mexico's emissions are unchanged from the 2005 Platform.

For Canada, year 2006 emissions were used, with several modifications:

i. Wildfires and prescribed burning emissions were not included because Canada does not include these inventory data in their modeling.

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

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

iv. Speciated VOC emissions from the ADOM chemical mechanism were not included.

v. Residual fuel CMV (C3) SCCs (22800030X0) were removed because these emissions are included in the c3marine sector, which covers not only emissions close to Canada but also emissions far at sea. Canada was involved in the inventory development of the c3marine sector emissions.

vi. Wind erosion (SCC=2730100000) and cigarette smoke (SCC=2810060000) emissions were removed from the nonpoint (nonpt) inventory; these emissions are also absent from the U.S. inventory.

vii. Quebec $PM_{2.5}$ emissions (2,000 tons/yr) were removed for one SCC (2305070000) for Industrial Processes, Mineral Processes, Gypsum, Plaster Products due to corrupt fields after conversion to SMOKE input format. This error should be corrected in a future inventory.

viii. Excessively high CO emissions were removed from Babine Forest Products Ltd (British Columbia plan-tid='5188') in the point inventory. This change was made because the value of the emissions was impossibly large.

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

Mexico emissions for 1999 (Eastern Research Group Inc., 2006) were used as these 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). This inventory includes emissions from all states in Mexico.

The offshore emissions include point source offshore oil and gas drilling platforms. Offshore emissions from the 2008 NEI point source inventory were used. The offshore sources were provided by the Mineral Management Services (MMS).

3.2.13 SMOKE-ready non-anthropogenic chlorine inventory

For the ocean chlorine, the same data as in the CAP and HAP 2002-based Platform was used. See ftp://ftp.epa.gov/EmisInventory/2002v3CAPHAP/documentation/ documentation for details.

3.3 Emissions Modeling Summary

SMOKE for the 2008 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 Mexico). The pollutants for all sectors except for biogenics and ocean chlorine are those inventoried for the NEI.

The pre-processing steps that comprise the emissions modeling task include temporal allocation, spatial allocation, pollutant speciation, and vertical allocation of point. This section provides some basic information about the tools and data files other than inventories used for emissions modeling as part of the 2008 Platform.

3.3.1 The SMOKE Modeling System

SMOKE version 2.7 was used to pre-process the emissions inventories to create the emissions inputs for CMAQ. SMOKE executables and source code are available from the Community Multiscale Analysis System (CMAS) Center at http://www.cmascenter.org. Additional information about SMOKE is available from http://www.smoke-model.org.

3.3.2 Key Emissions Modeling Settings

Emissions inventories for each modeling sector are processed separately through SMOKE to create gridded, hourly, speciated emissions. The final merge program (Mrggrid) is then run to combine the model-ready, sector-specific emissions across sectors. The SMOKE settings in the "run scripts" and the data in the SMOKE ancillary files control the approaches used by the individual SMOKE programs for each sector.

Table 3-7 summarizes the major SMOKE processing steps of each platform sector. The "Spatial" column shows the spatial approach: "point" indicates that SMOKE maps the source from a point (i.e., latitude and longitude) 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. The "Speciation" column indicates that all sectors use the SMOKE speciation step, though speciation of biogenic emissions 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.

Platform sector	Spatial	Speciation	Inventory resolution	Plume rise
ptipm	point	Yes	daily & hourly	in-line
ptnonipm	point	Yes	annual	in-line
othpt	point	Yes	annual	in-line
nonroad	surrogates & area-to-point	Yes	monthly	
othar	surrogates	Yes	annual	
seca_c3	point	Yes	annual	in-line
alm_no_c3	surrogates & area-to-point	Yes	annual	
on_noadj	surrogates	Yes	monthly	
on_moves_startpm	surrogates	Yes	monthly	
on_moves_runpm	surrogates	Yes	monthly	
othon	surrogates	Yes	annual	
nonpt	surrogates & area-to-point	Yes	annual	
ag	surrogates	Yes	annual	
afdust	surrogates	Yes	annual	
beis	pre-gridded landuse	in BEIS	hourly	
ptfire	point	Yes	daily	in-line

Table 3-8. 2008 Emission Model Species produced by SMOKE using the Carbon Bond 5 (CB05) Mechanism with Secondary Organic Aerosol (SOA) in CMAQ v4.7

Figure 3-3. CMAQ Modeling Domain

The last column in Table 3-7 is the "plume rise" column. The sectors with "In-line" in this column are the only ones which will have emissions in aloft layers, based on their plume rise. Here the term "in-line" refers to the fact that the plume rise for each hour is computed inside CMAQ using stack data in SMOKE output files, rather than within SMOKE. For most "in-line" sectors, the emissions are divided between ground-level and aloft emissions based on their characteristics (e.g., stack height). The one sector listed with "in-line" only, c3marine, was processed so that all of the emissions would be in aloft layers with no emissions in the 2-dimensional, layer-1 files created by SMOKE. Rather the speciated and temporalized source-based CMAQ inputs for c3marine were used for the vertical allocation.

One of the issues found was that when using in-line processing, the PELVCONFIG file cannot allow grouping, otherwise the "inline" versus "offline" (i.e., processing whereby SMOKE creates 3-dimensional files) will not give identical results. Since a PELVCONFIG file with grouping was used, the in-line approach should be used to exactly replicate our results.

3.3.3 Spatial Configuration

For this project, we ran SMOKE and CMAQ were run for a 12-km modeling domain as shown in Figure 3-3. The grid used a Lambert-Conformal projection, with Alpha = 33, Beta = 45 and Gamma = -97, with a center of X = -97 and Y = 40. Later sections provide details on the spatial surrogates and area-to-point data used to accomplish spatial allocation with SMOKE.

3.3.4 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 2005 Platform is the Carbon Bond 05 (CB05) mechanism (Yarwood, 2005) with secondary organic aerosol (SOA) and HONO enhancements as described in http://www.cmascenter.org/help/model_docs/cmaq/4.7/RELEASE_NOTES.txt.

From the perspective of emissions preparation, it is the same mechanism used in the 2005 and 2002 Platforms. Table 3-8 lists the model species produced by SMOKE for use in CMAQ.

Inventory Pollutant	Model Species	Model species description
CO	CO	Carbon monoxide
NO_X	NO	Nitrogen oxide
	NO2	Nitrogen dioxide
	HONO	Nitrous acid
SO_2	SO2	Sulfur dioxide
	SULF	Sulfuric acid vapor
NH_3	NH3	Ammonia
VOC	ALD2	Acetaldehyde
	ALDX	Propionaldehyde and higher aldehydes
	BENZENE	Benzene (not part of CB05)
	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	SESQ	Sesquiterpenes
	TERP	Terpenes
PM_{10}	PMC	Coarse PM > 2.5 microns and ≤ 10 microns
$PM_{2.5}$	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

Table 3-8. Model Species produced by SMOKE for CB05 with SOA for CMAQ 4.7

It should be noted that the BENZENE model species is not part of CB05 in that the concentrations of BENZENE do not provide any feedback into the chemical reactions (i.e., it is not "inside" the chemical mechanism). Rather, benzene is used as a reactive tracer, and as such is impacted by the CB05 chemistry. BENZENE, along with several reactive CBO5 species (such as TOL and XYL) plays a role in SOA formation in CMAQ 4.7.

The approach for speciating $PM_{2.5}$ emissions is the same as that described for the 2005 and 2002 platforms except that two of the onroad sectors were not further speciated in SMOKE, along with Canadian pre-speciated PM emissions. The approach for speciating VOC emissions from non-biogenic sources has the following characteristics: 1) for some sources, HAP emissions are used in the speciation process to allow integration of VOC and HAP emissions in the NEI; and, 2) for some mobile sources, "combination" profiles are specified by county and month and emission mode (e.g., exhaust, evaporative). SMOKE computes the resultant profile on-the-fly given the fraction of each specific profile specified for the particular county, month and emission mode. The SMOKE feature called the GSPRO_COMBO file supports this approach.

The VOC speciation approach for the 2008 Platform includes HAP emissions from the NEI in the speciation process for some sectors. That is, instead of speciating VOC to generate all of the species listed in Table 3-8, emissions of the 4 HAPs, benzene, acetaldehyde, formaldehyde and methanol (BAFM) from the NEI were integrated with the NEI VOC. The integration process combines the BAFM HAPs with the VOC in a way that does not double-count emissions and uses the BAFM directly in the speciation process. Generally, the HAP emissions from the NEI are believed to be more representative of emissions of these compounds than their generation via VOC speciation.

The BAFM HAPs were chosen for this special treatment because, with the exception of BENZENE, they are the only explicit VOC HAPs in the base version of CMAQ 4.7 model. By "explicit VOC HAPs," we mean model species that participate in the modeled chemistry using the CB05 chemical mechanism. The use of these HAP emission estimates along with VOC is called "HAP-CAP integration". BENZENE was chosen because it was added as a model species in the base version of CMAQ 4.7, and there was a desire to keep its emissions consistent between multi-pollutant and base versions of CMAQ.

The integration of HAP VOC with VOC is a feature available in SMOKE for all inventory formats other than PTDAY (the format used for the ptfire sector). SMOKE allows the user to specify the particular HAPs to integrate and the particular sources to integrate. The HAPs to integrate are specified in the INVTABLE file, and the sources to integrate are based on the NHAPEXCLUDE file (which lists the sources that are excluded from integration[5]). For the "integrate" sources,

[5] In SMOKE version 2.6 the options to specify sources for integration are expanded so that a user can specify the particular sources to include or exclude from integration, and there are settings to include or exclude all sources within a sector.

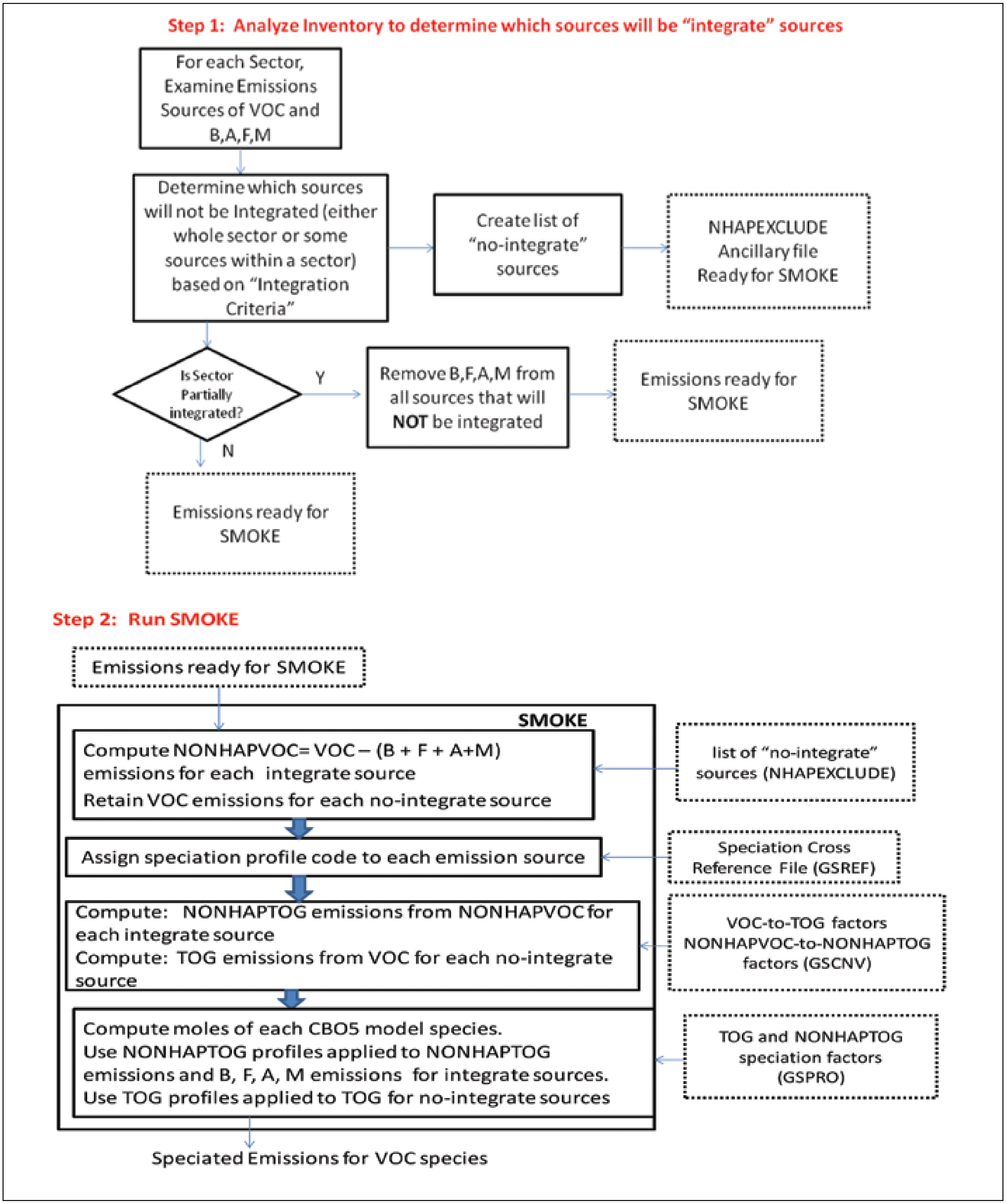


Figure 3-4. Process of integrating BAFM with VOC for use in VOC Speciation

PLATFORM SECTOR	Approach for Integrating NEI emissions of Benzene (B), Acetaldehyde (A), Formaldehyde (F) and Methanol (M)
ptipm	No integration because emissions of BAFM are relatively small for this sector
ptnonipm	No integration because emissions of BAFM are relatively small for this sector and it is not expected that criteria for integration would be met by a significant number of sources
ptfire	Full integration (However, NONHAPVOC computed outside of SMOKE since SMOKE cannot do this calculation for the day-specific fire formatted files)
ag	N/A—sector contains no VOC
afdust	N/A—sector contains no VOC
nonpt	Partial integration; details provided below table
nonroad	For other than California: Partial integration—did not integrate CNG or LPG sources (SCC beginning with 2268 or 2267) because NMIM computed only VOC and not any HAPs for these SCCs. For California: Full integration
alm_no_c3	Partial integration; details provided below table
seca_c3	Full integration
onroad	Full integration
biog	N/A—sector contains no inventory pollutant "VOC"; but rather specific VOC species
othpt	No integration—not the NEI
othar	No integration—not the NEI
othon	No integration—not the NEI

Table 3-9. Integration Status of 2008 Benzene, Acetaldehyde, Formaldehyde and Methanol (BAFM) Species in each Platform Sector

SMOKE subtracts the "integrate" HAPs from the VOC (at the source level) to compute emissions for the new pollutant "NONHAPVOC." The user provides NONHAPVOC-to-NONHAPTOG factors and NONHAPTOG speciation profiles. SMOKE computes NONHAPTOG and then applies the speciation profiles to allocate the NONHAPTOG to the other CMAQ VOC species not including the integrated HAPs.

CAP-HAP integration was considered for all sectors and "integration criteria" were developed for some of those. Table 3-9 summarizes the integration approach for each platform sector. For the nonpt sector, the following integration criteria were used to determine the sources to integrate:

1. Any source for which the sum of B, A, F, or M is greater than the VOC was not integrated, since this clearly identifies sources for which there is an inconsistency between VOC and VOC HAPs. This includes some cases in which VOC for a source is zero.
2. For some source categories (those that comprised 80% of the VOC emissions), sources were selected for integration in the category per specific criteria. For most of these source categories, sources are allowed to be integrated if they had the minimum combination of B, A, F, and M specified in the first column. For a few source categories, all sources were designated as "no-integrate".
3. For source categories that do not comprise the top 80% of VOC emissions, as long as the source has emissions of one of the B, F, A or M pollutants, then it can be integrated.
4. For the c1c2rail sector, the integration criteria were (1) that the source had to have at least one of the 4 HAPs and (2) that the sum of BAFM could not exceed the VOC emissions. The criteria for this sector were less complex than the nonpt sector because it has fewer source categories.

The SMOKE feature to compute speciation profiles from mixtures of other profiles in user-specified proportions was used in this project. The combinations are specified in the GSPRO_COMBO ancillary file by pollutant (including pollutant mode, e.g., EXH, VOC), state and county (i.e., state/county FIPS code) and time period (i.e., month).

This feature was used for onroad and nonroad mobile and gasoline-related related stationary sources. Since the ethanol content varies spatially (e.g., by state or sources use fuels with varying ethanol content, and therefore the speciation profiles require different combinations of gasoline and E10 county), temporally (e.g., by month) and by modeling year (i.e., future years have more thanol) the combo feature allows combinations to be specified at various levels for different years.

3.3.4 Temporal Processing Configuration

Table 3-10 summarizes the temporal aspect of the emissions processing configuration. It compares the key approaches used for temporal processing across the sectors. The temporal aspect of SMOKE processing is controlled through (a) the scripts T_TYPE (Temporal type) and M_TYPE (Merge type) settings and (b) ancillary data files. In addition to the resolution, temporal processing includes a ramp-up period for several days prior to January 1, 2008, intended to mitigate the effects of initial condition concentrations. The ramp up period for the national 12km grid was 10 days. For most sectors, the emissions from late December of 2008 were used to provide emissions for the end of December, 2007

3.3.6 Vertical Allocation of Emissions

Table 3-7 specifies the sectors for which plume rise is calculated. If there is no plume rise for a sector, the emissions are placed into layer 1 of the air quality model. Vertical plume rise was performed in-line within CMAQ for all of the SMOKE point-source sectors (ptipm, ptnonipm, ptfire, othpt, and c3marine). The in-line plume rise computed within CMAQ is nearly identical to the plume rise that would be calculated within SMOKE using the Laypoint program. See http://www.smoke-model.org/version2.7/SMOKE_v27_manual.pdf (Chapter 6) for full documentation of Laypoint. The selection of point sources for plume rise is pre-determined in SMOKE using the Elevpoint program (http://www.smoke-model.org/version2.7/SMOKE_v27_manual.pdf (Chapter 6). The calculation is done in conjunction with the CMAQ model time steps with interpolated meteorological data and is therefore more temporally resolved than when it is done in SMOKE. Also, the calculation of the location of the point source is slightly different than the one used in SMOKE and this can result in slightly different placement of point sources near grid cell boundaries.

For point sources, the stack parameters are used as inputs to the Briggs algorithm, but point fires do not have stack parameters. However, the ptfire inventory does contain data on the acres burned (acres per day) and fuel consumption (tons fuel per acre) for each day. CMAQ uses these additional parameters to estimate the plume rise of emissions into layers above the surface model layer. Specifically, these data are used to calculate heat flux, which is then used to estimate plume rise.

In addition to the acres burned and fuel consumption, heat content of the fuel is needed to compute heat flux. The heat content was assumed to be 8000 Btu/lb of fuel for all fires because specific data on the fuels were unavailable in the inventory. The plume rise algorithm applied to the fires is a modification of the Briggs algorithm with a stack height of zero.

CMAQ 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. The pressure difference across each layer divided by the pressure difference across the entire plume is used as a weighting factor to assign the emissions to layers. This approach gives plume fractions by layer and source.

3.3.7 Emissions Modeling Ancillary Files

In this section the ancillary data that SMOKE used to perform spatial allocation, chemical speciation, and temporal allocation for the 2008 Platform is summarized. The ancillary data files, particularly the cross-reference files, provide the specific inventory resolution at which spatial, speciation, and temporal factors are applied. For the 2008 Platform, spatial factors were generally applied by country/SCC, speciation factors by pollutant/SCC or (for combination profiles) state/county FIPS code and month, and temporal factors by some combination of country, state, county, SCC, and pollutant.

3.3.7.1 Spatial Allocation Ancillary Files

Spatial allocation was performed for a national 12-km domain. To do this, SMOKE used national 12-km spatial surrogates and a SMOKE area-to-point data file. For the U.S. and Mexico, the same spatial surrogates were used as were used for the 2005 Platform.

3.3.7.2 Surrogates for U.S. Emissions

More than sixty spatial surrogates were used to spatially allocate U.S. county-level emissions to the CMAQ 12-km grid cells. The surrogates are the same as those used for the 2005 Platform. The Surrogate Tool was used to generate all of the surrogates. The shapefiles 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 detailed steps in developing the county boundaries for the surrogates are documented at ftp://ftp.epa.gov/EmisInventory/emiss_shp2006/us/metadata_for_2002_county_boundary_shapefiles_rev.pdf. Table 3-11 lists the codes and descriptions of the surrogates. An area-to-point approach overrides the use of surrogates for some airport-related sources. The onroad off-network (parking area) emissions from the MOVES model were spatially allocated as shown in Table 3-12.

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

There are numerous airport-related emission sources in the 2005 NEI, such as aircraft, airport ground support equipment, and jet refueling. In the 2002 platform most of these emissions were contained in sectors with county-level resolution — alm (aircraft), nonroad (airport ground support) and nonpt (jet refueling), but in the 2005 and 2008 platforms aircraft emissions are included as point sources as part of the ptnonipm sector.

For the 2008 platform, the SMOKE "area-to-point" approach was used for airport ground support equipment (nonroad sector), and jet refueling (nonpt sector). The approach is described in detail in the 2002 Platform documentation: http://www.epa.gov/ttn/scram/reportsindex.htm. Nearly the same ARTOPNT file was used to implement the area-to-point approach as was done for the CAP and HAP-2002-based Platform. This was slightly updated from the CAP-only

2002 Platform by further allocating the Detroit-area airports into multiple sets of geographic coordinates to support finer scale modeling that was done under a different project. The updated file was retained for the 2008 Platform.

3.3.7.4 Surrogates for Canada and Mexico Emission Inventories

The Mexican emissions and single surrogate (population) were the same as those used in the 2002 and 2005 Platforms. For Canada, surrogates provided by Environment Canada with the 2006 emissions were used to spatially allocate the 2006 Canadian emissions for the 2005 and 2008 Platforms.

Platform Surrogate-13. Canadian Spatial Surrogates for 2005-based platform Canadian Emission

3.3.7.5 Chemical Speciation Ancillary Files

Several files are used by SMOKE to convert the inventory species to the CMAQ model species. The SMOKE environmental variable names used to specify the files containing the speciation –related information are shown below using capital letters in parentheses:

- Inventory table (INVTABLE) to control the pollutants processed and their key parameters,
- NONHAPVOC emissions calculation exclusions file (NHAPEXCLUDE),
- speciation VOC-to-TOG conversion factors (GSCNV),
- speciation cross references (GSREF) that map SCCs to speciation profiles,
- speciation profiles (GSPRO) that split the inventory pollutants into CMAQ species, and
- combined, monthly speciation profiles (GSPRO_COMBO).

For VOC speciation, SMOKE-ready profiles for the CB05 chemical mechanism were generated using the Speciation Tool (Eyth, 2006), including:

- TOG-to-model species profiles (used only for no-integrate sources)
- NONHAPTOG-to-model species profiles (used only for the integrate sources), and
- TOG-to-BENZENE (used only for no-integrate sources).

Speciation profile entries were added to the Speciation Tool to convert benzene, acetaldehyde, formaldehyde and methanol to the model species BENZENE, ALD2, FORM and METHANOL, respectively. These profiles were used only for the integrate sources. Note that the ‘integrate’ and ‘no-integrate’ sources were processed using the same GSREF and GSPRO files.

In addition to the speciation profiles, the Speciation Tool generates the SMOKE-ready speciation conversion files (GSCNV). Two of these were generated: one containing profile-specific VOC-to-TOG conversion factors and the other containing profile-specific NONHAPVOC-to-NONHAPTOG conversion factors.

The TOG and $PM_{2.5}$ speciation factors that are the basis of the chemical speciation approach were developed from the SPECIATE4.3 database (http://www.epa.gov/ttn/chief/software/speciate/), EPA’s repository of TOG and PM speciation profiles of air pollution sources. SPECIATE 4.2 development was a collaboration involving EPA’s ORD and EPA’s Office of Air Quality Planning and Standards (OAQPS) at Research Triangle Park, NC, and Environment Canada (EPA, 2006c).

The SPECIATE database contains speciation profiles for TOG, speciated into individual chemical compounds, VOC-to-TOG conversion factors associated with the TOG profiles and speciation profiles for $PM_{2.5}$. 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:

- PSO_4 : primary particulate sulfate
- PNO_3: primary particulate nitrate
- PEC: primary particulate elemental carbon
- POC: primary particulate organic carbon
- PMFINE: other primary particulate, less than 2.5 micrograms in diameter

An issue with SPECIATE 4.3 was that profile 92095 was inadvertently left out of the database. It was obtained from EPA ORD staff and was used for the nonpoint SCC 2101002000. For the other SCCs pertaining to bituminous coal combustion the sub-bituminous coal combustion profile (92084) was used. Table 3-14 shows that the

Resulting differences represent only a minor change to the SMOKE results. Minor changes were made in the PM profiles in comparison to the 2005 Platform.

These include:

- c3marine changed from profile Marine Vessel – Main Engine – Heavy Fuel Oil – Simplified (92200) to Marine Vessel – Main Engine – Heavy Fuel Oil (5674 in SPECIATE4.3)
- changed Draft Tire Burning – Simplified (92086) to Draft Solid Waste Combustion – Simplified (92082)

Key changes to the TOG profiles since the 2002 Platform are as follows:

- Updated the profile for aircraft from 1098 (Aircraft Landing/Takeoff (LTO)—Commercial) which is from SPECIATE3.2 and has a profile date of 1989, to 5565B (Aircraft Exhaust) from SPECIATE4.3.
- Updated the profile for forest fires from 0307 (Miscellaneous Burning - Forest Fires) which was from SPECIATE3.2 and has a profile date of 1989) to 5560 (Biomass Burning - Extratropical Forest, dated 2/2008 and was based on testing conducted in 2001)
- Changed the assignment of residential wood combustion (including woodstove and fireplace emissions) and other profiles that formerly used 4641

US EPA ARCHIVE DOCUMENT

pollutant	species	split factors sub-bituminous 92084	split factors bituminous 92095
PM2_5	PEC	0.0188	0.01696
PM2_5	PMFINE	0.8266	0.827928
PM2_5	PNO_3	0.0016	0.00208
PM2_5	POC	0.0263	0.026307
PM2_5	PSO_4	0.1267	0.126725

Table 3-14. Differences between two profiles used for coal combustion

(Fireplace wood combustion-oak wood) to 4642 (Fireplace wood combustion-pine wood) because of all three woods tested in the study (oak, pine and eucalyptus), the most complete testing was done for the pine wood (for example, benzene was only measured for pine)

- Updated the profiles for mobile onroad and nonroad sources to use more up-to-date test data. The updated profiles are:
  - 8750: Gasoline Exhaust—Reformulated gasoline
  - 8751: Gasoline Exhaust—E10 ethanol gasoline
  - 8753: Gasoline Vehicle - Evaporative emission - Reformulated gasoline
  - 8754: Gasoline Vehicle - Evaporative emission - E10 ethanol gasoline
- Utilized combination profiles comprised of the above updated exhaust and evaporative profiles to match the average ethanol content of fuels used by different counties and for different months of the year. Combinations were created based on the fuel properties data in the NMIM county database.

Speciation profiles for use with BEIS are not included in SPECIATE. The 2008 Platform uses BEIS3.14 and includes a species (SESQ) that was not in BEIS3.13 (the version used for the 2002 Platform). This species was mapped to the CMAQ species SESQT. The profile code associated with BEIS3.14 profiles for use with CB05 was “B10C5.”

The INVTABLE and NHAPEXCLUDE SMOKE input files have a critical function in the VOC speciation process for emissions modeling cases utilizing HAP-CAP integration, as is done for the 2008 Platform.

Two different INVTABLE files were prepared to use with different sectors of the platform. For sectors in which we chose no integration for the entire sector, a “no HAP use”, an INVTABLE that set the “KEEP” flag to “N” for BAFM was created. Thus, any BAFM in the inventory input into SMOKE would be dropped. This approach both avoids double-counting of these species and assumes that the VOC speciation is the best available approach for these species for the sectors using the approach. The second INVTABLE, used for sectors in which one or more sources are integrated, causes SMOKE to keep the BAFM pollutants and indicates that they are to be integrated with VOC (by setting the “VOC or TOG component” field to “V” for all four HAP pollutants.

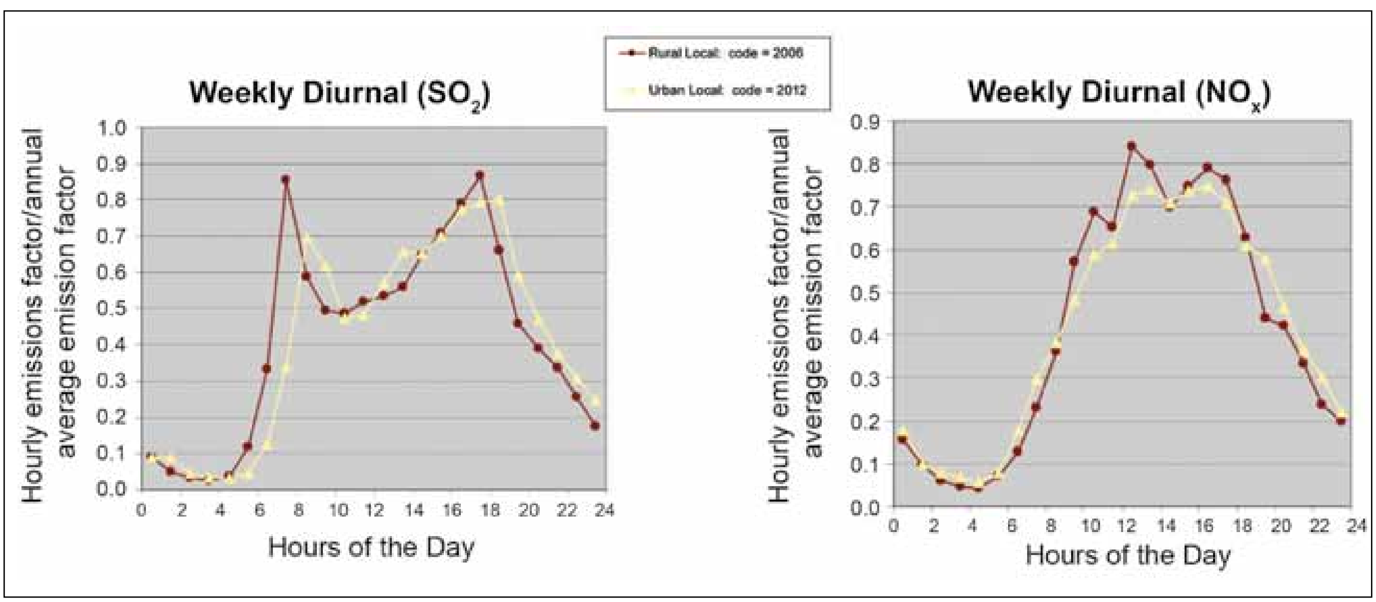


Figure 3-5. Diurnal Profiles for Parking Areas (Pollutants: SO_2 and NO_x)

Sector-specific NHAPEXCLUDE files were developed that provide the specific sources that are excluded from integration.

3.3.7.6 Temporal Allocation Ancillary Files

The emissions modeling step for temporal allocation creates the hourly emission inputs for CMAQ by adjusting the emissions from the inventory resolution (annual, monthly, daily or hourly) 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 3-1 and is repeated in the discussion of temporal settings.

The starting point for the temporal profiles was the 2005 Platform. The monthly, weekly, and diurnal temporal profiles and associated cross references used to create the 2008 hourly emissions inputs for CMAQ were generally based on the temporal allocation data used for the 2005 Platform. New profile assignments were added for SCCs in the 2008 inventory that were not in the 2005 inventory. Also, the profiles used for ptipm sources without CEM data were updated to represent the year 2008. Specific temporal profiles were assigned for the parking area SCCs provided by MOVES. The remainder of this section discusses the development of the new temporal profiles or profile assignments used in the 2008 Platform.

The state- and pollutant-specific diurnal profiles used to allocate the day-specific emissions for non-CEM sources in the ptipm sector were updated. The 2008 CEM data was used to create state-specific, day-to-hour factors averaged over the whole year and all units in each state. Diurnal factors were calculated using CEM SO_2 and NO_x emissions and heat input. SO_2 and NO_x-specific factors were computed from the CEM for these pollutants as shown in Figure 3-5. All other pollutants used factors created from the hourly heat input data. The resulting profiles were assigned by state and pollutant.

The temporal profile assignments for the Canadian 2006 inventory were provided by Environment Canada along with the inventory. They provided profile assignments that rely on the existing set of temporal profiles in the 2002 Platform. For point sources, they provided profile assignments by PLANTID.

4.0 CMAQ Air Quality Model Estimates

4.1 Introduction to the CMAQ Modeling Platform

The Clean Air Act (CAA) provides a mandate to assess and manage air pollution levels to protect human health and the environment. EPA has established National Ambient Air Quality Standards (NAAQS), requiring the development of effective emissions control strategies for such pollutants as ozone and particulate matter. Air quality models are used to develop these emission control strategies to achieve the objectives of the CAA.

Historically, air quality models have addressed individual pollutant issues separately. However, many of the same precursor chemicals are involved in both ozone and aerosol (particulate matter) chemistry; therefore, the chemical transformation pathways are dependent. Thus, modeled abatement strategies of pollutant precursors, such as volatile organic compounds (VOC) and NOx to reduce ozone levels, may exacerbate other air pollutants such as particulate matter.

To meet the need to address the complex relationships between pollutants, EPA developed the Community Multiscale Air Quality (CMAQ) modeling system. The primary goals for CMAQ are to:

- Improve the environmental management community's ability to evaluate the impact of air quality management practices for multiple pollutants at multiple scales.
- Improve the scientist's ability to better probe, understand, and simulate chemical and physical interactions in the atmosphere.

The CMAQ modeling system brings together key physical and chemical functions associated with the dispersion and transformations of air pollution at various scales. It was designed to approach air quality as a whole by including state-of-the-science capabilities for modeling multiple air quality issues, including tropospheric ozone, fine particles, toxics, acid deposition, and visibility degradation. CMAQ relies on emission estimates from various sources, including the U.S. EPA Office of Air Quality Planning and Standards' current emission inventories, observed emission from major utility stacks, and model estimates of natural emissions from biogenic and agricultural sources. CMAQ also relies on meteorological predictions that include assimilation of meteorological observations as constraints. Emissions and meteorology data are fed into CMAQ and run through various algorithms that simulate the physical and chemical processes in the atmosphere to provide estimated concentrations of the pollutants. Traditionally, the model has been used to predict air quality across a regional or national domain and then to simulate the effects of various changes in emission levels for policymaking purposes. For health studies, the model can also be used to provide supplemental information about air quality in areas where no monitors exist.

CMAQ was also designed to have multi-scale capabilities so that separate models were not needed for urban and regional scale air quality modeling. The grid spatial resolutions in past annual CMAQ runs have been 36 km x 36 km per grid for the "parent" domain, and nested within that domain are 12 km x 12 km grid resolution domains. The parent domain typically covered the continental United States, and the nested 12 km x 12 km domain covered the Eastern or Western United States. The CMAQ simulation performed for this 2008 assessment used a single domain that covers the entire continental U.S. (CONUS) and large portions of Canada and Mexico using 12 km by 12 km horizontal grid spacing. For urban applications, CMAQ has also been applied with a 4-km x 4-km grid resolution for urban core areas; however, the uncertainties in emissions and meteorology information can actually increase at this high of a resolution. Currently, 12 km x 12 km resolution is recommended for most applications as the highest resolution. With the temporal flexibility of the model, simulations can be performed to evaluate longer term (annual to multi-year) pollutant climatologies as well as short-term (weeks to months) transport from localized sources. By making CMAQ a modeling system that addresses multiple pollutants and different temporal and spatial scales, CMAQ has a "one atmosphere" perspective that combines the efforts of the scientific community. Improvements will be made to the CMAQ modeling system as the scientific community further develops the state-of-the-science.

For more information on CMAQ, go to http://www.epa.gov/asmdnerl/CMAQ or http://www.cmascenter.org.

4.1.1 Advantages and Limitations of the CMAQ Air Quality Model

An advantage of using the CMAQ model output for comparing with health outcomes is that it has the potential to provide complete spatial and temporal coverage. Additionally, meteorological predictions, which are also needed when comparing health outcomes, are available for every grid cell along with the air quality predictions.

A disadvantage of using CMAQ is that, as a deterministic model, it has none of the statistical qualities of interpolation techniques that fit the observed data to one degree or another. Furthermore, the emissions and meteorological data used in CMAQ each have large uncertainties, in particular for unusual emission or meteorological events. There are also uncertainties associated with the chemical transformation and fate process algorithms used in air quality models.

Figure 4-1. Map of the CMAQ Modeling Domain. The blue box denotes the 12 km national modeling domain (Same as Figure 3-3.)

Thus, emissions and meteorological data plus modeling uncertainties cause CMAQ to predict best on longer time scale bases (e.g., synoptic, monthly, and annual scales) and be most error prone at high time and space resolutions compared to direct measures.

One practical disadvantage of using CMAQ output is that the regularly spaced grid cells do not line up directly with counties or ZIP codes which are the geographical units over which health outcomes are likely to be aggregated. But it is possible to overlay grid cells with county or ZIP code boundaries and devise means of assigning an exposure level that nonetheless provides more complete coverage than that available from ambient data alone. Another practical disadvantage is that CMAQ requires significant data and computing resources to obtain results for daily environmental health surveillance.

This section describes the air quality modeling platform used for the 2008 CMAQ simulation. A modeling platform is a structured system of connected modeling-related tools and data that provide a consistent and transparent basis for assessing the air quality response to changes in emissions and/or meteorology. A platform typically consists of a specific air quality model, emissions estimates, a set of meteorological inputs, and estimates of "boundary conditions" representing pollutant transport from source areas outside the region modeled. We used the CMAQ[6] model as part of the 2008 Platform to provide a national scale air quality modeling analysis. The CMAQ model simulates the multiple physical and chemical processes involved in the formation, transport, and destruction of ozone and fine particulate matter ($PM_{2.5}$).

This section provides a description of each of the main components of the 2008 CMAQ simulation along with the results of a model performance evaluation in which the 2008 model predictions are compared to corresponding measured concentrations.

[6] Byun, D.W., and K. L. Schere, 2006: Review of the Governing Equations, Computational Algorithms, and Other Components of the Models-3 Community Multiscale Air Quality (CMAQ) Modeling System. Applied Mechanics Reviews, Volume 59, Number 2 (March 2006), pp. 51-77.

4.2 CMAQ Model Version, Inputs and Configuration

4.2.1 Model Version

CMAQ is a non-proprietary computer model that simulates the formation and fate of photochemical oxidants, including $PM_{2.5}$ and ozone, for given input sets of meteorological conditions and emissions. The CMAQ model version 4.7 was most recently peer-reviewed in February of 2009 for the U.S. EPA.[7] As mentioned previously, CMAQ includes numerous science modules that simulate the emission, production, decay, deposition and transport of organic and inorganic gas-phase and particle-phase pollutants in the atmosphere. This analysis employed a version of CMAQ based on the latest publicly released version of CMAQ (i.e., version 4.7.1[8]) at the time of the 2008 air quality modeling. CMAQ version 4.7.1 reflects updates to version 4.7 to improve the underlying science which include aqueous chemistry mass conservation improvements and improved vertical convective mixing. The model enhancements in version 4.7.1 also include:

1. Aqueous chemistry
   - Mass conservation improvements
     + Imposed 1 second minimum timestep for remainder of the cloud lifetime after 100 "iterations" in the solver
     + Force mass balance for the last timestep in the cloud by limiting oxidized amount to mass available
   - Implemented steady state assumption for OH
   - Only allow sulfur oxidation to control the aqueous chemistry solver timestep (previously, reactions of OH, GLY, MGLY, and Hg for multipollutant model also controlled the timestep)
2. Advection
   - Added additional divergence-based constraint on advection timestep
   - Vertical advection in the Yamo module is now represented with the PPM scheme to limit numerical diffusion
3. Model time step determination
   - Fixed a potential advection time step error
     + The sum of the advection steps for a given layer time step might not equal the output time step duration in some extreme cases
     + Ensured that the advection steps sum up to the synchronization step

National 12 km CMAQ Modeling Configuration	
Map Projection	Lambert Conformal Projection
Grid Resolution	12 km
Coordinate Center	97 W, 40 N
True Latitudes	33 and 45 N
Dimensions	459 x 299 x 24
Vertical extent	24 Layers: Surface to 50 mb level (see Table 4-2)

Table 4-1. Geographic Information for 12 km Modeling Domain

4. Horizontal diffusion
   - Fixed a potential error
     + Concentration data may not be correctly initialized if multiple sub-cycle time steps are required
     + Fix to initialize concentrations with values calculated in the previous sub-time step
5. Emissions
   - Bug fix in EMIS_DEFN.F to include point source layer 1 NH3 emissions
   - Bug fix to calculate soil NO "pulse" emissions in BEIS
   - Remove excessive logging of cases where ambient air temperature exceeds 315.0 Kelvin. When this occurs, the values are just slightly over 315
   - Bug fix for parallel decomposition errors in plume rise emissions
6. Photolysis
   - JPROC/phot_table and phot_sat options
     + Expanded lookup tables to facilitate applications across the globe and vertical extent to 20km
     + Updated temperature adjustments for absorption cross sections and quantum yields
     + Revised algorithm that processes TOMS datasets for OMI data format
   - In-line option
     + Asymmetry factor calculation updated using values from Mie theory integrated over log normal particle distribution; added special treatment for large particles in asymmetry factor algorithm to avoid numerical instabilities.

4.2.2 Model Domain and Grid Resolution

The CMAQ modeling analyses were performed for a domain covering the continental United States, as shown in Figure 4-1. This single domain covers the entire continental U.S. (CONUS) and large portions of Canada and Mexico using12 km by 12 km horizontal grid spacing. The model extends

[7] Allen, D., Burns, D., Chock, D., Kumar, N., Lamb, B., Moran, M. (February 2009 Draft Version). Report on the Peer Review of the Atmospheric Modeling and Analysis Division, NERL/ORD/EPA. U.S. EPA, Research Triangle Park, NC. CMAQ version 4.7 was released on December, 2008. It is available from the Community Modeling and Analysis System (CMAS) as well as previous peer-review reports at: http://www.cmascenter.org.

[8] CMAQ version 4.7.1 model code is available from the Community Modeling and Analysis System (CMAS) at: http://www.cmascenter.org.

vertically from the surface to 50 millibars (approximately 19 km) using a sigma-pressure coordinate system. Air quality conditions at the outer boundary of the 12 km domain were taken from a global model. Table 4-1 provides some basic geographic information regarding the 12 km CMAQ domain.

4.2.3 Modeling Period / Ozone Episodes

The 12 km CMAQ modeling domain was modeled for the entire year of 2008. The 2008 annual simulation was performed in two half-year segments (i.e., January through June, and July through December) for each emissions scenario. With this approach to segmenting an annual simulation we were able to reduce the overall throughput time for an annual simulation. The annual simulation included a "ramp-up" period, comprised of 10 days before the beginning of each half-year segment, to mitigate the effects of initial concentrations. All 365 model days were grid cells. The WRF simulation utilized 34 vertical layers with a surface layer of approximately 38 meters. Table 4-2 shows the vertical layer structure used in WRF and the layer collapsing approach to generate the CMAQ meteorological inputs. CMAQ resolved the vertical atmosphere with 24 layers, preserving greater resolution in the PBL.

In terms of the 2008 WRF meteorological model performance evaluation, an approach which included a combination of qualitative and quantitative analyses was used to assess the adequacy of the WRF simulated fields.[9] The qualitative used in the annual average levels of PM. For the 8-hour aspects involved comparisons of the model-estimated ozone, we used modeling results from the period between May 1 and September 30. This 153-day period generally conforms to the ozone season across most parts of the U.S. and contains the majority of days that observed high ozone concentrations.

4.2.4 Model Inputs: Emissions, Meteorology and Boundary Conditions

2008 Emissions: The emissions inventories used in the 2008 air quality modeling are described in Section 3, above. Meteorological Input Data: The gridded meteorological data for the entire year of 2008 at the 12 km continental United States scale domain was derived from version 3.1 of the Weather Research and Forecasting Model (WRF), Advanced Research WRF (ARW) core.[10] Previous CMAQ annual simulations have typically utilized meteorology provided by the 5th Generation Mesoscale Model (MM5).[11] The WRF Model is a next-generation mesoscale numerical weather prediction system developed for both operational forecasting and atmospheric research applications (http://wrf-model.org). The 2008 WRF simulation included the physics options of the Pleim-Xiu land surface model (LSM), Asymmetric Convective Model version 2 planetary boundary layer (PBL) scheme, Morrison double moment microphysics, Kain-Fritsch cumulus parameterization scheme and the RRTMG long-wave radiation (LWR) scheme.[12]

The WRF meteorological outputs were processed to create model-ready inputs for CMAQ using the Meteorology-Chemistry Interface Processor (MCIP) package[13], version 3.6, to derive the specific inputs to CMAQ: horizontal wind synoptic patterns against observed patterns from historical weather chart archives. Additionally, the evaluations compared spatial patterns of monthly average rainfall and monthly maximum planetary boundary layer (PBL) heights. The statistical portion of the evaluation examined the model bias and error for temperature, water vapor mixing ratio, solar radiation, and wind fields. These statistical values were calculated on a monthly basis.

Initial and Boundary Conditions: The lateral boundary and initial species concentrations are provided by a three- dimensional global atmospheric chemistry model, the GEOS-CHEM[14] model version 8-02-03. The global GEOS-CHEM model simulates atmospheric chemical and physical processes driven by assimilated meteorological observations from the NASA's Goddard Earth Observing System (GEOS). This model was run for 2008 with a grid resolution of 2.0 degrees x 2.5 degrees (latitude-longitude) and 47 vertical layers. The predictions were used to provide one-way dynamic boundary conditions at three-hour intervals and an initial concentration field for the CMAQ simulations. A GEOES-Chem evaluation was conducted for the purpose of validating the 2008 GEOS-Chem simulation for selected measurements relevant to their use as boundary conditions for CMAQ and reproducing GEOS-Chem evaluation plots reported in the literature for previous versions of the model.[15] More information is available about the GEOS-CHEM model and other applications using this tool at: http://acmg.seas.harvard.edu/presentations/powerpoints/geos_chem_mtg/yantosca.ppt.

4.3 CMAQ Model Performance Evaluation

An operational model performance evaluation for ozone and components (i.e., speed and direction), temperature, moisture, and its related speciated components was conducted for vertical diffusion rates, and rainfall rates for each grid cell in each vertical layer. The WRF simulation used the same CMAQ map projection, a Lambert Conformal projection centered at (-97, 40) with true latitudes at 33 and 45 degrees north. The 12 km WRF domain consisted of 459 by 299 the 2008 simulation using state/local monitoring sites data in

[9] U.S. Environmental Protection Agency, 2011. Meteorological Model Performance for Annual 2007 Simulations, Office of Air Quality Planning and Standards, Research Triangle Park, NC., 27711, EPA-454/R-11-007.

[10] Skamarock, W.C., Klemp, J.B., Dudhia, J., Gill, D.O., Barker, D.M., Duda, M.G., Huang, X., Wang, W., Powers, J.G., 2008. A Description of the Advanced Research WRF Version 3.

[11] Grell, G. A., Dudhia, A. J., and Stauffer, D. R., 1994. A description of the Fifth-Generation PennState/NCAR Mesoscale Model (MM5). NCAR Technical Note NCAR/TN-398+STR. Available at http://www.mmm.ucar.edu/mm5/doc1.html.

[12] Gilliam, R.C., Pleim, J.E., 2010. Performance Assessment of New Land Surface and Planetary Boundary Layer Physics in the WRF-ARW. Journal of Applied Meteorology and Climatology 49, 760-774.

[13] Otte T.L., Pleim, J.E., 2010. The Meteorology-Chemistry Interface Processor (MCIP) for the CMAQ modeling system: updates through v3.4.1. Geoscientific Model Development 3, 243-256.

[14] Yantosca, B., 2004. GEOS-CHEMv7-01-02 User's Guide, Atmospheric Chemistry Modeling Group, Harvard University, Cambridge, MA, October 15, 2004.

[15] Lam, Y-F., Fu, J.S., Jacob, D.J., Jang, C., Dolwick, P., 2010. 2006-2008 GEOS-Chem for CMAQ Initial and Boundary Conditions. 9th Annual CMAS Conference, October 11-13, 2010, Chapel Hill, NC.

Height (m)	Pressure (mb)	WRF	Depth (m)	CMAQ	Depth (m)
17,145	50	34	2,655	24	4,552
14,490	95	33	1,896		
12,593	140	32	1,499	23	2,749
11,094	185	31	1,250		
9,844	230	30	1,078	22	2,029
8,766	275	29	951		
7,815	320	28	853	21	1,627
6,962	365	27	775		
6,188	410	26	711	20	1,368
5,477	455	25	657		
4,820	500	24	612	19	1,185
4,208	545	23	573		
3,635	590	22	539	18	539
3,095	635	21	509	17	509
2,586	680	20	388	16	388
2,198	716	19	281	15	281
1,917	743	18	273	14	273
1,644	770	17	178	13	178
1,466	788	16	174	12	174
1,292	806	15	171	11	171
1,121	824	14	168	10	168
952	842	13	165	9	165
787	860	12	82	8	163
705	869	11	81		
624	878	10	80	7	160
544	887	9	80		
465	896	8	79	6	157
386	905	7	78		
307	914	6	78	5	78
230	923	5	77	4	77
153	932	4	38	3	76
114	937	3	38		
76	941	2	38	2	38
38	946	1	38	1	38

Table 4-2. Vertical layer structure for 2008 WRF and CMAQ simulations (heights are layer top).

order to estimate the ability of the CMAQ modeling system to replicate the 2008 base year concentrations for the 12 km continental U.S. domain.

There are various statistical metrics available and used by the science community for model performance evaluation. For a robust evaluation, the principal evaluation statistics used to evaluate CMAQ performance were two bias metrics, normalized mean bias and fractional bias; and two error metrics, normalized mean error and fractional error. Normalized mean bias (NMB) is used as a normalization to facilitate a range of concentration magnitudes. This statistic averages the difference (model - observed) over the sum of observed values. NMB is a useful model performance indicator because it avoids overinflating the observed range of values, especially at low concentrations. Normalized mean bias is defined as:

$$\text{NMB} = \frac{\sum_{1}^{n}(P-O)}{\sum_{1}^{n}(O)} * 100$$

where P = predicted concentrations and O = observed

Normalized mean error (NME), which is also similar to NMB, where the performance statistic is used as a normalization of the mean error. NME calculates the absolute value of the difference (model - observed) over the sum of observed values. Normalized mean error is defined as:

$$\text{NME} = \frac{\sum_{1}^{n}|P-O|}{\sum_{1}^{n}(O)} * 100$$

where P = predicted concentrations and O = observed

Fractional Bias (FB) is defined as:

$$\text{FB} = \frac{1}{n}\left(\frac{\sum_{1}^{n}(P-O)}{\sum_{1}^{n}\left(\frac{(P+O)}{2}\right)}\right) * 100$$

where P = predicted concentrations and O = observed

FB is a useful model performance indicator because it has the advantage of equally weighting positive and negative bias estimates. The single largest disadvantage in this estimate of model performance is that the estimated concentration (i.e., prediction, P) is found in both the numerator and denominator.

Fractional error (FE) is similar to fractional bias except the absolute value of the difference is used so that the error is always positive. Fractional error is defined as:

$$\text{FE} = \frac{1}{n}\left(\frac{\sum_{1}^{n}|P-O|}{\sum_{1}^{n}\left(\frac{(P+O)}{2}\right)}\right) * 100$$

where P = predicted concentrations and O = observed

In addition to the performance statistics, regional maps which show the normalized mean bias and error were prepared for the ozone season, May through September, at individual monitoring sites as well as on an annual basis for $PM_{2.5}$ and its component species.

Evaluation for 8-hour Daily Maximum Ozone: The operational model performance evaluation for hourly and eight-hour daily maximum ozone was conducted using the statistics defined above. Ozone measurements from 1176 sites for 2008 in the continental U.S. were included in the evaluation and were taken from the 2008 State/local monitoring site data in the Air Quality System (AQS) Aerometric Information Retrieval System (AIRS). The performance statistics were calculated using predicted and observed data that were paired in time and space on an hourly and/or 8-hour basis. Statistics were generated for the

Subregion	Season	No. of Obs	NMB (%)	NME (%)	FB (%)	FE (%)
Northeast	Winter	5,132	-10.4	19.6	-10.2	23.4
	Spring	12,060	-2.5	11.2	-2.5	12
	Summer	15,448	8.8	15.6	9.2	15.6
	Fall	10,890	15.9	22	16.2	22.1
Midwest	Winter	2,706	-7.4	22.8	-6.4	24.6
	Spring	11,659	-0.3	11.9	0.3	12.6
	Summer	16,244	6.7	14.3	6.7	14.3
	Fall	9,274	12.1	20.3	14.4	21.6
Central States	Winter	11,289	-0.4	16	0.5	19
	Spring	15,166	1.6	13.2	2.6	14.2
	Summer	16,641	19.5	25.3	20	25.3
	Fall	14,005	6.4	18.1	8	19.5
Southeast	Winter	6,277	1.5	14	2.2	15.1
	Spring	17,358	1.5	11.2	2.8	11.9
	Summer	19,419	15.7	21	17.9	22.2
	Fall	15,080	17.2	21.5	18.3	21.9
West	Winter	23,457	6.1	19.8	8.6	22.1
	Spring	27,252	-3	12.2	-2.5	12.8
	Summer	30,182	8.2	19	8.1	18.7
	Fall	27,203	11	20.4	11.7	21.2

Table 4-3. Summary of CMAQ 2008 8-Hour Daily Maximum Ozone Model Performance Statistics by Subregion and by Season.

following geographic groupings: domain wide and four large sub-regions[16]: Midwest, Northeast, Southeast, Central, and Western U.S.

The 8-hour ozone model performance bias and error statistics for each subregion and each season are provided in Table 4-4. Seasons were defined as: winter (December-January-February), spring (March-April-May), summer (June, July, August), and fall (September-October-November). Spatial plots of the normalized mean bias and error for individual monitors are shown in Figures 4-2 through 4-3. The statistics shown in these two figures were calculated over the ozone season using data pairs on days with observed 8-hour ozone of > 60 ppb.

In general, the model performance statistics indicate that the 8-hour daily maximum ozone concentrations predicted by the 2008 CMAQ simulation closely reflect the corresponding 8-hour observed ozone concentrations in space and time in each subregion of the 12 km modeling domain. As indicated by the statistics in Table 4-4, bias and error for 8-hour daily maximum ozone are relatively low in each subregion, not only in the summer when concentrations are highest, but also during other times of the year. Specifically, 8-hour ozone in the summer is slightly over predicted with the greatest over prediction in the Central States (NMB is 19.6 percent). In the spring, ozone is slightly under predicted in all the subregions except in the Central states where NMB is near negligible (NMB is 0.2 percent). In the winter, when concentrations are generally low, the model under predicts 8-hour ozone with the exception of the West (NMB is 3.0). In the fall, when concentrations are also relatively low, ozone is slightly over predicted; with NMBs less than 12 percent in each subregion.

Model bias at individual sites during the ozone season is similar to that seen on a subregional basis for the summer. The information in Figure 4-2 indicates that the bias for days with observed 8-hour daily maximum ozone greater than 60 ppb is within ± 20 percent at the vast majority of monitoring sites across the U.S. domain. The exceptions are sites in and/ or near Minneapolis, Duluth, District of Columbia, New York City, New Orleans, and San Antonio, as well as a few areas along the California coast. At these sites observed concentrations greater than 60 ppb are generally predicted in the range of ±20 to 40 percent. Looking at the map of bias, Figure 4-2 indicates that the low bias at these sites is not evident at other sites in these same areas. This suggests that the under prediction at these sites is likely due to very local features (e.g., meteorology and/or emissions) and not indicative of a systematic problem in the modeling platform. Model error, as seen from Figure 4-3, is 14 percent or less at most of the sites across the U.S. modeling domain. Somewhat greater error is evident at sites in several areas most notably along portions of the Northeast Corridor and in portions of Michigan, Minnesota, Louisiana, Texas, and the western most part of the modeling domain, (e.g., New Mexico, California, and Washington).

$PM_{2.5}$: The $PM_{2.5}$ evaluation focuses on $PM_{2.5}$ total mass and its components, including sulfate (SO_4), nitrate (NO_3), total nitrate ($TNO_3 = NO_3 + HNO_3$), ammonium (NH_4), elemental carbon (EC), and organic carbon (OC). The $PM_{2.5}$ bias and error performance statistics were calculated on an ttannual basis for each subregion (Table 4-5). $PM_{2.5}$ ambient measurements for 2008 were obtained from the following networks for model evaluation: Chemical Speciation Network (CSN—total of 211 sites, 24 hour average), Interagency Monitoring of PROtected Visual Environments (IMPROVE—total of 163 sites, 24 hour average), and Clean Air Status and Trends Network (CASTNet—total of 86, weekly average). For $PM_{2.5}$ species that are measured by more than one network, we calculated separate sets of statistics for each network by subregion. For brevity, Table 4-5 provides annual model performance statistics for PM and its component species for the 12 km continental U.S. domain and the five sub-regions defined above (Northeast, Midwest, Southeast, Central, and West). In addition to the tabular

[16] The subregions are defined by States where: Midwest is IL, IN, MI, OH, and WI; Northeast is CT, DE, MA, MD, ME, NH, NJ, NY, PA, RI, and VT; Southeast is AL, FL, GA, KY, MS, NC, SC, TN, VA, and WV; Central is AR, IA, KS, LA, MN, MO, NE, OK, and TX; West is AK, CA, OR, WA, AZ, NM, CO, UT, WY, SD, ND, MT, ID, and NV.

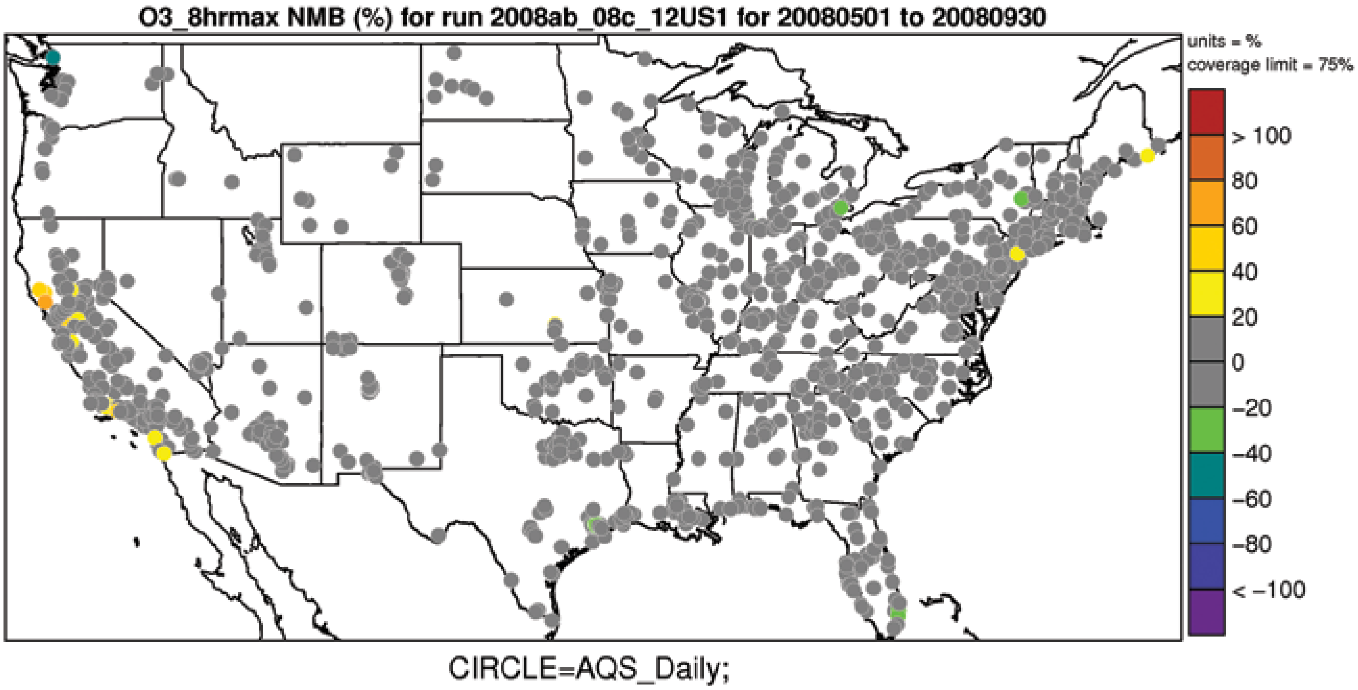


Figure 4-2. Normalized Mean Bias (%) of 8-hour daily maximum ozone greater than 60 ppb over the period May-September 2008 at monitoring sites in the continental U.S. modeling domain.

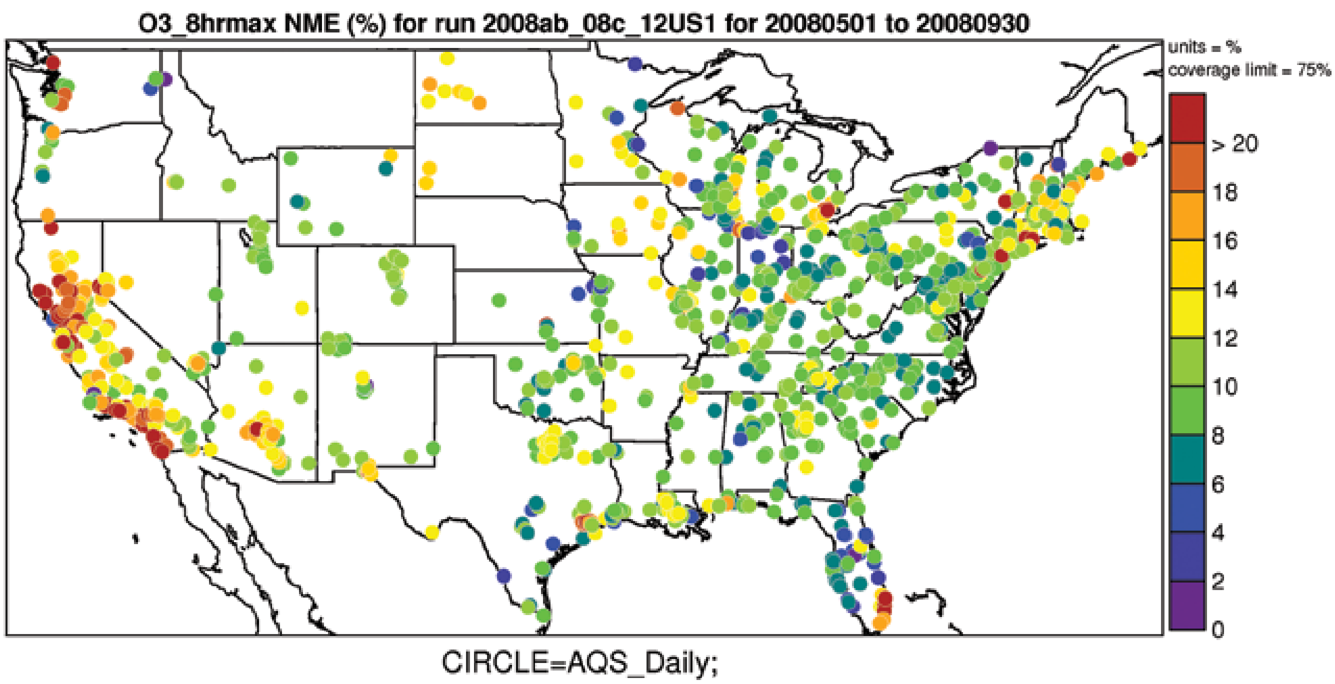


Figure 4-3. Normalized Mean Error (%) of 8-hour daily maximum ozone greater than 60 ppb over the period May-September 2008 at monitoring sites in the continental U.S. modeling domain.

summaries of bias and error statistics, annual spatial maps which show the normalized mean bias and error by site for each $PM_{2.5}$ species are provided in Figures 4-4 through 4-17.

As indicated by the statistics in Table 4-5, annual CMAQ $PM_{2.5}$ for 2008 shows a slight under prediction at rural IMPROVE monitoring sites in each subregion except the Northeast which shows an over prediction in NMB of 18.1 species are provided in Figures 4-4 through slight over predictions in the Midwest, Central and West whereas annual $PM_{2.5}$ is under predicted in the Southeast (NMB is -2.1 percent) and Northeast (NMB is -42.3).

Although not shown here, the mean observed concentrations of $PM_{2.5}$ are more than twice as high at the CSN sites (~16µg m^{-3}) as the IMPROVE sites (~ 6µg m^{-3}), thus illustrating the statistical differences between the urban CSN and rural IMPROVE networks.

Annual average sulfate is consistently under-predicted at CSN, IMPROVE, and CASTNet monitoring sites across the modeling domain, with NMB values ranging from -8 percent to -34 percent. Overall, sulfate bias performance is slightly better at urban CSN sites than at rural IMPROVE and/or suburban CASTNet sites. Sulfate performance shows moderate error, ranging from 22 to 45 percent. Annual model bias and error at individual sites, as displayed in Figures 4-6 and 4-7, suggest spatial patterns vary by region. The model bias for most of the Southeast, Central and Southwest states are within -20 to -40 percent. The model bias appears to be much less (±20 percent) in the Northeast, Midwest, and Northwest states. A few sites in the Northwest have biases much greater than 20 percent. Model error also shows a spatial trend by region, where much of the Eastern states are 20 to 30 percent, the Central U.S. states are 30 to 40 percent, and the Western states are greater than 40 percent.

Subregion			No. of Obs	NMB (%)	NME (%)	FB (%)	FE (%)
$PM_{2.5}$	CSN	Northeast	2,968	2.8	39.5	-0.8	36.9
		Midwest	2,143	0.0	34.8	-4.4	36.4
		Southeast	2,283	-15.3	38.2	-21.8	42.1
		Central	1,834	-13.9	41.7	-21.1	47.3
		West	2,956	-1.3	53.5	-12.3	52.3
	IMPROVE	Northeast	2,299	0.8	46.3	-8.3	43.8
		Midwest	599	-1.9	35.3	-11.0	39.4
		Southeast	1,920	-20.4	44.1	-27.3	52.6
		Central	2,463	-17.9	41.7	-26.9	50.5
		West	10,057	-17.5	62.0	-35.6	64.1
Sulfate	CSN	Northeast	3,143	-25.0	38.2	-29.4	42.9
		Midwest	2,324	-29.5	37.9	-31.2	42.3
		Southeast	2,851	-32.8	38.6	-38.5	45.8
		Central	2,215	-35.5	42.1	-40.6	49.3
		West	2,829	-30.3	44.7	-25.5	48.2
	IMPROVE	Northeast	2,301	-18.5	34.9	-16.8	37.4
		Midwest	599	-24.5	32.5	-23.9	37.3
		Southeast	1,887	-28.2	36.7	-28.6	43.4
		Central	2,508	-33.9	39.1	-35.4	45.2
		West	9,497	-23.5	43.9	-12.5	49.6
Nitrate	CASTNet	Northeast	777	-30.8	31.6	-36.2	37.7
		Midwest	637	-33.1	33.5	-40.3	40.8
		Southeast	1,117	-36.2	36.9	-44.4	45.7
		Central	390	-47.8	47.9	-61.0	61.2
		West	1,037	-39.8	45.1	-38.4	51.0
	CSN	Northeast	3,143	27.9	65.5	-11.7	71.1
		Midwest	2,325	23.4	56.0	-8.7	67.8
		Southeast	2,851	25.2	93.3	56.0	106.0
		Central	1,641	19.3	57.3	-24.5	80.6
		West	3,164	-32.4	61.8	-69.6	94.1

Subregion			No. of Obs	NMB (%)	NME (%)	FB (%)	FE (%)
Total Nitrate ($NO_3 + HNO_3$)	IMPROVE	Northeast	2,299	84.2	124.0	-0.6	94.9
		Midwest	597	61.8	88.7	-2.7	89.1
		Southeast	1,885	61.8	134.0	-53.2	121.0
		Central	2,502	44.5	76.2	-12.3	91.4
		West	10,150	-11.8	87.5	-60.0	115.0
	CASTNet	Northeast	777	54.7	59.3	41.2	49.1
		Midwest	637	33.5	40.1	28.3	34.4
		Southeast	1,117	39.9	54.7	25.7	45.4
		Central	390	14.6	35.1	9.0	33.9
		West	1,037	11.6	36.2	19.3	38.7
Ammonium	CSN	Northeast	3,143	-4.1	34.9	-1.4	35.7
		Midwest	2,325	-6.1	32.6	34.0	0.9
		Southeast	2,850	-13.5	39.5	-14.2	42.9
		Central	2,179	-10.5	39.4	-12.8	45.3
		West	3,164	-21.3	52.8	-8.7	55.6
	CASTNet	Northeast	777	-1.1	28.2	-1.2	30.6
		Midwest	637	9.3	26.4	7.5	24.4
		Southeast	1,117	-13.7	32.9	-15.4	35.5
		Central	390	-6.3	32.2	-10.6	36.1
		West	1,037	-14.2	41.1	-10.7	45.1
Elemental Carbon	CSN	Northeast	3,085	29.3	58.2	19.9	46.6
		Midwest	2,254	41.6	66.0	30.5	54.0
		Southeast	2,826	24.5	53.6	20.3	46.7
		Central	2,173	70.0	93.7	45.3	63.9
		West	2,935	36.0	81.6	18.0	64.3
	IMPROVE	Northeast	2,197	30.1	61.3	6.6	46.9
		Midwest	602	6.0	40.2	3.4	43.4
		Southeast	1,864	-0.1	44.8	1.7	46.1
		Central	2,445	7.3	43.0	1.1	42.2
		West	9,518	66.4	109.0	13.1	65.2
Organic Carbon	CSN	Northeast	3,043	-15.8	62.6	-16.6	65.4
		Midwest	2,194	-17.5	58.4	-11.7	65.4
		Southeast	2,779	-34.4	51.8	-40.9	62.9
		Central	2,138	-33.5	56.7	-41.2	68.1
		West	2,836	-15.5	57.8	-19.7	62.6
	IMPROVE	Northeast	2,198	-13.6	63.6	-30.2	62.1
		Midwest	602	-33.0	47.8	-40.9	60.9
		Southeast	1,878	-36.7	54.3	-54.2	68.7
		Central	2,452	-40.8	55.7	-65.9	75.6
		West	9,508	-7.9	76.9	-47.3	81.4

Table 4-4. Summary of CMAQ 2008 Annual $PM_{2.5}$ Species Model Performance Statistic

Annual average nitrate is over predicted at the urban and rural monitoring sites in most of the subregions in the12 km modeling domain (NMB in the range of 24% to 93%), while nitrate is under predicted in the West (NMB in the range of -23% to -32%). The bias statistics indicate that the model performance for nitrate is generally best at the urban CSN monitoring sites. Model performance of total nitrate at suburban CASTNet monitoring sites shows an over prediction across all subregions. Model error for nitrate is somewhat greater for each subregion as compared to sulfate. Model bias at individual sites indicates mainly over prediction of greater than 20 percent at most monitoring sites in the Eastern half of the U.S. as well and in the extreme Northwest, as indicated in Figure 4-8. The exception to this is in the Southwest of the modeling domain where there appears to be a greater number of sites with under prediction

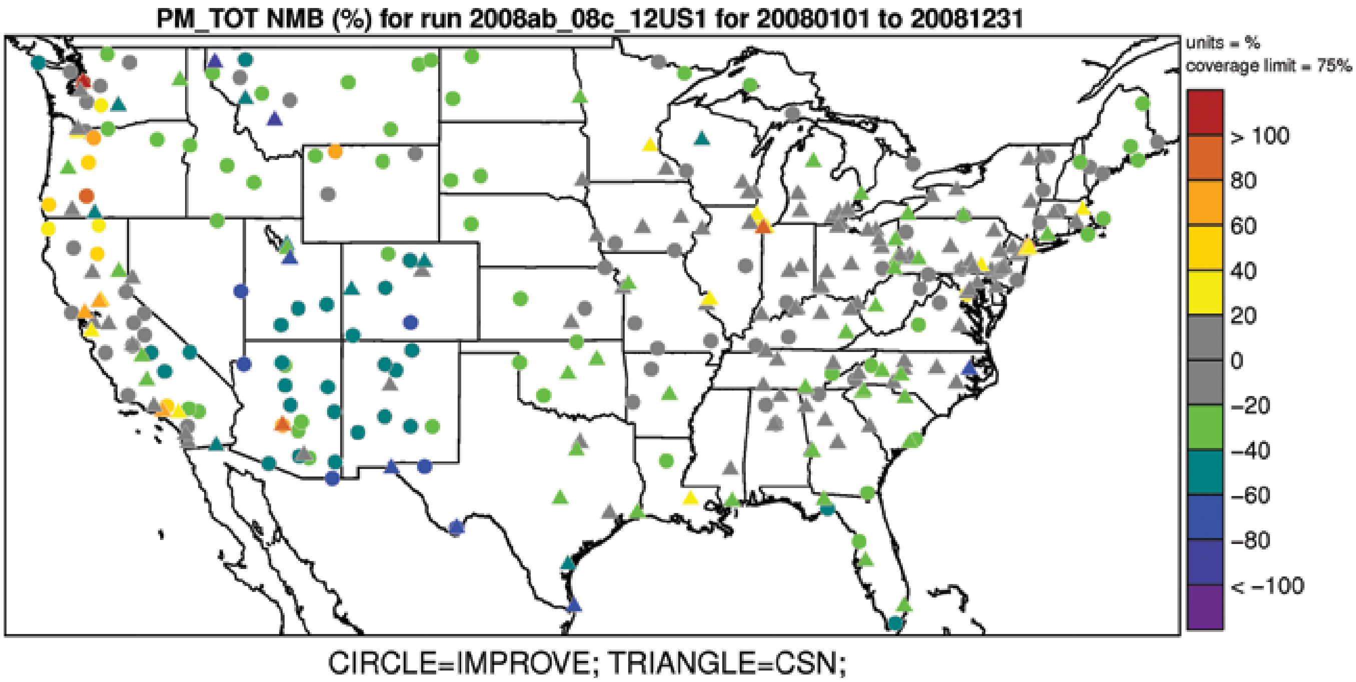


Figure 4-4. Normalized Mean Bias (%) of annual $PM_{2.5}$ mass at monitoring sites in the continental U.S. modeling domain.

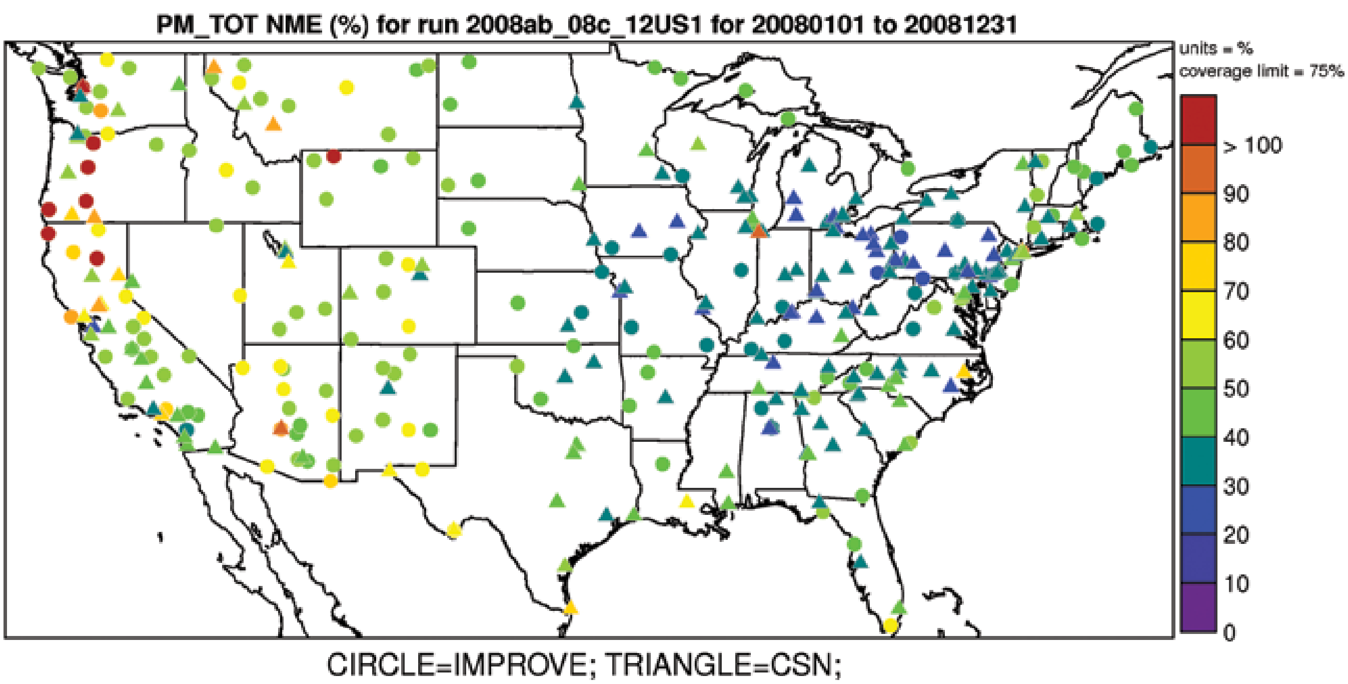


Figure 4-5. Normalized Mean Error (%) of annual $PM_{2.5}$ mass at monitoring sites in the continental U.S. modeling domain.

of nitrate of 20 to 80 percent. Model error for annual nitrate, as shown in Figure 4-9, is least at sites in portions of the Midwest and extending eastward to the Northeast corridor. Nitrate concentrations are typically higher in these areas than in other portions of the modeling domain.

Annual average ammonium model performance as indicated in Table 4-5 has a tendency for the model to slightly over predict in the Northeast, Midwest, and Central U.S. states across the CSN and CASTNet monitoring sites (NMB aranging from -0.4 to -10 percent). In contrast, the model tends to slightly under predict in the Southeast and Western states at CSN and CASTNet sites (NMB ranging from 5 to 18 percent). There is not a large variation from subregion to subregion or at urban versus rural sites in the error statistics for ammonium.

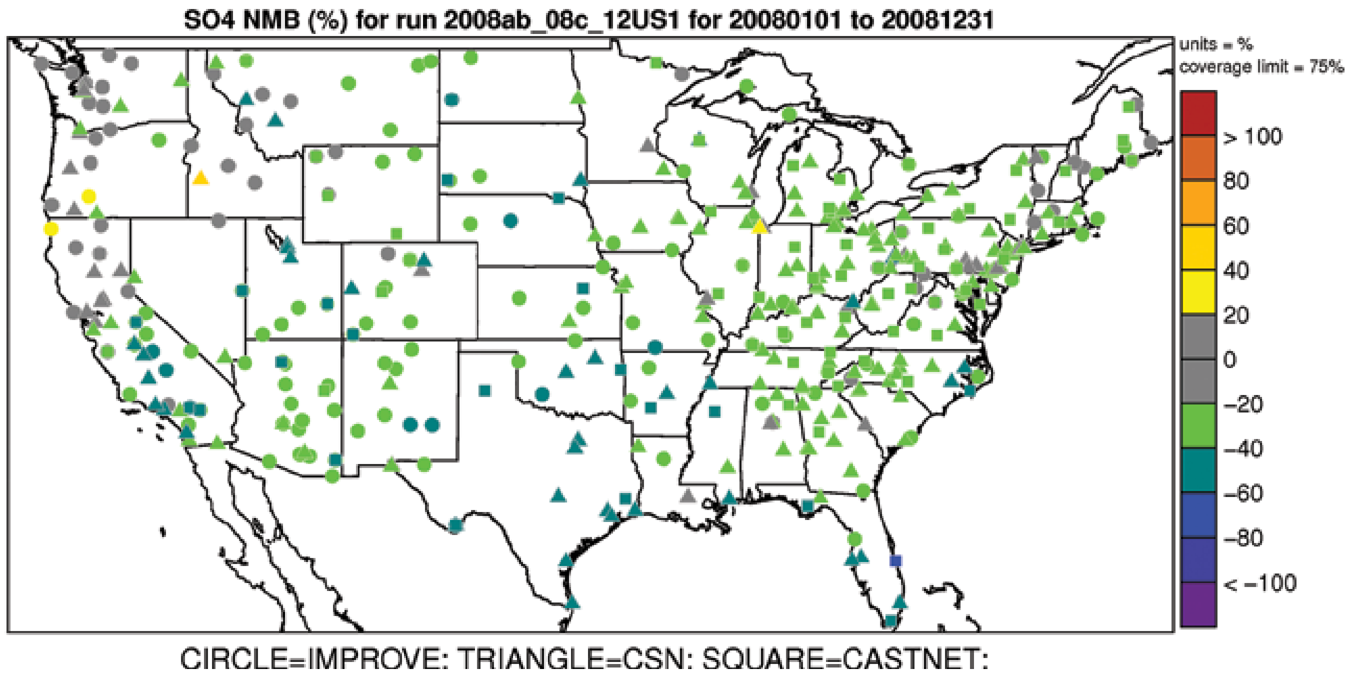


Figure 4-6. Normalized Mean Bias (%) of annual Sulfate at monitoring sites in the continental U.S. modeling domain.

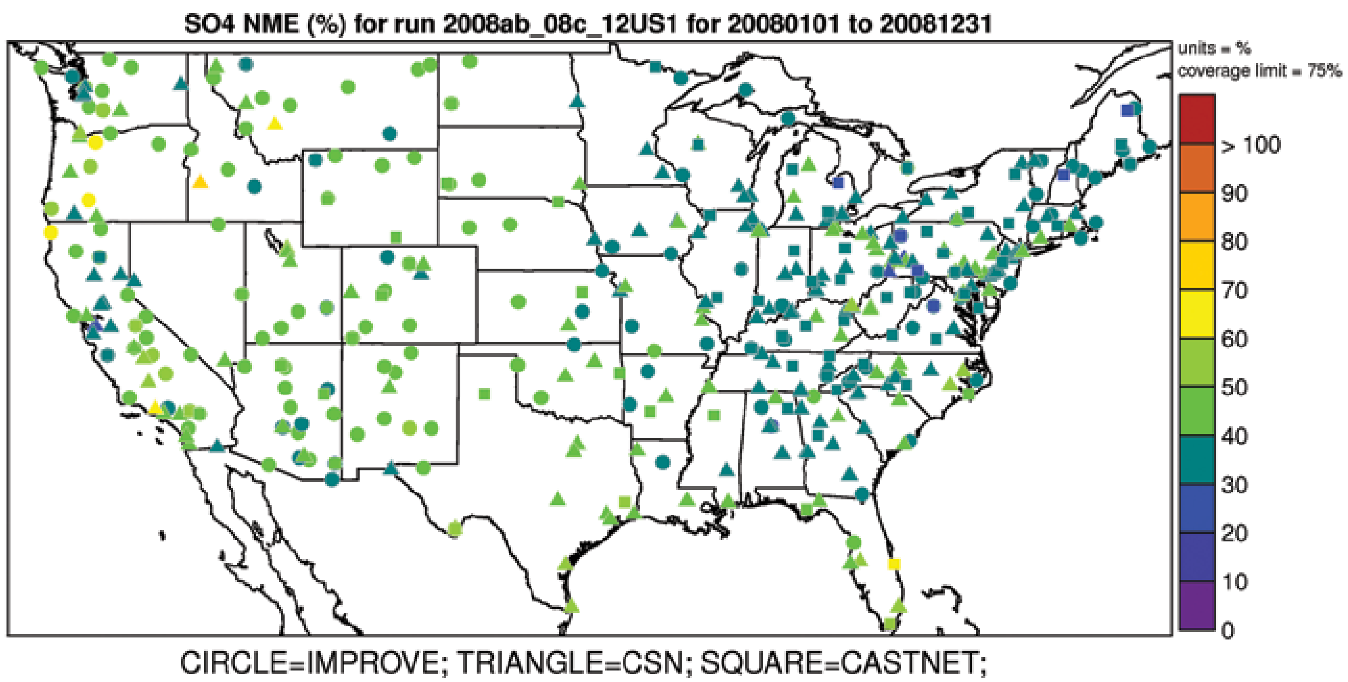


Figure 4-7. Normalized Mean Error (%) of annual Sulfate at monitoring sites in the continental U.S. modeling domain.

Annual average elemental carbon is under predicted in all subregions at urban sites with the exception of the slight over prediction in the Northeast. At rural sites, elemental carbon is over predicted in the Northeast, Central and West, although elemental carbon is under predicted in the Midwest and Southeast. Similar to ammonium error model performance, there is not a large variation from subregion to subregion or at urban versus rural sites.

Annual average organic carbon is under predicted in the Midwest, Southeast and Central states at the urban and rural monitoring sites. In contrast, organic carbon model bias tends to show a slight over prediction in the Northeast and West. Similar to ammonium and elemental carbon, error model performance does not show a large variation from subregion to subregion or at urban versus rural sites.

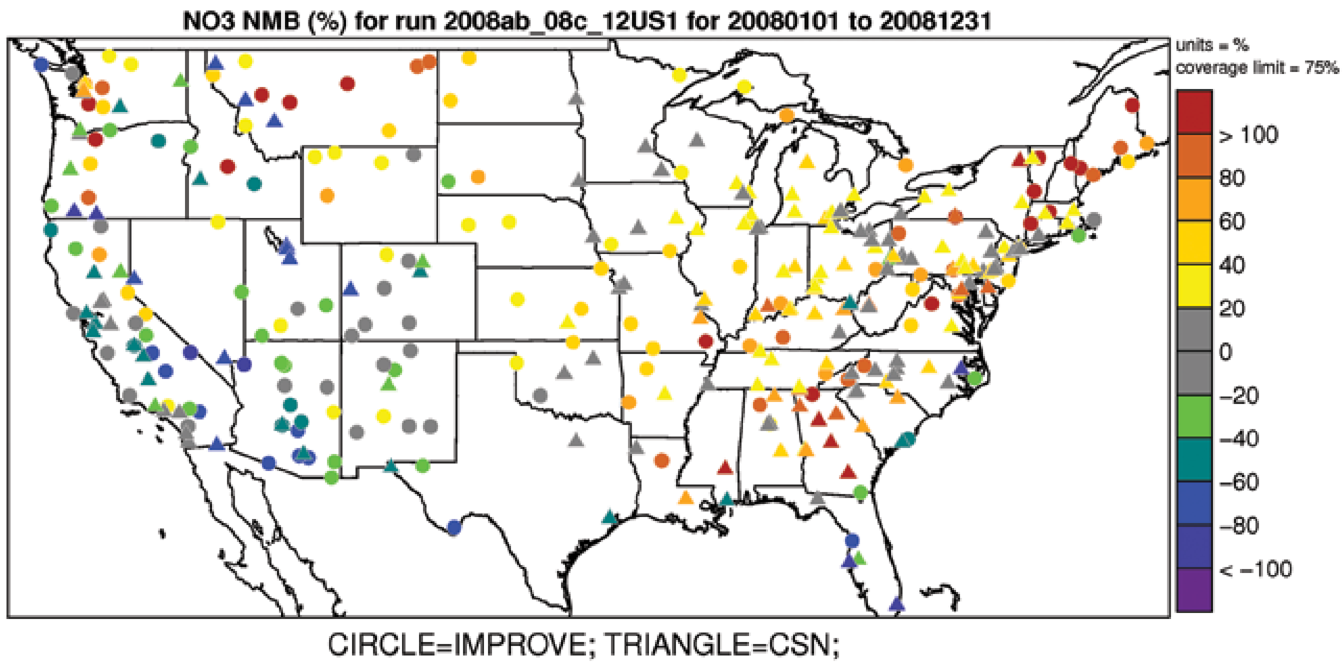


Figure 4-8. Normalized Mean Bias (%) of annual Nitrate at monitoring sites in the continental U.S. modeling domain.

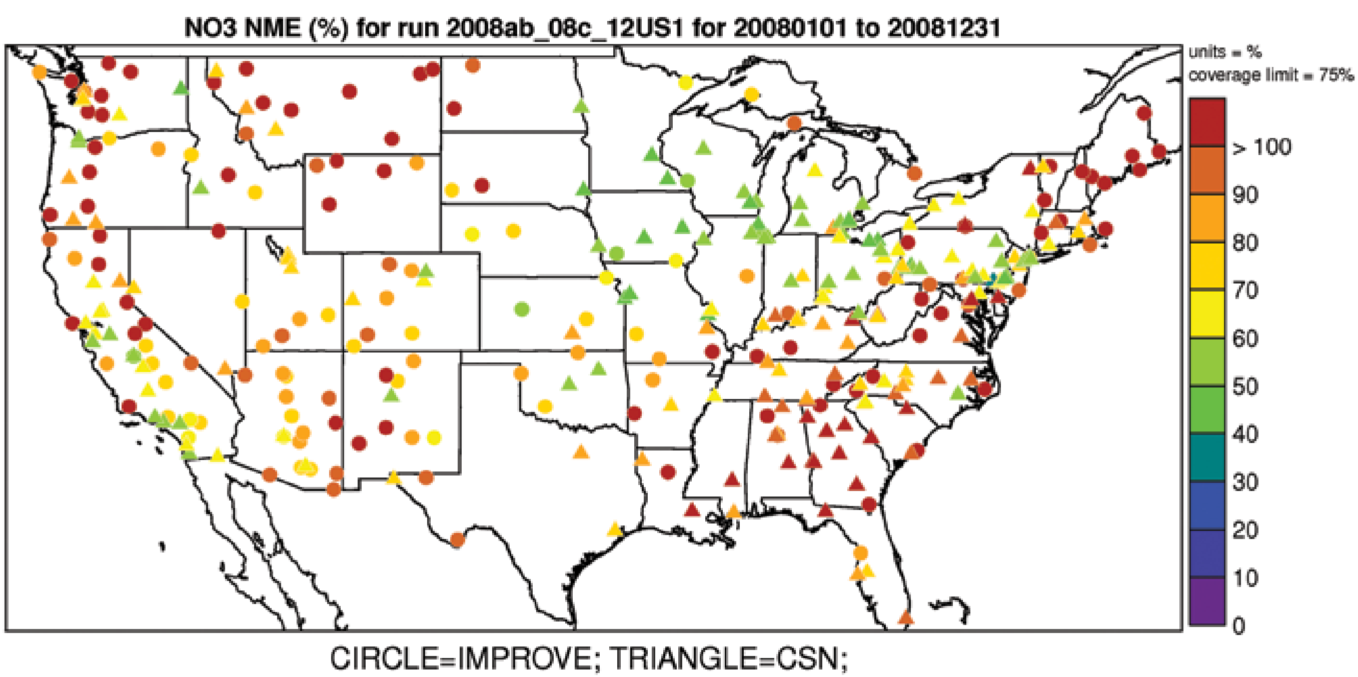


Figure 4-9. Normalized Mean Error (%) of annual Nitrate at monitoring sites in the continental U.S. modeling domain.

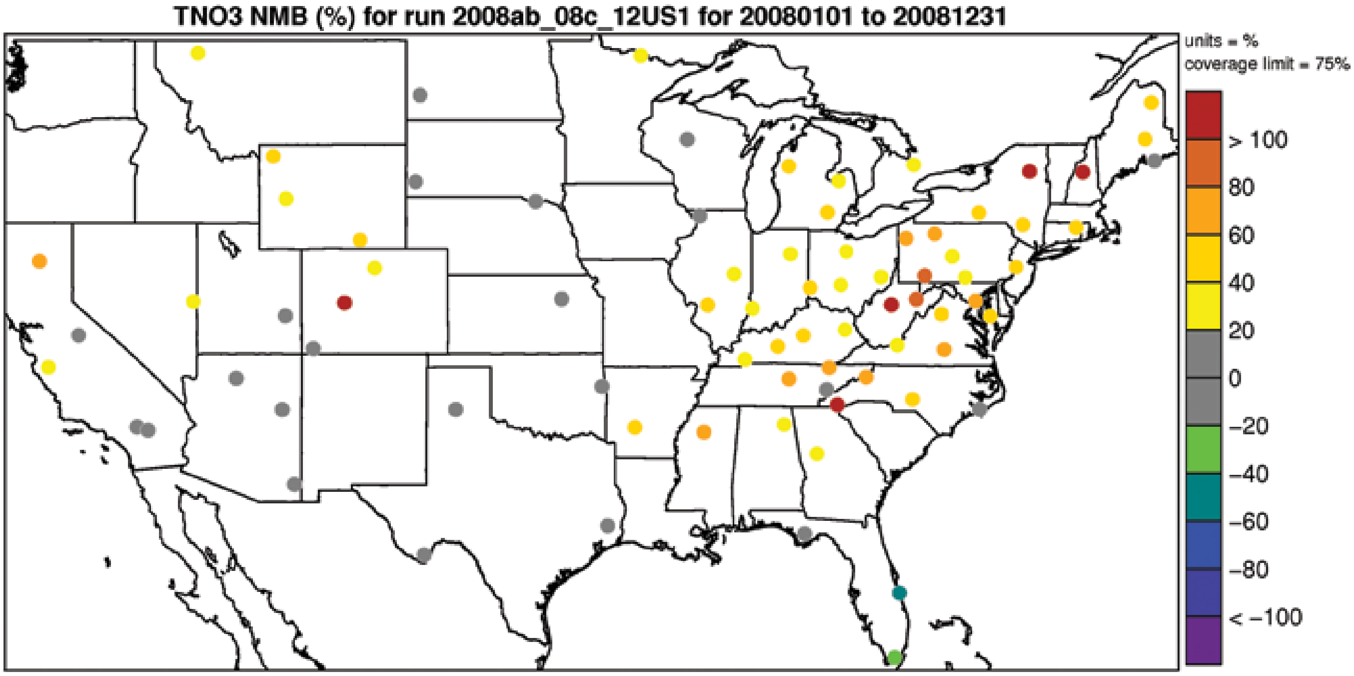


Figure 4-10. Normalized Mean Bias (%) of annual Total Nitrate at monitoring sites in the continental U.S. modeling domain.

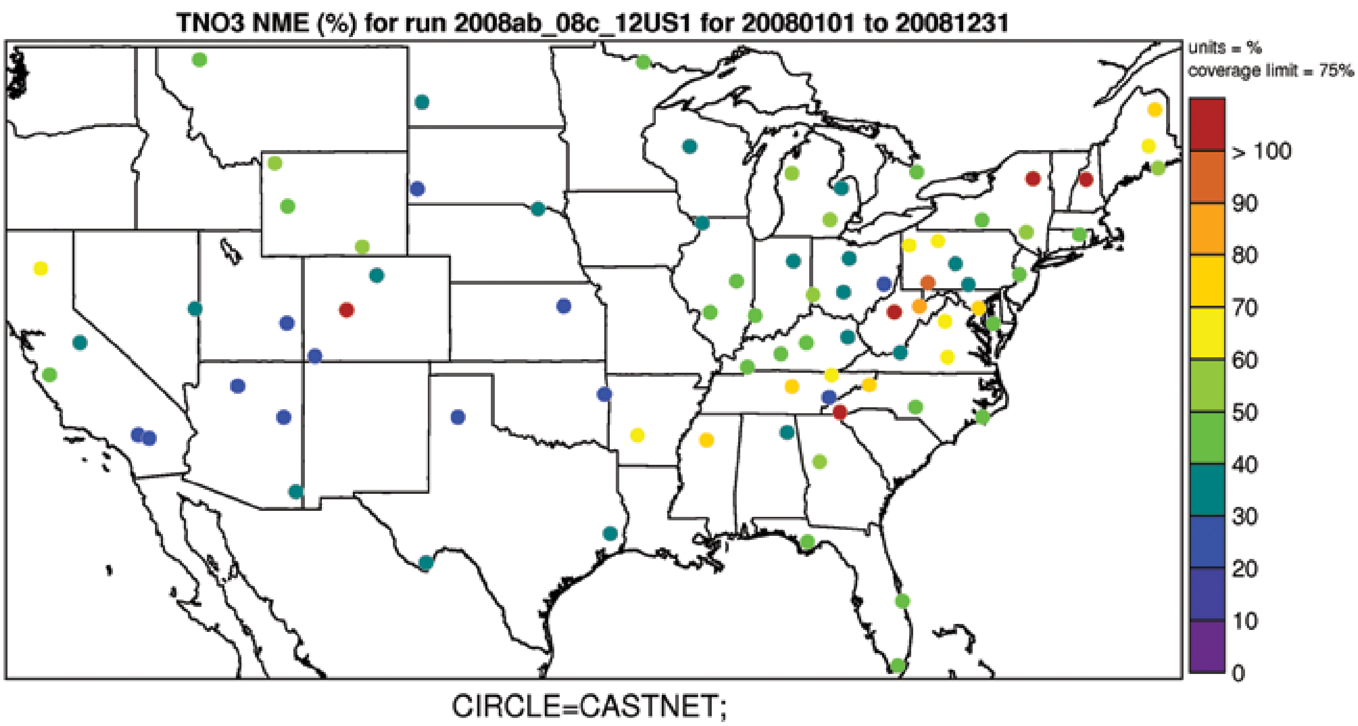


Figure 4-11. Normalized Mean Error (%) of annual Total Nitrate at monitoring sites in the continental U.S. modeling domain.

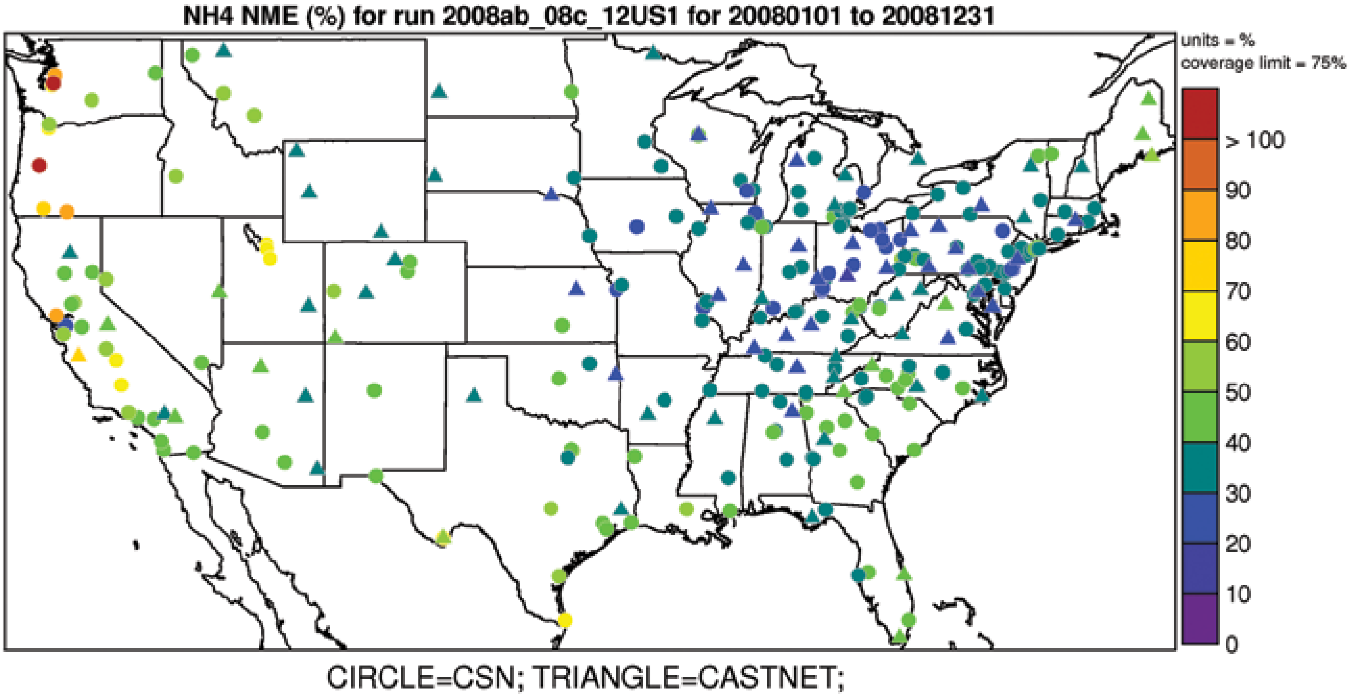


Figure 4-12. Normalized Mean Error (%) of annual Total Nitrate at monitoring sites in the continental U.S. modeling domain.

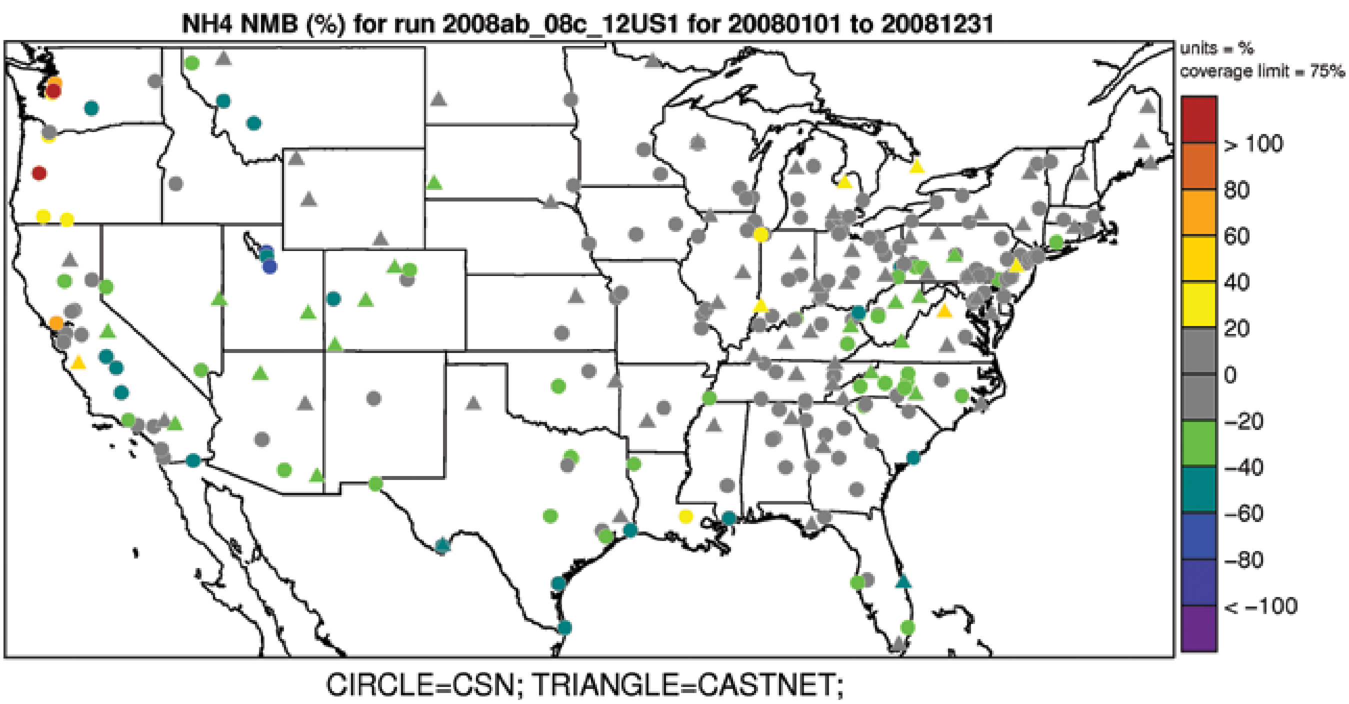


Figure 4-13. Normalized Mean Error (%) of annual Ammonium at monitoring sites in the continental U.S. modeling domain.

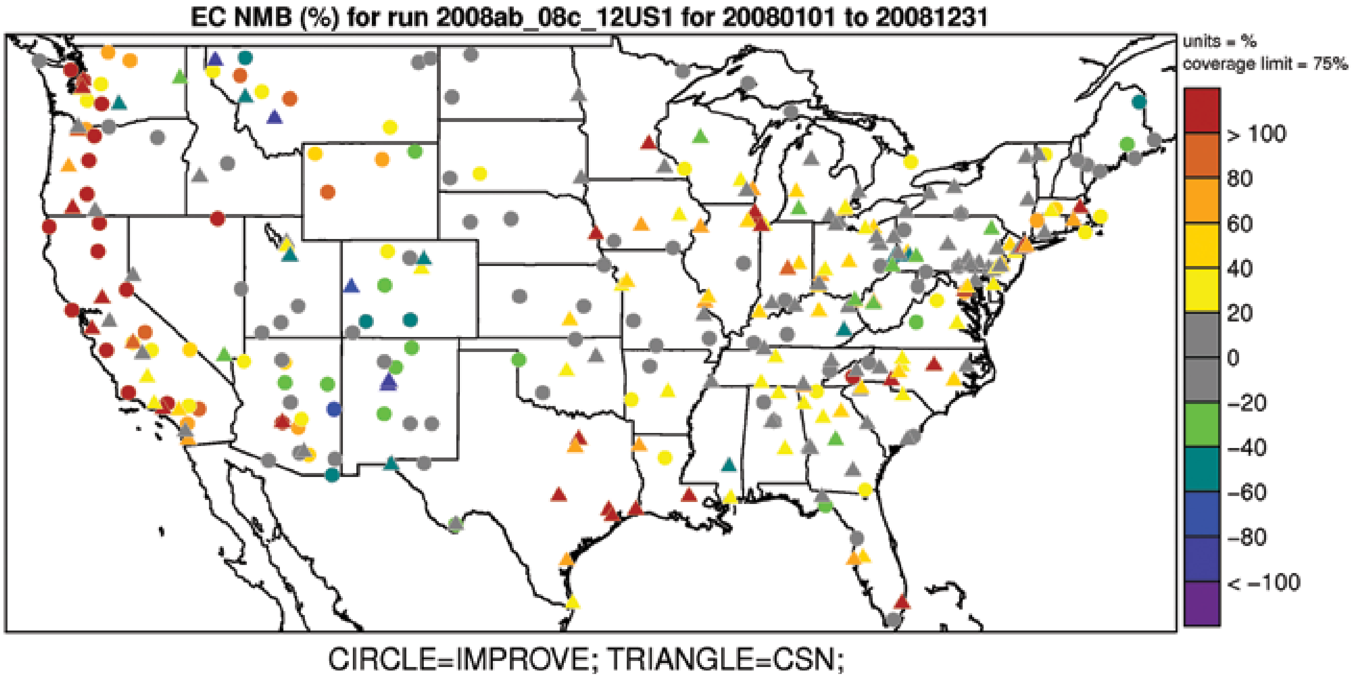


Figure 4-14. Normalized Mean Bias (%) of annual Elemental Carbon at monitoring sites in the continental U.S. modeling domain.

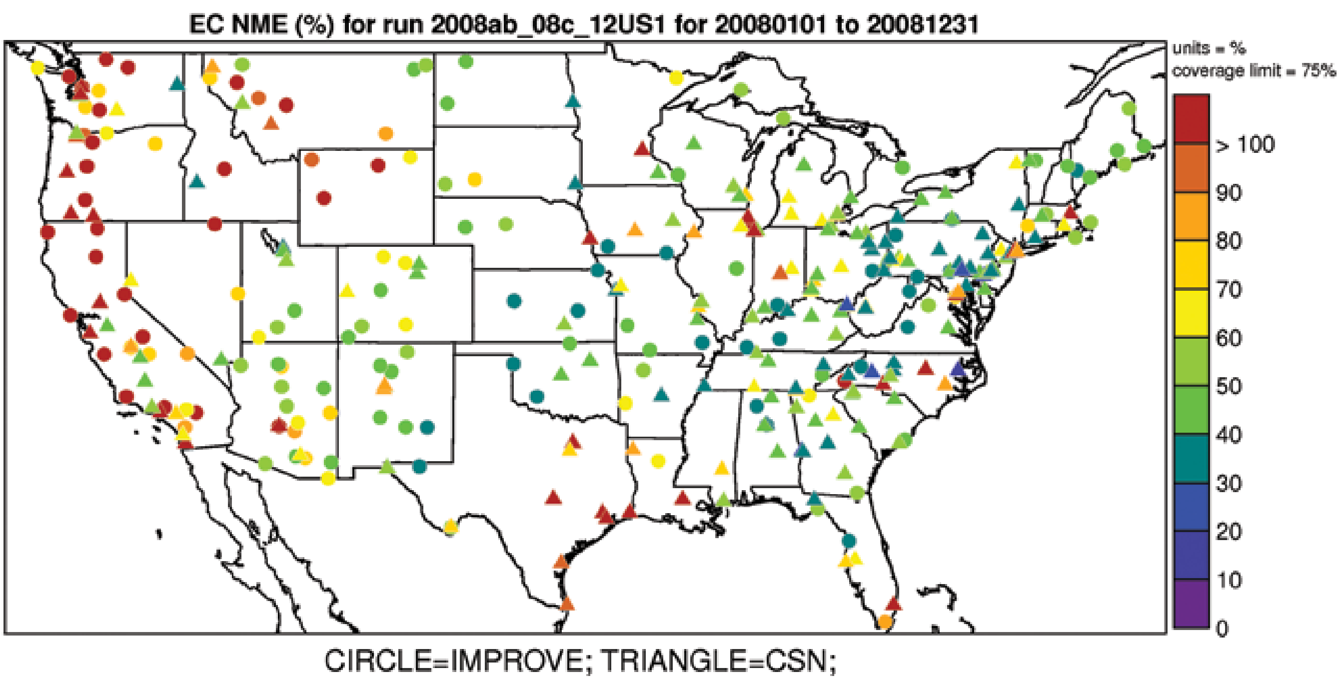


Figure 4-15. Normalized Mean Error (%) of annual Elemental Carbon at monitoring sites in the continental U.S. modeling domain.

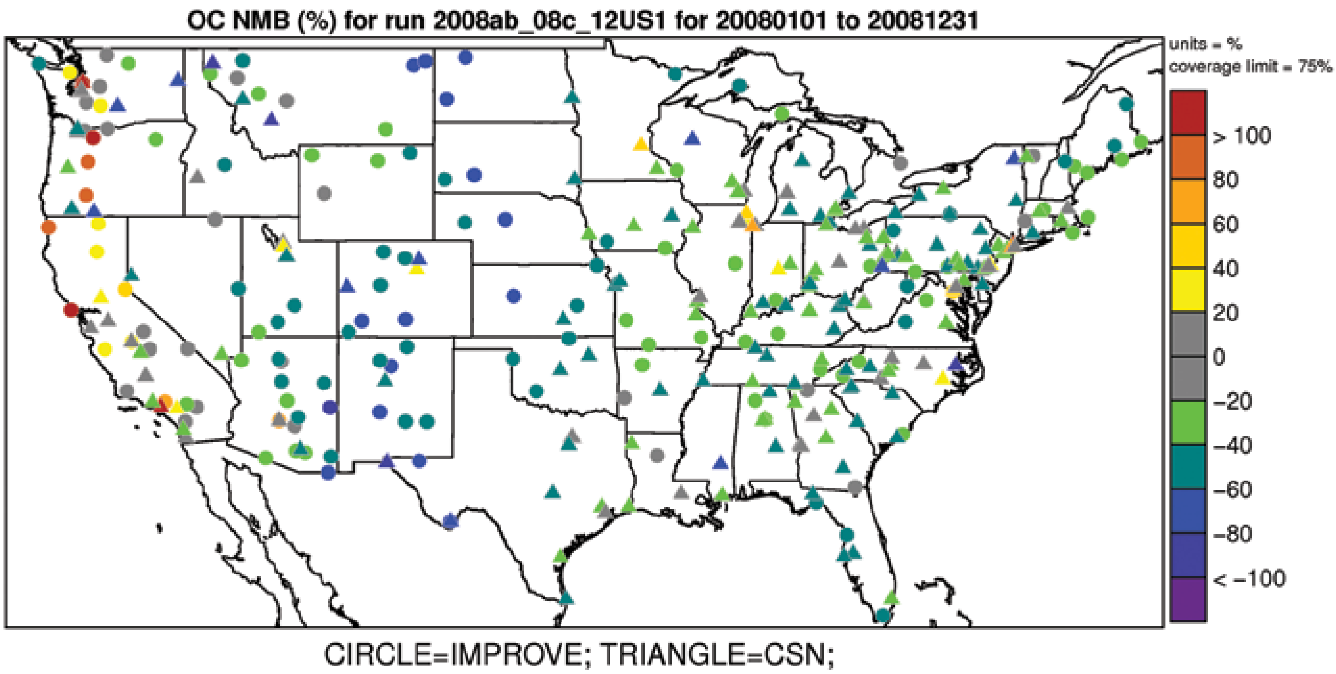


Figure 4-16. Normalized Mean Bias (%) of annual Organic Carbon at monitoring sites in the continental U.S. modeling domain.

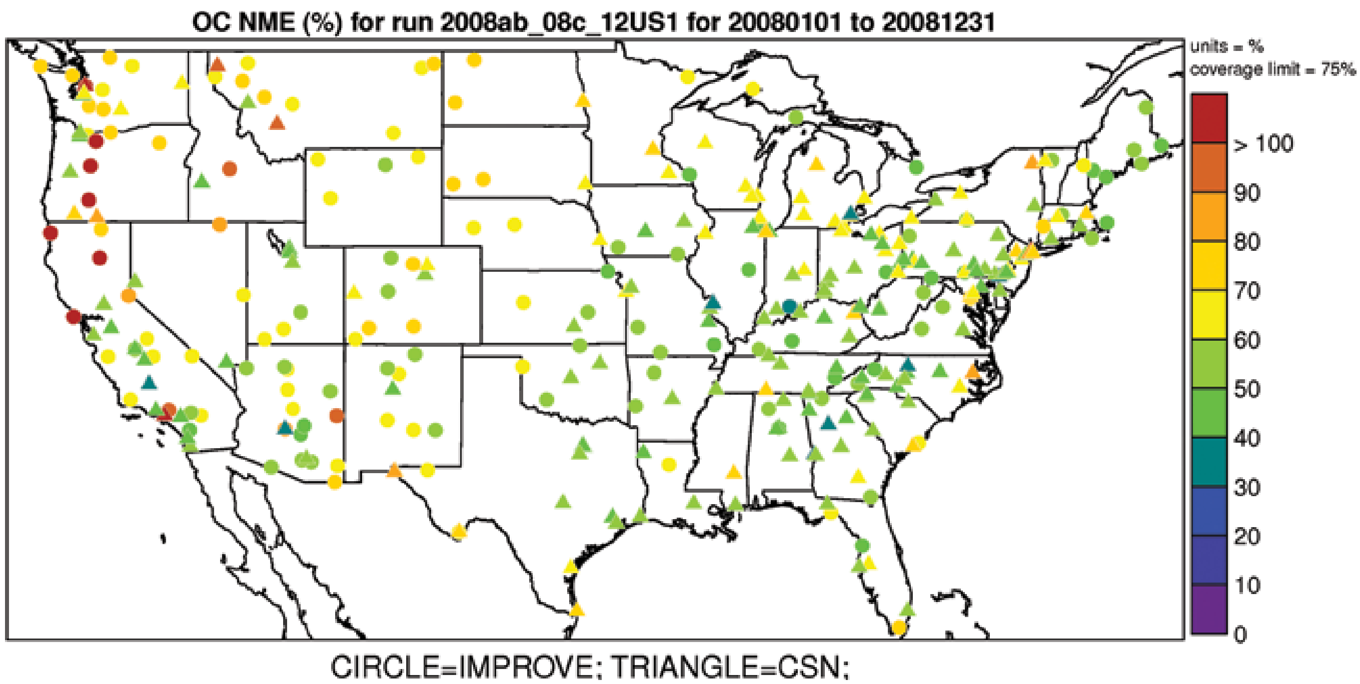


Figure 4-17. Normalized Mean Error (%) of annual Organic Carbon at monitoring sites in the continental U.S. modeling domain.

5.0
Bayesian Model-Derived Air Quality Estimates

5.1 Introduction

The need for improved spatial and temporal estimates of air quality has grown rapidly in recent years, as the development of more thorough air quality related health studies have begun requiring more thorough characterizations of ground-level air pollution levels. The most direct way to obtain accurate air quality information is from measurements made at surface monitoring stations across the country. However, many areas of the U.S. are not monitored and typically, air monitoring sites are sparsely and irregularly spaced over large areas. One way to address the limits to ambient air quality data is to combine air quality monitoring data and numerical model output in a scientifically coherent way for improved spatial and temporal predictions of air quality. This type of statistical modeling could provide spatial predictions over the temporal scales used to assess the associations between ambient air quality and public health outcomes and for assessing progress in air quality under new emission control programs. Hierarchical Bayesian Modeling (HBM) is used in numerous applications to combine different data sources with varying levels of uncertainty. This section will briefly introduce the Hierarchical-Bayesian approach developed by EPA for use in the EPHT program.

The approach discussed in this section combines the strength of both modeled and monitored pollution concentration values to characterize air quality with estimated accuracy and enhanced spatial and temporal coverage. The statistical approach is explained in McMillan, N., Holland, D.M., Morara, M, and Feng, J., "Combining Different Sources of Particulate Data Using Bayesian Space-Time Modeling," *Environmetrics*, **2010**, 21: pp 48—65, DOI: 10.1002/env.984.

5.2 Hierarchical Bayesian Space-Time Modeling System

5.2.1 Introduction to the Hierarchical-Bayesian Approach

EPA's Hierarchical-Bayesian (HB) space-time statistical model combines ambient air quality data from monitors with modeled CMAQ air quality output to produce daily predictions of pollution concentrations for defined time and space boundaries. Bayesian analysis decomposes a complex problem into appropriate linked stages (functions), i.e., a) air quality data; b) CMAQ model output; c) measurement errors and model bias; and d) the underlying 'true' concentration surface. A Bayesian approach incorporates 'prior knowledge' (e.g., numerical information describing known attributes/behaviors, statistical distributions, etc.) of the unknown parameters in the hierarchical model, which results in an improved estimation of the uncertainty of the 'true' air pollutant concentration at any location in space and time. A hierarchical model builds a combined solution, superior to either air quality monitor data or air quality modeling data alone.

The predictions of the ambient concentration 'surface' provided by EPA's HB Model are for a selected year and with spatial scope spanning across the contiguous U.S. (i.e., the 'lower 48' states). The HB Model methodology blends the best characteristics of monitored concentration values and modeled concentration values for prediction of the 'true' concentration values (surface) over time when both sources of data are available. Air quality monitors are assumed to measure the true pollutant concentration surface with some measurement error, but no bias. In contrast, numerical output from source-oriented air quality models is assumed to approximate the variability of the true surface while exhibiting both measurement error and bias (additive and multiplicative) across space and time. Given the typical exponentially distributed nature of air quality data, the HB Model performs its analysis with log-transformed monitoring and modeling inputs. The HB Model gives more weight to accurate monitoring data in areas where monitoring data exists, and relies on bias-adjusted model output in non-monitored areas. The HB Model approach offers the ability to predict important pollution gradients and uncertainties that might otherwise be unknown using interpolation results based solely on air quality monitoring data. EPA's HB Model can be used to obtain surrogate measures of air quality for studies addressing health outcomes.

5.2.2 Advantages and Limitations of the Hierarchical-Bayesian Approach

At a high level, the advantage of HB modeling methodology is its inherent ability to predict air quality estimates for selected times and spatial scales using air quality monitoring and air quality modeling data as input, while minimizing the limitations which arise when either of these methods are applied separately. Another important advantage of the HB modeling approach is the ability to predict estimates of errors in air quality. The HB modeling approach generates estimates of air quality for days when monitoring data is missing, in addition to estimating air quality in areas without monitors. An important disadvantage of HB modeling is the computational burden imposed on model users. Typically, these models are 'adjusted' by running numerous simulations, and at times the solutions are difficult to program and require significant computer resources. Thus, there is the need for EPA to develop an operational approach to HB modeling. It requires experience and statistical expertise to ensure that proper (initial) modeling assumptions have been used, that proper convergence criteria have been used for the HB Model, and that the results are reasonable.

In setting up the procedures for developing the HB Model estimates, EPA selected a set of data quality objectives, DQOs, to guide the acceptance of the results. Based on an independent data set (not used in the predictions), EPA calculates (1) the *Bias* as the absolute difference between the (log-transformed) measurement generated from the monitor at that location (i.e., the "true" value) and the log-transformed prediction that is made by the particular model; and (2) the *Mean Square Error (MSE),* calculated as the square of the bias. EPA presents three different types of MSE summaries: (a) day-specific MSE, averaged over all monitoring locations; (b) location-specific MSE, averaged over all monitoring days; and (c) the overall MSE (i.e., averaged across locations and time). MSE is a statistical score that represents overall (average) performance in which large deviation from the "true" value yields larger penalties compared to small errors. While these performance measures were used in evaluating the results, they have no absolute acceptance/rejection values and are considered on a case-by-case basis when evaluating the performance of any years of HB Model application. In general, while the DQO's usefulness is still being studied and EPA attempts to achieve these DQOs, these measures are helpful at this time to describe the quality of the HB predictions from one model year to another.

In developing and providing the HB Model results, EPA is attempting to advance the use of improved air quality estimates. As such, the proper use of the EPA results is important and discussed further in Section 5.6.

5.3 Results for O_3 and $PM_{2.5}$

The HB Model yields a predicted daily concentration and error estimate for those predictions within each grid cell for each day within the time period of interest. The concentrations are daily $PM_{2.5}$ or 8-hour maximum ozone levels. These predictions fall along a smooth (congruent) response surface across the entire region. The grid used by the HB Model is the same as that used in generating the CMAQ estimates. The smoothness of the surface is achieved by: 1) the choice of prior distributions for air data, CMAQ output, and the true underlying predictive surface; and 2) the conditional autoregressive model (CAR) spatial covariance structure where a grid's predicted concentration is assumed to be correlated with neighboring cells (note the HB Model can handle different size neighborhoods). The resulting HB Model prediction surface approximates the true underlying response surface while accounting for such factors as measurement error and potential space-time bias in the CMAQ output.

EPA stores the set of back-transformed predictions (pm_{25}_pred, O_3_pred) and standard errors (pm_{25}_stdd, O_3_stdd) from a given execution of the HB Model in tabular (comma-delimited) format within a file named as in the following example: pm_{25}_surface_12km_2007.csv. Table 5-1 presents an example of the output that can be obtained from this file. One row exists in this file for each grid cell-date combination within the study area. The relevant variables in this file, in the order in which they exist (and are portrayed within the column headings of the table), are as follows:

- Date: Represented by the data given in this row, in MM/DD/YYYY format.
- Longitude: The x-coordinate value transformed to longitude (degrees).
- Latitude: The y-coordinate value transformed to latitude (degrees).
- Column: The column associated with model results.
- Row: The row associated with model results.
- pm_{25}_pred or O_3_pred
- pm_{25}_stdd or O_3_stdd

5.4 Overview of HB Model Predictions

Below is a short description of the inputs and outputs for a HB Model application for 2007, 12 km grid, $PM_{2.5}$. A description of the input metadata and HB Model application can be found in Appendix E. The air quality data was obtained from EPA's AQS; CMAQ was run by EPA as documented previously in this report, and; the HB model was run by EPA/NERL. The domain of the CMAQ model (and therefore the HB Model predictions) is found in the following table.

Figure 5-1 shows the HB Model prediction for $PM_{2.5}$ during July 1-4, 2002. On July 1, the $PM_{2.5}$ levels were the highest along the U.S.-Canada border northeast of Lake Erie and into the mid- Atlantic region. As the days passed, the elevated $PM_{2.5}$ decreased in intensity and moved southeast. Examining the figure, it is possible to see the change in $PM_{2.5}$ level at any point in the domain. Figure 5-2 shows a close up of the HB Model predictions for July 2. The 12-km grid can be seen as small squares. Within each grid the predicted $PM_{2.5}$ concentrations are constant. As such, the $PM_{2.5}$ concentrations represent an average over the area where the public is exposed to ambient $PM_{2.5}$. Although actual concentrations within grid cells vary over space and time during a day, the ambient exposure is likely to be somewhat averaged as people move about within and between grid cells. Given the relationship between ambient concentrations, ambient exposures and personal exposure is not understood well, one area of study is the degree of misclassification between exposure and health outcomes based on varying grid sizes.

The HB Model results can track with the AQS data and CMAQ estimates and the predictions can differ from either the AQS data or the CMAQ estimates. Figure 5-3 shows HB predictions for a location where the predictions generally follow temporally the CMAQ and AQ data. This figure shows a series of days where AQS data and CMAQ estimates are

Date	Longitude	Latitude	Column	Row	O_3 pred (ppb)	O_3_stdd (ppb)
01/01/2008	-119.315	23.43627	12	15	23.011	4.6122
01/01/2008	-119.398	23.74126	12	16	22.979	4.6784
01/01/2008	-119.483	24.04658	12	17	22.919	4.8484
01/01/2008	-119.567	24.35223	12	18	22.987	4.7917
01/01/2008	-119.653	24.6582	12	19	23.19	4.84
01/01/2008	-119.739	24.96448	12	20	23.018	4.8264
01/01/2008	-119.826	25.27106	12	21	23.12	4.8651
01/01/2008	-119.913	25.57793	12	22	22.997	4.84
01/01/2008	-120.001	25.88509	12	23	22.968	4.8308
01/01/2008	-120.09	26.19253	12	24	22.949	4.8357

Note: The exact contents of this table may change over time. Please check the accompanying metadata files.

Table 5-1.HB Model Prediction Example Data File

Study Year	Bounding West Longitude	Bounding East Longitude	Bounding North Latitude	Bounding South Latitude
2008	111.1 deg W lon	65.4 deg W lon	51.25 deg N lat	23.0 deg N lat

Table 5-2. HB Model Domains for 12-km Applications

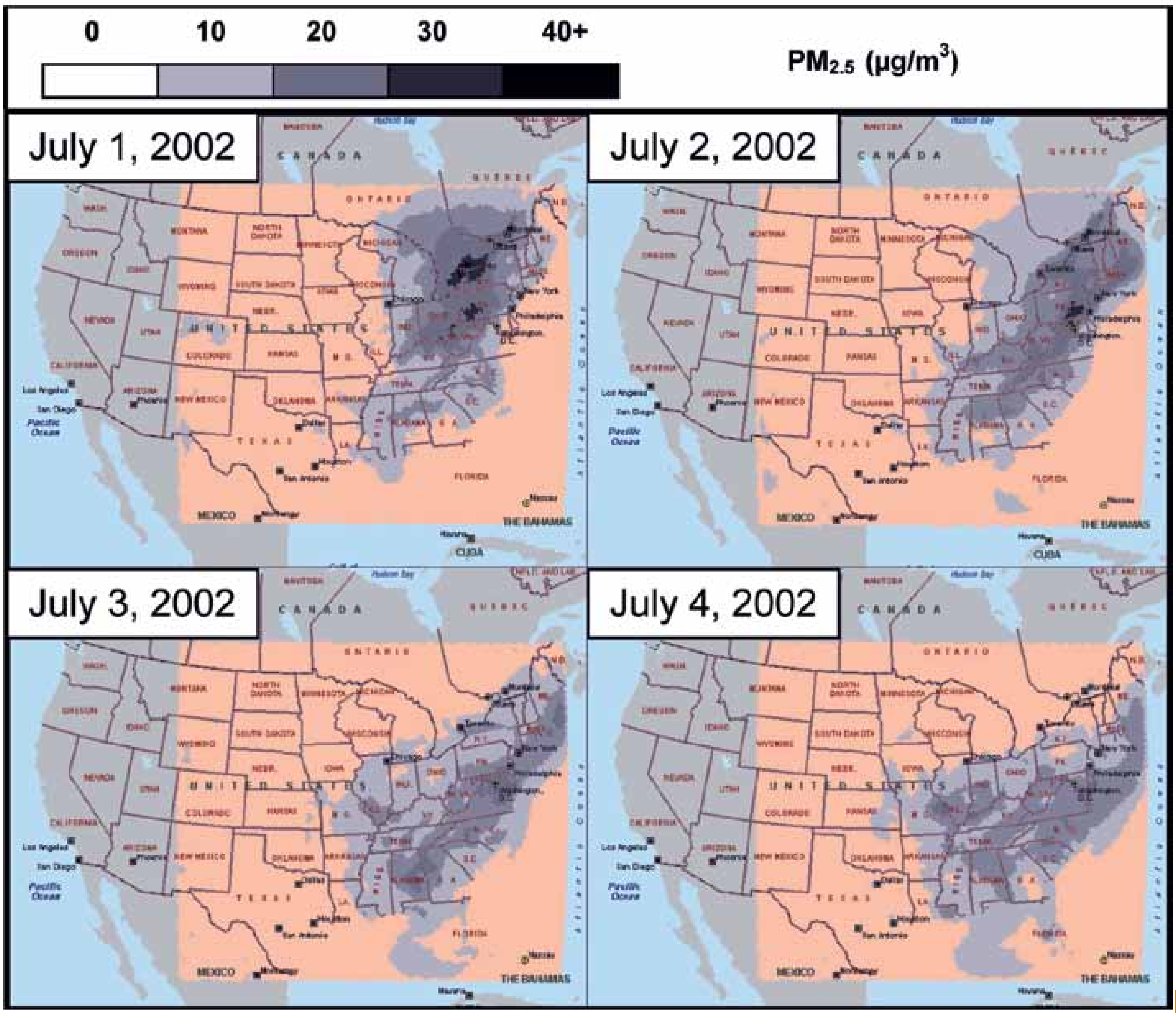


Figure 5-1. HB Prediction ($PM_{2.5}$) During July 1-4, 2002 (12 km grid cells)

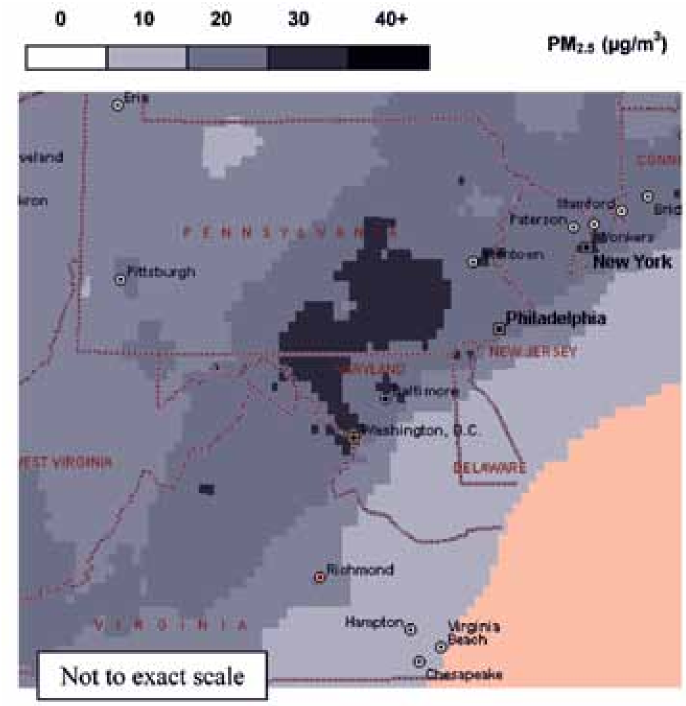


Figure 5-2. HB Prediction ($PM_{2.5}$) on July 2, 2002 (12 km grid cells)

fairly consistent. In such cases, the HB Model predictions track closely to both inputs. Figure 5-4 shows how the HB Model fills in $PM_{2.5}$ predictions for days when AQS data are not available (many $PM_{2.5}$ monitors are operational and collect samples in a 1-in-3 day time period.)On the unmonitored days, the HB Model predictions track well with the CMAQ estimates. Figure 5-5 shows a situation where AQS and CMAQ do not agree well and, while the HB Model tends to collect samples in a 1-in-3 day time period.)

Another way to view the ability of the HB Model to fill in estimates of air quality where no monitor exists can be seen in the following figures. The HB Model response surface is plotted with the grid demarcations in Figure 5-6 along with the measurements taken at the monitoring stations. Figure 5-7 rotates this plot to portray its 3-dimensionality, so that differences between the HB Model predictions and the monitoring data points can be better seen. The view portrayed in Figure 5-7 is as seen from the position of the red arrow in Figure 5-6. As in the previous figures, different colors represent different concentration gradients (as noted within the legend included in the plot). These figures show how the HB Model prediction surface aligns closely with the monitoring station data in most instances, except for a cluster of data points in the upper center of the plot. Figure 5-8 portrays the same plot as Figure 5-6, but with the CMAQ-estimated $PM_{2.5}$ surface added. The CMAQ surface features have more yellow shading within them, implying that the CMAQ concentration values somewhat underestimate the concentrations relative to the HB Model and the monitoring stations. However, in areas in which there are few or no monitoring stations, the HB Model surface corresponds closely with the CMAQ surface. This is to be expected, as the HB Model weighs (uses a bias adjustment of) the CMAQ data more heavily in areas without monitoring data.

Figure 5-9 displays the ozone concentration for the continental U.S. on July 26, 2005. The spheres represent the concentrations recorded at monitor locations. The green, blue, and yellow represent the HB concentration surface, which combines the CMAQ model estimates and the $PM_{2.5}$ monitor measurements.

5.5 Evaluation of HB Model Estimates

As reported in the McMillan paper (*Environmetrics*, 2010), model validation analysis was performed to compare the HB predictive results at 2001 STN/IMPROVE monitoring sites to predictions at those locations from two other approaches: (1) traditional kriging predictions based solely on the FRM monitoring data and (2) CMAQ output at these locations. In doing so, it was assumed the STN/IMPROVE measurements represent the "truth." The IMPROVE measurements are representative of rural areas (with few monitors) and may help assess the HBM results for these areas of interest. The potential bias in either the STN or IMPROVE gravimetric mass measurements compared to FRM data were not considered, although for gravimetric mass the monitors generally produce the same results. STN data collocated with FRM monitoring sites used in fitting the HB Model were eliminated from the validation data set, leaving 44 sites for the validation analysis.

In the validation analysis, mean squared prediction error and bias were calculated to evaluate the predictive capability of these three different models. To assess the ability of the HB Model to accurately characterize prediction uncertainty, the percentage of validation data within the 95 percent prediction credible interval was calculated. In the analysis, a similar analysis was performed for the kriging model by calculating 95 percent confidence intervals at the validation sites. An exponential variogram model was used for the kriging model. The exponential parameters were estimated by fitting this model to an empirical variogram based on combining the daily empirical variograms.

In this analysis, predictions for each day were obtained for the STN/IMPROVE site locations from the three modeling approaches and the validations statistics were calculated across all days and sites. The validation only occurs every third day, according to the sampling schedule of STN/IMPROVE. This corresponds to the full network FRM schedule. Thus, the analysis did not evaluate sparse monitoring days where data fusion is expected to outperform interpolation techniques based solely on the monitoring data.

In the analysis, the HBM was run several times using a range of reasonable priors. Then, the validation analysis assessed the relative predictive performance of the HBM, traditional kriging, and CMAQ as described above. In terms of mean squared prediction error (MSE), the HBM and kriging approaches provided similar results across all HBM runs. For bias, the HBM outperformed kriging by 10 to 15 percent depending on the prior assumptions for τ^X and τ^Y. CMAQ was nearly unbiased for this analysis.

Kriging uncertainties were reflected in the small percentage (59%) of kriging prediction intervals capturing the validation data. This compares to HBM predictive interval results of 80

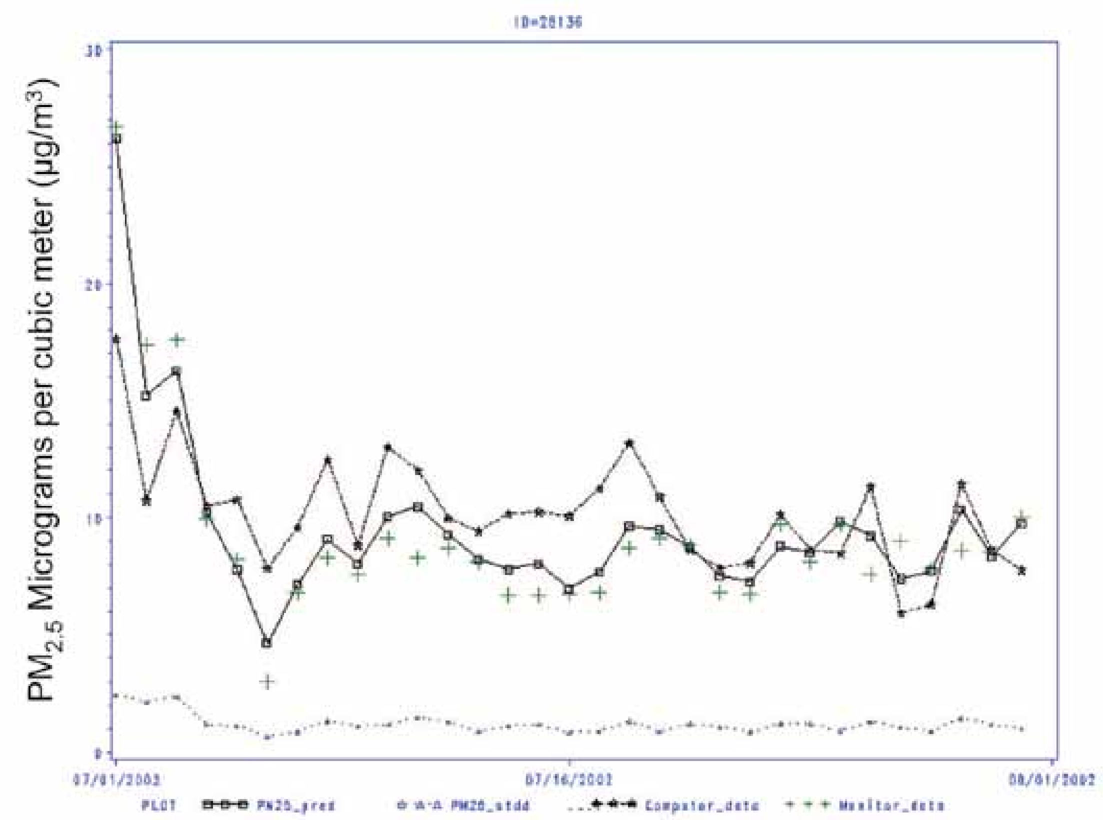


Figure 5-3. HB Prediction ($PM_{2.5}$) Temporally Matches AQS Data and CMAQ Estimates - Note: Computer_data = CMAQ Output

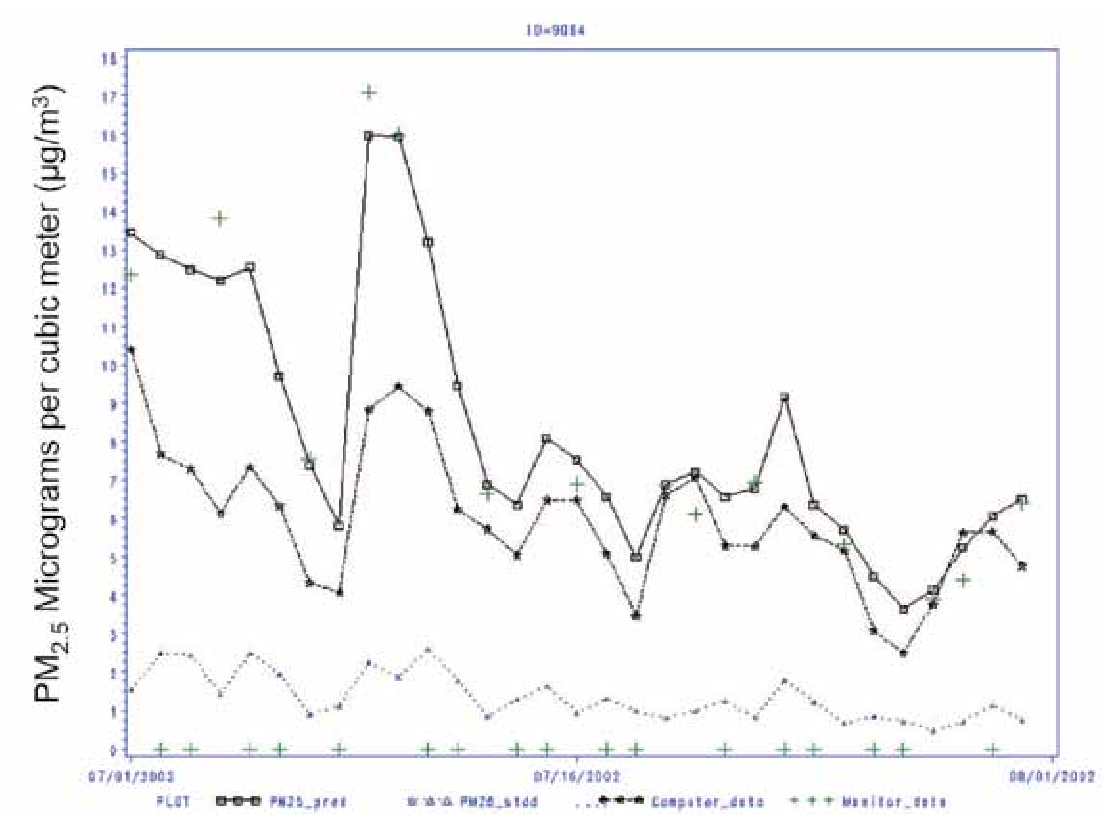


Figure 5-4. HB Prediction ($PM_{2.5}$) Compensates When AQS Data is Unavailable on FRM Monitor Non-Sampling Days - Note: Computer_data = CMAQ Output

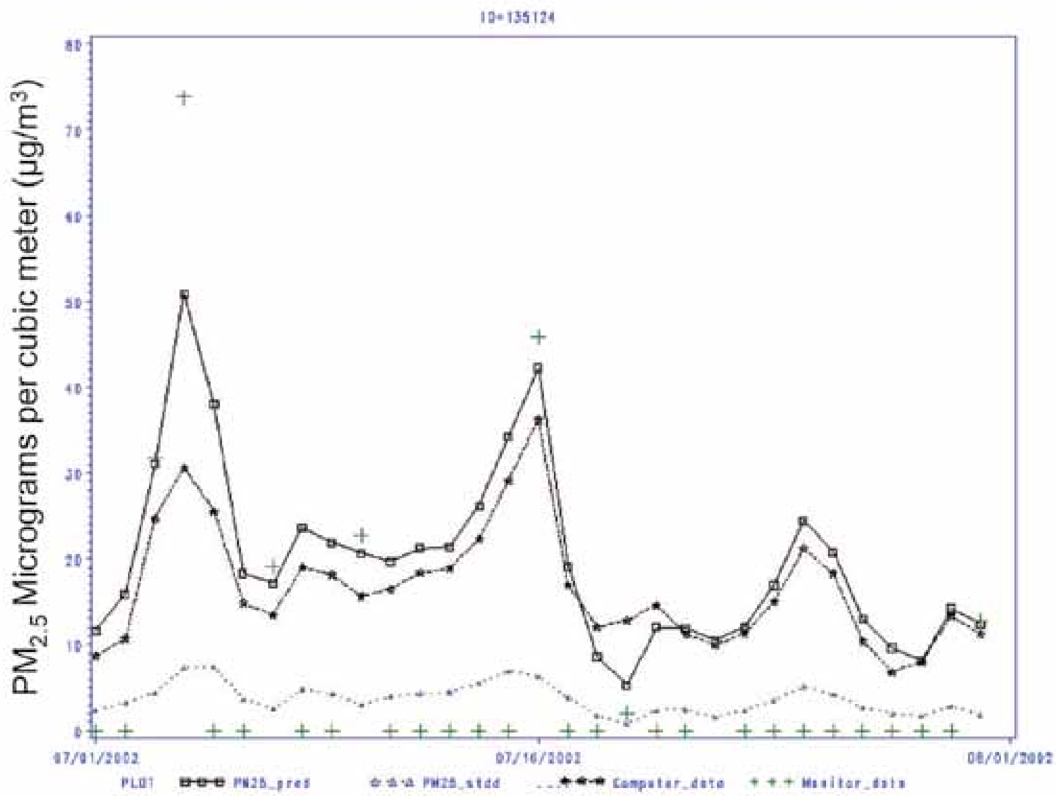


Figure 5-5. HB Prediction ($PM_{2.5}$) Mitigates CMAQ Bias when AQS and CMAQ Values Diverge - Note: Computer_data = CMAQ Output

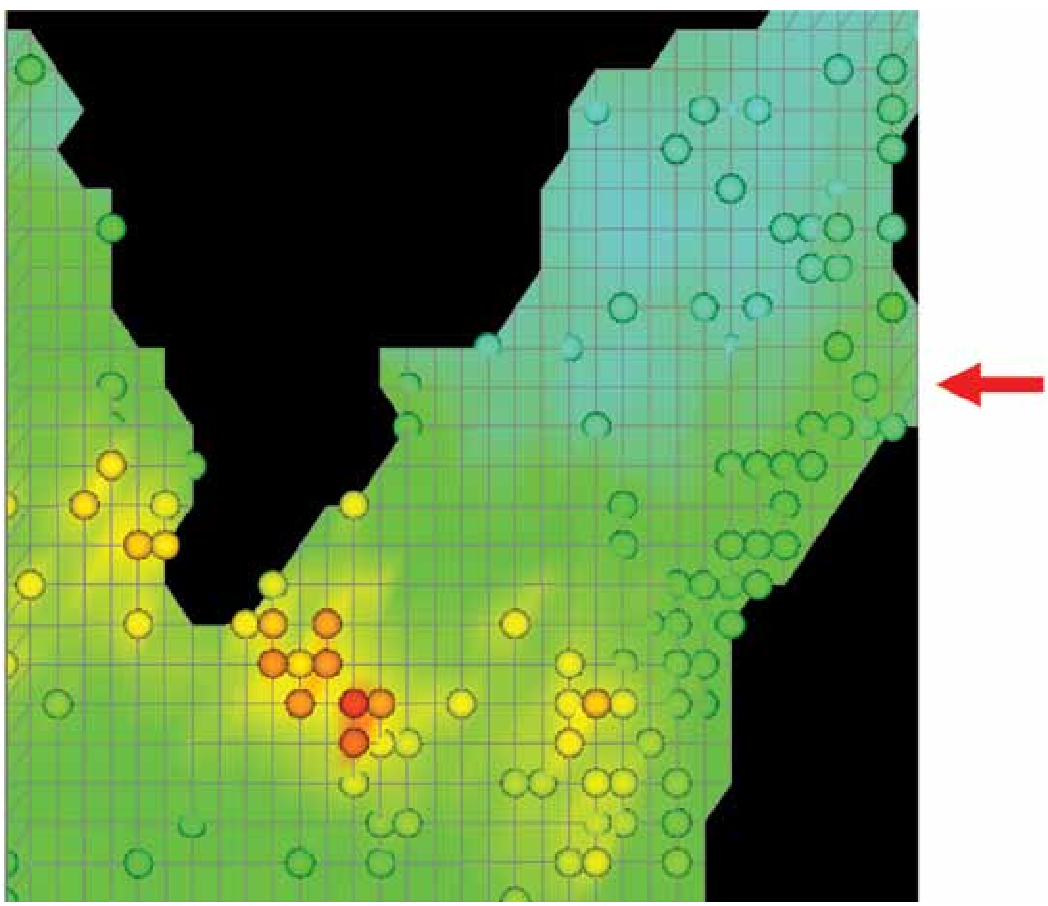


Figure 5-6. Plot of the Response Surface of $PM_{2.5}$ Concentrations as Predicted by the HB Model on a Specific Monitoring Day in the Northeast U.S., Along With $PM_{2.5}$ Measurements on a Specific Monitoring Day from FRM Monitors in the NAMS/SLAMS Network

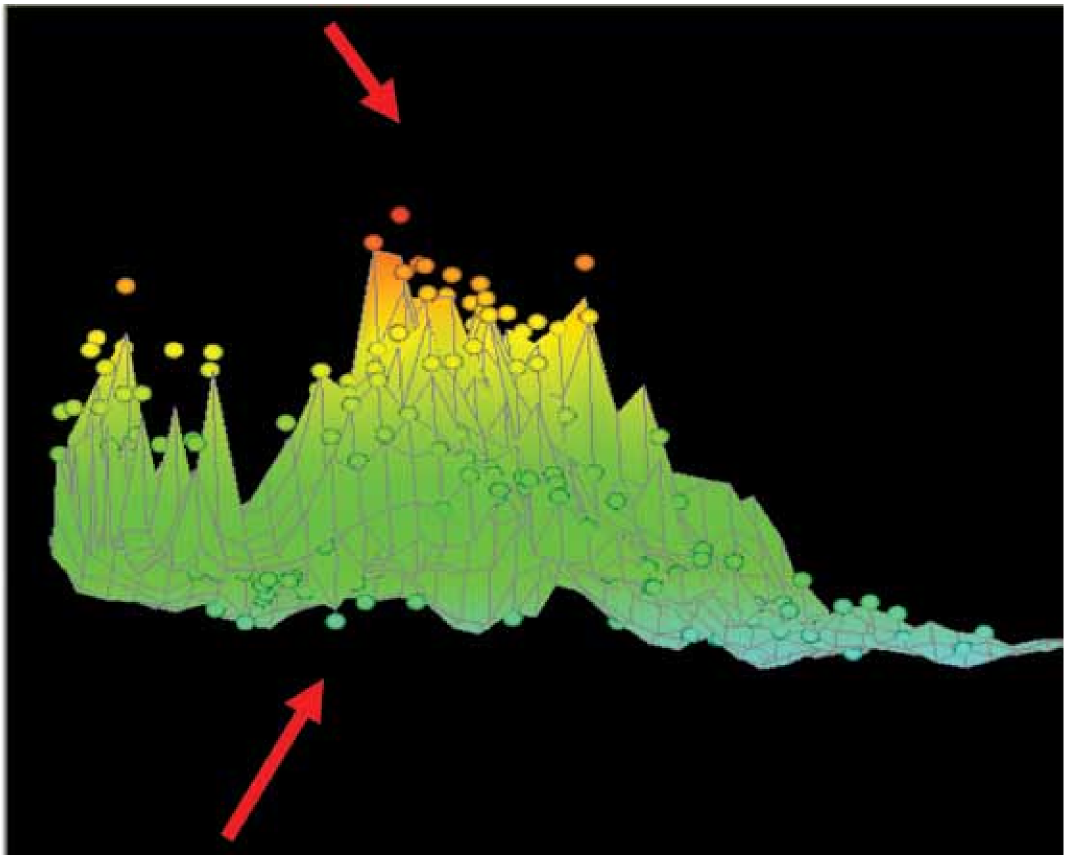


Figure 5-7. Rotated View of the Response Surface of $PM_{2.5}$ Concentrations as Predicted by the HBM on a Specific Monitoring Day in the Northeast U.S., Along With $PM_{2.5}$ Measurements on a Specific Monitoring Day from FRM Monitors in the NAMS/SLAMS Network

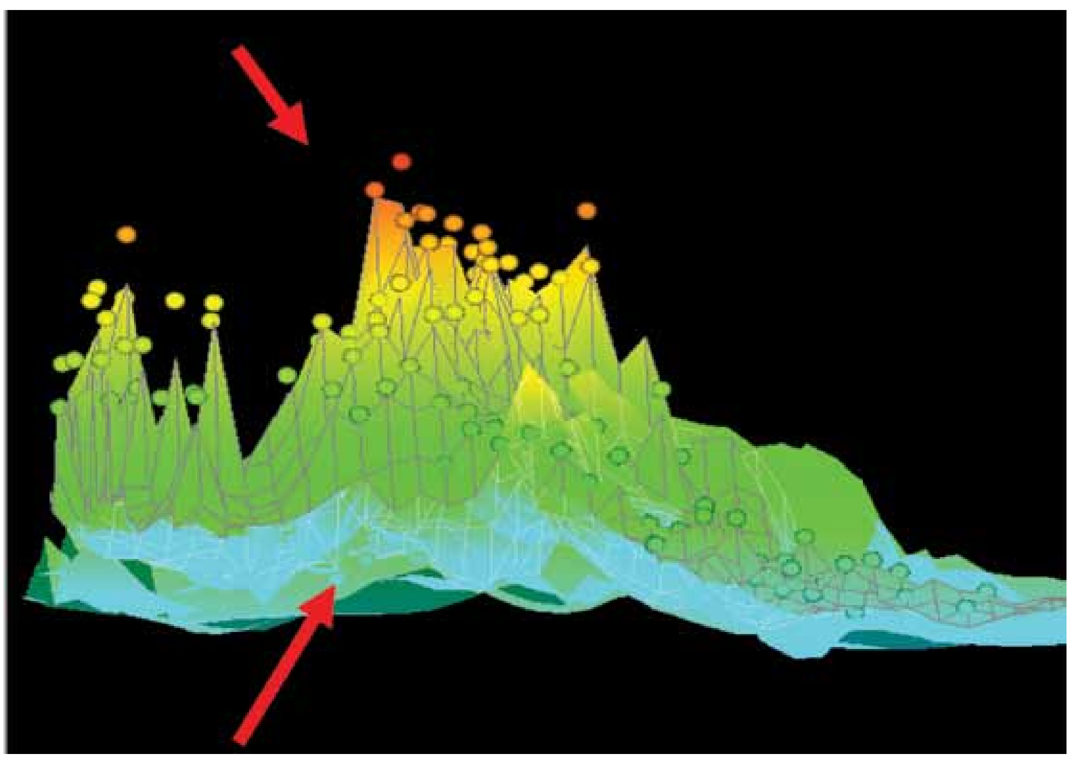


Figure 5-8. Rotated View of the Response Surface of $PM_{2.5}$ Concentrations as Predicted by the HBM on a Specific Monitoring Day in the Northeast U.S., Along With $PM_{2.5}$ Measurements on a Specific Monitoring Day from FRM Monitors in the NAMS/SLAMS Network, and the Response Surface as Predicted by the CMAQ Modeling System

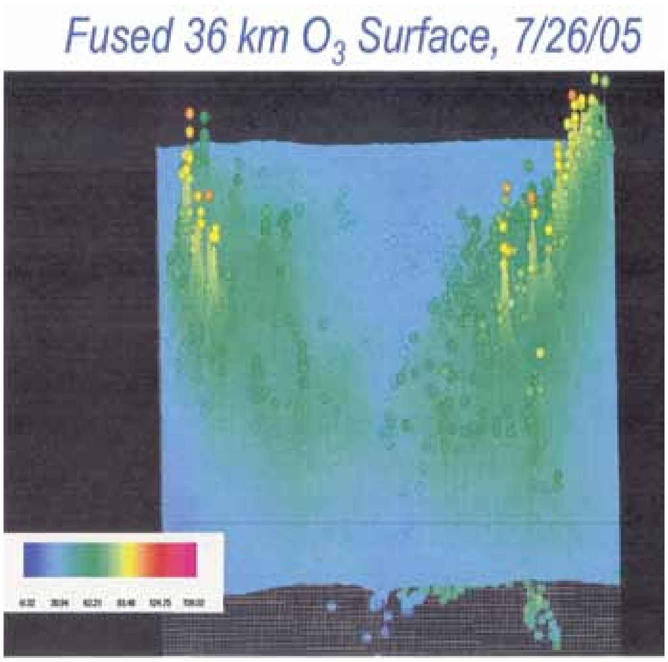


Figure 5-9. Fused 36 km O_3 Surface for the Continental U.S. (July 26, 2005).

to 90 percent depending on the HBM run. This occurs from the difference between the HBM results and the 95 percent nominal rate to the difference in the measurement errors in the validation to those in the FRM data used in fitting the HBM model. Unfortunately, error-free $PM_{2.5}$ monitoring data are not available with current $PM_{2.5}$ monitoring approaches.

5.6 Use of EPA HB Model Predictions

Over the next several years, NERL will be working to improve spatial and temporal estimates of ambient pollutant concentrations to facilitate improved modeling of human exposure. The goal is to improve exposure modeling for intracity and intercity exposure comparisons and to develop better understood exposure surrogates for use in air pollution health studies. Given the uncertain characterization of air quality, especially at locations at a distance from central monitoring sites, NERL has been working to develop the HB Model (and other approaches) for estimating ambient and exposure concentrations for use in health studies, benefits assessments, and other air program analyses.

The HB Model as developed by NERL is part of a continuing research program. Accordingly, it should be understood by users of the HB predictions that the underlying statistical model is continuing to be studied and improved. However, given the uncertain nature of air quality, especially at locations well-removed from monitoring sites, NERL has been working to develop the HB Model (and other approaches) for estimating ambient and exposure concentrations for use in health studies, benefits assessments, and other air program analyses. To encourage assessments of these predictions from the HB Model, NERL is making the predictions available based on a general DQO approach of determining whether the predictions from the HB Model are appropriate for use for these purposes. This approach allows use of uncertain results by providing the statistical error estimates for the predictions and an assessment of the predictions. In this manner, users can assess the effects of the uncertainty for the predictions with their studies.

Based on NERL's current model evaluation results, the HB Model predictions provide credible predictive surfaces of air quality (ozone and $PM_{2.5}$), in particular away from monitoring sites. The HB Model, as initially configured, predicts to the central tendency with the potential distributions (that is, each estimate represents a mean value from the distribution of possible values for each space-time point). This means that the HB Model will tend to under-predict very high values (the implications of this are being investigated). Nevertheless, the HB predictions, by "filling-in" pollutant concentration values for missing (non-monitored) locations and missing (unsampled) days of air quality estimates, are likely to be an improvement compared to simply using the monitoring results. In addition, as the HB Model is a space-time model, it is more credible than statistical interpolation of the monitoring data where there are missing monitoring data (this is the predominant issue for 1-in-3 day $PM_{2.5}$ monitoring sites across the U.S.). The HB Model, and other statistical methods, is more scientifically credible than simple mathematical techniques, such as inverse distance weighting.

Given the uncertainty and the complexity of using the HB Model predictions, careful use of the HB predictions is needed. Until a thorough study of several prediction years and scales (grid sizes) is completed, the results should be used by professionals with an ability to understand anomalous outcomes when using the predictions in a health study. An exception-based review of the HB predictions should be undertaken by each researcher, in the context of a study's data needs, to ensure "outliers" do not influence subsequent analyses. The HB predictions include a few very high values which cannot be rejected out-of-hand without further study. Studies of the representativeness of the HB Model predictions and additional experience with the prediction will provide a better understanding of the limits of using these predictions. The HB Model was initially designed for use as a source of air quality estimates in case-crossover analyses where temporal and spatial variability was needed. The predictions could be used within the EPHT program in health surveillance activities, to generate hypotheses for further studies, and as a basis for indicators in counties without monitors. They also can be used in Health Impact Assessments in place of interpolated monitoring data.

EPA continues to research approaches to combining air quality data and model results to predict statistically air quality estimates for use in health studies and elsewhere in the air program. There are key scientific questions that the HB Model (and other techniques) may help address. For example, determining the most representative scale (12 km or smaller scale) of ambient air quality measures (as surrogate for ambient exposure or personal exposure) for use in associating health outcome data with air quality changes needs to be better understood. The effect of (monitor) measurement variability and CMAQ bias on the usefulness of the HB predictions is also an important aspect for further improvement of air quality measures used in health studies.

Appendix A
Acronyms

ACRONYMS	
AirData	Database giving users access to air quality data collected at outdoor monitors across U.S.
AIRNow	Website providing public with access to national air quality information
AIRS	Aerometric Information Retrieval System
AMAD	Atmospheric Modeling and Analysis Division (of EPA/NERL)
AQS	Air Quality System database
ARW	Advanced Research WRF core model
ATSDR	Agency for Toxic Substances and Disease Registry (of CDC)
BAFM	Benzene, Acetaldehyde, Formaldehyde, and Methanol
BEIS	Biogenic Emissions Inventory System
BELD	Biogenic Emission Landuse Database
BlueSky	Emissions modeling framework
CAA	Clean Air Act
CAIR	Clean Air Interstate Rule
CAMD	EPA's Clean Air Markets Division
CAP	Criteria Air Pollutant
CAR	Conditional Auto Regressive spatial covariance structure (model)
CARB	California Air Resources Board
CASTNet	Clean Air Status and Trends Network
CDC	Centers for Disease Control and Prevention
CDX	Central Data Exchange
CEM	Continuous Emissions Monitoring
CERR	Consolidated Emissions Reporting Rule
CHIEF	Clearinghouse for Inventories and Emissions Factors
CMAS	Community Multiscale Analysis System
CMAQ	Community Multiscale Air Quality model
CMV	Commercial marine vessel
CNG	Compressed Natural Gas
CO	Carbon monoxide
CSN	Chemical Speciation Network
CV	Coefficient of Variation
DQO	Data Quality Objectives
ECA-IMO	Emissions Control Area-International Marine Organization
EEZ	Exclusive Economic Zone
EGU	Electric Generating Units
Emission Inventory	Listing of elements contributing to atmospheric release of pollutant substances
EMFAC	Emission Factor (California's onroad mobile model)
EPA	Environmental Protection Agency
EPHT	Environmental Public Health Tracking
ESD	Environmental Sciences Division (of EPA/NERL)
FAA	Federal Aviation Administration

ACRONYMS	
FB	Fractional Bias
FCCS	Fuel Characteristic Classification System
FDDA	Four Dimensional Data Assimilation
FE	Fractional Error
FEM	Federal Equivalent Method
FIPS	Federal Information Processing Standards
FRM	Federal Reference Method
HAP	Hazardous Air Pollutant
HBM	Hierarchical Bayesian Modeling
HEASD	Human Exposure and Atmospheric Sciences Division (of EPA/NERL)
HHS	Health and Human Services Department
HMS	Hazard Mapping System
HONO	Nitrous Acid
IAG	Interagency Agreement
ICS-209	Incident Status Summary form
IMPROVE	Interagency Monitoring of Protected Visual Environments
IPM	Integrated Planning Model
ITN	Itinerant
LDGV	Light Duty Gas Vehicle
LPG	Liquified Petroleum Gas
LSM	Land Surface Model
LWR	Long Wave Radiation
MACT	Maximum Achievable Control Technology
MM5	Mesoscale Model 5
MMS	Minerals Management Service
MOBILE	OTAQ's model for estimation of onroad mobile emissions factors
MODIS	Moderate Resolution Imaging Spectroradiometer
MOU	Memorandum of Understanding
MSAT	Mobile Source Air Toxics
MSE	Mean Square Error
MOVES	Motor Vehicle Emission Simulator
NAAQS	National Ambient Air Quality Standards
NAMS	National Ambient Air Monitoring Station
NEEDS	National Electric Energy Database System
NEI	National Emission Inventory
NERL	National Exposure Research Laboratory
NESHAP	National Emission Standards for Hazardous Air Pollutants
NH_3	Ammonia
NMB	Normalized Mean Bias
NME	Normalized Mean Error
NMIM	National Mobile Inventory Model
NO_2	Nitrogen Dioxide
NOAA	National Oceanic and Atmospheric Administration
NONROAD	OTAQ's model for estimation of nonroad mobile emissions
NO_x	Nitrogen oxides
OAQPS	EPA's Office of Air Quality Planning and Standards
OAR	EPA's Office of Air and Radiation
ORD	EPA's Office of Research and Development

ACRONYMS	
ORIS	Office of Regulatory Information Systems (code) - is a 4 or 5 digit number assigned by the Department of Energy's (DOE) Energy Information Agency (EIA) to facilities that generate electricity
ORL	One Record per Line
OTAQ	EPA's Office of Transportation and Air Quality
PAH	Polycyclic Aromatic Hydrocarbon
PEC	Particulate Elemental Carbon
PBL	Planetary Boundary Layer
PHASE	Public Health Air Surveillance Evaluation Project
PFC	Portable Fuel Container
PM	Particulate Matter
$PM_{2.5}$	Particulate matter less than or equal to 2.5 microns
PM_{10}	Particulate matter less than or equal to 10 microns
$PM_{10-2.5}$	Particulate matter with aerodynamic diameter between 2.5 and 10 microns
PMc	Coarse particulate matter (see definition for $PM_{10-2.5}$) (Coarse PM)
PMFINE	Primary particulate matter less than 2.5 micrometers in diameter
PNO_3	Primary Particulate nitrate
POC	Particulate Organic Carbon
Prescribed Fire	Intentionally set fire to clear vegetation
PSO_4	Primary Particulate sulfate
RIA	Regulatory Impact Analysis
RPO	Regional Planning Organization
RRTM	Rapid Radiative Transfer Model
SCC	Source Classification Code
SECA	Sulfur Emissions Control Area
SIP	State Implementation Plan
SLAMS	State and Local Air Monitoring Stations
SMARTFIRE	Satellite Mapping Automatic Reanalysis Tool for Fire Incident Reconciliation
SMOKE	Sparse Matrix Operator Kernel Emissions
SO_2	Sulfur Dioxide
SOA	Secondary Organic Aerosol
TCEQ	Texas Commission on Environmental Quality
TEOM	Tapered Element Oscillating Microbalance
TOG	Total Organic Gases
TRI	Toxic Release Inventory
TSD	Technical support document
VOC	Volatile organic compounds
VMT	Vehicle miles traveled
Wildfire	Uncontrolled forest fire
WRAP	Western Regional Air Partnership
WRF	Weather Research and Forecasting Model

Appendix B

U.S. 2008 Emissions Inventory Totals by: Sector, Pollutant Species, and Region (e.g., US State, Canadian Province, or Mexican Federal State)

Sector	CO	NH_3	NO_x	PM_{10}	PM_{25}	SO_2	VOC
afdust				5,694,058	792,141		
ag		3,569,837					
c1c2rail	237,860	636	1,438,940	49,163	46,364	50,358	54,524
nonpt	5,225,880	169,918	1,266,655	1,660,293	936,028	592,585	6,603,445
nonroad	17,895,250	2,074	1,874,385	183,854	175,326	31,766	2,445,581
onroad*	35,987,232	137,064	7,452,168	318,388	243,744	66,370	3,147,282
ptfire	30,326,302	496,460	348,254	3,026,530	2,564,856	207,860	7,136,612
ptipm	679,542	24,294	3,066,741	421,782	349,378	7,843,262	36,677
ptnonipm	2,932,043	69,114	2,045,916	581,026	380,814	1,577,530	1,055,754
c3marine	13,195		142,243	12,932	11,871	108,779	5,082
Con.US Total	93,297,303	4,469,397	17,635,302	11,948,027	5,500,523	10,478,508	20,484,957
* onroad emissions are the sum of on_noadj, startpm, and runpm sectors							

Table B-1a - 2008 Emissions Summary (tons/year), by Species and by Emission Sector/Source

Country & Sector	[tons/yr] CO	[tons/yr] NH_3	[tons/yr] NO_x	[tons/yr] PM_{10}	[tons/yr] $PM_{2.5}$	[tons/yr] SO_2	[tons/yr] VOC*
Canada othar	3,756,550	539,370	720,293	1,424,994	394,648	98,047	1,277,485
Canada othon	4,528,720	21,883	539,473	15,053	10,669	5,448	277,959
Canada othpt	1,151,363	21,194	863,597	117,583	68,306	1,767,089	431,876
Canada Subtotal	9,436,633	582,447	2,123,362	1,557,630	473,623	1,870,584	1,987,320
Mexico othar	351,324	255,125	171,396	75,679	49,111	82,908	398,409
Mexico othon	1,069,878	1,904	110,580	5,168	4,735	6,143	137,234
Mexico othpt	68,615	0	224,853	97,422	72,471	651,756	58,664
Mexico Subtotal	1,489,817	257,029	506,829	178,269	126,317	740,807	594,307
Offshore othpt	90,046	0	82,797	842	839	1,966	51,240
Canada c3marine	12,909		155,913	12,944	11,861	96,028	5,470
Offshore c3marine	77,199		930,958	77,552	71,307	577,849	32,730
2008 TOTAL	11,093,696	839,476	3,643,946	1,814,293	672,085	3,191,206	2,665,597
"* - VOC emissions are inventory (""actual"" VOC), gridded (within 12km US1 grid). Canada othpt includes a sum of all pre-speciated inventory gridded VOC."							

Table B-1b - 2008 Emissions Summary (tons/year), by Species, for Canada, Mexico, and Offshore Emission Sectors

Sector	ALDX	BENZENE	CL_2	CO	HCL	HONO	NH_3	NO	NO_2
ptipm	3	1,748	171	677,603	236,309	0	24,231	2,761,256	306,806
ptnonipm	10,848	37,898	3,228	2,939,606	47,380	1,054	69,251	1,845,924	204,049
othpt	903	33,970		1,151,363		0	21,194	777,237	86,360
ptfire	222,482	169,630		30,329,749		0	496,516	313,459	34,829
nonpt	70,938	51,497	1,605	5,210,185	5,465	0	169,911	1,136,008	126,223
on_noadj	41,369	90,484		35,995,095		59,232	136,992	6,759,289	585,477
nonroad	23,278	55,955		17,987,121		14,896	2,073	1,675,826	171,307
othar	33,802	62,151		4,107,874		5,911	794,495	802,514	83,265
othon	3,681	19,002		5,598,598		5,200	23,787	585,048	59,805
ag	4,944	1,446					3,574,855		
c1c2rail	5,881	319	0.04	238,511		11,543	638	1,298,594	132,745
afdust									
c3marine	307	0.43		103,339		9,835		1,106,523	113,146
beis	271,060			8,852,668				2,013,686	
ocean_cl2			79,028						
on_moves_runpm									
on_moves_startpm									
SMOKE TOTAL	689,496	524,101	84,032.2	113,191,712	289,153	107,671	5,313,942	21,075,364	1,904,011

Table B-2a 2008 Species Emission by Sector

Sector	PCA	PEC	PH_{2O}	PMC	PMFINE	PNO_3	POC	PSO_4	PTI	SO_2	SULF
ptipm	11,623	20,699	78	104,345	273,462	568	17,124	36,361	1,394	7,818,020	172,370
ptnonipm	8,709	36,289	4,052	203,561	237,954	3,677	51,142	52,461	1,485	1,581,458	12,515
othpt	1	3,619	1,470	49,277	51,894	282	5,995	6,515	0	1,767,089	0
ptfire	5,998	260,962	0	461,726	1,033,548	15,048	1,234,826	20,759	901	207,881	0
nonpt	2,792	61,990	570	715,393	466,331	2,606	383,328	16,741	526	586,868	9,293
on_noadj		119,769		68,927	22,351	215	35,685	1,443		50,468	0
nonroad	102	96,525	0	8,556	29,092	228	48,358	578	2	31,491	0
othar	11,896	55,636	836	1,056,914	261,610	979	115,959	9,574	680	180,954	1,950
othon	21	8,498	0	4,817	1,918	20	4,890	78	0	11,591	0
ag	158	378	137	16,689	3,677	679	2,334	327	4		
c1c2rail	27	35,845	0	2,807	2,274	53	8,182	137	0.19	50,496	0
afdust	38,807	1,166	1,044	4,901,917	750,047	663	36,373	3,892	3,292		
c3marine	246	475	35,196	8,392	47,725	0	10,704	36,167	4.76	782,954	0
beis											
ocean_cl2											
on_moves_runpm		5,354		3,783	6,667	14	31,749	206			
on_moves_startpm		6,075		1,533	2,149	11	9,585	7			
SMOKE TOTAL	80,380	713,283	43,383	7,608,637	3,190,701	25,043	1,996,235	185,245	8,289.1	13,069,271	196,129

Table B-2b 2008 Species Emission by Sector

Sector	ALDX	BENZENE	CL_2	CO	HCL	HONO	NH_3	NO	NO_2
MODEL READY US ONLY				93,481,209				16,896,879	1,674,582
Low level totals	464,684	338,321	82,635	79,274,228	10,182	97,886	4,727,053	15,085,733	1,248,238
ptipm elevated	3	1,743	171	674,667	235,230	0	24,124	2,750,244	305,583
ptnonipm elevated	2,609	15,604	1,226	2,044,690	43,742	0	46,209	1,393,715	154,857
c3marine elevated	307	0	0	103,339	0	9,835	0	1,106,523	113,146
othpt elevated	163	510	0	971,263	0	0	21,194	710,032	78,892
ptfire elevated	222,482	169,630	0	30,329,749	0	0	496,516	313,459	34,829
Model-ready domain totals	690,248.5	525,808.9	84,031.9	113,397,936	289,154	107,721	5,315,096	21,359,705	1,935,545

Table B-2c 2008 Species Emission by Sector

Sector	PCA	PEC	PH2O	PMC	PMFINE	PNO_3	POC	PSO_4	PTI	SO_2	SULF
MODEL READY US ONLY											
Low level totals	57,484	409,542	4,145	6,902,011	1,645,313	6,820	696,187	47,824	6,117	1,111,155	12,322
ptipm elevated	11,572	20,511	78	103,338	272,175	561	17,000	36,182	1,387	7,758,359	171,542
ptnonipm elevated	5,236	21,959	2,558	87,721	148,772	2,478	35,194	40,076	411	1,479,486	12,265
c3marine elevated	246	475	35,196	8,392	47,725	0	10,704	36,167	5	782,954	0
othpt elevated	1,232	2,728	1,601	72,744	96,453	355	9,405	16,472	132	2,383,677	10,971
ptfire elevated	5,998	260,962	0	461,726	1,033,548	15,048	1,234,826	20,759	901	207,881	0
Model-ready domain totals	81,768	716,177	43,579	7,635,932	3,243,986	25,261	2,003,317	197,480	8,952	13,723,512	207,100

Table B-2d 2008 Species Emission by Sector

Inventory State	CO	NO_x	PM_{10}	$PM_{2.5}$	NH_3	SO_2	VOC	CHLORINE	HCL
Alabama	11,479	113,954	5,246	2,820	577	369,333	1,058		3,887
Arizona	8,608	41,900	3,529	2,830	923	43,708	492		1,939
Arkansas	4,251	37,699	2,074	1,266	261	73,283	495		8,123
California	7,700	5,130	1,303	1,277	985	659	549		2
Colorado	5,177	61,855	1,628	527	468	56,683	508	22	148
Connecticut	8,898	3,927	552	487	283	7,695	149		1,128
Delaware	766	9,154	2,156	1,883	144	33,667	80		2,286
District of Columbia	3	29	4	3	0	57	0		
Florida	33,338	159,684	15,655	17,602	3,635	267,793	1,995	1	16,832
Georgia	11,702	107,550	12,750	6,003	1,058	516,020	1,563		20,126
Illinois	16,905	125,119	9,126	7,302	197	281,824	1,625		2,211
Indiana	16,144	199,533	106,924	100,438	352	601,085	1,998		18,664
Iowa	26,908	48,901	8,074	5,568	22	109,284	642	45	1,201
Kansas	8,305	52,788	3,193	1,756	359	95,905	757	4	344
Kentucky	15,601	158,934	9,441	34,287	795	348,551	1,599		8,514
Louisiana	35,024	45,609	7,476	4,760	1,477	88,331	1,091	0	7,125
Maine	565	689	96	85	57	1,039	38		0
Maryland	3,748	36,067	7,648	5,949	202	227,929	331		6,350
Massachusetts	3,633	9,525	836	677	196	46,523	332		1,801
Michigan	13,110	108,497	4,442	3,054	207	332,417	1,203	4	21,981
Minnesota	6,877	60,460	8,455	3,508	202	75,230	655	8	2,818
Mississippi	8,257	43,164	2,057	1,136	481	65,874	569		1,740
Missouri	21,002	93,055	9,566	6,103	143	276,777	1,601	0	2,753
Montana	2,899	28,231	722	734	6	21,539	410		489
Nebraska	3,466	42,981	2,305	1,879	192	75,701	443		7,672
Nevada	1,295	14,192	915	361	225	9,469	159	0	1,400
New Hampshire	990	4,654	524	281	154	36,902	94	2	936
New Jersey	3,105	13,543	4,648	4,613	174	24,710	281		1,544
New Mexico	16,082	28,752	696	678	274	11,844	281	0	23
New York	12,656	35,698	4,063	2,518	1,705	70,841	814	2	2,880
North Carolina	19,198	60,066	23,407	19,368	150	232,709	989	2	14,053
North Dakota	7,150	67,340	1,546	305	369	132,566	744		181
Ohio	15,663	242,302	49,732	44,770	66	753,437	1,320		17,260
Oklahoma	12,534	79,329	5,651	3,528	718	107,712	1,058		681
Oregon	962	9,417	1,112	706	252	11,358	226		30
Pennsylvania	20,823	186,334	16,476	7,893	423	867,793	762	7	22,968
Rhode Island	169	200	5	5	4	5	8		
South Carolina	11,326	45,740	18,299	14,579	283	160,976	553	2	5,641
South Dakota	572	13,851	242	229	34	13,537	126		1,374
Tennessee	6,918	86,496	7,167	5,320	207	212,619	894		5,106
Texas	221,564	155,616	21,425	11,619	4,406	482,400	3,624	17	3,999
Tribal	5,115	82,221	10,626	7,025	306	15,205	611		114
Utah	3,882	60,543	1,968	906	23	20,191	289	2	458
Vermont	1,194	296	44	43	15	2	33	2	40

Inventory State	CO	NO_x	PM_{10}	$PM_{2.5}$	NH_3	SO_2	VOC	CHLORINE	HCL
Virginia	5,617	51,787	3,027	1,552	269	132,093	548	3	5,194
Washington	2,641	10,920	489	459	92	2,322	15		4
West Virginia	9,925	100,349	6,303	4,616	33	312,268	1,191	0	3,301
Wisconsin	12,736	50,263	3,367	337	452	134,639	1,044	48	1,567
Wyoming	13,061	72,398	14,794	5,733	440	80,758	828		10,062
Con. US	679,542	3,066,741	421,782	349,378	24,294	7,843,262	36,677	171	236,949

Table B-3a - 2008 Integrated Planning Model Point Source (ptipm) Emissions by Species and by US State

Modeled State	ALD_2	ALDX	BENZENE	CH4	CL_2	CO	ETH	ETHA	ETOH	FORM	HCL
Alabama	0	0	39	559	0	11,448	2	178	0	234	3,876
Arizona	0	0	17	332	0	8,582	0	70	0	134	1,934
Arkansas	2	2	21	48	0	4,240	4	83	2	17	8,098
California	0	0	32	1,026	0	7,515	22	8	0	274	2
Colorado	0	0	19	217	22	5,163	0	91	0	89	148
Connecticut	0	0	4	151	0	8,874	2	15	0	72	1,125
Delaware	0	0	3	36	0	763	0	13	0	14	2,280
District of Columbia	0	0	0	0	0	3	0	0	0	0	0
Florida	0	0	74	2,012	1	33,260	58	182	0	786	16,785
Georgia	0	0	68	220	0	11,677	0	317	0	92	20,077
Illinois	0	0	74	75	0	16,859	1	347	0	24	2,206
Indiana	0	0	89	103	0	16,070	0	415	0	48	18,614
Iowa	0	0	30	15	45	26,823	1	137	0	2	1,198
Kansas	0	0	38	85	4	8,278	6	149	0	12	343
Kentucky	0	0	73	41	0	15,558	0	341	0	16	8,490
Louisiana	0	0	55	825	0	34,923	0	100	0	274	7,102
Maine	0	0	0	75	0	563	0	0	0	35	0
Maryland	0	0	15	9	0	3,737	0	69	0	4	6,333
Massachusetts	0	0	9	729	0	3,623	7	134	0	98	1,796
Michigan	0	0	58	203	4	13,082	8	238	4	68	21,920
Minnesota	0	0	47	90	8	6,860	23	131	17	14	2,810
Mississippi	0	0	23	703	0	8,245	0	43	0	245	1,734
Missouri	0	0	70	214	0	20,961	1	327	0	87	2,746
Montana	0	0	19	46	0	2,891	8	88	0	0	487
Nebraska	0	0	21	3	0	3,456	3	95	0	0	7,651
Nevada	0	0	5	78	0	1,291	0	22	0	43	1,395
New Hampshire	0	0	7	37	2	987	5	15	4	14	932
New Jersey	0	0	5	421	0	3,100	1	22	0	176	1,540
New Mexico	0	0	15	155	0	16,041	0	40	0	41	23
New York	0	0	45	703	2	12,638	10	57	0	222	2,871
North Carolina	0	0	53	84	2	19,168	11	203	9	27	14,029
North Dakota	0	0	34	0	0	7,128	0	161	0	0	180
Ohio	0	0	60	12	0	15,619	0	284	0	5	17,213

Modeled State	ALD_2	ALDX	BENZENE	CH4	CL_2	CO	ETH	ETHA	ETOH	FORM	HCL
Oklahoma	0	0	54	690	0	12,510	0	137	0	195	679
Oregon	0	0	3	359	0	958	0	15	0	154	30
Pennsylvania	0	0	33	394	7	20,774	7	127	2	145	22,910
Rhode Island	0	0	0	18	0	169	0	0	0	8	0
South Carolina	0	0	47	114	2	11,303	27	104	23	27	5,625
South Dakota	0	0	6	0	0	571	0	27	0	0	1,371
Tennessee	0	0	41	18	0	6,897	0	191	0	9	5,091
Texas	0	0	176	2,506	17	220,982	18	470	0	760	3,987
Tribal Data	0	0	28	0	0	5,099	0	132	0	0	114
Utah	0	0	13	67	2	3,871	1	62	0	14	456
Vermont	0	0	11	23	2	1,190	11	3	10	0	40
Virginia	0	0	22	133	3	5,602	1	98	0	76	5,178
Washington	0	0	1	0	0	2,631	0	3	0	0	4
West Virginia	0	0	55	6	0	9,898	0	256	0	2	3,292
Wisconsin	0	0	99	222	48	12,701	68	203	44	4	1,563
Wyoming	0	0	38	12	0	13,019	0	178	0	5	10,028
Domain total	3	3	1,748	13,872	171	677,603	310	6,385	116	4,567	236,309

Table B-3b - 2008 Integrated Planning Model Point Source (ptipm) Emissions by Species and by US State

Modeled State	HONO	IOLE	ISOP	MEOH	NH_3	NH_3_FERT	NO	NO_2	NO_x	NVOL
Alabama	0	0	0	0	576	0	102,224	11,358	113,582	0
Arizona	0	0	0	1	920	0	38,501	4,278	42,779	0
Arkansas	0	1	0	2	261	0	33,757	3,751	37,508	0
California	0	0	0	0	979	0	5,134	570	5,704	0
Colorado	0	0	0	0	467	0	55,783	6,198	61,981	0
Connecticut	0	0	0	0	282	0	3,533	393	3,926	0
Delaware	0	0	0	0	143	0	8,337	926	9,263	0
District of Columbia	0	0	0	0	0	0	84	9	94	0
Florida	0	0	0	0	3,626	0	145,651	16,183	161,835	0
Georgia	0	0	0	0	1,056	0	97,028	10,781	107,809	0
Illinois	0	0	0	0	197	0	112,320	12,480	124,800	0
Indiana	0	0	0	0	351	0	179,431	19,937	199,368	0
Iowa	0	0	0	0	22	0	44,007	4,890	48,897	0
Kansas	0	0	0	0	358	0	47,715	5,302	53,017	0
Kentucky	0	0	0	0	792	0	142,107	15,790	157,896	0
Louisiana	0	0	0	0	1,474	0	44,446	4,938	49,385	0
Maine	0	0	0	0	56	0	627	70	697	0
Maryland	0	0	0	0	201	0	32,989	3,665	36,655	0
Massachusetts	0	2	0	0	196	0	8,586	954	9,540	0
Michigan	0	0	0	0	207	0	96,214	10,690	106,904	0
Minnesota	0	0	0	0	201	0	54,464	6,052	60,515	0
Mississippi	0	0	0	0	480	0	38,909	4,323	43,233	0

Modeled State	HONO	IOLE	ISOP	MEOH	NH_3	NH_3_FERT	NO	NO_2	NO_X	NVOL
Missouri	0	0	0	0	143	0	83,830	9,314	93,144	0
Montana	0	0	0	0	6	0	26,741	2,971	29,713	0
Nebraska	0	0	0	0	191	0	38,855	4,317	43,173	0
Nevada	0	0	0	0	224	0	14,404	1,600	16,004	0
New Hampshire	0	0	0	0	153	0	4,188	465	4,654	0
New Jersey	0	0	0	0	173	0	12,284	1,365	13,649	0
New Mexico	0	0	0	0	273	0	25,741	2,860	28,601	0
New York	0	0	0	0	1,700	0	31,876	3,542	35,418	0
North Carolina	0	0	0	0	149	0	53,519	5,947	59,466	0
North Dakota	0	0	0	0	368	0	60,166	6,685	66,851	0
Ohio	0	0	0	0	66	0	215,851	23,983	239,835	0
Oklahoma	0	0	0	0	716	0	73,378	8,153	81,531	0
Oregon	0	0	0	0	251	0	8,517	946	9,463	0
Pennsylvania	0	0	0	0	422	0	167,223	18,580	185,804	0
Rhode Island	0	0	0	0	4	0	180	20	200	0
South Carolina	0	0	0	0	282	0	39,763	4,418	44,181	0
South Dakota	0	0	0	0	34	0	12,467	1,385	13,852	0
Tennessee	0	0	0	0	206	0	77,473	8,608	86,081	0
Texas	0	0	0	0	4,395	0	142,888	15,876	158,764	0
Tribal Data	0	0	0	0	305	0	74,017	8,224	82,241	0
Utah	0	0	0	0	23	0	55,559	6,173	61,732	0
Vermont	0	0	0	0	15	0	266	30	296	0
Virginia	0	0	0	0	268	0	38,529	4,281	42,810	0
Washington	0	0	0	0	92	0	9,827	1,092	10,919	0
West Virginia	0	0	0	0	33	0	89,458	9,940	99,398	0
Wisconsin	0	0	0	0	451	0	44,920	4,991	49,911	0
Wyoming	0	0	0	0	439	0	67,488	7,499	74,986	0
Domain total	0	4	1	3	24,231		2,761,256	306,806	3,068,063	1

Table B-3c - 2008 Integrated Planning Model Point Source (ptipm) Emissions by Species and by US State

Modeled State	OLE	PAL	PAR	PCA	PCL	PEC	PFE	PH2O	PK	PM_{10}
Alabama	41	148	450	86	2	202	72	0	12	5,231
Arizona	16	90	201	52	1	90	44	30	7	3,869
Arkansas	25	69	260	40	1	80	34	0	5	2,067
California	2	1	226	1	0	483	0	0	0	1,297
Colorado	21	23	229	13	0	72	11	0	2	1,623
Connecticut	4	18	52	12	25	18	11	0	5	551
Delaware	3	108	40	63	1	101	53	0	8	2,151
District of Columbia	0	0	0	0	0	0	0	0	0	4
Florida	57	701	851	406	15	1,865	344	0	54	20,224
Georgia	73	340	809	197	4	354	167	0	26	12,723
Illinois	82	429	882	248	8	339	210	0	34	9,102

Modeled State	OLE	PAL	PAR	PCA	PCL	PEC	PFE	PH2O	PK	PM_{10}
Indiana	96	5,890	1,075	3,404	62	4,398	2,882	1	458	106,345
Iowa	32	330	352	191	5	243	161	0	26	8,049
Kansas	38	99	421	57	1	103	49	0	8	3,183
Kentucky	79	2,039	867	1,178	21	1,478	997	0	158	35,434
Louisiana	23	94	612	114	1	984	51	1	8	7,457
Maine	0	0	4	0	0	27	0	0	0	103
Maryland	16	352	182	203	4	260	172	0	27	7,627
Massachusetts	18	12	170	7	1	99	6	0	1	834
Michigan	56	122	622	75	5	219	60	0	73	5,152
Minnesota	32	184	324	109	4	152	90	0	50	8,430
Mississippi	10	25	225	14	0	294	12	0	2	2,053
Missouri	76	358	830	207	4	293	175	0	28	9,544
Montana	20	39	221	48	1	26	21	0	3	1,205
Nebraska	24	111	241	64	1	81	54	0	9	2,298
Nevada	5	13	70	8	0	55	7	0	1	913
New Hampshire	4	14	40	8	0	19	7	0	2	523
New Jersey	6	240	59	139	3	397	117	0	19	4,637
New Mexico	9	32	153	18	0	78	16	0	2	694
New York	18	56	477	32	3	405	27	0	4	4,053
North Carolina	48	1,148	514	663	12	857	561	0	90	23,358
North Dakota	37	12	407	44	0	4	8	0	1	1,541
Ohio	66	2,454	721	1,418	26	1,952	1,200	45	191	49,589
Oklahoma	32	162	558	94	2	426	79	0	13	5,635
Oregon	4	27	39	16	0	114	13	0	2	1,109
Pennsylvania	29	448	360	259	5	408	219	0	35	16,435
Rhode Island	0	0	0	0	0	2	0	0	0	5
South Carolina	25	850	255	493	10	649	416	0	84	18,254
South Dakota	6	14	69	8	0	10	7	0	1	242
Tennessee	44	313	485	181	6	237	154	0	25	7,150
Texas	119	343	1,810	762	6	1,869	210	1	33	21,366
Tribal Data	30	418	335	242	4	300	205	0	32	10,593
Utah	14	51	153	30	1	54	25	0	4	1,962
Vermont	1	0	4	0	0	2	0	0	4	43
Virginia	23	65	280	38	2	108	32	0	5	3,028
Washington	1	25	8	15	0	32	12	0	2	487
West Virginia	59	274	653	158	3	199	134	0	21	6,284
Wisconsin	49	19	493	11	0	17	9	0	2	3,358
Wyoming	41	341	450	197	4	245	167	0	27	14,746
Domain total	1,513	18,904	18,540	11,623	255	20,699	9,303	78	1,605	452,559

Table B-3d - 2008 Integrated Planning Model Point Source (ptipm) Emissions by Species and by US State

Modeled State	$PM_{2.5}$	PMC	PMFINE	PMG	PMN	PMOTHR	PNA	PNCOM	PNH_4
Alabama	2,812	2,419	2,152	0	1	1,532	0	56	9
Arizona	2,821	1,048	2,292	0	0	1,859	0	60	5
Arkansas	1,262	805	987	0	0	702	0	23	4
California	1,271	26	342	0	0	213	0	124	0
Colorado	525	1,098	350	0	0	245	0	19	1
Connecticut	486	65	379	0	0	244	1	10	16
Delaware	1,879	272	1,513	0	1	1,073	0	27	6
District of Columbia	3	1	1	0	0	1	0	0	0
Florida	17,559	2,664	11,838	0	3	8,662	0	501	41
Georgia	5,991	6,732	4,770	0	2	3,375	0	101	20
Illinois	7,283	1,819	5,948	0	2	4,211	0	100	27
Indiana	99,938	6,407	81,766	0	28	57,996	0	1,377	343
Iowa	5,550	2,499	4,558	0	2	3,230	0	72	20
Kansas	1,751	1,432	1,394	0	0	987	0	29	6
Kentucky	34,191	1,244	28,116	0	10	19,931	0	438	119
Louisiana	4,749	2,708	2,310	5	0	1,509	1	358	6
Maine	85	19	26	0	0	19	0	7	0
Maryland	5,932	1,695	4,867	0	2	3,453	0	77	21
Massachusetts	674	159	356	0	0	284	0	26	1
Michigan	3,048	2,103	2,153	1	1	1,365	1	153	7
Minnesota	3,498	4,932	2,760	1	1	1,868	1	96	11
Mississippi	1,135	919	530	0	0	359	0	76	1
Missouri	6,090	3,453	4,960	0	2	3,514	0	85	21
Montana	732	473	560	2	0	348	0	30	3
Nebraska	1,874	424	1,539	0	1	1,092	0	24	6
Nevada	359	553	225	0	0	158	0	15	1
New Hampshire	281	242	213	0	0	151	0	6	1
New Jersey	4,602	36	3,461	0	1	2,443	0	106	14
New Mexico	676	18	475	0	0	334	0	21	2
New York	2,512	1,541	1,363	0	0	1,044	0	104	3
North Carolina	19,326	4,032	15,852	0	5	11,235	0	254	67
North Dakota	304	1,237	189	3	0	62	1	35	1
Ohio	44,642	4,947	36,640	0	12	26,616	0	653	143
Oklahoma	3,520	2,116	2,445	0	1	1,715	0	114	9
Oregon	703	405	441	0	0	307	0	30	2
Pennsylvania	7,874	8,561	6,314	0	2	4,492	0	118	26
Rhode Island	5	0	1	0	0	1	0	0	0
South Carolina	14,543	3,711	11,865	0	4	8,367	0	218	50
South Dakota	228	14	188	0	0	133	0	3	1
Tennessee	5,304	1,846	4,344	0	1	3,075	0	71	20
Texas	11,588	9,778	6,257	45	2	3,274	9	951	29
Tribal Data	7,004	3,590	5,764	0	2	4,087	0	89	24
Utah	903	1,059	718	0	0	508	0	15	3
Vermont	42	1	23	0	0	7	0	6	0

Modeled State	$PM_{2.5}$	PMC	PMFINE	PMG	PMN	PMOTHR	PNA	PNCOM	PNH_4
Virginia	1,548	1,480	1,105	0	0	824	0	30	4
Washington	457	30	356	0	0	252	0	9	1
West Virginia	4,603	1,681	3,784	0	1	2,682	0	59	16
Wisconsin	336	3,022	270	0	0	190	0	6	1
Wyoming	5,714	9,032	4,703	0	2	3,334	0	73	20
Domain total	348,214	104,345	273,462	57	90	193,366	15	6,860	1,132

Table B-2f 2008 Species Emission by Sector

Modeled State	PNO_3	POC	PSI	PSO4	PTI	SO_2	SULF	TERP	TOL	UNK	UNR	XYL
Alabama	7	141	224	311	11	365,866	6,375	0	141	0	263	147
Arizona	5	151	136	283	7	44,268	1,017	0	62	0	109	60
Arkansas	2	56	104	137	5	73,307	1,792	1	72	0	142	73
California	26	310	1	110	0	665	3	0	14	0	79	1
Colorado	3	48	34	51	2	56,718	1,384	0	71	0	133	74
Connecticut	3	25	34	61	2	7,691	105	0	12	0	23	12
Delaware	2	69	164	194	8	33,666	763	0	10	0	20	10
District of Columbia	0	1	0	1	0	212	3	0	0	0	0	0
Florida	79	1,251	1,058	2,527	52	270,195	5,413	0	152	0	349	143
Georgia	9	251	514	607	25	516,096	11,662	0	251	0	467	262
Illinois	6	249	648	741	31	281,777	6,089	0	270	0	508	282
Indiana	60	3,429	8,898	10,286	426	604,918	13,746	0	330	0	615	345
Iowa	4	180	498	566	24	109,300	2,671	0	109	0	203	113
Kansas	3	73	150	179	7	95,938	2,340	0	120	0	235	123
Kentucky	20	1,089	3,077	3,487	148	344,936	7,783	0	270	0	503	282
Louisiana	49	895	151	511	9	82,364	1,832	0	98	0	236	83
Maine	1	18	0	12	0	1,042	16	0	0	0	0	0
Maryland	4	192	531	610	25	228,360	5,152	0	55	0	103	57
Massachusetts	5	65	18	149	1	46,519	1,006	0	24	0	71	24
Michigan	7	383	281	287	9	329,729	7,461	0	188	0	361	197
Minnesota	2	241	332	343	13	75,238	1,830	0	98	0	219	103
Mississippi	15	191	37	104	2	65,866	846	0	41	0	98	35
Missouri	5	213	540	620	26	276,747	6,660	0	258	0	481	269
Montana	1	76	60	69	4	22,249	508	0	69	0	130	72
Nebraska	1	59	168	194	8	75,699	1,846	0	75	0	141	78
Nevada	2	40	20	38	1	9,347	212	0	18	0	33	18
New Hampshire	1	15	22	33	1	36,897	829	0	11	0	28	11
New Jersey	14	266	362	464	17	24,800	214	0	17	0	33	17
New Mexico	3	53	48	67	2	11,843	260	0	35	0	74	33
New York	19	261	84	464	4	70,200	1,424	0	61	0	167	50
North Carolina	13	633	1,733	1,971	83	232,633	5,187	0	159	0	313	166
North Dakota	1	86	19	23	2	132,593	3,792	0	127	0	236	133
Ohio	31	1,627	3,704	4,392	178	740,076	14,443	0	225	0	418	235
Oklahoma	18	285	245	346	12	107,851	2,353	0	122	0	266	114

Modeled State	PNO_3	POC	PSI	PSO4	PTI	SO_2	SULF	TERP	TOL	UNK	UNR	XYL
Oregon	5	75	41	68	2	11,344	277	0	12	0	23	13
Pennsylvania	9	295	677	847	33	867,323	18,071	0	96	0	193	98
Rhode Island	0	1	0	0	0	5	0	0	0	0	0	0
South Carolina	10	542	1,311	1,476	62	160,948	3,639	0	76	0	188	80
South Dakota	0	7	21	23	1	13,535	332	0	22	0	40	23
Tennessee	4	178	474	541	23	212,666	4,854	0	151	0	281	158
Texas	101	2,390	549	971	44	485,838	12,422	0	408	0	885	385
Tribal Data	4	221	631	714	30	15,205	363	0	105	0	194	109
Utah	1	38	77	91	4	20,188	327	0	45	0	87	47
Vermont	0	15	6	3	0	2	0	0	0	0	19	0
Virginia	4	75	99	257	5	124,240	2,779	0	78	0	146	81
Washington	1	22	38	46	2	2,320	57	0	3	0	5	3
West Virginia	3	148	414	470	20	312,270	7,057	0	203	0	378	212
Wisconsin	0	14	30	34	1	134,606	3,166	0	147	0	376	154
Wyoming	3	181	515	583	25	81,923	2,007	0	141	0	261	147
Domain total	568	17,124	28,780	36,361	1,394	7,818,020	172,370	1	5,051	0	10,135	5,133

Table B-3e - 2008 Integrated Planning Model Point Source (ptipm) Emissions by Species and by US State

Inventory State	CO	NH_3	NO_X	PM_{10}	$PM_{2.5}$	SO_2	VOC	CHLORINE	HCL
Alabama	108,422	1,568	67,339	36,882	27,678	65,886	31,534	76	1,375
Alaska	31,564	178	69,291	3,065	2,312	5,096	5,351		
Arizona	26,495	51	18,107	8,286	3,542	34,910	2,998	1	47
Arkansas	40,091	927	37,346	8,986	5,539	14,025	27,469	204	802
California	117,341	11,873	89,779	38,516	22,216	26,993	42,221	30	724
Colorado	45,822	1	51,380	19,077	7,242	8,356	71,685	3	186
Connecticut	4,295		4,666	290	147	518	1,095		0
Delaware	6,794	126	4,695	1,219	1,060	7,441	3,053	2	221
District of Columbia	435	0	567	47	45	286	69		
Florida	115,538	1,739	54,823	18,610	15,008	44,576	31,270	28	1,501
Georgia	83,096	5,551	56,690	8,353	6,010	46,429	29,337	1	589
Hawaii	14,400	572	23,100	3,539	2,907	26,124	3,250		235
Idaho	25,499	1,100	12,681	2,780	2,076	7,500	1,189	0	43
Illinois	94,067	1,289	85,187	20,476	11,267	95,802	51,945	135	1,067
Indiana	336,232	836	64,696	35,648	26,013	71,386	37,541	1	300
Iowa	29,363	3,397	40,834	9,005	5,618	51,632	21,695	22	1,045
Kansas	24,281	1,576	52,973	5,012	3,290	7,310	17,955	5	173
Kentucky	67,103	177	40,371	21,499	13,093	30,908	43,904	32	774
Louisiana	101,867	6,233	143,692	46,779	40,404	137,957	67,500	96	723
Maine	16,679	555	16,072	3,662	2,663	12,550	4,334	17	402
Maryland	75,041	0	21,781	4,115	2,731	27,252	2,865		86
Massachusetts	16,066	326	13,773	1,770	1,208	6,413	4,061	1	217
Michigan	77,519	713	75,324	20,250	11,892	57,172	27,884	18	4,737
Minnesota	29,566	1,854	58,689	19,848	14,256	24,022	22,429	22	1,370
Mississippi	35,131	1,482	51,990	8,757	6,618	18,266	32,271	99	229
Missouri	78,955	1,513	40,767	9,119	3,990	90,825	16,444	6	838
Montana	27,764	49	14,348	5,132	1,711	5,152	4,281	1	49
Nebraska	7,516	1,016	11,981	2,442	1,610	1,360	3,661	24	24
Nevada	12,098	77	14,156	4,499	1,824	1,838	2,825	0	15
New Hampshire	4,501	46	2,315	3,185	3,078	2,038	690	2	68
New Jersey	15,627	950	15,195	3,186	2,513	3,324	9,497	5	215
New Mexico	20,858	0	28,709	2,237	1,023	11,024	8,860	1	3
New York	72,072	1,328	43,694	5,770	4,065	43,742	6,907	27	923
North Carolina	57,424	1,372	37,813	10,652	7,471	41,832	38,064	105	1,209
North Dakota	10,338	6,002	11,403	2,920	2,265	9,537	3,133		34
Ohio	247,583	3,011	61,996	23,710	19,545	105,577	31,212	12	1,907
Oklahoma	41,709	2,340	63,722	8,434	4,852	29,384	24,740	11	354
Oregon	35,420	3	14,085	9,826	7,311	4,574	8,328	67	318
Pennsylvania	96,241	1,618	70,078	19,841	13,356	42,579	28,477	37	1,410
	1,635		563	67	35	57	218		
Rhode Island	3,835	115	1,430	170	133	1,017	1,210	0	4
South Carolina	90,406	1,840	28,851	7,698	4,947	30,528	24,464	23	1,195
South Dakota	2,285		165	50	10	21	98		
Tennessee	53,182	986	47,779	13,219	9,271	45,427	37,318	119	4,368
Texas	261,906	2,240	238,062	38,539	28,906	121,638	119,360	91	923

Inventory State	CO	NH_3	NO_x	PM_{10}	$PM_{2.5}$	SO_2	VOC	CHLORINE	HCL
Tribal	6,808	30	13,603	2,780	908	46	3,132	0	4
Utah	17,999	546	25,430	7,373	2,470	8,128	6,928	1,802	1,356
Vermont	1,167		206	158	80	165	456	0	4
	413		96	18	6	10	44		
Virginia	71,086	1,285	52,931	9,206	6,245	50,131	27,793	25	2,291
Washington	65,856	350	27,613	4,762	3,806	13,450	12,692	8	540
West Virginia	55,817	273	34,629	7,041	4,218	31,699	10,896	11	11,188
Wisconsin	63,491	471	39,185	9,315	1,146	58,688	30,503	24	1,424
Wyoming	33,359	281	42,310	29,897	14,441	26,213	17,478	21	23
Con. US	2,932,043	69,114	2,045,916	581,026	380,814	1,577,530	1,055,754	3,220	47,300

Table B-4a - 2008 Integrated Planning Model Non-Point Source (ptnonipm) Emissions by Species and by US State

Modeled State	ALD_2	ALDX	BENZENE	CH_4	CL_2	CO	ETH	ETHA	ETOH
Alabama	283	316	1,201	15,609	76	108,715	1,099	2,502	416
Alaska	0	0	0	0	0	0	0	0	0
Arizona	85	81	53	10,674	1	26,563	185	218	38
Arkansas	321	390	1,064	7,348	205	40,197	893	1,273	395
California	450	472	1,423	106,270	30	117,570	1,860	3,482	1,395
Colorado	355	193	901	64,348	3	45,920	583	6,865	243
Connecticut	11	13	41	280	0	4,306	50	13	6
Delaware	12	21	142	6,488	2	6,812	48	136	16
District of Columbia	0	1	3	26	0	436	0	0	0
Florida	378	448	1,606	66,253	28	115,885	1,860	1,584	914
Georgia	338	434	1,257	10,724	1	83,309	1,178	1,320	406
Hawaii	0	0	0	0	0	0	0	0	0
Idaho	37	33	73	452	0	25,567	77	91	46
Illinois	679	790	1,778	46,624	136	94,308	2,373	2,563	1,417
Indiana	366	374	1,373	7,941	1	337,139	1,177	530	1,376
Iowa	262	272	712	10,943	22	29,441	1,172	1,126	2,256
Kansas	133	135	543	24,871	5	24,345	224	574	176
Kentucky	130	179	670	5,168	32	67,280	800	913	18,173
Louisiana	290	464	2,750	53,126	97	102,142	2,684	6,223	572
Maine	40	52	286	714	17	16,712	279	235	169
Maryland	54	52	84	1,491	0	75,240	169	90	30
Massachusetts	50	54	167	4,788	1	16,106	260	234	83
Michigan	270	293	785	13,778	18	77,714	870	1,356	471
Minnesota	196	237	618	16,448	22	29,635	838	340	736
Mississippi	220	288	1,425	13,785	100	35,226	812	2,876	564
Missouri	164	210	354	15,215	6	79,164	360	310	398
Montana	28	37	277	4,637	1	27,838	181	519	28
Nebraska	50	50	175	2,419	24	7,534	58	63	93
Nevada	63	67	93	992	0	12,127	135	107	19
New Hampshire	8	10	26	1,666	2	4,509	49	54	22

Modeled State	ALD_2	ALDX	BENZENE	CH_4	CL_2	CO	ETH	ETHA	ETOH
New Jersey	80	76	349	9,423	5	15,662	267	247	50
New Mexico	19	28	170	11,397	1	20,913	66	677	16
New York	129	133	218	44,877	27	72,250	525	711	107
North Carolina	398	466	1,303	26,379	105	57,576	1,981	1,278	905
North Dakota	41	52	150	13,609	0	10,365	140	408	90
Ohio	473	480	1,235	43,798	12	248,254	1,094	1,325	531
Oklahoma	76	136	801	14,161	11	41,821	417	1,147	112
Oregon	109	118	354	4,174	67	35,514	322	709	142
Pennsylvania	255	275	1,778	15,927	37	96,403	1,103	1,914	380
Puerto Rico	0	0	0	0	0	0	0	0	0
Rhode Island	13	22	38	18,288	0	3,842	52	216	19
South Carolina	232	267	758	23,355	23	90,647	886	985	297
South Dakota	5	6	2	0	0	2,291	17	0	0
Tennessee	345	357	925	17,808	120	53,322	1,504	978	7,375
Texas	1,000	1,249	5,056	77,702	91	262,599	8,153	6,068	766
Tribal Data	2	2	23	8,362	0	6,826	11	622	6
Utah	68	79	360	4,904	1,806	18,045	334	560	22
Vermont	3	4	3	5	0	1,170	10	1	19
Virgin Islands	0	0	0	0	0	0	0	0	0
Virginia	216	239	1,733	14,343	25	71,271	1,489	1,284	743
Washington	169	182	515	36,818	8	66,030	444	676	181
West Virginia	65	70	360	13,855	11	55,966	820	1,944	147
Wisconsin	506	562	1,052	21,676	24	63,659	1,409	709	494
Wyoming	70	79	831	32,577	21	33,440	243	2,430	35
Con. US	9,545	10,848	37,898	966,514	3,228	2,939,606	41,559	60,487	42,895

Table B-4b - 2008 Integrated Planning Model Non-Point Source (ptnonipm) Emissions by Species and by US State

Modeled State	NO_2	NO_x	NVOL	OLE	PAL	PAR	PCA	PCL	PEC	PFE
Alabama	6,747	67,513	45	1,324	245	16,881	702	708	1,536	468
Alaska	0	0	0	0	0	0	0	0	0	0
Arizona	1,789	18,155	3	357	63	1,584	51	26	244	28
Arkansas	3,742	37,439	59	1,955	27	13,149	99	90	345	45
California	8,877	89,949	33	2,601	266	25,028	549	158	4,709	178
Colorado	5,125	51,503	17	1,231	213	63,594	123	33	840	87
Connecticut	464	4,679	7	61	0	671	1	3	48	1
Delaware	470	4,706	1	123	16	2,366	13	6	152	24
District of Columbia	57	568	0	1	1	41	1	0	13	0
Florida	5,410	54,938	51	2,358	52	15,236	216	249	935	69
Georgia	5,605	56,843	110	1,868	42	13,905	59	117	534	26
Hawaii	0	0	0	0	0	0	0	0	0	0
Idaho	1,270	12,715	2	60	26	587	20	8	132	12
Illinois	8,449	85,410	75	3,894	149	28,413	209	221	1,338	216

Modeled State	NO_2	NO_x	NVOL	OLE	PAL	PAR	PCA	PCL	PEC	PFE
Indiana	6,475	64,856	33	2,458	531	18,489	488	1,422	2,067	1,041
Iowa	4,091	40,936	36	1,282	75	10,437	198	131	342	150
Kansas	5,310	53,114	9	387	59	10,948	50	102	322	53
Kentucky	4,030	40,477	24	986	459	13,271	301	483	911	223
Louisiana	14,400	144,064	40	3,061	454	43,230	463	457	3,973	301
Maine	1,610	16,109	10	200	5	2,183	26	41	148	5
Maryland	2,172	21,833	3	179	24	1,391	89	166	210	83
Massachusetts	1,365	13,807	14	282	7	2,230	6	12	280	6
Michigan	7,529	75,506	30	1,948	166	13,887	859	571	758	256
Minnesota	5,866	58,838	20	953	259	13,779	575	276	1,252	211
Mississippi	5,211	52,131	47	1,905	26	18,338	61	131	491	50
Missouri	4,071	40,861	18	864	142	8,736	198	85	278	47
Montana	1,437	14,384	2	258	48	2,282	47	14	188	23
Nebraska	1,198	12,012	2	109	5	1,902	5	7	303	5
Nevada	1,392	14,187	4	272	36	1,495	65	20	301	15
New Hampshire	230	2,320	1	73	0	337	344	16	35	15
New Jersey	1,498	15,232	10	435	39	6,124	15	48	336	24
New Mexico	2,874	28,786	1	127	9	4,894	28	7	184	5
New York	4,317	43,798	6	425	74	3,693	118	50	592	31
North Carolina	3,762	37,907	140	1,745	57	18,875	104	133	629	53
North Dakota	1,142	11,432	5	155	16	1,886	21	34	389	24
Ohio	6,198	62,151	50	1,962	420	15,804	409	1,097	1,334	914
Oklahoma	6,384	63,885	11	1,240	62	15,556	177	149	464	43
Oregon	1,404	14,122	13	389	51	3,691	138	220	338	96
Pennsylvania	7,002	70,254	22	2,036	209	15,089	390	398	1,232	419
Puerto Rico	0	0	0	0	0	0	0	0	0	0
Rhode Island	141	1,433	6	105	0	595	0	0	46	0
South Carolina	2,889	28,924	140	1,733	74	12,826	179	111	343	69
South Dakota	16	166	0	9	0	44	0	0	8	0
Tennessee	4,759	47,906	45	1,650	228	15,249	181	367	733	320
Texas	23,696	238,685	72	6,597	406	70,361	442	299	4,293	263
Tribal Data	1,364	13,640	0	10	30	2,619	20	2	57	19
Utah	2,539	25,494	5	578	36	4,430	68	47	630	39
Vermont	20	206	0	5	0	281	0	0	7	0
Virgin Islands	0	0	0	0	0	0	0	0	0	0
Virginia	5,273	53,049	50	1,393	81	15,065	136	99	571	81
Washington	2,748	27,685	22	734	191	7,054	68	44	353	18
West Virginia	3,471	34,714	8	538	85	6,329	166	54	271	73
Wisconsin	3,921	39,290	23	1,409	20	17,270	21	35	242	22
Wyoming	4,241	42,417	10	453	612	10,800	210	37	551	232
Con. US	204,049	2,051,026	1,335	54,779	6,094	592,923	8,709	8,785	36,289	6,384

Table B-4c - 2008 Integrated Planning Model Non-Point Source (ptnonipm) Emissions by Species and by US State

Modeled State	PH2O	PK	PM_{10}	$PM_{2.5}$	PMC	PMFINE	PMG	PMN	PMOTHR
Alabama	218	784	36,970	27,732	9,238	17,634	87	32	10,206
Alaska	0	0	0	0	0	0	0	0	0
Arizona	53	35	8,307	3,551	4,756	2,796	4	1	2,249
Arkansas	26	193	9,007	5,553	3,454	3,244	9	2	1,724
California	247	320	38,541	22,218	16,324	12,174	23	9	7,911
Colorado	87	65	18,962	7,213	11,749	4,999	12	4	3,472
Connecticut	0	1	291	147	144	55	0	0	34
Delaware	11	3	1,222	1,062	159	639	2	2	467
District of Columbia	0	0	47	45	2	19	0	0	13
Florida	80	677	18,668	15,057	3,611	8,840	25	4	4,467
Georgia	48	128	8,452	6,025	2,427	3,333	3	1	1,919
Hawaii	0	0	0	0	0	0	0	0	0
Idaho	19	13	2,788	2,082	706	1,496	1	0	1,158
Illinois	161	122	20,525	11,295	9,230	7,292	15	13	5,075
Indiana	185	987	35,724	26,052	9,671	17,155	61	56	9,411
Iowa	86	70	9,020	5,625	3,394	4,089	10	12	2,813
Kansas	71	24	5,010	3,287	1,724	2,068	3	3	1,295
Kentucky	139	384	21,535	13,115	8,420	9,358	75	15	5,736
Louisiana	405	1,126	46,941	40,523	6,418	22,886	67	14	12,955
Maine	2	111	3,674	2,669	1,005	1,282	2	0	458
Maryland	17	212	4,130	2,739	1,391	1,797	4	4	834
Massachusetts	4	4	1,778	1,209	569	558	0	0	408
Michigan	248	476	20,294	11,916	8,377	7,362	14	17	3,069
Minnesota	178	261	22,540	14,225	8,315	9,507	21	10	5,858
Mississippi	38	187	8,779	6,635	2,144	3,779	6	3	2,057
Missouri	55	84	9,142	3,997	5,145	2,856	18	2	1,757
Montana	23	32	5,146	1,715	3,431	1,063	4	1	580
Nebraska	16	7	2,451	1,613	838	935	1	0	763
Nevada	19	16	4,501	1,826	2,675	1,123	6	1	721
New Hampshire	264	22	3,197	3,086	111	1,828	0	1	1,131
New Jersey	46	12	3,193	2,519	675	1,454	2	1	972
New Mexico	13	12	2,242	1,025	1,217	548	0	0	342
New York	38	63	5,801	4,074	1,727	2,277	3	1	1,449
North Carolina	20	201	10,682	7,489	3,193	4,291	8	2	2,483
North Dakota	6	11	2,927	2,271	656	1,355	2	1	990
Ohio	133	377	23,772	19,592	4,180	12,932	97	66	7,128
Oklahoma	104	60	8,457	4,865	3,592	2,973	5	2	1,791
Oregon	16	247	9,922	7,330	2,592	3,920	20	8	1,524
Pennsylvania	150	205	19,891	13,387	6,504	8,207	25	25	4,904
Puerto Rico	0	0	0	0	0	0	0	0	0
Rhode Island	0	0	173	133	40	41	0	0	29
South Carolina	40	140	7,718	4,959	2,759	2,845	8	5	1,353
South Dakota	0	0	50	10	40	1	0	0	0
Tennessee	63	228	13,266	9,295	3,971	6,328	41	28	3,606

Modeled State	PH2O	PK	PM_{10}	$PM_{2.5}$	PMC	PMFINE	PMG	PMN	PMOTHR
Texas	438	271	38,625	28,975	9,650	16,480	51	19	11,241
Tribal Data	5	18	2,784	909	1,874	671	3	0	393
Utah	15	59	7,385	2,475	4,910	1,355	7	2	816
Vermont	0	4	158	80	78	42	0	0	23
Virgin Islands	0	0	0	0	0	0	0	0	0
Virginia	47	96	9,274	6,259	3,014	3,825	7	5	2,349
Washington	26	83	4,774	3,817	958	2,142	24	1	1,089
West Virginia	60	114	7,046	4,221	2,825	2,999	23	4	1,970
Wisconsin	4	13	9,329	1,148	8,182	632	2	1	374
Wyoming	131	112	29,972	14,478	15,494	12,471	30	9	9,337
Con. US	4,052	8,670	585,084	381,523	203,561	237,954	832	388	142,705

Table B-4d - 2008 Integrated Planning Model Non-Point Source (ptnonipm) Emissions by Species and by US State

Modeled State	PNA	PNCOM	PNH4	PNO_3	POC	PSI	PSO_4	PTI
Alabama	1,925	1,241	86	325	3,113	868	5,125	63
Alaska	0	0	0	0	0	0	0	0
Arizona	18	82	18	66	216	163	229	4
Arkansas	278	417	43	96	1,053	283	814	7
California	152	1,251	113	215	3,397	896	1,724	101
Colorado	48	278	18	66	710	521	599	38
Connecticut	2	10	1	2	26	2	16	0
Delaware	3	50	5	9	126	34	136	3
District of Columbia	0	3	0	1	8	1	4	0
Florida	547	1,273	100	59	3,215	1,064	2,008	16
Georgia	372	363	47	137	933	196	1,087	12
Hawaii	0	0	0	0	0	0	0	0
Idaho	53	96	27	7	244	63	202	2
Illinois	105	446	54	99	1,166	473	1,401	33
Indiana	729	1,169	78	199	2,930	878	3,701	119
Iowa	70	194	19	55	492	210	648	49
Kansas	19	160	26	67	404	181	427	23
Kentucky	453	587	31	111	1,481	418	1,253	56
Louisiana	936	3,036	297	294	7,605	2,267	5,766	108
Maine	257	216	12	8	543	146	688	2
Maryland	187	98	12	21	251	64	460	3
Massachusetts	14	71	4	12	184	18	175	4
Michigan	403	580	119	257	1,469	550	2,071	35
Minnesota	212	709	85	172	1,786	738	1,508	113
Mississippi	238	586	24	38	1,469	282	859	89
Missouri	88	134	30	87	344	189	432	25
Montana	30	113	8	12	294	134	159	5
Nebraska	6	93	0	15	238	22	123	5
Nevada	15	84	16	34	220	87	147	23

Modeled State	PNA	PNCOM	PNH4	PNO_3	POC	PSI	PSO_4	PTI
New Hampshire	0	24	0	3	60	12	1,160	0
New Jersey	37	120	26	21	306	100	401	13
New Mexico	3	71	8	15	180	26	98	24
New York	87	197	14	42	510	123	654	29
North Carolina	295	529	17	29	1,344	359	1,197	30
North Dakota	2	139	31	25	351	76	151	2
Ohio	553	854	54	176	2,150	761	3,000	68
Oklahoma	94	197	101	74	496	163	858	25
Oregon	840	486	25	33	1,224	245	1,816	4
Pennsylvania	283	568	82	148	1,437	504	2,362	43
Puerto Rico	0	0	0	0	0	0	0	0
Rhode Island	0	10	0	2	26	1	18	0
South Carolina	326	282	28	50	710	198	1,011	32
South Dakota	0	0	0	0	2	0	0	0
Tennessee	365	434	16	58	1,098	361	1,077	89
Texas	382	1,652	157	283	4,230	781	3,690	78
Tribal Data	2	55	0	4	138	107	39	15
Utah	48	102	13	31	294	98	165	5
Vermont	0	10	0	0	25	6	6	0
Virgin Islands	0	0	0	0	0	0	0	0
Virginia	246	359	21	39	915	244	909	54
Washington	224	245	17	25	621	109	674	3
West Virginia	120	138	7	59	348	179	544	5
Wisconsin	22	56	2	4	158	55	112	5
Wyoming	41	238	44	95	603	1,413	757	26
Con. US	11,131	20,108	1,938	3,677	51,142	16,672	52,461	1,485

Table B-4e - 2008 Integrated Planning Model Non-Point Source (ptnonipm) Emissions by Species and by US State

Modeled State	SO_2	SULF	TERP	TOL	UNK	UNR	XYL
Alabama	66,064	112	1,066	3,289	0	6,808	3,516
Alaska	0	0	0	0	0	0	0
Arizona	35,012	63	13	324	1	295	92
Arkansas	14,061	100	1,032	2,760	1	5,864	2,706
California	27,057	14	723	4,558	2	6,584	2,225
Colorado	8,372	115	102	2,347	1	10,792	1,297
Connecticut	519	2	4	116	0	141	57
Delaware	7,461	92	7	240	0	640	124
District of Columbia	286	6	1	6	0	11	11
Florida	44,694	162	470	4,426	1	6,055	1,971
Georgia	46,561	610	2,246	3,125	1	5,632	2,373
Hawaii	0	0	0	0	0	0	0
Idaho	7,520	91	7	117	0	245	74
Illinois	96,051	690	235	5,476	2	8,383	3,283

Modeled State	SO_2	SULF	TERP	TOL	UNK	UNR	XYL
Indiana	71,567	584	149	6,465	0	5,639	4,167
Iowa	51,746	1,018	90	2,307	0	3,318	1,468
Kansas	7,293	4	61	2,047	0	2,581	1,060
Kentucky	30,991	142	151	5,721	1	3,640	3,185
Louisiana	138,340	24	1,179	6,840	0	13,604	3,784
Maine	12,581	143	133	420	0	1,019	321
Maryland	27,325	480	9	359	0	492	116
Massachusetts	6,430	69	22	471	0	617	244
Michigan	57,287	474	378	4,231	0	3,675	3,006
Minnesota	24,078	206	418	2,801	0	2,868	1,598
Mississippi	18,310	109	1,091	4,162	0	6,494	2,229
Missouri	91,007	657	119	2,648	1	1,938	1,957
Montana	5,166	5	248	297	0	1,004	104
Nebraska	1,364	18	25	679	1	601	279
Nevada	1,842	5	12	293	0	438	129
New Hampshire	2,043	25	2	100	0	144	28
New Jersey	3,332	4	53	1,231	0	1,312	701
New Mexico	11,054	0	19	195	0	1,307	63
New York	43,847	507	78	810	1	954	483
North Carolina	41,921	467	1,648	5,057	1	6,154	3,389
North Dakota	9,561	92	19	247	0	733	122
Ohio	105,865	1,484	131	4,245	1	6,070	2,804
Oklahoma	29,463	66	184	1,631	0	4,411	652
Oregon	4,586	5	970	818	1	1,824	757
Pennsylvania	42,688	286	394	4,015	1	6,254	2,081
Puerto Rico	0	0	0	0	0	0	0
Rhode Island	1,019	9	5	213	0	173	78
South Carolina	30,600	297	998	3,694	0	4,102	1,768
South Dakota	21	0	0	2	0	8	3
Tennessee	45,550	777	170	3,988	1	5,334	3,874
Texas	121,945	111	2,221	7,905	1	22,432	3,704
Tribal Data	46	0	140	29	0	616	30
Utah	8,149	87	55	631	1	1,534	209
Vermont	165	2	0	141	0	69	34
Virgin Islands	0	0	0	0	0	0	0
Virginia	50,234	643	591	3,538	1	5,978	1,833
Washington	13,487	22	310	1,419	1	2,329	1,040
West Virginia	31,775	187	97	1,030	0	2,101	583
Wisconsin	58,847	1,142	375	3,660	0	4,353	2,605
Wyoming	26,275	306	37	730	0	3,556	192
Con. US	1,581,458	12,515	18,486	111,853	24	181,128	68,408

Table B-4f - 2008 Integrated Planning Model Non-Point Source (ptnonipm) Emissions by Species and by US State

Inventory State	CO	NH_3	NO_x	PM_{10}	PM_{25}	SO_2	VOC	ALD_2	ALD_X	ETH
Aguascalientes	48		314	525	332	1,700	2,312			
Alberta	478,929	11,580	613,092	24,261	16,060	464,052	219,008	28	45	130
Baja Calif Norte	873		6,278	5,178	4,244	29,327	18,353			
Baja Calif Sur	956		5,270	1,222	932	20,884	815			
British Columbia	321,702	1,813	85,621	26,202	13,805	85,916	27,058	1	3	133
Campeche	15,285		25,396	4,139	2,804	166,332	3,421			
Chiapas	2,120		2,843	4,700	2,385	100,185	2,206			
Chihuahua	15,236		19,989	7,982	6,908	71,857	3,189			
Coahuila	19,900		142,733	29,337	28,316	182,347	6,199			
Colima	2,345		17,034	11,586	8,036	211,110	3,761			
Distrito Federal	1,360		1,709	1,150	881	2,916	14,268			
Durango	755		4,828	2,056	1,501	27,382	17,512			
Guanajuato	2,419		16,285	5,745	4,337	122,802	10,631			
Guerrero	1,746		16,328	9,603	6,926	206,388	3,378			
Gulf of Mexico	89,813		82,581	839	837	1,961	51,241			
Hidalgo	7,996		41,705	20,792	14,354	393,488	3,599			
Jalisco	4,702		5,139	6,920	3,677	20,105	11,501			
Manitoba	6,976	1,386	7,121	6,306	3,389	428,647	9,436	0	1	17
Mexico	5,200		14,138	3,466	2,726	13,578	16,648			
Michoacan	1,600		14,827	7,006	4,036	30,551	2,887			
Morelos	1,312		2,958	4,070	2,011	13,596	4,151			
NW Territories										
Nayarit	1,307		649	2,226	728	1,430	942			
New Brunswick	30,657	244	24,566	4,403	2,646	56,831	0		0	20
Newfoundland	13,769	4	19,178	6,842	3,607	26,033	31,678	0	0	13
Nova Scotia	5,927	51	37,436	3,367	1,751	129,756	345	0	0	11
Nuevo Leon	24,380		22,647	11,741	10,386	90,401	24,624			
Nunavut										
Oaxaca	1,974		6,651	6,891	3,747	65,388	7,042			
Ontario	173,086	6,882	129,435	31,136	19,303	475,691	1,719	12	6	122
Prince Edward Island	64	9	398	177	75	1,131	0		0	0
Puebla	1,582		3,843	9,003	7,158	15,397	6,020			
Quebec	396,891	937	57,162	20,132	13,299	183,804	0	1	1	46
Queretaro	721		2,424	2,359	1,750	3,358	1,523			
Quintana Roo	792		1,829	1,038	520	1,129	699			
San Luis Potosi	3,536		10,115	10,152	6,267	91,941	3,157			
Saskatchewan	44,419	921	70,272	7,719	4,302	132,647	233,612	0	2	16
Sinaloa	2,204		11,326	8,683	5,087	113,387	1,641			
Sonora	3,469		14,291	34,040	16,245	173,368	1,783			
Tabasco	25,331		9,910	20,072	11,087	160,336	24,119			
Tamaulipas	12,940		16,787	6,936	4,701	167,404	29,598			
Tlaxcala	119		548	292	169	3,199	588			

Inventory State	CO	NH_3	NO_x	PM_{10}	PM_{25}	SO_2	VOC	ALD_2	ALD_x	ETH
Veracruz	22,158		51,580	86,149	55,034	371,159	44,748			
Yucatan	348		3,665	2,063	1,673	30,801	1,873			
Yukon										
Zacatecas	88		708	555	312	21	52			
Canada Total	1,472,421	23,827	1,044,281	130,545	78,237	1,984,507	522,855	44	59	507
Mexico Total	184,800	0	494,745	327,678	219,269	2,903,265	273,239	0	0	0
TOTAL	1,747,033	23,827	1,621,607	459,062	298,343	4,889,733	847,335	44	59	507

Table B-5a - 2008 Other Point Source (othpt) Emissions by Species, by Canadian Province, and by Mexican Federal State

Inventory State	ETOH	FORM	IOLE	ISOP	MEOH	NVOL	OLE	PAR	TERP	TOL	UNR	XYL
Aguascalientes												
Alberta	28	43	14	4	33	18	145	2,395	15	56	610	41
Baja Calif Norte												
Baja Calif Sur												
British Columbia	19	22	25	0	13	1	54	1,021	24	15	137	5
Campeche												
Chiapas												
Chihuahua												
Coahuila												
Colima												
Distrito Federal												
Durango												
Guanajuato												
Guerrero												
Gulf of Mexico												
Hidalgo												
Jalisco												
Manitoba	4	23	4	0	2	0	11	412	0	8	56	11
Mexico												
Michoacan												
Morelos												
NW Territories												
Nayarit												
New Brunswick	13	27	0		0		3	140	0	1	60	2
Newfoundland	3	1	0	0	0	0	3	86	0	1	34	2
Nova Scotia	8	7	0	0	0	0	3	189	0	2	50	2
Nuevo Leon												
Nunavut												
Oaxaca												
Ontario	80	50	2	0	36	7	95	1,796	16	66	626	29
Prince Edward Island	0	0	0		0		0	7	0	0	1	0
Puebla												
Quebec	31	73	1	0	4	2	42	830	47	15	170	10
Queretaro												

Inventory State	ETOH	FORM	IOLE	ISOP	MEOH	NVOL	OLE	PAR	TERP	TOL	UNR	XYL
Quintana Roo												
San Luis Potosi												
Saskatchewan	1	9	2	0	0	0	15	368	1	5	52	5
Sinaloa												
Sonora												
Tabasco												
Tamaulipas												
Tlaxcala												
Veracruz												
Yucatan												
Yukon												
Zacatecas												
Canada Total	189	253	48	5	89	29	371	7,244	103	170	1,797	107
Mexico Total	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL	189	253	48	5	89	29	371	7,244	103	170	1,797	107

Table B-5b - 2008 Other Point Source (othpt) Emissions by Species, by Canadian Province, and by Mexican Federal State

Modeled State	ALD_2	ALDX	BENZENE	CH_4	CO	ETH	ETHA	ETOH	FORM	HONO
Aguascalientes	0	0	0	0	0	0	0	0	0	0
Alberta	4	378	14,336	147,170	363,175	1,492	21,211	9	12	0
Baja Calif Norte	288	330	470	1,144	876	610	233	373	248	0
Baja Calif Sur	3	0	18	340	945	62	17	0	277	0
British Columbia	1	2	0	40	120,169	87	6	15	17	0
Campeche	0	0	0	0	0	0	0	0	0	0
Chiapas	0	0	0	0	0	0	0	0	0	0
Chihuahua	45	42	82	145	15,278	74	127	41	35	0
Coahuila	71	76	114	438	19,955	135	215	50	482	0
Colima	0	0	0	0	0	0	0	0	0	0
Distrito Federal	0	0	0	0	0	0	0	0	0	0
Durango	19	2	11	59	709	2	21	1	216	0
Guanajuato	0	0	0	0	0	0	0	0	0	0
Guerrero	0	0	0	0	0	0	0	0	0	0
Gulf of Mexico	0	0	129	41,643	90,046	139	6,279	0	1,726	0
Hidalgo	0	0	0	0	0	0	0	0	0	0
Jalisco	0	0	0	0	0	0	0	0	0	0
Manitoba	0	21	733	9,064	7,004	18	1,264	4	23	0
Mexico	0	0	0	0	0	0	0	0	0	0
Michoacan	0	0	0	0	0	0	0	0	0	0
Morelos	0	0	0	0	0	0	0	0	0	0
NW Territories	0	0	0	0	0	0	0	0	0	0
Nayarit	0	0	0	0	0	0	0	0	0	0
New Brunswick	0	0	0	0	30,748	20	0	13	27	0
Newfoundland	0	0	0	0	8,511	9	0	3	0	0
Nova Scotia	0	0	7	305	5,942	40	45	8	7	0

Modeled State	ALD_2	ALDX	BENZENE	CH_4	CO	ETH	ETHA	ETOH	FORM	HONO
Nuevo Leon	60	50	197	3,918	24,447	81	66	70	12,620	0
Nunavut	0	0	0	0	0	0	0	0	0	0
Oaxaca	0	0	0	0	0	0	0	0	0	0
Ontario	12	6	6	3,384	173,893	122	438	81	50	0
Prince Edward Island	0	0	0	0	64	0	0	0	0	0
Puebla	0	0	0	0	0	0	0	0	0	0
Quebec	1	1	0	0	397,319	46	0	32	73	0
Queretaro	0	0	0	0	0	0	0	0	0	0
Quintana Roo	0	0	0	0	0	0	0	0	0	0
San Luis Potosi	0	0	0	0	0	0	0	0	0	0
Saskatchewan	0	495	18,889	205,024	44,537	185	28,952	1	14	0
Sinaloa	8	1	186	384	1,559	188	51	158	47	0
Sonora	27	18	35	63	3,478	32	48	12	18	0
Tabasco	0	0	0	0	0	0	0	0	0	0
Tamaulipas	13	13	21	46	1,368	23	22	9	10	0
Tlaxcala	0	0	0	0	0	0	0	0	0	0
Veracruz	0	0	0	0	0	0	0	0	0	0
Yucatan	0	0	0	0	0	0	0	0	0	0
Yukon	0	0	0	0	0	0	0	0	0	0
Zacatecas	0	0	0	0	0	0	0	0	0	0
Canada Total	19	903	33,970	364,986	1,151,363	2,019	51,916	166	224	0
Mexico Total	535	532	1,134	6,539	68,615	1,207	800	714	13,953	0
TOTAL	554	1,435	35,233	413,167	1,310,024	3,364	58,995	880	15,902	0

Table B-5c - 2008 Other Point Source (othpt) Emissions by Species, by Canadian Province, and by Mexican Federal State

Modeled State	IOLE	ISOP	MEOH	NH_3	NH3_FERT	NO	NO_2	NO_x	NVOL	OLE
Aguascalientes	0	0	0	0	0	0	0	0	0	0
Alberta	25	1	5	9,002	0	458,522	50,947	509,469	3	6,454
Baja Calif Norte	126	62	218	0	0	5,666	630	6,296	130	956
Baja Calif Sur	7	0	0	0	0	4,706	523	5,228	0	60
British Columbia	16	0	12	1,727	0	21,127	2,347	23,474	1	37
Campeche	0	0	0	0	0	0	0	0	0	0
Chiapas	0	0	0	0	0	0	0	0	0	0
Chihuahua	34	8	28	0	0	18,040	2,004	20,045	8	137
Coahuila	38	15	51	0	0	128,828	14,314	143,143	14	786
Colima	0	0	0	0	0	0	0	0	0	0
Distrito Federal	0	0	0	0	0	0	0	0	0	0
Durango	36	0	1	0	0	3,953	439	4,393	0	15
Guanajuato	0	0	0	0	0	0	0	0	0	0
Guerrero	0	0	0	0	0	0	0	0	0	0
Gulf of Mexico	0	0	0	0	0	74,517	8,280	82,797	0	120
Hidalgo	0	0	0	0	0	0	0	0	0	0

Modeled State	IOLE	ISOP	MEOH	NH_3	NH3_FERT	NO	NO_2	NO_X	NVOL	OLE
Jalisco	0	0	0	0	0	0	0	0	0	0
Manitoba	5	0	2	1,388	0	6,420	713	7,134	0	283
Mexico	0	0	0	0	0	0	0	0	0	0
Michoacan	0	0	0	0	0	0	0	0	0	0
Morelos	0	0	0	0	0	0	0	0	0	0
NW Territories	0	0	0	0	0	0	0	0	0	0
Nayarit	0	0	0	0	0	0	0	0	0	0
New Brunswick	0	0	0	245	0	22,187	2,465	24,652	0	3
Newfoundland	0	0	0	0	0	6,583	731	7,315	0	1
Nova Scotia	0	0	0	51	0	33,792	3,755	37,547	0	28
Nuevo Leon	63	8	28	0	0	20,439	2,271	22,710	8	277
Nunavut	0	0	0	0	0	0	0	0	0	0
Oaxaca	0	0	0	0	0	0	0	0	0	0
Ontario	2	0	37	6,911	0	116,846	12,983	129,829	7	96
Prince Edward Island	0	0	0	9	0	359	40	398	0	0
Puebla	0	0	0	0	0	0	0	0	0	0
Quebec	1	0	4	940	0	48,114	5,346	53,460	2	42
Queretaro	0	0	0	0	0	0	0	0	0	0
Quintana Roo	0	0	0	0	0	0	0	0	0	0
San Luis Potosi	0	0	0	0	0	0	0	0	0	0
Saskatchewan	30	0	0	921	0	63,287	7,032	70,319	0	7,040
Sinaloa	15	0	0	0	0	3,766	418	4,184	0	21
Sonora	29	4	12	0	0	12,898	1,433	14,331	3	60
Tabasco	0	0	0	0	0	0	0	0	0	0
Tamaulipas	8	3	9	0	0	4,070	452	4,522	2	39
Tlaxcala	0	0	0	0	0	0	0	0	0	0
Veracruz	0	0	0	0	0	0	0	0	0	0
Yucatan	0	0	0	0	0	0	0	0	0	0
Yukon	0	0	0	0	0	0	0	0	0	0
Zacatecas	0	0	0	0	0	0	0	0	0	0
Canada Total	78	1	61	21,194	0	777,237	86,360	863,597	13	13,983
Mexico Total	354	100	347	0	0	202,367	22,485	224,853	165	2,351
TOTAL	433	101	408	21,194	0	1,054,121	117,125	1,171,246	178	16,454

Table B-5d - 2008 Other Point Source (othpt) Emissions by Species, by Canadian Province, and by Mexican Federal State

Modeled State	PAL	PAR	PCA	PCL	PEC	PFE	PH2O	PK	PM_{10}	$PM_{2.5}$
Aguascalientes	0	0	0	0	0	0	0	0	0	0
Alberta	0	159,026	1	0	2,431	0	157	0	17,279	11,246
Baja Calif Norte	138	8,379	96	4	86	91	16	38	5,192	4,256
Baja Calif Sur	8	516	5	2	157	4	0	1	1,223	934
British Columbia	0	765	0	0	94	0	247	0	21,832	10,419
Campeche	0	0	0	0	0	0	0	0	0	0

Modeled State	PAL	PAR	PCA	PCL	PEC	PFE	PH2O	PK	PM_{10}	$PM_{2.5}$
Chiapas	0	0	0	0	0	0	0	0	0	0
Chihuahua	181	2,068	122	12	739	92	20	27	8,038	6,928
Coahuila	555	3,188	435	878	421	1,979	11	1,523	29,418	28,394
Colima	0	0	0	0	0	0	0	0	0	0
Distrito Federal	0	0	0	0	0	0	0	0	0	0
Durango	15	1,688	10	11	16	7	2	6	1,418	1,036
Guanajuato	0	0	0	0	0	0	0	0	0	0
Guerrero	0	0	0	0	0	0	0	0	0	0
Gulf of Mexico	4	51,431	11	0	398	4	0	2	842	839
Hidalgo	0	0	0	0	0	0	0	0	0	0
Jalisco	0	0	0	0	0	0	0	0	0	0
Manitoba	0	8,822	0	0	77	0	78	0	6,368	3,400
Mexico	0	0	0	0	0	0	0	0	0	0
Michoacan	0	0	0	0	0	0	0	0	0	0
Morelos	0	0	0	0	0	0	0	0	0	0
NW Territories	0	0	0	0	0	0	0	0	0	0
Nayarit	0	0	0	0	0	0	0	0	0	0
New Brunswick	0	141	0	0	24	0	63	0	4,422	2,657
Newfoundland	0	14	0	0	17	0	44	0	4,921	1,849
Nova Scotia	0	465	0	0	34	0	41	0	3,376	1,756
Nuevo Leon	195	18,040	146	60	213	87	95	69	11,774	10,415
Nunavut	0	0	0	0	0	0	0	0	0	0
Oaxaca	0	0	0	0	0	0	0	0	0	0
Ontario	0	3,564	0	0	212	0	458	0	31,393	19,369
Prince Edward Island	0	7	0	0	1	0	2	0	178	75
Puebla	0	0	0	0	0	0	0	0	0	0
Quebec	0	835	0	0	118	0	313	0	20,080	13,224
Queretaro	0	0	0	0	0	0	0	0	0	0
Quintana Roo	0	0	0	0	0	0	0	0	0	0
San Luis Potosi	0	0	0	0	0	0	0	0	0	0
Saskatchewan	0	207,242	0	0	613	0	68	0	7,735	4,311
Sinaloa	1	705	12	9	40	1	2	65	3,922	2,211
Sonora	998	1,376	483	41	363	428	33	168	34,134	16,290
Tabasco	0	0	0	0	0	0	0	0	0	0
Tamaulipas	72	448	43	1	59	37	16	6	2,304	2,008
Tlaxcala	0	0	0	0	0	0	0	0	0	0
Veracruz	0	0	0	0	0	0	0	0	0	0
Yucatan	0	0	0	0	0	0	0	0	0	0
Yukon	0	0	0	0	0	0	0	0	0	0
Zacatecas	0	0	0	0	0	0	0	0	0	0
Canada Total	0	380,880	1	0	3,619	0	1,470	0	117,583	68,306
Mexico Total	2,164	36,407	1,351	1,018	2,093	2,726	194	1,903	97,422	72,471
TOTAL	2,168	468,717	1,364	1,018	6,111	2,730	1,665	1,905	215,847	141,616

Table B-5e - 2008 Other Point Source (othpt) Emissions by Species, by Canadian Province, and by Mexican Federal State

Modeled State	PMC	PMFINE	PMG	PMN	PMOTHR	PNA	PNCOM	PNH4	PNO_3	POC
Aguascalientes	0	0	0	0	0	0	0	0	0	0
Alberta	6,033	6,284	0	0	5,558	0	568	0	86	1,522
Baja Calif Norte	937	3,109	2	3	2,133	102	117	7	6	293
Baja Calif Sur	289	452	0	0	397	0	20	0	2	60
British Columbia	11,412	8,500	0	0	7,946	0	306	0	31	767
Campeche	0	0	0	0	0	0	0	0	0	0
Chiapas	0	0	0	0	0	0	0	0	0	0
Chihuahua	1,110	4,491	1	2	3,241	12	467	12	49	1,168
Coahuila	1,024	17,721	9	92	9,302	678	1,277	33	88	3,191
Colima	0	0	0	0	0	0	0	0	0	0
Distrito Federal	0	0	0	0	0	0	0	0	0	0
Durango	382	655	0	0	561	7	6	1	1	15
Guanajuato	0	0	0	0	0	0	0	0	0	0
Guerrero	0	0	0	0	0	0	0	0	0	0
Gulf of Mexico	3	235	0	0	142	0	56	0	9	161
Hidalgo	0	0	0	0	0	0	0	0	0	0
Jalisco	0	0	0	0	0	0	0	0	0	0
Manitoba	2,968	2,705	0	0	2,519	0	108	0	12	272
Mexico	0	0	0	0	0	0	0	0	0	0
Michoacan	0	0	0	0	0	0	0	0	0	0
Morelos	0	0	0	0	0	0	0	0	0	0
NW Territories	0	0	0	0	0	0	0	0	0	0
Nayarit	0	0	0	0	0	0	0	0	0	0
New Brunswick	1,765	2,168	0	0	2,027	0	78	0	8	196
Newfoundland	3,072	1,509	0	0	1,410	0	54	0	5	136
Nova Scotia	1,620	1,410	0	0	1,316	0	54	0	6	135
Nuevo Leon	1,359	7,998	1	2	6,294	65	296	9	21	741
Nunavut	0	0	0	0	0	0	0	0	0	0
Oaxaca	0	0	0	0	0	0	0	0	0	0
Ontario	12,024	15,764	0	0	14,736	0	570	0	57	1,431
Prince Edward Island	103	61	0	0	57	0	2	0	0	6
Puebla	0	0	0	0	0	0	0	0	0	0
Quebec	6,857	10,789	0	0	10,087	0	389	0	39	973
Queretaro	0	0	0	0	0	0	0	0	0	0
Quintana Roo	0	0	0	0	0	0	0	0	0	0
San Luis Potosi	0	0	0	0	0	0	0	0	0	0
Saskatchewan	3,424	2,704	0	0	2,415	0	221	0	37	559
Sinaloa	1,710	1,293	2	0	976	2	108	1	2	270
Sonora	17,844	14,470	27	11	10,042	45	135	40	33	336
Tabasco	0	0	0	0	0	0	0	0	0	0
Tamaulipas	296	1,648	0	0	1,307	0	41	4	3	103
Tlaxcala	0	0	0	0	0	0	0	0	0	0

Modeled State	PMC	PMFINE	PMG	PMN	PMOTHR	PNA	PNCOM	PNH4	PNO_3	POC
Veracruz	0	0	0	0	0	0	0	0	0	0
Yucatan	0	0	0	0	0	0	0	0	0	0
Yukon	0	0	0	0	0	0	0	0	0	0
Zacatecas	0	0	0	0	0	0	0	0	0	0
Canada Total	49,277	51,894	0	0	48,072	0	2,351	0	282	5,995
Mexico Total	24,952	51,837	42	110	34,254	910	2,467	108	204	6,177
TOTAL	74,231	103,966	42	110	82,467	910	4,874	108	496	12,332

Table B-5f - 2008 Other Point Source (othpt) Emissions by Species, by Canadian Province, and by Mexican Federal State

Modeled State	PSI	PSO4	PTI	SO_2	SULF	TERP	TOL	UNK	UNR	XYL
Aguascalientes	0	0	0	0	0	0	0	0	0	0
Alberta	0	923	0	324,746	0	636	4,976	0	54,772	2,277
Baja Calif Norte	215	761	149	29,411	593	109	1,743	0	3,156	2,751
Baja Calif Sur	13	264	1	20,851	256	0	20	0	68	13
British Columbia	0	1,027	0	24,718	0	18	14	0	113	5
Campeche	0	0	0	0	0	0	0	0	0	0
Chiapas	0	0	0	0	0	0	0	0	0	0
Chihuahua	290	481	13	72,061	963	14	277	0	546	222
Coahuila	909	6,974	40	182,874	3,852	25	713	0	1,044	213
Colima	0	0	0	0	0	0	0	0	0	0
Distrito Federal	0	0	0	0	0	0	0	0	0	0
Durango	28	349	1	21,795	337	1	71	0	73	36
Guanajuato	0	0	0	0	0	0	0	0	0	0
Guerrero	0	0	0	0	0	0	0	0	0	0
Gulf of Mexico	14	37	0	1,966	0	0	2	0	9,840	0
Hidalgo	0	0	0	0	0	0	0	0	0	0
Jalisco	0	0	0	0	0	0	0	0	0	0
Manitoba	0	334	0	429,788	0	33	266	0	2,933	130
Mexico	0	0	0	0	0	0	0	0	0	0
Michoacan	0	0	0	0	0	0	0	0	0	0
Morelos	0	0	0	0	0	0	0	0	0	0
NW Territories	0	0	0	0	0	0	0	0	0	0
Nayarit	0	0	0	0	0	0	0	0	0	0
New Brunswick	0	262	0	56,996	0	0	1	0	60	2
Newfoundland	0	182	0	5,510	0	0	0	0	19	0
Nova Scotia	0	172	0	130,143	0	0	2	0	122	2
Nuevo Leon	283	1,443	395	90,655	1,055	26	880	0	928	556
Nunavut	0	0	0	0	0	0	0	0	0	0
Oaxaca	0	0	0	0	0	0	0	0	0	0
Ontario	0	1,905	0	477,044	0	16	66	0	1,031	29
Prince Edward Island	0	7	0	1,134	0	0	0	0	1	0
Puebla	0	0	0	0	0	0	0	0	0	0
Quebec	0	1,304	0	184,318	0	47	15	0	171	10
Queretaro	0	0	0	0	0	0	0	0	0	0

Modeled State	PSI	PSO4	PTI	SO_2	SULF	TERP	TOL	UNK	UNR	XYL
Quintana Roo	0	0	0	0	0	0	0	0	0	0
San Luis Potosi	0	0	0	0	0	0	0	0	0	0
Saskatchewan	0	399	0	132,693	0	833	6,742	0	71,806	3,017
Sinaloa	112	606	1	40,264	535	1	23	0	334	9
Sonora	1,968	1,088	52	173,863	2,952	6	116	0	234	81
Tabasco	0	0	0	0	0	0	0	0	0	0
Tamaulipas	109	194	11	19,982	427	4	56	0	140	62
Tlaxcala	0	0	0	0	0	0	0	0	0	0
Veracruz	0	0	0	0	0	0	0	0	0	0
Yucatan	0	0	0	0	0	0	0	0	0	0
Yukon	0	0	0	0	0	0	0	0	0	0
Zacatecas	0	0	0	0	0	0	0	0	0	0
Canada Total	0	6,515	0	1,767,089	0	1,583	12,083	0	131,028	5,472
Mexico Total	3,928	12,159	662	651,756	10,971	187	3,900	0	6,524	3,944
TOTAL	3,942	18,711	663	2,420,811	10,971	1,770	15,985	0	147,391	9,417

Table B-5g - 2008 Other Point Source (othpt) Emissions by Species, by Canadian Province, and by Mexican Federal State

Inventory State	CO	NH_3	NO_x	PM_{10}	PM_{25}	SO_2	VOC
Alabama	815,060	13,448	14,769	86,173	73,028	7,241	193,316
Arizona	153,499	2,536	2,966	16,394	13,893	1,420	36,458
Arkansas	763,056	12,497	9,032	76,392	64,739	5,312	179,643
California	11,761,623	192,271	120,963	1,161,203	984,070	76,303	2,763,895
Colorado	166,925	2,729	1,716	16,480	13,966	1,083	39,226
Connecticut	7,419	121	77	733	621	48	1,744
Delaware	811	13	19	90	76	9	194
Florida	951,881	15,619	12,801	96,667	81,921	7,096	224,526
Georgia	956,092	15,799	18,575	102,200	86,610	8,876	227,115
Idaho	1,317,703	21,510	11,942	128,657	109,031	8,056	309,201
Illinois	20,114	332	354	2,117	1,794	176	4,768
Indiana	16,090	267	345	1,749	1,482	159	3,831
Iowa	7,724	128	147	823	697	71	1,834
Kansas	231,626	3,851	5,691	25,823	21,884	2,514	55,354
Kentucky	112,241	1,851	1,991	11,829	10,024	984	26,609
Louisiana	2,053,970	33,471	15,673	197,916	167,726	11,658	481,146
Maine	5,683	93	85	584	495	45	1,343
Maryland	13,398	221	259	1,431	1,213	124	3,182
Massachusetts	1,227	20	21	129	109	11	291
Michigan	15,756	260	264	1,646	1,395	133	3,731
Minnesota	225,310	3,683	2,301	22,229	18,839	1,457	52,941
Mississippi	565,401	9,300	8,773	58,463	49,545	4,573	133,691
Missouri	249,573	4,109	4,062	25,975	22,013	2,076	59,065
Montana	780,030	12,722	6,501	75,652	64,112	4,595	182,876
Nebraska	6,919	115	183	783	664	79	1,657
Nevada	271,990	4,457	3,354	27,350	23,178	1,935	64,071
New Hampshire	419	7	7	44	37	4	99
New Jersey	33,860	554	370	3,362	2,849	226	7,963
New Mexico	137,208	2,259	2,259	14,304	12,122	1,150	32,480
New York	28,934	475	398	2,946	2,497	218	6,827
North Carolina	712,907	11,790	14,314	76,619	64,932	6,760	169,477
North Dakota	21,445	350	215	2,112	1,790	137	5,038
Ohio	15,798	260	251	1,638	1,388	129	3,737
Oklahoma	276,901	4,579	5,538	29,740	25,203	2,619	65,821
Oregon	3,468,077	56,584	30,027	337,359	285,897	20,774	813,398
Pennsylvania	33,257	548	564	3,482	2,951	284	7,877
South Carolina	331,083	5,464	6,076	35,073	29,722	2,965	78,548
South Dakota	14,030	231	249	1,479	1,253	123	3,326
Tennessee	215,389	3,542	3,290	22,225	18,835	1,726	50,915
Texas	1,167,486	19,151	15,400	118,294	100,249	8,612	275,298
Utah	125,243	2,051	1,497	12,552	10,637	877	29,490
Vermont	1,201	20	22	127	108	11	285
Virginia	323,217	5,330	5,705	34,037	28,845	2,825	76,618
Washington	715,910	11,696	6,981	70,339	59,610	4,528	168,127

Inventory State	CO	NH_3	NO_x	PM_{10}	PM_{25}	SO_2	VOC
West Virginia	112,246	1,845	1,692	11,562	9,798	893	26,527
Wisconsin	31,420	517	512	3,271	2,772	262	7,436
Wyoming	1,089,154	17,782	10,022	106,477	90,235	6,705	255,614
Con. US	30,326,302	496,460	348,254	3,026,530	2,564,856	207,860	7,136,612

Table B-6a - 2008 Point Source Fire (ptfire) Emissions by Species, by US State

Modeled State	ALD_2	ALDX	BENZENE	CH4	CO	ETH	ETHA	ETOH
Alabama	14,438	6,026	4,595	44,067	815,117	12,425	5,644	168
Arizona	2,723	1,136	866	8,310	153,499	2,343	1,064	32
Arkansas	13,422	5,602	4,271	40,966	763,418	11,551	5,247	156
California	206,411	86,155	65,688	630,001	11,761,813	177,635	80,685	2,395
Colorado	2,930	1,223	932	8,942	166,946	2,521	1,145	34
Connecticut	130	54	41	397	7,419	112	51	2
Delaware	14	6	5	44	811	12	6	0
Florida	16,769	6,999	5,337	51,182	951,963	14,431	6,555	195
Georgia	16,962	7,080	5,398	51,771	956,155	14,597	6,630	197
Idaho	23,091	9,638	7,349	70,478	1,317,707	19,872	9,026	268
Illinois	356	149	113	1,087	20,114	306	139	4
Indiana	286	119	91	873	16,090	246	112	3
Iowa	137	57	44	418	7,724	118	54	2
Kansas	4,134	1,725	1,316	12,617	231,625	3,558	1,616	48
Kentucky	1,987	830	632	6,066	112,256	1,710	777	23
Louisiana	35,936	15,000	11,436	109,684	2,054,224	30,926	14,047	417
Maine	100	42	32	306	5,683	86	39	1
Maryland	238	99	76	725	13,398	205	93	3
Massachusetts	22	9	7	66	1,227	19	8	0
Michigan	279	116	89	850	15,756	240	109	3
Minnesota	3,959	1,652	1,260	12,082	225,591	3,407	1,547	46
Mississippi	9,985	4,168	3,178	30,477	565,472	8,593	3,903	116
Missouri	4,411	1,841	1,404	13,463	249,572	3,796	1,724	51
Montana	13,657	5,700	4,346	41,684	780,028	11,753	5,338	158
Nebraska	124	52	39	378	6,919	107	48	1
Nevada	4,785	1,997	1,523	14,604	271,990	4,118	1,870	56
New Hampshire	7	3	2	23	419	6	3	0
New Jersey	595	248	189	1,815	33,860	512	232	7
New Mexico	2,426	1,012	772	7,403	137,211	2,087	948	28
New York	510	213	162	1,556	28,934	439	199	6
North Carolina	12,657	5,283	4,028	38,631	712,931	10,892	4,948	147
North Dakota	376	157	120	1,148	21,446	324	147	4
Ohio	279	116	89	852	15,799	240	109	3
Oklahoma	4,915	2,052	1,564	15,003	276,897	4,230	1,921	57
Oregon	60,774	25,367	19,341	185,494	3,469,785	52,302	23,756	705
Pennsylvania	588	246	187	1,796	33,258	506	230	7
South Carolina	5,866	2,448	1,867	17,904	331,088	5,048	2,293	68

Modeled State	ALD_2	ALDX	BENZENE	CH4	CO	ETH	ETHA	ETOH
South Dakota	248	104	79	758	14,030	214	97	3
Tennessee	3,802	1,587	1,210	11,605	215,381	3,272	1,486	44
Texas	20,558	8,581	6,542	62,746	1,167,410	17,692	8,036	239
Utah	2,202	919	701	6,722	125,243	1,895	861	26
Vermont	21	9	7	65	1,201	18	8	0
Virginia	5,723	2,389	1,821	17,469	323,302	4,925	2,237	66
Washington	12,561	5,243	3,997	38,337	716,189	10,810	4,910	146
West Virginia	1,981	827	631	6,048	112,272	1,705	775	23
Wisconsin	555	232	177	1,695	31,418	478	217	6
Wyoming	19,089	7,968	6,075	58,264	1,089,155	16,428	7,462	221
TOTAL	533,022	222,482	169,630	1,626,874	30,329,749	458,713	208,355	6,184

Table B-6b - 2008 Point Source Fire (ptfire) Emissions by Species, by US State

Modeled State	FORM	HFLUX	HONO	IOLE	ISOP	MEOH	NH3	NH3_FERT	NO
Alabama	21,133	20,574,857	0	1,142	940	18,777	13,449	0	13,293
Arizona	3,985	7,101,615	0	215	177	3,541	2,536	0	2,669
Arkansas	19,646	11,944,171	0	1,062	874	17,455	12,503	0	8,131
California	302,132	238,402,285	0	16,327	13,435	268,438	192,274	0	108,868
Colorado	4,288	2,828,609	0	232	191	3,810	2,729	0	1,545
Connecticut	191	174,273	0	10	8	169	121	0	69
Delaware	21	20,536	0	1	1	19	13	0	17
Florida	24,546	20,254,369	0	1,326	1,091	21,808	15,621	0	11,522
Georgia	24,828	26,147,024	0	1,342	1,104	22,059	15,800	0	16,718
Idaho	33,800	21,892,268	0	1,827	1,503	30,030	21,510	0	10,748
Illinois	521	412,803	0	28	23	463	332	0	319
Indiana	419	509,115	0	23	19	372	267	0	311
Iowa	200	168,185	0	11	9	178	128	0	132
Kansas	6,051	8,311,207	0	327	269	5,376	3,851	0	5,122
Kentucky	2,909	2,572,079	0	157	129	2,585	1,851	0	1,792
Louisiana	52,602	15,898,558	0	2,843	2,339	46,735	33,475	0	14,108
Maine	147	87,562	0	8	7	130	93	0	76
Maryland	348	318,614	0	19	15	309	221	0	233
Massachusetts	32	22,620	0	2	1	28	20	0	19
Michigan	408	340,567	0	22	18	362	260	0	237
Minnesota	5,794	2,919,085	0	313	258	5,148	3,687	0	2,072
Mississippi	14,616	11,148,075	0	790	650	12,986	9,301	0	7,897
Missouri	6,457	4,771,773	0	349	287	5,737	4,109	0	3,656
Montana	19,991	11,053,699	0	1,080	889	17,761	12,722	0	5,850
Nebraska	181	225,542	0	10	8	161	115	0	165
Nevada	7,004	8,697,819	0	378	311	6,223	4,457	0	3,019
New Hampshire	11	7,014	0	1	0	10	7	0	6
New Jersey	870	553,957	0	47	39	773	554	0	333
New Mexico	3,550	5,613,881	0	192	158	3,155	2,260	0	2,034

Modeled State	FORM	HFLUX	HONO	IOLE	ISOP	MEOH	NH3	NH3_ FERT	NO
New York	746	906,660	0	40	33	663	475	0	358
North Carolina	18,527	33,287,971	0	1,001	824	16,460	11,790	0	12,883
North Dakota	551	328,656	0	30	24	489	350	0	194
Ohio	409	315,106	0	22	18	363	260	0	225
Oklahoma	7,195	9,314,804	0	389	320	6,393	4,579	0	4,984
Oregon	88,958	47,620,189	0	4,807	3,956	79,038	56,612	0	27,040
Pennsylvania	861	1,081,903	0	47	38	765	548	0	508
South Carolina	8,586	8,509,440	0	464	382	7,629	5,464	0	5,469
South Dakota	364	353,228	0	20	16	323	231	0	224
Tennessee	5,565	5,151,986	0	301	247	4,945	3,542	0	2,961
Texas	30,091	25,210,399	0	1,626	1,338	26,736	19,150	0	13,859
Utah	3,224	2,637,367	0	174	143	2,864	2,051	0	1,348
Vermont	31	24,292	0	2	1	28	20	0	20
Virginia	8,378	10,294,958	0	453	373	7,443	5,331	0	5,136
Washington	18,385	12,519,367	0	994	818	16,335	11,700	0	6,285
West Virginia	2,900	2,015,285	0	157	129	2,577	1,846	0	1,523
Wisconsin	813	705,045	0	44	36	722	517	0	461
Wyoming	27,942	22,289,503	0	1,510	1,242	24,826	17,782	0	9,020
TOTAL	780,207	605,538,324	0	42,162	34,693	693,198	496,516	0	313,459

Table B-6c - 2008 Point Source Fire (ptfire) Emissions by Species, by US State

Modeled State	NO_2	NO_x	NVOL	OLE	PAL	PAR	PCA	PCL	PEC	PFE	PH2O
Alabama	1,477	14,770	0	17,456	34	38,644	53	181	7,958	32	0
Arizona	297	2,966	0	3,292	7	7,287	33	315	1,413	6	0
Arkansas	903	9,034	0	16,228	30	35,925	48	169	7,054	29	0
California	12,096	120,965	0	249,560	565	552,467	3,091	32,031	96,566	430	0
Colorado	172	1,717	0	3,542	8	7,842	42	434	1,378	6	0
Connecticut	8	77	0	157	0	349	2	25	59	0	0
Delaware	2	19	0	17	0	39	0	0	8	0	0
Florida	1,280	12,802	0	20,275	39	44,883	89	568	8,796	36	0
Georgia	1,858	18,576	0	20,508	40	45,400	64	230	9,433	39	0
Idaho	1,194	11,942	0	27,918	64	61,805	362	3,790	10,612	48	0
Illinois	35	354	0	430	1	953	1	4	196	1	0
Indiana	35	345	0	346	1	766	1	4	162	1	0
Iowa	15	147	0	166	0	367	1	2	76	0	0
Kansas	569	5,691	0	4,998	10	11,064	19	95	2,370	10	0
Kentucky	199	1,991	0	2,403	5	5,320	11	75	1,074	4	0
Louisiana	1,568	15,675	0	43,449	78	96,185	138	615	18,207	75	0
Maine	8	85	0	121	0	268	0	2	54	0	0
Maryland	26	259	0	287	1	636	1	3	132	1	0
Massachusetts	2	21	0	26	0	58	0	2	11	0	0
Michigan	26	264	0	337	1	746	2	12	149	1	0
Minnesota	230	2,302	0	4,786	9	10,595	16	76	2,045	8	0

Modeled State	NO_2	NO_x	NVOL	OLE	PAL	PAR	PCA	PCL	PEC	PFE	PH2O
Mississippi	877	8,775	0	12,073	23	26,726	38	142	5,392	22	0
Missouri	406	4,062	0	5,333	10	11,806	16	60	2,397	10	0
Montana	650	6,500	0	16,512	37	36,554	197	2,031	6,311	28	0
Nebraska	18	183	0	150	0	331	0	2	72	0	0
Nevada	335	3,354	0	5,785	14	12,807	85	901	2,222	10	0
New Hampshire	1	7	0	9	0	20	0	0	4	0	0
New Jersey	37	370	0	719	1	1,592	6	52	294	1	0
New Mexico	226	2,259	0	2,933	7	6,492	35	354	1,204	5	0
New York	40	398	0	616	1	1,365	7	71	249	1	0
North Carolina	1,431	14,315	0	15,303	34	33,877	142	1,343	6,650	29	0
North Dakota	22	215	0	455	1	1,007	6	58	176	1	0
Ohio	25	251	0	337	1	747	1	4	151	1	0
Oklahoma	554	5,537	0	5,943	12	13,156	34	259	2,676	11	0
Oregon	3,004	30,044	0	73,479	157	162,665	744	7,382	28,764	125	0
Pennsylvania	56	564	0	711	1	1,575	5	38	311	1	0
South Carolina	608	6,076	0	7,092	14	15,701	22	78	3,237	13	0
South Dakota	25	249	0	300	1	665	2	12	133	1	0
Tennessee	329	3,290	0	4,597	9	10,177	22	148	2,016	8	0
Texas	1,540	15,399	0	24,855	48	55,024	115	768	10,736	44	0
Utah	150	1,497	0	2,663	6	5,895	27	263	1,074	5	0
Vermont	2	22	0	26	0	57	0	0	12	0	0
Virginia	571	5,707	0	6,920	15	15,319	50	436	3,012	13	0
Washington	698	6,983	0	15,186	32	33,619	141	1,361	6,061	26	0
West Virginia	169	1,693	0	2,396	5	5,304	7	24	1,068	4	0
Wisconsin	51	512	0	671	1	1,486	2	7	302	1	0
Wyoming	1,002	10,022	0	23,080	54	51,093	321	3,406	8,685	39	0
TOTAL	34,829	348,288	0	644,448	1,376	1,426,656	5,998	57,830	260,962	1,127	0

Table B-6d - 2008 Point Source Fire (ptfire) Emissions by Species, by US State

Modeled State	PK	PM_{10}	PM_{2_5}	PMC	PMFINE	PMG	PMN	PMOTHR	PNA	PNCOM
Alabama	103	86,179	73,033	13,146	27,397	0	8	949	99	25,630
Arizona	221	16,394	13,893	2,501	5,600	2	1	185	50	4,675
Arkansas	98	76,427	64,769	11,658	24,309	0	7	842	89	22,723
California	22,614	1,161,221	984,086	177,135	410,147	238	37	13,290	4,652	324,166
Colorado	306	16,482	13,968	2,514	5,793	3	1	188	64	4,616
Connecticut	18	733	621	112	266	0	0	8	3	201
Delaware	0	90	76	14	29	0	0	1	0	27
Florida	377	96,675	81,928	14,747	31,238	3	8	1,071	152	28,491
Georgia	133	102,206	86,616	15,591	32,512	0	9	1,126	119	30,386
Idaho	2,678	128,657	109,031	19,626	45,776	28	4	1,477	542	35,743
Illinois	2	2,117	1,794	323	673	0	0	23	2	630
Indiana	2	1,749	1,482	267	556	0	0	19	2	520
Iowa	1	823	697	126	262	0	0	9	1	245
Kansas	60	25,823	21,884	3,939	8,266	0	2	285	34	7,650

Modeled State	PK	PM_{10}	$PM_{2.5}$	PMC	PMFINE	PMG	PMN	PMOTHR	PNA	PNCOM
Kentucky	50	11,830	10,026	1,805	3,830	0	1	131	19	3,482
Louisiana	380	197,941	167,747	30,194	63,202	2	18	2,183	250	58,726
Maine	2	584	495	89	188	0	0	6	1	173
Maryland	2	1,431	1,213	218	455	0	0	16	2	426
Massachusetts	1	129	109	20	43	0	0	1	0	37
Michigan	8	1,646	1,395	251	535	0	0	18	3	484
Minnesota	48	22,256	18,861	3,395	7,116	0	2	246	29	6,598
Mississippi	84	58,470	49,551	8,919	18,615	0	5	644	70	17,375
Missouri	35	25,975	22,013	3,962	8,265	0	2	286	31	7,721
Montana	1,433	75,652	64,112	11,540	26,643	15	3	865	297	21,159
Nebraska	1	783	664	119	249	0	0	9	1	233
Nevada	638	27,350	23,178	4,172	9,863	7	1	316	126	7,530
New Hampshire	0	44	37	7	14	0	0	0	0	13
New Jersey	36	3,362	2,849	513	1,131	0	0	38	9	968
New Mexico	250	14,304	12,122	2,182	4,996	3	1	163	53	4,022
New York	50	2,946	2,497	449	1,026	1	0	34	11	830
North Carolina	940	76,622	64,934	11,688	25,996	10	4	864	221	21,941
North Dakota	41	2,113	1,790	322	745	0	0	24	8	590
Ohio	2	1,638	1,389	250	521	0	0	18	2	487
Oklahoma	176	29,740	25,203	4,537	9,726	2	2	331	56	8,704
Oregon	5,190	337,527	286,040	51,487	116,544	54	15	3,830	1,136	95,605
Pennsylvania	26	3,482	2,951	531	1,149	0	0	39	7	1,014
South Carolina	45	35,073	29,723	5,350	11,155	0	3	386	41	10,428
South Dakota	8	1,479	1,253	226	483	0	0	16	3	433
Tennessee	99	22,224	18,834	3,390	7,205	1	2	246	37	6,537
Texas	515	118,286	100,243	18,044	38,324	4	10	1,312	195	34,807
Utah	185	12,552	10,637	1,915	4,318	2	1	142	41	3,564
Vermont	0	127	108	19	40	0	0	1	0	38
Virginia	302	34,046	28,852	5,193	11,328	3	2	381	80	9,864
Washington	954	70,366	59,632	10,734	24,049	10	4	796	217	20,059
West Virginia	13	11,565	9,801	1,764	3,675	0	1	127	13	3,440
Wisconsin	4	3,271	2,772	499	1,039	0	0	36	4	973
Wyoming	2,410	106,477	90,235	16,242	38,258	26	2	1,227	479	29,388
TOTAL	40,542	3,026,869	2,565,143	461,726	1,033,548	415	158	34,208	9,253	863,352

Table B-6e - 2008 Point Source Fire (ptfire) Emissions by Species, by US State

Modeled State	PNH_4	PNO_3	POC	PSI	PSO_4	PTI	SO_2	SULF	TERP	TOL	UNK	UNR	XYL
Alabama	250	780	36,656	8	243	49	7,241	0	2,040	6,626	0	46,213	1,448
Arizona	86	81	6,686	14	113	5	1,420	0	385	1,250	0	8,715	273
Arkansas	223	690	32,499	7	217	43	5,314	0	1,897	6,160	0	42,962	1,346
California	7,438	3,412	463,657	1,404	10,305	190	76,304	0	29,167	94,727	0	660,688	20,694
Colorado	103	53	6,602	19	141	3	1,083	0	414	1,345	0	9,378	294
Connecticut	5	1	288	1	8	0	48	0	18	60	0	417	13
Delaware	0	1	38	0	0	0	9	0	2	7	0	46	1

Modeled State	PNH_4	PNO_3	POC	PSI	PSO_4	PTI	SO_2	SULF	TERP	TOL	UNK	UNR	XYL
Florida	331	787	40,748	25	359	49	7,097	0	2,370	7,696	0	53,675	1,681
Georgia	298	921	43,458	10	291	58	8,876	0	2,397	7,784	0	54,293	1,701
Idaho	857	320	51,124	166	1,199	17	8,056	0	3,263	10,597	0	73,911	2,315
Illinois	6	19	901	0	6	1	176	0	50	163	0	1,140	36
Indiana	5	16	744	0	5	1	159	0	40	131	0	916	29
Iowa	2	7	350	0	2	0	71	0	19	63	0	438	14
Kansas	81	224	10,942	4	82	14	2,514	0	584	1,897	0	13,232	414
Kentucky	41	95	4,981	3	45	6	984	0	281	912	0	6,362	199
Louisiana	602	1,743	83,990	26	605	109	11,660	0	5,078	16,492	0	115,027	3,603
Maine	2	5	247	0	2	0	45	0	14	46	0	321	10
Maryland	4	13	609	0	4	1	124	0	34	109	0	761	24
Massachusetts	1	1	53	0	1	0	11	0	3	10	0	70	2
Michigan	6	13	692	1	7	1	133	0	39	128	0	892	28
Minnesota	69	194	9,436	3	70	12	1,458	0	559	1,817	0	12,671	397
Mississippi	172	524	24,850	6	169	33	4,573	0	1,411	4,583	0	31,961	1,001
Missouri	76	234	11,043	3	74	15	2,076	0	623	2,024	0	14,119	442
Montana	477	236	30,264	89	658	13	4,595	0	1,930	6,268	0	43,714	1,369
Nebraska	2	7	333	0	2	0	79	0	17	57	0	396	12
Nevada	195	45	10,771	40	278	2	1,935	0	676	2,196	0	15,315	480
New Hampshire	0	0	19	0	0	0	4	0	1	3	0	24	1
New Jersey	16	20	1,384	2	20	1	226	0	84	273	0	1,903	60
New Mexico	86	52	5,753	16	117	3	1,150	0	343	1,113	0	7,764	243
New York	17	11	1,187	3	24	1	218	0	72	234	0	1,632	51
North Carolina	385	410	31,382	59	497	25	6,760	0	1,789	5,809	0	40,513	1,269
North Dakota	13	6	844	3	19	0	137	0	53	173	0	1,204	38
Ohio	5	15	697	0	5	1	129	0	39	128	0	893	28
Oklahoma	113	222	12,449	11	130	14	2,619	0	695	2,256	0	15,733	493
Oregon	1,897	1,454	136,742	323	2,537	86	20,785	0	8,588	27,891	0	194,529	6,093
Pennsylvania	14	24	1,450	2	17	1	284	0	83	270	0	1,883	59
South Carolina	102	316	14,914	3	100	20	2,965	0	829	2,692	0	18,776	588
South Dakota	6	11	620	1	6	1	123	0	35	114	0	795	25
Tennessee	78	177	9,349	6	87	11	1,726	0	537	1,745	0	12,170	381
Texas	415	946	49,781	33	457	59	8,611	0	2,905	9,435	0	65,803	2,061
Utah	69	57	5,097	11	92	3	877	0	311	1,011	0	7,049	221
Vermont	0	1	54	0	0	0	11	0	3	10	0	68	2
Virginia	149	221	14,108	19	183	14	2,826	0	809	2,627	0	18,320	574
Washington	371	346	28,690	60	486	21	4,529	0	1,775	5,764	0	40,204	1,259
West Virginia	33	105	4,920	1	32	7	893	0	280	909	0	6,342	199
Wisconsin	9	30	1,391	0	9	2	262	0	78	255	0	1,777	56
Wyoming	747	200	42,035	149	1,056	10	6,705	0	2,697	8,761	0	61,102	1,914
TOTAL	15,859	15,048	1,234,826	2,530	20,759	901	207,881	0	75,320	244,617	0	1,706,119	53,440

Table B-6f- 2008 Point Source Fire (ptfire) Emissions by Species, by US State

Inventory State	CO	NH_3	NO_x	PM_{10}	$PM_{2.5}$	SO_2	VOC
Alabama	62,051	490	5,410	22,912	10,068	515	70,670
Alaska	15,144	352	6,113	7,203	2,505	2,666	9,710
Arizona	56,976	7,862	15,915	83,369	24,812	3,443	97,768
Arkansas	102,821	414	12,060	19,850	14,398	1,457	79,131
California	484,547	65,352	72,519	125,321	91,812	6,742	268,202
Colorado	97,394	1,967	7,883	25,065	16,035	348	63,065
Connecticut	50,762	981	8,178	10,414	8,324	11,887	33,511
Delaware	6,987	228	2,227	1,528	1,165	663	9,398
District of Columbia	5,311	180	1,296	816	802	799	5,758
Florida	110,709	479	5,768	43,184	20,957	514	253,306
Georgia	207,869	1,925	40,805	104,366	65,597	27,148	189,319
Hawaii	11,550	224	1,580	4,144	2,988	3,510	20,384
Idaho	122,431	2,298	14,996	11,939	6,055	29,224	52,970
Illinois	158,561	5,945	48,110	40,261	29,160	6,548	208,973
Indiana	118,256	2,228	22,856	34,911	21,062	15,323	167,257
Iowa	51,713	892	5,639	14,597	9,247	2,210	69,349
Kansas	81,939	1,525	19,290	20,238	11,912	7,485	74,639
Kentucky	74,599	752	5,211	30,029	13,378	902	61,290
Louisiana	175,707	27,402	31,984	45,081	27,090	2,844	159,883
Maine	54,368	1,148	6,035	11,574	8,463	8,518	26,738
Maryland	71,904	1,265	10,134	15,558	10,759	4,804	62,018
Massachusetts	66,404	2,080	19,360	14,594	11,805	18,627	84,470
Michigan	235,044	5,317	36,033	48,257	37,043	13,775	188,531
Minnesota	162,885	2,444	19,165	48,490	27,486	8,365	112,973
Mississippi	98,286	293	4,972	16,983	12,837	276	59,465
Missouri	105,393	1,659	18,762	25,604	16,900	44,416	120,482
Montana	20,960	299	2,058	19,942	5,085	348	16,669
Nebraska	25,763	479	2,893	6,611	4,768	236	41,004
Nevada	17,348	344	4,334	61,655	10,698	4,916	39,408
New Hampshire	45,977	382	5,530	8,795	6,849	5,921	21,639
New Jersey	59,743	3,084	49,099	15,956	9,826	8,432	99,994
New Mexico	32,552	443	2,953	16,437	6,062	92	34,777
New York	190,042	5,690	88,583	48,126	35,810	70,217	344,555
North Carolina	238,998	1,039	23,583	74,611	59,833	13,084	176,879
North Dakota	24,822	160	1,814	12,118	4,177	671	21,229
Ohio	232,489	4,480	37,358	49,049	37,860	13,355	171,244
Oklahoma	113,452	861	84,426	22,161	12,153	4,535	247,806
Oregon	112,375	1,167	4,745	21,900	17,370	934	60,218
Pennsylvania	225,040	1,800	61,457	42,708	31,772	123,928	195,009
P.R.	741	15	35	1,165	1,151	6	25,095
Rhode Island	14,766	325	2,232	2,755	2,326	2,646	9,918
South Carolina	74,837	559	10,308	13,778	9,279	1,082	91,926
South Dakota	12,351	182	1,824	5,008	2,507	315	26,595
Tennessee	94,619	1,011	26,607	40,270	21,660	64,854	103,452
Texas	261,973	2,513	323,436	72,659	33,869	1,556	1,747,776

Inventory State	CO	NH_3	NO_x	PM_{10}	$PM_{2.5}$	SO_2	VOC
Tribal	7,741	35	251	211	137	389	1,574
Utah	40,429	1,827	8,473	30,808	9,036	1,289	61,455
Vermont	50,376	464	3,807	9,605	8,175	3,733	11,038
V.I.	18	0	1	32	32	0	677
Virginia	117,042	1,592	22,426	36,164	20,926	32,474	136,713
Washington	131,717	1,629	6,973	26,660	20,385	1,462	96,878
West Virginia	50,161	419	4,876	27,875	9,309	4,675	25,043
Wisconsin	221,507	3,250	27,026	42,451	35,485	6,740	130,992
Wyoming	18,429	170	17,246	124,493	16,826	1,689	114,623
U.S. TOTAL	5,225,880	169,918	1,266,655	1,660,293	936,028	592,585	6,603,445

Table B-7a - 2008 Non-Point Source (nonpt) Emissions by Species, by US State

Inventory State	ACETALD	BENZENE	CHLORINE	FORMALD	HCL	METHANO
Alabama	110	206		100	80	2,714
Alaska	36	154		56	6	398
Arizona	112	329	0	182	120	773
Arkansas	105	381		99	39	1,880
California	861	1,528	1,591	1,642	33	931
Colorado	369	807		836	16	2,875
Connecticut	155	386		313	11	2,027
Delaware	22	110		53	5	495
District of Columbia	20	37		42	0	343
Florida	231	1,044		320	50	10,670
Georgia	190	544		151	77	5,638
Hawaii	22	129		38	13	472
Idaho	690	591	2	549	202	529
Illinois	394	1,316		665	659	8,890
Indiana	386	1,263		495	25	4,386
Iowa	153	515		222	31	1,748
Kansas	96	265		147	19	43
Kentucky	1,146	627		264	55	2,607
Louisiana	89	274		70	35	2,568
Maine	149	469	1	235	68	874
Maryland	177	482	0	335	14	1,216
Massachusetts	217	503		447	7	81
Michigan	872	2,692		1,354	278	6,264
Minnesota	653	1,618	5	1,134	283	983
Mississippi	103	390		80	44	1,711
Missouri	250	836		355	51	3,853
Montana	58	163		85	12	563
Nebraska	73	249		115	14	1,038
Nevada	68	109		110	40	1,663
New Hampshire	113	315	0	165	37	110
New Jersey	105	249		223	10	107
New Mexico	80	287		128	13	1,155

Inventory State	ACETALD	BENZENE	CHLORINE	FORMALD	HCL	METHANO
New York	546	2,477	2	971	577	11,345
North Carolina	311	838		346	98	5,369
North Dakota	30	95		44	7	373
Ohio	793	2,598		982	539	7,093
Oklahoma	99	357		105	60	2,283
Oregon	385	929		777	20	2,206
Pennsylvania	425	1,121		883	102	7,139
P.R.	13	40		13	4	2,302
Rhode Island	43	113		96	2	608
South Carolina	107	457	0	78	56	2,974
South Dakota	38	127		50	11	468
Tennessee	193	552		208	1,250	4,095
Texas	411	951		522	98	14,087
Tribal	85	18	0	58	3	8
Utah	76	190		133	7	1,592
Vermont	133	442		241	11	360
V.I.	0	1		0	0	65
Virginia	301	736		438	59	4,498
Washington	442	1,054		967	24	3,813
West Virginia	109	334		126	29	1,056
Wisconsin	768	2,498		1,109	173	4,274
Wyoming	29	104		47	5	310
U.S. TOTAL	13,443	34,901	1,601	19,204	5,482	145,923

Table B-7b - 2008 Non-Point Source (nonpt) Emissions by Species, by US State

Modeled State	ALD_2	ALDX	BENZENE	CH_4	CL_2	CO	ETH	ETHA	ETOH
Alabama	611	464	224	855	0	62,328	1,043	78	3,841
Alaska	0	0	0	0	0	0	0	0	0
Arizona	830	1,275	467	18,203	0	57,170	1,825	443	5,093
Arkansas	1,295	938	479	1,223	0	102,944	1,276	747	2,629
California	5,157	5,744	2,823	394,044	1,595	486,980	6,227	7,632	9,258
Colorado	853	2,246	812	6,278	0	97,704	2,101	670	3,864
Connecticut	404	923	388	2,585	0	51,025	1,007	268	2,635
Delaware	76	166	113	5,992	0	7,020	131	84	424
District of Columbia	52	121	40	359	0	5,341	103	33	454
Florida	2,853	1,973	1,115	2,613	0	111,199	1,885	247	13,608
Georgia	2,026	1,359	1,400	5,018	0	208,820	3,065	272	11,842
Hawaii	0	0	0	0	0	0	0	0	0
Idaho	1,023	1,035	605	1,357	2	122,701	1,191	128	2,428
Illinois	1,380	2,232	1,949	11,059	0	159,192	2,591	694	9,571
Indiana	1,145	1,885	1,660	7,681	0	118,758	1,966	496	6,566
Iowa	715	1,128	534	1,779	0	51,689	822	213	2,266
Kansas	1,074	864	806	1,900	0	81,963	1,690	168	1,906
Kentucky	1,766	843	635	3,014	0	74,924	1,374	226	3,570
Louisiana	2,710	1,955	1,347	5,137	0	175,649	4,347	407	7,180

Modeled State	ALD_2	ALDX	BENZENE	CH_4	CL_2	CO	ETH	ETHA	ETOH
Maine	314	767	479	4,963	1	54,605	1,013	244	1,087
Maryland	555	1,206	506	22,790	0	72,210	1,337	407	4,300
Massachusetts	609	1,494	613	216,646	0	66,753	1,365	1,754	3,803
Michigan	1,998	3,420	2,813	104,607	0	236,135	3,518	7,790	8,909
Minnesota	1,453	2,694	1,646	7,483	5	163,323	2,847	771	6,289
Mississippi	911	538	427	630	0	98,755	1,471	63	2,213
Missouri	1,359	1,474	909	3,028	0	105,701	1,570	323	5,239
Montana	177	296	165	655	0	21,035	344	81	733
Nebraska	419	647	264	949	0	25,779	429	99	1,355
Nevada	261	623	129	1,601	0	17,440	542	151	2,947
New Hampshire	223	422	323	13,904	0	46,173	796	204	729
New Jersey	564	1,430	360	74,010	0	60,031	1,224	946	4,274
New Mexico	368	404	289	1,004	0	32,663	588	104	1,577
New York	2,079	3,549	2,778	1,062,559	2	190,933	3,434	7,512	25,743
North Carolina	1,351	1,548	1,075	5,137	0	239,919	4,332	353	10,011
North Dakota	303	377	119	356	0	24,861	277	47	489
Ohio	1,770	2,706	2,647	7,982	0	233,470	2,933	699	9,620
Oklahoma	740	950	1,617	31,927	0	113,712	624	50,761	2,736
Oregon	879	1,924	936	6,141	0	112,807	2,544	674	3,346
Pennsylvania	1,504	2,867	1,310	8,393	0	225,955	3,511	890	11,109
Puerto Rico	0	0	0	0	0	0	0	0	0
Rhode Island	121	294	114	829	0	14,844	305	86	784
South Carolina	811	467	472	960	0	75,070	1,083	77	3,926
South Dakota	180	307	131	452	0	12,381	205	43	613
Tennessee	824	952	584	2,434	0	94,986	1,449	223	5,427
Texas	2,801	5,155	8,623	282,708	0	262,982	2,380	446,501	19,757
Tribal Data	0	0	0	0	0	0	0	0	0
Utah	453	682	239	16,126	0	40,557	584	211	3,014
Vermont	244	688	447	2,120	0	50,629	859	224	534
Virgin Islands	0	0	0	0	0	0	0	0	0
Virginia	1,149	1,639	1,726	12,745	0	117,527	3,023	713	8,048
Washington	1,120	2,713	1,064	7,119	0	132,184	2,770	755	5,166
West Virginia	344	348	340	984	0	50,365	810	98	1,365
Wisconsin	1,468	2,687	2,536	7,555	0	222,508	2,978	753	5,172
Wyoming	116	520	420	364	0	18,482	177	7,391	407
TOTAL	51,438	70,938	51,497	2,378,258	1,605	5,210,185	83,963	543,755	247,855

Table B-7c - 2008 Non-Point Source (nonpt) Emissions by Species, by US State

Modeled State	NO_2	NO_x	NVOL	OLE	PAL	PAR	PCA	PCL	PEC	PFE
Alabama	543	5,433	94	747	236	52,525	57	441	625	87
Alaska	0	0	0	0	0	0	0	0	0	0
Arizona	1,593	15,930	50	2,052	666	71,771	225	461	864	490
Arkansas	1,209	12,086	147	1,322	54	52,668	16	1,061	1,371	20
California	7,272	72,719	329	7,220	285	178,133	143	1,758	6,140	150
Colorado	793	7,925	63	1,544	106	35,740	27	81	830	40
Connecticut	823	8,225	4	590	22	21,172	6	145	543	9
Delaware	223	2,233	8	122	4	6,420	1	11	68	2
District of Columbia	130	1,301	7	69	0	3,650	0	3	44	0
Florida	580	5,796	235	2,983	246	175,579	63	895	1,391	93
Georgia	4,087	40,868	319	2,468	621	130,379	400	1,983	3,556	246
Hawaii	0	0	0	0	0	0	0	0	0	0
Idaho	1,502	15,017	153	1,384	90	29,374	35	164	437	38
Illinois	4,827	48,267	647	2,395	154	138,600	73	979	2,308	89
Indiana	2,292	22,919	430	2,322	162	109,542	59	514	1,457	72
Iowa	566	5,658	195	1,735	60	39,491	16	360	672	23
Kansas	1,932	19,318	116	1,907	33	52,932	10	688	1,202	13
Kentucky	524	5,238	35	1,012	183	40,698	45	530	905	68
Louisiana	3,199	31,986	65	2,724	343	113,619	87	1,726	2,295	126
Maine	606	6,058	39	659	52	15,783	13	254	658	20
Maryland	1,017	10,174	32	856	52	44,820	14	313	730	20
Massachusetts	1,944	19,440	75	865	30	61,507	14	96	681	13
Michigan	3,617	36,173	235	2,692	125	121,303	35	597	2,233	49
Minnesota	1,922	19,219	261	2,746	221	67,368	56	550	1,641	83
Mississippi	500	4,998	56	1,169	32	41,785	11	977	1,252	12
Missouri	1,881	18,805	193	1,560	96	81,482	26	760	1,290	36
Montana	207	2,069	25	352	168	10,832	40	130	238	62
Nebraska	290	2,904	113	984	21	23,511	6	205	359	8
Nevada	435	4,346	33	420	589	26,039	144	73	218	218
New Hampshire	555	5,551	20	423	18	14,638	6	252	549	7
New Jersey	4,928	49,283	35	860	54	77,419	16	86	528	23
New Mexico	297	2,967	10	426	115	25,142	29	194	355	42
New York	8,894	88,940	377	2,992	156	228,864	87	743	2,381	71
North Carolina	2,365	23,653	379	2,937	133	119,292	65	4,622	5,912	59
North Dakota	182	1,821	67	590	91	12,006	22	200	285	34
Ohio	3,747	37,468	326	2,197	125	112,674	36	1,016	2,557	48
Oklahoma	8,463	84,632	53	1,447	78	176,392	45	455	773	30
Oregon	477	4,767	60	1,574	49	34,686	14	307	1,094	19
Pennsylvania	6,159	61,587	304	2,281	152	132,331	47	967	2,261	60
Puerto Rico	0	0	0	0	0	0	0	0	0	0
Rhode Island	224	2,245	1	181	5	6,162	1	30	143	2
South Carolina	1,033	10,326	128	897	39	67,354	12	622	840	15
South Dakota	183	1,831	67	572	28	16,249	7	104	176	10
Tennessee	2,664	26,638	140	5,084	214	68,287	141	741	1,520	97
Texas	32,431	324,315	416	7,952	388	1,158,957	99	1,033	1,976	147
Tribal Data	0	0	0	0	0	0	0	0	0	0

Modeled State	NO_2	NO_x	NVOL	OLE	PAL	PAR	PCA	PCL	PEC	PFE
Utah	851	8,508	112	628	261	43,761	70	230	448	97
Vermont	382	3,819	3	460	13	5,288	8	148	530	5
Virgin Islands	0	0	0	0	0	0	0	0	0	0
Virginia	2,248	22,478	253	2,081	169	93,455	80	648	1,393	71
Washington	701	7,007	162	2,468	68	54,795	19	359	1,233	27
West Virginia	489	4,891	3	458	202	17,529	51	376	617	75
Wisconsin	2,710	27,101	293	2,193	80	80,635	24	755	2,300	32
Wyoming	1,729	17,295	5	577	1,229	104,562	289	93	110	450
TOTAL	126,223	1,262,231	7,170	84,177	8,312	4,397,202	2,792	29,733	61,990	3,509

Table B-7d - 2008 Non-Point Source (nonpt) Emissions by Species, by US State

Modeled State	PH2O	PK	PM_{10}	PM_{2_5}	PMC	PMFINE	PMG	PMN	PMOTHR
Alabama	3	380	22,770	10,064	12,706	6,048	17	4	2,089
Alaska	0	0	0	0	0	0	0	0	0
Arizona	28	459	82,646	24,763	57,883	17,606	39	37	9,952
Arkansas	0	839	19,811	14,408	5,402	7,032	13	1	733
California	149	1,622	125,524	92,177	33,347	40,723	42	11	8,961
Colorado	1	166	24,986	16,065	8,922	7,196	8	2	1,200
Connecticut	0	149	10,432	8,361	2,071	3,591	3	0	555
Delaware	0	13	1,529	1,169	360	493	1	0	83
District of Columbia	0	7	820	807	14	314	0	0	24
Florida	2	735	42,966	20,993	21,974	10,527	24	4	2,390
Georgia	17	4,411	104,090	65,639	38,451	37,389	91	9	11,899
Hawaii	0	0	0	0	0	0	0	0	0
Idaho	0	151	11,892	6,060	5,832	3,174	5	1	1,002
Illinois	3	706	40,231	29,245	10,987	13,536	16	3	2,606
Indiana	1	423	34,821	21,121	13,700	9,916	13	3	2,068
Iowa	0	312	14,523	9,232	5,291	4,379	7	1	677
Kansas	1	552	20,294	11,914	8,380	5,531	8	1	802
Kentucky	2	462	29,859	13,396	16,463	7,019	15	3	1,713
Louisiana	10	1,403	44,834	27,045	17,789	14,849	34	5	3,487
Maine	0	235	11,572	8,490	3,081	3,986	5	1	753
Maryland	0	282	15,545	10,796	4,748	4,844	7	1	712
Massachusetts	2	187	14,618	11,855	2,763	5,096	5	1	1,015
Michigan	1	668	48,286	37,186	11,100	16,225	15	2	1,867
Minnesota	2	585	48,296	27,520	20,776	13,100	18	4	2,362
Mississippi	0	768	17,013	12,891	4,122	6,190	11	1	534
Missouri	1	640	25,542	16,933	8,610	8,009	13	2	1,130
Montana	1	134	19,751	5,070	14,681	3,352	10	3	1,413
Nebraska	0	173	6,591	4,769	1,822	2,204	3	0	275
Nevada	6	149	61,034	10,627	50,406	8,548	31	9	4,861
New Hampshire	0	222	8,807	6,876	1,931	3,082	4	0	392

Modeled State	PH2O	PK	PM_{10}	PM_{2_5}	PMC	PMFINE	PMG	PMN	PMOTHR
New Jersey	8	99	15,965	9,864	6,101	4,343	5	1	1,003
New Mexico	1	188	16,317	6,060	10,257	3,406	8	2	1,040
New York	4	763	48,166	35,939	12,226	15,895	17	3	3,502
North Carolina	2	3,685	75,248	60,009	15,240	29,121	49	2	2,734
North Dakota	1	173	12,014	4,169	7,846	2,497	7	1	801
Ohio	1	964	49,063	37,996	11,066	16,842	19	2	1,871
Oklahoma	23	688	22,098	12,162	9,936	6,418	14	1	1,715
Oregon	0	333	21,912	17,428	4,484	7,551	7	1	801
Pennsylvania	1	920	46,283	31,880	14,403	14,543	21	3	2,222
Puerto Rico	0	0	0	0	0	0	0	0	0
Rhode Island	0	34	2,762	2,337	425	980	1	0	133
South Carolina	0	490	13,769	9,305	4,464	4,440	8	1	515
South Dakota	0	94	4,981	2,509	2,472	1,289	3	0	284
Tennessee	1	1,105	40,243	21,699	18,544	11,502	19	2	3,332
Texas	278	869	72,337	33,937	38,401	18,234	33	7	7,028
Tribal Data	0	0	0	0	0	0	0	0	0
Utah	3	227	30,555	9,021	21,533	5,614	17	4	2,265
Vermont	0	211	9,630	8,210	1,419	3,622	3	0	460
Virgin Islands	0	0	0	0	0	0	0	0	0
Virginia	1	773	36,111	20,978	15,134	10,378	16	2	2,422
Washington	1	387	26,653	20,444	6,209	8,927	9	1	1,025
West Virginia	2	335	27,668	9,306	18,362	5,485	14	3	1,792
Wisconsin	1	780	42,516	35,628	6,888	15,534	14	1	1,480
Wyoming	10	259	123,015	16,644	106,372	15,750	63	20	9,842
TOTAL	570	30,210	1,646,388	930,996	715,393	466,331	804	167	111,820

Table B-7e - 2008 Non-Point Source (nonpt) Emissions by Species, by US State

Modeled State	PNA	PNCOM	PNH_4	PNO_3	POC	PSI	PSO_4	PTI
Alabama	50	2,039	85	27	3,264	554	100	7
Alaska	0	0	0	0	0	0	0	0
Arizona	88	3,232	77	48	5,843	1,805	400	47
Arkansas	83	3,881	210	48	5,755	120	202	2
California	324	26,058	333	348	43,417	659	1,549	228
Colorado	25	5,263	25	34	7,936	249	69	3
Connecticut	18	2,595	32	20	4,049	54	158	1
Delaware	2	364	2	3	592	10	13	0
District of Columbia	1	277	1	2	442	0	5	0
Florida	94	5,229	170	68	8,816	573	191	7
Georgia	219	11,142	382	96	21,738	5,945	2,860	23
Hawaii	0	0	0	0	0	0	0	0
Idaho	18	1,450	35	16	2,266	181	167	4
Illinois	94	8,109	300	127	12,791	397	483	8
Indiana	69	5,989	144	89	9,262	393	396	7
Iowa	35	2,674	74	26	4,068	139	87	2
Kansas	55	3,157	137	44	4,801	74	335	1

Modeled State	PNA	PNCOM	PNH_4	PNO_3	POC	PSI	PSO_4	PTI
Kentucky	56	3,404	106	35	5,314	427	122	5
Louisiana	150	6,329	341	81	9,445	798	376	10
Maine	25	2,447	53	20	3,672	125	153	2
Maryland	33	3,223	64	29	5,075	121	119	2
Massachusetts	19	3,513	21	27	5,756	180	296	1
Michigan	78	12,352	137	89	18,404	294	236	4
Minnesota	70	8,503	122	63	12,528	520	190	7
Mississippi	75	3,505	193	44	5,222	70	184	1
Missouri	69	4,860	153	49	7,413	221	170	3
Montana	21	943	26	10	1,434	396	37	5
Nebraska	19	1,402	41	14	2,145	49	47	1
Nevada	45	1,011	11	17	1,757	1,380	87	21
New Hampshire	24	2,060	52	21	3,098	46	126	1
New Jersey	20	2,874	22	28	4,794	131	171	2
New Mexico	24	1,438	38	15	2,230	284	54	3
New York	115	9,744	147	142	16,298	534	1,224	9
North Carolina	350	16,043	943	202	23,760	428	1,014	5
North Dakota	21	892	40	10	1,329	213	47	3
Ohio	106	12,145	217	96	18,200	289	301	4
Oklahoma	45	2,543	85	27	4,485	693	459	2
Oregon	37	5,799	70	40	8,632	113	110	1
Pennsylvania	99	9,416	202	81	14,564	430	431	5
Puerto Rico	0	0	0	0	0	0	0	0
Rhode Island	4	752	7	6	1,171	11	37	0
South Carolina	51	2,475	122	32	3,870	88	122	1
South Dakota	10	655	21	7	1,008	72	29	1
Tennessee	70	4,443	148	50	7,788	1,176	839	13
Texas	122	7,115	195	118	12,162	908	1,447	12
Tribal Data	0	0	0	0	0	0	0	0
Utah	37	1,733	44	21	2,858	617	80	8
Vermont	17	2,608	33	17	3,898	116	144	0
Virgin Islands	0	0	0	0	0	0	0	0
Virginia	66	5,311	131	49	8,638	680	520	8
Washington	45	6,743	81	50	10,100	161	134	2
West Virginia	42	2,044	75	24	3,076	468	105	6
Wisconsin	82	11,928	170	84	17,452	187	257	2
Wyoming	81	468	11	12	715	2,900	57	36
TOTAL	3,303	242,179	6,130	2,606	383,328	26,278	16,741	526

Table B-7f - 2008 Non-Point Source (nonpt) Emissions by Species, by US State

Modeled State	SO_2	SULF	TERP	TOL	UNK	UNR	XYL
Alabama	516	6	790	3,747	0	7,240	3,528
Alaska	0	0	0	0	0	0	0
Arizona	3,443	55	720	8,108	0	10,566	6,307
Arkansas	1,459	0	666	5,410	0	10,182	5,809
California	6,760	26	2,418	21,455	0	36,201	17,795
Colorado	350	1	429	4,072	0	9,276	3,081
Connecticut	11,958	180	220	2,038	0	4,192	1,561
Delaware	667	10	90	741	0	1,160	534
District of Columbia	802	12	46	322	0	831	262
Florida	516	1	1,608	16,859	0	22,811	19,753
Georgia	27,143	517	1,520	11,939	0	23,416	12,493
Hawaii	0	0	0	0	0	0	0
Idaho	29,238	600	1,384	4,113	0	8,504	4,168
Illinois	6,563	70	1,639	7,986	0	36,862	9,318
Indiana	15,340	215	2,576	11,914	0	26,849	13,062
Iowa	2,221	43	576	4,319	0	10,217	5,813
Kansas	7,484	103	531	6,621	0	10,269	6,230
Kentucky	906	11	387	3,886	0	6,358	4,059
Louisiana	2,842	10	1,344	11,811	0	16,280	9,124
Maine	8,554	122	268	1,954	0	5,062	1,359
Maryland	4,824	73	612	4,503	0	7,112	3,191
Massachusetts	18,717	285	1,046	8,829	0	11,877	6,184
Michigan	13,788	239	1,609	12,742	0	31,960	10,956
Minnesota	8,375	131	1,184	6,956	0	18,180	6,843
Mississippi	277	0	296	3,713	0	5,411	4,652
Missouri	44,420	986	985	9,163	0	16,155	9,365
Montana	350	5	110	884	0	2,260	1,067
Nebraska	237	2	337	2,505	0	5,995	3,623
Nevada	4,920	74	730	3,270	0	5,769	2,582
New Hampshire	5,947	83	417	2,326	0	3,286	1,932
New Jersey	8,463	121	909	10,531	0	11,855	7,455
New Mexico	93	0	187	2,520	0	3,150	3,101
New York	70,438	854	7,480	32,607	0	41,703	25,018
North Carolina	13,108	189	2,294	11,381	0	24,968	9,771
North Dakota	675	9	175	974	0	3,283	1,907
Ohio	13,378	175	2,140	10,587	0	27,101	9,078
Oklahoma	4,534	79	1,058	5,940	0	69,706	5,659
Oregon	939	9	353	3,979	0	8,593	3,724
Pennsylvania	124,025	1,661	1,992	12,496	0	25,912	12,686
Puerto Rico	0	0	0	0	0	0	0
Rhode Island	2,662	40	66	614	0	1,212	441
South Carolina	1,084	3	722	6,788	0	10,615	7,153
South Dakota	316	4	185	1,298	0	3,536	3,432
Tennessee	64,841	1,424	1,008	8,797	0	12,460	6,235
Texas	1,561	0	7,811	49,185	0	549,608	30,279
Tribal Data	0	0	0	0	0	0	0

Modeled State	SO_2	SULF	TERP	TOL	UNK	UNR	XYL
Utah	1,293	15	558	3,834	0	8,282	3,671
Vermont	3,743	50	43	868	0	2,226	467
Virgin Islands	0	0	0	0	0	0	0
Virginia	32,497	620	1,228	7,382	0	19,832	6,693
Washington	1,469	17	723	5,900	0	14,354	6,169
West Virginia	4,677	94	119	1,616	0	2,504	1,602
Wisconsin	6,760	67	1,178	9,030	0	22,554	8,470
Wyoming	1,694	2	680	2,881	0	22,229	4,885
TOTAL	586,868	9,293	55,444	371,396	0	1,239,962	332,547

Table B-7g - 2008 Non-Point Source (nonpt) Emissions by Species, by US State

Inventory State	CO	NH_3	NO_x	PM_{10}	$PM_{2.5}$
Alabama	645,692	2,722	147,666	5,059	3,758
Alaska	114,764	229	14,296	460	350
Arizona	689,164	2,876	195,507	7,017	5,298
Arkansas	432,174	1,469	85,528	2,672	1,997
California	3,266,499	15,347	678,335	22,297	14,884
Colorado	583,752	2,244	109,917	3,288	2,262
Connecticut	341,861	1,483	79,048	2,761	1,979
Delaware	108,142	412	20,952	777	536
District of Columbia	39,844	173	7,588	310	200
Florida	2,197,368	9,247	466,426	18,091	12,662
Georgia	1,330,232	4,698	262,676	9,146	6,614
Hawaii	123,944	481	18,977	497	268
Idaho	213,608	687	30,173	802	478
Illinois	1,476,899	4,865	295,947	10,275	7,376
Indiana	913,953	3,254	203,152	6,557	4,914
Iowa	409,573	1,395	88,018	2,853	2,198
Kansas	348,360	1,337	74,844	2,406	1,789
Kentucky	553,591	2,163	135,128	4,386	3,395
Louisiana	516,371	2,105	116,128	3,891	2,884
Maine	212,681	656	39,001	1,191	897
Maryland	600,162	2,621	128,727	4,238	2,965
Massachusetts	608,242	2,559	124,247	4,300	2,993
Michigan	1,392,478	4,539	270,195	9,693	7,067
Minnesota	860,095	2,627	152,126	5,003	3,654
Mississippi	418,114	1,967	110,817	3,854	3,022
Missouri	890,436	3,132	187,018	6,160	4,574
Montana	151,901	487	34,085	1,033	827
Nebraska	239,143	862	58,679	2,092	1,635
Nevada	208,052	978	41,130	1,086	668
New Hampshire	159,416	597	31,488	1,037	763
New Jersey	852,691	3,461	148,466	4,550	2,872
New Mexico	299,214	1,198	80,121	2,508	1,943
New York	1,713,545	6,288	265,576	7,395	4,499
North Carolina	1,479,833	4,771	268,445	8,997	6,487
North Dakota	114,127	353	23,620	723	569
Ohio	1,464,295	5,032	280,346	8,933	6,511
Oklahoma	589,173	2,219	127,793	4,330	3,240
Oregon	444,184	1,536	84,858	2,620	1,890
Pennsylvania	1,325,520	4,998	250,844	8,393	6,086
Rhode Island	92,638	393	13,670	394	224
South Carolina	663,972	2,255	128,149	4,481	3,325
South Dakota	116,200	406	27,485	851	679
Tennessee	983,913	3,139	210,064	7,075	5,400
Texas	2,567,424	11,675	716,982	27,176	21,063

Inventory State	CO	NH_3	NO_x	PM_{10}	$PM_{2.5}$
Utah	366,771	1,201	69,679	2,162	1,541
Vermont	83,469	324	14,229	408	295
Virginia	1,074,205	3,800	194,054	6,002	4,164
Washington	761,089	2,555	151,484	5,437	4,052
West Virginia	277,027	942	54,622	1,555	1,187
Wisconsin	783,934	2,588	135,952	4,055	2,857
Wyoming	126,203	428	31,187	932	751
Cont. US	35,987,232	137,064	7,452,168	251,254	181,926

Table B-8a - 2008 On Road Non-Temperature Adjusted (on_noadj) Emissions by Species, by US State

Inventory State	SO_2	VOC	ACETALD	BENZENE	FORMALD
Alabama	1,069	55,779	491	1,555	883
Alaska	130	6,304	49	447	84
Arizona	1,049	62,915	541	1,854	1,054
Arkansas	596	33,374	241	1,062	555
California	1,778	303,138	2,698	7,908	4,325
Colorado	881	48,543	457	1,706	672
Connecticut	528	31,274	358	885	501
Delaware	160	8,863	79	253	140
District of Columbia	66	3,240	26	90	45
Florida	3,863	191,300	1,421	5,639	2,661
Georgia	1,656	104,405	773	3,450	1,564
Hawaii	160	10,730	86	304	97
Idaho	293	16,481	137	640	236
Illinois	2,079	124,911	1,491	3,588	2,082
Indiana	1,381	76,095	989	2,101	1,367
Iowa	604	33,917	448	984	546
Kansas	556	29,050	278	965	451
Kentucky	867	46,207	475	1,376	840
Louisiana	858	43,777	374	1,238	716
Maine	280	15,689	139	521	235
Maryland	998	53,819	497	1,637	813
Massachusetts	796	51,332	530	1,449	786
Michigan	2,230	114,175	1,078	3,930	1,742
Minnesota	1,001	68,886	904	2,202	1,035
Mississippi	774	36,695	326	1,002	640
Missouri	1,410	74,164	750	2,341	1,237
Montana	232	11,451	86	454	205
Nebraska	393	20,823	268	619	352
Nevada	273	19,661	149	607	239
New Hampshire	203	12,573	113	376	188
New Jersey	1,114	71,371	699	2,014	931
New Mexico	525	25,933	250	853	463
New York	2,162	134,596	1,224	4,049	1,718
North Carolina	2,072	105,729	613	3,553	1,505
North Dakota	154	9,409	131	292	152

Inventory State	SO_2	VOC	ACETALD	BENZENE	FORMALD
Ohio	2,174	111,525	1,166	3,397	1,740
Oklahoma	948	47,263	403	1,389	739
Oregon	561	33,449	309	1,460	496
Pennsylvania	1,875	110,284	819	3,196	1,529
Rhode Island	104	7,992	70	217	93
South Carolina	970	48,292	296	1,566	736
South Dakota	179	9,960	131	300	165
Tennessee	1,473	73,032	648	2,151	1,150
Texas	4,685	231,231	2,178	6,359	4,560
Utah	561	28,606	224	1,077	416
Vermont	116	6,499	53	196	86
Virginia	1,494	82,822	601	2,639	1,212
Washington	1,009	55,563	508	2,361	875
West Virginia	391	20,769	179	676	309
Wisconsin	1,008	65,063	770	1,960	932
Wyoming	205	10,174	100	378	188
Cont. US	50,652	2,982,099	27,488	90,514	46,107

Table B-8b - 2008 On Road Non-Temperature Adjusted (on_noadj) Emissions by Species, by US State

Modeled State	ALD_2	ALD_X	BENZENE	CH_4	CO	ETH	ETHA	ETOH	FORM
Alabama	891	864	1,557	6,128	646,800	3,063	944	310	1,327
Alaska	0	0	0	0	0	0	0	0	0
Arizona	991	1,053	1,852	6,628	688,102	3,352	1,021	478	1,549
Arkansas	469	554	1,064	3,897	433,349	1,951	600	0	833
California	4,630	3,303	7,884	34,812	3,258,226	16,879	5,361	7,582	6,602
Colorado	757	513	1,705	6,031	583,679	2,906	929	872	1,052
Connecticut	531	425	883	3,836	341,228	1,883	591	1,242	753
Delaware	140	124	252	1,052	108,135	518	162	0	212
District of Columbia	50	36	89	374	39,671	181	58	0	70
Florida	2,887	2,468	5,620	20,049	2,192,300	9,889	3,089	0	4,082
Georgia	1,492	1,412	3,450	12,403	1,331,467	6,090	1,911	0	2,400
Hawaii	0	0	0	0	0	0	0	0	0
Idaho	244	183	640	2,108	213,484	1,017	325	0	368
Illinois	2,228	1,762	3,586	15,869	1,476,831	7,788	2,444	3,067	3,121
Indiana	1,430	1,359	2,100	9,005	914,870	4,541	1,387	2,524	2,009
Iowa	641	481	986	4,289	410,878	2,107	660	1,190	829
Kansas	468	393	966	3,512	348,836	1,723	541	319	686
Kentucky	783	853	1,380	5,298	554,965	2,686	816	409	1,231
Louisiana	702	740	1,241	4,663	517,828	2,357	718	0	1,068
Maine	239	197	524	2,080	213,824	1,009	320	0	367
Maryland	871	634	1,637	6,549	599,860	3,178	1,009	0	1,238
Massachusetts	881	666	1,445	6,246	607,183	3,052	962	143	1,197
Michigan	1,797	1,498	3,926	14,475	1,391,111	7,063	2,230	857	2,679
Minnesota	1,289	816	2,205	9,103	861,849	4,404	1,402	2,358	1,604

Modeled State	ALD_2	ALD_x	BENZENE	CH_4	CO	ETH	ETHA	ETOH	FORM
Mississippi	602	693	1,005	3,817	419,585	1,959	588	0	940
Missouri	1,228	1,141	2,342	8,946	890,742	4,437	1,378	743	1,850
Montana	157	207	456	1,441	152,576	722	222	18	306
Nebraska	387	323	620	2,551	239,773	1,266	393	747	526
Nevada	284	183	607	2,198	207,930	1,056	339	324	382
New Hampshire	196	153	377	1,610	159,793	781	248	0	291
New Jersey	1,149	629	2,012	8,908	852,421	4,248	1,372	1,477	1,478
New Mexico	431	489	855	2,841	300,170	1,450	438	148	679
New York	2,049	1,123	4,044	17,559	1,712,494	8,336	2,704	2,332	2,769
North Carolina	1,328	1,339	3,554	12,770	1,480,399	6,231	1,967	0	2,350
North Dakota	184	131	294	1,249	114,751	611	192	302	233
Ohio	1,885	1,580	3,396	13,617	1,465,833	6,701	2,097	1,318	2,653
Oklahoma	745	715	1,388	5,300	589,708	2,638	817	0	1,116
Oregon	521	452	1,461	4,100	444,543	2,009	632	319	767
Pennsylvania	1,622	1,387	3,200	12,494	1,327,568	6,118	1,925	111	2,383
Rhode Island	129	60	216	939	92,504	445	145	14	151
South Carolina	632	720	1,567	5,558	664,669	2,757	856	0	1,125
South Dakota	188	145	301	1,278	116,785	629	197	338	249
Tennessee	1,164	1,117	2,150	8,407	983,974	4,180	1,295	0	1,741
Texas	3,872	5,121	6,357	23,575	2,567,805	12,382	3,632	154	6,504
Utah	409	339	1,075	3,610	366,326	1,749	556	75	646
Vermont	98	66	197	828	83,852	397	128	0	138
Virginia	1,160	981	2,641	10,247	1,074,598	4,970	1,579	0	1,875
Washington	862	833	2,357	6,777	760,521	3,350	1,044	266	1,332
West Virginia	321	270	679	2,559	278,269	1,250	394	0	479
Wisconsin	1,150	647	1,965	8,715	786,366	4,170	1,342	1,731	1,461
Wyoming	165	191	378	1,241	126,664	627	191	0	277
TOTAL	47,329	41,369	90,484	351,541	35,995,095	173,104	54,147	31,770	69,980

Table B-8c - 2008 On Road Non-Temperature Adjusted (on_noadj) Emissions by Species, by US State

Modeled State	HONO	IOLE	ISOP	MEOH	NH_3	NH3_FERT	NO	NO_2	NO_x
Alabama	1,175	856	0	0	2,726	0	134,108	11,632	146,915
Alaska	0	0	0	0	0	0	0	0	0
Arizona	1,551	956	0	0	2,871	0	177,026	15,278	193,855
Arkansas	681	505	0	0	1,473	0	77,710	6,759	85,150
California	5,388	4,467	2	0	15,312	0	614,290	53,855	673,533
Colorado	874	709	0	0	2,242	0	99,656	8,768	109,298
Connecticut	627	424	0	0	1,479	0	71,567	6,168	78,362
Delaware	166	136	0	0	412	0	19,004	1,637	20,808
District of Columbia	60	51	0	0	172	0	6,856	602	7,517
Florida	3,702	3,071	2	0	9,224	0	421,861	37,139	462,702
Georgia	2,088	1,603	1	0	4,699	0	238,262	20,662	261,012
Hawaii	0	0	0	0	0	0	0	0	0
Idaho	240	248	0	0	686	0	27,360	2,460	30,061

Modeled State	HONO	IOLE	ISOP	MEOH	NH_3	NH3_FERT	NO	NO_2	NO_x
Illinois	2,350	1,750	0	0	4,857	0	268,159	23,192	293,700
Indiana	1,614	1,027	0	0	3,255	0	184,258	15,919	201,791
Iowa	701	463	0	0	1,398	0	80,081	6,786	87,567
Kansas	596	429	0	0	1,338	0	68,003	5,844	74,442
Kentucky	1,075	673	0	0	2,167	0	122,830	10,504	134,409
Louisiana	925	683	0	0	2,107	0	105,503	9,168	115,596
Maine	311	234	0	0	658	0	35,554	3,020	38,884
Maryland	1,023	830	0	0	2,618	0	116,688	10,186	127,897
Massachusetts	986	779	0	0	2,553	0	112,530	9,729	123,244
Michigan	2,145	1,673	1	0	4,534	0	244,980	21,002	268,126
Minnesota	1,210	947	0	0	2,628	0	138,162	11,851	151,224
Mississippi	883	568	0	0	1,973	0	100,844	8,592	110,319
Missouri	1,487	1,082	0	0	3,134	0	169,693	14,647	185,826
Montana	271	164	0	0	489	0	31,029	2,630	33,930
Nebraska	467	282	0	0	863	0	53,374	4,480	58,320
Nevada	327	303	0	0	977	0	37,205	3,403	40,936
New Hampshire	251	191	0	0	597	0	28,647	2,429	31,327
New Jersey	1,181	1,060	0	0	3,456	0	134,434	12,029	147,643
New Mexico	638	385	0	0	1,200	0	72,812	6,244	79,694
New York	2,115	1,994	1	0	6,280	0	240,740	21,503	264,358
North Carolina	2,135	1,628	1	0	4,771	0	243,711	21,011	266,857
North Dakota	188	129	0	0	354	0	21,517	1,820	23,525
Ohio	2,228	1,633	1	0	5,029	0	254,280	22,039	278,548
Oklahoma	1,016	732	0	0	2,221	0	115,989	10,010	127,015
Oregon	675	487	0	0	1,539	0	77,067	6,685	84,427
Pennsylvania	1,994	1,739	1	0	4,996	0	227,736	19,535	249,266
Rhode Island	109	129	0	0	392	0	12,365	1,118	13,591
South Carolina	1,019	743	0	0	2,257	0	116,313	10,059	127,390
South Dakota	219	136	0	0	408	0	25,040	2,105	27,364
Tennessee	1,669	1,119	1	0	3,138	0	190,761	16,155	208,585
Texas	5,691	3,477	2	0	11,666	0	649,926	55,737	711,354
Utah	554	429	0	0	1,199	0	63,113	5,538	69,204
Vermont	114	101	0	0	325	0	12,982	1,111	14,207
Virginia	1,545	1,273	1	0	3,800	0	176,075	15,444	193,063
Washington	1,202	809	0	0	2,553	0	137,431	11,651	150,284
West Virginia	436	317	0	0	945	0	49,768	4,252	54,455
Wisconsin	1,083	926	0	0	2,591	0	123,616	10,686	135,385
Wyoming	248	147	0	0	430	0	28,373	2,404	31,025
TOTAL	59,232	44,498	18	0	136,992		6,759,289	585,477	7,403,997

Table B-8d - 2008 On Road Non-Temperature Adjusted (on_noadj) Emissions by Species, by US State

Modeled State	NVOL	OLE	PAR	PEC	PM_{10}	$PM_{2.5}$	PMC	PMFINE	PNO_3
Alabama	32	3,681	32,369	2,518	5,006	3,712	1,294	426	4
Alaska	0	0	0	0	0	0	0	0	0
Arizona	39	4,021	36,496	3,553	6,924	5,220	1,705	586	6
Arkansas	20	2,338	18,997	1,315	2,644	1,972	672	227	2
California	109	20,244	172,482	9,217	22,041	14,675	7,366	2,273	19
Colorado	16	3,483	27,011	1,479	3,255	2,234	1,021	309	3
Connecticut	15	2,230	16,968	1,275	2,725	1,948	777	254	2
Delaware	4	623	5,058	328	768	529	239	78	1
District of Columbia	1	219	1,887	118	306	197	110	34	0
Florida	85	11,999	114,039	8,058	17,868	12,477	5,391	1,736	15
Georgia	49	7,332	59,678	4,338	9,035	6,519	2,516	821	8
Hawaii	0	0	0	0	0	0	0	0	0
Idaho	6	1,224	9,186	254	795	472	323	96	1
Illinois	62	9,259	67,932	4,695	10,146	7,267	2,879	961	8
Indiana	52	5,361	41,294	3,249	6,485	4,851	1,634	555	6
Iowa	17	2,496	18,336	1,544	2,824	2,171	652	216	3
Kansas	14	2,064	16,292	1,227	2,381	1,767	614	197	2
Kentucky	32	3,201	25,940	2,349	4,341	3,354	987	336	4
Louisiana	28	2,837	25,705	1,935	3,852	2,850	1,002	329	3
Maine	7	1,211	8,685	615	1,179	886	293	96	1
Maryland	21	3,833	30,674	1,920	4,189	2,924	1,265	397	4
Massachusetts	23	3,670	29,005	1,914	4,248	2,949	1,299	409	3
Michigan	51	8,458	63,057	4,589	9,572	6,963	2,609	873	8
Minnesota	27	5,229	37,025	2,400	4,945	3,603	1,342	441	4
Mississippi	27	2,352	21,525	2,135	3,818	2,989	830	280	4
Missouri	41	5,300	41,291	2,997	6,088	4,511	1,577	533	5
Montana	8	861	6,256	596	1,023	818	205	71	1
Nebraska	12	1,497	11,275	1,141	2,069	1,615	454	158	2
Nevada	6	1,276	11,463	397	1,076	660	416	120	1
New Hampshire	5	939	7,057	524	1,026	754	273	86	1
New Jersey	18	5,105	40,157	1,719	4,502	2,832	1,669	495	3
New Mexico	19	1,732	14,779	1,349	2,481	1,919	562	191	2
New York	31	10,016	74,913	2,646	7,329	4,446	2,883	834	6
North Carolina	45	7,508	60,436	4,284	8,897	6,400	2,498	804	8
North Dakota	5	723	5,045	408	717	563	154	51	1
Ohio	56	8,013	62,175	4,331	8,834	6,425	2,409	777	8
Oklahoma	26	3,177	27,369	2,199	4,284	3,199	1,085	357	4
Oregon	16	2,405	18,519	1,232	2,592	1,865	727	235	2
Pennsylvania	47	7,396	64,571	4,088	8,299	6,004	2,295	726	7
Rhode Island	2	542	4,702	124	390	221	169	47	0
South Carolina	26	3,317	27,816	2,204	4,429	3,279	1,149	385	4
South Dakota	5	744	5,372	496	843	671	172	58	1
Tennessee	40	5,025	41,884	3,805	6,994	5,328	1,666	548	6
Texas	203	14,776	133,601	14,284	26,840	20,769	6,071	2,141	24

Modeled State	NVOL	OLE	PAR	PEC	PM_{10}	$PM_{2.5}$	PMC	PMFINE	PNO_3
Utah	11	2,103	15,960	1,023	2,137	1,520	617	195	2
Vermont	2	479	3,707	203	406	293	112	34	0
Virginia	32	5,989	47,084	2,691	5,940	4,111	1,829	569	5
Washington	30	4,008	30,671	2,695	5,367	3,993	1,375	464	5
West Virginia	9	1,504	11,785	854	1,541	1,174	367	115	1
Wisconsin	20	4,977	35,442	1,910	4,015	2,822	1,194	365	3
Wyoming	7	747	5,592	545	922	742	180	62	1
TOTAL	1,455	207,526	1,688,560	119,769	248,390	179,463	68,927	22,351	215

Table B-8e - 2008 On Road Non-Temperature Adjusted (on_noadj) Emissions by Species, by US State

Modeled State	POC	PSO_4	SO_2	SULF	TERP	TOL	UNK	UNR	XYL
Alabama	733	30	1,066	0	47	8,224	20	5,050	8,267
Alaska	0	0	0	0	0	0	0	0	0
Arizona	1,033	42	1,042	0	59	9,137	25	5,853	9,090
Arkansas	412	16	595	0	31	4,945	13	3,308	5,080
California	3,085	81	1,771	0	163	45,573	70	25,959	43,457
Colorado	422	20	878	0	24	7,314	10	4,956	7,210
Connecticut	402	16	525	0	23	4,613	10	2,916	4,248
Delaware	118	4	160	0	6	1,325	3	815	1,365
District of Columbia	42	2	66	0	2	485	1	284	500
Florida	2,560	109	3,842	0	127	28,096	54	17,189	28,683
Georgia	1,298	54	1,649	0	73	15,608	31	10,356	16,096
Hawaii	0	0	0	0	0	0	0	0	0
Idaho	117	5	293	0	9	2,495	4	1,792	2,596
Illinois	1,543	60	2,069	0	94	18,464	40	11,839	17,943
Indiana	1,002	39	1,377	0	78	11,055	33	7,170	10,300
Iowa	391	17	603	0	26	4,990	11	3,244	4,695
Kansas	326	15	555	0	21	4,327	9	2,913	4,335
Kentucky	639	26	865	0	49	6,777	21	4,481	6,760
Louisiana	559	24	856	0	41	6,404	18	4,004	6,524
Maine	167	7	280	0	10	2,404	4	1,598	2,504
Maryland	579	25	994	0	31	8,110	13	5,065	8,393
Massachusetts	597	26	792	0	34	7,696	14	4,687	7,899
Michigan	1,437	56	2,221	0	76	17,141	33	11,748	17,438
Minnesota	729	29	997	0	41	10,172	17	6,880	9,705
Mississippi	547	24	773	0	40	5,322	17	3,333	5,403
Missouri	940	36	1,406	0	62	10,998	26	7,325	11,028
Montana	144	6	232	0	12	1,697	5	1,317	1,748
Nebraska	302	12	392	0	18	3,048	8	2,021	2,839
Nevada	136	7	272	0	8	2,960	4	1,802	2,893
New Hampshire	137	6	202	0	7	1,916	3	1,194	1,990
New Jersey	588	27	1,110	0	27	10,831	12	6,394	10,623
New Mexico	361	15	523	0	28	3,764	12	2,626	3,774
New York	916	44	2,156	0	46	20,558	20	12,560	20,489
North Carolina	1,251	53	2,065	0	67	15,904	29	10,563	16,435

Modeled State	POC	PSO_4	SO_2	SULF	TERP	TOL	UNK	UNR	XYL
North Dakota	98	4	154	0	7	1,382	3	942	1,327
Ohio	1,255	54	2,166	0	84	16,615	36	10,748	16,619
Oklahoma	612	26	945	0	39	6,978	16	4,393	7,151
Oregon	380	15	559	0	24	4,941	10	3,937	4,987
Pennsylvania	1,133	50	1,869	0	70	16,469	30	10,013	16,871
Rhode Island	47	2	104	0	2	1,214	1	677	1,250
South Carolina	660	26	967	0	38	7,169	16	4,755	7,365
South Dakota	112	5	178	0	8	1,463	3	977	1,386
Tennessee	925	44	1,467	0	60	10,820	26	6,848	11,113
Texas	4,160	160	4,662	0	304	32,999	130	21,485	33,292
Utah	286	13	559	0	17	4,300	7	3,060	4,439
Vermont	53	2	116	0	3	998	1	611	1,037
Virginia	810	36	1,490	0	48	12,539	20	8,038	12,992
Washington	799	31	1,004	0	45	8,186	19	6,469	8,355
West Virginia	195	9	391	0	14	3,135	6	2,059	3,244
Wisconsin	519	24	1,007	0	30	9,801	13	6,226	9,573
Wyoming	128	6	205	0	11	1,499	5	1,124	1,544
TOTAL	35,685	1,443	50,468	0	2,181	442,861	930	283,601	442,856

Table B-8f - 2008 On Road Non-Temperature Adjusted (on_noadj) Emissions by Species, by US State

Inventory State	CO	NH_3	NO_x	PM_{10}	$PM_{2.5}$	SO_2	evp VOC	exh VOC
Alabama	295,017	30	25,922	2,676	2,540	464	8,584	37,044
	67,354	7	3,380	711	665	394	1,009	17,599
Arizona	364,951	40	33,771	3,465	3,303	671	7,976	31,989
Arkansas	202,649	26	24,840	2,588	2,472	464	4,724	26,906
California	2,004,320	191	164,716	16,049	15,260	211	34,663	169,713
Colorado	294,194	35	31,315	3,212	3,066	608	3,869	28,472
Connecticut	187,766	18	15,887	1,427	1,353	247	3,127	19,993
Delaware	54,361	5	4,675	454	432	83	923	5,445
District of Columbia	14,842	3	2,686	230	221	58	261	1,121
Florida	1,326,819	136	108,015	11,025	10,486	2,108	38,202	138,053
Georgia	569,066	58	50,533	5,095	4,854	960	10,578	52,117
	57,611	6	4,504	445	423	76	1,665	4,470
Idaho	113,521	16	14,122	1,619	1,542	276	2,021	19,283
Illinois	664,101	100	100,145	8,755	8,394	1,905	9,831	66,077
Indiana	364,343	54	56,103	4,690	4,492	1,030	6,477	38,431
Iowa	230,793	52	57,133	5,220	5,026	1,052	3,467	32,725
Kansas	178,779	37	42,489	3,930	3,792	816	2,563	16,082
Kentucky	225,712	29	27,925	2,732	2,609	506	5,086	28,262
Louisiana	289,631	32	25,833	2,706	2,569	473	10,345	41,138
Maine	124,591	13	7,344	1,125	1,055	136	2,030	26,450
Maryland	298,069	31	25,216	2,573	2,443	454	5,693	30,745
Massachusetts	330,176	31	26,270	2,404	2,282	423	5,035	34,159
Michigan	708,166	85	65,661	6,886	6,515	1,154	14,290	119,590
Minnesota	389,825	65	61,028	6,308	6,024	1,106	8,432	75,634
Mississippi	175,475	21	19,458	2,012	1,915	355	5,816	25,550
Missouri	364,418	48	47,628	4,631	4,432	880	7,140	42,267
Montana	76,299	16	16,921	1,759	1,692	337	1,100	11,006
Nebraska	112,444	31	36,061	3,380	3,263	701	1,902	12,640
Nevada	160,130	20	17,045	1,779	1,697	321	3,004	14,694
New Hampshire	104,912	10	7,145	842	793	120	1,668	17,233
New Jersey	487,327	45	36,609	3,481	3,302	602	8,678	48,449
New Mexico	90,199	10	8,547	874	834	166	1,887	8,945
New York	919,179	88	70,432	6,993	6,638	1,208	15,433	105,064
North Carolina	621,937	59	52,772	5,189	4,944	987	11,563	57,836
North Dakota	68,535	29	34,607	3,311	3,201	684	972	10,635
Ohio	707,850	78	74,559	6,542	6,239	1,337	10,282	65,896
Oklahoma	234,919	29	27,706	2,711	2,593	518	5,090	24,505
Oregon	234,888	26	23,432	2,401	2,285	430	3,899	28,035
Pennsylvania	642,954	61	54,162	5,363	5,095	917	10,400	66,644
	196,287	14	10,219	1,179	1,116	194	4,575	15,358
Rhode Island	51,048	5	4,077	348	330	63	810	5,246
South Carolina	314,089	30	25,712	2,532	2,409	481	6,497	31,358
South Dakota	61,431	21	24,721	2,378	2,296	484	1,044	9,497
Tennessee	359,895	39	35,813	3,484	3,318	641	8,121	40,533
Texas	1,249,819	142	132,059	12,519	11,974	2,538	26,648	106,954
Utah	144,530	16	13,205	1,485	1,410	252	2,731	20,582
Vermont	49,465	5	3,651	467	441	65	776	9,048
	6,833	1	501	55	52	11	194	681

Inventory State	CO	NH_3	NO_x	PM_{10}	$PM_{2.5}$	SO_2	evp VOC	exh VOC
Virginia	468,871	46	38,939	3,955	3,765	738	6,812	42,625
Washington	384,786	43	38,046	3,813	3,632	702	5,607	44,437
West Virginia	100,286	9	7,325	922	871	129	2,253	13,891
Wisconsin	433,801	57	47,279	4,938	4,680	810	8,819	86,050
Wyoming	44,072	6	4,844	577	549	95	775	8,058
Con. US	17,895,250	2,074	1,874,385	183,854	175,326	31,766	347,909	1,997,110

Table B-9a - 2008 Non-Road (nonroad) Emissions by Species, by US State

Inventory State	rfl VOC	ACETALD	evp BENZ	exh BENZ	rfl BENZ	FORMALD
Alabama	1,657	173	148	851	29	371
	298	41	21	249	6	118
Arizona	2,279	235	138	827	39	520
Arkansas	937	150	100	659	19	342
California	12,694	1,158	522	4,339	193	2,471
Colorado	1,855	224	62	680	28	495
Connecticut	1,167	109	39	424	15	214
Delaware	304	32	16	138	5	67
District of Columbia	78	16	5	33	1	36
Florida	7,777	779	686	3,542	140	1,647
Georgia	3,229	331	209	1,424	61	748
	436	34	23	115	6	70
Idaho	552	103	36	351	10	236
Illinois	3,591	614	137	1,450	49	1,284
Indiana	2,071	327	86	816	27	664
Iowa	1,120	341	45	584	14	716
Kansas	869	240	42	412	14	529
Kentucky	1,170	177	87	652	19	383
Louisiana	1,461	177	186	943	26	373
Maine	600	85	36	383	11	203
Maryland	2,108	189	77	709	27	381
Massachusetts	1,890	188	74	770	28	380
Michigan	3,572	601	210	1,892	52	1,156
Minnesota	1,971	496	108	1,113	25	993
Mississippi	886	122	104	568	16	264
Missouri	1,992	300	120	1,010	31	643
Montana	295	99	24	234	6	234
Nebraska	557	206	24	284	7	448
Nevada	1,084	119	50	385	17	261
New Hampshire	516	63	29	307	9	141
New Jersey	2,931	268	127	1,158	42	540
New Mexico	536	60	33	229	9	131
New York	4,861	530	249	2,345	75	1,151
North Carolina	3,383	324	254	1,633	74	754
North Dakota	241	202	12	195	3	440
Ohio	4,237	456	159	1,584	65	954
Oklahoma	1,277	173	91	618	23	379

Inventory State	rfl VOC	ACETALD	evp BENZ	exh BENZ	rfl BENZ	FORMALD
Oregon	1,321	161	65	634	22	349
Pennsylvania	3,860	411	138	1,456	52	847
	1,261	74	101	464	28	176
Rhode Island	277	27	12	120	4	54
South Carolina	1,646	161	143	881	36	370
South Dakota	253	147	13	174	3	318
Tennessee	1,993	224	146	977	36	490
Texas	6,839	836	491	2,909	123	1,849
Utah	696	91	54	433	13	221
Vermont	238	34	14	139	4	81
	41	4	4	20	1	8
Virginia	2,743	262	136	1,199	53	587
Washington	2,114	261	98	1,024	36	568
West Virginia	561	56	40	316	10	126
Wisconsin	2,086	401	125	1,276	29	806
Wyoming	187	39	14	136	3	90
Con. US	100,562	12,780	5,815	45,213	1,637	27,303

Table B-9b - 2008 Non-Road (nonroad) Emissions by Species, by US State

Modeled State	ALD_2	ALD_X	BENZENE	CH_4	CO	ETH	ETHA	ETOH	FORM
Alabama	496	379	1,095	6,402	297,755	3,076	986	220	771
Alaska	0	0	0	0	0	0	0	0	0
Arizona	532	484	1,046	5,209	365,276	2,543	802	182	871
Arkansas	361	288	828	4,546	204,588	2,335	700	0	621
California	2,565	2,147	5,373	28,410	2,006,668	13,804	4,374	4,019	4,333
Colorado	436	398	803	4,645	294,390	2,344	715	296	794
Connecticut	255	205	523	3,505	188,775	1,662	540	772	433
Delaware	77	62	169	922	54,769	449	142	0	125
District of Columbia	27	35	40	155	14,973	82	24	0	49
Florida	2,105	1,692	4,536	23,429	1,336,522	11,233	3,609	0	3,154
Georgia	787	692	1,790	8,603	570,821	4,208	1,325	0	1,314
Hawaii	0	0	0	0	0	0	0	0	0
Idaho	231	186	414	3,307	114,501	1,666	509	0	429
Illinois	1,099	958	1,775	10,716	664,768	5,726	1,648	1,737	1,992
Indiana	617	511	1,033	6,347	365,080	3,337	976	1,302	1,083
Iowa	546	469	689	5,334	232,845	3,151	819	938	1,046
Kansas	362	327	502	2,320	178,792	1,615	356	154	692
Kentucky	404	348	817	4,744	227,690	2,387	730	170	687
Louisiana	545	393	1,212	7,175	293,716	3,462	1,105	0	811
Maine	248	174	450	4,730	126,313	2,214	729	0	467
Maryland	452	354	852	5,208	299,512	2,510	802	0	710
Massachusetts	459	360	943	5,850	332,024	2,777	901	94	748
Michigan	1,438	960	2,306	20,942	714,334	9,985	3,225	372	2,383
Minnesota	964	719	1,326	13,275	393,792	6,727	2,042	2,379	1,765

Modeled State	ALD_2	ALD_X	BENZENE	CH_4	CO	ETH	ETHA	ETOH	FORM
Mississippi	343	254	734	4,407	177,684	2,181	678	0	536
Missouri	628	517	1,235	7,037	366,748	3,678	1,083	348	1,086
Montana	168	147	271	1,762	76,767	1,058	271	9	339
Nebraska	289	267	334	1,822	112,522	1,331	279	397	573
Nevada	242	242	464	2,361	160,135	1,164	364	157	420
New Hampshire	178	132	368	3,047	106,040	1,429	469	0	317
New Jersey	654	513	1,412	8,352	489,786	3,970	1,286	812	1,064
New Mexico	136	118	280	1,484	90,678	732	229	48	227
New York	1,295	1,035	2,832	18,197	925,858	8,693	2,802	1,504	2,259
North Carolina	826	712	2,091	9,649	624,984	4,714	1,486	0	1,384
North Dakota	260	229	216	1,489	68,557	1,229	227	253	536
Ohio	977	783	1,966	10,967	708,953	5,477	1,688	911	1,667
Oklahoma	383	305	771	4,058	236,305	2,125	624	0	637
Oregon	368	310	764	4,766	236,158	2,340	734	223	643
Pennsylvania	954	723	1,785	11,273	645,649	5,451	1,736	44	1,564
Puerto Rico	0	0	0	0	0	0	0	0	0
Rhode Island	70	54	149	904	51,475	429	139	7	111
South Carolina	434	365	1,130	5,298	316,402	2,556	816	0	712
South Dakota	202	175	198	1,418	61,591	1,025	217	259	407
Tennessee	573	463	1,249	6,853	362,341	3,365	1,055	0	930
Texas	1,845	1,623	3,722	17,273	1,253,646	8,792	2,659	47	3,027
Utah	239	212	528	3,532	145,639	1,696	544	24	434
Vermont	92	67	167	1,599	49,979	758	246	0	172
Virgin Islands	0	0	0	0	0	0	0	0	0
Virginia	609	536	1,462	7,080	470,845	3,452	1,090	0	1,043
Washington	586	503	1,224	7,521	387,033	3,697	1,158	143	1,032
West Virginia	163	127	386	2,404	101,225	1,148	370	0	270
Wisconsin	941	655	1,536	15,335	437,701	7,389	2,361	1,935	1,685
Wyoming	90	72	158	1,397	44,520	689	215	0	170
TOTAL	28,551	23,278	55,955	337,061	17,987,121	167,862	51,886	19,757	48,524

Table B-9c - 2008 Non-Road (nonroad) Emissions by Species, by US State

Modeled State	HONO	IOLE	ISOP	MEOH	NH_3	NH_3_FERT	NO	NO_2	NO_X
Alabama	207	768	1	0	31	0	23,258	2,377	25,842
Alaska	0	0	0	0	0	0	0	0	0
Arizona	268	677	1	0	39	0	30,149	3,082	33,499
Arkansas	197	513	0	0	26	0	22,174	2,267	24,637
California	1,310	3,361	3	0	191	0	147,325	15,060	163,695
Colorado	248	518	0	0	35	0	27,927	2,855	31,031
Connecticut	127	369	0	0	18	0	14,273	1,459	15,858
Delaware	37	107	0	0	5	0	4,194	429	4,660
District of Columbia	21	22	0	0	3	0	2,396	245	2,663
Florida	862	3,060	3	0	137	0	96,979	9,913	107,754
Georgia	401	1,054	1	0	58	0	45,164	4,617	50,182

Modeled State	HONO	IOLE	ISOP	MEOH	NH_3	NH_3_FERT	NO	NO_2	NO_x
Hawaii	0	0	0	0	0	0	0	0	0
Idaho	112	336	0	0	16	0	12,609	1,289	14,010
Illinois	795	1,162	1	0	99	0	89,413	9,140	99,348
Indiana	445	689	0	0	54	0	50,071	5,118	55,634
Iowa	453	529	0	0	52	0	51,010	5,214	56,678
Kansas	336	274	0	0	36	0	37,796	3,864	41,996
Kentucky	222	540	0	0	29	0	24,965	2,552	27,739
Louisiana	207	876	1	0	32	0	23,236	2,375	25,817
Maine	59	454	0	0	13	0	6,603	675	7,337
Maryland	201	625	1	0	31	0	22,618	2,312	25,131
Massachusetts	209	653	0	0	31	0	23,567	2,409	26,186
Michigan	522	2,148	1	0	85	0	58,733	6,004	65,258
Minnesota	485	1,280	0	0	65	0	54,518	5,573	60,576
Mississippi	155	525	0	0	21	0	17,431	1,782	19,368
Missouri	378	794	1	0	48	0	42,545	4,349	47,272
Montana	134	180	0	0	16	0	15,056	1,539	16,729
Nebraska	285	198	0	0	30	0	32,071	3,278	35,634
Nevada	135	292	0	0	20	0	15,208	1,555	16,897
New Hampshire	57	305	0	0	10	0	6,423	657	7,136
New Jersey	292	946	1	0	45	0	32,885	3,362	36,538
New Mexico	68	181	0	0	10	0	7,642	781	8,491
New York	561	1,945	1	0	88	0	63,152	6,456	70,168
North Carolina	419	1,166	1	0	59	0	47,191	4,824	52,434
North Dakota	273	147	0	0	28	0	30,766	3,145	34,184
Ohio	592	1,235	1	0	78	0	66,589	6,807	73,988
Oklahoma	220	491	0	0	29	0	24,754	2,530	27,505
Oregon	186	516	0	0	26	0	20,959	2,142	23,288
Pennsylvania	431	1,284	1	0	61	0	48,451	4,953	53,835
Puerto Rico	0	0	0	0	0	0	0	0	0
Rhode Island	33	101	0	0	5	0	3,666	375	4,073
South Carolina	205	638	0	0	30	0	23,030	2,354	25,589
South Dakota	195	142	0	0	21	0	21,989	2,248	24,432
Tennessee	285	814	1	0	39	0	32,043	3,276	35,604
Texas	1,049	2,255	2	0	142	0	117,962	12,058	131,069
Utah	105	375	0	0	16	0	11,809	1,207	13,121
Vermont	29	157	0	0	5	0	3,269	334	3,632
Virgin Islands	0	0	0	0	0	0	0	0	0
Virginia	310	825	1	0	46	0	34,832	3,561	38,702
Washington	303	811	1	0	43	0	34,045	3,480	37,827
West Virginia	58	267	0	0	9	0	6,563	671	7,293
Wisconsin	375	1,475	1	0	57	0	42,190	4,313	46,878
Wyoming	38	139	0	0	6	0	4,328	442	4,809
TOTAL	14,896	38,218	27	0	2,073	0	1,675,826	171,307	1,862,029

Table B-9d - 2008 Non-Road (nonroad) Emissions by Species, by US State

Modeled State	NVOL	OLE	PAL	PAR	PCA	PCL	PEC	PFE	PH2O	PK
Alabama	9	3,664	0	28,246	1	1	1,244	1	0	0
Alaska	0	0	0	0	0	0	0	0	0	0
Arizona	15	3,042	0	25,274	2	1	1,815	1	0	0
Arkansas	6	2,619	0	18,978	1	1	1,400	1	0	0
California	63	16,336	0	127,518	9	9	7,829	3	0	1
Colorado	12	2,694	0	19,587	2	1	1,732	1	0	0
Connecticut	5	1,981	0	14,020	1	1	642	0	0	0
Delaware	2	530	0	3,927	0	0	226	0	0	0
District of Columbia	1	97	0	857	0	0	151	0	0	0
Florida	47	13,549	0	112,331	6	3	5,510	2	0	0
Georgia	20	4,990	0	39,020	3	2	2,611	1	0	0
Hawaii	0	0	0	0	0	0	0	0	0	0
Idaho	3	1,888	0	12,362	1	0	842	0	0	0
Illinois	26	6,236	0	45,077	5	5	5,160	2	0	0
Indiana	13	3,668	0	26,784	3	3	2,691	1	0	0
Iowa	9	3,124	0	20,874	3	2	3,360	1	0	0
Kansas	7	1,432	0	11,098	2	1	2,622	1	0	0
Kentucky	9	2,739	0	20,126	2	1	1,478	1	0	0
Louisiana	8	4,106	0	31,957	1	1	1,276	1	0	0
Maine	2	2,652	0	16,305	0	0	371	0	0	0
Maryland	10	2,996	0	22,964	1	1	1,220	0	0	0
Massachusetts	10	3,340	0	23,951	1	2	1,107	0	0	0
Michigan	18	11,836	0	78,135	4	4	2,955	1	0	0
Minnesota	13	7,523	0	48,374	3	2	3,434	1	0	0
Mississippi	5	2,529	0	19,248	1	1	1,008	0	0	0
Missouri	12	4,075	0	29,875	3	2	2,628	1	0	0
Montana	2	1,038	0	6,924	1	0	1,118	0	0	0
Nebraska	6	1,126	0	8,411	2	1	2,290	1	0	0
Nevada	8	1,382	0	11,034	1	0	954	0	0	0
New Hampshire	2	1,717	0	11,014	0	0	317	0	0	0
New Jersey	14	4,760	0	35,246	2	2	1,596	1	0	0
New Mexico	3	860	0	6,725	0	0	458	0	0	0
New York	25	10,335	0	72,207	4	4	3,280	1	0	0
North Carolina	20	5,575	0	43,075	3	3	2,650	1	0	0
North Dakota	3	937	0	6,407	2	1	2,314	1	0	0
Ohio	20	6,310	0	46,460	4	4	3,400	1	0	0
Oklahoma	7	2,362	0	18,319	1	1	1,531	1	0	0
Oregon	8	2,728	0	19,152	1	1	1,206	0	0	0
Pennsylvania	19	6,462	0	47,187	3	4	2,538	1	0	0
Puerto Rico	0	0	0	0	0	0	0	0	0	0
Rhode Island	1	516	0	3,713	0	0	161	0	0	0
South Carolina	10	3,051	0	23,475	1	1	1,258	1	0	0
South Dakota	3	865	0	5,931	1	1	1,622	1	0	0
Tennessee	12	3,948	0	29,987	2	2	1,767	1	0	0

Modeled State	NVOL	OLE	PAL	PAR	PCA	PCL	PEC	PFE	PH2O	PK
Texas	48	10,146	0	84,236	7	6	7,021	3	0	1
Utah	5	2,014	0	13,739	1	1	703	0	0	0
Vermont	1	900	0	5,657	0	0	185	0	0	0
Virgin Islands	0	0	0	0	0	0	0	0	0	0
Virginia	15	4,088	0	30,545	2	2	1,995	1	0	0
Washington	13	4,313	0	29,975	2	2	1,957	1	0	0
West Virginia	3	1,368	0	9,727	0	0	385	0	0	0
Wisconsin	10	8,614	0	54,465	3	2	2,221	1	0	0
Wyoming	1	793	0	5,069	0	0	285	0	0	0
TOTAL	585	193,855	4	1,425,569	102	87	96,525	38	0	7

Table B-9e - 2008 Non-Road (nonroad) Emissions by Species, by US State

Modeled State	PM_{10}	PM2_5	PMC	PMFINE	PMG	PMN	PMOTHR	PNA	PNCOM
Alabama	2,682	2,544	138	510	0	0	307	1	197
Alaska	0	0	0	0	0	0	0	0	0
Arizona	3,448	3,287	162	549	0	0	314	0	229
Arkansas	2,581	2,464	117	389	0	0	217	0	168
California	16,000	15,209	790	2,836	0	0	1,671	4	1,131
Colorado	3,194	3,048	146	482	0	0	270	0	207
Connecticut	1,428	1,354	74	281	0	0	169	1	108
Delaware	454	431	22	78	0	0	46	0	32
District of Columbia	228	220	8	21	0	0	9	0	12
Florida	11,026	10,485	542	1,904	0	0	1,125	1	762
Georgia	5,079	4,838	242	838	0	0	483	1	345
Hawaii	0	0	0	0	0	0	0	0	0
Idaho	1,616	1,539	77	262	0	0	151	0	108
Illinois	8,705	8,345	360	1,088	0	0	552	2	520
Indiana	4,661	4,463	197	617	0	0	319	1	287
Iowa	5,180	4,986	194	503	0	0	219	1	277
Kansas	3,889	3,751	137	327	0	0	124	0	197
Kentucky	2,726	2,602	123	410	0	0	227	1	177
Louisiana	2,718	2,579	139	510	0	0	308	0	197
Maine	1,135	1,064	71	295	0	0	194	0	99
Maryland	2,570	2,439	131	476	0	0	287	0	185
Massachusetts	2,406	2,282	123	461	0	0	276	1	178
Michigan	6,898	6,525	374	1,436	0	0	889	2	532
Minnesota	6,292	6,006	286	939	0	0	524	1	405
Mississippi	2,014	1,916	98	346	0	0	202	0	140
Missouri	4,611	4,411	200	631	0	0	337	1	286
Montana	1,745	1,678	67	177	0	0	81	0	94
Nebraska	3,344	3,228	116	264	0	0	94	0	165
Nevada	1,769	1,687	82	270	0	0	153	0	115
New Hampshire	847	798	49	199	0	0	127	0	70
New Jersey	3,484	3,303	180	672	0	0	406	1	258
New Mexico	872	831	41	139	0	0	80	0	58

Modeled State	PM_{10}	PM2_5	PMC	PMFINE	PMG	PMN	PMOTHR	PNA	PNCOM
New York	7,003	6,645	357	1,316	0	0	790	2	511
North Carolina	5,178	4,932	246	859	0	0	493	1	354
North Dakota	3,274	3,166	109	223	0	0	66	0	154
Ohio	6,511	6,208	303	1,044	0	0	590	2	439
Oklahoma	2,699	2,581	118	373	0	0	200	0	168
Oregon	2,397	2,281	116	409	0	0	239	0	166
Pennsylvania	5,357	5,088	270	990	0	0	588	2	389
Puerto Rico	0	0	0	0	0	0	0	0	0
Rhode Island	349	331	18	66	0	0	39	0	26
South Carolina	2,531	2,407	123	439	0	0	256	1	177
South Dakota	2,354	2,273	81	181	0	0	63	0	115
Tennessee	3,480	3,313	166	584	0	0	336	1	240
Texas	12,458	11,913	545	1,743	0	0	938	2	781
Utah	1,486	1,411	76	276	0	0	166	0	107
Vermont	469	443	27	106	0	0	67	0	38
Virgin Islands	0	0	0	0	0	0	0	0	0
Virginia	3,944	3,753	191	667	0	0	389	1	271
Washington	3,806	3,624	182	628	0	0	363	1	258
West Virginia	925	874	51	199	0	0	124	0	72
Wisconsin	4,936	4,676	260	974	0	0	595	1	369
Wyoming	578	549	29	101	0	0	60	0	40
TOTAL	183,337	174,781	8,556	29,092	0	0	16,524	35	12,213

Table B-9f - 2008 Non-Road (nonroad) Emissions by Species, by US State

Modeled State	PNH_4	PNO_3	POC	PSI	PSO_4	PTI	SO_2	SULF	TERP	TOL	UNK	UNR	XYL
Alabama	0	3	778	1	8	0	461	0	17	7,413	6	3,933	7,630
Alaska	0	0	0	0	0	0	0	0	0	0	0	0	0
Arizona	0	4	909	1	10	0	665	0	25	6,290	10	3,617	6,401
Arkansas	0	3	664	1	8	0	459	0	17	5,088	4	2,903	5,319
California	1	21	4,471	7	53	0	212	0	111	32,193	40	18,799	31,831
Colorado	0	4	821	1	9	0	602	0	23	5,096	7	2,972	5,189
Connecticut	0	2	423	1	6	0	246	0	9	3,638	3	2,019	3,551
Delaware	0	1	125	0	1	0	82	0	3	1,037	1	588	1,080
District of Columbia	0	0	47	0	1	0	58	0	2	203	1	140	204
Florida	0	12	3,030	5	28	0	2,096	0	78	28,444	30	15,573	29,395
Georgia	0	6	1,366	2	16	0	952	0	36	10,013	13	5,963	10,370
Hawaii	0	0	0	0	0	0	0	0	0	0	0	0	0
Idaho	0	2	430	1	4	0	273	0	10	3,497	2	1,756	3,684
Illinois	0	11	2,055	2	30	0	1,888	0	64	11,513	16	6,856	11,381
Indiana	0	7	1,131	1	18	0	1,020	0	33	6,828	8	3,989	6,650
Iowa	0	6	1,100	1	16	0	1,040	0	39	5,340	6	3,130	5,328
Kansas	0	5	785	1	13	0	806	0	31	2,652	5	1,861	2,672
Kentucky	0	4	701	1	9	0	502	0	19	5,339	6	2,984	5,500
Louisiana	0	3	782	1	7	0	471	0	16	8,420	5	4,359	8,768
Maine	0	1	394	1	2	0	135	0	4	4,846	2	2,155	5,140

Modeled State	PNH_4	PNO_3	POC	PSI	PSO_4	PTI	SO_2	SULF	TERP	TOL	UNK	UNR	XYL
Maryland	0	3	734	1	7	0	451	0	17	5,945	6	3,165	6,173
Massachusetts	0	3	702	1	9	0	420	0	16	6,419	6	3,472	6,678
Michigan	0	9	2,104	4	21	0	1,143	0	36	22,231	11	10,332	23,287
Minnesota	0	7	1,608	2	18	0	1,095	0	41	13,054	8	6,528	13,118
Mississippi	0	3	553	1	6	0	352	0	12	5,097	3	2,676	5,314
Missouri	0	6	1,132	1	14	0	872	0	32	7,827	8	4,500	8,032
Montana	0	2	376	0	5	0	333	0	13	1,870	1	1,097	1,960
Nebraska	0	4	660	0	10	0	692	0	26	1,996	4	1,388	1,914
Nevada	0	2	457	1	4	0	318	0	13	2,770	5	1,638	2,791
New Hampshire	0	1	278	1	2	0	119	0	4	3,186	2	1,539	3,366
New Jersey	0	5	1,019	2	12	0	599	0	23	9,217	9	5,104	9,319
New Mexico	0	1	230	0	2	0	165	0	6	1,723	2	983	1,767
New York	0	9	2,018	4	23	0	1,200	0	45	19,546	16	10,590	19,952
North Carolina	0	7	1,398	2	18	0	979	0	36	11,142	13	6,770	11,563
North Dakota	0	4	616	0	9	0	675	0	26	1,515	2	1,068	1,499
Ohio	0	9	1,730	3	24	0	1,325	0	43	11,998	13	7,021	12,184
Oklahoma	0	3	665	1	8	0	513	0	19	4,702	4	2,707	4,880
Oregon	0	3	656	1	7	0	427	0	16	5,147	5	2,848	5,314
Pennsylvania	0	7	1,533	3	20	0	909	0	34	12,534	12	6,691	13,057
Puerto Rico	0	0	0	0	0	0	0	0	0	0	0	0	0
Rhode Island	0	1	102	0	1	0	62	0	2	999	1	541	1,041
South Carolina	0	3	699	1	9	0	478	0	17	6,124	6	3,658	6,363
South Dakota	0	3	460	0	7	0	479	0	18	1,452	2	940	1,433
Tennessee	0	5	945	2	12	0	636	0	23	7,866	7	4,383	8,183
Texas	0	16	3,092	4	41	0	2,515	0	94	20,938	31	12,506	21,541
Utah	0	2	425	1	4	0	250	0	9	3,823	3	2,016	4,005
Vermont	0	1	150	0	1	0	64	0	2	1,654	1	763	1,751
Virgin Islands	0	0	0	0	0	0	0	0	0	0	0	0	0
Virginia	0	5	1,075	2	12	0	732	0	27	7,974	10	4,842	8,287
Washington	0	5	1,023	2	11	0	696	0	26	8,129	8	4,528	8,462
West Virginia	0	1	287	1	3	0	129	0	5	2,656	2	1,407	2,782
Wisconsin	0	6	1,460	3	15	0	801	0	26	15,182	7	7,297	15,556
Wyoming	0	1	160	0	1	0	94	0	3	1,462	1	703	1,544
TOTAL	7	228	48,358	73	578	2	31,491	0	1,248	374,027	374	207,301	383,208

Table B-9g - 2008 Non-Road (nonroad) Emissions by Species, by US State

Canada 2006; Mexico 1999							
State	CO	NH_3	NO_x	PM_{10}	$PM_{2.5}$	SO_2	VOC
Aguascalientes	9,255	24,138	5,735	3,157	1,541	5,775	22,172
Alberta	464,690	141,855	176,384	644,389	121,113	10,661	225,452
Baja Calif Norte	42,320	8,692	24,558	6,007	4,487	18,782	57,725
Baja Calif Sur	5,196	5,703	7,697	1,097	822	1,742	6,853
British Columbia	543,613	25,700	101,066	112,037	54,584	13,061	144,658
Campeche	43,598	15,300	19,808	7,659	5,952	806	15,281
Chiapas	307,151	98,737	10,510	50,737	40,312	2,904	102,636
Chihuahua	69,406	42,773	35,635	17,112	10,676	27,881	77,697
Coahuila	27,292	26,782	19,113	4,952	3,392	9,953	51,770
Colima	11,400	6,098	6,526	2,102	1,555	596	9,032
Distrito Federal	34,005	1,062	28,363	3,598	3,121	448	123,036
Durango	45,164	48,924	11,960	11,605	7,037	2,403	30,855
Guanajuato	88,824	52,479	20,320	19,939	13,324	23,872	82,150
Guerrero	177,489	53,821	8,365	28,541	23,601	3,696	68,769
Hidalgo	98,521	24,836	22,109	18,233	14,374	1,491	48,775
Jalisco	117,633	144,622	40,428	28,097	17,269	20,904	113,181
Manitoba	157,420	66,937	44,186	102,434	19,652	2,869	75,295
Mexico	201,999	38,777	34,415	28,972	21,453	34,329	237,770
Michoacan	150,837	78,741	25,446	26,276	20,117	2,893	77,699
Morelos	30,391	11,253	6,856	4,789	3,824	1,317	27,104
NW Territories							
Nayarit	29,462	25,320	7,010	5,998	4,238	1,534	16,224
New Brunswick	106,990	4,223	14,917	33,576	12,403	8,992	37,271
Newfoundland	83,220	526	10,908	19,284	9,059	3,925	21,323
Nova Scotia	118,701	6,785	15,768	33,332	12,872	8,004	34,638
Nuevo Leon	33,291	20,843	21,984	7,012	5,186	17,548	74,343
Nunavut							
Oaxaca	267,289	63,795	19,403	42,883	35,392	2,198	86,874
Ontario	1,302,135	107,100	222,885	349,134	101,907	24,556	387,702
Prince Edward Island	31,154	2,294	3,122	6,406	2,053	1,052	6,888
Puebla	188,398	61,425	16,908	31,595	25,331	3,473	111,829
Quebec	1,018,512	85,957	106,106	238,635	95,742	19,848	300,687
Queretaro	29,063	15,275	6,829	5,676	4,153	5,943	29,582
Quintana Roo	34,432	4,367	7,749	5,629	4,506	2,102	16,211
San Luis Potosi	98,867	35,078	14,476	17,716	13,555	1,752	49,368
Saskatchewan	175,797	115,370	80,855	229,110	33,676	11,236	106,007
Sinaloa	62,337	65,473	21,724	16,844	9,968	2,374	42,342
Sonora	78,763	51,474	22,496	11,620	9,093	2,254	47,410
Tabasco	73,276	42,693	16,207	11,859	9,940	3,400	33,418
Tamaulipas	53,066	38,039	32,073	14,110	8,144	2,939	56,557
Tlaxcala	29,464	7,946	6,603	5,397	3,871	2,780	21,231
Veracruz	360,169	128,466	47,316	55,880	47,157	4,929	156,835
Yucatan	92,356	38,077	11,942	14,300	12,347	1,680	39,478
Yukon							
Zacatecas	35,186	40,875	14,646	15,736	7,115	3,620	26,308
Canada Total	4,002,230	556,747	776,196	1,768,338	463,061	104,205	1,339,919

Canada 2006; Mexico 1999							
State	CO	NH_3	NO_x	PM_{10}	$PM_{2.5}$	SO_2	VOC
Mexico Total	2,925,901	1,321,883	595,212	525,127	392,852	218,319	1,960,517
TOTAL	6,928,131	1,878,630	1,371,408	2,293,465	855,914	322,523	3,300,437

Table B-10a - 2008 Other Non-Point and Non-Road (othar) Emissions by Species, by Canadian Province, and by Mexican Federal State

Modeled									
State	ALD_2	ALD_x	BENZENE	CH_4	CO	ETH	ETHA	ETOH	FORM
Aguascalientes	0	0	0	0	0	0	0	0	0
Alberta	5,012	4,661	8,235	156,611	390,703	7,283	3,710	4,099	4,213
Baja Calif Norte	632	457	1,029	284	42,406	426	80	2,196	515
Baja Calif Sur	90	69	165	95	3,828	54	18	171	75
British Columbia	3,247	2,442	4,401	283,444	480,530	5,115	3,604	5,013	3,346
Campeche	0	0	0	0	0	0	0	0	0
Chiapas	0	0	0	0	0	0	0	0	0
Chihuahua	1,761	1,248	1,182	2,281	69,582	1,051	283	2,842	1,497
Coahuila	639	413	698	480	27,357	342	81	1,894	434
Colima	0	0	0	0	0	0	0	0	0
Distrito Federal	0	0	0	0	0	0	0	0	0
Durango	676	481	465	1,145	25,564	418	140	599	661
Guanajuato	0	0	0	0	0	0	0	0	0
Guerrero	0	0	0	0	0	0	0	0	0
Hidalgo	0	0	0	0	0	0	0	0	0
Jalisco	0	0	0	0	0	0	0	0	0
Manitoba	1,846	1,580	3,036	93,261	143,786	3,266	1,633	1,537	1,687
Mexico	0	0	0	0	0	0	0	0	0
Michoacan	0	0	0	0	0	0	0	0	0
Morelos	0	0	0	0	0	0	0	0	0
NW Territories	0	0	0	0	0	0	0	0	0
Nayarit	0	0	0	0	0	0	0	0	0
New Brunswick	1,142	800	2,545	94,982	106,912	2,844	1,479	1,684	1,243
Newfoundland	255	177	569	21,057	25,949	696	329	383	281
Nova Scotia	1,142	853	2,577	72,544	117,963	2,612	1,218	1,675	1,208
Nuevo Leon	734	616	1,192	485	29,782	456	103	3,083	563
Nunavut	0	0	0	1	12	0	0	0	0
Oaxaca	0	0	0	0	0	0	0	0	0
Ontario	9,079	6,760	13,199	578,783	1,287,719	16,476	8,666	13,267	9,250
Prince Edward Island	219	163	476	16,795	31,102	522	262	266	219
Puebla	0	0	0	0	0	0	0	0	0
Quebec	10,914	8,138	16,391	628,390	1,005,317	19,609	9,784	11,965	11,342
Queretaro	0	0	0	0	0	0	0	0	0
Quintana Roo	0	0	0	0	0	0	0	0	0
San Luis Potosi	0	0	0	0	2	0	0	0	0
Saskatchewan	2,959	2,624	3,867	96,072	166,569	4,506	2,089	2,063	2,461
Sinaloa	1,426	1,009	783	1,961	52,085	850	230	1,015	1,376
Sonora	1,467	931	876	1,080	78,905	922	145	1,563	1,544
Tabasco	0	0	0	0	0	0	0	0	0

Modeled State	ALD_2	ALD_x	BENZENE	CH_4	CO	ETH	ETHA	ETOH	FORM
Tamaulipas	460	356	457	213	20,761	235	42	1,342	305
Tlaxcala	0	0	0	0	0	0	0	0	0
Veracruz	0	0	0	0	0	0	0	0	0
Yucatan	0	0	0	0	0	0	0	0	0
Yukon	0	0	0	0	0	0	0	0	0
Zacatecas	33	23	9	50	1,041	19	5	14	30
Canada Total	35,815	28,198	55,296	2,041,938	3,756,550	62,930	32,775	41,953	35,252
Mexico Total	7,918	5,603	6,855	8,074	351,324	4,771	1,128	14,720	7,000
TOTAL	43,733	33,802	62,151	2,050,012	4,107,874	67,701	33,903	56,673	42,252

Table B-10b - 2008 Other Non-Point and Non-Road (othar) Emissions by Species, by Canadian Province, and by Mexican Federal State

Modeled State	ALD_2	ALD_x	BENZENE	CH_4	CO	ETH	ETHA	ETOH	FORM
Aguascalientes	0	0	0	0	0	0	0	0	0
Alberta	5,012	4,661	8,235	156,611	390,703	7,283	3,710	4,099	4,213
Baja Calif Norte	632	457	1,029	284	42,406	426	80	2,196	515
Baja Calif Sur	90	69	165	95	3,828	54	18	171	75
British Columbia	3,247	2,442	4,401	283,444	480,530	5,115	3,604	5,013	3,346
Campeche	0	0	0	0	0	0	0	0	0
Chiapas	0	0	0	0	0	0	0	0	0
Chihuahua	1,761	1,248	1,182	2,281	69,582	1,051	283	2,842	1,497
Coahuila	639	413	698	480	27,357	342	81	1,894	434
Colima	0	0	0	0	0	0	0	0	0
Distrito Federal	0	0	0	0	0	0	0	0	0
Durango	676	481	465	1,145	25,564	418	140	599	661
Guanajuato	0	0	0	0	0	0	0	0	0
Guerrero	0	0	0	0	0	0	0	0	0
Hidalgo	0	0	0	0	0	0	0	0	0
Jalisco	0	0	0	0	0	0	0	0	0
Manitoba	1,846	1,580	3,036	93,261	143,786	3,266	1,633	1,537	1,687
Mexico	0	0	0	0	0	0	0	0	0
Michoacan	0	0	0	0	0	0	0	0	0
Morelos	0	0	0	0	0	0	0	0	0
NW Territories	0	0	0	0	0	0	0	0	0
Nayarit	0	0	0	0	0	0	0	0	0
New Brunswick	1,142	800	2,545	94,982	106,912	2,844	1,479	1,684	1,243
Newfoundland	255	177	569	21,057	25,949	696	329	383	281
Nova Scotia	1,142	853	2,577	72,544	117,963	2,612	1,218	1,675	1,208
Nuevo Leon	734	616	1,192	485	29,782	456	103	3,083	563
Nunavut	0	0	0	1	12	0	0	0	0
Oaxaca	0	0	0	0	0	0	0	0	0
Ontario	9,079	6,760	13,199	578,783	1,287,719	16,476	8,666	13,267	9,250
Prince Edward Island	219	163	476	16,795	31,102	522	262	266	219
Puebla	0	0	0	0	0	0	0	0	0
Quebec	10,914	8,138	16,391	628,390	1,005,317	19,609	9,784	11,965	11,342
Queretaro	0	0	0	0	0	0	0	0	0

Modeled State	ALD_2	ALD_X	BENZENE	CH_4	CO	ETH	ETHA	ETOH	FORM
Quintana Roo	0	0	0	0	0	0	0	0	0
San Luis Potosi	0	0	0	0	2	0	0	0	0
Saskatchewan	2,959	2,624	3,867	96,072	166,569	4,506	2,089	2,063	2,461
Sinaloa	1,426	1,009	783	1,961	52,085	850	230	1,015	1,376
Sonora	1,467	931	876	1,080	78,905	922	145	1,563	1,544
Tabasco	0	0	0	0	0	0	0	0	0
Tamaulipas	460	356	457	213	20,761	235	42	1,342	305
Tlaxcala	0	0	0	0	0	0	0	0	0
Veracruz	0	0	0	0	0	0	0	0	0
Yucatan	0	0	0	0	0	0	0	0	0
Yukon	0	0	0	0	0	0	0	0	0
Zacatecas	33	23	9	50	1,041	19	5	14	30
Canada Total	35,815	28,198	55,296	2,041,938	3,756,550	62,930	32,775	41,953	35,252
Mexico Total	7,918	5,603	6,855	8,074	351,324	4,771	1,128	14,720	7,000
TOTAL	43,733	33,802	62,151	2,050,012	4,107,874	67,701	33,903	56,673	42,252

Table B-10c - 2008 Other Non-Point and Non-Road (othar) Emissions by Species, by Canadian Province, and by Mexican Federal State

Modeled State	HONO	IOLE	ISOP	MEOH	NH_3	NH_3_FERT	NO	NO_2	NO_X
Aguascalientes	0	0	0	0	0	0	0	0	0
Alberta	1,071	1,321	548	3,828	126,958	0	138,248	14,290	153,608
Baja Calif Norte	155	488	14	1,559	8,711	0	22,150	2,307	24,611
Baja Calif Sur	51	43	2	140	3,973	0	6,104	627	6,783
British Columbia	533	755	108	2,502	23,244	0	75,002	7,799	83,334
Campeche	0	0	0	0	0	0	0	0	0
Chiapas	0	0	0	0	0	0	0	0	0
Chihuahua	215	704	31	2,118	42,865	0	32,137	3,355	35,708
Coahuila	125	537	9	1,357	26,835	0	17,239	1,790	19,154
Colima	0	0	0	0	0	0	0	0	0
Distrito Federal	0	0	0	0	0	0	0	0	0
Durango	56	136	15	568	40,334	0	7,595	788	8,439
Guanajuato	0	0	0	0	0	0	0	0	0
Guerrero	0	0	0	0	0	0	0	0	0
Hidalgo	0	0	0	0	0	0	0	0	0
Jalisco	0	0	0	0	0	0	0	0	0
Manitoba	302	523	163	1,369	67,048	0	38,284	3,954	42,540
Mexico	0	0	0	0	0	0	0	0	0
Michoacan	0	0	0	0	0	0	0	0	0
Morelos	0	0	0	0	0	0	0	0	0
NW Territories	0	0	0	0	0	0	0	0	0
Nayarit	0	0	0	0	0	0	0	0	0
New Brunswick	77	271	26	532	4,230	0	13,414	1,414	14,905
Newfoundland	21	54	5	101	214	0	2,740	284	3,045
Nova Scotia	94	215	30	633	6,795	0	13,808	1,441	15,342
Nuevo Leon	141	505	9	2,223	17,369	0	19,426	2,017	21,584

Modeled State	HONO	IOLE	ISOP	MEOH	NH_3	NH_3_FERT	NO	NO_2	NO_x
Nunavut	0	0	0	0	0	0	0	0	0
Oaxaca	0	0	0	0	0	0	0	0	0
Ontario	1,398	2,557	305	9,253	107,039	0	198,278	20,637	220,313
Prince Edward Island	20	53	10	106	2,300	0	2,777	288	3,086
Puebla	0	0	0	0	0	0	0	0	0
Quebec	672	2,020	315	5,641	85,974	0	93,955	9,770	104,397
Queretaro	0	0	0	0	0	0	0	0	0
Quintana Roo	0	0	0	0	0	0	0	0	0
San Luis Potosi	0	0	0	0	2	0	1	0	1
Saskatchewan	595	765	308	1,916	115,568	0	71,749	7,378	79,723
Sinaloa	123	333	27	859	51,648	0	15,324	1,580	17,027
Sonora	156	507	37	1,212	51,580	0	20,288	2,098	22,542
Tabasco	0	0	0	0	0	0	0	0	0
Tamaulipas	102	244	4	929	9,861	0	13,615	1,410	15,128
Tlaxcala	0	0	0	0	0	0	0	0	0
Veracruz	0	0	0	0	0	0	0	0	0
Yucatan	0	0	0	0	0	0	0	0	0
Yukon	0	0	0	0	0	0	0	0	0
Zacatecas	3	7	1	12	1,948	0	377	39	419
Canada Total	4,782	8,534	1,820	25,880	539,370	0	648,257	67,254	720,293
Mexico Total	1,129	3,503	150	10,976	255,125	0	154,257	16,011	171,396
TOTAL	5,911	12,037	1,969	36,856	794,495	0	802,514	83,265	891,689

Table B-10d - 2008 Other Non-Point and Non-Road (othar) Emissions by Species, by Canadian Province, and by Mexican Federal State

Modeled State	NVOL	OLE	PAL	PAR	PCA	PCL	PEC	PFE	PH2O	PK
Aguascalientes	0	0	0	0	0	0	0	0	0	0
Alberta	586	10,917	2,347	109,444	3,724	318	7,744	2,018	179	1,022
Baja Calif Norte	63	656	16	45,073	14	111	1,286	12	1	95
Baja Calif Sur	4	101	2	3,618	4	1	252	2	0	3
British Columbia	108	5,012	486	70,568	521	824	5,501	382	214	1,005
Campeche	0	0	0	0	0	0	0	0	0	0
Chiapas	0	0	0	0	0	0	0	0	0	0
Chihuahua	103	1,165	125	56,408	57	61	2,537	84	2	103
Coahuila	52	504	24	41,371	14	20	1,047	16	1	29
Colima	0	0	0	0	0	0	0	0	0	0
Distrito Federal	0	0	0	0	0	0	0	0	0	0
Durango	21	492	67	11,956	25	39	810	44	1	56
Guanajuato	0	0	0	0	0	0	0	0	0	0
Guerrero	0	0	0	0	0	0	0	0	0	0
Hidalgo	0	0	0	0	0	0	0	0	0	0
Jalisco	0	0	0	0	0	0	0	0	0	0
Manitoba	177	3,979	604	38,506	602	85	2,732	495	35	300
Mexico	0	0	0	0	0	0	0	0	0	0
Michoacan	0	0	0	0	0	0	0	0	0	0

Modeled State	NVOL	OLE	PAL	PAR	PCA	PCL	PEC	PFE	PH2O	PK
Morelos	0	0	0	0	0	0	0	0	0	0
NW Territories	0	0	0	0	0	0	0	0	0	0
Nayarit	0	0	0	0	0	0	0	0	0	0
New Brunswick	16	1,912	225	18,660	271	56	895	188	17	321
Newfoundland	1	365	67	2,909	90	10	211	57	4	87
Nova Scotia	19	1,597	224	17,699	272	41	1,085	183	16	315
Nuevo Leon	86	796	17	54,708	16	44	1,395	12	1	48
Nunavut	0	0	0	2	0	0	0	0	0	0
Oaxaca	0	0	0	0	0	0	0	0	0	0
Ontario	400	16,231	2,329	233,229	3,051	261	11,564	2,304	174	1,479
Prince Edward Island	9	402	42	3,347	46	6	226	34	3	49
Puebla	0	0	0	0	0	0	0	0	0	0
Quebec	211	13,837	1,323	157,775	1,702	303	8,081	1,201	129	1,880
Queretaro	0	0	0	0	0	0	0	0	0	0
Quintana Roo	0	0	0	0	0	0	0	0	0	0
San Luis Potosi	0	0	0	0	0	0	0	0	0	0
Saskatchewan	330	6,018	1,130	53,663	1,392	110	5,452	903	57	451
Sinaloa	34	836	141	21,969	45	97	1,623	92	1	137
Sonora	47	892	47	34,102	21	409	1,867	31	1	345
Tabasco	0	0	0	0	0	0	0	0	0	0
Tamaulipas	51	367	77	24,606	26	7	1,292	50	1	26
Tlaxcala	0	0	0	0	0	0	0	0	0	0
Veracruz	0	0	0	0	0	0	0	0	0	0
Yucatan	0	0	0	0	0	0	0	0	0	0
Yukon	0	0	0	0	0	0	0	0	0	0
Zacatecas	1	16	6	392	2	0	36	4	0	2
Canada Total	1,858	60,270	8,777	705,800	11,671	2,014	43,491	7,765	828	6,908
Mexico Total	463	5,825	522	294,204	225	790	12,146	347	7	845
TOTAL	2,321	66,095	9,299	1,000,005	11,896	2,804	55,636	8,112	836	7,753

Table B-10e - 2008 Other Non-Point and Non-Road (othar) Emissions by Species, by Canadian Province, and by Mexican Federal State

Modeled State	PM_{10}	$PM_{2.5}$	PMC	PMFINE	PMG	PMN	PMOTHR	PNA	PNCOM	PNH_4
Aguascalientes	0	0	0	0	0	0	0	0	0	0
Alberta	355,140	71,517	283,624	52,977	150	60	31,435	204	4,158	45
Baja Calif Norte	6,017	4,494	1,523	1,585	1	0	497	21	751	22
Baja Calif Sur	883	649	233	181	0	0	54	2	107	0
British Columbia	85,007	45,930	39,077	21,837	55	24	7,557	644	8,453	27
Campeche	0	0	0	0	0	0	0	0	0	0
Chiapas	0	0	0	0	0	0	0	0	0	0
Chihuahua	17,143	10,699	6,444	4,298	2	2	1,406	26	2,065	15
Coahuila	4,960	3,398	1,562	1,132	0	0	343	14	599	4
Colima	0	0	0	0	0	0	0	0	0	0
Distrito Federal	0	0	0	0	0	0	0	0	0	0
Durango	7,380	4,245	3,134	1,880	1	1	470	11	966	10
Guanajuato	0	0	0	0	0	0	0	0	0	0
Guerrero	0	0	0	0	0	0	0	0	0	0
Hidalgo	0	0	0	0	0	0	0	0	0	0
Jalisco	0	0	0	0	0	0	0	0	0	0
Manitoba	98,827	18,816	80,010	12,318	53	14	6,521	47	1,611	12
Mexico	0	0	0	0	0	0	0	0	0	0
Michoacan	0	0	0	0	0	0	0	0	0	0
Morelos	0	0	0	0	0	0	0	0	0	0
NW Territories	0	0	0	0	0	0	0	0	0	0
Nayarit	0	0	0	0	0	0	0	0	0	0
New Brunswick	33,584	12,406	21,179	7,415	32	5	3,140	29	2,107	10
Newfoundland	10,078	3,251	6,828	2,086	10	1	959	4	490	2
Nova Scotia	33,294	12,822	20,472	7,564	31	5	3,249	15	2,189	10
Nuevo Leon	6,073	4,626	1,447	1,488	1	0	433	23	839	8
Nunavut	3	1	3	1	0	0	0	0	0	0
Oaxaca	0	0	0	0	0	0	0	0	0	0
Ontario	347,907	101,240	246,667	62,447	265	72	31,700	119	12,745	76
Prince Edward Island	6,417	2,055	4,362	1,224	5	1	553	2	304	2
Puebla	0	0	0	0	0	0	0	0	0	0
Quebec	232,315	94,408	137,907	52,166	176	34	20,303	125	19,244	86
Queretaro	0	0	0	0	0	0	0	0	0	0
Quintana Roo	0	0	0	0	0	0	0	0	0	0
San Luis Potosi	1	0	0	0	0	0	0	0	0	0
Saskatchewan	222,425	32,204	190,221	22,143	53	25	12,733	60	1,732	18
Sinaloa	14,564	8,410	6,154	3,776	2	2	942	21	1,879	23
Sonora	11,638	9,107	2,531	3,749	4	1	454	43	2,180	83
Tabasco	0	0	0	0	0	0	0	0	0	0
Tamaulipas	6,560	3,270	3,290	1,234	1	1	481	9	340	1
Tlaxcala	0	0	0	0	0	0	0	0	0	0
Veracruz	0	0	0	0	0	0	0	0	0	0
Yucatan	0	0	0	0	0	0	0	0	0	0
Yukon	0	0	0	0	0	0	0	0	0	0

Modeled State	PM_{10}	$PM_{2.5}$	PMC	PMFINE	PMG	PMN	PMOTHR	PNA	PNCOM	PNH_4
Zacatecas	458	211	247	110	0	0	38	0	40	0
Canada Total	1,424,994	394,648	1,030,346	242,176	831	241	118,151	1,249	53,035	290
Mexico Total	75,679	49,111	26,568	19,435	13	9	5,118	169	9,766	168
TOTAL	1,500,672	443,758	1,056,914	261,610	844	250	123,268	1,419	62,801	458

Table B-10f - 2008 Other Non-Point and Non-Road (othar) Emissions by Species, by Canadian Province, and by Mexican Federal State

Modeled State	PNO_3	POC	PSI	PSO_4	PTI	SO_2	SULF
Aguascalientes	0	0	0	0	0	0	0
Alberta	152	9,680	7,202	965	185	9,567	22
Baja Calif Norte	12	1,304	44	306	1	18,838	288
Baja Calif Sur	1	196	5	19	0	1,366	20
British Columbia	258	17,211	1,638	1,122	31	11,423	29
Campeche	0	0	0	0	0	0	0
Chiapas	0	0	0	0	0	0	0
Chihuahua	20	3,381	342	463	8	27,965	427
Coahuila	8	1,062	66	149	2	9,984	152
Colima	0	0	0	0	0	0	0
Distrito Federal	0	0	0	0	0	0	0
Durango	9	1,507	184	40	4	1,539	22
Guanajuato	0	0	0	0	0	0	0
Guerrero	0	0	0	0	0	0	0
Hidalgo	0	0	0	0	0	0	0
Jalisco	0	0	0	0	0	0	0
Manitoba	35	3,425	1,902	306	42	2,803	7
Mexico	0	0	0	0	0	0	0
Michoacan	0	0	0	0	0	0	0
Morelos	0	0	0	0	0	0	0
NW Territories	0	0	0	0	0	0	0
Nayarit	0	0	0	0	0	0	0
New Brunswick	18	3,830	1,000	248	16	9,019	101
Newfoundland	4	885	298	65	5	958	7
Nova Scotia	14	3,895	1,003	264	16	7,866	72
Nuevo Leon	10	1,485	45	248	2	17,568	268
Nunavut	0	0	0	0	0	0	0
Oaxaca	0	0	0	0	0	0	0
Ontario	192	24,160	7,779	2,876	170	24,435	170
Prince Edward Island	2	564	175	38	3	1,053	5
Puebla	0	0	0	0	0	0	0
Quebec	145	32,084	5,606	1,932	96	19,741	188
Queretaro	0	0	0	0	0	0	0
Quintana Roo	0	0	0	0	0	0	0
San Luis Potosi	0	0	0	0	0	0	0
Saskatchewan	49	4,207	3,410	354	83	11,182	95
Sinaloa	17	2,943	384	51	8	1,821	24

Modeled State	PNO_3	POC	PSI	PSO_4	PTI	SO_2	SULF
Sonora	26	3,359	126	106	3	2,263	31
Tabasco	0	0	0	0	0	0	0
Tamaulipas	6	718	210	21	5	1,485	20
Tlaxcala	0	0	0	0	0	0	0
Veracruz	0	0	0	0	0	0	0
Yucatan	0	0	0	0	0	0	0
Yukon	0	0	0	0	0	0	0
Zacatecas	0	63	17	2	0	79	1
Canada Total	869	99,942	30,013	8,170	647	98,047	697
Mexico Total	110	16,017	1,423	1,404	33	82,908	1,253
TOTAL	979	115,959	31,436	9,574	680	180,954	1,950

Table B-10g - 2008 Other Non-Point and Non-Road (othar) Emissions by Species, by Canadian Province, and by Mexican Federal State

Modeled State	TERP	TOL	UNK	UNR	XYL
Aguascalientes	0	0	0	0	0
Alberta	1,372	20,269	35	42,719	14,002
Baja Calif Norte	1,613	6,427	4	8,816	4,325
Baja Calif Sur	89	439	1	866	317
British Columbia	462	20,247	10	22,878	12,669
Campeche	0	0	0	0	0
Chiapas	0	0	0	0	0
Chihuahua	2,276	7,887	10	11,036	5,389
Coahuila	1,237	5,372	4	6,630	3,757
Colima	0	0	0	0	0
Distrito Federal	0	0	0	0	0
Durango	365	1,742	3	3,237	1,202
Guanajuato	0	0	0	0	0
Guerrero	0	0	0	0	0
Hidalgo	0	0	0	0	0
Jalisco	0	0	0	0	0
Manitoba	421	7,423	10	14,835	5,531
Mexico	0	0	0	0	0
Michoacan	0	0	0	0	0
Morelos	0	0	0	0	0
NW Territories	0	0	0	0	0
Nayarit	0	0	0	0	0
New Brunswick	105	5,115	2	8,187	3,593
Newfoundland	17	772	0	1,556	572
Nova Scotia	129	4,183	2	8,439	2,766
Nuevo Leon	2,181	8,337	5	11,607	5,743
Nunavut	0	1	0	0	1
Oaxaca	0	0	0	0	0
Ontario	1,580	52,030	38	76,235	37,563
Prince Edward Island	29	778	1	1,559	583

Modeled State	TERP	TOL	UNK	UNR	XYL
Puebla	0	0	0	0	0
Quebec	1,065	38,321	19	66,178	25,782
Queretaro	0	0	0	0	0
Quintana Roo	0	0	0	0	0
San Luis Potosi	0	0	0	0	0
Saskatchewan	697	9,853	22	20,878	7,345
Sinaloa	347	2,804	6	5,277	1,809
Sonora	968	4,212	5	6,444	2,793
Tabasco	0	0	0	0	0
Tamaulipas	1,013	3,755	5	4,807	2,746
Tlaxcala	0	0	0	0	0
Veracruz	0	0	0	0	0
Yucatan	0	0	0	0	0
Yukon	0	0	0	0	0
Zacatecas	5	49	0	88	38
Canada Total	5,876	158,992	138	263,465	110,404
Mexico Total	10,093	41,026	43	58,809	28,120
TOTAL	15,970	200,018	181	322,274	138,524

Table B-10h - 2008 Other Non-Point and Non-Road (othar) Emissions by Species, by Canadian Province, and by Mexican Federal State

Inventory Totals (Canada - 2006; Mexico - 1999)							
State	CO	PM_{10}	$PM_{2.5}$	NO_x	SO_2	NH_3	VOC
Aguascalientes	51,156	226	207	4,609	269	80	5,915
Alberta	787,448	2,659	1,995	96,682	941	2,643	50,394
Baja Calif Norte	135,646	697	639	14,593	829	269	17,696
Baja Calif Sur	13,074	68	62	1,408	81	29	1,713
British Columbia	587,324	1,805	1,262	70,139	625	2,643	42,481
Campeche	23,169	121	111	2,453	144	42	3,116
Chiapas	110,136	556	509	11,340	661	192	14,224
Chihuahua	161,063	754	691	15,784	896	273	19,447
Coahuila	115,759	547	501	11,396	650	187	13,901
Colima	16,569	85	78	1,746	101	35	2,257
Distrito Federal	813,226	3,092	2,833	68,638	3,677	1,070	97,578
Durango	66,416	296	271	6,133	352	107	7,482
Guanajuato	206,136	912	835	18,617	1,092	378	24,259
Guerrero	97,332	496	455	10,156	590	175	12,738
Hidalgo	64,276	294	269	5,980	350	101	7,612
Jalisco	547,239	2,180	1,997	47,275	2,591	785	65,657
Manitoba	262,215	765	573	29,128	256	810	16,827
Mexico	894,875	3,564	3,265	77,043	4,238	1,390	106,628
Michoacan	128,606	585	536	11,922	696	224	15,363
Morelos	66,134	308	283	6,288	367	107	8,026
NW Territories							
Nayarit	29,792	154	141	3,170	183	50	3,924
New Brunswick	147,496	527	389	20,844	221	613	9,081
Newfoundland	79,015	220	154	8,378	74	364	4,125
Nova Scotia	136,611	413	289	15,582	158	648	8,194
Nuevo Leon	391,398	1,804	1,653	40,350	2,145	621	52,458
Nunavut							
Oaxaca	96,671	453	415	9,352	538	142	11,800
Ontario	1,212,175	4,163	2,711	146,473	1,618	8,388	64,827
Prince Edward Island	27,533	89	67	3,293	26	105	1,669
Puebla	208,013	933	854	19,031	1,108	336	24,699
Quebec	978,672	3,533	2,533	116,250	1,277	5,158	58,668
Queretaro	57,535	257	236	5,250	306	109	6,750
Quintana Roo	37,062	189	173	3,921	225	68	4,976
San Luis Potosi	96,895	423	388	8,727	503	140	10,865
Saskatchewan	399,253	1,136	880	42,462	339	881	27,613
Sinaloa	91,371	476	436	9,879	566	213	11,806
Sonora	81,056	419	384	8,714	498	169	10,537
Tabasco	53,000	275	252	5,633	326	144	7,030
Tamaulipas	125,260	647	593	13,527	770	242	16,220
Tlaxcala	42,848	189	173	3,876	225	75	5,001
Veracruz	221,679	1,114	1,020	22,912	1,324	417	28,823
Yucatan	64,848	331	303	6,873	393	111	8,644
Yukon							

Inventory Totals (Canada - 2006; Mexico - 1999)							
State	CO	PM_{10}	$PM_{2.5}$	NO_x	SO_2	NH_3	VOC
Zacatecas	41,502	175	160	3,568	208	64	4,450
Canada Total	4,617,742	15,310	10,853	549,231	5,535	22,252	283,879
Mexico Total	5,149,744	22,622	20,724	480,164	26,902	8,346	631,594
TOTAL	9,767,487	37,932	31,577	1,029,395	32,437	30,598	915,473

Table B-11a - 2008 Other On-Road Source (othon) Emissions by Species, by Canadian Province, and by Mexican Federal State

Modeled State	ALD_2	ALD_X	BENZENE	CH_4	CO	ETH	ETHA	ETOH	FORM
Aguascalientes	0	0	0	0	0	0	0	0	0
Alberta	1,218	472	2,211	5,706	761,875	2,738	877	0	1,135
Baja Calif Norte	408	147	813	2,105	136,058	1,001	324	0	394
Baja Calif Sur	30	11	59	154	9,936	73	24	0	29
British Columbia	898	302	1,926	4,995	576,782	2,360	768	0	896
Campeche	0	0	0	0	0	0	0	0	0
Chiapas	0	0	0	0	0	0	0	0	0
Chihuahua	492	192	884	2,279	161,555	1,095	350	0	457
Coahuila	350	136	632	1,630	116,112	783	251	0	326
Colima	0	0	0	0	0	0	0	0	0
Distrito Federal	0	0	0	0	0	0	0	0	0
Durango	99	38	182	470	33,533	225	72	0	93
Guanajuato	0	0	0	0	0	0	0	0	0
Guerrero	0	0	0	0	0	0	0	0	0
Hidalgo	0	0	0	0	0	0	0	0	0
Jalisco	0	0	0	0	0	0	0	0	0
Manitoba	391	142	772	1,998	262,864	951	307	0	377
Mexico	0	0	0	0	0	0	0	0	0
Michoacan	0	0	0	0	0	0	0	0	0
Morelos	0	0	0	0	0	0	0	0	0
NW Territories	0	0	0	0	0	0	0	0	0
Nayarit	0	0	0	0	0	0	0	0	0
New Brunswick	226	87	414	1,067	147,963	512	164	0	211
Newfoundland	20	7	41	107	17,236	51	16	0	20
Nova Scotia	189	68	377	975	137,048	464	150	0	183
Nuevo Leon	1,238	457	2,395	6,193	390,957	2,954	952	0	1,183
Nunavut	0	0	0	0	0	0	0	0	0
Oaxaca	0	0	0	0	0	0	0	0	0
Ontario	1,574	594	2,960	7,648	1,215,665	3,657	1,175	0	1,487
Prince Edward Island	39	14	77	198	27,622	94	30	0	37
Puebla	0	0	0	0	0	0	0	0	0
Quebec	1,436	545	2,677	6,913	981,573	3,309	1,063	0	1,352
Queretaro	0	0	0	0	0	0	0	0	0
Quintana Roo	0	0	0	0	0	0	0	0	0
San Luis Potosi	0	0	0	0	1	0	0	0	0
Saskatchewan	643	234	1,266	3,277	400,092	1,560	504	0	619
Sinaloa	198	71	401	1,038	67,608	493	160	0	193

Modeled State	ALD_2	ALD_X	BENZENE	CH_4	CO	ETH	ETHA	ETOH	FORM
Sonora	243	87	484	1,253	81,302	596	193	0	235
Tabasco	0	0	0	0	0	0	0	0	0
Tamaulipas	213	76	428	1,107	72,073	526	170	0	207
Tlaxcala	0	0	0	0	0	0	0	0	0
Veracruz	0	0	0	0	0	0	0	0	0
Yucatan	0	0	0	0	0	0	0	0	0
Yukon	0	0	0	0	0	0	0	0	0
Zacatecas	2	1	3	9	742	4	1	0	2
Canada Total	6,632	2,465	12,720	32,885	4,528,720	15,695	5,054	0	6,316
Mexico Total	3,273	1,216	6,282	16,238	1,069,878	7,750	2,496	0	3,118
TOTAL	9,905	3,681	19,002	49,123	5,598,598	23,445	7,550	0	9,434

Table B-11b - 2008 Other On-Road Source (othon) Emissions by Species, by Canadian Province, and by Mexican Federal State

Modeled State	HONO	IOLE	ISOP	MEOH	NH_3	NH_3_FERT	NO	NO_2	NO_X
Aguascalientes	0	0	0	0	0	0	0	0	0
Alberta	749	746	0	0	2,558	0	84,213	8,609	93,570
Baja Calif Norte	117	274	0	0	270	0	13,179	1,347	14,643
Baja Calif Sur	9	20	0	0	18	0	965	99	1,072
British Columbia	551	648	0	0	2,596	0	62,006	6,338	68,896
Campeche	0	0	0	0	0	0	0	0	0
Chiapas	0	0	0	0	0	0	0	0	0
Chihuahua	127	298	0	0	274	0	14,255	1,457	15,839
Coahuila	91	213	0	0	187	0	10,292	1,052	11,436
Colima	0	0	0	0	0	0	0	0	0
Distrito Federal	0	0	0	0	0	0	0	0	0
Durango	27	61	0	0	59	0	3,005	307	3,339
Guanajuato	0	0	0	0	0	0	0	0	0
Guerrero	0	0	0	0	0	0	0	0	0
Hidalgo	0	0	0	0	0	0	0	0	0
Jalisco	0	0	0	0	0	0	0	0	0
Manitoba	234	260	0	0	812	0	26,287	2,687	29,208
Mexico	0	0	0	0	0	0	0	0	0
Michoacan	0	0	0	0	0	0	0	0	0
Morelos	0	0	0	0	0	0	0	0	0
NW Territories	0	0	0	0	0	0	0	0	0
Nayarit	0	0	0	0	0	0	0	0	0
New Brunswick	167	139	0	0	615	0	18,824	1,924	20,916
Newfoundland	15	14	0	0	79	0	1,645	168	1,828
Nova Scotia	125	127	0	0	650	0	14,072	1,438	15,636
Nuevo Leon	323	807	0	0	621	0	36,305	3,711	40,339
Nunavut	0	0	0	0	0	0	0	0	0
Oaxaca	0	0	0	0	0	0	0	0	0
Ontario	1,175	998	0	0	8,412	0	132,238	13,517	146,931
Prince Edward Island	26	26	0	0	105	0	2,974	304	3,304

Modeled State	HONO	IOLE	ISOP	MEOH	NH_3	NH_3_FERT	NO	NO_2	NO_x
Puebla	0	0	0	0	0	0	0	0	0
Quebec	933	902	0	0	5,173	0	104,959	10,729	116,621
Queretaro	0	0	0	0	0	0	0	0	0
Quintana Roo	0	0	0	0	0	0	0	0	0
San Luis Potosi	0	0	0	0	0	0	0	0	0
Saskatchewan	341	427	0	0	883	0	38,308	3,916	42,564
Sinaloa	58	135	0	0	169	0	6,581	673	7,312
Sonora	70	163	0	0	170	0	7,870	804	8,744
Tabasco	0	0	0	0	0	0	0	0	0
Tamaulipas	62	144	0	0	134	0	7,012	717	7,792
Tlaxcala	0	0	0	0	0	0	0	0	0
Veracruz	0	0	0	0	0	0	0	0	0
Yucatan	0	0	0	0	0	0	0	0	0
Yukon	0	0	0	0	0	0	0	0	0
Zacatecas	1	1	0	0	1	0	58	6	64
Canada Total	4,316	4,286	2	0	21,883	0	485,526	49,631	539,473
Mexico Total	885	2,117	1	0	1,904	0	99,522	10,173	110,580
TOTAL	5,200	6,403	3	0	23,787	0	585,048	59,805	650,053

Table B-11c - 2008 Other On-Road Source (othon) Emissions by Species, by Canadian Province, and by Mexican Federal State

Modeled State	NVOL	OLE	PAL	PAR	PCA	PCL	PEC	PFE	PH2O	PK
Aguascalientes	0	0	0	0	0	0	0	0	0	0
Alberta	14	3,316	1	27,600	2	1	1,191	2	0	0
Baja Calif Norte	4	1,215	0	10,091	1	0	297	1	0	0
Baja Calif Sur	0	89	0	737	0	0	22	0	0	0
British Columbia	7	2,867	1	23,788	2	1	696	2	0	0
Campeche	0	0	0	0	0	0	0	0	0	0
Chiapas	0	0	0	0	0	0	0	0	0	0
Chihuahua	6	1,326	1	11,037	1	0	321	2	0	0
Coahuila	4	948	0	7,891	1	0	233	1	0	0
Colima	0	0	0	0	0	0	0	0	0	0
Distrito Federal	0	0	0	0	0	0	0	0	0	0
Durango	1	273	0	2,268	0	0	68	0	0	0
Guanajuato	0	0	0	0	0	0	0	0	0	0
Guerrero	0	0	0	0	0	0	0	0	0	0
Hidalgo	0	0	0	0	0	0	0	0	0	0
Jalisco	0	0	0	0	0	0	0	0	0	0
Manitoba	4	1,154	0	9,585	1	0	362	1	0	0
Mexico	0	0	0	0	0	0	0	0	0	0
Michoacan	0	0	0	0	0	0	0	0	0	0
Morelos	0	0	0	0	0	0	0	0	0	0
NW Territories	0	0	0	0	0	0	0	0	0	0
Nayarit	0	0	0	0	0	0	0	0	0	0
New Brunswick	3	620	0	5,159	0	0	250	0	0	0
Newfoundland	0	62	0	513	0	0	20	0	0	0

Modeled State	NVOL	OLE	PAL	PAR	PCA	PCL	PEC	PFE	PH2O	PK
Nova Scotia	2	562	0	4,673	0	0	171	0	0	0
Nuevo Leon	13	3,582	1	29,772	3	1	765	4	0	0
Nunavut	0	0	0	0	0	0	0	0	0	0
Oaxaca	0	0	0	0	0	0	0	0	0	0
Ontario	17	4,432	2	36,863	4	1	1,465	5	0	0
Prince Edward Island	0	115	0	952	0	0	43	0	0	0
Puebla	0	0	0	0	0	0	0	0	0	0
Quebec	16	4,009	1	33,350	3	1	1,553	3	0	0
Queretaro	0	0	0	0	0	0	0	0	0	0
Quintana Roo	0	0	0	0	0	0	0	0	0	0
San Luis Potosi	0	0	0	0	0	0	0	0	0	0
Saskatchewan	6	1,892	0	15,723	1	0	555	1	0	0
Sinaloa	2	599	0	4,971	1	0	150	1	0	0
Sonora	2	723	0	6,009	1	0	179	1	0	0
Tabasco	0	0	0	0	0	0	0	0	0	0
Tamaulipas	2	639	0	5,304	1	0	158	1	0	0
Tlaxcala	0	0	0	0	0	0	0	0	0	0
Veracruz	0	0	0	0	0	0	0	0	0	0
Yucatan	0	0	0	0	0	0	0	0	0	0
Yukon	0	0	0	0	0	0	0	0	0	0
Zacatecas	0	5	0	43	0	0	1	0	0	0
Canada Total	70	19,029	5	158,204	13	4	6,304	15	0	1
Mexico Total	34	9,397	4	78,124	8	2	2,194	11	0	1
TOTAL	104	28,426	8	236,327	21	6	8,498	25	0	1

Table B-11d - 2008 Other On-Road Source (othon) Emissions by Species, by Canadian Province, and by Mexican Federal State

Modeled State	PM_{10}	PM_{2_5}	PMC	PMFINE	PMG	PMN	PMOTHR	PNA	PNCOM
Aguascalientes	0	0	0	0	0	0	0	0	0
Alberta	2,573	1,931	642	196	0	0	45	1	133
Baja Calif Norte	699	641	59	100	0	0	29	0	60
Baja Calif Sur	52	48	4	7	0	0	2	0	4
British Columbia	1,773	1,240	533	151	0	0	39	0	96
Campeche	0	0	0	0	0	0	0	0	0
Chiapas	0	0	0	0	0	0	0	0	0
Chihuahua	756	693	63	108	0	0	31	0	65
Coahuila	549	503	46	78	0	0	23	0	47
Colima	0	0	0	0	0	0	0	0	0
Distrito Federal	0	0	0	0	0	0	0	0	0
Durango	161	148	14	23	0	0	7	0	14
Guanajuato	0	0	0	0	0	0	0	0	0
Guerrero	0	0	0	0	0	0	0	0	0
Hidalgo	0	0	0	0	0	0	0	0	0
Jalisco	0	0	0	0	0	0	0	0	0
Manitoba	767	575	193	56	0	0	13	0	38
Mexico	0	0	0	0	0	0	0	0	0

Modeled State	PM_{10}	PM_{2_5}	PMC	PMFINE	PMG	PMN	PMOTHR	PNA	PNCOM
Michoacan	0	0	0	0	0	0	0	0	0
Morelos	0	0	0	0	0	0	0	0	0
NW Territories	0	0	0	0	0	0	0	0	0
Nayarit	0	0	0	0	0	0	0	0	0
New Brunswick	529	390	139	36	0	0	8	0	25
Newfoundland	48	34	14	4	0	0	1	0	2
Nova Scotia	414	290	124	32	0	0	8	0	21
Nuevo Leon	1,802	1,651	151	258	0	0	74	1	154
Nunavut	0	0	0	0	0	0	0	0	0
Oaxaca	0	0	0	0	0	0	0	0	0
Ontario	4,176	2,720	1,457	351	1	0	93	1	221
Prince Edward Island	89	67	22	6	0	0	1	0	4
Puebla	0	0	0	0	0	0	0	0	0
Quebec	3,545	2,542	1,003	263	0	0	62	1	177
Queretaro	0	0	0	0	0	0	0	0	0
Quintana Roo	0	0	0	0	0	0	0	0	0
San Luis Potosi	0	0	0	0	0	0	0	0	0
Saskatchewan	1,139	882	257	85	0	0	18	0	59
Sinaloa	353	324	30	50	0	0	15	0	30
Sonora	421	386	35	60	0	0	17	0	36
Tabasco	0	0	0	0	0	0	0	0	0
Tamaulipas	371	340	31	53	0	0	15	0	32
Tlaxcala	0	0	0	0	0	0	0	0	0
Veracruz	0	0	0	0	0	0	0	0	0
Yucatan	0	0	0	0	0	0	0	0	0
Yukon	0	0	0	0	0	0	0	0	0
Zacatecas	3	3	0	0	0	0	0	0	0
Canada Total	15,053	10,669	4,384	1,180	2	0	287	4	779
Mexico Total	5,168	4,735	433	739	1	0	213	3	442
TOTAL	20,222	15,405	4,817	1,918	3	0	500	6	1,220

Table B-11e - 2008 Other On-Road Source (othon) Emissions by Species, by Canadian Province, and by Mexican Federal State

Modeled State	PNH_4	PNO_3	POC	PSI	PSO_4	PTI	SO_2
Aguascalientes	0	0	0	0	0	0	0
Alberta	9	3	534	3	9	0	911
Baja Calif Norte	6	1	240	2	4	0	831
Baja Calif Sur	0	0	18	0	0	0	62
British Columbia	7	2	386	2	6	0	614
Campeche	0	0	0	0	0	0	0
Chiapas	0	0	0	0	0	0	0
Chihuahua	6	1	259	2	4	0	898
Coahuila	4	1	188	1	3	0	652
Colima	0	0	0	0	0	0	0
Distrito Federal	0	0	0	0	0	0	0
Durango	1	0	55	0	1	0	192

Modeled State	PNH_4	PNO_3	POC	PSI	PSO_4	PTI	SO_2
Guanajuato	0	0	0	0	0	0	0
Guerrero	0	0	0	0	0	0	0
Hidalgo	0	0	0	0	0	0	0
Jalisco	0	0	0	0	0	0	0
Manitoba	2	1	154	1	3	0	257
Mexico	0	0	0	0	0	0	0
Michoacan	0	0	0	0	0	0	0
Morelos	0	0	0	0	0	0	0
NW Territories	0	0	0	0	0	0	0
Nayarit	0	0	0	0	0	0	0
New Brunswick	1	0	101	0	2	0	221
Newfoundland	0	0	10	0	0	0	16
Nova Scotia	2	0	85	0	1	0	159
Nuevo Leon	15	2	617	4	9	0	2,142
Nunavut	0	0	0	0	0	0	0
Oaxaca	0	0	0	0	0	0	0
Ontario	18	4	886	5	14	0	1,624
Prince Edward Island	0	0	17	0	0	0	26
Puebla	0	0	0	0	0	0	0
Quebec	12	3	711	3	12	0	1,281
Queretaro	0	0	0	0	0	0	0
Quintana Roo	0	0	0	0	0	0	0
San Luis Potosi	0	0	0	0	0	0	0
Saskatchewan	4	1	237	1	4	0	340
Sinaloa	3	0	121	1	2	0	420
Sonora	3	1	144	1	2	0	500
Tabasco	0	0	0	0	0	0	0
Tamaulipas	3	0	127	1	2	0	442
Tlaxcala	0	0	0	0	0	0	0
Veracruz	0	0	0	0	0	0	0
Yucatan	0	0	0	0	0	0	0
Yukon	0	0	0	0	0	0	0
Zacatecas	0	0	1	0	0	0	4
Canada Total	55	14	3,120	16	51	0	5,448
Mexico Total	42	6	1,770	12	27	0	6,143
TOTAL	97	20	4,890	28	78	0	11,591

Table B-11f - 2008 Other On-Road Source (othon) Emissions by Species, by Canadian Province, and by Mexican Federal State

Modeled State	SULF	TERP	TOL	UNK	UNR	XYL
Aguascalientes	0	0	0	0	0	0
Alberta	0	21	7,179	9	5,669	7,433
Baja Calif Norte	0	6	2,634	3	2,065	2,732
Baja Calif Sur	0	0	192	0	151	200

Modeled State	SULF	TERP	TOL	UNK	UNR	XYL
British Columbia	0	11	6,223	5	4,856	6,466
Campeche	0	0	0	0	0	0
Chiapas	0	0	0	0	0	0
Chihuahua	0	9	2,869	4	2,268	2,970
Coahuila	0	6	2,052	3	1,621	2,124
Colima	0	0	0	0	0	0
Distrito Federal	0	0	0	0	0	0
Durango	0	2	590	1	466	611
Guanajuato	0	0	0	0	0	0
Guerrero	0	0	0	0	0	0
Hidalgo	0	0	0	0	0	0
Jalisco	0	0	0	0	0	0
Manitoba	0	6	2,501	2	1,962	2,594
Mexico	0	0	0	0	0	0
Michoacan	0	0	0	0	0	0
Morelos	0	0	0	0	0	0
NW Territories	0	0	0	0	0	0
Nayarit	0	0	0	0	0	0
New Brunswick	0	4	1,342	2	1,059	1,390
Newfoundland	0	0	134	0	105	139
Nova Scotia	0	3	1,219	1	956	1,265
Nuevo Leon	0	19	7,762	8	6,100	8,047
Nunavut	0	0	0	0	0	0
Oaxaca	0	0	0	0	0	0
Ontario	0	26	9,601	11	7,561	9,948
Prince Edward Island	0	1	248	0	195	257
Puebla	0	0	0	0	0	0
Quebec	0	24	8,683	10	6,843	8,995
Queretaro	0	0	0	0	0	0
Quintana Roo	0	0	0	0	0	0
San Luis Potosi	0	0	0	0	0	0
Saskatchewan	0	10	4,102	4	3,219	4,254
Sinaloa	0	3	1,298	1	1,017	1,347
Sonora	0	4	1,568	2	1,230	1,627
Tabasco	0	0	0	0	0	0
Tamaulipas	0	3	1,385	1	1,085	1,437
Tlaxcala	0	0	0	0	0	0
Veracruz	0	0	0	0	0	0
Yucatan	0	0	0	0	0	0
Yukon	0	0	0	0	0	0
Zacatecas	0	0	11	0	9	12
Canada Total	0	105	41,232	45	32,425	42,742
Mexico Total	0	52	20,362	22	16,011	21,107
TOTAL	0	157	61,594	67	48,437	63,849

Table B-11g- 2008 Other On-Road Source (othon) Emissions by Species, by Canadian Province, and by Mexican Federal State

Inventory				
State	NH_3	PM_{10}	PM_{25}	VOC
Alabama	61,960			
Arizona	39,458	456	50	
Arkansas	120,201			
California	284,485	12,116	7,269	41,404
Colorado	68,478			
Connecticut	2,487			
Delaware	13,065			
DC	0			
Florida	33,336			
Georgia	84,657			
Hawaii	6,898			
Idaho	102,949	11,053		40,365
Illinois	151,319			
Indiana	101,628			
Iowa	295,549			
Kansas	166,759			
Kentucky	51,648			
Louisiana	36,973			
Maine	4,737			
Maryland	27,021			
Massachusetts	2,153			
Michigan	60,793			
Minnesota	183,614			
Mississippi	58,456			
Missouri	124,330			
Montana	54,945			
Nebraska	176,171			
Nevada	5,371			
New Hampshire	1,148			
New Jersey	3,335			
New Mexico	45,891			
New York	39,881			
North Carolina	27,190			
North Dakota	78,690			
Ohio	83,531			
Oklahoma	97,170			
Oregon	42,639			
Pennsylvania	70,700			
Rhode Island	262			
South Carolina	29,804			
South Dakota	131,431			
Tennessee	33,879			
Texas	288,248			
Tribal	1,418	158		560

Inventory				
State	NH_3	PM_{10}	PM_{25}	VOC
Utah	44,614	414	62	10,119
Vermont	7,554			
Virginia	41,593			
Washington	42,720			
West Virginia	12,426			
Wisconsin	115,329			
Wyoming	19,259			
Con. US	3,569,837	24,039	7,382	91,888

Table B-12a - 2008 Agricultural (ag) Emissions by Species, by US State

Modeled									
State	ALD_2	ALD_X	BENZENE	CH_4	ETH	ETHA	ETOH	FORM	IOLE
Alabama	0	0	0	0	0	0	0	0	0
Arizona	0	0	0	0	0	0	0	0	0
Arkansas	0	0	0	0	0	0	0	0	0
California	5,383	3,386	0	362,032	0	103,819	10,266	0	0
Colorado	0	0	0	0	0	0	0	0	0
Connecticut	0	0	0	0	0	0	0	0	0
Delaware	0	0	0	0	0	0	0	0	0
District of Columbia	0	0	0	0	0	0	0	0	0
Florida	0	0	0	0	0	0	0	0	0
Georgia	0	0	0	0	0	0	0	0	0
Hawaii	0	0	0	0	0	0	0	0	0
Idaho	829	973	1,310	3,415	1,724	646	646	730	311
Illinois	0	0	0	0	0	0	0	0	0
Indiana	0	0	0	0	0	0	0	0	0
Iowa	0	0	0	0	0	0	0	0	0
Kansas	0	0	0	0	0	0	0	0	0
Kentucky	0	0	0	0	0	0	0	0	0
Louisiana	0	0	0	0	0	0	0	0	0
Maine	0	0	0	0	0	0	0	0	0
Maryland	0	0	0	0	0	0	0	0	0
Massachusetts	0	0	0	0	0	0	0	0	0
Michigan	0	0	0	0	0	0	0	0	0
Minnesota	0	0	0	0	0	0	0	0	0
Mississippi	0	0	0	0	0	0	0	0	0
Missouri	0	0	0	0	0	0	0	0	0
Montana	0	0	0	0	0	0	0	0	0
Nebraska	0	0	0	0	0	0	0	0	0
Nevada	0	0	0	0	0	0	0	0	0
New Hampshire	0	0	0	0	0	0	0	0	0
New Jersey	0	0	0	0	0	0	0	0	0
New Mexico	0	0	0	0	0	0	0	0	0
New York	0	0	0	0	0	0	0	0	0
North Carolina	0	0	0	0	0	0	0	0	0
North Dakota	0	0	0	0	0	0	0	0	0
Ohio	0	0	0	0	0	0	0	0	0

Modeled State	ALD_2	ALD_x	BENZENE	CH_4	ETH	ETHA	ETOH	FORM	IOLE
Oklahoma	0	0	0	0	0	0	0	0	0
Oregon	0	0	0	0	0	0	0	0	0
Pennsylvania	0	0	0	0	0	0	0	0	0
Rhode Island	0	0	0	0	0	0	0	0	0
South Carolina	0	0	0	0	0	0	0	0	0
South Dakota	0	0	0	0	0	0	0	0	0
Tennessee	0	0	0	0	0	0	0	0	0
Texas	0	0	0	0	0	0	0	0	0
Tribal Data	0	0	0	0	0	0	0	0	0
Utah	855	585	136	52,075	180	14,899	1,534	76	32
Vermont	0	0	0	0	0	0	0	0	0
Virginia	0	0	0	0	0	0	0	0	0
Washington	0	0	0	0	0	0	0	0	0
West Virginia	0	0	0	0	0	0	0	0	0
Wisconsin	0	0	0	0	0	0	0	0	0
Wyoming	0	0	0	0	0	0	0	0	0
Con. US	7,067	4,944	1,446	417,522	1,903	119,364	12,445	806	343

Table B-12b - 2008 Agricultural (ag) Emissions by Species, by US State

Modeled State	ISOP	MEOH	NH3	NH3_FERT	NVOL	OLE	PAL	PAR
Alabama	0	0	62,077	0	0	0	0	0
Arizona	0	0	39,498	0	0	0	1	0
Arkansas	0	0	120,404	0	0	0	0	0
California	0	0	284,940	0	0	0	94	26,136
Colorado	0	0	68,571	0	0	0	0	0
Connecticut	0	0	2,491	0	0	0	0	0
Delaware	0	0	13,087	0	0	0	0	0
District of Columbia	0	0	0	0	0	0	0	0
Florida	0	0	33,397	0	0	0	0	0
Georgia	0	0	84,817	0	0	0	0	0
Hawaii	0	0	0	0	0	0	0	0
Idaho	186	651	103,069	0	181	2,593	0	19,880
Illinois	0	0	151,471	0	0	0	0	0
Indiana	0	0	101,754	0	0	0	0	0
Iowa	0	0	295,933	0	0	0	0	0
Kansas	0	0	167,089	0	0	0	0	0
Kentucky	0	0	51,731	0	0	0	0	0
Louisiana	0	0	37,022	0	0	0	0	0
Maine	0	0	4,743	0	0	0	0	0
Maryland	0	0	27,063	0	0	0	0	0
Massachusetts	0	0	2,155	0	0	0	0	0
Michigan	0	0	60,845	0	0	0	0	0
Minnesota	0	0	183,807	0	0	0	0	0
Mississippi	0	0	58,549	0	0	0	0	0
Missouri	0	0	124,543	0	0	0	0	0

Modeled State	ISOP	MEOH	NH3	NH3_FERT	NVOL	OLE	PAL	PAR
Montana	0	0	54,991	0	0	0	0	0
Nebraska	0	0	176,389	0	0	0	0	0
Nevada	0	0	5,379	0	0	0	0	0
New Hampshire	0	0	1,150	0	0	0	0	0
New Jersey	0	0	3,339	0	0	0	0	0
New Mexico	0	0	45,944	0	0	0	0	0
New York	0	0	39,921	0	0	0	0	0
North Carolina	0	0	27,224	0	0	0	0	0
North Dakota	0	0	78,717	0	0	0	0	0
Ohio	0	0	83,619	0	0	0	0	0
Oklahoma	0	0	97,365	0	0	0	0	0
Oregon	0	0	42,695	0	0	0	0	0
Pennsylvania	0	0	70,797	0	0	0	0	0
Rhode Island	0	0	263	0	0	0	0	0
South Carolina	0	0	29,861	0	0	0	0	0
South Dakota	0	0	131,548	0	0	0	0	0
Tennessee	0	0	33,938	0	0	0	0	0
Texas	0	0	288,808	0	0	0	0	0
Tribal Data	0	0	0	0	0	0	0	0
Utah	19	68	44,699	0	19	270	6	5,804
Vermont	0	0	7,562	0	0	0	0	0
Virginia	0	0	41,663	0	0	0	0	0
Washington	0	0	42,766	0	0	0	0	0
West Virginia	0	0	12,447	0	0	0	0	0
Wisconsin	0	0	115,427	0	0	0	0	0
Wyoming	0	0	19,287	0	0	0	0	0
Con. US	205	719	3,574,855	0	200	2,863	100	51,820

Table B-12c - 2008 Agricultural (ag) Emissions by Species, by US State

Modeled State	PCA	PCL	PEC	PFE	PH2O	PK	PM_{10}	PM_{2_5}	PMC
Alabama	0	0	0	0	0	0	0	0	0
Arizona	1	0	3	1	1	1	456	50	406
Arkansas	0	0	0	0	0	0	0	0	0
California	156	28	376	87	136	149	12,139	7,284	4,856
Colorado	0	0	0	0	0	0	0	0	0
Connecticut	0	0	0	0	0	0	0	0	0
Delaware	0	0	0	0	0	0	0	0	0
District of Columbia	0	0	0	0	0	0	0	0	0
Florida	0	0	0	0	0	0	0	0	0
Georgia	0	0	0	0	0	0	0	0	0
Hawaii	0	0	0	0	0	0	0	0	0
Idaho	0	0	0	0	0	0	11,075	0	11,075
Illinois	0	0	0	0	0	0	0	0	0
Indiana	0	0	0	0	0	0	0	0	0

Modeled State	PCA	PCL	PEC	PFE	PH2O	PK	PM_{10}	$PM_{2.5}$	PMC
Iowa	0	0	0	0	0	0	0	0	0
Kansas	0	0	0	0	0	0	0	0	0
Kentucky	0	0	0	0	0	0	0	0	0
Louisiana	0	0	0	0	0	0	0	0	0
Maine	0	0	0	0	0	0	0	0	0
Maryland	0	0	0	0	0	0	0	0	0
Massachusetts	0	0	0	0	0	0	0	0	0
Michigan	0	0	0	0	0	0	0	0	0
Minnesota	0	0	0	0	0	0	0	0	0
Mississippi	0	0	0	0	0	0	0	0	0
Missouri	0	0	0	0	0	0	0	0	0
Montana	0	0	0	0	0	0	0	0	0
Nebraska	0	0	0	0	0	0	0	0	0
Nevada	0	0	0	0	0	0	0	0	0
New Hampshire	0	0	0	0	0	0	0	0	0
New Jersey	0	0	0	0	0	0	0	0	0
New Mexico	0	0	0	0	0	0	0	0	0
New York	0	0	0	0	0	0	0	0	0
North Carolina	0	0	0	0	0	0	0	0	0
North Dakota	0	0	0	0	0	0	0	0	0
Ohio	0	0	0	0	0	0	0	0	0
Oklahoma	0	0	0	0	0	0	0	0	0
Oregon	0	0	0	0	0	0	0	0	0
Pennsylvania	0	0	0	0	0	0	0	0	0
Rhode Island	0	0	0	0	0	0	0	0	0
South Carolina	0	0	0	0	0	0	0	0	0
South Dakota	0	0	0	0	0	0	0	0	0
Tennessee	0	0	0	0	0	0	0	0	0
Texas	0	0	0	0	0	0	0	0	0
Tribal Data	0	0	0	0	0	0	0	0	0
Utah	2	0	0	4	0	1	415	62	353
Vermont	0	0	0	0	0	0	0	0	0
Virginia	0	0	0	0	0	0	0	0	0
Washington	0	0	0	0	0	0	0	0	0
West Virginia	0	0	0	0	0	0	0	0	0
Wisconsin	0	0	0	0	0	0	0	0	0
Wyoming	0	0	0	0	0	0	0	0	0
Con. US	158	29	378	91	137	152	24,085	7,396	16,689

Table B-12d - 2008 Agricultural (ag) Emissions by Species, by US State

Modeled State	PMFINE	PMG	PMN	PMOTHR	PNA	PNCOM	PNH_4	PNO_3	POC
Alabama	0	0	0	0	0	0	0	0	0
Arizona	25	0	0	10	0	6	2	5	16
Arkansas	0	0	0	0	0	0	0	0	0
California	3,592	0	3	1,441	36	925	243	674	2,316
Colorado	0	0	0	0	0	0	0	0	0
Connecticut	0	0	0	0	0	0	0	0	0
Delaware	0	0	0	0	0	0	0	0	0
District of Columbia	0	0	0	0	0	0	0	0	0
Florida	0	0	0	0	0	0	0	0	0
Georgia	0	0	0	0	0	0	0	0	0
Hawaii	0	0	0	0	0	0	0	0	0
Idaho	0	0	0	0	0	0	0	0	0
Illinois	0	0	0	0	0	0	0	0	0
Indiana	0	0	0	0	0	0	0	0	0
Iowa	0	0	0	0	0	0	0	0	0
Kansas	0	0	0	0	0	0	0	0	0
Kentucky	0	0	0	0	0	0	0	0	0
Louisiana	0	0	0	0	0	0	0	0	0
Maine	0	0	0	0	0	0	0	0	0
Maryland	0	0	0	0	0	0	0	0	0
Massachusetts	0	0	0	0	0	0	0	0	0
Michigan	0	0	0	0	0	0	0	0	0
Minnesota	0	0	0	0	0	0	0	0	0
Mississippi	0	0	0	0	0	0	0	0	0
Missouri	0	0	0	0	0	0	0	0	0
Montana	0	0	0	0	0	0	0	0	0
Nebraska	0	0	0	0	0	0	0	0	0
Nevada	0	0	0	0	0	0	0	0	0
New Hampshire	0	0	0	0	0	0	0	0	0
New Jersey	0	0	0	0	0	0	0	0	0
New Mexico	0	0	0	0	0	0	0	0	0
New York	0	0	0	0	0	0	0	0	0
North Carolina	0	0	0	0	0	0	0	0	0
North Dakota	0	0	0	0	0	0	0	0	0
Ohio	0	0	0	0	0	0	0	0	0
Oklahoma	0	0	0	0	0	0	0	0	0
Oregon	0	0	0	0	0	0	0	0	0
Pennsylvania	0	0	0	0	0	0	0	0	0
Rhode Island	0	0	0	0	0	0	0	0	0
South Carolina	0	0	0	0	0	0	0	0	0
South Dakota	0	0	0	0	0	0	0	0	0
Tennessee	0	0	0	0	0	0	0	0	0
Texas	0	0	0	0	0	0	0	0	0
Tribal Data	0	0	0	0	0	0	0	0	0

Modeled State	PMFINE	PMG	PMN	PMOTHR	PNA	PNCOM	PNH_4	PNO_3	POC
Utah	60	0	0	32	0	1	0	0	2
Vermont	0	0	0	0	0	0	0	0	0
Virginia	0	0	0	0	0	0	0	0	0
Washington	0	0	0	0	0	0	0	0	0
West Virginia	0	0	0	0	0	0	0	0	0
Wisconsin	0	0	0	0	0	0	0	0	0
Wyoming	0	0	0	0	0	0	0	0	0
Con. US	3,677	0	3	1,482	37	932	244	679	2,334

Table B-12e - 2008 Agricultural (ag) Emissions by Species, by US State

Modeled State	PSI	PSO_4	PTI	TERP	TOL	UNK	UNR	XYL
Alabama	0	0	0	0	0	0	0	0
Arizona	2	2	0	0	0	0	0	0
Arkansas	0	0	0	0	0	0	0	0
California	291	325	4	0	0	0	2,630	0
Colorado	0	0	0	0	0	0	0	0
Connecticut	0	0	0	0	0	0	0	0
Delaware	0	0	0	0	0	0	0	0
District of Columbia	0	0	0	0	0	0	0	0
Florida	0	0	0	0	0	0	0	0
Georgia	0	0	0	0	0	0	0	0
Hawaii	0	0	0	0	0	0	0	0
Idaho	0	0	0	316	2,901	0	8,654	2,185
Illinois	0	0	0	0	0	0	0	0
Indiana	0	0	0	0	0	0	0	0
Iowa	0	0	0	0	0	0	0	0
Kansas	0	0	0	0	0	0	0	0
Kentucky	0	0	0	0	0	0	0	0
Louisiana	0	0	0	0	0	0	0	0
Maine	0	0	0	0	0	0	0	0
Maryland	0	0	0	0	0	0	0	0
Massachusetts	0	0	0	0	0	0	0	0
Michigan	0	0	0	0	0	0	0	0
Minnesota	0	0	0	0	0	0	0	0
Mississippi	0	0	0	0	0	0	0	0
Missouri	0	0	0	0	0	0	0	0
Montana	0	0	0	0	0	0	0	0
Nebraska	0	0	0	0	0	0	0	0
Nevada	0	0	0	0	0	0	0	0
New Hampshire	0	0	0	0	0	0	0	0
New Jersey	0	0	0	0	0	0	0	0
New Mexico	0	0	0	0	0	0	0	0
New York	0	0	0	0	0	0	0	0
North Carolina	0	0	0	0	0	0	0	0
North Dakota	0	0	0	0	0	0	0	0
Ohio	0	0	0	0	0	0	0	0

Modeled State	PSI	PSO_4	PTI	TERP	TOL	UNK	UNR	XYL
Oklahoma	0	0	0	0	0	0	0	0
Oregon	0	0	0	0	0	0	0	0
Pennsylvania	0	0	0	0	0	0	0	0
Rhode Island	0	0	0	0	0	0	0	0
South Carolina	0	0	0	0	0	0	0	0
South Dakota	0	0	0	0	0	0	0	0
Tennessee	0	0	0	0	0	0	0	0
Texas	0	0	0	0	0	0	0	0
Tribal Data	0	0	0	0	0	0	0	0
Utah	15	0	0	33	302	0	1,277	228
Vermont	0	0	0	0	0	0	0	0
Virginia	0	0	0	0	0	0	0	0
Washington	0	0	0	0	0	0	0	0
West Virginia	0	0	0	0	0	0	0	0
Wisconsin	0	0	0	0	0	0	0	0
Wyoming	0	0	0	0	0	0	0	0
Con. US	308	327	4	349	3,203	0	12,561	2,412

Table B-12f - 2008 Agricultural (ag) Emissions by Species, by US State

Inventory State	CO	NH_3	NO_x	PM_{10}	$PM_{2.5}$	SO_2
Alabama	5,654	14	33,252	1,158	1,096	1,191
Alaska	2,430	4	13,293	454	440	699
Arizona	3,443	11	23,545	783	721	243
Arkansas	3,732	12	23,815	798	746	569
California	15,052	34	88,341	2,975	2,825	3,257
Colorado	2,193	7	15,054	501	461	155
Connecticut	1,123	3	6,717	219	210	305
Delaware	350	1	2,500	91	87	257
District of Columbia	68	0	438	12	12	20
Florida	6,436	14	36,036	1,246	1,195	1,699
Georgia	4,756	13	30,008	1,032	965	731
Hawaii	1,809	3	9,388	334	324	555
Idaho	1,218	4	8,490	281	259	86
Illinois	8,506	26	54,168	1,841	1,719	1,241
Indiana	4,945	14	30,871	1,061	994	805
Iowa	3,922	13	26,278	889	821	373
Kansas	5,127	16	35,838	1,181	1,081	374
Kentucky	5,556	18	32,902	1,132	1,073	1,185
Louisiana	28,167	65	149,229	5,270	5,095	8,294
Maine	1,473	3	8,365	282	271	418
Maryland	3,277	8	18,345	633	608	846
Massachusetts	1,846	5	11,081	376	358	635
Michigan	5,770	15	32,096	1,110	1,066	1,569
Minnesota	5,787	15	34,920	1,178	1,113	1,160
Mississippi	4,381	12	25,200	863	824	1,080
Missouri	7,542	22	47,249	1,609	1,505	1,167
Montana	3,445	11	23,768	773	712	243
Nebraska	10,514	33	71,627	2,408	2,215	743
Nevada	987	3	6,754	227	209	69
New Hampshire	92	0	902	22	21	76
New Jersey	8,347	17	43,971	1,555	1,505	2,499
New Mexico	3,638	11	24,814	822	756	257
New York	4,736	13	28,822	971	919	985
North Carolina	1,998	6	13,057	438	408	272
North Dakota	2,230	7	15,475	501	461	157
Ohio	8,830	24	53,859	1,869	1,757	1,576
Oklahoma	2,845	9	19,726	646	595	228
Oregon	3,121	7	19,466	642	608	607
Pennsylvania	3,769	19	26,879	900	831	331
Puerto Rico	674	1	3,497	124	121	207
Rhode Island	512	1	2,703	95	92	155
South Carolina	1,273	4	9,054	331	301	697
South Dakota	561	2	4,184	128	118	40
Tennessee	4,497	13	27,438	950	893	802
Texas	18,660	33	104,351	3,618	3,461	7,411

Inventory State	CO	NH_3	NO_x	PM_{10}	$PM_{2.5}$	SO_2
Tribal	27	0	236	3	3	9
Utah	1,322	6	9,181	296	267	699
Vermont	72	0	736	18	17	5
Virginia	5,795	16	33,704	1,193	1,129	1,194
Washington	7,599	19	43,484	1,500	1,429	1,788
West Virginia	4,593	12	26,515	924	879	1,042
Wisconsin	2,683	8	17,048	568	533	435
Wyoming	5,417	17	36,686	1,244	1,145	382
Cont US	237,860	636	1,438,940	49,163	46,364	50,358

Table B-13a - 2008 C1 and C2 Marine and Locomotive (c1c2rail) Emissions by Species, by US State

Inventory State	VOC	ACETALD	BENZENE	CHLORIN	FORMALD	METHANOL
Alabama	1,180	35	8		75	
Alaska	324	14	4		29	
Arizona	1,171	21	3		49	
Arkansas	977	22	4		49	
California	3,098	97	26	0	195	0
Colorado	746	14	2		32	
Connecticut	176	7	2		14	
Delaware	83	4	1		9	
District of Columbia	30	0	0		0	
Florida	1,000	40	10		83	
Georgia	1,267	30	6		67	
Hawaii	203	11	3		23	
Idaho	420	8	1		18	
Illinois	2,301	52	9		116	
Indiana	1,269	31	6		68	
Iowa	1,257	25	4		56	
Kansas	1,758	32	4		75	
Kentucky	1,142	32	7		69	
Louisiana	3,506	170	45		345	
Maine	204	9	2		19	
Maryland	541	19	5		39	
Massachusetts	351	9	2		19	
Michigan	853	34	9		71	
Minnesota	1,237	36	8		77	
Mississippi	756	26	6		55	
Missouri	1,959	46	8		102	
Montana	1,151	21	3		49	
Nebraska	3,581	67	9		153	
Nevada	339	6	1		14	
New Hampshire	35	0	0		1	
New Jersey	1,001	52	14		104	
New Mexico	1,223	23	3		52	
New York	999	29	6		62	
North Carolina	568	13	2		28	

Inventory						
State	VOC	ACETALD	BENZENE	CHLORIN	FORMALD	METHANOL
North Dakota	745	14	2		32	
Ohio	2,131	56	11		121	
Oklahoma	943	18	3		41	
Oregon	741	20	4		42	
Pennsylvania	1,394	38	8		82	
Puerto Rico	76	4	1		8	
Rhode Island	60	3	1		6	
South Carolina	430	9	1		20	
South Dakota	192	4	0		8	
Tennessee	1,082	28	5		60	
Texas	4,103	104	29		240	
Tribal	11	0	0		0	
Utah	473	6	1		15	
Vermont	27	1	0		1	
Virginia	1,239	36	8		77	
Washington	1,371	47	11		98	
West Virginia	883	28	6		59	
Wisconsin	677	16	3		36	
Wyoming	1,851	34	5		79	
Cont US	54,524	1,473	315	0	3,187	0

Table B-13b - 2008 C1 and C2 Marine and Locomotive (c1c2rail) Emissions by Species, by US State

Modeled									
State	ALD_2	ALDX	BENZENE	CH_4	CL_2	CO	ETH	ETHA	ETOH
Alabama	42	118	8	0	0	5,669	45	10	0
Alaska	0	0	0	0	0	0	0	0	0
Arizona	32	169	3	0	0	3,453	57	0	0
Arkansas	28	121	4	0	0	3,743	43	4	0
California	114	300	26	0	0	15,093	115	29	0
Colorado	19	108	2	0	0	2,199	36	0	0
Connecticut	8	11	2	0	0	1,126	5	3	0
Delaware	7	4	1	0	0	351	2	1	0
District of Columbia	4	4	0	0	0	68	1	0	0
Florida	45	62	10	0	0	6,454	29	16	0
Georgia	38	157	6	0	0	4,769	55	5	0
Hawaii	0	0	0	0	0	0	0	0	0
Idaho	11	61	1	0	0	1,222	20	0	0
Illinois	66	291	9	0	0	8,529	102	8	0
Indiana	39	153	6	0	0	4,958	54	6	0
Iowa	33	175	4	0	0	3,933	60	1	0
Kansas	45	254	5	0	0	5,141	85	0	0
Kentucky	39	113	7	0	0	5,571	43	11	0
Louisiana	184	91	45	0	0	28,244	70	82	0
Maine	10	9	2	0	0	1,477	5	4	0
Maryland	32	36	5	0	0	3,286	16	8	0
Massachusetts	34	27	4	0	0	1,851	11	4	0
Michigan	38	47	9	0	0	5,786	23	15	0

Modeled State	ALD_2	ALDX	BENZENE	CH_4	CL_2	CO	ETH	ETHA	ETOH
Minnesota	43	129	8	0	0	5,802	48	10	0
Mississippi	30	59	6	0	0	4,393	24	10	0
Missouri	58	241	9	0	0	7,563	85	8	0
Montana	29	167	3	0	0	3,454	56	0	0
Nebraska	90	518	9	0	0	10,542	174	0	0
Nevada	9	49	1	0	0	989	16	0	0
New Hampshire	1	5	0	0	0	92	2	0	0
New Jersey	55	19	14	0	0	8,370	18	25	0
New Mexico	31	177	3	0	0	3,648	59	0	0
New York	34	102	6	0	0	4,749	38	9	0
North Carolina	16	74	2	0	0	2,004	26	2	0
North Dakota	19	108	2	0	0	2,236	36	0	0
Ohio	68	245	11	0	0	8,854	88	12	0
Oklahoma	24	135	3	0	0	2,852	45	0	0
Oregon	24	82	4	0	0	3,129	30	5	0
Pennsylvania	46	141	9	0	0	3,779	53	12	0
Puerto Rico	0	0	0	0	0	0	0	0	0
Rhode Island	3	1	1	0	0	514	1	2	0
South Carolina	12	59	1	0	0	1,276	20	1	0
South Dakota	5	28	0	0	0	563	9	0	0
Tennessee	34	125	5	0	0	4,509	45	6	0
Texas	123	363	29	0	0	18,711	145	48	0
Tribal Data	0	0	0	0	0	0	0	0	0
Utah	9	70	1	0	0	1,325	23	0	0
Vermont	1	4	0	0	0	73	1	0	0
Virginia	43	127	8	0	0	5,811	48	10	0
Washington	54	116	11	0	0	7,620	47	16	0
West Virginia	33	80	6	0	0	4,605	31	9	0
Wisconsin	20	82	3	0	0	2,691	29	3	0
Wyoming	46	268	5	0	0	5,431	90	0	0
TOTAL	1,825	5,881	319	0	0	238,511	2,166	399	0

Table B-13c - 2008 C1 and C2 Marine and Locomotive (c1c2rail) Emissions by Species, by US State

Modeled State	FORM	HONO	IOLE	ISOP	MEOH	NH_3	NH_3_FERT	NO	NO_2
Alabama	92	267	9	3	0	14	0	30,009	3,068
Alaska	0	0	0	0	0	0	0	0	0
Arizona	74	189	7	0	0	11	0	21,249	2,172
Arkansas	66	191	6	1	0	12	0	21,492	2,197
California	236	709	23	9	0	34	0	79,724	8,150
Colorado	47	121	4	0	0	7	0	13,586	1,389
Connecticut	16	54	1	1	0	3	0	6,062	620
Delaware	10	20	1	0	0	1	0	2,256	231
District of Columbia	3	4	0	0	0	0	0	395	40
Florida	91	289	8	5	0	14	0	32,521	3,324
Georgia	89	241	8	2	0	13	0	27,081	2,768

Modeled State	FORM	HONO	IOLE	ISOP	MEOH	NH_3	NH_3_FERT	NO	NO_2
Hawaii	0	0	0	0	0	0	0	0	0
Idaho	27	68	2	0	0	4	0	7,662	783
Illinois	157	435	15	3	0	26	0	48,885	4,997
Indiana	90	248	8	2	0	14	0	27,860	2,848
Iowa	81	211	8	0	0	13	0	23,715	2,424
Kansas	111	287	10	0	0	16	0	32,343	3,306
Kentucky	85	264	8	3	0	18	0	29,693	3,035
Louisiana	355	1,197	34	25	0	65	0	134,674	13,767
Maine	20	67	2	1	0	3	0	7,549	772
Maryland	49	147	4	2	0	8	0	16,556	1,692
Massachusetts	34	89	3	1	0	5	0	10,000	1,022
Michigan	77	257	7	5	0	15	0	28,965	2,961
Minnesota	95	280	9	3	0	15	0	31,514	3,221
Mississippi	63	202	6	3	0	12	0	22,743	2,325
Missouri	136	379	13	2	0	22	0	42,641	4,359
Montana	73	191	7	0	0	11	0	21,450	2,193
Nebraska	226	575	21	0	0	33	0	64,641	6,608
Nevada	22	54	2	0	0	3	0	6,095	623
New Hampshire	1	7	0	0	0	0	0	814	83
New Jersey	106	353	10	7	0	17	0	39,682	4,056
New Mexico	77	199	7	0	0	11	0	22,394	2,289
New York	76	231	7	3	0	13	0	26,010	2,659
North Carolina	39	105	4	1	0	6	0	11,784	1,205
North Dakota	47	124	4	0	0	7	0	13,965	1,428
Ohio	155	432	14	4	0	24	0	48,606	4,969
Oklahoma	60	158	6	0	0	9	0	17,802	1,820
Oregon	54	156	5	1	0	7	0	17,567	1,796
Pennsylvania	102	216	10	4	0	19	0	24,258	2,480
Puerto Rico	0	0	0	0	0	0	0	0	0
Rhode Island	6	22	1	0	0	1	0	2,439	249
South Carolina	28	73	3	0	0	4	0	8,171	835
South Dakota	12	34	1	0	0	2	0	3,776	386
Tennessee	77	220	7	2	0	13	0	24,762	2,531
Texas	289	837	32	14	0	33	0	94,173	9,627
Tribal Data	0	0	0	0	0	0	0	0	0
Utah	24	74	3	0	0	6	0	8,286	847
Vermont	2	6	0	0	0	0	0	664	68
Virginia	94	270	9	3	0	16	0	30,417	3,109
Washington	114	349	11	5	0	19	0	39,243	4,011
West Virginia	70	213	7	3	0	12	0	23,929	2,446
Wisconsin	47	137	5	1	0	8	0	15,385	1,573
Wyoming	117	294	11	0	0	17	0	33,108	3,384
TOTAL	4,020	11,543	384	119	0	638	0	1,298,594	132,745

Table B-13c - 2008 C1 and C2 Marine and Locomotive (c1c2rail) Emissions by Species, by US State

Modeled State	NO_x	NVOL	OLE	PAL	PAR	PCA	PCL	PEC	PFE
Alabama	33,343	5	48	0	604	1	0	847	0
Alaska	0	0	0	0	0	0	0	0	0
Arizona	23,610	8	54	0	567	0	0	557	0
Arkansas	23,880	6	43	0	488	0	0	577	0
California	88,583	13	125	0	1,593	2	1	2,184	1
Colorado	15,095	5	35	0	362	0	0	357	0
Connecticut	6,735	0	6	0	94	0	0	162	0
Delaware	2,507	0	3	0	42	0	0	68	0
District of Columbia	439	0	1	0	13	0	0	9	0
Florida	36,135	3	36	0	533	1	0	924	0
Georgia	30,090	7	56	0	630	1	0	746	0
Hawaii	0	0	0	0	0	0	0	0	0
Idaho	8,514	3	19	0	204	0	0	200	0
Illinois	54,316	13	102	0	1,145	1	0	1,329	0
Indiana	30,956	7	55	0	634	1	0	769	0
Iowa	26,350	8	57	0	615	0	0	635	0
Kansas	35,936	12	81	0	853	1	0	836	0
Kentucky	32,993	5	47	0	590	1	0	829	0
Louisiana	149,638	3	111	0	1,950	3	1	3,939	1
Maine	8,388	0	7	0	111	0	0	210	0
Maryland	18,396	2	20	0	281	0	0	470	0
Massachusetts	11,112	1	13	0	169	0	0	276	0
Michigan	32,183	2	30	0	462	1	0	824	0
Minnesota	35,015	6	51	0	629	1	0	861	0
Mississippi	25,270	3	29	0	399	0	0	637	0
Missouri	47,379	11	86	0	977	1	0	1,164	0
Montana	23,833	8	53	0	559	0	0	550	0
Nebraska	71,823	24	166	0	1,739	1	0	1,713	1
Nevada	6,773	2	16	0	164	0	0	162	0
New Hampshire	904	0	2	0	18	0	0	16	0
New Jersey	44,091	1	31	0	559	1	0	1,164	0
New Mexico	24,882	8	57	0	594	0	0	585	0
New York	28,901	5	41	0	512	1	0	710	0
North Carolina	13,093	3	25	0	281	0	0	316	0
North Dakota	15,517	5	35	0	362	0	0	356	0
Ohio	54,007	11	91	0	1,071	1	0	1,358	0
Oklahoma	19,780	6	43	0	459	0	0	460	0
Oregon	19,519	4	31	0	376	0	0	470	0
Pennsylvania	26,953	6	57	0	719	0	0	642	0
Puerto Rico	0	0	0	0	0	0	0	0	0
Rhode Island	2,710	0	2	0	34	0	0	71	0
South Carolina	9,078	3	20	0	211	0	0	233	0
South Dakota	4,196	1	9	0	93	0	0	91	0
Tennessee	27,513	6	46	0	546	1	0	690	0
Texas	104,637	16	165	0	2,182	2	1	2,675	1
Tribal Data	0	0	0	0	0	0	0	0	0

Modeled State	NO_x	NVOL	OLE	PAL	PAR	PCA	PCL	PEC	PFE
Utah	9,206	3	22	0	234	0	0	206	0
Vermont	738	0	1	0	13	0	0	13	0
Virginia	33,796	6	51	0	633	1	0	873	0
Washington	43,603	5	53	0	715	1	0	1,105	0
West Virginia	26,587	4	35	0	458	1	0	679	0
Wisconsin	17,095	4	29	0	340	0	0	412	0
Wyoming	36,786	12	86	0	899	1	0	885	0
TOTAL	1,442,883	266	2,283	0	27,713	27	10	35,845	12

Table B-13d - 2008 C1 and C2 Marine and Locomotive (c1c2rail) Emissions by Species, by US State

Modeled State	PH2O	PK	PM_{10}	$PM_{2.5}$	PMC	PMFINE	PMG	PMN	PMOTHR	PNA
Alabama	0	0	1,161	1,099	62	54	0	0	4	0
Alaska	0	0	0	0	0	0	0	0	0	0
Arizona	0	0	786	723	63	35	0	0	3	0
Arkansas	0	0	800	748	52	37	0	0	3	0
California	0	0	2,983	2,833	150	139	0	0	11	0
Colorado	0	0	503	463	40	23	0	0	2	0
Connecticut	0	0	220	210	9	10	0	0	1	0
Delaware	0	0	91	88	4	4	0	0	0	0
District of Columbia	0	0	12	12	1	1	0	0	0	0
Florida	0	0	1,250	1,199	51	59	0	0	5	0
Georgia	0	0	1,035	968	67	47	0	0	4	0
Hawaii	0	0	0	0	0	0	0	0	0	0
Idaho	0	0	282	259	23	13	0	0	1	0
Illinois	0	0	1,846	1,723	123	84	0	0	7	0
Indiana	0	0	1,064	997	67	49	0	0	4	0
Iowa	0	0	891	824	68	40	0	0	3	0
Kansas	0	0	1,184	1,084	100	53	0	0	4	0
Kentucky	0	0	1,136	1,076	60	53	0	0	4	0
Louisiana	0	0	5,284	5,109	176	250	0	0	20	0
Maine	0	0	282	272	10	13	0	0	1	0
Maryland	0	0	635	610	25	30	0	0	2	0
Massachusetts	0	0	377	359	19	18	0	0	1	0
Michigan	0	0	1,113	1,069	43	52	0	0	4	0
Minnesota	0	0	1,181	1,116	65	55	0	0	4	0
Mississippi	0	0	866	827	39	40	0	0	3	0
Missouri	0	0	1,613	1,509	104	74	0	0	6	0
Montana	0	0	776	713	62	35	0	0	3	0
Nebraska	0	0	2,414	2,221	193	109	0	0	9	0
Nevada	0	0	228	210	18	10	0	0	1	0
New Hampshire	0	0	22	21	1	1	0	0	0	0
New Jersey	0	0	1,559	1,510	50	74	0	0	6	0
New Mexico	0	0	824	758	66	37	0	0	3	0
New York	0	0	974	921	52	45	0	0	4	0
North Carolina	0	0	439	409	29	20	0	0	2	0

Modeled State	PH2O	PK	PM_{10}	$PM_{2.5}$	PMC	PMFINE	PMG	PMN	PMOTHR	PNA
North Dakota	0	0	502	462	40	23	0	0	2	0
Ohio	0	0	1,874	1,762	113	86	0	0	7	0
Oklahoma	0	0	648	597	51	29	0	0	2	0
Oregon	0	0	643	609	34	30	0	0	2	0
Pennsylvania	0	0	903	833	70	41	0	0	3	0
Puerto Rico	0	0	0	0	0	0	0	0	0	0
Rhode Island	0	0	95	93	3	5	0	0	0	0
South Carolina	0	0	332	302	30	15	0	0	1	0
South Dakota	0	0	129	119	10	6	0	0	0	0
Tennessee	0	0	953	895	57	44	0	0	4	0
Texas	0	0	3,628	3,470	158	170	0	0	14	0
Tribal Data	0	0	0	0	0	0	0	0	0	0
Utah	0	0	297	267	30	13	0	0	1	0
Vermont	0	0	18	17	1	1	0	0	0	0
Virginia	0	0	1,197	1,132	65	55	0	0	4	0
Washington	0	0	1,504	1,433	71	70	0	0	6	0
West Virginia	0	0	927	881	46	43	0	0	3	0
Wisconsin	0	0	570	534	36	26	0	0	2	0
Wyoming	0	0	1,248	1,148	100	56	0	0	4	0
TOTAL	0	2	49,298	46,491	2,807	2,274	0	0	182	0

Table B-13e - 2008 C1 and C2 Marine and Locomotive (c1c2rail) Emissions by Species, by US State

Modeled State	PNCOM	PNH_4	PNO_3	POC	PSI	PSO_4	PTI	SO_2	SULF	TERP	TOL	UNK	UNR	XYL
Alabama	48	0	1	193	0	3	0	1,194	0	12	100	3	143	80
Alaska	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Arizona	32	0	1	127	0	2	0	244	0	12	93	5	141	63
Arkansas	33	0	1	132	0	2	0	571	0	10	81	4	118	59
California	124	0	3	499	0	8	0	3,266	0	31	265	9	384	213
Colorado	20	0	1	81	0	1	0	155	0	7	60	3	90	40
Connecticut	9	0	0	37	0	1	0	306	0	2	16	0	21	14
Delaware	4	0	0	15	0	0	0	258	0	1	7	0	10	6
District of Columbia	1	0	0	2	0	0	0	20	0	0	2	0	3	1
Florida	53	0	1	211	0	4	0	1,703	0	10	89	2	121	79
Georgia	42	0	1	170	0	3	0	733	0	13	104	5	153	76
Hawaii	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Idaho	11	0	0	46	0	1	0	86	0	4	33	2	51	22
Illinois	76	0	2	303	0	5	0	1,245	0	23	189	8	278	137
Indiana	44	0	1	175	0	3	0	807	0	13	105	4	153	78
Iowa	36	0	1	145	0	2	0	374	0	13	101	5	152	69
Kansas	48	0	1	191	0	3	0	375	0	17	140	7	212	94
Kentucky	47	0	1	189	0	3	0	1,189	0	11	98	3	138	79
Louisiana	224	0	6	899	0	15	0	8,317	0	35	329	2	423	320
Maine	12	0	0	48	0	1	0	419	0	2	19	0	25	17
Maryland	27	0	1	107	0	2	0	849	0	5	47	1	65	41
Massachusetts	16	0	0	63	0	1	0	637	0	3	28	1	41	24

Modeled State	PNCOM	PNH_4	PNO_3	POC	PSI	PSO_4	PTI	SO_2	SULF	TERP	TOL	UNK	UNR	XYL
Michigan	47	0	1	188	0	3	0	1,574	0	8	77	1	103	70
Minnesota	49	0	1	196	0	3	0	1,163	0	12	104	4	150	82
Mississippi	36	0	1	145	0	2	0	1,082	0	8	67	2	91	57
Missouri	66	0	2	266	0	4	0	1,170	0	19	161	7	237	119
Montana	31	0	1	126	0	2	0	244	0	11	92	5	139	62
Nebraska	98	0	3	391	0	7	0	745	0	36	286	15	433	192
Nevada	9	0	0	37	0	1	0	69	0	3	27	1	41	18
New Hampshire	1	0	0	4	0	0	0	76	0	0	3	0	4	2
New Jersey	66	0	2	266	0	4	0	2,506	0	10	94	0	121	93
New Mexico	33	0	1	133	0	2	0	258	0	12	98	5	148	66
New York	40	0	1	162	0	3	0	988	0	10	85	3	121	67
North Carolina	18	0	0	72	0	1	0	273	0	6	46	2	69	33
North Dakota	20	0	1	81	0	1	0	158	0	7	59	3	90	40
Ohio	77	0	2	310	0	5	0	1,580	0	21	177	7	258	134
Oklahoma	26	0	1	105	0	2	0	229	0	9	75	4	114	51
Oregon	27	0	1	107	0	2	0	609	0	7	62	2	90	48
Pennsylvania	37	0	1	147	0	2	0	332	0	14	119	4	169	95
Puerto Rico	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rhode Island	4	0	0	16	0	0	0	156	0	1	6	0	7	6
South Carolina	13	0	0	53	0	1	0	699	0	4	35	2	52	24
South Dakota	5	0	0	21	0	0	0	40	0	2	15	1	23	10
Tennessee	39	0	1	158	0	3	0	805	0	11	90	4	131	68
Texas	152	0	4	611	0	10	0	7,431	0	42	364	10	502	302
Tribal Data	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Utah	12	0	0	47	0	1	0	701	0	5	38	2	58	26
Vermont	1	0	0	3	0	0	0	5	0	0	2	0	3	1
Virginia	50	0	1	199	0	3	0	1,197	0	12	105	4	150	83
Washington	63	0	2	252	0	4	0	1,793	0	14	119	3	166	100
West Virginia	39	0	1	155	0	3	0	1,045	0	9	76	2	107	63
Wisconsin	23	0	1	94	0	2	0	436	0	7	56	2	82	42
Wyoming	50	0	1	202	0	3	0	384	0	18	148	8	224	99
TOTAL	2,041	0	53	8,182	0	137	0	50,496	0	542	4,593	170	6,604	3,567

Table B-13f - 2008 C1 and C2 Marine and Locomotive (c1c2rail) Emissions by Species, by US State

Inventory State	PM_{10}	PM_{25}
Alabama	316,235	41,972
Arizona	237,189	37,325
Arkansas	370,311	54,467
California	581,315	66,583
Colorado	255,800	41,435
Connecticut	26,453	4,170
Delaware	9,176	1,650
DC	2,569	383
Florida	262,545	36,479
Georgia	567,581	74,002
Idaho	246,111	30,431
Illinois	718,327	115,655
Indiana	466,833	71,377
Iowa	515,278	88,023
Kansas	437,780	56,121
Kentucky	169,282	26,298
Louisiana	175,847	25,174
Maine	36,845	5,873
Maryland	66,245	9,978
Massachusetts	142,944	16,271
Michigan	348,669	50,743
Minnesota	649,170	95,566
Mississippi	283,754	40,473
Missouri	784,636	102,285
Montana	330,710	45,642
Nebraska	489,022	74,501
Nevada	219,786	24,514
New Hampshire	19,579	2,957
New Jersey	22,718	4,857
New Mexico	800,435	84,202
New York	258,770	35,764
North Carolina	187,746	32,518
North Dakota	408,038	71,206
Ohio	387,255	61,837
Oklahoma	712,975	90,927
Oregon	211,414	26,874
Pennsylvania	230,030	33,025
Rhode Island	6,797	922
South Carolina	210,718	26,772
South Dakota	249,015	43,572
Tennessee	146,479	25,256
Texas	2,304,226	290,624
Utah	210,380	25,889
Vermont	35,311	4,310

Inventory		
State	PM_{10}	PM_{25}
Virginia	136,362	19,432
Washington	183,646	29,356
West Virginia	87,291	10,972
Wisconsin	239,548	40,566
Wyoming	477,186	52,719
Con. US Total	16,236,331	2,251,951

Table B-14a - 2008 Area Fugitive Dust (afdust) Emissions by Species, by US State

Modeled (after transport fraction and met-adjustment)									
State	PAL	PCA	PCL	PEC	PFE	PH2O	PK	PMFINE	PMG
Alabama	354	358	11	34	274	16	111	6,030	32
Arizona	1,369	1,352	37	44	943	40	382	22,919	95
Arkansas	1,230	598	22	16	846	14	308	15,389	39
California	1,634	2,461	38	64	1,351	73	545	32,436	97
Colorado	1,321	845	25	21	936	21	347	17,985	47
Connecticu	23	26	1	3	18	1	7	409	2
Delaware	30	25	1	3	22	1	9	465	2
District o	5	7	0	1	4	0	2	94	0
Florida	619	687	20	57	485	21	192	11,018	66
Georgia	834	662	21	40	604	24	235	12,670	55
Idaho	526	562	12	8	420	15	160	8,882	39
Illinois	2,750	1,459	48	35	1,889	35	693	35,046	65
Indiana	1,489	828	28	27	1,034	21	381	19,461	54
Iowa	2,238	940	38	23	1,507	21	545	26,826	53
Kansas	1,600	1,377	35	36	1,224	37	458	24,663	108
Kentucky	371	226	8	13	259	6	97	5,052	17
Louisiana	438	287	11	15	295	8	113	6,218	25
Maine	35	32	1	3	26	1	10	578	4
Maryland	147	128	3	8	106	4	41	2,270	6
Massachuse	114	171	3	6	101	5	40	2,323	14
Michigan	697	481	16	24	504	13	188	9,909	39
Minnesota	1,942	1,046	36	24	1,351	25	494	25,114	72
Mississipp	658	389	13	15	465	10	171	8,767	26
Missouri	1,572	1,187	33	33	1,168	31	434	22,990	93
Montana	1,265	681	24	14	869	16	320	16,448	50
Nebraska	2,435	1,311	45	29	1,706	31	622	31,447	91
Nevada	917	1,240	23	12	637	37	273	17,464	39
New Hampsh	9	9	0	1	7	0	3	148	1
New Jersey	53	44	2	9	39	2	16	858	6
New Mexico	2,344	3,253	65	60	2,046	90	789	45,864	292
New York	285	273	8	20	220	8	85	4,670	23
North Caro	435	278	10	24	307	8	116	6,024	20
North Dako	2,198	833	37	15	1,457	17	525	25,678	45
Ohio	1,142	638	22	28	791	16	292	14,918	37
Oklahoma	2,711	2,071	57	45	2,022	53	751	39,795	163

Modeled (after transport fraction and met-adjustment)									
State	PAL	PCA	PCL	PEC	PFE	PH2O	PK	PMFINE	PMG
Oregon	435	320	9	12	319	9	119	6,314	25
Pennsylvan	298	260	6	10	217	7	84	4,582	12
Rhode Isla	9	14	0	1	7	0	3	177	1
South Caro	297	302	8	16	236	9	90	4,998	28
South Dako	1,316	509	22	12	878	11	316	15,439	28
Tennessee	393	241	8	15	274	7	103	5,307	14
Texas	8,719	7,453	191	207	6,606	199	2,482	133,966	560
Utah	583	672	15	15	453	19	178	10,388	52
Vermont	15	17	0	1	12	0	5	264	2
Virginia	188	186	5	14	144	6	56	3,135	16
Washington	890	444	16	16	610	11	223	11,203	25
West Virgi	40	45	1	2	30	1	12	708	3
Wisconsin	781	414	14	17	534	10	197	10,009	21
Wyoming	1,423	1,165	43	19	894	34	367	22,729	127
Con. US Total	51,178	38,807	1,096	1,166	37,147	1,044	13,988	750,047	2,730
					Con. US PM_{10}:		5,694,058		
					Con. US PM2_5:		792,141		

Table B-14b - 2008 Area Fugitive Dust (afdust) Emissions by Species, by US State

Modeled (after transport fraction and met-adjustment)							
State	PMN	PMOTHR	PNA	PNCOM	PNH4	PNO_3	POC
Alabama	7	3,577	10	182	14	34	455
Arizona	28	14,207	42	429	11	17	1,072
Arkansas	20	8,490	20	259	9	11	649
California	37	20,335	28	730	21	20	1,824
Colorado	23	10,225	22	322	11	13	805
Connecticu	0	246	1	13	0	0	32
Delaware	1	269	1	13	0	0	33
District o	0	57	0	3	0	0	8
Florida	13	6,634	19	320	7	8	801
Georgia	16	7,424	19	290	17	39	726
Idaho	11	5,333	7	179	5	9	449
Illinois	45	19,533	45	582	21	22	1,455
Indiana	25	10,912	26	348	11	14	870
Iowa	35	14,609	37	421	15	18	1,054
Kansas	31	14,419	24	507	14	23	1,270
Kentucky	6	2,861	8	105	3	3	263
Louisiana	8	3,632	12	121	3	4	302
Maine	1	346	1	16	0	0	40
Maryland	3	1,340	4	52	1	1	131
Massachuse	3	1,438	2	60	1	2	150
Michigan	12	5,665	14	212	6	8	529
Minnesota	32	14,037	32	425	14	20	1,064
Mississipp	11	4,923	11	166	5	6	416
Missouri	29	13,264	25	456	13	21	1,142

Modeled (after transport fraction and met-adjustment)							
State	PMN	PMOTHR	PNA	PNCOM	PNH4	PNO_3	POC
Montana	21	9,265	22	268	9	13	672
Nebraska	41	17,519	38	539	18	25	1,349
Nevada	20	11,321	27	278	9	9	693
New Hampsh	0	88	0	4	0	0	11
New Jersey	1	493	2	34	1	0	84
New Mexico	56	28,286	29	1,043	26	56	2,613
New York	5	2,749	7	126	3	3	315
North Caro	7	3,402	11	144	4	3	360
North Dako	34	13,898	36	373	14	17	935
Ohio	19	8,349	21	281	9	9	703
Oklahoma	50	23,005	40	766	23	37	1,918
Oregon	8	3,637	8	130	4	5	325
Pennsylvan	6	2,707	6	95	3	3	239
Rhode Isla	0	110	0	5	0	0	12
South Caro	6	2,966	6	125	3	5	313
South Dako	20	8,344	21	234	9	10	586
Tennessee	7	2,994	8	111	3	3	278
Texas	167	78,418	140	2,743	79	120	6,864
Utah	13	6,392	12	213	6	10	533
Vermont	0	159	0	6	0	0	16
Virginia	4	1,860	5	85	2	2	213
Washington	14	6,198	15	195	7	7	488
West Virgi	1	435	1	17	0	1	41
Wisconsin	13	5,582	14	180	6	6	450
Wyoming	29	14,250	51	327	8	22	818
Con. US Total	938	436,206	934	14,537	451	663	36,373

Table B-14c - 2008 Area Fugitive Dust (afdust) Emissions by Species, by US State

Modeled (after transport fraction and met-adjustment)						
State	PSI	PSO_4	PTI	PMC	PM_{10}	PM_{25}
Alabama	1,062	53	24	42,789	49,395	6,606
Arizona	3,900	155	84	129,882	154,089	24,207
Arkansas	3,459	49	75	82,796	98,911	16,115
California	4,960	282	125	268,222	302,848	34,626
Colorado	3,758	79	84	94,383	113,285	18,902
Connecticu	69	3	2	2,435	2,882	447
Delaware	89	3	2	2,333	2,837	504
District o	15	1	0	584	687	103
Florida	1,892	82	43	73,212	85,179	11,966
Georgia	2,416	82	53	84,542	98,098	13,557
Idaho	1,576	58	37	63,769	73,174	9,405
Illinois	7,711	126	171	190,175	226,860	36,685
Indiana	4,212	74	92	109,904	130,350	20,446
Iowa	6,232	70	135	134,260	162,252	27,992
Kansas	4,722	137	107	175,268	201,399	26,130
Kentucky	1,060	22	23	27,708	33,063	5,354

Modeled (after transport fraction and met-adjustment)						
State	PSI	PSO_4	PTI	PMC	PM_{10}	PM_{25}
Louisiana	1,239	30	26	38,971	45,541	6,570
Maine	104	4	2	3,429	4,056	626
Maryland	424	14	10	13,502	15,926	2,424
Massachuse	363	19	9	19,681	22,182	2,501
Michigan	2,017	48	45	59,814	70,332	10,518
Minnesota	5,488	89	120	145,437	171,748	26,311
Mississipp	1,876	36	42	49,833	59,073	9,240
Missouri	4,582	115	103	153,849	178,150	24,302
Montana	3,560	59	77	97,626	114,832	17,206
Nebraska	6,900	111	151	181,421	214,382	32,961
Nevada	2,583	146	60	147,878	166,203	18,325
New Hampsh	26	1	1	922	1,084	161
New Jersey	162	6	3	3,331	4,288	957
New Mexico	7,369	349	174	414,413	463,354	48,940
New York	858	31	20	29,249	34,289	5,041
North Caro	1,253	29	28	30,084	36,524	6,440
North Dako	6,079	57	130	125,320	152,021	26,702
Ohio	3,229	59	71	79,726	95,444	15,718
Oklahoma	7,905	198	177	273,962	315,956	41,994
Oregon	1,263	32	28	40,416	47,104	6,688
Pennsylvan	861	28	20	29,295	34,156	4,861
Rhode Isla	27	2	1	1,274	1,466	192
South Caro	901	33	21	35,865	41,230	5,364
South Dako	3,650	36	79	74,675	90,757	16,082
Tennessee	1,119	24	25	26,473	32,101	5,627
Texas	25,628	750	582	940,634	1,082,541	141,907
Utah	1,741	73	40	77,463	88,483	11,020
Vermont	46	2	1	2,020	2,304	283
Virginia	565	21	13	19,978	23,364	3,386
Washington	2,500	38	55	58,534	70,286	11,752
West Virgi	118	5	3	5,277	6,034	757
Wisconsin	2,194	37	48	52,127	62,647	10,520
Wyoming	3,937	131	75	187,172	210,891	23,720
Con. US Total	147,699	3,892	3,292	4,901,917		

Table B-14d - 2008 Area Fugitive Dust (afdust) Emissions by Species, by US State

Inventory State	CO	NO_x	PM_{10}	$PM_{2.5}$	SO_2	VOC	ACETALD	BENZENE	FORMALD
Alabama	355	910	81	75	623	33	0	0	0
Alaska	826	10,310	839	772	6,277	349	0	0	1
California	1,428	12,755	923	848	8,285	393	0	0	1
Connecticut	118	1,419	121	111	965	48	0	0	0
Delaware	183	2,862	281	259	2,152	76	0	0	0
District of Columbia	0	1	0	0	1	0	0	0	0
Florida	1,850	22,323	2,122	1,953	17,655	726	0	0	1
Georgia	166	1,869	164	151	1,574	73	0	0	0
Hawaii	227	2,689	239	220	1,740	97	0	0	0
Illinois	9	107	9	8	67	4	0	0	0
Indiana	4	47	4	4	32	2	0	0	0
Louisiana	1,837	18,979	1,676	1,538	12,815	668	0	0	1
Maine	91	1,087	96	88	818	36	0	0	0
Maryland	389	4,637	404	372	3,077	163	0	0	0
Massachusetts	301	3,578	319	294	3,054	124	0	0	0
Michigan	905	11,316	906	834	6,728	384	0	0	1
Minnesota	26	320	27	25	206	11	0	0	0
Mississippi	98	1,163	103	94	827	40	0	0	0
New Jersey	609	6,719	618	569	8,611	261	0	0	0
New York	448	5,166	432	398	3,165	197	0	0	0
Non-US SECA C3	165,937	2,002,109	166,068	152,783	1,232,054	70,447	16	1	110
North Carolina	124	1,452	125	115	1,772	51	0	0	0
Offshore to EEZ	56,209	680,381	56,508	51,946	421,992	23,879	5	0	37
Ohio	210	2,613	212	195	1,577	89	0	0	0
Oregon	252	2,475	230	211	1,453	132	0	0	0
Pennsylvania	278	3,352	288	266	3,059	111	0	0	0
Rhode Island	18	213	19	17	482	7	0	0	0
South Carolina	278	3,142	282	260	4,102	119	0	0	0
Texas	1,134	9,671	1,357	1,246	10,368	377	0	0	1
Virginia	250	2,974	255	235	2,373	106	0	0	0
Washington	1,768	20,259	1,811	1,643	12,433	823	0	0	1
West Virginia	2	28	2	2	17	1	0	0	0
Wisconsin	65	807	65	60	489	27	0	0	0
British Columbia	5,108	61,901	5,137	4,661	38,074	2,171	0	0	3
Nova Scotia	10,020	120,624	10,028	9,237	74,401	4,255	1	0	7
Ontario	398	4,979	399	367	2,961	169	0	0	0
Total	251,919	3,025,236	252,152	231,857	1,886,277	106,448	24	1	167
Con. US total	13,195	142,243	12,932	11,871	108,779	5,082	1	0	8
Canada total	15,526	187,504	15,564	14,265	115,436	6,595	2	0	10

Table B-15a - 2008 C3 Commercial Marine (c3 marine) Emissions by Species, by US State

Modeled State	ALD_2	ALD_x	BENZENE	CH_4	CO	ETH	ETHA	ETOH	FORM
Alabama	0	0	0	0	356	1	1	0	0
Alaska	0	0	0	0	0	0	0	0	0
California	0	3	0	0	1,432	7	13	0	1
Connecticut	0	0	0	0	118	1	2	0	0
Delaware	0	1	0	0	184	1	3	0	0
District of Columbia	0	0	0	0	0	0	0	0	0
Florida	0	5	0	0	1,855	13	24	0	1
Georgia	0	1	0	0	166	1	2	0	0
Hawaii	0	0	0	0	0	0	0	0	0
Illinois	0	0	0	0	9	0	0	0	0
Indiana	0	0	0	0	4	0	0	0	0
Louisiana	0	5	0	0	1,842	12	22	0	1
Maine	0	0	0	0	92	1	1	0	0
Maryland	0	1	0	0	390	3	5	0	0
Massachusetts	0	1	0	0	302	2	4	0	0
Michigan	0	3	0	0	908	7	13	0	1
Minnesota	0	0	0	0	26	0	0	0	0
Mississippi	0	0	0	0	98	1	1	0	0
New Jersey	0	2	0	0	610	5	9	0	0
New York	0	1	0	0	449	4	7	0	0
Non-US SECA C3	3	90	0	0	29,769	229	418	0	20
North Carolina	0	0	0	0	124	1	2	0	0
Offshore to EEZ	5	143	0	0	47,431	365	668	0	32
Ohio	0	1	0	0	211	2	3	0	0
Oregon	0	1	0	0	253	2	4	0	0
Pennsylvania	0	1	0	0	278	2	4	0	0
Rhode Island	0	0	0	0	18	0	0	0	0
South Carolina	0	1	0	0	279	2	4	0	0
Texas	0	3	0	0	1,137	7	13	0	1
Virginia	0	1	0	0	250	2	4	0	0
Washington	0	6	0	0	1,773	15	27	0	1
West Virginia	0	0	0	0	2	0	0	0	0
Wisconsin	0	0	0	0	65	0	1	0	0
British Columbia	0	13	0	0	4,398	34	62	0	3
Nova Scotia	1	24	0	0	8,113	62	114	0	6
Ontario	0	1	0	0	399	3	6	0	0
Total	11	307	0	0	103,339	786	1,437	0	70
Con. US total	1	36	0	0	13,231	92	169	0	8
Canada total	1	39	0	0	12,909	99	182	0	9

Table B-15b - 2008 C3 Commercial Marine (c3 marine) Emissions by Species, by US State

Modeled State	HONO	IOLE	ISOP	MEOH	NO	NO_2	NO_x	NVOL	OLE	PAL
Alabama	7	0	0	0	821	84	912	0	1	1
Alaska	0	0	0	0	0	0	0	0	0	0
California	102	5	4	0	11,511	1,177	12,790	0	14	7
Connecticut	11	1	0	0	1,281	131	1,423	0	2	1
Delaware	23	1	1	0	2,583	264	2,870	0	3	2
District of Columbia	0	0	0	0	1	0	1	0	0	0
Florida	179	9	7	0	20,146	2,059	22,385	0	26	15
Georgia	15	1	1	0	1,687	172	1,874	0	3	1
Hawaii	0	0	0	0	0	0	0	0	0	0
Illinois	1	0	0	0	97	10	107	0	0	0
Indiana	0	0	0	0	42	4	47	0	0	0
Louisiana	152	8	7	0	17,128	1,751	19,031	0	24	12
Maine	9	0	0	0	981	100	1,090	0	1	1
Maryland	37	2	2	0	4,185	428	4,650	0	6	3
Massachusetts	29	2	1	0	3,229	330	3,588	0	4	2
Michigan	91	5	4	0	10,212	1,044	11,347	0	14	6
Minnesota	3	0	0	0	289	30	321	0	0	0
Mississippi	9	0	0	0	1,050	107	1,166	0	1	1
New Jersey	54	3	3	0	6,063	620	6,737	0	9	4
New York	41	2	2	0	4,662	477	5,180	0	7	3
Non-US SECA C3	2,874	156	125	0	323,467	33,085	359,426	0	448	212
North Carolina	12	1	1	0	1,310	134	1,456	0	2	1
Offshore to EEZ	4,572	249	199	0	514,366	52,593	571,531	0	715	338
Ohio	21	1	1	0	2,358	241	2,620	0	3	2
Oregon	20	2	1	0	2,233	228	2,482	0	5	2
Pennsylvania	27	1	1	0	3,025	309	3,362	0	4	2
Rhode Island	2	0	0	0	192	20	213	0	0	0
South Carolina	25	1	1	0	2,835	290	3,150	0	4	2
Texas	78	5	4	0	8,727	892	9,697	0	13	10
Virginia	24	1	1	0	2,684	274	2,982	0	4	2
Washington	163	10	8	0	18,283	1,869	20,314	0	29	13
West Virginia	0	0	0	0	25	3	28	0	0	0
Wisconsin	6	0	0	0	729	74	810	0	1	0
British Columbia	426	23	18	0	47,968	4,907	53,301	0	66	31
Nova Scotia	781	42	34	0	87,859	8,979	97,619	0	122	58
Ontario	40	2	2	0	4,494	459	4,993	0	6	3
Total	9,835	535	428	0	1,106,523	113,146	1,229,504	0	1,538	733
Con. US total	1,141	63	50	0	128,369	13,122	142,633	0	181	92
Canada total	1,247	68	54	0	140,321	14,346	155,913	0	194	92

Table B-15d - 2008 C3 Commercial Marine (c3 marine) Emissions by Species, by US State

Modeled State	PAR	PCA	PCL	PEC	PFE	PH2O	PK	PM_{10}	$PM_{2.5}$
Alabama	22	0	0	0	0	28	0	81	75
Alaska	0	0	0	0	0	0	0	0	0
California	269	2	0	4	4	315	0	925	850
Connecticut	33	0	0	1	1	41	0	121	112
Delaware	52	1	0	1	1	96	0	282	260
District of Columbia	0	0	0	0	0	0	0	0	0
Florida	497	5	0	10	10	725	0	2,127	1,959
Georgia	50	0	0	1	1	56	0	165	152
Hawaii	0	0	0	0	0	0	0	0	0
Illinois	2	0	0	0	0	3	0	9	8
Indiana	1	0	0	0	0	1	0	4	4
Louisiana	457	4	0	8	8	571	0	1,681	1,543
Maine	25	0	0	0	0	33	0	96	88
Maryland	112	1	0	2	2	138	0	405	373
Massachusetts	85	1	0	1	2	109	0	320	294
Michigan	263	2	0	4	4	309	0	909	836
Minnesota	8	0	0	0	0	9	0	27	25
Mississippi	27	0	0	0	0	35	0	103	95
New Jersey	178	1	0	3	3	211	0	619	571
New York	135	1	0	2	2	148	0	434	399
Non-US SECA C3	8,630	71	0	137	145	10,175	0	29,852	27,462
North Carolina	35	0	0	1	1	43	0	125	115
Offshore to EEZ	13,750	114	0	219	231	16,229	0	47,700	43,844
Ohio	61	1	0	1	1	72	0	212	195
Oregon	90	1	0	1	1	78	0	230	212
Pennsylvania	76	1	0	1	1	99	0	289	266
Rhode Island	5	0	0	0	0	6	0	19	17
South Carolina	81	1	0	1	1	96	0	283	260
Texas	258	3	0	6	7	462	0	1,361	1,249
Virginia	72	1	0	1	1	87	0	256	236
Washington	563	4	0	8	9	610	0	1,816	1,647
West Virginia	1	0	0	0	0	1	0	2	2
Wisconsin	19	0	0	0	0	22	0	66	60
British Columbia	1,276	10	0	20	21	1,485	0	4,427	4,017
Nova Scotia	2,350	19	0	37	39	2,766	0	8,117	7,477
Ontario	116	1	0	2	2	136	0	400	368
Total	29,599	246	0	475	501	35,196	0	103,464	95,072
Con. US total	3,478	31	0	60	63	4,404	0	12,968	11,904
Canada total	3,741	31	0	59	62	4,388	0	12,944	11,861

Table B-15e - 2008 C3 Commercial Marine (c3 marine) Emissions by Species, by US State

Modeled State	PMC	PMFINE	PMG	PMN	PMOTHR	PNA	PNCOM	PNH_4	PNO_3
Alabama	7	38	0	0	5	0	3	0	0
Alaska	0	0	0	0	0	0	0	0	0
California	75	427	3	0	58	0	38	0	0
Connecticut	10	56	0	0	8	0	5	0	0
Delaware	22	130	1	0	18	0	12	0	0
District of Columbia	0	0	0	0	0	0	0	0	0
Florida	169	984	6	0	134	0	88	0	0
Georgia	13	76	0	0	10	0	7	0	0
Hawaii	0	0	0	0	0	0	0	0	0
Illinois	1	4	0	0	1	0	0	0	0
Indiana	0	2	0	0	0	0	0	0	0
Louisiana	138	775	5	0	105	0	69	0	0
Maine	8	44	0	0	6	0	4	0	0
Maryland	32	187	1	0	26	0	17	0	0
Massachusetts	25	148	1	0	20	0	13	0	0
Michigan	73	420	3	0	57	0	38	0	0
Minnesota	2	13	0	0	2	0	1	0	0
Mississippi	8	48	0	0	6	0	4	0	0
New Jersey	49	287	2	0	39	0	26	0	0
New York	34	200	1	0	27	0	18	0	0
Non-US SECA C3	2,389	13,771	88	0	1,872	0	1,237	0	0
North Carolina	10	58	0	0	8	0	5	0	0
Offshore to EEZ	3,856	22,019	139	0	2,997	0	1,973	0	0
Ohio	17	98	1	0	13	0	9	0	0
Oregon	19	106	1	0	14	0	10	0	0
Pennsylvania	23	134	1	0	18	0	12	0	0
Rhode Island	1	9	0	0	1	0	1	0	0
South Carolina	22	131	1	0	18	0	12	0	0
Texas	112	627	4	0	85	0	56	0	0
Virginia	20	118	1	0	16	0	11	0	0
Washington	168	827	5	0	113	0	74	0	0
West Virginia	0	1	0	0	0	0	0	0	0
Wisconsin	5	30	0	0	4	0	3	0	0
British Columbia	410	2,017	13	0	275	0	181	0	0
Nova Scotia	641	3,756	24	0	511	0	336	0	0
Ontario	32	185	1	0	25	0	17	0	0
Total	8,392	47,725	303	0	6,493	0	4,279	0	0
Con. US total	1,064	5,978	38	0	814	0	536	0	0
Canada total	1,083	5,958	38	0	811	0	533	0	0

Table B-15f - 2008 C3 Commercial Marine (c3 marine) Emissions by Species, by US State

Modeled State	POC	PSI	PSO_4	PTI	SO_2	SULF
Alabama	8	0	28	0	624	0
Alaska	0	0	0	0	0	0
California	96	0	323	0	8,308	0
Connecticut	13	0	43	0	967	0
Delaware	29	0	99	0	2,158	0
District of Columbia	0	0	0	0	1	0
Florida	220	0	745	0	17,704	0
Georgia	17	0	58	0	1,578	0
Hawaii	0	0	0	0	0	0
Illinois	1	0	3	0	68	0
Indiana	0	0	1	0	32	0
Louisiana	174	0	587	0	12,850	0
Maine	10	0	34	0	820	0
Maryland	42	0	142	0	3,086	0
Massachusetts	33	0	112	0	3,063	0
Michigan	94	0	318	0	6,747	0
Minnesota	3	0	9	0	206	0
Mississippi	11	0	36	0	829	0
New Jersey	64	0	217	0	8,634	0
New York	45	0	152	0	3,174	0
Non-US SECA C3	3,100	0	10,455	1	221,207	0
North Carolina	13	0	44	0	1,776	0
Offshore to EEZ	4,932	0	16,674	2	356,642	0
Ohio	22	0	74	0	1,581	0
Oregon	24	0	81	0	1,457	0
Pennsylvania	30	0	101	0	3,067	0
Rhode Island	2	0	7	0	483	0
South Carolina	29	0	99	0	4,113	0
Texas	141	0	475	0	10,396	0
Virginia	27	0	90	0	2,379	0
Washington	185	0	627	0	12,468	0
West Virginia	0	0	1	0	17	0
Wisconsin	7	0	23	0	490	0
British Columbia	452	0	1,528	0	32,818	0
Nova Scotia	840	0	2,843	0	60,242	0
Ontario	41	0	140	0	2,968	0
Total	10,704	0	36,167	5	782,954	0
Con. US total	1,339	0	4,527	1	109,077	0
Canada total	1,334	0	4,510	1	96,028	0

Table B-15g - 2008 C3 Commercial Marine (c3 marine) Emissions by Species, by US State

Modeled State	TERP	TOL	UNK	UNR	XYL	
Alabama	0	4	0	4	4	ALD2 and FORM don't match up exactly due to molecular weights
Alaska	0	0	0	0	0	
California	5	46	0	46	47	
Connecticut	1	6	0	6	6	
Delaware	1	9	0	9	9	
District of Columbia	0	0	0	0	0	
Florida	9	85	0	85	86	
Georgia	1	9	0	9	9	
Hawaii	0	0	0	0	0	
Illinois	0	0	0	0	0	
Indiana	0	0	0	0	0	
Louisiana	8	78	0	78	79	
Maine	0	4	0	4	4	
Maryland	2	19	0	19	19	
Massachusetts	1	14	0	14	15	
Michigan	5	45	0	45	46	
Minnesota	0	1	0	1	1	
Mississippi	0	5	0	5	5	
New Jersey	3	30	0	30	31	
New York	2	23	0	23	23	
Non-US SECA C3	151	1,469	0	1,469	1,493	
North Carolina	1	6	0	6	6	
Offshore to EEZ	240	2,341	0	2,344	2,379	
Ohio	1	10	0	10	11	
Oregon	2	15	0	15	16	
Pennsylvania	1	13	0	13	13	
Rhode Island	0	1	0	1	1	
South Carolina	1	14	0	14	14	
Texas	5	44	0	44	45	
Virginia	1	12	0	12	13	
Washington	10	96	0	96	97	
West Virginia	0	0	0	0	0	
Wisconsin	0	3	0	3	3	
British Columbia	22	217	0	217	221	
Nova Scotia	41	400	0	401	406	
Ontario	2	20	0	20	20	
Total	518	5,040	0	5,044	5,122	
Con. US total	61	592	0	593	602	
Canada total	65	637	0	638	647	

Table B-15h - 2008 C3 Commercial Marine (c3 marine) Emissions by Species, by US State

72 degrees State	OTHER	PEC_72	PMC_72	PMFINE_72	PNO_3	POC_72	PSO_4
Alabama	6.2	58.0	38.8	70.0	0.3	318.8	4.2
Arizona	6.3	59.3	44.7	81.4	0.3	375.4	3.5
Arkansas	3.2	29.7	23.0	41.9	0.1	193.4	2.4
California	37.5	350.7	248.5	452.7	1.7	2,076.0	8.3
Colorado	5.5	51.3	34.0	61.3	0.3	278.8	3.9
Connecticut	3.7	34.7	23.7	42.9	0.2	196.0	2.1
Delaware	0.9	8.4	6.1	11.1	0.0	50.8	0.7
District of Columbia	0.4	3.6	2.7	5.0	0.0	23.0	0.3
Florida	21.3	199.1	136.7	246.7	1.0	1,127.0	15.8
Georgia	9.9	92.9	74.5	136.1	0.5	630.9	6.4
Idaho	1.4	13.4	10.7	19.5	0.1	90.4	1.4
Illinois	10.4	97.5	78.9	143.9	0.5	667.5	8.5
Indiana	7.4	68.9	47.6	85.9	0.3	392.5	5.5
Iowa	3.1	28.8	19.9	36.0	0.1	164.6	2.3
Kansas	3.1	28.8	19.7	35.6	0.1	162.7	2.3
Kentucky	4.9	45.7	31.6	57.1	0.2	261.0	3.2
Louisiana	4.9	45.4	31.0	56.0	0.2	255.8	3.4
Maine	1.3	12.3	10.1	18.4	0.1	85.3	1.2
Maryland	6.3	59.2	42.1	76.2	0.3	349.2	4.3
Massachusetts	6.3	59.1	39.1	70.6	0.3	321.2	3.2
Michigan	10.1	94.1	70.6	127.9	0.5	589.2	9.5
Minnesota	5.8	54.4	40.7	73.9	0.3	340.6	4.0
Mississippi	4.5	42.2	25.6	45.8	0.2	206.6	2.8
Missouri	6.9	64.9	49.8	90.5	0.3	418.0	5.8
Montana	1.1	9.9	6.9	12.5	0.0	57.1	0.9
Nebraska	1.9	17.4	12.2	22.1	0.1	101.2	1.4
Nevada	2.5	23.6	14.6	26.3	0.1	118.9	1.2
New Hampshire	1.4	12.8	8.7	15.8	0.1	72.0	0.8
New Jersey	8.3	77.9	54.1	97.9	0.4	447.9	5.1
New Mexico	2.7	25.1	17.4	31.4	0.1	143.7	2.0
New York	14.8	138.4	99.5	180.3	0.7	827.4	10.3
North Carolina	10.0	93.7	75.8	138.2	0.5	640.7	8.8
North Dakota	0.8	7.2	5.0	9.0	0.0	41.2	0.6
Ohio	12.0	111.7	76.2	137.5	0.5	627.6	9.1
Oklahoma	5.0	46.8	32.4	58.5	0.2	267.3	3.8
Oregon	3.4	31.7	23.5	42.7	0.2	196.7	2.3
Pennsylvania	13.3	124.3	76.7	137.6	0.6	621.3	7.7
Rhode Island	1.1	10.4	6.4	11.5	0.1	51.9	0.5
South Carolina	5.0	46.7	34.7	62.9	0.2	289.8	3.9
South Dakota	0.9	8.5	5.9	10.6	0.0	48.5	0.7
Tennessee	6.6	61.9	48.4	88.0	0.3	406.9	5.6
Texas	27.9	260.6	168.8	303.9	1.3	1,380.2	16.4
Utah	2.7	25.2	19.6	35.6	0.1	164.4	2.4
Vermont	0.8	7.6	4.5	8.0	0.0	36.0	0.5
Virginia	8.6	80.0	61.5	111.9	0.4	516.7	6.5

72 degrees State	OTHER	PEC_72	PMC_72	PMFINE_72	PNO_3	POC_72	PSO_4
Washington	5.9	55.4	40.2	72.8	0.3	334.4	4.0
West Virginia	2.0	19.0	14.3	25.9	0.1	119.3	1.6
Wisconsin	5.7	53.4	40.0	72.6	0.3	334.7	4.3
Wyoming	1.0	8.9	6.2	11.2	0.0	51.3	0.8
Cont. US	316.7	2,960.3	2,103.9	3,811.1	14.4	17,471.8	206.5

Table B-16a - 2008 Running [vehicle] Exhaust PM (runpm) Emissions by Species, by US State

Temperature adjusted State	OTHER	PEC	PMC	PMFINE	PNO_3	POC	PSO_4
Alabama	6.2	83.6	55.6	98.2	0.3	459.8	4.2
Arizona	6.3	77.9	58.1	104.2	0.3	489.3	3.5
Arkansas	3.2	47.7	36.7	65.4	0.1	311.2	2.4
California	37.5	487.3	344.4	615.8	1.7	2,891.6	8.3
Colorado	5.5	117.6	76.9	133.4	0.3	639.4	3.9
Connecticut	3.7	73.1	49.5	86.4	0.2	413.4	2.1
Delaware	0.9	15.1	10.8	19.1	0.0	91.1	0.7
District of Columbia	0.4	6.3	4.8	8.4	0.0	40.3	0.3
Florida	21.3	222.6	152.5	273.3	1.0	1,260.3	15.8
Georgia	10.0	138.3	110.3	197.8	0.5	939.3	6.4
Idaho	1.4	31.5	24.9	44.0	0.1	212.9	1.4
Illinois	10.4	227.7	182.1	322.2	0.5	1,559.1	8.5
Indiana	7.4	150.4	102.5	178.8	0.3	856.9	5.5
Iowa	3.1	74.5	50.9	88.4	0.1	426.5	2.3
Kansas	3.1	58.0	39.2	68.6	0.1	327.3	2.3
Kentucky	4.9	85.3	58.4	102.4	0.2	487.7	3.2
Louisiana	4.9	60.1	40.8	72.6	0.2	338.4	3.4
Maine	1.3	31.0	25.1	44.3	0.1	214.9	1.2
Maryland	6.3	109.1	76.7	135.0	0.3	643.5	4.3
Massachusetts	6.3	130.5	85.3	148.2	0.3	709.2	3.2
Michigan	10.1	229.7	170.1	298.1	0.5	1,440.2	9.5
Minnesota	5.8	167.9	123.8	216.1	0.3	1,051.2	4.0
Mississippi	4.5	59.8	36.0	63.1	0.2	292.9	2.8
Missouri	6.9	128.1	97.3	172.1	0.3	825.6	5.9
Montana	1.1	27.0	18.5	32.1	0.0	155.2	0.9
Nebraska	1.9	41.6	28.9	50.4	0.1	242.6	1.4
Nevada	2.5	37.6	23.5	41.1	0.1	193.0	1.2
New Hampshire	1.4	30.5	20.6	35.9	0.1	172.6	0.8
New Jersey	8.3	151.1	103.8	182.0	0.4	868.8	5.1
New Mexico	2.7	45.0	30.9	54.2	0.1	257.4	2.0
New York	14.8	296.9	212.4	372.6	0.7	1,789.0	10.3
North Carolina	10.0	148.0	119.0	212.7	0.5	1,013.3	8.8
North Dakota	0.8	24.8	16.9	29.2	0.0	142.2	0.6
Ohio	12.0	244.5	164.7	286.8	0.5	1,374.1	9.1
Oklahoma	5.0	76.8	52.6	92.7	0.2	438.2	3.8
Oregon	3.4	63.1	46.3	81.7	0.2	391.5	2.3
Pennsylvania	13.3	258.5	157.8	272.5	0.6	1,295.5	7.7
Rhode Island	1.1	21.8	13.3	23.0	0.1	109.3	0.5

Temperature adjusted							
State	OTHER	PEC	PMC	PMFINE	PNO_3	POC	PSO_4
South Carolina	5.0	67.3	49.7	88.7	0.2	418.2	3.9
South Dakota	0.9	23.9	16.4	28.4	0.0	137.2	0.7
Tennessee	6.6	102.5	79.5	141.5	0.3	674.4	5.6
Texas	27.9	342.2	220.4	390.3	1.3	1,812.1	16.4
Utah	2.7	56.6	43.4	76.5	0.1	369.1	2.4
Vermont	0.8	19.6	11.4	19.5	0.0	93.2	0.5
Virginia	8.6	136.9	104.4	185.5	0.4	884.5	6.5
Washington	5.9	114.1	81.7	143.6	0.3	688.6	4.0
West Virginia	2.0	37.7	27.9	49.3	0.1	236.2	1.6
Wisconsin	5.7	148.3	109.6	191.7	0.3	930.1	4.3
Wyoming	1.0	24.5	16.8	29.1	0.0	140.9	0.8
TOTAL	316.7	5,353.9	3,783.2	6,666.6	14.4	31,749.4	206.4

Table B-16b - 2008 Running [vehicle] Exhaust PM (runpm) Emissions by Species, by US State

72 DEGREES STATE	OTHER	PEC_72	PMC_72	PMFINE_72	PNO_3	POC_72	PSO_4
Alabama	4.4	41.1	10.6	17.3	0.2	64.4	0.1
Arizona	5.0	46.5	12.1	19.7	0.2	73.7	0.1
Arkansas	2.7	25.1	6.5	10.7	0.1	40.0	0.1
California	26.4	246.9	63.8	104.3	1.2	389.4	0.3
Colorado	3.7	34.4	8.9	14.4	0.2	53.8	0.1
Connecticut	2.4	22.6	5.8	9.5	0.1	35.4	0.1
Delaware	0.7	6.7	1.7	2.8	0.0	10.6	0.0
District of Columbia	0.3	2.8	0.7	1.2	0.0	4.5	0.0
Florida	15.3	142.8	36.9	60.2	0.7	224.4	0.5
Georgia	8.6	80.6	21.0	34.3	0.4	128.5	0.2
Idaho	1.3	11.7	3.0	5.0	0.1	18.6	0.0
Illinois	8.9	83.5	21.8	35.6	0.4	133.3	0.3
Indiana	5.3	49.9	12.9	21.0	0.2	78.4	0.2
Iowa	2.3	21.9	5.6	9.2	0.1	34.4	0.1
Kansas	2.2	20.9	5.4	8.8	0.1	32.8	0.1
Kentucky	3.5	33.1	8.5	13.9	0.2	52.0	0.1
Louisiana	3.4	32.2	8.3	13.5	0.2	50.5	0.1
Maine	1.2	11.6	3.0	4.9	0.1	18.5	0.0
Maryland	4.5	41.6	10.8	17.6	0.2	65.6	0.1
Massachusetts	4.0	37.8	9.7	15.9	0.2	59.2	0.1
Michigan	7.9	74.3	19.3	31.5	0.4	117.7	0.3
Minnesota	4.6	43.5	11.3	18.4	0.2	68.8	0.1
Mississippi	2.9	27.4	7.0	11.4	0.1	42.4	0.1
Missouri	5.6	52.5	13.6	22.3	0.3	83.4	0.2
Montana	0.8	7.7	2.0	3.2	0.0	12.1	0.0
Nebraska	1.5	13.6	3.5	5.7	0.1	21.4	0.1
Nevada	1.5	14.1	3.6	5.9	0.1	21.8	0.0
New Hampshire	1.0	9.3	2.4	3.9	0.0	14.6	0.0
New Jersey	5.8	54.4	14.0	22.9	0.3	85.6	0.2
New Mexico	2.0	18.3	4.7	7.7	0.1	28.8	0.1
New York	10.8	100.5	26.0	42.5	0.5	158.7	0.3
North Carolina	8.8	82.0	21.4	34.9	0.4	130.8	0.3
North Dakota	0.6	5.5	1.4	2.3	0.0	8.7	0.0
Ohio	8.2	76.3	19.7	32.1	0.4	119.8	0.3
Oklahoma	3.7	34.3	8.8	14.4	0.2	53.9	0.1
Oregon	2.7	25.2	6.5	10.7	0.1	39.9	0.1
Pennsylvania	7.5	70.5	18.1	29.5	0.3	109.7	0.3
Rhode Island	0.6	5.6	1.4	2.4	0.0	8.7	0.0
South Carolina	4.0	37.1	9.6	15.7	0.2	58.8	0.1
South Dakota	0.7	6.5	1.7	2.7	0.0	10.2	0.0
Tennessee	5.6	52.2	13.6	22.2	0.3	83.1	0.2
Texas	18.0	168.4	43.3	70.6	0.8	262.7	0.6
Utah	2.2	20.3	5.3	8.6	0.1	32.3	0.1
Vermont	0.5	4.6	1.2	1.9	0.0	7.1	0.0
Virginia	7.0	65.1	16.9	27.6	0.3	103.3	0.2
Washington	4.4	40.7	10.6	17.2	0.2	64.4	0.1
West Virginia	1.7	15.9	4.1	6.8	0.1	25.2	0.1

72 DEGREES							
STATE	OTHER	PEC_72	PMC_72	PMFINE_72	PNO_3	POC_72	PSO_4
Wisconsin	4.6	43.3	11.2	18.4	0.2	68.7	0.2
Wyoming	0.7	6.7	1.7	2.8	0.0	10.5	0.0
Cont. US	232.1	2,169.6	561.1	916.3	10.6	3,421.0	7.1

Table B-17a - 2008 Starting [vehicle] Exhaust PM (startpm) Emissions by Species, by US State

Temperature adjusted							
State Name	OTHER	PEC	PMC	PMFINE	PNO_3	POC	PSO_4
Alabama	4.4	78.0	19.7	28.8	0.2	122.1	0.1
Arizona	5.0	76.4	19.5	29.2	0.2	121.1	0.1
Arkansas	2.7	56.5	14.4	20.6	0.1	89.8	0.1
California	26.4	430.3	109.5	162.2	1.2	679.1	0.3
Colorado	3.7	134.5	33.6	45.8	0.2	210.5	0.1
Connecticut	2.4	76.5	19.2	26.5	0.1	120.3	0.1
Delaware	0.7	17.7	4.5	6.3	0.0	27.9	0.0
District of Columbia	0.3	7.2	1.8	2.6	0.0	11.4	0.0
Florida	15.2	174.1	44.6	70.0	0.7	273.5	0.5
Georgia	8.6	157.3	40.2	58.8	0.4	250.6	0.2
Idaho	1.3	46.9	11.9	16.2	0.1	74.7	0.0
Illinois	8.9	344.1	87.1	118.7	0.4	549.0	0.3
Indiana	5.3	182.9	45.9	62.8	0.2	287.4	0.2
Iowa	2.3	108.8	27.2	36.5	0.1	170.9	0.1
Kansas	2.2	67.2	16.9	23.3	0.1	105.5	0.1
Kentucky	3.5	93.0	23.4	32.8	0.2	146.2	0.1
Louisiana	3.5	53.2	13.5	20.2	0.2	83.4	0.1
Maine	1.2	51.9	13.1	17.8	0.1	82.8	0.0
Maryland	4.5	114.2	28.8	40.5	0.2	180.0	0.1
Massachusetts	4.0	135.6	33.9	46.5	0.2	212.3	0.1
Michigan	7.9	320.8	80.8	109.7	0.4	508.6	0.3
Minnesota	4.7	286.5	71.9	95.4	0.2	453.9	0.1
Mississippi	2.9	50.2	12.6	18.5	0.1	77.6	0.1
Missouri	5.6	163.3	41.3	57.5	0.3	259.4	0.2
Montana	0.8	38.5	9.6	12.9	0.0	60.5	0.0
Nebraska	1.5	58.9	14.8	20.0	0.1	92.8	0.1
Nevada	1.5	30.1	7.6	10.9	0.1	47.0	0.0
New Hampshire	1.0	38.8	9.7	13.2	0.0	60.9	0.0
New Jersey	5.8	161.0	40.5	56.5	0.3	253.3	0.2
New Mexico	2.0	50.6	12.7	17.9	0.1	79.6	0.1
New York	10.7	353.3	89.0	122.4	0.5	558.3	0.3
North Carolina	8.8	173.6	44.3	64.2	0.4	276.9	0.3
North Dakota	0.6	44.2	11.0	14.5	0.0	69.4	0.0
Ohio	8.2	277.9	69.7	95.4	0.4	436.2	0.3
Oklahoma	3.7	78.9	19.9	28.5	0.2	124.0	0.1
Oregon	2.7	73.8	18.7	26.1	0.1	116.8	0.1
Pennsylvania	7.6	241.5	60.3	82.7	0.3	375.8	0.3
Rhode Island	0.6	18.7	4.7	6.4	0.0	29.0	0.0

Temperature adjusted							
State Name	OTHER	PEC	PMC	PMFINE	PNO_3	POC	PSO_4
South Carolina	4.0	68.7	17.5	25.7	0.2	108.8	0.1
South Dakota	0.7	36.6	9.1	12.2	0.0	57.5	0.0
Tennessee	5.6	121.7	31.0	44.3	0.3	193.7	0.2
Texas	18.0	270.2	68.4	102.4	0.8	421.7	0.6
Utah	2.2	76.6	19.4	26.5	0.1	121.8	0.1
Vermont	0.5	21.7	5.4	7.2	0.0	33.5	0.0
Virginia	7.0	158.5	40.3	57.3	0.3	251.7	0.2
Washington	4.4	127.2	32.1	44.5	0.2	200.9	0.1
West Virginia	1.7	49.2	12.4	17.3	0.1	77.8	0.1
Wisconsin	4.6	243.3	61.1	81.8	0.2	385.6	0.2
Wyoming	0.7	34.4	8.6	11.5	0.0	54.0	0.0
TOTAL	232.2	6,074.8	1,533.1	2,149.3	10.6	9,585.4	7.1

Table B-17b - 2008 Starting [vehicle] Exhaust PM (startpm) Emissions by Species, by US State

Appendix C
Metadata

Output Data
The pm25_surface_12km_2007.csv (or o3_surface_12km_2007.csv) file is the output file from EPA's Hierarchical Bayesian Model (HBM) that combines $PM_{2.5}$ (or O_3) monitoring data from National Air Monitoring Stations/State and Local Air Monitoring Stations (NAMS/SLAMS) and Models-3/Community Multiscale Air Quality (CMAQ) computer-simulated $PM_{2.5}$ or O_3 data. This file provides a spatial interpolation of air quality that takes advantage of the strengths of monitoring network observations and modeling estimates to generate daily surrogate measures for $PM_{2.5}$ and relates these measures to available public health data. The file covers the contiguous lower 48 states of the United States. The time frame covered is January 1, 2007 through December 31, 2007. The standard errors of the estimates should be taken in to account when using the results. This file is a comma-separated values (CSV) file. This is a flat file that is platform-independent. In the Microsoft Windows computing environment, this file can be read easily by Excel.

The file contains the posterior means and standard errors of the estimated space-time surface, the posterior means and standard errors of the estimated space-time bias surface, and the posterior means and standard errors for a surface made up of 12 km x 12 km contiguous grids. The contiguous 12 km x 12 km grids cover the whole lower 48 contiguous states of the United States. The file includes the following variables: Date, Latitude, Longitude, posterior mean estimated $PM_{2.5}$ or O_3 concentration on natural log scale (PredAvg), row position of grid cell, column position of grid cell, standard error of the estimated $PM_{2.5}$ or O_3 concentration on the natural log scale (PredStd), the natural log of the estimated CMAQ model data bias (Bias), and the standard error of the estimated CMAQ model data bias (BiasStd). Values of -999 in the data set represent missing (or intentionally excluded) values. Excluded values are generated when grid cells are not included in the model calculation. These are not actual missing values but intentionally not included in the grid for calculation of the estimated surface. An example of such a grid cell not included is grid cells that fall over water.

Input Data
The actual monitoring data from the NAMS/SLAMS network were downloaded from the Air Quality System (AQS) database. Only Federal Reference Method (FRM) samplers and only those samplers with sample duration of one day (24-hour integrated sample) were included in the data set.

The CMAQ data was created from version 4.7 (4.7.1) of the model which includes improved aqueous chemistry and photolysis mechanisms. The $PM_{2.5}$ data is a 24-hour integrated $PM_{2.5}$ concentration calculated on a 12-km x 12- km grid for the entire United States. These CMAQ results are based on emission inputs for the 2005v4 Platform from the 2005 National Emission Inventory (NEI), Version 2, which includes emissions of CO, NO_x, VOC, SO_2, NH_3, PM_{10}, and $PM_{2.5}$ and hazardous air pollutants (HAPs), including chlorine, HCl, benzene, acetaldehyde, formaldehyde, and methanol. In addition, the meteorological data used for these model results is from the Weather Research and Forecasting Model (WRF) version 3.1 simulations (Advanced Research WRF [ARW] core).

The HBM combines the actual monitoring data (NAMS/SLAMS), the estimated $PM_{2.5}$ or O_3 concentration surface (CMAQ), and the prediction of $PM_{2.5}$ or O_3 through space and time. The model assumes that both the actual monitoring data and the CMAQ data provide good information about the same underlying pollutant surface, but with different measurement error structures. It gives more weight to the accurate monitoring data in areas where monitoring data exists and relies on the CMAQ data and satellite data in areas where no monitoring data is available. The modeling is divided into hierarchical components where each level of the hierarchy is modeled conditional on the preceding levels. To fit the model, a custom-designed Monte Carlo Markov Chain (MCMC) software algorithm was used. Model-specific input parameters of statistical distributions for the model and simulation parameters (priors) are specified for each run of the model. The projections for the grid cell structure are as follows:

Projection: Lambert conformal with spherical earth, radius = 6370.0 km

12-km Resolution

NCOLS = 459

NROWS = 299

P_ALP = 33.00

P_BET = 45.00

P_GAM = -97.00

XCENT = -97.00

YCENT = 40.00

XORIG = -2556000.00

YORIG = -1728000.00

XCELL = 12000.00

YCELL = 12000.00

These values are for the 12-km grid resolution of CMAQ.

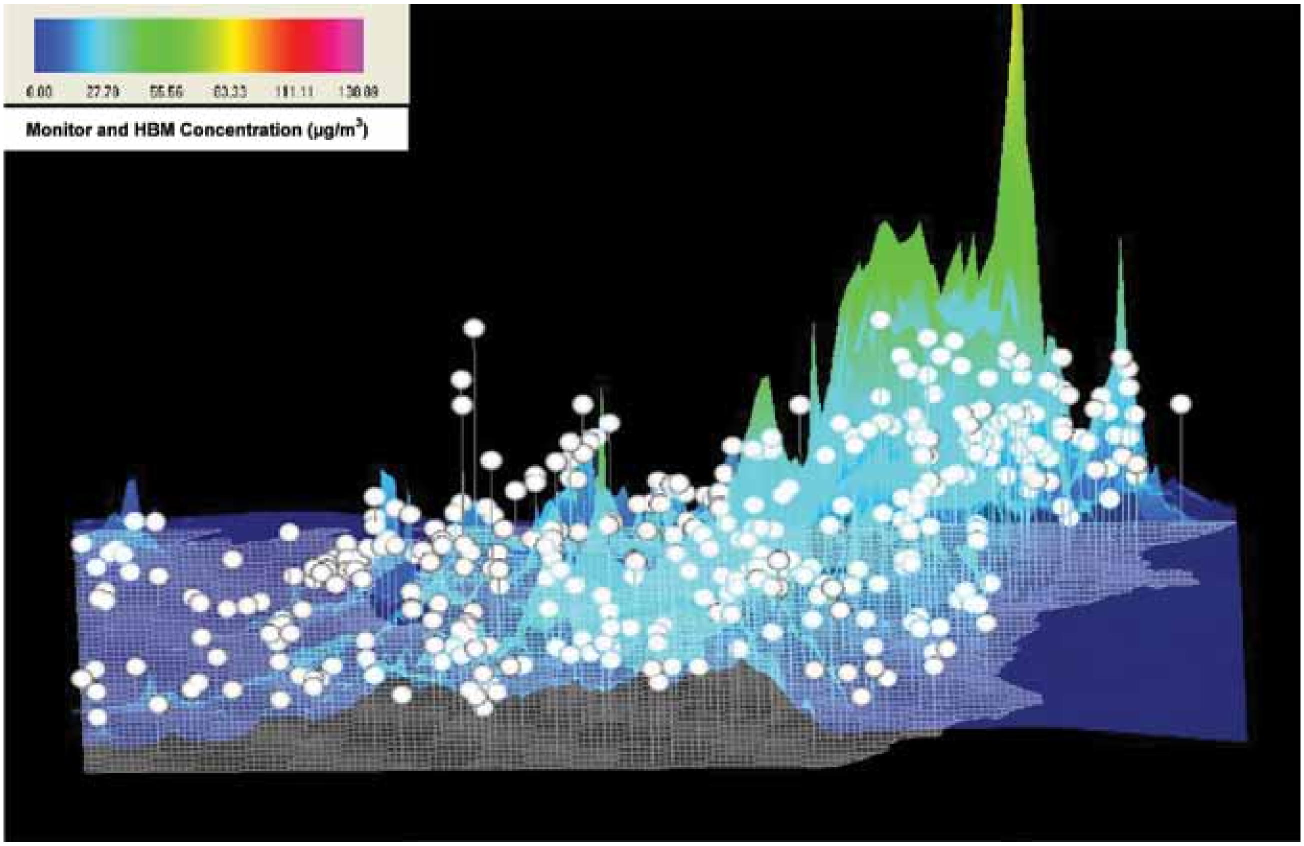


Figure C-1. $PM_{2.5}$ Monitoring Data and CMAQ Surface (Separately Displayed—White Spheres Represent Monitor Locations and Associated Concentration Values)

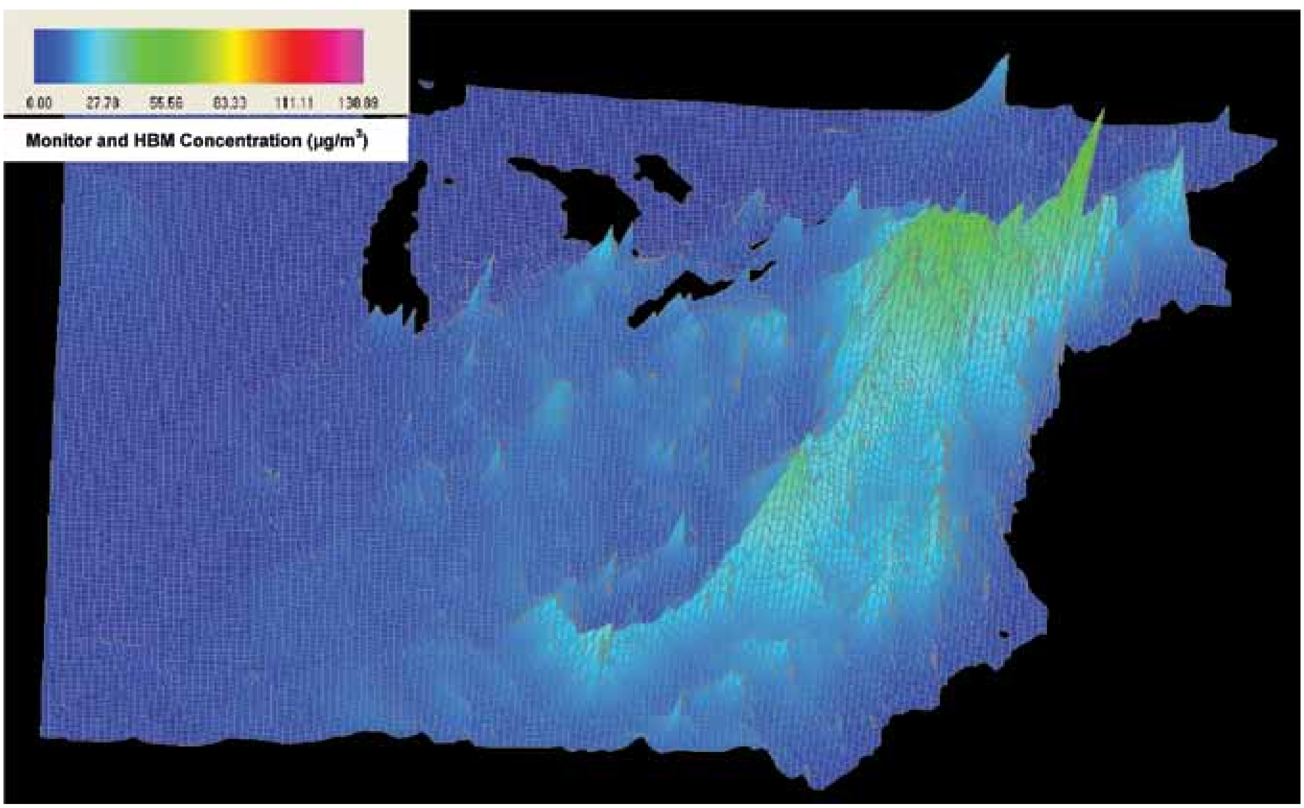


Figure C-2. Combined $PM_{2.5}$ Monitoring Data and CMAQ Surface (Via HBM)

The geographic boundaries of the HB output cover the following region:

111.1 degrees W longitude—West Bounding Coordinate

65.4 degrees W longitude—East Bounding Coordinate

51.25 degrees N latitude—North Bounding Coordinate

23.0 degrees N latitude—South Bounding Coordinate

The definitions for the 12-km x 12-km CMAQ grid cells are contained in a text (*.txt) file. The file contains the latitude and longitude coordinates of the following points for each grid cell: 1) center; 2) southwest corner; 3) southeast corner; 4) northwest corner; and 5) northeast corner. The AQS data for $PM_{2.5}$ and O_3 are contained in separate text (*.txt) files. These files contain the following data: parameter occurrence code (for pollutant); state code; city code; site ID; sampling frequency; data; sample value; monitor protocol (i.e., 1 in 3 days); partition, etc. Example figures of a) a separate air quality monitor with CMAQ data, and b) combined air quality monitor data and CMAQ data for $PM_{2.5}$ are shown below.

Use of HB Data to Generate Health Indicators

The HB output data can be used to generate health (air) indicators which are useful to researchers when developing health impact assessments (HIA). The HB output is provided in a gridded (x-y/row-column) format and that format must be translated to different coordinate systems (e.g., county-based/relevant coordinates) to provide health indicator data for the area(s) of interest. An important coordinate projection system used as a standard coordinate representation format to express different location designation systems in consistent terms is the Lambert Conformal Conic (LCC) projection coordinate system. The North American Datum (NAD) geodetic system describes the Earth's ellipsoid based on the latitude and longitude location of an initial point, and serves as the basis of maps and surveys of the Earth's surface. The NAD-27 datum is based on the Clarke Ellipsoid (Earth spheroid) of 1866 and is centered at a base station on the Meades Ranch in Kansas. The NAD-83 grid projection/datum is based on the Geodetic Reference Spheroid (GRS) of 1980 and is geocentric (e.g., based on the Earth's center with no directionality or initial point located on the Earth's surface). The NAD coordinate system is important because health-related data (used to calculate health indicators) are collected and cataloged based on this coordinate system (e.g., U.S. Census data is based on NAD-83 coordinates).

The HB output provides ambient concentration data for both ozone and fine particulate matter in x-y-based grid cells, and to correlate this concentration data with health data, the x-y locations must be 'mapped' to latitude/longitude locations and then mapped to the correct datum/projection system linked with the health data. The typical latitude and longitude grids are based on the World Geodetic System (WGS) projection for 1984 (WGS-84), while the U.S. Census uses the NAD-83 grid and the SAS statistical analysis software uses NAD-83 grid projection. When generating the linkage between the ambient concentration data and the health data, a methodology or protocol must be developed to relate the appropriate coordinate system/geocoding information between them.

CDC, EPA, and the state departments of air and/or health of New York, New Jersey, Massachusetts, and Minnesota have developed an initial set of health indicators using the HB output data correlated with available health data/information. They have developed a 'relationship file' to map the x-y-based grid cells to latitude/longitude format with the appropriate datum/projection system(s). Shapefile information also resides in this file allowing compatibility with GIS map formats/applications. The relationship file has a grid ID, representing the row and column of the grid cell. This grid ID is a six-digit identifier from the HB raw data set that concatenates column and row designation. There are 66,000 grid cells per day times 365 days worth of data (the New York State Health Department uses SAS to process this data and CDC uses ArcGIS to process the data). The relationship file recognizes the importance of having consistent geocoding data for HB grids for Health Impact Analyses (HIA). The U.S. Census files (TIGER2000 files) are in NAD-83 format, which is what the SAS statistical software processes. The WGS-84 format is almost exactly like NAD-83 format except there is an offset of a few feet for grid points (centroids). WGS-84 is used by the CMAQ air quality model. Air Quality models such as CMAQ, which serve as input to the HB model, uses the meteorological software MM5 which is based on the Lambert Conformal Conic (LCC) projection. As long as the HB output data (latitude and longitude grid coordinates) can be mapped to the NAD-83 or NAD-84 (WGS-84) to match census data, air indicators can be generated for HIA. The x and y coordinates given in the HB are used to plot the latitude and longitude with an offset to match non-NAD-83 grid references. When defining Earth points, coordinate information should be modified into a format compatible with county-based maps and transformed into an elliptical projection. NetCDF file can be converted in ArcGIS to make shape files. The New Jersey state air department used the Theissen Polygon tool on HB data to generate shapefiles.

How CMAQ and HB x-y grid locations are transformed to latitude and longitude values:

There is an IOAPI file providing rows/columns, cell height/width, origin in LCC, offset by ½ cell width/height to get center cell (centroid). Conversion uses an LCC routine in IOAPI library, passing parameters (Earth radius, central meridian [longitude: -97 degrees]), two key latitude values 33 degrees and 45 degrees, central meridian, -97 and latitude of origin, 40.0. These arguments are required for the LCC routine, which returns latitude and longitude. The code for transforming an LCC projection (e.g., CMAQ and HB Model x-y grid coordinates) to latitude and longitude values:

LCPGEO Fortran Code—LCC Conversion Program
****

Fortran Code for converting Lambert Conformal Conic to geodetic (lat/lon):

```
      subroutine lcpgeo(iway,phic,xlonc,truelat1,truelat2,xloc,
      yloc, & xlon,ylat)
c     write(*,*)'INCALL:',phic,xlonc,truelat1,truelat2
c
c     LCPGEO performs Lambert Conformal to geodetic
      (lat/lon) translation
c
c     Code based on the TERRAIN preprocessor for MM5
      v2.0, developed by Yong-Run Guo and Sue Chen,
      National Center for Atmospheric Research, and
      Pennsylvania State University
      10/21/1993
c
c     Input arguments:
c     iway        Conversion type
c                 0 = geodetic to Lambert Conformal
c                 1 = Lambert Conformal to geodetic
c     phic        Central latitude (deg, neg for southern hem)
c     xlonc       Central longitude (deg, neg for western hem)
c     truelat1    First true latitude (deg, neg for southern hem)
c     truelat2    Second true latitude (deg, neg for southern
                  hem)
c     xloc/yloc   Projection coordinates (km)
c     xlon/ylat   Longitude/Latitude (deg)
c
c     Output arguments:
c     xloc/yloc   Projection coordinates (km)
c     xlon/ylat   Longitude/Latitude (deg)
c
      data conv/57.29578/, a/6370./
c
c---Entry Point
c
      if (phic.lt.0) then
         sign = -1.
      else
         sign = 1.
      endif
      pole = 90.
      if (abs(truelat1).gt.90.) then
         truelat1 = 60.
         truelat2 = 30.
         truelat1 = sign*truelat1
         truelat2 = sign*truelat2
       endif
      xn = alog10(cos(truelat1/conv)) - alog10(cos(truelat2/
      conv))
      xn = xn/(alog10(tan((45. - sign*truelat1/2.)/conv)) -
           & alog10(tan((45. - sign*truelat2/2.)/conv)))

      psi1= 90. - sign*truelat1
      psi1 = psi1/conv
      if (phic.lt.0.) then
         psi1 = -psi1
         pole = -pole
      endif
         psi0 = (pole - phic)/conv
      xc = 0.
      yc = -a/xn*sin(psi1)*(tan(psi0/2.)/tan(psi1/2.))**xn
c
c---Calculate lat/lon of the point (xloc,yloc)
c
       if (iway.eq.1) then
          xloc = xloc + xc
          yloc = yloc + yc
      if (yloc.eq.0.) then
       if (xloc.ge.0.) flp = 90./conv
      if (xloc.lt.0.) flp = -90./conv
      else
       if (phic.lt.0.) then
          flp = atan2(xloc,yloc)
      else
          flp = atan2(xloc,-yloc)
      endif
      endif
          flpp = (flp/xn)*conv + xlonc
      if (flpp.lt.-180.) flpp = flpp + 360.
       if (flpp.gt. 180.) flpp = flpp - 360.
          xlon = flpp
c
      r = sqrt(xloc*xloc + yloc*yloc)
      if (phic.lt.0.) r = -r
      cell = (r*xn)/(a*sin(psi1))
      rxn = 1.0/xn
      cel1 = tan(psi1/2.)*cell**rxn
      cel2 = atan(cel1)
       psx = 2.*cel2*conv
      ylat = pole - psx
c
c---Calculate x/y from lat/lon
c
      else
      ylon = xlon - xlonc
      if (ylon.gt. 180.) ylon = ylon - 360.
      if (ylon.lt.-180.) ylon = ylon + 360.
      flp = xn*ylon/conv
      psx = (pole - ylat)/conv
      r = -a/xn*sin(psi1)*(tan(psx/2.)/tan(psi1/2.))**xn
      if (phic.lt.0.) then
          xloc = r*sin(flp)
          yloc = r*cos(flp)
      else
          xloc = -r*sin(flp)
          yloc = r*cos(flp)
       endif
      endif
c
c     write(*,*)xloc,xc,yloc,yc
      xloc = xloc - xc
      yloc = yloc - yc
c
       return
       end
```

****

CMAQ Projection Information—Source:

http://www.baronams.com/products/ioapi/GRIDDESC.html

Coordinate Information

COORD-NAME	COORDTYPE	P_ALP	P_BET	P_GAM	XCENT	YCENT
'LAM_40N97W'	2	33.000	45.000	-97.000	-97.000	40.000

Grid Information

GRID-NAME	COORD-NAME	XORIG (m)	YORIG (m)	XCELL (m)	YCELL (m)	NCOLS	NROWS	NTHIK
12US1	'LAM_40N97W'	-1008000	-1620000	12000	12000	279	240	1

P_ALP = "PROJ_ALPHA"
P_BET = "PROJ_BETA"
LAMGRD3 = P_ALP <= P_BET. These are the two latitudes which determine the projection cone.
P_GAM = the central meridian
XCENT, **YCENT** = lat/lon coordinates for the center (0, 0) of the Cartesian coordinate system.
X_ORIG is the X coordinate of the grid origin (lower left corner of the cell at column=row=1), given in map projection units (meters, except in Lat-Lon coordinate systems).
Y_ORIG is the Y coordinate of the grid origin (lower left corner of the cell at column=row=1), given in map projection units (meters, except in Lat-Lon coordinate systems).
X_CELL is the cell dimension parallel to the X coordinate axis, given in map projection units (meters, except for Lat-Lon coordinate systems).
Y_CELL is the cell dimension parallel to the Y coordinate axis, given in map projection units (meters, except for Lat-Lon coordinate systems).
NCOLS is the number of columns (dimensionality in the X direction).
NROWS is the number of rows (dimensionality in the Y direction).
NTHIK is the thickness (number) of cells on the boundary domain required to accurately describe boundary mass flux (e.g., CMAQ uses NTHIK = 1)

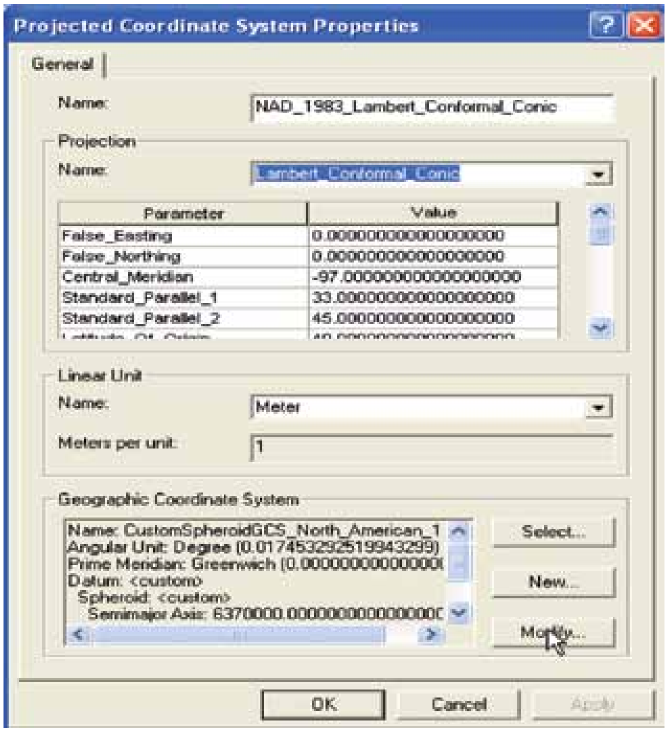
ArcMap Projection Information (HB grid example):

Data Type: File Geodatabase Feature Class
Location: U:\Projects\MMc-courtney\Grids\templates\grid_templates.gdb
Feature Class: template_mdhi_12_nb
Feature Type: Simple
Geometry Type: Polygon
Projected Coordinate System: NAD_1983_Lambert_Conformal_Conic
Projection: Lambert_Conformal_Conic
False_Easting: 0.00000000
False_Northing: 0.00000000
Central_Meridian: -97.00000000
Standard_Parallel_1: 33.00000000
Standard_Parallel_2: 45.00000000
Latitude_Of_Origin: 40.00000000
Linear Unit: Meter
Geographic Coordinate System: Custom-SpheroidGCS_North_American_1983
Datum: <custom>
Prime Meridian: Greenwich
Angular Unit: Degree

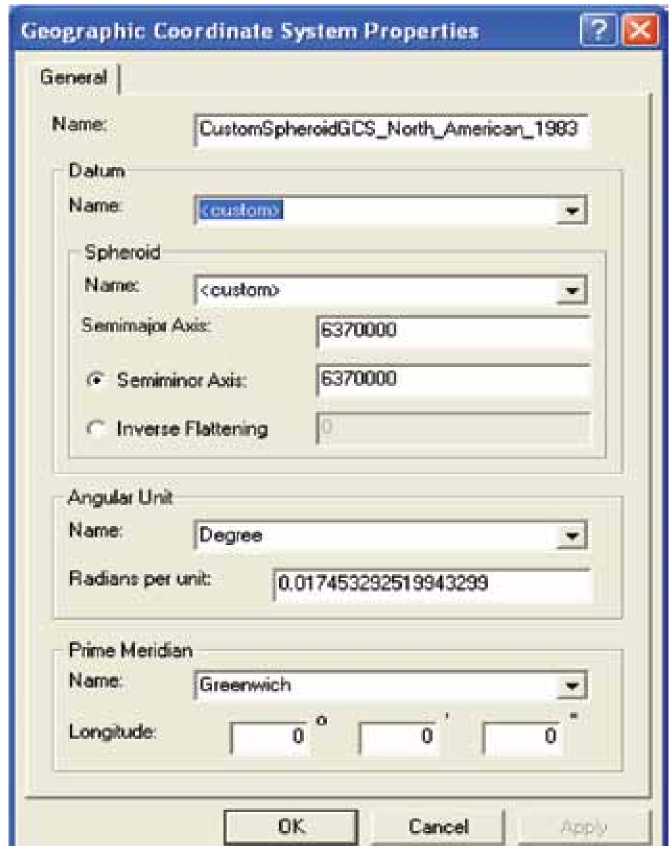
Changing a data set's spheroid to a sphere.

1) In ArcCatalog, right click the data set of interest, and choose **Properties**. Click the **XY Coordinate System** tab. Click Modify…

2) From the Geographic Coordinate System of the Projected Coordinate System Properties window, click Modify…



3) From the Geographic Coordinate System window, first choose <custom> in the list of datum (it's at the top) and then choose <custom> for the spheroid. Enter 6370000 in both the semimajor and semiminor boxes.



Projection Information for HB Grid—Example #1

Year	Geographic Coordinate System	Datum	Prime Meridian	Angular Unit	Projected Coordinate System	False Easting	False Northing	Central Meridian	Standard Parallel_1	Standard Parallel_2	Scale Factor	Latitude of Origin	Linear Unit
2001	Lat/Lon	Spherical R=6370997	NA	Degrees	Lambert Conformal Conic	0.0	0.0	-97.0	33.0	45.0	1.0	40.0	Meters
2002	:	Spherical R=6370000	:	:	:	:	:	:	:	:	:	:	:
2003	:	:	:	:	:	:	:	:	:	:	:	:	:
2004	:	:	:	:	:	:	:	:	:	:	:	:	:
2005	:	:	:	:	:	:	:	:	:	:	:	:	:
2006	:	:	:	:	:	:	:	:	:	:	:	:	:
2007	:	:	:	:	:	:	:	:	:	:	:	:	:
2008	:	:	:	:	:	:	:	:	:	:	:	:	:

Grid Descriptive Parameters

Year	Grid Resolution (km)	XORIG (m)	YORIG (m)	XCELL (m)	YCELL (m)	NCOLS	NROWS
2001	12	-252000	-1284000	12000	12000	213	188
2001	36	-2736000	-2088000	36000	36000	148	112
2002	12	-1008000	-1620000	12000	12000	279	240
2002	36	-2736000	-2088000	36000	36000	148	112
2003	12	-1008000	-1620000	12000	12000	279	240
2003	36	-2736000	-2088000	36000	36000	148	112
2004	12	-1008000	-1620000	12000	12000	279	240
2004	36	-2736000	-2088000	36000	36000	148	112
2005	12	-1008000	-1620000	12000	12000	279	240
2005	36	-2736000	-2088000	36000	36000	148	112
2006	12	-1008000	-1620000	12000	12000	279	240
2006	36	-2736000	-2088000	36000	36000	148	112
2007	12	-1008000	-1620000	12000	12000	279	240

Projection Information for HB Grid—Example #2

Year	Datumw	Semimajor Axis (m)	Semiminor Axis (m)	Angular Unit	Projected Coordinate System	False Easting	False Northing	Longitude of Central Meridian	Latitude of Standard Parallel_1	Latitude of Standard Parallel_2	Latitude of Origin	Linear Unit
2001	*(i.e., NAD83 or WGS84)*	*(i.e., 6370000)*	*(i.e., 637000)*	*(i.e., degree or radians)*	*(i.e., Lambert Conformal Conic)*	*(i.e., 0.0)*	*(i.e., 0.0)*	*(i.e., -97.000)*	*(i.e., 33.000)*	*(i.e., 45.000)*	*(i.e., 40.0)*	*(i.e., meters)*
2002												
2003												
2004												
2005												
2006												
2007												
2008												

SCIENCE

EPA
United States
Environmental Protection
Agency

Office of Research and Development (8101R)
Washington, DC 20460